From: Kathleen Donoghue [kadonoghue@azwater.gov]
Sent: Monday, April 30, 2007 11:09 AM
To: strategies@lc.usbr.gov
Cc: astephens@az.gov; lfaeth@az.gov; Colleen Lane; Gregg Houtz; Glenda Winters; Herb Guenther; Nicole Swindle; Perri Benemelis; Tom Carr; Tim Henley; Patrick Schiffer; margaret_Bradley@IOS.DOI; jharkins@lc.usbr.gov; lwalkoviak@lc.usbr.gov; rgold@uc.usbr.gov; bjohnson@usbr.gov
Subject: State of Arizona Comments on the Draft EIS, Colorado RiverOperations

Attachments: Ltr - Kempthorne 4-27-07.pdf

Attached please find the State of Arizona, Department of Water Resources Comments regarding the Draft Environmental Impact Statement, Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead. The attached shall serve as the official submission for the State of Arizona pursuant to the notice published in 72 FR 9027 on February 28, 2007.

A hard copy of the letter and five Exhibits have been mailed this date by first class U.S. mail to the Honorable Dirk Kempthorne (original) and to Robert W. Johnson, Rick Gold, Jayne Harkins and Larry Walkoviak.

Director Guenther would like to thank you for the opportunity to make this submission.

If you have any problems retrieving the documents, please contact Kathy Donoghue at 602-771-8476, or by replying to this email.

Kathleen A. Donoghue
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ARIZONA DEPARTMENT OF WATER RESOURCES
3550 North Central Avenue, Phoenix, Arizona 85012
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April 30, 2007

Janet Napolitano
Governor

Herbert R. Guenther
Director

Honorable Dirk Kempthorne
Secretary of the United States Department of the Interior
1849 C. Street, NW
Washington, D.C. 20240

Re: Arizona Department of Water Resources Comments Regarding the *Draft Environmental Impact Statement, Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead*

Dear Mr. Secretary:

The Arizona Department of Water Resources (ADWR) submits the following comments to the *Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, Draft Environmental Impact Statement* (February 2007). By Arizona statute, ADWR is the state agency within Arizona that is authorized and assigned the responsibility to consult, advise and confer with the Secretary of Interior regarding matters dealing with the operation of the mainstem of the Colorado River.

Arizona relies on Colorado River water for municipal and industrial use along the River and in Central Arizona; as well as for agricultural use in both areas. As you are aware, Arizona will be impacted by shortage water supply reductions more than any other Lower Basin State. There have historically been significant differences among the seven Colorado River Basin states concerning important elements of the Law of the River. Hydrological conditions on the River require that the Secretary, in consultation with the Basin states, adopt shortage guidelines. The process for adoption of such guidelines could have been the occasion for each of the Basin states to assert its legal positions—resulting in extended litigation and years of uncertainty for Colorado River water users. The seven states chose, instead, to seek agreement on shortage guidelines and guidelines for the management of Lakes Mead and Powell for an interim period of nineteen years, and to reserve their legal positions for later resolution if necessary.

Arizona worked diligently with the other Basin states to achieve agreement on the Basin States' Preliminary Proposal recommended to you on February 3, 2006. Since that time, and following the publication of the Draft EIS, Arizona has continued to work closely with the other states to refine and improve the Basin States' Preliminary Proposal and to develop one set of comments to the Draft EIS on behalf of all of the states ("Basin States' Comments"). The Basin states are submitting the Basin States' Comments, together with the Basin States' Proposal, which includes the Basin States' Agreement, Proposed Interim Guidelines for Colorado River Operations, Draft Forbearance Agreement and Arizona-Nevada Shortage Sharing Agreement ("Basin States' Proposal") under separate cover. Arizona has joined in and strongly supports the Basin States' Comments and Proposal.

Arizona submits the following additional comments to supplement and buttress the Basin States Comments and to address concerns specific to Arizona.

Supplemental Comments in Support of the Basin States' Proposal:

Reclamation Should Adopt the Basin States Alternative as the Preferred Alternative

Reclamation should adopt the Basin States Alternative because it is the compromise alternative developed by the Governor's Representatives of the seven Colorado River Basin States, and, for the reasons stated in the Basin States' Comments, it is the best of the five alternatives analyzed in the Draft EIS. The Basin States Alternative would provide more benefits to Arizona than the No Action Alternative, and is acceptable to all of the states that will be directly affected by its implementation. The Basin States Alternative addresses the issues identified during the Environmental Impact Statement (EIS) scoping process, and it can be implemented immediately upon issuance of the Record of Decision.

Each of the other four alternatives analyzed in the Draft EIS fails to adequately address the issues identified during scoping. The No Action Alternative is unacceptable for several reasons. First, it fails to address the Secretary's objectives because it does not include shortage guidelines for the Lower Basin. In addition, the No Action Alternative does not comply with existing law, as explained in Arizona's November 28, 2005 scoping letter.[1]

The Water Supply Alternative reflects the traditional strategy for managing reservoir systems in the West—i.e., shortages are declared only when water is physically unavailable for delivery. The DEIS indicates that there would likely be no shortages to Arizona during the interim period under this alternative. However, there would also be less water retained in storage in Lake Powell under the Water Supply Alternative, and it lacks consensus Basin States' support.

While the analysis of the No Action and Water Supply alternatives is important because they expand the range of analyzed impacts, neither includes negotiated criteria for the coordinated operation of Lake Powell and Lake Mead, or specific guidelines for the implementation of future water supply reductions in the Lower Colorado River Basin under defined shortage conditions. Nor do these two alternatives allow for the intentional creation of surplus in Lake Mead by a Lower Colorado River Mainstream contractor and release of the surplus for use within the state that intentionally created the surplus, with the forbearance of the other Lower Division States.

With regard to the other two alternatives, substantive changes to the Law of the River would be required in order to implement either the Conservation Before Shortage (CBS) or the Reservoir Storage Alternative.

The CBS Alternative includes the intentional creation of surplus and release of the surplus from Lake Mead contained in the Basin States Alternative, but it depends upon a funding mechanism that does not currently exist. According to Reclamation, "The viability of the Conservation Before Shortage program funding proposal is not known at this time. Reclamation currently does not have the authority to implement all facets of this proposal and additional legislation would be necessary to gain such authority."[2] The CBS Alternative also proposes to allow Mexico to participate in an ICS program. Together with the other Basin States,

[1] See note 4, *infra*, and accompanying text.
[2] Draft EIS, Section 2.4.5, page 2-13.

Arizona supports the concept of Mexican participation in an ICS mechanism at some time in the future. An international framework and agreement would be a necessary prerequisite to the adoption of an ICS-type water management program for Mexico. Arizona stands ready to participate in discussions with Mexico, the U.S. federal government, and the other Basin States with regard to the development of such a framework.

Finally, the only remaining alternative, the Reservoir Storage Alternative serves a valuable purpose by allowing analysis of a broad range of impacts in the EIS, but it contains provisions that impound water for power generation and recreation to the detriment of downstream agricultural and domestic uses. This is prohibited by Article IV (b) of the Colorado River Compact (Compact) which clearly states that "Subject to the provisions of this compact, water of the Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes."

Also, the shortage criteria proposed in the Reservoir Storage Alternative doubles the maximum shortage reduction proposed in the Basin States Alternative. This is unacceptable to Arizona. The shortage criteria in the Basin States Alternative were adapted from criteria developed by the Director's Shortage Sharing Workgroup in Arizona. The Workgroup met for almost two years to develop a recommendation regarding the appropriate implementation strategy and volume of shortage reductions. This recommendation was later refined by the subsequent Arizona-Nevada Shortage-Sharing Agreement, executed on February 9, 2007 (Shortage-Sharing Agreement) between Nevada and Arizona apportioning lower basin shortages between the two states.

Mischaracterization of Intentionally Created Surplus

The Draft EIS characterizes Intentionally Created Surplus ("ICS") as a water management mechanism for storage and delivery of conserved and/or non-system water. This is not a correct description of ICS as it is used in the Basin States' Proposal. ICS is characterized in the Basin States' Proposal as a category of Surplus water under the provisions of Article II(B)(2) of the Consolidated Decree in *Arizona v. California*, just as Domestic Surplus under the Interim Surplus Guidelines is a category of Surplus water. The Basin States, CBS and Reservoir Storage Alternatives each include a provision for the development of ICS. The Consolidated Decree allocates Surplus water among Arizona (46%), California (50%) and Nevada (4%). A state may forbear its use of Surplus water, which would allow the Secretary to allocate the apportioned but unused surplus to another state pursuant to Article II(B)(6). The Draft EIS describes the creation of ICS for each of the above referenced alternatives, but fails to describe the required forbearance that would make that water available for the intended use. Reclamation should, in the Final EIS, accurately describe ICS as a category of Surplus, include a description of the forbearance necessary for the delivery of ICS to the entity that created the Surplus, and, in the Record of Decision, adopt guidelines for the creation and delivery of ICS as set forth in the Proposed Interim Guidelines contained in the Basin States' Proposal.[3]

[3] Attached to this Arizona Comments Letter as Exhibit 1 is "Changes to DEIS Volume I and Appendix M to Conform to Basin States Proposal re Intentionally Created Surplus" to conform the DEIS to the Proposed Interim Guidelines contained in the Basin States' Proposal.

Comments Addressing Concerns Specific to Arizona

Default Operating Criteria After Termination of Interim Guidelines

For the most part, the Interim Guidelines that would be adopted upon adoption of a ROD consistent with the Basin States Alternative will terminate in 2026, and could, under certain circumstances, terminate prior to 2026. The Draft EIS does not clearly set forth the default operating criteria for Lakes Powell and Mead that would apply upon termination of the Interim Guidelines. Before utilizing the present 602(a) storage algorithm for calculating 602(a) storage requirements for releases from Lake Powell, the Secretary should conduct a complete review of Section 602(a) of the Colorado River Basin Project Act of 1968 in consultation with the Basin States and consider Arizona's comments concerning the validity of the use of the present 602(a) algorithm, as stated in Arizona's scoping comments submitted November 28, 2005 as a part of this NEPA process.[4]

Colorado River Compact Deliveries

Article III(d) of the Compact defines the minimum, ten-year release requirement from the Upper Basin to the Lower Basin, in addition to the releases required by Articles III (c) and (e). The Basin States Alternative describes reservoir operations to balance the contents of Lake Powell and Lake Mead, with varied Powell releases based on water surface trigger elevations for the reservoirs. Nevertheless, Arizona will continue to monitor the ten-year releases in order to evaluate compliance with Article III (d) of the Compact. Even during the proposed interim period, gauging whether the experimental interim release schedule actually causes less than 75 MAF of flow at Lee Ferry in a ten-year period will help to determine the effectiveness of the proposed guidelines. The information also might be a factor in adjusting Powell releases within the agreed range during the proposed interim period, and may demonstrate the need for adjustment of the proposed release schedule after consultation with the Basin States and the Secretary.

Shortage Criteria

The *Director's Shortage Sharing Workgroup Recommendation, October 24, 2006 (Revised) Final*,[5] describes a method to distribute Arizona shortage reductions between the CAP and equivalent priority mainstream Colorado River water users. The assumptions regarding the distribution of shortage reductions between Arizona and Nevada have since been defined, as reflected in the Shortage-Sharing Agreement.[6] Arizona water users will be impacted by shortage water supply reductions more than any other Lower Basin State. Reclamation should consider the Director's Shortage Sharing Workgroup Recommendation and the Shortage-Sharing Agreement with Nevada when adopting a preferred alternative.

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[4] Letter from Herbert R. Guenther to Robert W. Johnson, November 28, 2005, pp. 1-2, attached as Exhibit 2.
[5] Attached as Exhibit 3.
[6] The Arizona-Nevada Shortage-Sharing Agreement, February 9, 2007, is attached to the Basin States' Comments as part of the Basin States' Proposal.

Analysis of the Impact of Multiple, Consecutive-Year Colorado River Shortages in Arizona

The Draft EIS includes the following statement: "Key to the impact analysis is the assumption that the most conservative way to estimate impacts is to assume that, if a shortage occurs, farmers would react by fallowing irrigated lands."[7] This is an adequate approach for analyzing shortage reductions expected to last for a single year. However, we disagree with the assumption that this approach captures the expected impact for multiple, consecutive-year shortage reductions. Since fourth priority agricultural water users in Mohave County, Arizona have no reasonably available replacement water supply, a long-term shortage will likely result in the permanent loss of production for some lands. Within the CAP service area, where groundwater is available as a replacement water supply, agricultural producers will have additional costs for the rehabilitation or replacement of irrigation wells as well as additional hydropower costs to pump groundwater.

Arizona has analyzed the likelihood of multiple year Colorado River shortage reductions, using Reclamation's data.[8] Modeling for the No Action Alternative indicates a 44 percent probability of five or more years of consecutive shortage during the interim period (2008 through 2026) and a 95 percent probability from 2027 through 2060. Under the Basin States Alternative the probability of consecutive shortage years is less, but still significant, with a 29 percent probability of five or more years of consecutive shortage during the interim period and a 96 percent probability between 2027 and 2060. Reclamation should consider the socioeconomic and other impacts to both agricultural and municipal water users of multiple, consecutive-year shortages.

The Draft EIS further concludes that "No permanent change in land uses would occur under any of the alternatives because shortages would be of a temporary nature and agricultural lands would likely not be permanently removed from production."[9] Arizona disagrees with this conclusion. Under all alternatives analyzed in the Draft EIS, multiple year shortage reductions are possible. Reclamation should consider the impacts of prolonged shortage and address the impacts in the Final EIS.

Analysis of Shortage Impacts in Arizona

Fourth priority mainstream uses (agricultural and municipal) in Arizona will be reduced proportionately as soon as the first Colorado River water supply reductions are implemented. The Draft EIS does not describe the adverse impacts to fourth priority mainstream municipal Colorado River water users. Future estimated shortage reductions to mainstream users, including Lake Havasu City and Bullhead City, run as high as 30 percent of entitlement. Shortage reductions will also reduce the Cocopah Indian Tribe's fourth priority entitlement as well as agricultural water uses in the Mohave Valley. Under Reclamation's current interpretation of Article V accounting under the Consolidated Decree in *Arizona v. California*, there is no locally available, non-Colorado River water supply to offset these shortage reductions.

[7] Draft EIS, Section 4.14.1.2, page 4-263.
[8] Data taken from Reclamation's DEIS CRSS Model Output data files NA.Short.cy.xls and BS.Short.cy.xls. ADWR analyzed the data found in these files to determine the duration of shortages. The graphed results are shown in Exhibit 4.
[9] Draft EIS, Section 4.14.2, page 4-270.

The Draft EIS analyzes a range of shortage reductions from 200,000 acre-feet to 2,500,000 acre-feet. The impact analysis generally assumes increased impacts from increased volumes of shortage. While it is reasonable to assume that adverse impacts increase as shortage reductions increase, this approach fails to acknowledge that there has never before been a declared shortage of Colorado River water, and there will be adverse impacts to a variety of water users in Arizona when the first shortage reductions are implemented.

The Final EIS should recognize Arizona's shortage planning measures and investments over the last decade. It should also acknowledge the additional costs of demand reduction programs already in place that would be operative during shortage reductions. Arizona cities have already invested millions of dollars to develop shortage water supplies and to implement demand reduction programs. The Arizona Water Banking Authority has spent more than $106 million to store water to supplement municipal supplies during times of shortage. Such measures should be included in the analysis of the impacts of shortage.

Conclusion

Adoption of the Basin States Alternative would initiate an opportunity for nineteen years of peace on the River. The outstanding differences among the seven basin states over various aspects of the Law of the River would be set aside for this interim period while a new, agreed method for managing the Colorado River and new shortage criteria are implemented. By the year 2020, the Secretary and the Basin States will have had enough experience with these interim procedures to allow informed and productive consultation concerning River management and shortage guidelines for the period after 2026. If an alternative other than the Basin States Alternative were to be adopted, the compromises encompassed in the Basin States' Proposal would not be preserved and differences among the states would not be deferred.

Arizona strongly recommends that the Secretary choose the Basin States Alternative as the preferred alternative in the FEIS and adopt a ROD with the guidelines and criteria necessary to implement the Basin States Alternative in substantial conformance with the carefully negotiated Basin States' Proposal.[10]

Sincerely,

Herbert R. Guenther

Attachments

1. Exhibit 1: Changes to DEIS Volume I and Appendix M to Conform to Basin States' Proposal re Intentionally Created Surplus.
2. Exhibit 2: Letter from Herbert R. Guenther to Robert W. Johnson, November 28, 2005.

[10] Attached as Exhibit 5 are additional technical corrections by the State of Arizona regarding the Draft EIS that are self-explanatory and therefore not discussed in the body of this letter..

3. Exhibit 3: Director's Shortage Sharing Workgroup Recommendation, October 24, 2006 (Revised) Final
4. Exhibit 4: Arizona Multiple Consecutive Year Shortage Graphs.
5. Exhibit 5: ADWR technical corrections to DEIS.

c: Robert W. Johnson, Commissioner, U. S. Bureau of Reclamation
Rick Gold, Regional Director, U. S. Bureau of Reclamation, Upper Colorado Regional Office
Jayne Harkins, Acting Regional Director, U. S. Bureau of Reclamation, Lower Colorado Regional Office
Larry Walkoviak, Deputy Regional Director, U. S. Bureau of Reclamation, Lower Colorado Regional Office

EXHIBIT 1

Changes to DEIS Volume I and Appendix M to Conform to Basin States' Proposal re Intentionally Created Surplus

CHANGES TO DEIS VOLUME I AND APPENDIX M TO CONFORM TO BASIN STATES PROPOSAL RE INTENTIONALLY CREATED SURPLUS

ES.1 Background

The Secretary of the United States Department of the Interior (Secretary), acting through the Bureau of Reclamation (Reclamation), proposes to adopt specific interim guidelines for Colorado River Lower Basin (Lower Basin) shortages and coordinated operations for Lake Powell and Lake Mead, particularly under drought and low reservoir conditions.

Reclamation, as the agency that is designated to act on the Secretary's behalf with respect to operation of Olen Canyon Dam and Hoover Dam and managing the mainstream waters of the lower Colorado River pursuant to federal law, is the lead federal agency for the purposes of compliance pursuant to the National Environmental Policy Act of 1969 (NEPA) for the development and implementation of the proposed interim guidelines. Five federal agencies are cooperating for purposes of assisting with environmental analysis and preparation of the Draft EIS. The cooperating agencies are the Bureau of Indian Affairs (BIA), United States Fish and Wildlife Service (FWS), National Park Service (NPS), Western Area Power Administration (Western), and the United States Section of the International Boundary and Water Commission (USIBWC).

The Draft EIS includes six chapters as outlined below:

- Chapter 1: Purpose and Need;
- Chapter 2: Description of Alternatives;
- Chapter 3: Affected Environment;
- Chapter 4: Environmental Consequences;
- Chapter 5: Other Considerations and Cumulative Impacts; and
- Chapter 6: Consultation and Coordination.

ES.1.1 Purpose and Need for Action

During the period of 2000 through 2006, the Colorado River Basin experienced the worst drought conditions in approximately one hundred years of recorded history. During this period, storage in Colorado River reservoirs has dropped from nearly full to less than 60 percent of capacity at the end of 2006. Currently, the Department of the Interior (Department) does not have specific operational guidelines in place to define the circumstances under which the Secretary would reduce the annual amount of water available for consumptive use from Lake Mead nor to address the coordinated operations of Lake Powell and Lake Mead during drought and low reservoir conditions.

The purpose of the proposed federal action is to: 1) improve Reclamation's management of the Colorado River by considering tradeoffs between frequency and magnitude of reductions of water deliveries, and considering the effects on water storage in Lake Powell and Lake Mead, and on water supply, power production, recreation, and other environmental resources; 2) provide mainstream United States users of Colorado River water, particularly those in the Lower Division states, a greater degree of predictability with respect to the amount of annual water deliveries in future years, particularly under drought and low reservoir conditions; and 3) provide for the creation and delivery of intentionally created surplus ("ICS") water in Lake Mead.

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ES.1.2 Proposed Federal Action

The proposed federal action includes the adoption of specific interim guidelines for Lower Basin shortages and coordinated operations for Lake Powell and Lake Mead. These interim guidelines would remain in effect for determinations to be made through 2025 regarding water supply and reservoir operating decisions through 2026 and would provide guidance each year in development of the Annual Operating Plan for Colorado River Reservoirs (AOP). This proposed federal action considers four operational elements that collectively are designed to address the purpose and need for the proposed federal action.

The interim guidelines would be used by the Secretary to:

- Determine those circumstances under which the Secretary would reduce the annual amount of water available for consumptive use from Lake Mead to the Colorado River Lower Division states (Arizona, California, and Nevada) below 7.5 million acre-feet (maf) (a "Shortage") pursuant to Article II(13)(3) of the United States Supreme Court in the case of Arizona v. California, 547 U.S. (2006) (Consolidated Decree);

- Define the coordinated operation of Lake Powell and Lake Mead to provide improved operation of these two reservoirs, particularly under low reservoir conditions;

- Establish the conditions for the creation and delivery, pursuant to applicable federal law, of intentionally created surplus water in Lake Mead for use within the Lower Division states to increase the flexibility of meeting water use needs from Lake Mead; and

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- Determine those conditions under which the Secretary may declare the availability of ICS and other surplus water for use within the Lower Division states. The proposed federal action would modify the substance of the existing Interim Surplus Guidelines (ISG), published in the Federal Register on January 25, 2001 (66 Fed. Reg. 7772), and the term of the ISG from 2016 to 2026.

ES.1.3 Geographic Scope

The geographic region that could potentially be affected by the proposed federal action begins with Lake Powell and extends downstream along the Colorado River floodplain to the Southerly International Boundary (SIB) with Mexico. In addition to the potential impacts that may occur within the river corridor, the alternatives may also affect the water supply that is available to

specific Colorado River water users in the Lower Basin. The following water agency service areas are also included in the appropriate affected environment discussions:

- Arizona water users, particularly the lower priority water users located in the Central Arizona Project service area;
- The Southern Nevada Water Authority service area; and
- The Metropolitan Water District of Southern California service area. Figure ES-1 shows the geographic scope for the Draft EIS.

ES.1.4 Alternatives

Five alternatives are considered and analyzed in the Draft EIS. The alternatives consist of a No Action Alternative and four action alternatives. The four action alternatives are: Basin States Alternative, Conservation Before Shortage Alternative, Water Supply Alternative, and Reservoir Storage Alternative. The action alternatives reflect input from Reclamation staff, the cooperating agencies, stakeholders, and other interested parties.

Reclamation received two written proposals for alternatives that met the purpose and need of the proposed federal action, one from the seven Colorado River Basin States (Basin States) and another from a consortium of environmental non-governmental organizations (NGO). These proposals were used by Reclamation to formulate two of the alternatives considered and analyzed in the Draft EIS (Basin States Alternative and Conservation Before Shortage Alternative, respectively). A third alternative (Water Supply Alternative) was developed by Reclamation and a fourth alternative (Reservoir Storage Alternative) was developed by Reclamation in coordination with the NPS and Western. The alternatives were posted on Reclamation's website (http://www.usbr.gov/lc/region/programs/strategies.html) on June 30, 2006.

Reclamation has not identified a preferred alternative in the Draft EIS. The preferred alternative will be identified following public comments on the Draft EIS and will be expressed in the Final EIS. The preferred alternative may be one of the specific alternatives described below or it may incorporate elements or variations of these alternatives.

Summary descriptions of the No Action Alternative and the four action alternatives considered in the Draft EIS are provided below and in Table ES-l.

