CHAPTER 1 – INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The Secretary of the U.S. Department of the Interior (Secretary), acting through the U.S. Bureau of Reclamation (Reclamation), is considering the adoption of specific interim criteria under which surplus water conditions may be declared in the lower Colorado River Basin during an interim period that would extend through 2015.

The long-term Colorado River system management objectives require the Secretary to:

- Minimize flood damages from river flows,
- Release water only in accordance with the 1964 Decree in *Arizona v. California* (Decree),
- Protect and enhance the environmental resources of the basin,
- Provide reliable delivery of water for beneficial consumptive use,
- Increase flexibility of water deliveries under a complex allocation system,
- Encourage efficient use of renewable water supplies,
- Minimize curtailment to users who depend on such supplies, and
- Consider power generation needs.

This additional action under consideration is intended to recognize these objectives.

The Secretary is vested with the responsibility of managing the mainstream waters of the lower Colorado River pursuant to applicable Federal law. This responsibility is carried out consistent with a collection of documents known as the *Law of the River*, which includes a combination of Federal and state statutes, interstate compacts, court decisions and decrees, an international treaty, contracts with the Secretary, operating criteria, regulations and administrative decisions (see Section 1.3.2.1 for a further discussion of the *Law of the River*).

As the agency that is designated to act on the Secretary's behalf with respect to these matters, Reclamation is the Lead Federal Agency for the purposes of National Environmental Policy Act (NEPA) compliance for the development and implementation of the proposed interim surplus criteria. The National Park Service (NPS) and the United States Section of the International Boundary and Water Commission (USIBWC) are cooperating agencies for purposes of assisting with the environmental analysis.

This Draft Environmental Impact Statement (DEIS) has been prepared pursuant to the National Environmental Policy Act (NEPA) of 1969 as amended and the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500 through 1508) to address the formulation and evaluation of specific interim surplus criteria and to identify the potential environmental effects of implementing such criteria.

This DEIS addresses the environmental issues associated with, and analyzes the environmental consequences of, various alternative-specific interim surplus criteria. Because the number of alternatives could be infinite, the alternatives addressed in this DEIS are those Reclamation has determined would meet the purpose and need for the Federal action and represent a broad range of the most reasonable alternatives. A preferred alternative has not been selected at this time.

1.1.1 PROPOSED FEDERAL ACTION

The proposed Federal action is the adoption of specific interim surplus criteria pursuant to Article III(3)(b) of the *Criteria for Coordinated Long-Range Operation of the Colorado River Reservoirs Pursuant to the Colorado River Basin Project Act of September 30, 1968* (Long-Range Operating Criteria [LROC]). The interim surplus criteria would be used annually to determine the conditions under which the Secretary may declare the availability of "surplus" water, as defined, for use within the states of Arizona, California and Nevada. The criteria must be consistent with both the Decree entered by the U.S. Supreme Court in 1964 in the case of *Arizona v. California* and the LROC. The interim surplus criteria would remain in effect through calendar year 2015, subject to five-year reviews concurrent with the LROC reviews, and applied each year as part of the Annual Operating Plan (AOP).

1.1.2 BACKGROUND

Pursuant to Article II(B)2 of the Decree, if there exists sufficient water available in a single year for pumping or release from Lake Mead to satisfy annual consumptive use in the states of California, Nevada, and Arizona in excess of 7.5 million acre-feet (maf), such water may be determined by the Secretary to be made available as "surplus" water. The Secretary is authorized to determine the conditions upon which such water may be made available. The Colorado River Basin Project Act of 1968 (CRBPA) directs the Secretary to adopt criteria for coordinated long-range operation of reservoirs on the Colorado River in order to comply with and carry out the provisions of the Colorado River Compact (Compact), the Colorado River Storage Project Act (CRSPA), the Boulder Canyon Project Act of 1928 (BCPA) and the U.S.-Mexico Water Treaty of 1944 (Treaty). These criteria are the LROC, described in detail later in this chapter (see also Attachment A). The Secretary sponsors a formal review of the LROC at least every five years.

The LROC provide that the Secretary will determine the extent to which the reasonable beneficial consumptive use requirements of mainstream users in the Lower Division states of Arizona, California and Nevada (Lower Division) can be met. The LROC define a *normal year* as a year in which annual pumping and release from Lake Mead will be sufficient to satisfy 7.5 maf of annual consumptive use in accordance with the Decree. A *surplus year* is defined as a year in which water in quantities greater than normal (i.e., 7.5 maf) are available for pumping or release from Lake Mead pursuant to Article II(B)2 of the Decree after consideration of relevant factors, including the factors listed in the LROC.

Pursuant to the CRBPA, the LROC are utilized by the Secretary, on an annual basis, to make determinations with respect to the projected plan of operations of the storage reservoirs in the Colorado River Basin. The AOP is prepared by Reclamation, acting on behalf of the Secretary, in consultation with representatives of the Colorado River Basin states (Basin States) and other parties as required by Federal law. The interim surplus criteria proposed for adoption by the Secretary will serve to implement the provisions of Article III(3)(b) of the LROC on an annual basis in the determinations made by the Secretary as part of the AOP.

1.1.3 PURPOSE OF AND NEED FOR ACTION

To date, on an annual basis, the Secretary has applied factors, including but not limited to those found in Article III(3)(b)(i-iv) of the LROC, in annual determinations of the availability of surplus quantities of water for pumping or release from Lake Mead. As a result of actual operating experience through preparation of AOPs, the Secretary has determined that there is a need for more specific surplus criteria, consistent with the Decree and applicable Federal law, to assist in the Secretary's annual decision making.

For many years, California has been diverting more than its 4.4 maf apportionment. Prior to 1996, California drew on unused apportionments of other Lower Division states made available by the Secretary. Since 1996, California has also drawn on surplus water made available by Secretarial determination. California is in the process of developing the means to reduce its annual use of Colorado River water to 4.4 maf. Arizona is approaching use of its apportionment and Nevada is expected to reach its apportionment in 2000.

Additionally, through adoption of specific surplus criteria, the Secretary will be able to afford mainstream users of Colorado River water, particularly users in California who currently utilize surplus flows, a greater degree of predictability with respect to the likely existence, or lack thereof, of surplus conditions on the river in a given year. The surplus criteria may identify the specific amount of surplus water to be made available in a given year, based upon factors such as the elevation of Lake Mead. The increased level of predictability, both with respect to the prospective existence of surplus conditions and the potential quantity of water available on an

annual basis, will assist planning and operations of the entities that receive surplus Colorado River water pursuant to contracts with the Secretary.

1.1.4 RELATIONSHIP WITH U.S.-MEXICO WATER TREATY

Under Article 10(a) of the Treaty, the United Mexican States (Mexico) is entitled to an annual amount of 1.5 maf of Colorado River water. In addition to surplus determinations for the Lower Division states made pursuant to Article II(2)(b) of the Decree and Article III(3)(B) of the LROC, under Article 10(b) of the Treaty, Mexico may schedule up to an additional 0.2 maf when "there exists a surplus of waters of the Colorado River in excess of the amount necessary to satisfy uses in the United States." This proposed action is not intended to identify conditions when Mexico may schedule this additional 0.2 maf. Reclamation is currently engaged in discussions with Mexico through the IBWC on the effects of this action.

1.1.5 LEAD AND COOPERATING AGENCIES

The Secretary is vested with the responsibility of managing the mainstream waters of the lower Colorado River pursuant to Federal law. This responsibility is carried out consistent with the *Law of the River*. Reclamation, as the agency that is designated to act on the Secretary's behalf with respect to these matters, is the lead Federal agency for the purposes of NEPA compliance for the development and implementation of the proposed interim surplus criteria.

The NPS and the USIBWC are cooperating agencies for purposes of assisting with the environmental analysis. The NPS administers three areas of national significance along the Colorado River: Glen Canyon National Recreation Area (GCNRA), Grand Canyon National Park, and Lake Mead National Recreation Area (LMNRA). The NPS administers recreation, cultural and natural resources in these areas from offices at Page and Grand Canyon, Arizona, and Boulder City, Nevada, respectively. The NPS also grants and administers concessions for the operation of marinas and other recreation facilities at Lake Powell and Lake Mead.

The IBWC is a binational organization responsible for administration of the provisions of the Treaty, including the Colorado River waters allocated to Mexico, protection of lands along the Colorado River from floods by levee and floodway projects, solution of international boundary sanitation and other water quality problems, and preservation of the river as the international boundary. The International Boundary and Water Commission (IBWC) consists of the United States Section and the Mexican Section, which have their headquarters in the adjoining cities of El Paso, Texas, and Ciudad Juarez, Chihuahua, respectively.

1.2 SUMMARY OF CONTENTS OF THIS DEIS

Following is a brief description of the topics presented in the various chapters of the DEIS.

Chapter 1, Introduction, includes the following: identification of the purpose of and need for the interim surplus criteria being considered by Reclamation; background information concerning the apportionment of Colorado River water and the physical facilities associated with the Colorado River system; and discussion of the institutional framework within which the river system is managed. Chapter 1 also discusses previous and ongoing actions that have a relationship to the interim surplus criteria proposal.

Chapter 2, Description of Alternatives, describes the process of formulating alternatives and presents the reservoir operation strategies of each alternative under consideration. A summary table of potential environmental consequences is provided at the end of Chapter 2.

Chapter 3, Affected Environment and Environmental Consequences, presents the analysis of baseline conditions along with potential impacts that could result from implementation of the interim surplus criteria alternatives under consideration. The discussion addresses both the affected environment (existing conditions within the area of potential effect) and environmental consequences (potential effects of the interim surplus criteria alternatives that could occur as compared to baseline projections).

Chapter 4, Other NEPA Considerations, discusses cumulative impacts, the relationship between short-term use and long-term productivity, and irreversible and irretrievable commitments of resources affected by the interim surplus criteria under consideration.

Chapter 5, Consultation and Coordination, describes the public scoping process, including public notices and scoping meetings, and summarizes the issues raised by the public. This chapter also describes the coordination with Federal and state agencies during the production of this document and any permitting or formal consultation that may be necessary for implementation of proposed interim surplus criteria.

In addition to the above, this DEIS includes a list of acronyms used throughout this document as well as a glossary of commonly used terms and an index. Finally, numerous documents providing detailed historical background and/or technical information on the project have been included as attachments to this DEIS.

1.3 WATER SUPPLY MANAGEMENT AND ALLOCATION

This section summarizes the water supply available to the Colorado River Basin from natural runoff, its distribution under the *Law of the River*, and the reservoirs and diversion facilities through which the water supply is administered from Lake Powell to the Northerly International Boundary (NIB).

1.3.1 COLORADO RIVER SYSTEM WATER SUPPLY

The Colorado River serves as a source of water for irrigation, domestic and other uses in the states of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming and in Mexico. The Colorado River also serves as a source of water for a variety of recreational and environmental benefits.

The Colorado River drainage basin is located in the southwestern United States, as shown on Map 1-1, and occupies a total area of approximately 250,000 square miles. The Colorado River is approximately 1,400 miles in length and originates along the Continental Divide in Rocky Mountain National Park in Colorado. Elevations in the Colorado River basin range from sea level to over 14,000 feet above mean sea level (msl) in the mountainous headwaters.