TABLE ES-1

Matrix of Alternatives

Alternatives	Shortage Guidelines to reduce deliveries from Lake Mead (elevations in feet msl)	Coordinated Reservoir Operations (Lake Mead & Lake Powell) (elevations in feet msl)	Intentionally Created Surplus	Interim Surplus Guidelines for deliveries/releases from Lake Mead
No Action	• Determination made through the AOP process, absent shortage guidelines • Reasonably represented by a two-level shortage strategy – probabilistic protection of Lake Mead elevation 1,050 and absolute protection of Lake Mead elevation 1,000	• Minimum objective release of 8.23 maf from Lake Powell unless storage equalization releases are required • Operation at low reservoir levels reasonably represented by a 8.23 maf release from Lake Powell down to Lake Powell dead pool	• No guidelines for creation and delivery of ICS. r	• No modification or extension of the ISG which end in 2016 • After 2016, determination made through the AOP process, absent surplus guidelines; reasonably represented by the spill avoidance (referred to as the 70R Strategy)
Basis States	• Shortages (i.e., reduced deliveries) of 400,500 and 600 kaf from Lake Mead at elevations 1,075, 1,050, and 1,025 respectively • Initiate efforts to develop additional guidelines for shortages if Lake Mead falls below elevation 1,025 (Note: includes consultation with Basin States	• Under high reservoir conditions, minimum objective release of 8.23 maf from Lake Powell unless storage equalization release are required • Under lower reservoir conditions, either reduce Lake Powell release or balance volumes depending upon elevation at Lake Powell and Lake Mead	• Guidelines for the creation and delivery of ICS for augmentation by extraordinary conservation , system efficiency, tributary conservation and importation of non system water • Maximum total ICS in Lake Mead of 2.1 maf • System assessment of 5 percent of ICS	• Modification of ISG to eliminate Partial Domestic Surplus conditio • Extension of the modified guidelines through 2026
Conservation Before Shortage	• Shortages are implemented in any given year when necessary to keep Lake Mead above SNWA's lower intake at elevation 1,000 (absolute protection of elevation 1,000)	• Under high reservoir conditions, minimum objective release of 8.23 maf from Lake Powell unless storage equalization releases are required • Under lower reservoir conditions, either reduce Lake Powell release or balance volumes depending upon elevation at Lake Powell and Lake	• Guidelines for the creation and delivery of different volumes of ICS tied to Lake Mead elevation • Guidelines for the creation Storage and delivery of ICS for augmentation by extraordinary conservation ed, system efficiency, tributary	• Modification of ISG to eliminate Partial Domestic Surplus conditio • Extension of the modified guidelines through 2026

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Deleted: No water management mechanism for storage and delivery of conserved system and/or non system water

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Deleted: Prior to shortage, conservation of different volumes of water tied to Lake Mead elevation

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Alternatives	Shortage Guidelines to reduce deliveries from Lake Mead (elevations in feet msl)	Coordinated Reservoir Operations (Lake Mead & Lake Powell) (elevations in feet msl)	Intentionally Created Surplus	Interim Surplus Guidelines for deliveries/releases from Lake Mead
		Mead	conservation and importation of system and/or non system water • Water for environmental uses • Maximum total ICS greater than 4.2 maf f • System assessment of 5 percent of ICS	
Water Supply	• Release full annual entitlement amounts until Lake Mead is drawn down to dead pool (elevation 895)	• Minimum objective release of 8.23 maf from Lake Powell unless storage equalization releases are required • Balancing if Lake Powell is below elevation 3,575 or Lake Mead is below elevation 1,075	• No guidelines for creation and delivery of ICS	• Extension of the existing ISG through 2026
Reservoir Storage	• Shortages (i.e. reduced deliveries) of 600, 800, 1,000 and 1,200 kaf from Lake Mead at elevations 1,100, 1,075, 1,050, and 1,025 respectively	• Minimum objective release of 8.23 maf from Lake Powell if Lake Powell is above elevation 3,595 unless storage equalization releases are required • 7.8 maf release from Lake Powell between Lake Powell elevations of 3,560 and 3,595 • Balancing below Lake Powell elevation of 3,560	• Guidelines for the creation Storage and delivery of ICS for augmentation by extraordinary conservation ed, system efficiency, tributary conservation and importation of system and/or non system water • Maximum total ICS of 3.05 maf f • System assessment of 10 percent of ICS	• Permissive provisions of existing ISG terminate in 2007, and during period from 2008 to 2026, surplus determinations are limited to Quantified and Flood Control Conditions.

Deleted: **Lake Mead Storage and Delivery of Conserved System or Non-system Water**

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Deleted: System assessment of 10 percent of stored conserved system and/or non-system water

ES.1.4.1 No Action Alternative

The No Action Alternative provides a baseline for comparison of each of the action alternatives. The No Action Alternative represents a projection of future conditions that could occur during the life of the proposed federal action without an action alternative being implemented.

Pursuant to the Long-Range Operating Criteria (LROC), the Secretary makes a number of determinations at the beginning of each operating year through the development and execution of the AOP, including the water supply available to users in the Lower Basin and the annual release from Lake Powell. However, the LROC currently does not include specific guidelines for such determinations. Furthermore, there is no actual operating experience under very low reservoir conditions, i.e., there has never been a shortage determination in the Lower Basin. Therefore, in the absence of specific guidelines, the outcome of the annual determination in any particular year in the future cannot be precisely known. However, a reasonable representation of future conditions under the No Action Alternative is needed for comparison to each action alternative. The modeling assumptions used for this representation are consistent with assumptions used in previous environmental compliance documents for the ISG, the Colorado River Water Delivery Agreement, and the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). However, the assumptions used in the No Action Alternative are not intended to limit or predetermine these decisions in any future AOP determination.

ES.1.4.2 Basin States Alternative

The Basin States Alternative was developed by the Basin States and proposes a coordinated operation of Lake Powell and Lake Mead that would minimize shortages in the Lower Basin and avoid risk of curtailments of Colorado River water use in the Upper Basin. This alternative includes shortages to conserve reservoir storage; coordinated operations of Lakes Powell and Mead determined by specified reservoir conditions; guidelines for the creation and delivery of intentionally created surplus through extraordinary conservation, system efficiency, tributary conservation and importation of non-system water in the Lower Basin; and a modification and extension of the ISG through 2026.

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ES.1.4.3 Conservation Before Shortage Alternative

The Conservation Before Shortage Alternative was developed by a consortium of NGOs. The Conservation Before Shortage Alternative includes voluntary, compensated reductions (shortages) in water use to minimize involuntary shortages in the Lower Basin and avoid risk of curtailments of Colorado River water use in the Upper Basin. This alternative includes voluntary shortages prior to involuntary shortages; coordinated operations of Lakes Powell and Mead determined by specified reservoir conditions; an expanded system for the creation and delivery of intentionally created surplus through extraordinary conservation, system efficiency, tributary conservation and importation of non-system water in the Lower Basin, including water for environmental uses; and a modification and extension of the ISG through 2026.

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ES.1.4.4 Water Supply Alternative

The Water Supply Alternative maximizes water deliveries at the expense of retaining water in storage in the reservoirs for future use. This alternative would reduce water deliveries only when insufficient water to meet entitlements is available in Lake Mead. When reservoir conditions are relatively low, Lakes Powell and Mead would share water

("balance contents"). This alternative does not include any guidelines for the creation and delivery of ICS. The existing ISG would be extended through 2026.

Deleted: a mechanism for the storage and delivery of conserved system and non-system water in Lake Mead.

ES.1.4.5 Reservoir Storage Alternative

The Reservoir Storage Alternative was developed in coordination with the cooperating agencies and other stakeholders, primarily Western and the NPS. This alternative would keep more water in storage in Lake Powell and Lake Mead by reducing water deliveries and by increasing shortages to benefit power and recreational interests. This alternative includes larger, more frequent shortages that serve to conserve reservoir storage; coordinated operations of Lakes Powell and Mead determined by specified reservoir conditions (more water would be held in Lake Powell than under the Basin States Alternative); and an expanded system for the creation and delivery of intentionally created surplus through extraordinary conservation, system efficiency, tributary conservation and importation of non-system water in the Lower Basin. The existing ISG would be terminated after 2007.

Deleted: mechanism for the storage and delivery of conserved system and non-system water in Lake Mead

ES.2 Summary of Potential Environmental Effects

ES.2.1 Methodology

Hydrologic modeling of the Colorado River system was conducted to determine the potential hydrologic effects of the alternatives. The modeling provides projections of potential future Colorado River system conditions (i.e., reservoir elevations, reservoir releases, river flows) for comparison of those conditions under the No Action Alternative to conditions under each action alternative. Due to the uncertainty with regard to future inflows into the system, multiple simulations were performed in order to quantify the uncertainties of future conditions and as such, the modeling results are typically expressed in probabilistic terms.

The hydrologic modeling also provides the basis for the analysis of the potential effects of each alternative on other environmental resources such as recreation, biology, and electrical power. The potential effects to specific resources are identified and analyzed for each action alternative and are compared to the potential effects to that resource under the No Action Alternative. These comparisons are typically expressed in terms of the relative differences in probabilities between the No Action Alternative and the action alternatives.

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ES.2.3 Water Deliveries

All of the action alternatives generally improve water supply conditions during the interim period relative to the No Action Alternative, improve the probability that normal deliveries will

be met, and reduce the probability that Shortage condition deliveries will occur. The differences between the action alternatives and the No Action Alternative, in terms of the probability of occurrence for Normal conditions water supply deliveries, diminish after 2027 and converge by about 2038.

The Water Supply Alternative provides the same probability of Surplus condition deliveries as the No Action Alternative (between about 30 to 40 percent) between 2008 and 2016 and this alternative consistently provides the highest probability of Surplus condition deliveries during the interim period. The Reservoir Storage Alternative provides the lowest probabilities (between about 10 to 20 percent) during the interim period. The surplus provisions under the Basin States and Conservation Before Shortage alternatives are similar and the probability of Surplus conditions between 2010 through 2016 is slightly less than under the No Action Alternative. After 2026 the probability for all alternatives converges and ranges between 10 and 20 percent.

During most of the interim period, the probability of involuntary and voluntary shortage is less under all of the action alternatives compared to the No Action Alternative. The probability of occurrence of shortages under the Water Supply Alternative is generally less than under the No Action Alternative and other action alternatives during the interim period. However, after 2026, the Water Supply Alternative has the highest probability of occurrence. Average shortages that occur under the Water Supply Alternative are significantly less than those observed under the No Action Alternative during the interim period.

The probability of occurrence of shortages under the Reservoir Storage Alternative is slightly higher than under the No Action Alternative between 2008 and 2013. However, after 2013 and through about 2037, shortages under the Reservoir Storage Alternative occur less frequently as compared to the No Action Alternative. In terms of magnitude, the average shortage volumes that are observed during the interim period are highest under the Reservoir Storage Alternative.

Shortages also occur less frequently under the Basin States and Conservation Before Shortage alternatives during the interim period as compared to the No Action Alternative and are similar after 2026. The probability values of the Basin States Alternative and Conservation Before Shortage Alternative differ by a maximum of about five percent with those of the Conservation Before Shortage Alternative being generally slightly lower than those under the Basin States Alternative. The probability of an involuntary and voluntary shortage under the No Action Alternative in 2026 is 47 percent. In contrast, in 2026, the probability of an involuntary and voluntary shortage under the Basin States, Conservation Before Shortage, Water Supply, and Reservoir Storage alternatives is 35 percent, 33 percent, nine percent, and 37 percent, respectively. In terms of magnitude, the average involuntary and voluntary shortages that are observed under the Basin States and Conservation Before Shortage alternatives are similar to each other and both are less than those observed under the No Action Alternative during the interim period. After 2026, the average shortage volumes are similar.

The ICS Program assumed as part of the Basin States, Conservation Before Shortage and Reservoir Storage alternatives has the effect of decreasing the occurrence of shortages. The greatest reduction during the interim period occurs under the Reservoir Storage Alternative.

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Chapter 1.

1.1 Introduction (Text unchanged and intentionally omitted)

1.2 Proposed Federal Action

The proposed federal action includes the adoption of specific interim guidelines for Lower Basin shortages and coordinated operations of Lake Powell and Lake Mead. These interim guidelines would remain in effect for determinations to be made through 2025 regarding water supply and reservoir operating decisions through 2026 and would provide guidance each year in development of the AOP. This proposed federal action considers four operational elements that collectively are designed to address the purpose and need for the proposed federal action; these elements are addressed in each of the alternatives described in Chapter 2.

The interim guidelines would be used by the Secretary to:

1. Determine those circumstances under which the Secretary would reduce the annual amount of water available for consumptive use from Lake Mead to the Colorado River Lower Division states (Arizona, California, and Nevada) (Section 1.7) below 7.5 million acre-feet (maf) (a "Shortage") pursuant to Article II(B)(3) of the Consolidated Decree;
2. Define the coordinated operation of Lake Powell and Lake Mead to provide improved operation of these two reservoirs, particularly under low reservoir conditions;
3. Allow for the intentional creation of surplus pursuant to applicable federal law, so that conserved Colorado River system and non-system water in Lake Mead can be made available by forbearance in order to increase the flexibility of meeting water use needs from Lake Mead, particularly under drought and low reservoir conditions; and
4. Determine those conditions under which the Secretary may declare the availability of surplus water for use within the Lower Division states. The proposed federal action would modify the substance of the existing Interim Surplus Guidelines (ISG), published in the Federal Register on January 25, 2001 (66 Fed. Reg. 7772), and the term of the ISG from 2016 to 2026.

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1.3 Purpose of and Need for Action

The purpose of the proposed federal action is to: 1) improve Reclamation's management of the Colorado River by considering the tradeoffs between the frequency and magnitude of reductions of water deliveries, and considering the effects on water storage in Lake Powell and Lake Mead, water supply, power production, recreation, and other environmental resources; 2) provide mainstream United States users of Colorado River water, particularly those in the Lower Division states, a greater degree of predictability with respect to the amount of annual water deliveries in future years, particularly under drought and low reservoir conditions; and, 3)

provide for intentionally created surplus so that conserved Colorado River system and non-system water in Lake Mead can be made available by forbearance.

Deleted: additional mechanisms for the storage and delivery of water supplies in Lake Mead.

The proposed federal action is needed for the following reasons:

- The Colorado River is of unique and strategic importance in the southwestern United States for water supply, hydropower production, flood control, recreation, fish and wildlife habitat, and other benefits. In addition, the United States has a delivery obligation to the United Mexican States (Mexico) for certain waters of the Colorado River pursuant to the 1944 Treaty between the United States and Mexico Relating to the Utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande (1944 Treaty);
- The seven-year period from 2000 through 2006 was the driest seven-year period in the 100-year historical record; this drought in the Colorado River Basin has reduced Colorado River system storage, while demands for Colorado River water supplies have continued to increase. From October 1, 1999 through September 30, 2006, storage in Colorado River reservoirs fell from 55.7 maf (approximately 97 percent of capacity) to 33.4 maf (approximately 56.4 percent of capacity), and was as low as 29.7 maf (approximately 52 percent of capacity) in 2004. This drought was the first sustained drought experienced in the Colorado River Basin at a time when all major storage facilities were in place, and when use by the Lower Division states met or exceeded the annual "normal" apportionment of 7.5 maf pursuant to Article II(B)(1) of the Consolidated Decree (Section 1.7). These conditions, among other factors, led the Department to conclude that additional management guidelines are necessary and desirable for the efficient management of the major mainstream Colorado River reservoirs;
- In the future, low reservoir conditions may not be limited to drought periods because of anticipated future demands on Colorado River water supplies. Future Colorado River water demands are projected to increase the frequency and magnitude of drought and low reservoir conditions on the Colorado River;
- As a result of actual operating experience and through reviews of the LROC and preparation of AOPs, particularly during recent drought years, the Secretary has determined a need for more specific guidelines, consistent with the Consolidated Decree and other applicable provisions of federal law to assist in the Secretary's determination of annual water supply conditions in the Lower Basin under low reservoir conditions. The increased level of predictability is needed by water managers and the entities that receive Colorado River water to better plan for and manage available water supplies, and to better integrate the use of Colorado River water with other water supplies that they rely on;
- To date, storage of water and flows in the Colorado River has been sufficient so that it has not been necessary to reduce Lake Mead annual releases below 7.5 maf; that is, the Secretary has never reduced deliveries by declaring a "shortage" on the lower Colorado River. Without operational guidelines in place, water users who rely on the Colorado River in the Lower Division states are not currently able to identify particular reservoir conditions under which the Secretary would reduce the annual amount of water available for consumptive use from Lake Mead to the Lower Division states below 7.5 maf. Nor

are these water users able to identify the frequency or magnitude of any potential future annual reductions in their water deliveries;

- After public consultation meetings held in the summer of 2005, the Secretary has also determined the desirability of developing additional operational guidelines that will provide for releases greater than or less than 8.23 maf from Lake Powell; and
- To further enhance this coordinated reservoir approach, the Secretary has also determined a need for intentionally created surplus guidelines that provide water users in the Lower Division states the opportunity to conserve, and take delivery of water in and from Lake Mead for the purposes of enhancing existing water supplies, particularly under low reservoir conditions. The Secretary has determined the need to modify and extend the ISG to coincide with the duration of the proposed new guidelines. This will provide an integrated approach for reservoir management and more predictability for future Lower Division water supplies.

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1.4 Lead and Cooperating Agencies (Text unchanged and intentionally omitted)

1.5 Scope of the EIS (Text unchanged and intentionally omitted)

1.6 Summary of Contents of this Draft EIS (Text unchanged and intentionally omitted)

1.7 Water Supply Management and Allocation (Text unchanged and intentionally omitted)

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1.7.1.1 Apportionment Provisions

The initial apportionment of water from the Colorado River was determined as part of the Compact, which divided the Colorado River system into two sub-basins, the Upper Basin and the Lower Basin (Figure 1.7-1). The Upper Basin includes those parts of the states of Colorado, Utah, Wyoming, Arizona and New Mexico within and from which waters drain naturally into the Colorado River above Lee Ferry, Arizona. The Lower Basin includes those parts of the states of Arizona, California, Nevada, New Mexico and Utah within and from which waters naturally drain into the Colorado River system below Lee Ferry Compact Point. The Compact also divided the seven Basin States into the Upper Division and the Lower Division states (Figure 1.7-3). The Upper Division states are Wyoming, Utah, Colorado and New Mexico. The Lower Division states are Arizona, California, and Nevada.

The Compact apportioned to the Lower Basin states and the Upper Basin states, in perpetuity, the exclusive beneficial consumptive use of 7.5 maf of water per year (mafy). In addition to this apportionment, Article III(b) of the Compact gives the Lower Basin states the right to increase their beneficial consumptive use by 1.0 mafy. The Compact also stipulates in Article III(d) that the Upper Division states will not cause the flow of the river at Lee Ferry Compact Point to be depleted below an aggregate of 75 maf for any period of 10 consecutive years.

The Compact, in Article VII, states that nothing in the Compact shall be construed as affecting the obligations of the United States to Indian tribes. While the rights of most Indian tribes to Colorado River water were subsequently adjudicated, some Tribal rights remain unadjudicated. To the extent that Indian tribes consumptively use water from the Colorado River, such uses are charged against the apportionment of the relevant Colorado River Basin state.

Upper Division State Apportionments. Upper Division state apportionments were established by the Upper Colorado River Basin Compact of 1948. These apportionments allocate the Upper Basin states consumptive use after deduction of up to 50,000 acre-feet per year (afy) for Arizona as follows: Wyoming, 14.00 percent; Utah, 23.00 percent; Colorado, 51.75 percent; and New Mexico, 11.25 percent. The Upper Basin state apportionments have not yet been fully developed.

Lower Division State Apportionments. Lower Division state apportionments were established by Congress in the BCPA. These apportionments are: California, 4.4 maf; Arizona, 2.8 maf; and Nevada, 0.3 maf, totaling 7.5 maf, subject to annual increases or reductions pursuant to Secretarial determinations of Shortage or Surplus conditions.

Under Article II(B)(2) of the Decree in *Arizona v. California*,when the Secretary determines there is a Surplus, California is entitled to 50% of the Surplus, Arizona is entitled to 46% and Nevada is entitled to 4%.

Figure 1.7-4 presents a schematic of the operation of the Colorado River, primarily in the Lower Basin. The Consolidated Decree confirms the apportionments to the Lower Division states established by the BCPA and guides the Secretary's operation of facilities, including Hoover Dam, on the lower Colorado River. If water apportioned for use in a Lower Division state is not consumed by that state in any year, the Secretary may release the unused water for use in another Lower Division state. Consumptive use by a Lower Division state includes delivered water that is stored off-stream for future use by that state or another state.

All mainstream Colorado River waters apportioned to the Lower Basin, except for a few thousand acre-feet (af) apportioned for use in Arizona, have been fully allocated to specific entities and, except for certain federal establishments, placed under permanent water delivery contracts with the Secretary for irrigation or domestic use. These entities include irrigation districts, water districts, municipalities, Indian tribes, public institutions, private water companies, and individuals. Federal establishments with federal reserved rights established pursuant to Article II(D) of the Consolidated Decree are not required to have a contract with the Secretary, but the water allocated to a federal establishment is included within the apportionment of the Lower Division state in which the federal establishment is located; e.g., Fort Mojave Indian Reservation in California and the Havasu National Wildlife Refuge in Arizona.

The highest priority lower Colorado River water rights are present perfected rights (PPRs), which the Consolidated Decree defines as those perfected rights existing on June 25, 1929, the effective date of the BCPA. The Consolidated Decree also recognizes federal Indian reserved rights for the quantity of water necessary to irrigate all the practicably irrigable acreage (lands considered suitable for irrigation) on five Indian reservations along the lower Colorado River. The Consolidated Decree defines the rights of Indian and other federal reservations to be federal

establishment PPRs. PPRs are important because in any year in which less than 7.5 maf of Colorado River water is available for consumptive use in the Lower Division states, PPRs will be satisfied first, in the order of their priority without regard to state lines.

Waters available to a Lower Division state within its apportionment, but having a priority date later than June 25, 1929, have been allocated by the Secretary through execution of water delivery contracts to water users within that state as required by Section 5 of the BCPA.

Allocation of Colorado River water to Mexico is governed by the 1944 Treaty. Article 10(a) of the 1944 Treaty states:

> "(a) A guaranteed annual quantity of 1,500,000 acre-feet (1,850,234,000 cubic meters) to be delivered in accordance with the provisions of Article 15 of this Treaty"

Further, Article 10(b) of the 1944 Treaty provides:

> "(b) Any other quantities arriving at the Mexican points of diversion, with the understanding that in any year in which, as determined by the United States Section, there exists a surplus of waters of the Colorado River in excess of the amount necessary to supply uses in the United States and the guaranteed quantity of 1,500,000 acre-feet (1,850,234,000 cubic meters) annually to Mexico, the United States undertakes to deliver to Mexico, in the manner set out in Article 15 of this Treaty, additional waters of the Colorado River system to provide a total quantity not to exceed 1,700,000 acre-feet (2,096,931,000 cubic meters) a year. Mexico shall acquire no right beyond that provided by this subparagraph by the use of the waters of the Colorado River system, for any purpose whatsoever, in excess of 1,500,000 acre-feet (1,850,234,000 cubic meters) annually."

Additionally, Article 10 of the 1944 Treaty provides:

> "In the event of extraordinary drought or serious accident to the irrigation system in the United States, thereby making it difficult for the United States to deliver the guaranteed quantity of 1,500,000 acre-feet (1,850,234,000 cubic meters) a year, the water allotted to Mexico under subparagraph (a) of this Article will be reduced in the same proportion as consumptive uses in the United States are reduced."

The proposed federal action is for the purpose of adopting additional operational guidelines to improve the Department's annual management and operation of key Colorado River reservoirs for an interim period through 2026. However, in order to assess the potential effects of the proposed federal action in this Draft EIS, certain modeling assumptions (discussed in Chapter 2) are used that display projected water deliveries to Mexico. Reclamation's modeling assumptions

are not intended to constitute an interpretation or application of the 1944 Treaty or to represent current or future United States policy regarding deliveries to Mexico.