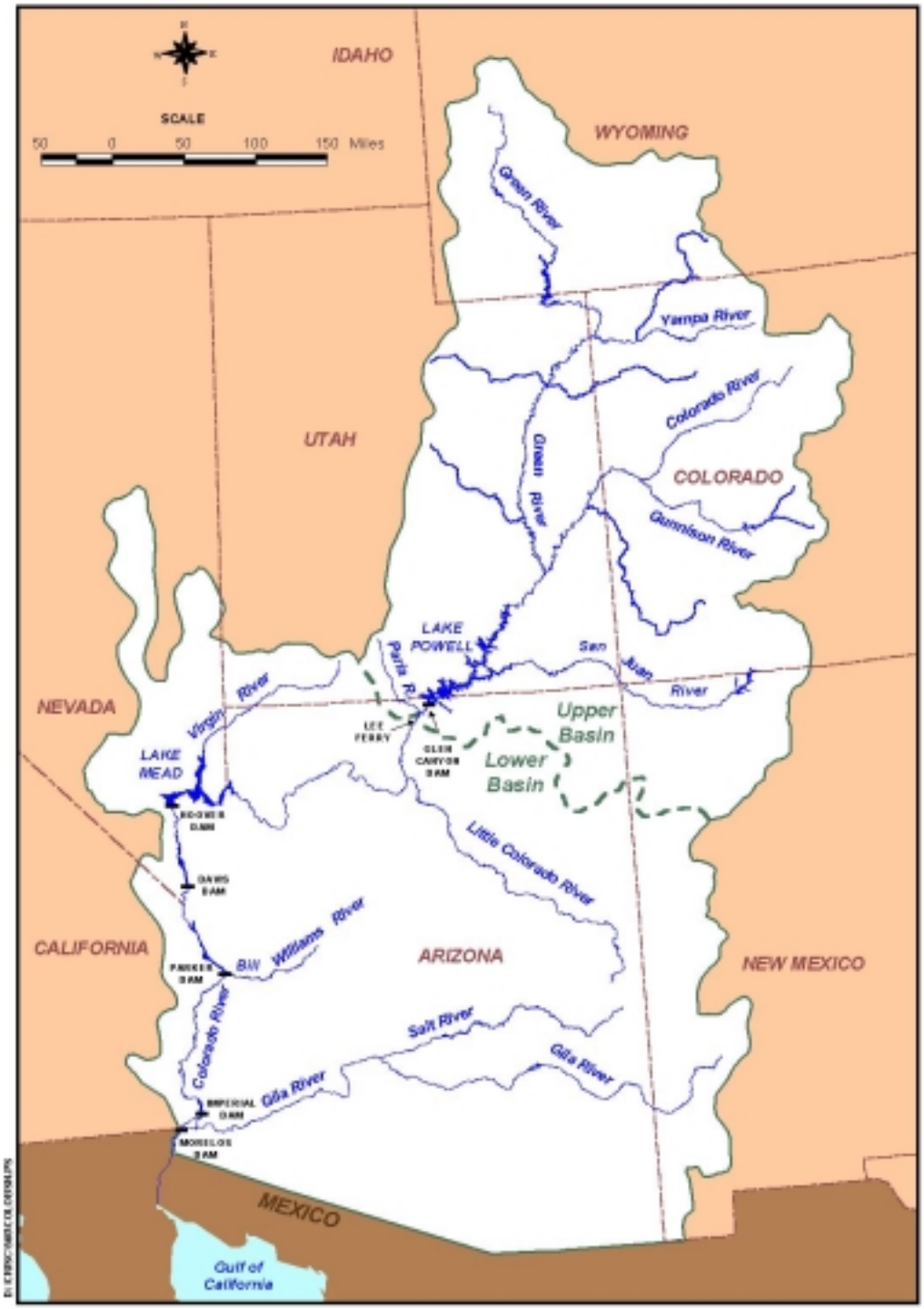
Climate varies significantly throughout the Colorado River Basin. Most of the basin is comprised of desert or semiarid rangelands, which generally receive less than 10 inches of precipitation per year. In contrast, many of the mountainous areas that rim the northern portion of the basin receive, on average, over 40 inches of precipitation per year.

Figure 1-1
Locations of Lee Ferry and Lees Ferry

Most of the total annual flow in the Colorado River Basin is a result of mountain snowmelt. Because of this, natural flow is very high in the late spring and early summer, diminishing rapidly by mid-summer. While flows in late summer through autumn sometimes increase following rain events, natural flow in the late summer through winter is generally low. Major tributaries to the Colorado River include the Green, San Juan, Yampa, Gunnison and Gila rivers.

The annual flow of the Colorado River varies considerably from year to year. The natural flow at the Lees Ferry gaging station (see Figure 1-1), located 17 river miles below Glen Canyon Dam, has varied annually, from 5 maf to 23 maf. Natural

Map 1-1 Colorado River Drainage Basin



flow represents an estimate of flows that would exist without storage, depletion, or transbasin diversion by man.

Most of the lower Colorado River's water, or about 88 percent of the annual natural supply, flows into the Lower Basin from the Upper Basin at Lee Ferry. The remaining 12 percent of the lower Colorado River's water is attributed to sidewash inflows due to rainstorms and tributary rivers in the Lower Basin. The Colorado River Lower Basin's mean annual tributary inflow is about 1.38 maf, not including the Gila River inflow. Actual tributary inflows are highly variable from year to year.

1.3.2 APPORTIONMENT OF WATER SUPPLY

This section summarizes the Colorado River apportionments of the Basin States and Mexico stemming from the *Law of the River*, past and current river diversions and consumptive use, and projected future depletions. The apportionments of the Basin States are stipulated in terms of consumptive use, which consists of diversions minus return flows to the river system that are available for downstream deliveries.

1.3.2.1 THE *LAW OF THE RIVER*

As stated previously, the Secretary is vested with the responsibility to manage the mainstream waters of the lower Colorado River pursuant to applicable Federal law. The responsibility is carried out consistent with a body of documents often referred to as the *Law of the River*. The *Law of the River* encompasses numerous operating criteria, regulations and administrative decisions included in Federal and state statutes, interstate compacts, court decisions and decrees, an international treaty and contracts with the Secretary.