The United States will conduct all necessary and appropriate discussions regarding the proposed federal action and implementation of the 1944 Treaty with Mexico through the IBWC in consultation with the Department of State.

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1.7.1.2 Surplus Water Supply Condition Determinations

Surplus conditions exist when the Secretary determines that sufficient mainstream water is available for release to satisfy consumptive use in the Lower Division states in excess of 7.5 maf annually. This excess consumptive use is surplus and is distributed for use in Arizona, California, and Nevada pursuant to the terms and conditions provided in the ISG, adopted in 2001, as agreed by the Lower Basin States. The current provisions of the ISG are scheduled to terminate in 2016.

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In general terms, the ISG link the availability of surplus water to the elevation of Lake Mead. When Lake Mead is full and Reclamation is making flood control releases, surplus supplies are unlimited. As Lake Mead's elevation drops, surplus water amounts are reduced, and ultimately eliminated. Surplus availability is also linked to continued progress by California to take actions to reduce its historic reliance on water in excess of its 4.4 mafy apportionment.

If a state does not use all of its apportioned water for the year, the Secretary may allow other states of the Lower Division to use the unused apportionment, provided that the use is authorized by a water delivery contract with the Secretary.

* * * * *

2.1 Development of Alternatives

Based on the information and comments received during the scoping process, the proposed federal action has been designed to reflect, among others, three important considerations:

1. Encouraging Conservation of Water: Many comments submitted to Reclamation focused on the importance of encouraging and utilizing water conservation as an important tool to better manage limited water supplies and therefore minimize the likelihood and severity of potential future shortages. Water conservation could occur through a number of approaches such as fallowing of land, canal lining, financial incentives to maximize conservation, dry-year options, and associated storage and recovery methodologies and procedures to address conservation actions by particular parties.
2. Consideration of Reservoir Operations at all Operational Levels: Many comments submitted to Reclamation urged Reclamation to consider and analyze management and operational guidelines for the full range of operational levels at Lake Powell and Lake Mead. It was suggested that this approach is integral to the prudent development of new

low-reservoir operational guidelines, as the approach and management of these reservoirs at higher elevations has a direct impact on available storage, thereby affecting the likelihood and severity of potential future shortages.

3. Term of Operational Guidelines: Many comments urged Reclamation to consider interim, rather than permanent, additional operational guidelines. In this manner, Reclamation would have the ability to use actual operating experience for a period of years, thereby facilitating a better understanding of the operational effects of the new guidelines. Modifications could then be made, if necessary, based on this operating experience.

As a result of the analyses of the comments and input received by Reclamation, the following four operational elements of the proposed federal action were developed;

1. **Shortage Guidelines**: Adoption of guidelines that would identify those circumstances under which the Secretary would reduce the annual amount of water available for consumptive use from Lake Mead to the Lower Division states below 7.5 maf, pursuant to the Consolidated Decree.

The primary purpose of this element is the orderly rationing of water supplies during drought and low-reservoir conditions. While Lake Powell and Lake Mead have large storage capacities, water supply demands are increasing and careful management of existing water supplies will help ensure sufficient supplies are available to meet these demands. The proposed shortage guidelines in the alternatives range from aggressive shortages to no reduction of water supplies until the reservoirs are empty. Most of the alternatives have discrete stepped levels of shortage associated with specific Lake Mead reservoir elevations.

2. **Coordinated Reservoir Operations**: Adoption of guidelines for the coordinated operation of Lake Powell and Lake Mead to provide improved operation of these two reservoirs, particularly under low-reservoir conditions.

Lake Powell and Lake Mead operations are currently coordinated only under high reservoir elevations through storage equalization. The action alternatives consider various options designed to better utilize existing reservoir storage throughout the full range of reservoir operations to enhance both water supply and other benefits of the reservoir system for both basins.

3. **Intentionally Created Surplus Guidelines.**: Adoption of guidelines for the intentional creation of surplus water and Secretarial declaration of surplus in order to make conserved Colorado River system and non-system water available in the Lower Colorado River to those who create such surplus water, pursuant to applicable federal law, to increase the flexibility of meeting water use needs from Lake Mead, particularly under drought and low-reservoir conditions.

One way to increase water deliveries during drought is the augmentation of existing water supplies through extraordinary conservation, system efficiency projects, tributary conservation and water importation . The alternatives consider options for the intentional creation of surplus water ("ICS") in Lake Mead whereby system and non-system water may be conserved in Lake

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Mead, with various limits on the maximum amount and delivery of the ICS. The alternatives range from an operational scenario that considers no new mechanism (status quo) to a maximum Lake Mead ICS volume of 4.2 maf.

Reclamation will establish guidelines for administration of ICS as part of this public NEPA process. The guidelines will set forth Reclamation requirements for verification of the creation of ICS and water accounting procedures. Although the guidelines for this element are interim and will expire in 2026, some of the conservation projects established under the guidelines could be permanent in duration.

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4. **Interim Surplus Guidelines (ISG)**: Adoption of guidelines that would identify the conditions under which the Secretary may declare the availability of surplus water for use within the Lower Division states. The proposed federal action would modify the substance of the existing ISG and extend the term of the ISG from 2016 to 2026.

The ISG are due to expire in 2016. The alternatives range from termination of the permissive provisions of the existing ISG in 2007 to extension of the current provisions of the ISG through 2026. This element of the proposed federal action helps establish an operational strategy for the full range of reservoir operations through 2026.

The alternatives considered and analyzed in this Draft EIS include some formulation of each of these four operational elements.

Reclamation has developed four action alternatives for analysis in this EIS. These alternatives reflect input from Reclamation staff, the cooperating agencies, stakeholders, and other interested parties. Reclamation received two written proposals for alternatives that met the purpose and need of the proposed federal action, one from the Basin States and another from a consortium of environmental organizations. These proposals were used by Reclamation to formulate two of the alternatives considered and analyzed in this Draft EIS. A third alternative (Water Supply Alternative) was developed by Reclamation and a fourth alternative (Reservoir Storage Alternative) was developed in coordination with the NPS and Western. The alternatives were posted on Reclamation's website (http://www.usbr.gov/lc/region/programs/strategies.html) on June 30, 2006.

Reclamation has not identified a preferred alternative in this Draft EIS. The preferred alternative will be identified following public comments on the Draft EIS and will be expressed in the Final EIS. The preferred alternative may be one of the specific alternatives described below or it may incorporate elements or variations of these alternatives.

2.2 No Action Alternative

The No Action Alternative provides a baseline against which action alternatives can be compared. The No Action Alternative represents a projection of current conditions to the most reasonable future responses or conditions that could occur during the life of the proposed federal action without any action alternative being implemented.

Pursuant to the LROC, the Secretary makes a number of determinations at the beginning of each operating year through the development and execution of the AOP, including the water supply available to users in the Lower Basin and the annual release from Lake Powell. The LROC do not include specific guidelines for such determinations. Furthermore, there is no actual operating experience under very low reservoir conditions, e.g., there has never been a shortage determination in the Lower Basin. Therefore, in the absence of specific guidelines, the outcome of the annual determination in any particular year in the future cannot be precisely known. However, a reasonable representation of future conditions under the No Action Alternative is needed for comparison to each action alternative. The modeling assumptions used for this representation are consistent with assumptions used in previous environmental compliance documents for the ISG, the Colorado River Water Delivery Agreement, and the LCR MSCP (Section 1.8). However, the assumptions used in the No Action Alternative are not intended to limit or predetermine the action decision in any future AOP determination.

The formulation of the four elements for the No Action Alternative follows.

2.2.1 Shortage Guidelines

Each year, the Secretary makes a determination as to whether the consumptive use requirements of mainstream users in the Lower Division states will be met under a Normal, Surplus, or Shortage condition, in accordance with the Consolidated Decree and the LROC. The LROC specify that the Secretary will consider all relevant factors in making a shortage determination and list some of the factors to be considered. However, there is no specific guidance as to exactly when, how, or to whom reductions in deliveries would be made. Therefore, it is impossible to know exactly how the Secretary might make a shortage determination in the future. Furthermore, conditions in the Colorado River Basin have been such that there has not been a need to declare a Shortage condition and there is no actual operating experience with regard to shortage determinations.

To obtain a reasonable representation of future conditions under no action (while not representing official policy of the Department with regard to future determinations), the following assumptions were made;

- As used in modeling assumptions for previous environmental compliance documents, shortage trigger elevations (Figure 2.2-1) were used to prevent Lake Mead's water level from declining below elevation 1,050 feet msl with approximately an 80 percent probability (known as a "Level 1 Shortage", Appendix A). In a given year, a shortage (or reduction in deliveries) that ranges from approximately 350 to 500 kaf would be imposed when the projected January 1 Lake Mead elevation is below the trigger elevation for that year; and
- If Lake Mead's elevation were to continue to decline, additional reductions would be imposed to keep Lake Mead above 1,000 feet msl. This approach essentially provides absolute protection of SNWA's lower intake (elevation 1,000 feet msl) at Lake Mead and would reduce deliveries to water users (including SNWA) by amounts required to maintain the Lake Mead water level at or above 1,000 feet msl.

In accordance with the Consolidated Decree, the CRBPA, and other key provisions of the Law of the River, the Secretary has the authority to declare and allocate shortages to the Lower Division states. Although some guidance exists with regard to how shortages would be allocated (e.g., PPR deliveries must be met without regard to state lines, California does not incur shortages until Arizona post-1968 contracts are reduced completely), there are no specific guidelines in place to further inform the Secretary's decision with respect to how shortages might be shared by the water users in Arizona, California and Nevada. In addition, the determination of deliveries to Mexico is not a part of the proposed federal action. Any such determination would be made in accordance with the 1944 Treaty (Section 1.7).

Nevertheless, modeling assumptions with respect to the distribution of shortages for the Lower Division states and Mexico are necessary in order to analyze potential impacts to hydrologic and other environmental resources. These modeling assumptions were applied to the No Action Alternative as well as the action alternatives, i.e., the modeling assumptions with regard to the distribution of shortages are identical in all alternatives.

It was assumed that shortages would be allocated to each Lower Division state and Mexico based on percentages of the total shortage being applied. The modeling assumptions for distribution of shortages used in this Draft EIS are presented in Table 2.2-1. More detailed descriptions of these modeling assumptions are provided in Appendix A under Stage 1.

Shortages are first imposed under Stage 1 and would be applied to the most junior users within Arizona (those with post-1968 water rights, i.e., 4t and 5th priority rights within Arizona) and Nevada (primarily the SNWA). Stage 1 shortages continue until the deliveries to the post-1968 water rights holders in Arizona (including the CAP) are reduced to zero. The maximum amount of Stage 1 shortages during the period of analysis is dependent on the scheduled depletions for the post-1968 water rights holders and decreases over time from approximately 1.8 maf in 2008 to 1.7 maf in 2060.

After deliveries to the 4th and 5th priority rights within Arizona are reduced to zero, additional reductions are applied to Arizona, California, and Nevada. These shortages, referred to as Stage 2 shortages, continue to the maximum necessary to keep Lake Mead elevation above 1,000 feet nisi.

2.2.2 Coordinated Reservoir Operations

The No Action Alternative assumes Lake Powell's operation would follow the current operating criteria as specified by the LROC and as implemented through the AOP process. The three possible factors affecting the annual releases from Lake Powell are: 1) minimum objective release; 2) storage equalization; and 3) spill avoidance.

Pursuant to the LROC, the objective under current operational conditions is to maintain a minimum release of water from Lake Powell of 8.23 maf for the water year. Under the No Action Alternative, a minimum release of 8.23 maf is assumed to be made each water year unless storage equalization or spill avoidance determinations are in effect.

Annual releases from Lake Powell greater than the minimum objective release occur when Upper Basin storage is greater than the storage required by 602(a) storage, and the storage in Lake Powell is forecast to be greater than the storage in Lake Mead by the end of that water year. Under these conditions, additional releases are made from Lake Powell to equalize the storage in Lake Mead with the storage in Lake Powell by the end of the water year.

The 602(a) storage requirement specifies the amount of storage in Upper Basin reservoirs necessary to assure deliveries to the Lower Basin in compliance with the Compact without impairment to the annual consumptive use in the Upper Basin. If the 602(a) storage requirement is not met, equalization does not occur. The LROC specifies that all relevant factors including historic stream flows, the most critical period of record, the probabilities of water supply, and estimated future depletions be considered when determining the 602(a) storage amount.

In 2004, an Interim 602(a) Storage Guideline was adopted that specifies that through 2016, the 602(a) storage requirement shall utilize a storage amount of not less than 14.85 maf which corresponds to 3,630 feet msl for Lake Powell. Under the No Action Alternative, the determination of 602(a) storage is consistent with the storage criterion and the provisions of the Interim 602(a) Storage Guideline. The algorithm used to calculate the 602(a) storage requirement is presented in Appendix A.

Annual release volumes from Lake Powell greater than the minimum objective of 8.23 maf may also be made to avoid anticipated spills. An objective in the operation of Glen Canyon Dam is to attempt to safely fill Lake Powell each summer. When carryover storage from the previous year in combination with forecasted inflow is projected to exceed Lake Powell's storage capacity, Reclamation schedules the release of the volumes of water needed to avoid spills. Subject to actual inflows, Lake Powell is operated to reach storage of about 23.8 maf in July (0.5 maf from full pool). In years when Lake Powell fills or nearly fills during the summer, additional releases in the late summer and early winter are made to draw the reservoir level down, so that there is at least 2.4 maf of vacant space in Lake Powell on September 30 for flood protection. Under the No Action Alternative, it is assumed that spill avoidance releases are made when necessary.

2.2.3 Intentionally Created Surplus Guidelines

There are currently no guidelines in place for the creation and delivery of intentionally created surplus water ("ICS") in Lake Mead; therefore, the No Action Alternative assumes that none will exist during the interim period.

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2.2.4 Interim Surplus Guidelines

The ISG specify ranges of Lake Mead elevations and operational conditions that are used to determine the availability of surplus water for each year during their effective term. The elevation ranges are coupled with specific uses of surplus water so that if Lake Mead's elevation declines, the amount of surplus water is reduced. The different surplus conditions are described below:

2.2.4.1 Flood Control Surplus

If flood control releases are anticipated to be required given the current inflow forecast, the Secretary declares Flood Control Surplus conditions for that year. The estimated annual amount of surplus water available for pumping and release from Lake Mead (in addition to the 7.5 maf normal apportionment) varies over time (2002 to 2016) and ranges between 1.20 to 1.58 mafy. Under current practice, Mexico is allowed to schedule up to an additional 200 thousand acre-feet (kaf) pursuant to the 1944 Treaty during flood control years when water supplies exceed those required for use in the United States.

2.2.4.2 Quantified Surplus (70R Strategy)

If flood control releases are anticipated to be required assuming the 70`h percentile inflow (the inflow value from the historical record that has not been exceeded more than 30 percent of the time), the Secretary declares Quantified Surplus conditions for that year. The estimated annual amount of surplus water available for pumping and release from Lake Mead (in addition to the 7.5 maf normal apportionment) varies over time (2002 to 2016) and ranges between 1.02 to 1.45 mafy.

2.2.4.3 Full Domestic Surplus (Lake Mead at or above Elevation 1,145 feet msl)

If the projected January 1 Lake Mead elevation is at or above 1,145 feet msl but below the elevation calculated by the 70R Strategy, the Secretary declares a Full Domestic Surplus condition for that year. The projected annual amounts of surplus water available for pumping and release from Lake Mead (in addition to the 7.5 maf normal apportionment) vary over time (2002 to 2016) and range between 340 to 535 thousand acre-feet per year (kafy).

2.2.4.4 Partial Domestic Surplus (Lake Mead at or above Elevation 1,125 feet msl)

If the projected January 1 Lake Mead elevation is at or above 1,125 feet msl and below 1,145 feet msl, the Secretary declares Partial Domestic Surplus conditions for that year. The estimated annual amounts of surplus water available for pumping and release from Lake Mead (in addition to the 7.5 maf normal apportionment) vary over time (2002 to 2016) and range between 90 to 375 kafy.

2.2.4.5 Normal and Shortage Conditions (Lake Mead below Elevation 1,125 feet msl)

If the projected January 1 Lake Mead elevation is at or below 1,125 feet msl, the Secretary declares Normal conditions or Shortage conditions for that year.

Under the No Action Alternative, surplus determinations through 2016 would be as described above. After 2016, it is assumed that surplus determinations would only be based on the more conservative Quantified Surplus (70R Strategy) and Flood Control Surplus conditions. Further details of these modeling assumptions to represent the ISG are presented in Appendix A.

2.3 Basin States Alternative

The Basin States Alternative proposes a coordinated operation of Lake Powell and Lake Mead that would minimize shortages in the Lower Basin and avoid risk of curtailments of use in the Upper Basin. This alternative also provides for ICS guidelines in order to promote extraordinary conservation, system efficiency, tributary conservation and importation of non-system water in the Lower Basin. The formulation of the four elements for the Basin States Alternative follows.

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2.3.1 Shortage Guidelines

The Basin States Alternative provides discrete stepped levels of shortage associated with specific Lake Mead elevations as presented below. This alternative provides criteria for shortages of up to a maximum of 600 kaf at Lake Mead elevation of 1,025 feet msl and suggests that consultations between the Basin States and Reclamation would be undertaken to define additional shortages below that elevation. The possible outcomes of such a consultation process are unknown; therefore, for modeling purposes it was assumed that shortages of 600 kaf would continue to be applied at Lake Mead elevations below 1,025 feet msl. The stepped shortages modeled under the Basin States Alternative are as follows:

- When Lake Mead is projected to be below elevation 1,075 feet msl and at or above 1,050 feet msl on January 1, a shortage of 400 kaf shall be declared for that year;
- When Lake Mead is projected to be below elevation 1,050 feet msl and at or above 1,025 feet msl on January 1, a shortage of 500 kaf shall be declared for that year;
- When Lake Mead is projected to be below elevation 1,025 feet msl on January 1, a shortage of 600 kaf shall be declared for that year; and
- When Lake Mead elevation approaches the top of the dead pool (895 feet msl), the deliveries from Lake Mead are reduced to the amount of water available.

2.3.2 Coordinated Reservoir Operations

Under the Basin States Alternative, the annual Lake Powell release is based on a volume of water in storage or corresponding elevation in Lake Powell and Lake Mead as described below.

2.3.2.1 Equalization

The Basin States Alternative provides an elevation schedule (Table 2.3-1) that would be used in determining when equalization releases would be made.

When Lake Powell is at or above these specified elevations and when the volume of Lake Powell is projected to be greater than the volume of Lake Mead at the end of the water year, Lake Powell would release greater than 8.23 mafy to equalize its volume with Lake Mead. Otherwise, 8.23 maf is released from Lake Powell.

2.3.2.2 Upper Elevation Balancing

When Lake Powell is below the elevations stated in Table 2.3-1 and is projected to be at or above 3,575 feet msl at the end of the water year, a release in the amount of 8.23 maf from Lake Powell would be made if the projected elevation of Lake Mead is at or above 1,075 feet msl at the end of the water year. If the projected end of water year elevation of Lake Mead is below 1,075 feet msl, the volumes of Lake Mead and Lake Powell would be balanced if possible, within the constraint that the release from Lake Powell would not be more than 9.0 maf and no less than 7.0 maf.

2.3.2.3 Mid-Elevation Releases

When Lake Powell elevation is projected to be below 3,575 feet msl and at or above 3,525 feet msl at the end of the water year, a release in the amount of 7.48 maf would be made if the projected end of water year elevation of Lake Mead is at or above 1,025 feet msl. If the projected end of water year elevation of Lake Mead is below 1,025 feet msl, a release of 8.23 maf from Lake Powell would be made.

2.3.2.4 Lower Elevation Balancing

When the projected end of water year elevation of Lake Powell is below 3,525 feet msl, Lake Mead and Lake Powell would be balanced if possible, within the constraint that the release from Lake Powell would not be more than 9.5 maf and no less than 7.0 maf.

2.3.3 Intentionally Created Surplus Guidelines

The Basin States Alternative includes the adoption of guidelines for the creation and delivery of ICS to encourage and account for augmentation and conservation of water supplies, e.g., fallowing of land, canal lining, system efficiency improvements, tributary conservation and introduction of non-system water in the Lower Basin.

In addition to increasing the flexibility of meeting water use needs from Lake Mead, the ICS would benefit the system by providing more water in Lake Mead. At the time ICS is created, five percent of the ICS would be dedicated to the system on a one-time basis. Additionally, ICS in Lake Mead longer than one year would be subject to annual evaporation losses of three percent per year. If flood control releases occur, ICS would be reduced on a pro-rata basis among all holders of ICS until no ICS remains, i.e., ICS would be released first. No ICS would be available for delivery in shortage years. However, Developed Water (water produced by tributary conservation and imported non-system water) would be available for delivery during a declared shortage, with certain limitations.

The maximum amount of ICS that can be created during any year, the maximum cumulative amount of ICS that can be available at any one time, and the maximum amount of ICS that may be recovered for use in each Basin State in any one year under this alternative are presented in Table 2.3-2.

Table 2.3-2

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Basin States Alternative

Volume Limitations of ICS

Entity	***Maximum Annual Creation of ICS (kaf)***	***Maximum Cumulative Total ICS (kaf)***	***Maximum Annual Deliveries of ICS (kaf)***
Arizona	*100*	*300*	*300*
California	*400*	*1,500*	*400*
Nevada	*125*	*300*	*300*
Total	***625***	***2,100***	***1,000***

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2.3.4 Interim Surplus Guidelines

The Basin States Alternative includes both a modification and an extension of the ISG. The ISG would be extended through 2026 and be modified by eliminating the Partial Domestic Surplus condition, beginning in 2008, and limiting the amount of water available under the Full Domestic Surplus condition during the period 2017 through 2026.1 The elimination of the Partial Domestic Surplus condition reduces the amount of surplus water that could be made available and leaves more water in storage to reduce the severity of future shortages.

2.4 Conservation Before Shortage Alternative

The Conservation Before Shortage Alternative was developed by a coalition of NGOs, including Defenders of Wildlife, Environmental Defense, National Wildlife Federation, Pacific Institute, Sierra Club, Sonoran Institute, The Nature Conservancy, and the Rivers Foundation of the Americas. The Conservation Before Shortage Alternative includes voluntary, compensated reductions in water use to minimize involuntary shortages in the Lower Basin and avoid risk of curtailments of use in the Upper Basin. This alternative also provides a mechanism for promoting water conservation in the Lower Basin by expanding the ICS mechanism. The formulation of the four elements for the Conservation Before Shortage Alternative follows.

2.4.1 Shortage Guidelines

Although the Conservation Before Shortage Alternative does not include stepped, involuntary shortages, it does include voluntary conservation levels similar to the Basin States Alternative shortage levels described in Section 2.3. These voluntary conservation levels are described below.

During 2017 through 2026, the distribution of Domestic Surplus water would be limited as follows: 1) for use by MWD, 250 kafy in addition to the amount of California's basic apportionment available to MWD; 2) for use by SNWA, 100 kafy in addition to the amount of Nevada's basic apportionment available to SNWA; and 3) for use in Arizona, 100 kafy in addition to the amount of Arizona's basic apportionment available to Arizona contractors.

This alternative provides a shortage strategy that would absolutely protect Lake Mead elevation of 1,000 feet msl whereby water deliveries would be reduced by the amount required to maintain Lake Mead elevations at or above 1,000 feet msl.

2.4.2 Coordinated Reservoir Operations

The Conservation Before Shortage Alternative assumes the same coordinated reservoir operations as the Basin States Alternative described in Section 2.3.

Intentionally Created Surplus Guidelines. The ICS triggers proposed under this alternative are as follows:

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- When Lake Mead is projected to be below elevation 1,075 feet msl and at or above 1,050 feet msl on January 1, the Secretary will seek the conservation of 400 kaf of water which would become ICS;
- When Lake Mead is projected to be below elevation 1,050 feet msl and at or above 1,025 feet msl on January 1, the Secretary will seek the conservation of 500 kaf of water which would become ICS; and
- When Lake Mead is projected to be below 1,025 feet msl on January 1, the Secretary will seek the conservation of 600 kaf of water become ICS.

The ICS would be generated by activities similar to those described in the Basin States Alternative (Section 2.3). In addition, participation in the ICS program would be expanded to include other entities as shown in Table 2.4-1.

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The maximum amount of ICS that can be created during any year, the maximum cumulative amount of ICS that can be available at any one time, and the maximum amount of ICS that may be recovered by each entity in any one year under this alternative are presented in Table 2.4-1.

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Table 2.4-1

Conservation Before Shortage Alternative

Volume Limitations of ICS

Entity	***Maximum Annual Creation of ICS (kaf)***	***Maximum Cumulative Total ICS (kaf)***	***Maximum Annual Deliveries of ICS (kaf)***
Arizona	*100*	*300*	*300*
California	*400*	*1,500*	*400*
Nevada	*125*	*300*	*300*

Unassigned	*825*	*2,100*	*600*
Total	***1,450***	***4,200***	***1,600***

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2.5 Water Supply Alternative

The Water Supply Alternative is intended to maximize water deliveries at the expense of retaining water in storage in the reservoirs for future use. This alternative would implement shortages only when insufficient water to meet entitlements is available in Lake Mead. The formulation of the four elements for the Water Supply Alternative follows.

2.5.1 Shortage Guidelines

Under the Water Supply Alternative, shortages would not be imposed until Lake Mead nears elevation 895 feet msl (top of the dead pool). Near that elevation, releases would be limited to the amount of water available. However, when Lake Mead elevation drops below 1,000 feet msl SNWA would be unable to take water through its lower intake.

2.5.2 Coordinated Reservoir Operations

When Lake Powell elevation is projected to be above 3,575 feet msl at the end of the water year, the operation of Lake Powell is the same as the No Action Alternative unless Lake Mead elevation is below 1075 feet msl. When Lake Powell elevation is projected to be below 3,575 feet msl at the end of the water year or Lake Mead elevation is projected to be below 1,075 feet msl at the end of the water year, the volumes of Lake Powell and Lake Mead would be balanced if possible, within the constraint that the release from Lake Powell would not be more than 9.5 maf and no less than 7.0 maf.

2.5.3 Intentionally Created Surplus Guidelines

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The Water Supply Alternative does not include a guidelines for the creation and delivery of ICS.

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11 conserved system and non-system water in Lake Mead.

2.5.4 Interim Surplus Guidelines

Under this alternative, the existing ISG would be extended through 2026.

2.6 Reservoir Storage Alternative

The Reservoir Storage Alternative was developed in coordination with the cooperating agencies and other stakeholders, primarily Western and the NPS. This alternative would keep more water in storage in Lake Powell and Lake Mead by reducing water deliveries and increasing shortages to benefit power and recreational interests. This alternative also provides a mechanism for promoting water conservation in the Lower Basin. The formulation of the four elements for the Reservoir Storage Alternative follows.

2.6.1 Shortage Guidelines

The Reservoir Storage Alternative is similar to the Basin States Alternative in that it provides

discrete stepped levels of shortage associated with specific Lake Mead reservoir elevations (Section 2.3). However, shortages in this alternative begin at a higher Lake Mead elevation and the stepped shortages are larger so that more water would be retained in storage and higher Lake Powell and Lake Mead elevations would be maintained. The Reservoir Storage Alternative does not contain provisions that would protect the Lake Mead elevation of 1,000 feet msl.

The stepped shortages under this alternative are as follows:

- When Lake Mead is projected to be below elevation 1,100 feet msl and at or above 1,075 feet msl on January 1, a shortage of 600 kaf would be imposed for that year;
- When Lake Mead is projected to be below elevation 1,075 feet msl and at or above 1,050 feet msl on January 1, a shortage of 800 kaf would be imposed for that year;
- When Lake Mead is projected to be below elevation 1,050 feet msl and at or above 1,025 feet msl on January 1, a shortage of 1,000 kaf would be imposed for that year; and
- When Lake Mead is projected to be below 1,025 feet msl on January 1, a shortage of 1,200 kaf would be imposed for that year.

2.6.2 Coordinated Reservoir Operations

When Lake Powell elevation is projected to be above 3,595 feet msl at the end of the water year, the operation of Lake Powell would be the same as under the No Action Alternative. Elevations at Lake Powell that trigger releases that are less than the minimum objective release of 8.23 maf are tied to critical recreation elevations at Lake Powell as follows:

- When Lake Powell elevation is projected to be below 3,595 feet msl and above 3,560 feet msl at the end of the water year, a release in the amount of 7.80 maf from Lake Powell would be made; and
- When Lake Powell elevation is projected to be below 3,560 feet msl at the end of the water year, the volumes of Lake Powell and Lake Mead would be balanced if possible, within the constraint that the release from Lake Powell would not be more than 9.5 maf and no less than 7.8 maf.

2.6.3 Intentionally Created Surplus Guidelines

Under the Reservoir Storage Alternative, ICS would be created by activities similar to those described under the Basin States Alternative (Section 2.3). Participation in ICS program would include the entities as shown in Table 2.6-1.

The maximum amount of ICS that can be created during any year, the maximum cumulative amount of ICS that can be available at any one time, and the maximum amount of ICS that may be recovered by each entity in any one year under this alternative are presented in Table 2.6-1.

Table 2.6-1
Reservoir Storage Alternative
Volume Limitations of ICS

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Entity	Maximum Annual ICS (kaf)	Maximum Cumulative Total ICS (kaf)	Maximum Annual Delivery of ICS (kaf)
Arizona	100	300	300
California	400	1,500	400
Nevada	125	300	300
Unassigned	475	950	950
Total	1,100	3,050	1,950

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2.6.4 Interim Surplus Guidelines

Under the Reservoir Storage Alternative, the permissive provisions of the existing ISG are terminated in 2007 and surplus determinations revert to the Quantified Surplus and Flood Control Surplus conditions during the period beginning in 2008 and ending in 2026.

2.7 Summary Comparison of Alternatives

A summary comparison of the alternatives identified and analyzed is provided in Table 2.7-1 through Table 2.7-3 for Lake Powell and Lake Mead.

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TABLE 2.7-1

Matrix of Alternatives

Alternatives	Shortage Guidelines to reduce deliveries from Lake Mead (elevations in feet msl)	Coordinated Reservoir Operations (Lake Mead & Lake Powell) (elevations in feet msl)	Intentionally Created Surplus	Interim Surplus Guidelines for deliveries/releases from Lake Mead
No Action	• Determination made through the AOP process, absent shortage guidelines • Reasonably represented by a two-level shortage strategy – probabilistic protection of Lake Mead elevation 1,050 and absolute protection of Lake Mead elevation 1,000	• Minimum objective release of 8.23 maf from Lake Powell unless storage equalization releases are required • Operation at low reservoir levels reasonably represented by a 8.23 maf release from Lake Powell down to Lake Powell dead pool	• No guidelines for creation and delivery of ICS. r	• No modification or extension of the ISG which end in 2016 • After 2016, determination made through the AOP process, absent surplus guidelines; reasonably represented by the spill avoidance (referred to as the 70R Strategy)
Basis States	• Shortages (i.e., reduced deliveries) of 400,500 and 600 kaf from Lake Mead at elevations 1,075, 1,050, and 1,025 respectively • Initiate efforts to develop additional guidelines for shortages if Lake Mead falls below elevation 1,025 (Note: includes reconsultation with Basin States	• Under high reservoir conditions, minimum objective release of 8.23 maf from Lake Powell unless storage equalization release are required • Under lower reservoir conditions, either reduce Lake Powell release or balance volumes depending upon elevation at Lake Powell and Lake Mead	• Guidelines for the creation and delivery of ICS for augmentation by extraordinary conservation , system efficiency, tributary conservation and importation of non system water • Maximum total ICS in Lake Mead of 2.1 maf • System assessment of 5 percent of ICS.	• Modification of ISG to eliminate Partial Domestic Surplus condition • Extension of the modified guidelines through 2026
Conservation Before Shortage	• Shortages are implemented in any given year when necessary to keep Lake Mead above SNWA's lower intake at elevation 1,000 (absolute protection of elevation 1,000)	• Under high reservoir conditions, minimum objective release of 8.23 maf from Lake Powell unless storage equalization releases are required • Under lower reservoir conditions, either reduce Lake Powell release or balance volumes depending upon	• Guidelines for the creation and delivery of different volumes of ICS tied to Lake Mead elevation • Guidelines for the creation Storage and delivery of ICS for augmentation by extraordinary conservation ed, system	• Modification of ISG to eliminate Partial Domestic Surplus condition • Extension of the modified guidelines through 2026

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Alternatives	Shortage Guidelines to reduce deliveries from Lake Mead (elevations in feet msl)	Coordinated Reservoir Operations (Lake Mead & Lake Powell) (elevations in feet msl)	Intentionally Created Surplus	Interim Surplus Guidelines for deliveries/releases from Lake Mead
		elevation at Lake Powell and Lake Mead	efficiency, tributary conservation and importation of system and/or non system water • • Water for environmental uses • Maximum total ICS greater than 4.2 maf • System assessment of 5 percent of ICS	
Water Supply	• Release full annual entitlement amounts until Lake Mead is drawn down to dead pool (elevation 895)	• Minimum objective release of 8.23 maf from Lake Powell unless storage equalization releases are required • Balancing if Lake Powell is below elevation 3,575 or Lake Mead is below elevation 1,075	• No guidelines for creation and delivery of ICS.	• Extension of the existing ISG through 2026
Reservoir Storage	• Shortages (i.e. reduced deliveries) of 600, 800, 1,000 and 1,200 kaf from Lake Mead at elevations 1,100, 1,075, 1,050, and 1,025 respectively	• Minimum objective release of 8.23 maf from Lake Powell if Lake Powell is above elevation 3,595 unless storage equalization releases are required • 7.8 maf release from Lake Powell between Lake Powell elevations of 3,560 and 3,595 • Balancing below Lake Powell elevation of 3,560	• Guidelines for the creation Storage and delivery of ICS for augmentation by extraordinary conservation ed, system efficiency, tributary conservation and importation of system and/or non system water • r • Maximum total ICS of 3.05 maf • System assessment of 10 percent of ICS.	• Permissive provisions of existing ISG terminate in 2007, and during period from 2008 to 2026, surplus determinations are limited to Quantified and Flood Control Conditions.

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SECTIONS 3.1 THROUGH 4.2.7 ARE UNCHANGED AND INTENTIONALLY OMITTED.

4.2.8 Modeling Assumptions Specific to Alternatives

Each alternative includes specific assumptions with regard to the four operational elements of the proposed federal action. Assumptions with regard to Shortage Guidelines, Coordinated Reservoir Operations, and the ISG were presented in Chapter 2 and are detailed in Appendix A. In this section, the assumptions with regard to the Creation and Delivery of ICS element are summarized. Details of these assumptions are presented in Appendix M.

Modeling Assumptions Regarding Creation and Delivery of ICS The general concept of creation and delivery of ICS is that water users could conserve system water or non-system water and order equivalent quantities of water in Lake Mead to be delivered in non-shortage years, subject to specified losses and other conditions. .

Three alternatives assume ICS guidelines (Basin States Alternative, Conservation Before Shortage Alternative, and Reservoir Storage Alternative). Each alternative specifies the maximum amount of ICS that can be created during any year, the maximum amount of ICS that may be recovered during any year, and the maximum cumulative amount of ICS that can be available at any one time (Tables 2.3-2, 2.4 1, and 2.6-1). These volume limitations are recognized in the model as are other rules that specify under which water supply conditions ICS may be delivered.

Under all three alternatives, it is assumed that specific losses would be applied to the ICS in Lake Mead, including a one-time system assessment, and yearly evaporation losses. At the time the ICS is created, the entity that generates the ICS is required to dedicate a percent of the ICS to the system, defined as a system assessment, on a one-time basis to provide a water supply benefit to the system. For the Basin States Alternative and the Conservation Before Shortage Alternative, the system assessment is assumed to be five percent. For the Reservoir Storage Alternative, the system assessment is assumed-to be ten percent. Additionally, ICS in Lake Mead is subject

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to annual evaporation losses which are assumed to be three percent per year. The exception to this is during Shortage conditions, when no evaporation loss is applied.

At this time, it is unknown which entities might participate in an ICS program. Furthermore, the timing and magnitude of the creation and delivery of ICS is unknown. However, modeling assumptions with respect to the entities that might participate and their respective level of participation were needed to enable the evaluation of the ICS program and its potential effects on environmental resources, particularly to reservoir storage and river flows below Lake Mead.

Table 4.2-3 summarizes the modeling assumptions with regard to the entities that were assumed to participate under each alternative, the activities undertaken to create ICS, and the water supply conditions under which ICS could occur. Appendix M further describes these and other key modeling assumptions. The proposed federal action is for the purpose of adopting additional operational strategies to improve the Department's annual management and operation of key Colorado River reservoirs. However, in order to assess the potential effects of the proposed federal action in this Draft EIS, certain modeling assumptions are used that display projected water deliveries to Mexico. Reclamation's modeling assumptions are not intended to constitute an interpretation or application of the 1944 Treaty or to represent current or future United States policy regarding deliveries to Mexico. The United States will conduct all necessary and appropriate discussions regarding the proposed federal action and implementation of the 1944 Treaty with Mexico through the IBWC in consultation with the Department of State 1.

Under the Conservation Before Shortage Alternative, extraordinary conservation is assumed to occur during voluntary shortage conditions but not during involuntary shortage conditions.

Notwithstanding the lack of an existing mechanism to implement such modeling assumptions, Reclamation utilized these assumptions for a number of reasons, including the following: (1) a larger volume of potential storage in Lake Mead is identified and the associated impacts are thereby analyzed; (2) the maximum potential changes to river flows below Hoover Dam are identified and the associated

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impacts analyzed; (3) the assignment of water conservation amounts to entities in the Lower Basin states in excess of amounts currently requested by each state is avoided; and (4) a program of potential future cooperation between the United States and Mexico is identified.

mechanism in place. For each alternative, the inclusion of the mechanism has the effect of decreasing the probability of shortages. Under the Basin States and Conservation Before Shortage alternatives the probability of shortage is reduced an average of about five percent from 2010 through 2026. Under the Reservoir Storage Alternative the reduction is greater, an average of 12 percent from 2010 through 2026, due to the greater amount of storage credits that are assumed to be generated under this alternative.

Table 4.2-3
Modeling Assumptions Creation and Delivery of ICS r

Water Supply Condition		BS, CBS &RS [1]						CBS & RS	CBS	RS
		California	Arizona	Nevada				Mexico	Federal	Federal
		Extraordin Conservati	Extraordin Conservati	Tributary Conservati	Groundwat	Desalinizati	Drop 2 Reservoir	Extraordina Conservati	Extraordin Conservat	Extraord Conserva
Flood Control Surplus	Store	No	No	No	No	No	No	No	No	No
	Deliver	No	No	No	No	No	No	No	No	No
Quantified (70R) Surplus	Store	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
	Deliver	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Full Domestic Surplus	Store	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
	Deliver	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Normal	Store	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Deliver	Yes	yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Shortage (involuntary voluntary)	Store	No	No	Yes	Yes	Yes	No	No	No [3]	Yes
	Deliver	No	No	Yes	Yes	Yes	No	No	No	Yes
System Assessment		Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Period of Activity		2006-2026	2017-2026	2009-2060	2009-2060	2020-2060	Temporary	2008-2026	2008-	2008-

Notes:

1. *BS = Basin States Alternative, CBS = Conservation Before Shortage Alternative,* RS = Reservoir *Storage Alternative*
2. *yes = activity assumed to occur*
3. *no = activity assumed to not occur*
4. *Beginning in 2012, Nevada is assumed* to *receive 40 kafy of the water conserved by the Drop* 2 *Reservoir during*

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Normal and Surplus years *until* a *total of 300 kaf has been credited to Nevada. Thereafter, water conserved by the Drop* 2 *Reservoir* is *assumed to be system water.*

5. *Under the Conservation Before Shortage Alternative, extraordinary conservation is assumed to be undertaken by the federal government during voluntary shortage conditions but not during involuntary shortage conditions*

6 *These modeling assumptions do not reflect policy decisions and are not intended to constitute an interpretation* or *application* of *the* 1944 *Treaty. They have been developed* for *comparison* of *the alternatives.*

4.4.4.1 Shortage Conditions

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Sensitivity of Shortage Conditions to the Creation and Delivery of ICS. The ICS program assumed as part of the Basin States, Conservation Before Shortage and Reservoir Storage Alternatives impacts the probability of shortage occurrences. Because a potential effect of the ICS program is an increase in the amount of water in Lake Mead, a Shortage condition is likely to occur less often with the ICS guidelines in place. Figure 4.4-7 presents the sensitivity of the occurrence of a Shortage condition to the creation and delivery of ICS by comparing these three alternatives with and without the ICS guidelines in place. For each alternative, the inclusion of ICS has the effect of decreasing the probability of Shortages. Under the Basin States and Conservation Before Shortage alternatives, the probability of Shortage is reduced an average of about five percent from 2010 through 2026. Under the Reservoir Storage alternative the reduction is greater, an average of 12 percent from 2010 through 2026, due to the greater amount of ICS that is assumed to be generated under this alternative.

Figure 4.4-7
Involuntary and Voluntary Lower Basin Shortages
Comparison of Action Alternatives With and Without ICS
Probability of Occurrence of any Amount
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4.4.4.2 Surplus Conditions

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A Surplus condition exists in a particular year when the Secretary determines that there is sufficient mainstream water available to satisfy in excess of 7.5 maf of consumptive use in the Lower Division states. The elements of the proposed federal action include a modification and/or extension of the ISG and each alternative expresses a particular assumption for determining Surplus conditions (Chapter 2).

Probability of Surplus of Any Amount. Figure 4.4-8 compares the probabilities of Surplus conditions between the alternatives. For the No Action Alternative, the probability of surplus drops from about 40 percent to 20 percent in 2017 due to the expiration of the ISG. For the Basin States, Conservation Before Shortage and Water Supply alternatives, the probabilities of surplus are between 30 percent and 40 percent through 2026 since they assume an extension of some provisions of the ISG. Probabilities for the Basin States and Conservation Before Shortage alternatives are lower compared to the Water Supply Alternative, however, since both assume that the ISG would be modified and the more permissive provisions (e.g., Partial Domestic Surplus) would be eliminated. For the Reservoir Storage Alternative, surplus determinations are limited to Quantified Surplus (70R Strategy).and Flood Control Surplus conditions, beginning in 2008, and that assumption is reflected in the lower probabilities compared to the other action alternatives throughout the interim period. The probabilities for all alternatives converge to between 10 percent and 20 percent after the interim period since they all revert to the No Action Alternative assumptions after 2026.

Probability of Various Types of Surplus. Figure 4.4-9 presents a comparison of the probability of occurrence of the Partial Domestic Surplus condition for each alternative. The probability is zero for the Basin States, Conservation Before Shortage and Reservoir Storage alternatives since no provisions for Partial Domestic Surplus are contained in those alternatives. The probability of Partial Domestic Surplus for the No Action and the Water Supply alternatives are identical through 2016. After 2016, the probability of Partial Domestic Surplus under the No Action Alternative drops to zero since the ISG expire, while the Water Supply Alternative assumes an extension of the existing ISG through 2026.

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Figure 4.4-10 presents a comparison of the probability of occurrence of the Full Domestic Surplus condition for each alternative. The probability is zero for the Reservoir Storage Alternative since it does not include a provision for this condition. The probability of Full Domestic Surplus for the No Action and Water Supply alternatives are nearly identical through 2016 since they have the same assumptions during that period, with the Water Supply Alternative continuing the Full Domestic Surplus provision through 2026. The Basin States and Conservation Before Shortage alternatives also have nearly identical probabilities through 2026 since they have the same assumptions during that period. The probabilities for the Basin States and Conservation Before Shortage alternatives are slightly higher than the No Action and Water Supply alternatives since they do not have a provision for Partial Domestic Surplus. This keeps the reservoir slightly higher increasing the chance of a Full Domestic Surplus determination.

Figure 4.4-11 presents a comparison of the probability of the Quantified (70R) Surplus condition for each alternative. The probabilities for the No Action, Basin States, Conservation Before Shortage, and Water Supply alternatives are nearly identical, with the Reservoir Storage Alternative being slightly higher since it tends to keep the reservoir at higher elevations.

Figure 4.4-12 presents a comparison of the probability of the Flood Control Surplus condition for each alternative. The probabilities for the No Action, Basin States, Conservation Before Shortage, and Water Supply alternatives are nearly identical, with the Reservoir Storage Alternative being slightly higher since it tends to keep the reservoir at higher elevations.

Sensitivity of Surplus Conditions to Creation and Delivery of ICS. The ICS program assumed as part of the Basin States, Conservation Before Shortage and Reservoir Storage alternatives impacts the probability of Surplus occurrences. Because a potential effect of the ICS guidelines is an increase in the amount of water in Lake Mead, a Surplus condition is likely to occur more often with the ICS guidelines in place.

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Figure 4.4-13 presents the sensitivity of the occurrence of a Surplus condition to the creation and delivery of ICS by comparing these three alternatives with and without the ICS program in place. For each alternative, the inclusion of the ICS program has the effect of slightly increasing the probability of a surplus. The maximum increase is about five percent under the Basin States and Conservation Before Shortage alternatives and occurs in 2011. The maximum increase is about four percent under the Reservoir Storage Alternative, occurring in 2014 and 2015.

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Figure 4.4-7
Surplus Deliveries to Lower Basin States
Comparison of Action Alternatives With and Without ICS
Probability of Occurrence
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4.4.5 Total Water Deliveries to the Lower Division States

This section presents the simulated water deliveries to the three Lower Division states. Deliveries to each state may deviate from a state's apportionment due to Surplus or Shortage conditions as well as the creation and delivery of ICS to and from Lake Mead. For the alternatives that do not include some form of ICS (the No Action Alternative and the Water Supply Alternative), water deliveries above or below a state's apportionment occur only during Surplus conditions or Shortage conditions respectively. Water deliveries under the Basin States, Conservation Before Shortage and Reservoir Storage alternatives in excess of a state's apportionment can occur due to a Surplus conditions as well as when ICS is delivered. Also under these alternatives, water deliveries less than a state's apportionment can occur due to a Shortage condition as well as when water is being created within that state under the ICS guidelines. In the following sections, the modeled water deliveries are presented with and without the ICS program to facilitate understanding of the differences.

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4.4.5.1 Total Water Deliveries to Arizona

This section presents the simulated water deliveries to Arizona under the No Action Alternative and the action alternatives.

No Action Alternative. Water deliveries to Arizona are projected to fluctuate throughout the 53-year period of analysis reflecting variations in hydrologic conditions. The 90th, 50th' and 10th percentile ranking of modeled water deliveries to Arizona under the No Action Alternative are presented in Figure 4.4-16. Since the No Action Alternative does not include an ICS program, deviations from annual deliveries of 2.8 mafy are due to Shortage and Surplus conditions.

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The 90th percentile line generally coincides with Arizona's depletion schedule during full surplus water supply conditions. The exceptions to this are the periods from 2008 through 2014 and 2055 through 2060. As indicated by this 90th percentile line, the probability that the No Action Alternative would provide Arizona's full surplus depletion schedule is at least 10 percent for the period 2015 through 2055.

The 50th percentile line represents the median annual depletion values. This 50th percentile line generally coincides with Arizona's projected depletion schedule under Normal conditions through year 2028. After 2028, the median annual Arizona modeled depletion values fluctuate between 2.41 maf and 2.80 maf.

The 10th percentile line represents the depletion values above which 90 percent of the annual depletion values were observed. The 10th percentile annual depletion values were 2.80 maf from 2008 through 2010, approximately 2.4 maf from 2011 through 2037. After 2037, the 10th percentile annual depletion values fluctuated between 2.17 maf and 2.33 maf.