Particularly notable among these documents are:

1) The Colorado River Compact of 1922, which apportioned water among the Upper and Lower basins;

2) The BCPA of 1928, which authorized construction of Hoover Dam and the All-American Canal (AAC), apportioned water among the Lower Division states, required that water users in the Lower Basin have a contract with the Secretary and established the responsibilities of the Secretary to direct, manage and coordinate the operation of Colorado River dams and related works in the Lower Basin;

3) The California Seven Party Water Agreement of 1931, which established the relative priorities of rights among major users of Colorado River water in California;

4) The Treaty of 1944 and subsequent specific applications through minutes of the IBWC related to the quantity and quality of Colorado River water delivered to Mexico;

5) The Upper Colorado River Basin Compact of 1948 (Upper Basin Compact), which apportioned the Upper Basin water supply;

6) The CRSPA of 1956, which authorized a comprehensive water development plan for the Upper Basin that included the construction of Glen Canyon Dam;

7) The 1964 Decree, which confirmed the apportionment of the Lower Basin tributaries was reserved for the exclusive use of the states in which the tributaries are located; confirmed the Lower Basin mainstem apportionments of 4.4 maf for California, 2.8 maf to Arizona and 0.3 maf for Nevada; addressed the reservation of water for Indian reservations and other Federal reservations in California, Arizona and Nevada; and confirmed the significant role of the Secretary in managing the mainstream of the Colorado River within the Lower Basin;

8) The CRBPA of 1968, which authorized construction of a number of water development projects including the Central Arizona Project (CAP) and required the Secretary to develop the LROC;

9) The Colorado River Basin Salinity Control Act of 1974, which authorized a number of salinity control projects and provided a framework to improve and meet salinity standards for the Colorado River in the United States and Mexico; and

10) The Grand Canyon Protection Act of 1992, which addressed the protection of resources in Grand Canyon National Park and Glen Canyon National Recreation Area.

Additional documents in the *Law of the River* include, but are not limited to, documents listed in Table 1-1. Among other provisions of applicable Federal law, NEPA and the Endangered Species Act (ESA) provide a statutory overlay on certain actions taken by the Secretary. For example, as noted in Section 1.1, preparation of this DEIS has been undertaken pursuant to NEPA.

Table 1-1
Documents Included in the *Law of the River*

The River and Harbor Act, March 3, 1899

The Reclamation Act of June 17, 1902

Reclamation of Indian Lands in Yuma, Colorado River and Pyramid Lake Indian Reservations Act of April 21, 1904

Yuma Project authorized by the Secretary of the Interior on May 10, 1904, pursuant to Section 4 of the Reclamation Act of June 17, 1902

Warren Act of February 21, 1910

Protection of Property Along the Colorado River Act of June 25, 1910

Patents and Water-Right Certificates Acts of August 9, 1912 and August 26, 1912

Yuma Auxiliary Project Act of January 25, 1917

Availability of Money for Yuma Auxiliary Project Act of February 11, 1918

Sale of Water for Miscellaneous Purposes Act of February 25, 1920

Federal Power Act of June 10, 1920

The Colorado River Compact of November 24, 1922

The Colorado River Front Work and Levee System Acts of March 3, 1925 and January 21,1927-June 28, 1946

The Boulder Canyon Project Act of December 21, 1928

The California Limitation Act of March 4, 1929

The California Seven Party Agreement of August 18, 1931

The Parker and Grand Coulee Dams Authorization of August 30, 1935

The Parker Dam Power Project Appropriation Act of May 2, 1939

The Reclamation Project Act of August 4, 1939

The Boulder Canyon Project Adjustment Act of July 19, 1940

The Flood Control Act of December 22, 1944

U.S.-Mexico Water Treaty of February 3, 1944

Gila Project Act of July 30, 1947

The Upper Colorado River Basin Compact of October 11, 1948

Consolidated Parker Dam Power Project and Davis Dam Project Act of May 28, 1954

Palo Verde Diversion Dam Act of August 31, 1954

Change Boundaries, Yuma Auxiliary Project Act of February 15, 1956

The Colorado River Storage Project Act of April 11, 1956

Water Supply Act of July 3, 1958

Boulder City Act of September 2, 1958

Report of the Special Master, Simon H. Rifkind, *Arizona v. California*, et al., December 5, 1960

U.S. Supreme Court Decree, *Arizona v. California*, March 9, 1964

International Flood Control Measures, Lower Colorado River Act of August 10, 1964

Southern Nevada (Robert B. Griffith) Water Project Act of October 22, 1965

The Colorado River Basin Project Act of September 30, 1968

Criteria for the Coordinated Long Range Operation of Colorado River Reservoirs, June 8, 1970

Supplemental Irrigation Facilities, Yuma Division Act of September 25, 1970

Minutes 218, March 22, 1965; 241, July 14, 1972, (replaced 218); and 242, August 30, 1973, (replaced 241) of the International Boundary and Water Commission, pursuant to the U.S.-Mexico Water Treaty of 1944

The Colorado River Basin Salinity Control Act of June 24, 1974

U.S. Supreme Court Supplemental Decrees, *Arizona v. California*, January 9, 1979 and April 16, 1984

Hoover Power Plant Act of August 17, 1984

The Numerous Colorado River Water Delivery and Project Repayment Contracts with the States of Arizona and Nevada, cities, water districts and individuals

Hoover and Parker-Davis Power Marketing Contracts

Reclamation States Emergency Drought Relief Act of 1991

Grand Canyon Protection Act of October 30, 1992

1.3.2.2 APPORTIONMENT PROVISIONS

The initial apportionment of water from the Colorado River was determined as part of the 1922 Colorado River Compact. The Compact divided the Colorado River into two sub-basins, the Upper Basin and the Lower Basin (see Map 1-2). 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 (Arizona).

Map 1-2
Upper and Lower Basins of the Colorado River

The Compact then apportioned to each basin, in perpetuity, the exclusive beneficial consumptive use of 7.5 maf of water a year. The Compact also divided the seven Basin States into the Upper Division and the Lower Division (see Map 1-3). The Upper Division consists of the states of Wyoming, Utah, Colorado and New Mexico. The Lower Division consists of the states of Arizona, California and Nevada. The Compact also stipulates in Article 3(d) that the states of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 maf for any period of 10 consecutive years.