Comparison of Action Alternatives Without ICS Guidelines to No Action Alternative. Figure 4.4-17 provides a comparison of the cumulative distribution of Arizona's depletions under the action alternatives without the ICS Guidelines to those of the No Action Alternative during the interim period (years 2008 through 2026). The results presented in Figure 4.4-17 can be used to compare how often Arizona

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might expect deliveries above and below its 2.8 mafy apportionment due to Surplus and Shortage conditions under the different alternatives.

Figure 4.4-17
Arizona Modeled Annual Depletions
Comparison of Action Alternatives (Without ICS Guidelines) to No Action Alternative
Years 2008 through 2026
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Figure 4.4-18 provides a similar comparison of the cumulative distribution of water deliveries to Arizona under the action alternatives without the ICS Guidelines to those of the No Action Alternative for the 34-year period (years 2027 through 2060) that would follow the interim period.

Sensitivity of Total Water Deliveries to Arizona to Creation and Delivery of ICS. Arizona water deliveries under the Basin States, Conservation Before Shortage, and Reservoir Storage alternatives are impacted by the modeling assumptions made to postulate potential future participation in an ICS program (Appendix M). This section isolates the impacts of those assumptions on Arizona's modeled depletions.

Figure 4.4-18
Arizona Modeled Annual Depletions
Comparison of Action Alternatives (Without ICS Guidelines) to No Action Alternative
Years 2027 through 2060
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(Conforming changes should be made to Figures 4.4-19 through 4.4-33)

Figure 4-4.19 provides a comparison of the cumulative distribution of Arizona's depletions under the Basin States, Conservation Before Shortage, and Reservoir Storage alternatives, with and without the ICS program in place during the interim period. With the ICS program in place, deliveries of approximately 2.7 mafy are due

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to the storage of conserved water. With the ICS program removed, occurrences of deliveries less than 2.8 mafy or greater than 2.8 mafy reflect only Shortage or Surplus conditions respectively. These observations mirror the effects of the ICS program on the probability of voluntary and involuntary total Lower Basin Shortage and Surplus Conditions presented in the previous subsection.

Figure 4-4.20 provides a comparison of the cumulative distribution of Arizona's depletions under the action alternatives that include the creation and delivery of ICS with and without the ICS program in place for the 34-year period that would follow the interim period. There is almost no effect of the ICS program during these years as it is assumed only ICS previously created may be delivered during this period.

(MAKE CONFORMING CHANGES REGARDING DELIVERIES TO CALIFORNIA, NEVADA AND MEXICO DESCRIBED IN SECTIONS 4.4.5.2 THROUGH 4.4.6)

4.4.5.2 Total Water Deliveries to California

4.4.5.3 Total Water Deliveries to Nevada

4.4.6 Water Deliveries to Mexico

4.4.8 Summary

The following conclusions were drawn from the analyses of water deliveries.

4.4.8.1 Normal Conditions

All of the action alternatives improve water supply conditions during the interim period relative to the No Action Alternative, improve the probability that normal deliveries will be met, and reduce the probability that Shortage condition deliveries will occur. The differences between the action alternatives and the No Action

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Alternative, in terms of the probability of occurrence for Normal conditions water supply deliveries, diminish after 2027 and converge by about 2038.

4.4.8.2 Surplus Conditions

The Water Supply Alternative exhibits the same probability of Surplus condition deliveries as the No Action Alternative (between about 30 to 40 percent) between 2008 and 2016 due to the provisions for the Partial Domestic Surplus as provided in the ISG. The ISG provisions terminate under the No Action Alternative in 2016. These conditions are retained in the Water Supply Alternative through 2026 and therefore this alternative consistently provides the highest probability of Surplus condition deliveries during the interim period. The Reservoir Storage Alternative exhibits the lowest probabilities (between about 10 to 20 percent) during the interim period because surplus determinations are limited to Quantified and Flood Control Surplus conditions beginning in 2008. The surplus provisions under the Basin States and Conservation Before Shortage alternatives are similar and the probability of Surplus conditions between 2010 and the probability of occurrence through 2016 is slightly less than under the No Action • Alternative due to the absence of the Partial Domestic Surplus provision in these two alternative. After the end of the interim period in 2026 the probability for all alternatives converges to between 10 and 20 percent.

The ICS program assumed as part of the Basin States, Conservation Before Shortage and Reservoir Storage alternatives has the effect of increasing the occurrence of a Surplus Condition. The maximum increase observed is about four to five percent occurring in one to two years.

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4.4.8.3 Shortage Conditions

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The ICS program assumed as part of the Basin States, Conservation Before Shortage, and Reservoir Storage alternatives has the effect of decreasing the occurrence of

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shortages. The greatest reduction during the interim period occurs in the Reservoir Storage Alternative (about 12 percent) as it is assumed that a larger amount of ICS is created under this alternative. The Conservation Before Shortage Alternative is assumed to create a larger amount of ICS than the Basin States Alternative, resulting in a shortage probability of about two to three percent less during the interim period.

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5.1.29 Cumulative Impacts by Resource

5.1.29.1 Hydrologic Resources and Water Delivery

SNWA's development of pre-BCPA water rights on the Virgin River and Muddy River, and the development of Coyote Spring Valley groundwater could potentially result in increased flows into Lake Mead, and increased deliveries from Lake Mead, under the ICS Guidelines element of the proposed federal action. These hydrologic effects were included in the modeling conducted for this EIS, and these impacts are already included in the analysis in Sections 4.3 and 4.4. Similarly, the increase in return flows to Lake Mead for the northern Nevada groundwater projects were also included in the hydrologic analysis.

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The LCR MSCP would not result in any cumulative effects because it would not alter water system operations.

The Drop 2 Reservoir Project would result in a reduction in over-deliveries to Mexico. These hydrologic effects were included in the hydrologic modeling for Lake Mead conducted for this EIS, and any resulting impacts are already included in the analysis in Sections 4.3 and 4.4.

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Appendix M

Modeling Assumptions:
Creation and Delivery of Intentionally Created Surplus

Three of the action alternatives assume the creation and delivery of intentionally created surplus ("ICS") derived from extraordinary conservation system efficiency projects, tributary conservation and importation of non-system water (the Basin States, Conservation Before Shortage and Reservoir Storage alternatives). This appendix describes the modeling assumptions used in the CRSS regarding the activities assumed to generate ICS and the conditions under which the ICS is assumed to be created and delivered.

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M.1 Introduction

At this time, it is unknown which entities might participate in the Intentionally Created Surplus ("ICS") program that allows the creation and delivery of ICS derived from extraordinary conservation, system efficiency projects, tributary conservation or importation of non-system water. Furthermore, the timing and magnitude of the creation and delivery of ICS is unknown. However, modeling assumptions with respect to the entities that might participate and their respective level of participation were needed to enable the evaluation of the ICS program and its potential effects on environmental resources, particularly to reservoir storage and river flows below Lake Mead.

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The proposed federal action is for the purpose of adopting additional operational strategies to improve the Department's annual management and operation of key Colorado River reservoirs. However, in order to assess the potential effects of the proposed federal action in this Draft EIS, certain modeling assumptions are used that display projected water deliveries to Mexico. Reclamation's modeling assumptions are not intended to constitute an interpretation or application of the 1944 Treaty or to represent current or future United States policy regarding deliveries to Mexico. The United States will conduct all necessary and appropriate discussions regarding the proposed federal action and implementation of the 1944 Treaty with Mexico through the IBWC in consultation with the Department of State. [1]

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For two of the action alternatives (the Conservation Before Shortage Alternative and the Reservoir Storage Alternative), it was assumed that ICS would be created and used for environmental purposes. These modeling assumptions were utilized in this Draft EIS in order to analyze the potential impacts to environmental resources of the ICS program, particularly with regard to reservoir elevations and river flow impacts. The use of these modeling assumptions does not represent any determination by Reclamation as to whether, or how, these releases could be made under current administration of the river.

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M.2 General Modeling Assumptions

Three alternatives assume the creation and delivery of ICS (the Basin States, Conservation Before Shortage and Reservoir Storage alternatives). This section explains the general modeling assumptions

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regarding how ICS is created and delivered within the CRSS model. Examples of the accounting for ICS within the model are also presented below.

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[1] Notwithstanding the lack of an existing mechanism to implement such modeling assumptions, Reclamation utilized these assumptions for a number of reasons, including the following: (1) a larger volume of potential storage in Lake Mead is identified, (2) the maximum potential impacts on river flows below Hoover Dam are identified, (3) the alternative proponent's recommendations as to participating entities and levels of participation are modeled, (4) the arbitrary assignment of water conservation amounts to entities in the Lower Basin states is avoided, and (5) a program of potential future cooperation between the United States and Mexico is identified.

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M.2.1 Creation of ICS

When ICS is created, the model assumes either a delivery from Lake Mead is decreased or a new gain to the system is introduced, resulting in an increase to Lake Mead storage. If the reduced delivery is located downstream of Lake Mead, creation of the ICS results in a reduction in the release from Lake Mead and river flow downstream.

At the beginning of each year, the model assumes that ICS will be generated based on annual schedules and that the scheduled amount does not change throughout the year. The ability to create ICS in Lake Mead is assumed to be in effect from 2008 through 2026 (i.e., ICS is assumed to not be created in Lake Mead after 2026).

The activity resulting in the creation of ICS is assumed to originate from a point on the river located furthest downstream in order to evaluate the maximum effects of the creation and delivery of ICS on river flows. In general, ICS created for use by a particular state is assumed to be created by an entity within that state that had an annual depletion schedule sufficiently large enough to accommodate the reductions. In the case of the Conservation Before Shortage and Reservoir Storage alternatives, which assume creation and delivery of ICS for Mexico and the federal government, these activities were assumed to occur within Mexico because this is the last major user in the lower part of the river and again, this permitted evaluation of the potential effects on river flow reductions.

A one-time system assessment is assumed to be dedicated to the system upon the creation of ICS . The system assessment is assumed to be five percent of the volume of ICS created for the Basin States and Conservation Before Shortage alternatives. For the Reservoir Storage Alternative, the system assessment is assumed to be ten percent of the volume of ICS created. For example, if an entity wishes to create lOO kaf of ICS, then the ICS that must be created becomes: 100 kaf / (1 system assessment).

The model assumes that the accounting of ICS occurs annually, at the end of the year. ICS in Lake Mead is assumed to be subject to the following rules:

- An annual 3 percent deduction for evaporation. The deduction occurs at the end of the year and is based on the available ICS at the beginning of the year.
- No evaporation deductions occur during Shortage conditions.
- In the event of a flood control release, ICS is eliminated and stored water reverts to the system.
- The total volume of ICS in Lake Mead at any given time is not included in the determination of a Quantified Surplus using the 70R Strategy.
- The amount of ICS that may be generated in a single year is constrained by assumed maximum annual and maximum total limits. These assumed limits vary by alternative and are presented in Section M.3.

M.2.2 Delivery of ICS

When ICS is delivered from Lake Mead, the model assumed that a delivery from Lake Mead was increased for that year, resulting in a decrease in Lake Mead storage. If the increased delivery is located downstream of Lake Mead, delivery of

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the ICS results in an increase in the release from Lake Mead and river flow downstream.

At the beginning of each year, the model assumes that ICS will be delivered based on annual schedules and that the scheduled delivery amount does not change throughout the year. Although the ability to create ICS in Lake Mead is assumed to be in effect from 2008 through 2026 (i.e., ICS may not be created in Lake Mead after 2026), a lO-year period (from 2027 through 2036) was assumed for entities to take any ICS remaining after the end of the interim period.

After 2026, some conservation activities assumed to be undertaken by Nevada are assumed to continue through 2060 (tributary conservation, groundwater return flows, and desalinization described further in Section M.3.1). The model assumes delivery of that water to Nevada in the year that the conservation occurs.

M.2.3 **Examples of ICS Accounting**

Table M-I provides an example of ICS accounting in CRSS. A "put" refers to the creation of ICS. A "take" is the delivery of ICS. Although most calculations in CRSS occur on a monthly basis, the model calculates available ICS annually, at the end of the year. At the end of year n, the balance of ICS is determined as,

$$Balance_n = Balance_{n-1} + Put(1 - Assessment\%) - Take - Evap\%(Balance_{n-1})$$

Table M·1
Example of ICS Accounting (af)

Year	Put	Assessment[1]	Put Adjusted for Assessment	Requested Take	Actual Take	Evaporation	Balance
1	0	0	0	0	a	a	0
2	200,000	10,000	190,000	0	0	0	190,000
3	100,000	5,000	95,000	50,000	50,000	5,700	229,300
4	0	0	a	200, 000	200,000	6,879	22,421
5	0	0	0	50.000	21,748	673	0

1 Assuming a system assessment of five percent

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Year 1: The ICS balance is zero and there is no activity for this year.

Year 2: A put of 200 kaf is scheduled for this year. There is a 200 kaf reduction in delivery for this year. Assuming a system assessment of 5 percent, 190 kaf of ICS is generated for this year and 10 kaf (five percent of 200 kaf) is credited to the system. There are no takes scheduled. Evaporation is counted as 3 percent of the previous year's balance. Because the balance in Year 1 is 0, there is no evaporation loss deducted in Year 2.

Year 3: Applying the scheduled put and take values to the equation above a balance of 229,300 is created.

$$229{,}300 = 190{,}000 + 100{,}000(1 - 0.05) - 50{,}000 - 0.03(190{,}000)$$

Year 4: Applying the scheduled put and take values to the equation above a balance of 22,421 is created.

$$22{,}421 = 229{,}300 + 0(1 - 0.05) - 200{,}000 - 0.03(229{,}300)$$

Year 5: The requested take is higher than the available ICS. Therefore the actual take is constrained by the available credits to be 21,748 af.

M.3 Modeling Assumptions Specific to Alternatives

Modeling assumptions with respect to the entities that might participate and their respective level of participation were needed to enable the evaluation of the potential effects of the ICS program for each alternative. These assumptions include the maximum amount of ICS that may be created during any year, the maximum amount of ICS that may be delivered during any year, and the maximum total amount of ICS that may be available at anyone time. In addition, assumptions with regard to the timing and magnitude of the creation and delivery of ICS are needed. The assumptions made for each alternative are detailed in the following sections.

M.3.1 Basin States Alternative

As discussed in Section 2.3, the Basin States Alternative assumes the levels of participation as shown in Table M-2.

Table M-2
Basin States Alternative Volume limitations on Creation and Delivery of ICS

Entity	Maximum Annual Creation of ICS (kaf)	Maximum Cumulative Total ICS (kaf)	Maximum Annual Delivery of ICS (kaf)
Arizona	100	300	300
California	400	1,500	400
Nevada	125	300	300
Total	625	2,100	1,000

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These volume limitations are recognized in CRSS as are other rules that specify under which water supply conditions ICS may be created or delivered, as summarized in Section M.3.4. The schedules for Arizona, California and Nevada were provided by the Arizona Department of Water Resources (ADWR), the Metropolitan Water District of Southern California (MWD) and the Southern Nevada Water Authority (SNW A), respectively, and are detailed below.

M.3.1.1 ***Arizona***

In order to analyze the maximum effects on river flows, the model assumes that Arizona ICS is generated through extraordinary conservation by the Yuma County Water Users Association and are delivered to CAP. According to the creation and delivery schedules provided by ADWR, the creation of ICS begins in 2017, as shown in Table M-3. It was assumed that ICS is created and delivered only during otherwise Normal conditions.

M.3.1.2 ***California***

In order to analyze the maximum effects on river flows, the model assumes that California ICS is created through extraordinary conservation by the Imperial Irrigation District and is delivered to MWD. Schedules for the creation and delivery of ICS were provided by MWD. Ninety-nine (99) schedules were provided, corresponding to the 99 hydrologic traces used in the ISM simulations (Section 4.2). As an example, one of these schedules is presented in Table M-3. In 2008 California is assumed to begin with an ICS balance of 100 kaf due to pilot programs in place in 2006 and 2007. It was assumed that ICS is created and delivered only during otherwise Normal conditions.

M.3.1.3 ***Nevada***

As provided by SNW A, four different conservation activities are assumed to be undertaken by Nevada to generate ICS. Each activity is subject to different assumptions as to when ICS may be created and used as described below. The schedules provided by SNW A are shown in Table M-3.

Tributary Conservation. It was assumed that water from extraordinary conservation on the Muddy and Virgin Rivers would generate ICS. This activity is assumed to be in place during the period from 2009 through 2060. In the CRSS model, a gain to Lake Mead was introduced as the source of these ICS and it is assumed that delivery is taken by SNW A from Lake Mead. In general, it was assumed that ICS may be created during all water supply conditions (except the Flood Control Surplus condition) and may be delivered during Normal and Shortage conditions. However, it was also assumed that SNW A would take ICS during a Full Domestic Surplus condition if needed to avoid exceeding the maximum cumulative total amount of ICS. After 2026, it is assumed that the tributary conservation ICS would continue to be created each year and would be delivered in the same year. The system assessment is assumed to be in effect through 2060.

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Groundwater. SNW A return flows originating from Nevada groundwater development projects are assumed to be available during the period from 2009 through 2060. In the CRSS model, a gain to Lake Mead was introduced as the source of groundwater and it is assumed that delivery is taken by SNW A from Lake Mead. It was assumed that groundwater return flows are stored and delivered only during Normal and Shortage conditions. After 2026, it is assumed that the groundwater return flows would continue to be created each year and would be used in the same year. The system assessment for groundwater is assumed to be in effect through 2060.

Desalinization. SNW A is assumed to receive water generated from desalinization beginning in 2012 through 2060. To account for water created through desalinization, a gain was introduced to the system below Imperial Dam. Desalinization water is assumed to be generated and taken during all water supply conditions except during Flood Control Surplus conditions. After 2026, it is assumed that the desalinization water would continue to be created each year and would be delivered in the same year. The system assessment for desalinization is assumed to be in effect through 2060.

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Drop 2 Reservoir. As discussed in Section 4.2.7, the proposed Drop 2 Reservoir is assumed to be in operation beginning in 2010 and to conserve an average of 69 kafy, reducing the average over-delivery to Mexico from 77 kafy to 8 kafy under all alternatives. Under the three action alternatives that assume the creation and delivery of ICS, SNW A is assumed to create and receive delivery of ICS conserved by the Drop 2 Reservoir beginning in 2013 during Surplus (excluding the Flood Control Surplus condition) and Normal conditions. A system assessment is not applied to Drop 2 Reservoir ICS. Nevada takes delivery of Drop 2 Reservoir ICS at a maximum rate of 40 kaf each year until a total of 300 kaf has been taken. Thereafter, water conserved by the Drop 2 Reservoir is assumed to be system water.

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Table M-3

Assumed ICS Creation and Delivery Schedules for Conservation Activities Under the Basin States Alternative[1]

YEAR	Arizona		California[2]				Nevada		
	Extraordinary Conservation (af)		Extraordinary Conservation (af)		Tributary Conservation (af)		Groundwater (af)		De
	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER	CRE
2008	0	0	400,000	0	0	0	0	0	
2009	0	0	400, 000	0	30 ,000	5,000	13,000	13,000	
2010	0	0	400,000	0	30,000	5,000	13,000	13,000	
2011	0	0	400,000	0	30,000	5,000	13,000	13,000	
2012	0	0	400,000	0	30,000	5,000	13,000	13,000	
2013	0	0	400,000	0	30,000	5,000	13,000	13,000	
2014	0	0	100,000	0	30,000	5,000	13,000	13,000	
2015	0	0	0	0	30,000	5,000	13,000	13,000	
2016	0	0	300,000	0	30,000	5,000	13,000	13,000	
2017	100,000	0	400,000	0	30,000	5,000	13,000	13,000	
2018	100,000	0	300,000	0	30,000	5,000	13,000	13,000	
2019	100,000	0	200,000	0	30,000	5,000	13,000	13,000	
2020	0	300,000	0	100,000	30,000	5,000	80,000	80,000	75,
2021	100,000	50,000	0	100,000	30,000	5,000	80,000	80,000	75,
2022	100,000	0	0	200,000	30,000	5,00il	80,000	80,000	75,
2023	100,000	0	0	0	30,000	5,000	80,000	80, 000	75,
2024	50,000	0	100,000	0	30,000	5,000	80, 000	80,000	75,

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Table M-3
Assumed ICS Creation and Delivery Schedules for Conservation Activities Under the Basin States Alternative[1]

	Arizona		California'		Nevada					
	Extraordinary)' Conservation (all		Extraordinary' Conservation (af)		Tributary Conservation (af)		Groundwater (af)		Desaliniz	
YEAR	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER	CREATE	
2025	0	50,000	0	100,000	30,000	30,000	80,000	80,000	75,000	
2026	0	50,000	0	400,000	30,000	30,000	80,000	80,000	75,000	
2027	0	50,000	0	300,000	30,000	30,000	80,000	80,000	75,000	
2028	0	50,000	0	200,000	30,000	30,000	80,000	80,000	75,000	
2029	0	50,000	0	0	30,000	30,000	80,000	80,000	75,000	
2030	0	50,000	0	0	30,000	30,000	80,000	80,000	75,000	
2031	0	50,000	0	400,000	30,000	30,000	80,000	80,000	75,000	
2032	0	50,000	0	400,000	30,000	30,000	80,000	80,000	75,000	
2033	0	50,000	0	400,000	30,000	30,000	80,000	80,000	75,000	
2034	0	50,000	0	400,000	30,000	30,000	80,000	80,000	75,000	
2035	0	50,000	0	400,000	30,000	30,000	80,000	80,000	75,000	
2036	0	50,000	0	400,000	30,000	30,000	80,000	80,000	75,000	
2037	0	0	0	0	30,000	30,000	80,000	80,000	75,000	
2038	0	0	0	0	30,000	30,000	80,000	80,000	75,000	
2039	0	0	0	0	30,000	30,000	80,000	80,000	75,000	
2040	0	0	0	0	30,000	30,000	80,000	80,000	75,000	
2041	0	0	0	0	30,000	30,000	80,000	80,000	75,000	
2042	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2043	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2044	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2045	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2046	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2047	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2048	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2049	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2050	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2051	0	0	0	0	30,000	30,000	80,000	80,000	75,000	
2052	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2053	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2054	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2055	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2056	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2057	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2058	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000
2059	0	0	0	0	30,000	30,000	80,000	80,000	75,000	75,000

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2060	0	0	0	0	30,000	30,000	80,000–	80,000	75,000	75,000

[1] *Actual modeled delivery amounts may be less depending on availability. system assessment and evaporation losses.*

[2] *Reclamation was provided 99 distinct creation and delivery schedules by MWD to be used with the Index Sequential Method The schedule in this table is an example of one schedule corresponding to one hydrologic sequence.*

M.3.2 Conservation Before Shortage

As discussed in Section 2.4, the Conservation Before Shortage Alternative assumes the levels of participation as shown in Table M-4.

Table M-4
Conservation Before Shortage Alternative Volume limitations of ICS Creation and Delivery

Entity	Maximum Annual Creation Storage of ICS (kaf)	Maximum Cumulative Total ICS (kaf)	Maximum Annual Delivery of ICS (kaf)
Arizona	100	300	300
California	400	1,500	400
Nevada	125	300	300
Unassigned	825	2100	600
Total	1,450	4,200	1,600

These volume limitations are recognized in CRSS as are other rules that specify under which water supply conditions ICS may be created or delivered as summarized in Section M.3.4. The schedules for the Conservation Before Shortage Alternative for the participation of the Lower Division states were assumed to be identical to those used in the Basin States Alternative (Table M-3). The schedules for the expanded participation by other entities (Unassigned in Table M-4) were provided by the NGOs and are detailed below.