Section VII of the Compact states that nothing in this Compact shall be construed as affecting the obligations of the United States to Indian tribes. While the rights of most tribes to Colorado River water were subsequently adjudicated, some tribal rights remain unadjudicated.

1.3.2.2.1 Upper Division State Apportionments

The Compact apportioned 7.5 maf of water in perpetuity to the Upper Basin. The Upper Basin Compact divided the Upper Basin's 7.5 maf apportionment between the four Upper Division states and Arizona as follows:

- Wyoming 14.00 percent
- Utah 23.00 percent
- Colorado 51.75 percent
- New Mexico 11.25 percent
- Arizona 50,000 acre-feet (af)

In 1988, a determination of Upper Basin water supply was made in *Hydrologic Determination: Water Availability from Navajo Reservoir and the Upper Colorado River Basin for Use in New Mexico* (Interior, 1989). In consideration of Article 3(d) of the Compact and accounting for the decrease in the average natural flow of the Colorado River since the signing of the Compact in 1922, the determination concluded that Upper Basin annual water depletion can reasonably be expected to reach 6 maf.

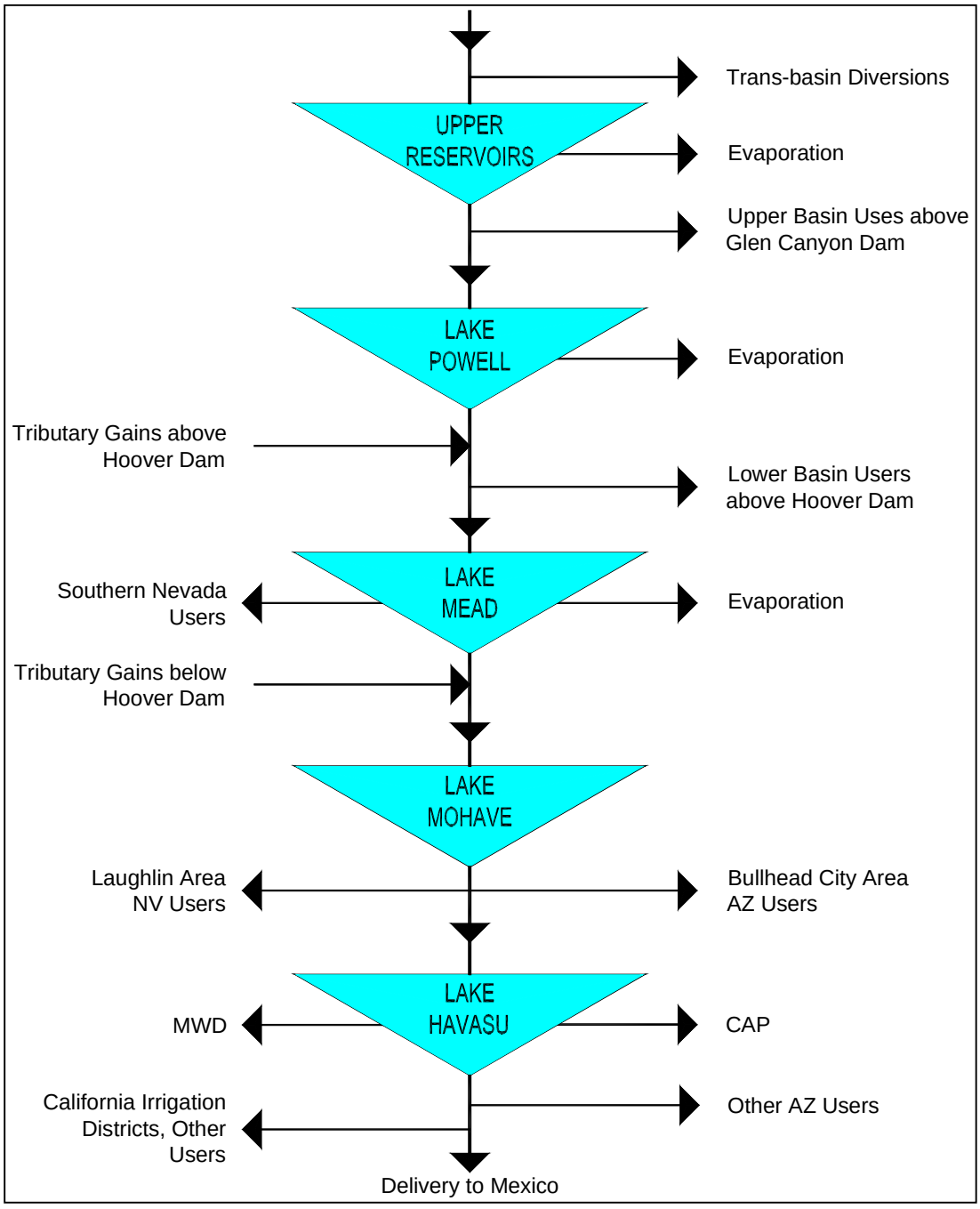
Map 1-3
Upper and Lower Division States of the Colorado River

1.3.2.2.2 Lower Division State Apportionments

The Lower Division states' apportionments are expressed in terms of a fixed amount of consumptive use for each state, subject to varying provisions at times of surpluses or shortages. These apportionments are: California 4.4 maf; Arizona 2.8 maf; and Nevada 0.3 maf, totaling 7.5 maf. Figure 1-2 presents a schematic of the operation of the Colorado River, primarily in the Lower Basin. The apportionments to the Lower Division were established by the BCPA and confirmed by the Decree. 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 offstream for future use by that state or another state.

All mainstream Colorado River waters apportioned to the Lower Basin, except for a few thousand af apportioned to the State of 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 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.

Figure 1-2
Schematic of Colorado River Releases and Diversions



The highest priority Colorado River water rights are present perfected rights (PPRs), which the Decree defines as those perfected rights existing on June 25, 1929, the effective date of the BCPA. The Decree also recognizes Federal Indian reserved rights for the quantity of water necessary to irrigate all the practicably irrigable acreage on five Indian reservations along the lower Colorado River. The 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 to water users within that state after consultation with the state as required by the BCPA.

1.3.2.2.3 Mexico Apportionment

Mexico has an annual apportionment of 1.5 maf of Colorado River water, based on the provisions of the Treaty. Mexico may also receive additional water under two conditions. First, when surplus water exists in excess of the amount that can be beneficially used by the Basin States, Mexico is apportioned up to an additional 200,000 af of water. Second, when high runoff and flooding occur on the Colorado or Gila rivers that is substantially more than can be put to beneficial use by the Lower Division states, such runoff flows into Mexico.

Deliveries to Mexico are subject to reduction under extraordinary drought conditions or serious accident to the irrigation system in the United States. In such cases, deliveries to Mexico, as provided for under the Treaty, could be reduced in proportion to the reduction faced by users in the United States.

As part of this NEPA documentation, international impacts are addressed pursuant to Executive Order 12114-Environmental Effects Abroad of Major Federal Actions, January 4, 1997, and the July 1, 1997 CEQ Guidelines on NEPA Analyses for Transboundary Impacts.

1.3.3 LONG-RANGE OPERATING CRITERIA

The CRBPA required the Secretary to adopt operating criteria for the Colorado River by January 1, 1970. The LROC, adopted in 1970 and included as Attachment A to this DEIS, address the operation of the Colorado River reservoirs in compliance with requirements set forth in the Compact, the CRSPA, the BCPA, the Treaty of 1944 and other applicable Federal laws. Under the LROC, the Secretary makes annual determinations in the AOP (discussed in the following section) regarding the availability of Colorado River water for deliveries to the Lower Division states (i.e., Arizona, California and Nevada). A requirement to, at times, equalize the active

storage between Lake Powell and Lake Mead, to the extent practicable, is also addressed in the LROC, as required by the CRBPA. A more complete discussion of this concept is presented in Section 1.4.2 of this document.

Section 602 of the CRBPA, as amended, provides that the LROC can only be modified after correspondence with the governors of the seven Basin States and appropriate consultation with such state representatives as each governor may designate. To meet these requirements, the LROC call for formal reviews at least every five years. The reviews are conducted as a public involvement process and are attended by representatives of the seven Basin States, Indian Tribes, the general public including representatives of the academic and scientific communities, environmental organizations, the recreation industry and contractors for the purchase of Federal power produced at Glen Canyon Dam. Past reviews have not resulted in any changes to the criteria.

1.3.4 ANNUAL OPERATING PLAN

The CRBPA requires preparation of an AOP for the Colorado River reservoirs that guides the operation of the system for the water year. The AOP describes how Reclamation will manage the reservoirs over a 12-month period, consistent with the LROC and the Decree. The AOP is prepared annually by Reclamation in cooperation with the Basin states, other Federal agencies, Indian tribes, state and local agencies and the general public, including governmental interests as required by Federal law. As part of the AOP process, the Secretary makes annual determinations regarding the availability of Colorado River water for deliveries to the Lower Division states as described below.

1.3.4.1 NORMAL, SURPLUS AND SHORTAGE DETERMINATIONS

The Secretary is required to determine when normal, surplus or shortage conditions occur in the lower Colorado River, based on various factors including storage and hydrologic conditions in the Colorado River Basin.

Normal conditions exist when the Secretary determines that sufficient mainstream water is available to satisfy 7.5 maf of annual consumptive use in the Lower Division states. If a state will 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 covered under a contract with the using entity.

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 to California, Arizona and Nevada in allocations of 50, 46 and 4 percent, respectively. As stated above, if a state will 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 covered under a contract with the using entity. Surplus water was made available by the Secretary in 1996, 1997, 1998, 1999 and 2000. Deliveries of surplus water to Mexico were made in 1997, 1998, 1999 and 2000.

Shortage conditions exist when the Secretary determines that insufficient mainstream water is available to satisfy 7.5 maf of annual consumptive use in the Lower Division states. When making a shortage determination, the Secretary must consult with various parties as set forth in the Decree and consider all relevant factors as specified in the LROC (described above), including Treaty obligations, the priorities set forth in the Decree, and the reasonable consumptive use requirements of mainstream water users in the Lower Division. The Secretary is required to first provide for the satisfaction of the PPRs in the order of their priority, then to users who held contracts on September 30, 1968 (up to 4.4 maf in California), and finally to users who had contracted on September 30, 1968, when the CAP was authorized. To date, a shortage has never been determined.

1.3.5 SYSTEM RESERVOIRS AND DIVERSION FACILITIES

The Colorado River system contains numerous reservoirs that provide an aggregate of approximately 60 maf of active storage. Lake Powell and Lake Mead provide approximately 85 percent of this storage. Upper Basin reservoirs provide approximately 31.2 maf active storage, of which Lake Powell provides 24.3 maf. The other major storage reservoirs in the Upper Basin include Flaming Gorge Reservoir on the Green River, Navajo Reservoir on the San Juan River, and Blue Mesa Reservoir on the Gunnison River.

The Lower Basin dams and reservoirs include Hoover, Davis and Parker dams, shown on Map 1-4. Hoover Dam created Lake Mead and can store up to 26.2 maf of active storage. Davis Dam was constructed by Reclamation to re-regulate Hoover Dam's releases to aid in the annual delivery of 1.5 maf to Mexico. Davis Dam creates Lake Mohave and provides 1.8 maf. Parker Dam forms Lake Havasu from which water may be pumped by both the Metropolitan Water District of Southern California (MWD) and the CAP. Parker Dam re-regulates both Davis Dam releases and the U.S. Army Corps of Engineers' (Corps) Alamo Dam releases on the Bill Williams River and releases water for downstream use in the United States and Mexico. Other Lower Basin mainstream reservoirs, listed in Table 1-2, are operated primarily for the purpose of river flow regulation to facilitate diversion of water to Arizona, California and Mexico. Diversion facilities of the Lower Division states tend to concentrate diversions for various beneficiary groups and various uses into common diversion facilities.