The Conservation Before Shortage proposal includes voluntary, compensated reductions in water use prior to the imposition of involuntary shortages (Section 2.4). To model this proposal, it was assumed that ICS of 400, 500 and 600 kafy would be created when Lake Mead was at specific elevations within the range of 1,075 feet msl and 1 ,025 feet msl, as described in Section 2.4.3. For modeling purposes and to maximize river flow effects, this ICS were assumed to be created via extraordinary conservation within Mexico. The system assessment is applied when this ICS is created and it was assumed that this ICS would remain in Lake Mead and would be counted toward the replacement of the bypass flows to the Cienega de Santa Clara in Mexico.

The model maintains an accounting for the bypass flow replacement. In each year, the model releases 109 kaf (Section 4.2.6) for the bypass flows and deducts that amount from the bypass flow replacement account. Any deficit that accumulates in the account is tracked and offset at a later time when Lake Mead is below elevation 1,075 feet msl and ICS is created. The maximum positive volume for the account is assumed to be 1.5 maf and any additional ICS that is

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created above that amount is assumed to convert to system water. Evaporation losses are applied to any positive balance in the account at the end of each year.

The NGOs also postulated that ICS would be created by Mexico and be used for the purpose of environmental flows in Mexico. This ICS would be subject to the system assessment and evaporation losses and would be created and delivered during Surplus or otherwise Normal conditions, but not during Flood Control Surplus or Shortage conditions. Two sets of environmental flows are assumed to occur. The first are pulse flows to the Colorado River Delta flowing into the Gulf of California, assumed to occur every five years after the last flood control release, with the first flow scheduled for 2012 (referred to as "Delta Pulse Flows" in Table *M-5)*. Each year, ICS of 50 kaf is assumed to be created. Delta pulse flows are of magnitude 250 kaf; however, in the fifth year ICS of 50 kaf is assumed to be created and delivered in the same year and a system assessment is not applied. The model assumes that Delta pulse flows would flow past the NIB and are counted as part of Mexico's delivery. The second set of environmental flows (termed "Other Environmental Flows Below NIB" in Table *M-5)* is assumed also to occur every five years, with the first scheduled for 2010 at a volume of 80 kaf. Each year 40 kaf of ICS is scheduled to be created for these flows. After 2010, these flows increase to a volume of 200 kaf and similar to the Delta pulse flows, in the fifth year ICS of 40 kaf is assumed to be created and delivered in the same year. The model also assumes that this water would flow past the NIB and is counted as part of Mexico's delivery.

The NGOs postulated an additional activity to create 100 kafy of ICS to be delivered for environmental uses within the United States (termed "Additional Environmental Uses" in Table M-S). It was assumed that this ICS would be created and delivered during otherwise Normal and Surplus conditions and would be subject to the system assessment and evaporation losses. For modeling purposes and to maximize river flow effects, this ICS was also assumed to be generated via extraordinary conservation within Mexico.

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The assumed schedules for these activities are presented in Table *M-5*.

Table M-5
Assumed ICS Creation and Delivery Schedules for
Other Conservation Activities Under the Conservation Before Shortage Alternative[1]

Year	Delta Pulse Flows		Other Environmental Flows Below NIB		Additional Environmental Uses	
	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER
2008	52,632	0	42.105	0	105,263	100,000
2009	52,632	0	42.105	0	105,263	100,000
2010	52,632	0	0	80,000	105,263	100,000
2011	52,632	0	42,105	0	105,263	100,000
2012	50,000	250,000	42,105	0	105,263	100,000
2013	52,632	0	42,105	0	105,263	100,000
2014	52,632	0	42,105	0	105,263	100,000
2015	52,632	0	40,000	200,000	105,263	100,000
2016	52,632	0	42,105	0	105,263	100,000
2017	50,000	250,000	42,105	0	105,263	100,000
2018	52,632	0	42,105	0	105,263	100,000
2019	52,632	0	42,105	0	105,263	100,000
2020	52,632	0	40,000	200,000	105,263	100,000
2021	52,632	0	42,105	0	105,263	100,000
2022	50,000	250,000	42,105	0	105.263	100,000
2023	52,632	0	42,105	0	105,263	100,000
2024	52,632	0	42,105	0	105.263	100,000
2025	52,632	0	40,000	200,000	105,263	100,000
2026	52,632	0	42,105	0	105.263	100,000
2027	50,000	250,000	0	0	0	100,000
2028	0	0	0	0	0	100.000
2029	0	0	0	0	0	100,000

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Table M-5
Assumed ICS Creation and Delivery Schedules for
Other Conservation Activities Under the Conservation Before Shortage Alternative[1]

Year	Delta Pulse Flows		Other Environmental Flows Below NIB		Additional Environmental Uses	
	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER
2030	0	0	0	200,000	0	100,000
2031	0	0	0	0	0	100,000
2032	0	250,000	0	0	0	100,000
2033	0	0	0	0	0	100,000
2034	0	0	0	0	0	100,000
2035	0	0	0	200,000	0	100,000
2036	0	0	0	0	0	100,000
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0
2041	0	0	0	0	0	0
2042	0	0	0	0	0	0
2043	0	0	0	0	0	0
2044	0	0	0	0	0	0
2045	0	0	0	0	0	0
2046	0	0	0	0	0	0
2047	0	0	0	0	0	0
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
2054	0	0	0	0	0	0
2055	0	0	0	0	0	0
2056	0	0	0	0	0	0
2057	0	0	0	0	0	0
2058	0	0	0	0	0	0
2059	0	0	0	0	0	0
2060	0	0	0	0	0	0

Creation e amounts are adjusted for system assessment, Actual modeled delivery amounts may be less depending on availability and evaporation losses.

M.3.3 Reservoir Storage Alternative

As discussed in Section 2.6, the Reservoir Storage Alternative assumes the levels of participation as shown **in** Table M-6.

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Table M-6
Reservoir Storage Alternative Volume Limitations of ICS Creation, and Delivery

Entity	Maximum Annual Creation of ICS r (kaf)	Maximum Cumulative Total Storage of ICS (kaf)	Maximum Annual Delivery of ICS r (kaf)
Arizona	100	300	300
California	400	1,500	400
Nevada	125	300	300
Unassigned	475	950	950
Total	1,100	3,050	1,950

These volume limitations are recognized in CRSS as are other rules that specify under which water supply conditions ICS may be created or delivered as summarized in Section M.3.4. The schedules for the Reservoir Storage Alternative for the participation of the Lower Division states were assumed to be identical to those used in the Basin States Alternative (Table M-3). The schedules for the expanded participation by other entities (Unassigned in Table M-6) are detailed below.

Some of the activities assumed in the Conservation Before Shortage Alternative were also assumed for the Reservoir Storage Alternative. In particular, the schedules for the "Delta Pulse Flows" and "Other Environmental Flows Below NIB" (Table M-5) were assumed to be identical. Other additional activities were assumed for the Reservoir Storage Alternative in order to assess the potential effects of the creation and delivery of ICS with limits different from either the Basin States or the Conservation Before Shortage alternatives.

During all water supply conditions except the Flood Control Surplus condition, ICS is assumed to be created to replace bypass flows to the Cienega de Santa Clara in Mexico. As noted in Section 4.2.6, the model assumes that 109 kafy is released from Lake Mead for the bypass flows. Because the system assessment for the Reservoir Storage Alternative is assumed to be 10 percent, ICS of 121 kafy is assumed to be created each year to replace the bypass flows (termed "Bypass Flow Replacement" in Table M-7). For modeling purposes and to maximize river flow effects this ICS was assumed to be created via extraordinary conservation within Mexico.

It was also assumed that ICS of 55 kafy would be created for environmental consumptive uses (in the amount of 50 kafy after the system assessment) in the United States (termed "Environmental Uses" in Table M-7). This ICS is assumed to be created and delivered during all conditions (except the Flood Control Surplus condition). For modeling purposes and to maximize river now effects this water was assumed to be created via extraordinary conservation within Mexico.

During otherwise Normal and Surplus conditions only, an additional 150 kafy of ICS is assumed to be created each year with a delivery of 100 kafy (termed "Additional Conservation Activities" in Table M-7). For modeling purposes and to maximize river flow effects, this ICS was assumed to be created via extraordinary conservation within Mexico and delivered to SNW A at Lake Mead.

The assumed schedules for these activities are shown in Table M-7.

M.3.4 Summary of Assumed ICS Creation and Delivery Activities

A summary of the activities assumed to occur under the various water supply conditions (Surplus, otherwise Normal, and Shortage conditions) for each alternative is presented in Table M-8.

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Table M-7

Assumed ICS Creation and Delivery Schedules for Other Conservation Activities Under the Reservoir Storage Alternative[1]

	Environmental Uses		Bypass Flow Replacement		Additional Conservation Activities	
YEAR	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER
2008	55,555	50,000	121,111	109,000	150,000	100,000
2009	55,555	50,000	121,111	109,000	150,000	100,000
2010	55,555	50,000	121,111	109,000	150,000	100,000
2011	55,555	50,000	121,111	109,000	150,000	100,000
2012	55,555	50,000	121,111	109,000	150,000	100,000
2013	55,555	50,000	121,111	109,000	150,000	100,000
2014	55,555	50,000	121,111	109,000	150,000	100,000
2015	55,555	50,000	121,111	109,000	150,000	100,000
2016	55,555	50, 000	121,111	109,000	150,000	100,000
2017	55,555	50, 000	121,111	109,000	150,000	100,000
2018	55,555	50, 000	121,111	109,000	150,000	100,000
2019	55,555	50,000	121,111	109,000	150,000	100,000
2020	55,555	50,000	121,111	109,000	150,000	100,000
2021	55,555	50, 000	121,111	109,000	150,000	100,000
2022	55,555	50,000	121,111	109,000	150,000	100,000
2023	55,555	50,000	121,111	109,000	150,000	100,000
2024	55,555	50,000	121,111	109,000	150,000	100,000
2025	55,555	50,000	121,111	109,000	150,000	100,000
2026	55,555	50,000	121,111	109,000	150,000	100,000
2027	0	50, 000	0	109,000	0	100,000
2028	0	50,000	0	109,000	0	100,000
2029	0	50,000	0	109,000	0	100,000
2030	0	50, 000	0	109,000	0	100,000
2031	0	50,000	0	109,000	0	100,000
2032	0	50, 000	0	109,000	0	100,000
2033	0	50, 000	0	109,000	0	100,000
2034	0	50,000	0	109,000	0	100,000
2035	0	50,000	0	109,000	0	100,000
2036	0	50,000	0	109,000	0	100,000
2037	0	0	0	0	0	0
2038	0	0	0	0	0	0
2039	0	0	0	0	0	0
2040	0	0	0	0	0	0
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2043	0	0	0	0	0	0

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Table M-7

Assumed ICS Creation and Delivery Schedules for Other Conservation Activities Under the Reservoir Storage Altemative[1]

YEAR	Environmental Uses		Bypass Flow Replacement		Additional Conservation Activities	
	CREATE	DELIVER	CREATE	DELIVER	CREATE	DELIVER
2044	0	0	0	0	0	0
2045	0	0	0	0	0	0
2046	0	0	0	0	0	0
2047	0	0	0	0	0	0
2048	0	0	0	0	0	0
2049	0	0	0	0	0	0
2050	0	0	0	0	0	0
2051	0	0	0	0	0	0
2052	0	0	0	0	0	0
2053	0	0	0	0	0	0
2054	0	0	0	0	0	0
2055	0	0	0	0	0	0
2056	0	0	0	0	0	0
2057	0	0	0	0	0	0
2058	0	0	0	0	0	0
2059	0	0	0	0	0	0
2060	0	0	0	0	0	0

Creation amounts are adjusted for system assessment. Actual modeled delivery amounts may be less depending on availability and evaporation losses.

Table M-8

Modeling Assumptions for Creation and Delivery of ICS

Water Supply Condition		BS, CBS & RS[1]						CBS & RS	CBS	
		California	Arizona	Nevada				Mexico	Federal	F
		Extraordinary Conservation	Extraordinary Conservation	Tributary Conservation	Groundwater	Desalinization	Drop 2 Reservoir[4]	Extraordinary Conservation	Extraordinary Conservation	Extr Cor
Flood Control	Create	no	no	no	no	no	no	no	no	
Surplus	Deliver	no	no	no	no	no	no	no	no	
Quantified (70R)	Create	no	no	yes	no	yes	yes	yes	yes	
Surplus	Deliver	no	no	no	no	yes	yes	yes	yes	
Full Domestic	Create	no	no	yes	no	yes	yes	yes	yes	
Surplus	Deliver	no	no	yes	no	yes	yes	yes	yes	
Normal	Create	yes	yes	yes	yes	yes	ves	yes	yes	
	Deliver	yes	yes	yes	yes	yes	yes	yes	yes	
Shortage (involuntary and voluntary)	Create	no	no	yes	yes	yes	no	no	no[5]	
	Deliver	no	no	yes	yes	yes	no	no	no	
Svstem Assessment		yes	yes	yes	yes	yes	no	yes	yes	
Period of Activitv		2006-2026	2017-2026	2009-2060	2009-2060	2020-2060	Temporary	2008-2026	2008-2026	20

Notes:

1 *BS" Basin States, CBS" Conservation Before Shortage, RS" Reservoir Storage*

2 *yes" Activity assumed to occur*

3. *no " Activity assumed to not occur*

4 *Beginning in 2012, Nevada* is *assumed to receive 40 kafy of the water conserved by the Drop* 2 *Reservoir during Normal and Surplus years until a total* of *300 kaf has been credited to Nevada. Thereafter, water conserved by the Drop* 2 *Reservoir* is *assumed to be system water.*

Under the Conservation Before Shortage Alternative, extraordinary conservation is assumed to be undertaken by the federal government during voluntary shortage conditions but not during involuntary shortage conditions.

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EXHIBIT 2

Letter from Herbert R. Guenther to Robert W. Johnson, November 28, 2005

ARIZONA DEPARTMENT OF WATER RESOURCES
3550 North Central Avenue, Phoenix, Arizona 85012-2105
Telephone (602) 771-8426

November 28, 2005

JANET NAPOLITANO
Governor

HERBERT R. GUENTHER
Director

[Via Facsimile (702) 293-8156 and Regular Mail]

Mr. Robert W. Johnson
Regional Director
Bureau of Reclamation
Lower Colorado Region
1000, P.O. Box 61470
Boulder City, Nevada 89006-1470

Re: ***Arizona's Comments Concerning Scope of Colorado River Reservoir Operations: Development of Lower Basin Shortage Guidelines and Coordinated Management Strategies for Lake Powell and Lake Mead Under Low Reservoir Conditions***

Dear Mr. Johnson:

The Arizona Department of Water Resources (Department) submits the following comments regarding the scope of the environmental impact statement (EIS) for the proposed *Colorado River Reservoir Operations: Development of Lower Basin Shortage Guidelines and Coordinated Management Strategies for Lake Powell and Lake Mead Under Low Reservoir Conditions* (70 Fed. Reg. 189 (September 30, 2005)) (hereinafter Shortage Guidelines). The Department requests that the Bureau of Reclamation draft the scope of the Shortage Guidelines broadly enough to incorporate an alternative that includes all of the following actions:

1. The EIS evaluation for the Shortage Guidelines should include a complete review of Section 602(a) of the Colorado River Basin Project Act of 1968 (Project Act) and the 602(a) storage algorithm (algorithm) used to determine releases from Lake Powell. The present method for calculating 602(a) storage requirements results in the overstatement of the amount of storage in the Upper Basin reservoirs that is intended to protect against curtailment in the Upper Division States. Currently, 5.179 million acre-feet (maf) are added to the 602(a) storage requirement for power protection. That, in turn, arbitrarily reduces the probability of equalization and increases the likelihood of shortages to Arizona.

   The Department requests that the alternative remove power protection from the algorithm. At a minimum, any alternative provided for in the EIS should recognize that water supply for consumptive uses has a higher priority than water supply for power.

2. The Department requests that the alternative use actual Upper Basin depletions and projected new depletions that are verifiable to calculate the 602(a) storage requirement on an annual basis. The projected Upper Basin depletion schedules currently used in the algorithm are significantly overstated. This overstatement results in an increase in 602(a) storage of approximately 3.8 maf in 2006 and 2007, which increases the probability of shortages to Arizona. The Department recommends that Reclamation utilize the Upper Basin depletion projections contained in the Draft Interim Surplus Guidelines Environmental Impact Statement as they track far more closely with actual Upper Basin depletions than do the current Upper Basin depletion schedules used in the algorithm.

3. The Department requests that the alternative eliminate the 14.85 million acre-feet (maf) storage requirement set forth in the Interim 602(a) Storage Guideline for Management of Colorado River (Interim 602(a) Storage Guideline). The guideline artificially limits equalization releases and will have the same detrimental effect on the State of Arizona as the current algorithm. The amount of 14.85 maf is far in excess of the amount needed to fulfill the requirements of 602(a) of the Project Act.

The Department also notes that the Secretary does not appear to be considering the available storage in all of the reservoirs authorized by the Colorado River Storage Project Act, 43 U.S.C. § 620 *et seq.* in determining whether forecasted active storage in the Upper Basin is greater than the Section 602(a) storage requirement under subarticle II(3) of the Coordinated Long-Range Operation of Colorado River System Reservoirs. If this is the case, the Department requests that the Secretary adjust the Colorado River System Simulation Model to properly calculate active storage in the Upper Basin.

Finally, the Department requests that any alternative incorporate Arizona's recommendation for total Lower Basin shortages, which includes Mexico. Arizona's recommended shortages range in volume from 400,000 acre-feet (af)to 600,000 af and would be implemented as follows:

a. For Mead elevations between 1075 ft. and 1050 ft., the shortage reduction should be 400,000 af.
b. For Mead elevations between 1050 ft. and 1025 ft., the shortage reduction should be 500,000 af.
c. For Mead elevations beginning at elevation 1025 ft. and below, the shortage reduction should be 600,000 af.

Hydrologic conditions that could necessitate reductions in excess of 600,000 af must trigger a Secretarial consultation process to determine how to implement additional reductions in the least damaging and most equitable manner possible. Further, if hydrologic conditions indicate that Powell elevations are rising and may reach equalization elevations in the coming year, the Secretary may have the discretion, after consultation with Arizona, to forego a shortage declaration even if a Lake Mead trigger elevation has been reached.

The Seven Colorado River Basin States continue to collaborate on the development of conjunctive operation of Lakes Powell and Mead to minimize shortages to the Lower Division States and avoid curtailment on the Upper Division States. Arizona is committed to finding a solution that benefits both basins. It is crucial, however, that the EIS be scoped broadly enough to include an alternative that incorporates the above adjustments to 602(a) storage and that all alternatives include Arizona's recommendation regarding shortages as outlined above. Please contact me if you have any questions.

Sincerely,

Herbert R. Guenther

HRG:ckl

EXHIBIT 3

Director's Shortage Sharing Workgroup Recommendation, October 24, 2006 (Revised) Final

Director's Shortage Sharing Workgroup Recommendation

October 24, 2006
(Revised)
Final

In 2005, the Director established the Arizona Shortage Sharing Stakeholder Workgroup (Workgroup). The Workgroup had two specific goals:

1. Develop a recommendation to the Director regarding the appropriate volume and implementation strategy for implementing future Colorado River shortages in the lower basin.
2. Develop a recommendation to the Director for allocating shortages between the Central Arizona Project (CAP) and equivalent priority mainstream Colorado River water users.

The Workgroup effort supports a larger Bureau of Reclamation (Reclamation) Environmental Impact Analysis process to develop lower basin shortage criteria and conjunctive management strategies for the operation of Lakes Powell and Mead. Reclamation currently plans to issue a Record of Decision in December 2007.

Shortage Volume and Implementation Strategy

The Workgroup developed the following recommendation for implementing lower basin shortages:

1. At or below Lake Mead elevation 1075 feet, 400,000 acre-feet shortage
2. Below elevation 1050 feet, 500,000 acre-feet shortage
3. Below elevation 1025 to 1000 feet, 600,000 acre-feet shortage
4. Below elevation 1000 feet, reconsultation with Reclamation and the states

The recommendation assumes that the first step will be to reduce water deliveries to Mexico and the next step will be to calculate shortage sharing with Nevada. Hydrologic conditions that necessitate reductions in excess of 600,000 acre-feet will trigger a Secretarial consultation process to determine how to implement additional reductions in the least damaging and most equitable manner possible. That consultation process has not been defined, but should be developed with input from the basin states.

The Director forwarded this recommendation to the other Colorado River basin states, and it has been incorporated into the *Seven Basin States' Preliminary Proposal Regarding Colorado River Interim Operations, February 3, 2006,* with one modification, that reconsultation would be triggered at elevation 1025.

Shortage Allocation Between CAP and Fourth Priority Mainstream Entitlements

The Workgroup analyzed methods for allocating shortage reductions between CAP and fourth priority mainstream water users. The CAP has an established priority system for implementing shortage reductions. Excess water supplies are reduced first. If additional reductions are needed, non-Indian agricultural priority water supplies are reduced until gone, and finally municipal/industrial/Indian uses are reduced according to the formula in the Gila River Indian Community Water Rights Settlement

Agreement. There is no equivalent shortage implementation system for fourth priority mainstream water users. Fourth priority mainstream uses (agricultural and municipal) will be reduced proportionately as soon as Arizona Colorado River shortage reductions are implemented. Future estimated shortage reductions to mainstream users including Lake Havasu and Bullhead City run as high as 30 percent. Under Reclamation's current interpretation for Article V accounting, there is no locally available, non-Colorado River water supply to offset these shortage reductions.

The Director requested that a small technical subgroup of Workgroup stakeholders begin working with the Department to develop a shortage allocation recommendation. The technical group established principals to guide a shortage allocation strategy:

1. Define a method for the Secretary to utilize when allocating shortages to Arizona users
2. Beneficiaries bear the costs of shortage protections
3. Shortages must be allocated in a reasonable manner based on existing contracts and agreements
4. To the extent possible, treat similar users groups equitably

The Mohave County Water Authority (MCWA) presented a recommendation for proportional shortage reductions to fourth priority mainstream water supplies based on entitlement. Shortage reductions to mainstream domestic water supplies could be mitigated by the Arizona Water Banking Authority. The Department completed additional technical analysis of the proposal, which was endorsed by the technical group. The technical group recommends that Arizona fourth priority shortages be allocated as follows:

1. Determine shortage amount and allocation to Mexico. Allocate the remaining shortage amount first to Nevada, and the remainder to Arizona. The enclosed spreadsheet first allocates 16.7% of the shortage to Mexico. The remaining shortage amount is then allocated 7.4% to Nevada and the remainder to Arizona.
2. Determine the estimated priority 1-3 consumptive use amount based on the last non-shortage year use. Determine the Total Water Supply Available for Fourth Priority Diversion. Subtract the priority 1-3 consumptive use amount from the Arizona Colorado River water allocation of 2,800,000 acre-feet.
3. Determine the Fourth Priority Mainstream Shortage Percentage. Divide the fourth priority mainstream diversion entitlement, 164,652 acre-feet, by the Total Water Supply Available for Fourth Priority Diversion (#2).
4. Determine the total water supply Available for Fourth Priority Diversion after Shortage Reduction. Subtract the Arizona portion of lower basin shortage from Total Water Supply Available for Fourth Priority Diversion amount (#2).
5. Determine the Fourth Priority Mainstream Shortage Reduced Water Supply. Multiply the Available for Fourth Priority Diversion after Shortage Reduction (#4) water supply by the Fourth Priority Mainstream Shortage Percentage (#3).
6. Determine the remaining, CAP water supply. The Total Water Supply Available for Fourth Priority Diversion amount is based on estimated priority 1-3 water use. Actual use may be higher than estimated, and could result in an inadvertent CAP overrun. The CAP has agreed to be responsible for payback, under the Inadvertent Overrun and Payback Policy, up to the amount of the water user's entitlement. Actual use may be lower than estimated, resulting in an increased water supply for CAP.

Since there is a fixed maximum diversion entitlement for fourth priority mainstream water users, as noted in the *Contract Between the United States and the Central Arizona Water Conservation District for Delivery of Water and Repayment of Costs of the Central Arizona Project, December 1, 1988*, the mainstream fourth priority water supply has been calculated based on that entitlement. After determining the mainstream fourth priority water supply, the remaining water supply is available for diversion by the CAP, including any available return flow from mainstream water uses.

The shortage allocation recommendation includes the opportunity for mainstream municipal water users to firm 100 percent of their individual municipal/industrial entitlements. Based on updated population projections (2003) the AWBA would need between 450,000 and 525,000 acre-feet of credits for fourth priority mainstream municipal and industrial water users. As AWBA credits are used and replaced, the new credits will be earmarked in the name of the entity that replaced the credits, thereby creating a revolving fund. The AWBA has not foreclosed the opportunity for any fourth priority mainstream entitlement holder to contract with the AWBA for firming.

Shortage Sharing Scenarios - Pro Rata Reductions Based On Priority 4 Entitlements

(Values in Acre-feet)

Year	Priority 1-3 Mainstream Projected Consumptive Use[1]	Available for Priority 4 Diversions - Normal Supply [2]	Priority 4 Mainstream Total Entitlement	Priority 4 Mainstream Shortage Sharing Percentage	Arizona Portion of Lower Basin Shortage[3]	Available for Priority 4 Diversion - Reduced Supply	Priority 4 Mainstream Diversion - Reduced Supply	Projected Priority 4 Mainstream Diversion [1]	Priority 4 Mainstream Diversion - Net Reduction
400,000 Acre-Feet Shortage									
2010	1,171,867	1,556,133	164,652	10.58%	308,588	1,247,545	132,001	155,880	23,879
2016	1,177,135	1,550,865	164,652	10.62%	308,588	1,242,277	131,890	158,961	27,071
2025	1,185,597	1,542,403	164,652	10.68%	308,588	1,233,815	131,710	162,362	30,652
2031	1,191,580	1,536,420	164,652	10.72%	308,588	1,227,832	131,582	163,799	32,217
500,000 Acre-Feet Shortage									
2010	1,171,867	1,556,133	164,652	10.58%	385,735	1,170,398	123,838	155,880	32,042
2016	1,177,135	1,550,865	164,652	10.62%	385,735	1,165,130	123,699	158,961	35,261
2025	1,185,597	1,542,403	164,652	10.68%	385,735	1,156,668	123,475	162,362	38,887
2031	1,191,580	1,536,420	164,652	10.72%	385,735	1,150,685	123,314	163,799	40,485
600,000 Acre-Feet Shortage									
2010	1,171,867	1,556,133	164,652	10.58%	462,881	1,093,251	115,675	155,880	40,204
2016	1,177,135	1,550,865	164,652	10.62%	462,881	1,087,983	115,509	158,961	43,452
2025	1,185,597	1,542,403	164,652	10.68%	462,881	1,079,521	115,239	162,362	47,122
2031	1,191,580	1,536,420	164,652	10.72%	462,881	1,073,538	115,047	163,799	48,752

ENDNOTES

[1] Source: Arizona Department of Water Resources 2003 mainstem Colorado River water use projections.

[2] An amount of 72,000 acre-feet has also been deducted to account for higher priority Ak-Chin and Salt River Pima-Maricopa Indian settlement water.

[3] This amount is determined by first deducting Mexico's share (16.7%) of the total Lower Basin shortage. The remaining shortage volume is apportioned first to Nevada (7.42%) and the remainder to Arizona.

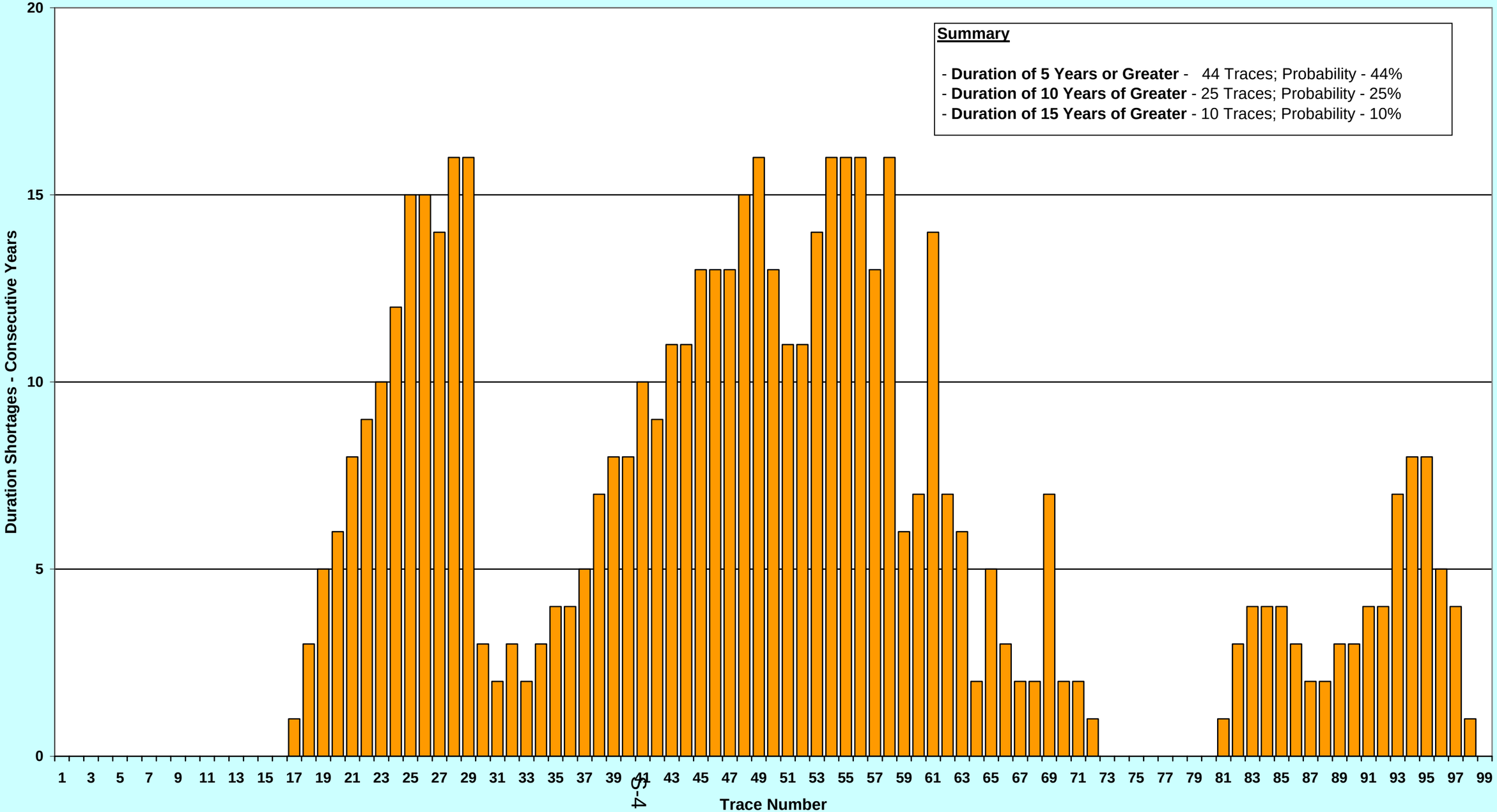
EXHIBIT 4

Arizona Multiple Consecutive Year Shortage Graphs

No Action (NA.short.cy)
Maximum Duration of Shortages
2008-2026

Summary

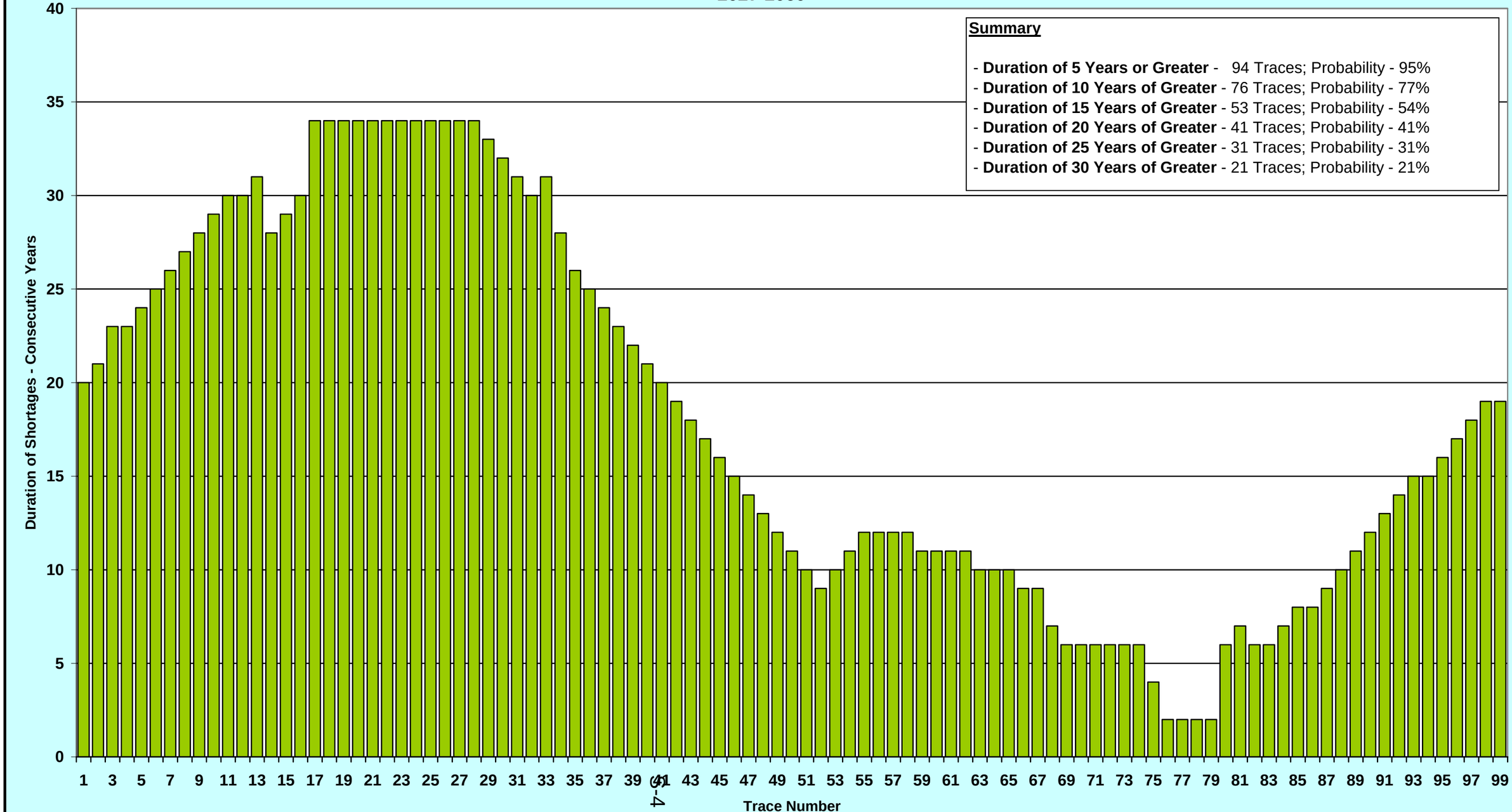
- **Duration of 5 Years or Greater** - 44 Traces; Probability - 44%
- **Duration of 10 Years or Greater** - 25 Traces; Probability - 25%
- **Duration of 15 Years or Greater** - 10 Traces; Probability - 10%



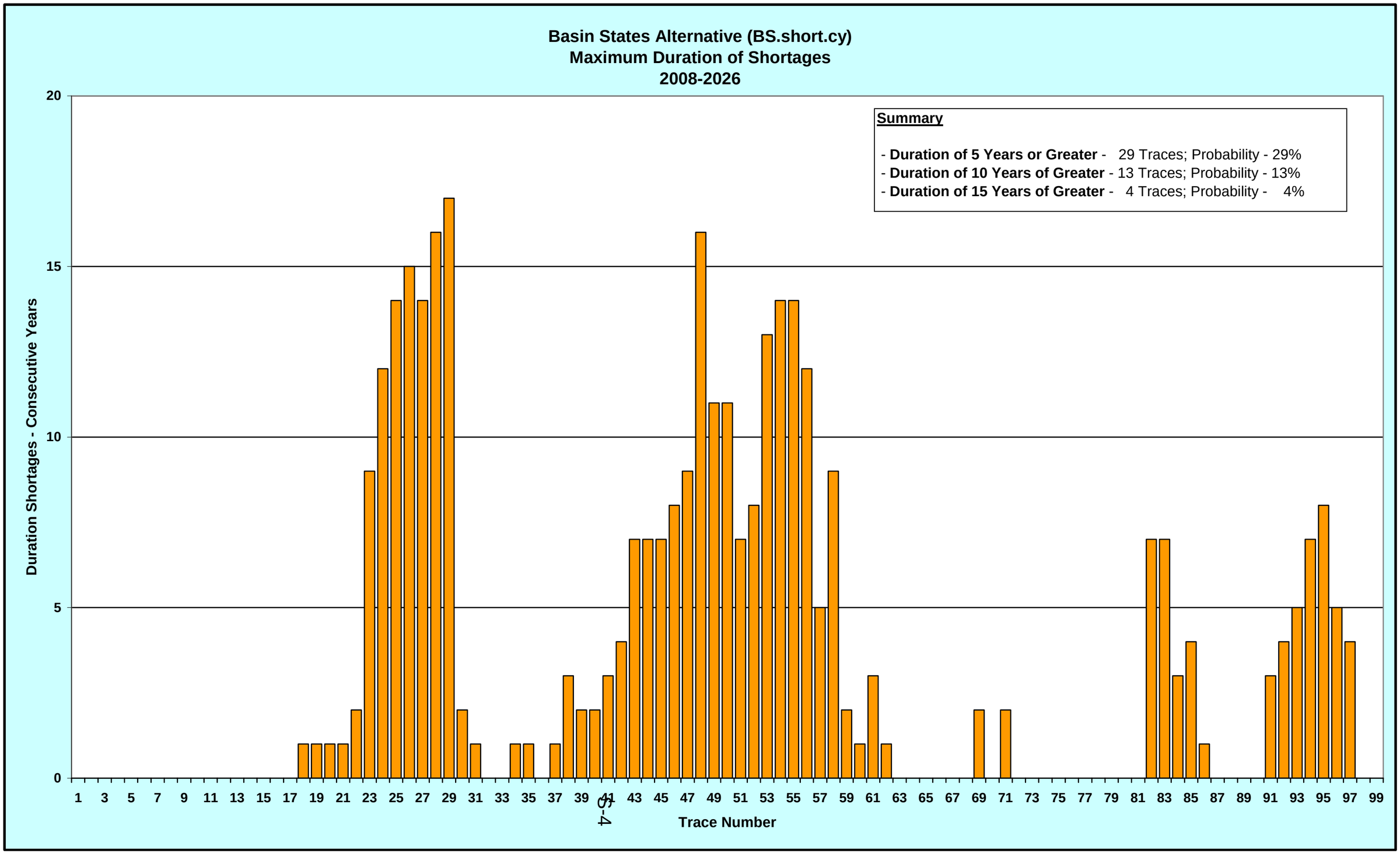
No Action (NA.short.cy)
Maximum Duration of Shortages
2027-2060

Summary

- **Duration of 5 Years or Greater** - 94 Traces; Probability - 95%
- **Duration of 10 Years of Greater** - 76 Traces; Probability - 77%
- **Duration of 15 Years of Greater** - 53 Traces; Probability - 54%
- **Duration of 20 Years of Greater** - 41 Traces; Probability - 41%
- **Duration of 25 Years of Greater** - 31 Traces; Probability - 31%
- **Duration of 30 Years of Greater** - 21 Traces; Probability - 21%



Basin States Alternative (BS.short.cy)
Maximum Duration of Shortages
2008-2026



Basin States Alternative (BS.short.cy)
Maximum Duration of Shortages
2027-2060

Summary

- **Duration of 5 Years or Greater** - 95 Traces; Probability - 96%
- **Duration of 10 Years of Greater** - 74 Traces; Probability - 75%
- **Duration of 15 Years of Greater** - 53 Traces; Probability - 54%
- **Duration of 20 Years of Greater** - 41 Traces; Probability - 41%
- **Duration of 25 Years of Greater** - 32 Traces; Probability - 32%
- **Duration of 30 Years of Greater** - 22 Traces; Probability - 22%

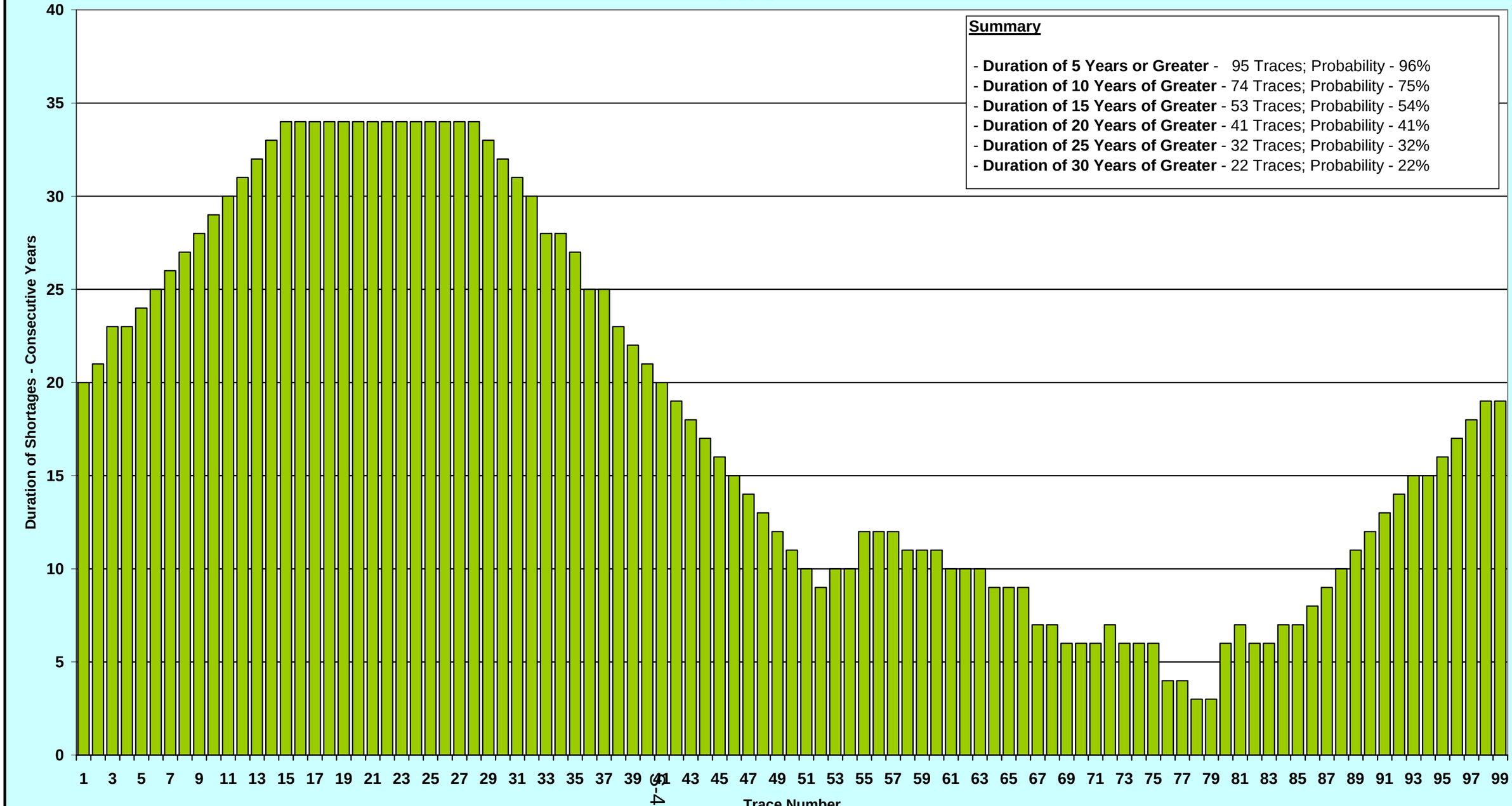


EXHIBIT 5

ADWR Technical Corrections to DEIS

ARIZONA DEPARTMENT OF WATER RESOURCES

COMMENTS ON UNITED STATES BUREAU OF RECLAMATION'S
DRAFT ENVIRONMENTAL IMPACT STATEMENT
COLORADO RIVER INTERIM GUIDELINES FOR LOWER BASIN SHORTAGES AND COORDINATED OPERATIONS FOR LAKE MEAD AND LAKE POWELL

Page	Chapter/ Section	Line(s)	Comment Type	Comment
ES-3	ES.1.3	8	Text	Change bullet to read: Arizona water users, particularly lower priority users **along the main stem of the lower Colorado River** and located in the Central Arizona Project service area.
ES-17	ES.2.13		Analysis	ADWR believes that the duration of shortages has not been properly addressed through out the DEIS and thus the impacts of shortages to Arizona have been minimized in the DEIS.
ES-19	Table ES-2	4.8	Text	Biological Resources, a superscript 1 appears, indicating a footnote but there is no footnote.
ES-19	Table ES-2	4.10	Text	Indian Trust Assets, a superscript 2 appears but there is no footnote.
ES-21	Table ES-2	4.13	Text	Transportation, a superscript 1 appears but there is no footnote.
ES-22	Table ES-2	4.14	Analysis	Addition of a table comparing the relative performance of the action alternatives to the No Action alternative in achieving the purposes identified in the DEIS is suggested. The qualitative approach utilizing "+" and "-" symbols, e.g. +++ is better than ++, etc., is suggested.
ES-22	Table ES-2	4.14	Analysis	Socioeconomics and Land Use, a superscript 1 appears but there is no footnote. The information presented under 4.14 is not clear. What are the percentages of? Also, since the number for socioeconomic effect for the Conservation Before Shortage alternative is based on only counting effects once shortage is mandatory, as described in Chapter 2, a footnote should be added to clarify that the number shown is not directly comparable to the others in the same row.
ES-22	Table ES-2	4.14	Analysis	ADWR believes that there are significant impacts to municipal and industrial sectors caused by shortages, especially due to the duration of shortages.
1-14	1.7.2.2	Figure 1.7-3	Text	The portion of northeastern Arizona north of the dashed green basin dividing line should be crosshatched to indicate that it is Upper Division.
1-18	1.7.3	29-38	Text	There is no mention of municipal and industrial uses along the lower Colorado River that withdraw water from wells located within the floodplain of the Colorado River.
1-26	1.8.5	19	Analysis	The Conservation Plan was actually designed to mitigate adverse effects of covered activities under the Endangered Species Act. The LCR MSCP EIS does not address nor provide NEPA compliance for the covered activities. The finding that "…all species that use the habitats impacted by LCR MSCP-covered activities benefit from the conservation actions currently being carried out under the LCR MSCP, and are therefore fully mitigated for within the limits of the LCR MSCP analysis." needs clarification. Supporting quantification and documentation would be needed before concluding that all effects of covered activities, to all species, have been mitigated. As stated in the LCR MSCP EIS, p. 1-17, line 8 at 1.2.4 "This EIS/EIR evaluates only the impacts of implementing the Conservation Plan and issuance of a section 10(a)(1)(B) permit by the Service based on this plan because these are the two components of the proposed action."
2-13	2.4.5	18	Text	The Conservation Before Shortage alternative features the additional objective of making water available for environmental uses. This additional objective is beyond the stated purpose of the proposed federal action identified on p. 1-3, line 2 at 1.3.
2-14	2.6.1	25	Text	The Reservoir Storage alternative features the additional objective of maintaining Lakes Powell and Mead at higher elevations. This additional objective is beyond the stated purpose of the proposed federal action identified on p. 1-3, line 2 at 1.3.
2-19	2.7	Table 2.7-2	Text	A line needs to be added that separates the "Flood Control Surplus" from the "Quantified Surplus (70R) - which is not shown.
2-21	2.8	Table 2.8-1	Analysis	ADWR would like to see a line for Lake Mead December elevation, probability of elevations less than or equal to 1,000 feet msl for both 2026 and 2060.