Map 1-4
Lower Colorado River Dams

Table 1-2 summarizes the Colorado River storage facilities (i.e., dams and reservoirs) and major diversions from Lake Powell downstream to Morelos Dam. Also included in Table 1-2 is the AAC, which releases water for delivery to Mexico and thereby contributes to operating the river system for required deliveries. Attachment B, Dams and Reservoirs Along the Lower Colorado River, describes the reservoirs and their operation.

Table 1-2
Colorado River Storage Facilities and Major Diversions from Lake Powell to Morelos Dam

Facility	Reservoir	Location	Storage Capacity (acre-feet)
Glen Canyon Dam	Lake Powell	Upstream of Lee Ferry, Utah, Arizona	24,322,000 Active
Hoover Dam	Lake Mead	Nevada and Arizona near Las Vegas, 270 miles downstream of Glen Canyon Dam	26,200,000 Active
Davis Dam	Lake Mohave	70 miles downstream of Hoover Dam	1,818,000
Parker Dam	Lake Havasu[1]	150 miles downstream of Hoover Dam	648,000
Headgate Rock Dam	Lake Moovalya	164 miles downstream of Hoover Dam	N.A.[3]
Palo Verde Diversion Dam	Unnamed impoundment	209 miles downstream of Hoover Dam	N.A.[3]
Senator Wash regulating facility	Senator Wash Reservoir[2]	290 miles downstream of Hoover Dam near Imperial Dam	13,800
Imperial Dam	Unnamed impoundment	290 miles downstream of Hoover Dam	1,000
Laguna Dam	Unnamed impoundment	300 miles downstream of Hoover Dam	700
Morelos Dam	Unnamed impoundment	320 miles downstream of Hoover Dam	N.A.[3]

[1] Lake Havasu provides a relatively constant water level for pumped diversions by MWD and CAP.
[2] Senator Wash Reservoir is an offstream reservoir with a pumping/generating plant.
[3] Run-of-river diversion structure.

In Nevada, the state's consumptive use apportionment water is used almost exclusively for municipal and industrial (M&I) purposes. About 90 percent of this water is diverted from Lake Mead at a point approximately five miles northwest of Hoover Dam at Saddle Island into the Southern Nevada Water Authority (SNWA) facilities. Most of the remainder of Nevada's diversion occurs below Davis Dam in the Laughlin area.

In Arizona, there are several points of diversion plus up to 50,000 af delivered above Glen Canyon Dam. The intake to the CAP is a pumping plant on Lake Havasu below the confluence of the Bill Williams River. Irrigation water for the Fort Mojave Indian Reservation, near Needles, California, is pumped from wells.

Irrigation water for the Colorado River Indian Reservation near Parker, Arizona, is diverted at Headgate Rock Dam, which was constructed for that purpose. A river pumping plant in the Cibola area provides water to irrigate lands adjacent to the river. The furthermost downstream major diversion for Arizona occurs at Imperial Dam, where water is diverted into the Gila Gravity Main Canal for irrigation for the Gila and Wellton-Mohawk projects and into the AAC for subsequent release into the Yuma Main Canal for the Yuma Project and the City of Yuma.

California receives most of its Colorado River water at three diversion points: MWD's pumping plant on Lake Havasu; the Palo Verde Irrigation and Drainage District's diversion at the Palo Verde Diversion Dam, near Blythe, California; and the AAC diversion at Imperial Dam, which also diverts a portion of the water delivered to Mexico.

1.3.6 FLOOD CONTROL OPERATION

Under the BCPA, flood control was specified as the project purpose having first priority for the operation of Hoover Dam. Subsequently, Section 7 of the Flood Control Act of 1944 established that the Secretary of War (now the Corps) will prescribe regulations for flood control for projects authorized, wholly or in part, for such purposes.

The Los Angeles District of the Corps published the current flood control regulations in the *Water Control Manual for Flood Control, Hoover Dam and Lake Mead Colorado River, Nevada and Arizona* (Water Control Manual) dated December 1982. The Field Working Agreement between Corps and Reclamation for the flood control operation of Hoover Dam and Lake Mead, as prescribed by the Water Control Manual, was signed on February 8, 1984. The flood control plan is the result of a coordinated effort between the Corps and Reclamation; however, the Corps is responsible for providing the flood control regulations and has authority for final approval. The Secretary is responsible for operating Hoover Dam in accordance with these regulations. Any deviation from the flood control operating instructions must be authorized by the Corps.

Flood control operation of Lake Mead was established to deal with two distinct types of flooding—snowmelt and rain. Snowmelt constitutes about 70 percent of the annual runoff in the Upper Basin. Lake Mead's uppermost 1.5 maf of storage capacity, between elevations 1219.61 feet above mean sea level (msl) and 1229.0 feet msl, is allocated exclusively to control floods from rain events.

The flood control regulations set forth two primary criteria to deal with snowmelt:

- Preparatory reservoir space requirements, applicable from August 1 through December 31; and

- Application of runoff forecasts to determine releases, applicable from January 1 through July 31.

In preparation for each year's seasonal snow accumulation and associated runoff, the first criterion provides a progressive expansion of the total Colorado River system reservoir space required during the latter months of each year. Required system space increases from 1.5 maf on August 1 to 5.35 maf on January 1. Required flood storage space can be located within Lake Mead and in specified upstream projects including: Lake Powell and Navajo, Blue Mesa, Flaming Gorge and Fontenelle reservoirs.

Space-building releases from Lake Mead are made when needed to meet the required August 1 to January 1 flood control space. Space-building releases beyond the minimum requirements of the Corps' Water Control Manual (often described as anticipatory flood control releases) may be considered by the Secretary. The Secretary takes into consideration the following: 1) the channel capacity of the river below Davis Dam; 2) the channel capacity and channel maintenance of the river below the Southerly International Boundary (SIB) (through the IBWC); and 3) power plant maintenance requirements of Hoover, Davis and Parker dams.

Between January 1 and July 31, flood control releases, based on the maximum forecasted inflow into Lake Mead, may be required to prevent filling of Lake Mead beyond its 1.5 maf minimum flood control space. Each month, runoff forecasts are developed by the National Weather Service's Colorado River Basin Forecast Center. Average monthly releases are determined each month and apply only to the current month.