Page	Chapter/ Section	Line(s)	Comment Type	Comment
2-25	Table 2.8-1	4.14	Analysis	Socioeconomics and Land Use, the information presented is not clear. What are the percentages of? Also, since the number for socioeconomic effect for the Conservation Before Shortage alternative is based on only counting effects once shortage is mandatory, as described in Chapter 2, a footnote should be added to clarify that the number shown is not directly comparable to the others in the same row.
2-25	Table 2.8-1	4.14	Analysis	ADWR believes that there are significant impacts to municipal and industrial sectors caused by shortages, especially due to the duration of shortages.
3-7	3.2.1.4	23	Text	Picacho State Recreation Area is managed by the State of California, not Arizona.
3-10	3.2.2	Figure 3.2-3	Text	The City of Nogales no longer has a CAP allocation and should not be shown in this figure. There are also several dots in shown Gila County, what are these ?
3-16	3.3.1	5-12	Text	This section is repetitive; it has already been described on page 3-15, lines 31-35 and page 3-16, lines 1-3.
3-24	3.3.6	14	Text	The numbers should be checked. It appears that a decimal point was used where a comma should have been placed.
3-33	3.4.2.1	Table 3.4-3	Text	The estimated diversion entitlement value for Arizona of 1,078,398 does match the value of 1,077,971 shown in Table G-80. ADWR believes that the latter value is correct.
3-39	3.4.6.1	Table 3.4-4	Text	A footnote should be added that states the Priorities 2 and 3 is co-equal.
3-41	3.4.3.6	Table 3.4-6	Text	The listing for Nevada Department of Wildlife should be checked.
3-50	3.5.6	15-17	Text	Lines 15-17 should follow the discussion of the McCulloch plant in line 10, and all that should follow the completed discussion of the PG&E plume as the latter is downstream from the former.
3-70	3.8.3	Table 3.8-7	Text	Under location "GCS" should be GCD for Glen Canyon Dam.
3-71	3.8.3	Table 3.8-7	Text	Under Yuma clapper rail the subspecies should yumanensis.
3-80	3.9.7.3	1	Text	The heading should be 3.9.8 as the section is not a subsection under Davis Dam to Parker Dam.
3-80	3.9.7.4	27	Text	The heading should be 3.9.9 as the section is not a subsection under Davis Dam to Parker Dam.
3-82	3.10.2.1	Table 3.10-1	Text	It would be helpful if a total for all of the Tribes is shown after the States totals.
3-86	3.10.2.2	Table 3.10-2	Text	The table has left out the allocations for the Tonto-Apache (128 acre-feet) and Pascua-Yaqui (500 acre-feet) Reservations, and Tohono O'Odham - Chuichu District (8,000 acre-feet).
				There are also 22,000 acre-feet for the Salt River-Pima Maricopa Community, which is delivered to various Phoenix area cities, and 500 acre-feet for the Yavapai-Prescott Tribe; which has been assigned to the City of Scottsdale. Both these allocations retain their CAP Indian Priority.
3-87	3.10.2.2	10-13	Text	Why is a CAP Indian allocation, which is not covered by water rights settlement, not considered an Indian Trust Asset?
3-121	3.12.4.6	34	Text	Delete "an area." Except for areas specifically closed the entire reach is open and accessible to fishing.
3-127	3.14	9	Analysis	The assumption "No long-term permanent changes in land uses are expected to be caused by the proposed federal action because only agricultural lands would be directly affected during a shortage and these lands would be fallowed and not permanently removed from production." may not be valid. Extended fallowing could result in a change in land use or economic failure of the agricultural operation.
3-127	3.14	9-16	Analysis	If an evaluation of the duration of shortages had been made, agricultural land may in fact be permanently removed.
3-127	3.14	17-24	Analysis	There is no mention of agricultural lands along the main stem of the lower Colorado River, such as the Mohave Valley Irrigation District or numerous smaller agricultural operations that will be impacted by shortages.
3-128	3.14.2	13	Text	As a county the correct spelling is Mohave. While water stored in Lake Pleasant does overlay lands within Yavapai County, CAP water does not serve Yavapai County.
3-128	3.14.2.1	Table 3.14-1	Text	Under the column "Total Land Acres", the acreage values for the CAP Counties and Western Arizona Counties are shown as the same - 14,928,438. This does not appear to be correct.

Page	Chapter/ Section	Line(s)	Comment Type	Comment
3-129	3.14.2.1	8-13	Text	There is no mention of municipal entities located along the main stem of the lower Colorado River, such as Bullhead City, Lake Havasu City, Parker, and Ehrenberg. They will also be affected by shortages, probably more so than the Central Arizona cities.
3-129	3.14.2.1	21-29	Analysis	Why was 1994 chosen as the reference year ? Why wasn't data from the 2000 census utilized?
3-130	3.14.2.2	4-8	Text	There is only a small portion of the Fort Mojave Indian Reservation that is located in Clark County, Nevada, which appears to be less than 5,000 acres shown in Table 3.14-2. All of the agricultural lands in Clark County do not use Colorado River water.
3-131	3.14.2.3	9-14	Text	There are also significant agricultural lands found in these counties, especially located in the Palo Verde and Imperial Irrigation Districts, and the Coachella Valley Water District.
4-10	4.2.7.1	Table 4.2-1	Text	Under the "Calculation" column, the "-" in the formula for the calculation for Nevada's stage 1 shortage distribution should be an "=" sign.
4-37	4.3.2.2	13	Text	The value should be **82.3** maf rather than **8.23** maf.
4-61	4.3.6.2	8	Text	As described "A point immediately downstream of Havasu NWR…." would be in Lake Havasu north of Lake Havasu City. The description should be checked.
4-61	4.3.6.2	7-8	Text	Table 4.3-24 does show that the Basin States Alternative goes below Lake Mead elevation 1,000 feet msl, so the statement in these lines is not accurate.
4-64	4.3.6.3	9-13	Text	It would be useful if a table showing the analysis of stage versus flow be shown here, instead of simply referencing the LCR MSCP. This comment also applies to section 4.3.7.2
4-81	4.4.1.1		Analysis	There is no discussion or evaluation of the length or duration of shortages.
4-83	4.4.4.1		Text	The duration of shortages should also be displayed in this section.
4-86	4.4.4.1	7-13	Text	ADWR believes that the determination of the average shortage volume is incorrect. The probability of any shortage occurring in a given year throughout the 99 traces is 1/99. So the average shortage volume for the year would be divided by 99. The average shortage for a given year is then the sum of yearly average shortages that occur throughout the 99 traces.
4-93	4.4.4.1	Figure 4.4-6	Text	The maximum values of shortages shown in this figure do not appear to match the values shown in Table 4.4-10.
4-123	4.4.7.1	Table 4.4-15	Text	Why are CAP Indian and M&I users shorted in the year 2017 for a shortage of 400,000 acre-feet ? Based on Table G-55, there is enough Excess Water and CAP NIA Priority Water to cover the Arizona portion of the shortage.
4-124	4.4.7.1	Table 4.4.-15	Text	For the shortage year of 2040 and under the shortages of 1,800,000 and 2,500,000 acre-feet, the shortages to CAP Indian and M&I sectors should not exceed their CAP subcontract allocations.
4-128	4.4.8	2	Text	A section should be added comparing the timeline within the year for implementation of the approach of each alternative. Implementation issues should be identified. For example, under the Conservation Before Shortage alternative there should be a discussion of what happens if the Secretary is not able to achieve sufficient reductions in use through voluntary conservation and when in the year, or if, a decision to make a mandatory reduction to make up for the insufficiency of voluntary conservation would be made. A narrative discussion is suggested.
4-261	4.14.1.1	13	Text	Economic impacts to entities that benefit from CAP allocations through exchange should be addressed. The ability of such entities to find other water may be limited. The priority of such exchanged water should be addressed as well. Entities receiving CAP water through exchange include: Camp Verde Yavapai-Apache Nation, Tonto Apache Tribe, and San Carlos Apache Tribe.
4-261	4.14.1.1	14-21	Text / Analysis	There is no mention of agricultural lands along the main stem of the lower Colorado River. There is not any analysis of the effects caused by the length or duration of shortages.
4-263	4.14.1.1	22	Analysis	The assumption "While fallowing of lands may occur during shortages, there are other sources of water that may be used by farmers in order to offset shortages." is not valid for Mohave Valley agriculture or other lands along the Colorado River since groundwater has been found by Reclamation to be within the accounting surface of the Colorado River.
4-263	4.14.1.2	26-27	Text	In Arizona, there is not any groundwater banking that is available for use by the agricultural sector.
4-264	4.14.1.3	3-11	Text	There is no mention of agricultural uses along the main stem of the lower Colorado River that would be affected by shortages

Page	Chapter/ Section	Line(s)	Comment Type	Comment
4-266	4.14.1.3	8-18	Analysis	There are direct and indirect costs associated with paying farmers to fallow lands in the Conservation Before Shortage alternative. Reclamation should contact the Imperial Irrigation District to get information about their fallowing programs (as part of Quantification Settlement Agreement and California Water Delivery Agreement).
4-267	4.14.1.3	13	Analysis	Analyses of the following is not clear: "The M&I shortages allocated to each state were compared to the drought plans or actions that state or local agencies could institute during a shortage." Cities along the Colorado River that utilize post 1968 contract water may not have alternative supplies available.
4-269	4.14.2	Table 4.14-1	Text	In the "Indian Agriculture" section of this table, why is there Indian agricultural lands shown for shortages of 400,000 and 500,000 acre-feet for the year 2017 ?
4-270	4.14.2	6	Analysis	The assumption "No permanent change in land uses would occur under any of the alternatives because shortages would be of a temporary nature and agricultural lands would likely not be permanently removed from production." may not be valid. Multi-year fallowing could result in alternate land use or collapse of the farming operation.
4-270	4.14.2	7	Analysis	ADWR believes that the impacts would not be "temporary" because of the length of shortages.
4-271	4.14.2.1	10	Text	Why are effects in Graham County evaluated?
4-272	4.14.2.1	Table 4.14.-2	Text	In the year "2025" section, why is the probability of shortage value of 16 for 400,000 acre-feet under the "BS" column less than probability of shortage value of 18 shown in the year "2017" section ?
4-274	4.14.2.1	29-32	Text	"Even if considered to be permanent, these potential changes in jobs and personal income area not considered substantial because the changes represent less than one percent of total employment and personal income within the seven-county study area in Arizona." The impact analysis should be reported on a county by county basis in order to avoid understating the impact due to the overwhelming influence of total employment and income in urban Maricopa County. Impacts in Maricopa County may not be comparable to those in Pinal County.
4-275	4.14.2.1	10	Text	Under the Conservation Before Shortage alternative there should be a discussion of what happens if the Secretary is not able to achieve sufficient reductions in use through voluntary conservation and when in the year, or if, a decision to make a mandatory reduction to make up for the insufficiency of voluntary conservation would be made. The timeline for the process under the Conservation Before Shortage should be considered and compared against the purpose statement identified in the DEIS, particularly the purpose of increasing predictability. Since Reclamation has attempted voluntary reductions to replace the bypass stream for the Yuma Desalting Plant, the relative success of that program might serve as a benchmark for the concept.
4-275	4.14.2.1	10	Analysis	Economic effects of the Conservation Before Shortage alternative are not directly comparable to the other alternatives. That alternative assumes federal subsidy of conservation actions up to 1.5 mafy then 50:50 cost share with non-fed users after that. The impact analysis only includes effects of involuntary shortages. Impact analysis does not include effects to users of a water use fee to cost share conservation measures.
4-275	4.14.2.1	10-18	Analysis	There should be an estimate of the cost to pay farmers to fallow land under this alternative.
4-275	4.14.2.1	39	Analysis	Economic effects and reduction in jobs are compared against all seven CAP service area counties. The large size of the Maricopa County economy may mask effects.
4-276	4.14.2.1	2	Text	The word "both" doesn't fit.
4-277	4.14.2.2	26-35	Analysis	What about losses in tax revenue from decreases in tourism or manufacturing. The impacts seem low considering that the impacts of the length or duration of shortages was not analyzed.
4-281	4-.14.2.4	36-40	Text	It appears that the only agricultural lands located in Clark County that use Colorado River water are the Fort Mojave Indian Reservation lands.
4-282	4.14.3.1	28	Text	Shortages greater than 800,000 acre-feet occur; they should also be evaluated.
4-282	4.14.3.1	37-8	Analysis	ADWR believes there are economic costs associated drought response programs that need to be addressed.
4-283	4.14.3.2	14-16	Text	The sentence that begins with "MWD has implemented…" seems redundant.
4-286	4.14.5.3	29-32	Analysis	The statements may be true for shortages of 1 or 2 years in length, but would not be true for shortages of long duration.

Page	Chapter/ Section	Line(s)	Comment Type	Comment
5-6	5.1.20	36	Text	It appears that section 5.1 "Federal Statutes and Policies" runs into a listing of cumulative projects on page 5-8. Separation of the sections by adding 5.2 Cumulative Projects between lines 35 and 36 on p. 5-6, and renumbering thereafter, would address the issue.
5-10	5.1.26	20	Analysis	Again, as stated in the LCR MSCP EIS, p. 1-17, line 8 at 1.2.4 "This EIS/EIR evaluates only the impacts of implementing the Conservation Plan and issuance of a section 10(a)(1)(B) permit by the Service based on this plan because these are the two components of the proposed action." It is important that the scope not be misconstrued. The LCR MSCP EIS did not make findings on the effects of the covered activities from a NEPA perspective.
A-21	A.6.3	32-33	Text	References Table A-22 in Section A-10. A-10 does not include any tables.
A-23	A.6.3.1	1-10	Text	ADWR believes that the shortage distribution between CAP and Priority 4 main stem users should follow the ADWR shortage recommendations
A-24	A.6.3.1	1-2	Text	This line is redundant.
A-24	A.6.3.1	7	Text	It seems that the CRSS model should determine how much shortage is needed to protect the 80P1050 level and absolute protection of elevation 1,000 feet at Lake Mead. The amount of shortage is distributed among the lower Basin users. From the discussion, it appears that the total shortage is not determined by the model, per se.
D-4	Appendix C	Table D-1d	Text	The schedules shown for the Hopi Tribe and Mohave County Water Authority (entitlement portion transferred from the Cibola Valley Irrigation District) do not match the schedules provide by ADWR.
D-7	Appendix C	Table D-1g	Text	Should these schedules be included as part of the CAP contractors' schedules ?
D-9	Appendix C	Table D-1i	Text	The schedule shown for Desert Lawn Memorial Park does not match the schedule provided by ADWR.
E-1 to E-4	Appendix E	Table E 1	Text	The "Date" column within the Table needs to indicate what the date is associated with. The contract and priority dates associated with each entitlement are not always the same, particularly when an entitlement has been transferred. The Department believes that this column should indicate the priority date. The following priority dates that need to be revised are those associated with partial transfers of Cibola Valley Irrigation and Drainage District (CVIDD) entitlements. The dates associated with the Hopi Tribe (Contact No. 04-XX-30-W0432) and Mohave County Water Authority (MCWA) (Contract No. 04-XX-30-W0431) for their surplus, unused apportionment and the fourth priority entitlements need to be changed to CVIDD's 1983 priority date. The priority date for B&F Investment, LLCs entitlement (Contract No. 06-XX-30 W0453) also needs to be changed to 1983.
E-1 to E-4	Appendix E	Table E 1	Text	For 5th and 6th priority entitlements, list the type of water use in the "Use" column rather than listing the priority of the entitlement. Those entitlements that are 5th and/or 6th can be listed under the "5th priority" category.
E-1 to E-4	Appendix E	Table E 1	Text	For those 4th priority entitlement holders that can provide both agricultural and M&I water, present the associated volumes and types of use on separate lines.
E-1 to E-4	Appendix E	Table E 1	Text	For those entitlement holders that have an entitlement that specifies both a consumptive use and a diversion volume, only present the consumptive use volume, or if both values are displayed, only count the consumptive use volume. Counting both values results in an inflated entitlement. The affected entitlement holders include Cibola, Imperial and Havasu National Wildlife Refuges and the City of Parker.
E-1 to E-4	Appendix E	Table E 1	Text	The 5th and 6th priority entitlement associated with Arizona State Land Department Contract No. 4-07-30-W0317 is **9,067** acre-feet, not **9,067.2** acre-feet.
E-1 to E-4	Appendix E	Table E 1	Text	The "not specified ******" and "unquantified ******" footnoted items are not described in footnotes section. To increase legibility, numbers, rather than asterisks, should be used to identify footnoted items.
E-1 to E-4	Appendix E	Table E 1	Text	The Amendment No. 1 of MCWA's Contract No. 05-07-30-W0320, which includes the conversion of 3,500 acre-feet of 5th and 6th priority entitlement to 4th priority entitlement, has been finalized and is ready for signature. As a result, the 3,500 acre-feet of entitlement should be reflected as 4th priority M&I entitlement. The priority date for this entitlement is 1968. The 5th and 6th priority entitlement should continue to remain "upon request" with a priority date of 1995.

Page	Chapter/ Section	Line(s)	Comment Type	Comment
E-1 to E-4	Appendix E	Table E 1	Text	The 5th and 6th priority entitlement that has been subcontracted under the above MCWA contract needs to be revised: Arizona-American Water Company has a subcontract for 950 acre feet; MVIDD has two subcontracts, one for 380 acre-feet and another for 600 acre-feet.
E-1 to E-4	Appendix E	Table E 1	Text	Revise the "Total" for this section (5th priority) according to recommended changes.
E-1 to E-4	Appendix E	Table E 1	Text	The Brooke Water Company's new M&I contract (Contract No. 4-07-30-W0444) has been finalized and is ready for signature. This contract will supersede and replace Brooke's existing contract (Contract No. 4-07-30-W0042). Under the new contract, Brooke will have 360 acre-feet of 1st priority entitlement with a priority date of 1910, 320 acre-feet of 4th priority with a priority date of 1983 and 120 acre-feet of 4th priority with a priority date of 2007.
E-1 to E-4	Appendix E	Table E 1	Text	For "ChaCha", give full entitlement holder name, which is CHACHA, LLC.
E-1 to E-4	Appendix E	Table E 1	Text	CVIDD's total 4th priority entitlement is **12,126** acre-feet, not **12,066** acre-feet. Also, the domestic water component of 300 acre-feet should be presented separately from the 11,826 acre feet that is available for irrigation purposes.
E-1 to E-4	Appendix E	Table E 1	Text	The contract (Contract No. 6-XX-30-W0450) for Fisher's Landing Water and Sewer Works, LLC for 53 acre-feet of 4th priority M&I entitlement has been executed.
E-1 to E-4	Appendix E	Table E 1	Text	Jessen Family Limited Partnership has an irrigation contract (Contract No. 00-XX-30-W0448) for 1,080 acre-feet.
E-1 to E-4	Appendix E	Table E 1	Text	MVIDD – 8,000 acre-feet would better represent the M&I component of the District's 4th priority entitlement. Present 8,000 acre-feet M&I component on separate line from 27,060 acre-feet for irrigation use.
E-1 to E-4	Appendix E	Table E 1	Text	North Baja – Display the 72 acre-feet M&I component on a separate line from North Baja's 408 acre-feet irrigation entitlement.
E-1 to E-4	Appendix E	Table E 1	Text	There is no amount displayed for the total unallocated 4th priority water. The amount is 11,487 acre-feet. As it will be used to cover existing and projected M&I uses, it should be characterized as M&I entitlement.
E-1 to E-4	Appendix E	Table E 1	Text	Revise the "Total" for this section (4th priority) according to recommended changes.
E-1 to E-4	Appendix E	Table E 1	Text	While the Harold Sturges and Erma Sturges Warren Act contracts may not have been terminated, the contract volumes were incorporated into the ASLD irrigation contract (Contract No. 4-07-30-W0317) for farm land that is located within the Gila Monster Ranch. If the contracts are not removed completely from the list, the entitlement amounts need to be removed
E-1 to E-4	Appendix E	Table E 1	Text	Revise the "Total" for this section (2nd/3rd priority) according to receommended changes.
E-1 to E-4	Appendix E	Table E 1	Text	Revise the "Total" for this section (1st priority) according to recommended changes.
G-1	Appendix G	33-35	Text	There is not any mention of the Priority 4 lower Colorado River main stem users and shortage sharing between them and the CAP.
G-3	Appendix G	Table G 2	Text	There is no explanation on how the value of 1,729,907 under the "Consumptive Use Entitlement" is derived for the "Stage 1 Shortage". This is a critical value in the computation of the distribution of the shortages..
G-3	Appendix G	Table G 2	Text	The value under the "Deliverable Consumptive Use" column for Arizona should be **1,063,925** not **2,063,925**.
G-10	Appendix G	Table G 3	Text	In the "CAP Priorities Before 2044 (after Losses)" and "CAP Priorities After 2044 (After Losses)" sections of the, in the CAP 2 row, some of the values shown for the Indian priority water are incorrect. The value **343,097** should be **343,079**. The total of the values shown above the 291,574 acre-feet of Indian priority water should be 51,505 acre-feet not 51,415 acre-feet. GRIC subcontract entitlement listed as 11.305, should be 11,305 - appears twice in table. (PB)
G-14	Appendix G	18	Text	Text references the next 18,735 of shortage (11,305+7,430); Table G-3 total is 18,645 (11,305+7,340)
G-18	Appendix G	2-3	Text	"The consumptive use entitlement column above shows the potential Stage I and II Shortages for each state and Mexico." Change to: The consumptive use reduction column above shows the potential Stage I and Stage II Shortages for each state and Mexico.

Page	Chapter/ Section	Line(s)	Comment Type	Comment
G-20	Appendix G	Table G-9	Text	It would be easier to follow this table if the columns for "Adjusted Delivery" and "Shortage Allocation" were switched.
G-23	Appendix G	Table G-11	Text	The total allocations for CAP Indian priority water should total 343,079 acre-feet, not the 332,966 acre-feet shown in the "Entitlement" section.
G-25	Appendix G	Table G-12	Text	The Hopi Tribe irrigation entitlement that it acquired from CVIDD needs to be included in this Table.
G-25	Appendix G	Table G-12	Text	The Mohave County Water Authority entitlement is in the final stages of the process to convert it to an M&I use to meet the future increased water demands of Bullhead and Lake Havasu cities.
G-25	Appendix G	Table G-12	Text	Although priority 2 and 3 entitlements are considered coequal, the contractors listed under priority 2 should be correctly listed as priority 3.
G-26	Appendix G	Table G-12	Text	Harold and Irma Sturges contracts - Refer to the comment described above regarding the Harold and Irma Sturges contract inclusions in Appendix E, Table E-1.
G-26	Appendix G	Table G-12	Text	The "Arizona Total" values appear to be incorrect. This total and the "Total Ag by County" totals should be equal.
G-47	Appendix G	Table G-15	Text	The "Subtotal Values" in the "Arizona" section of this table do not appear equal the sum of the values for the various Arizona priority groups.
G-107	Appendix G	Table G-55	Text	How were CAP conveyance losses computed.
H-1	Appendix H	1-18	Text	The Salt-River Pima Maricopa Community, the Fort McDowell Indian Community, and the Chuichu District of the Tohono O"Odham Nation are not listed.
H-4	Appendix H, H.3.1.	Table H-2	Text	Several values in this appear to be a negative cost of water. What does this mean?
M-8	Appendix M	10-18	Text	Text indicates that CBS includes voluntary, compensated reductions in water use that also create storage credits in Lake Mead. CBS may create compensated water use reductions OR create water storage in Lake Mead, but may not do both using the same water at the same time. Please add text that describes the timing of conservation savings, when storage occurs, and for how long before application to shortage.