The Colorado River Floodway Act of 1986 required Reclamation and other Federal agencies to identify the floodway of the lower Colorado River at a 100-year event or a flow rate of 40,000 cubic feet per second (cfs), whichever is greater. The Colorado River Floodway Act requires that the minimum flood release from Hoover Dam can be no less than 40,000 cfs. Downstream, 100-year events on the tributaries were included in the analysis flows. The floodway maps identifying the floodway of the Colorado River were completed and sent to the U.S. Congress (Congress) in the early 1990s. The Act also calls for a review, at least once every five years, to make technical modifications to the floodway boundaries and maps, if required. These maps have been adopted by the Federal Emergency Management Agency (FEMA) for flood insurance purposes. Reclamation has the responsibility to maintain the floodway.

1.3.7 HYDROPOWER GENERATION

Reclamation is authorized by legislation to produce electric power at each of the major Colorado River system dams, except Navajo Dam. Power generation at the Glen Canyon Dam Powerplant requires the water surface elevation of Lake Powell to

be above 3490 feet msl. Water is released from Glen Canyon Dam Powerplant into the Colorado River through a combination of the eight main generating units. At Hoover Powerplant, the minimum water surface elevation of Lake Mead necessary for power generation is approximately 1083 feet msl. Water is released from Hoover Powerplant to Lake Mohave through a combination of the 17 main generating units. Water is then released at Davis Dam Powerplant into the river through a combination of the five generators. Parker Dam is the last major regulating and reservoir facility on the lower Colorado River. All releases scheduled from Parker Dam are in response to downstream water orders and reservoir regulation requirements, and pass through a combination of its four generators.

Although Reclamation is the Federal agency authorized to produce power at the major Colorado River system dams, Western Area Power Administration (Western) is the Federal agency authorized to market this power. Western enters into electric service contracts on behalf of the United States with public and private utility systems for distribution of hydroelectric power produced at Reclamation facilities. The released water generates power, but water is not to be released from any Colorado River facility for the sole purpose of generating power.

Under operating agreements with Western, Reclamation is subject to downstream water requirements to meet the power generation schedules of Hoover, Parker and Davis dams. Western produces these schedules in accordance with existing electric service contracts, recognizing Reclamation's release requirements on the lower Colorado River (i.e., based on downstream delivery requirements) from the respective reservoirs.

1.4 RELATED AND ONGOING ACTIONS

A number of ongoing and new actions proposed by Reclamation and other entities are related to the development of interim surplus criteria and the analysis contained in this document. This section describes these actions and their relationship to the development of interim surplus criteria. The following actions have been described in environmental documents, consultation packages under Section 7 of the ESA or as project planning documents. Where appropriate, this DEIS references information contained in these documents. The documents described below are available for public inspection at Reclamation offices in Boulder City, Nevada; Salt Lake City, Utah; and Phoenix and Yuma, Arizona.

1.4.1 CALIFORNIA COLORADO RIVER WATER USE PLAN (4.4 PLAN)

The California Colorado River Water Use Plan (also known as the California 4.4 Plan or the 4.4 Plan) calls for conservation measures to be put in place that will reduce California's dependency on surplus Colorado River water. Surplus water is required to meet California's current needs until implementation of the conservation

measures can take place. During the period ending in 2015, the State of California has indicated that it intends to reduce its reliance on Colorado River water to meet its water needs above and beyond its 4.4-maf apportionment under the Decree. It is important for the long-term administration of the system to bring the Lower Basin uses in accordance with the Lower Basin apportionment. In order to achieve its goals, California has expressed a need to rely in some measure on the existence of surplus Colorado River water through 2015. These interim surplus criteria will aid California and its primary Colorado River water users as California reduces its consumptive use to 4.4 maf while ensuring that the other Basin States will not be placed at undue risk of future shortages.

The 4.4 Plan contains numerous water conservation projects and intrastate water exchanges. The 4.4 Plan is related to the implementation of the interim surplus criteria in the following ways.

First, compliance with the 4.4 Plan is necessary to ensure the Colorado River system meets the normal year deliveries in the Lower Basin over the long-term. Failure to comply with the plan places at risk the objective of providing reliable delivery of water for beneficial consumptive use to Lower Basin users. Therefore, regardless of which alternative is ultimately selected, failure of California to carry out the 4.4 Plan may result in termination or suspended application of the 15-year interim surplus criteria and reversion to the current system of surplus determinations that are made through the AOP process. Therefore, the Secretary may condition the continuation of interim surplus criteria for the entire period through 2015 on a showing of satisfactory progress in implementing the 4.4 Plan.

Second, because of the close linkage between various elements of the 4.4 Plan and the quantities of water involved, the reliable interim supply of surplus water from the Colorado River is an indispensable pre-condition to the successful implementation of the 4.4 Plan from the perspective of the State of California.

From the standpoint of environmental documentation and compliance, the 4.4 Plan and its various elements have been, or will be, addressed under separate Federal and state environmental reporting procedures. Certain aspects of the 4.4 Plan that may require Secretarial action are anticipated to be addressed in a Secretarial decision document that will undergo appropriate environmental compliance documentation.

1.4.2 GLEN CANYON DAM OPERATIONS

Glen Canyon Dam is operated consistent with the CRSPA and the LROC, which were promulgated in compliance with Section 602 of the CRBPA. Glen Canyon Dam is also operated consistent with the 1996 Record of Decision (ROD) on the Operation of Glen Canyon Dam (Attachment C) developed as directed under the Grand Canyon Protection Act.

The minimum release from Lake Powell, as specified in the LROC, is 8.23 maf per year. In years with very low inflow, or in years when Lake Powell is significantly drawn down, annual releases of 8.23 maf from Lake Powell are made. The LROC also require that, when Upper Basin storage is greater than the storage required under Section 602(a) of the Colorado River Basin Project Act, releases from Lake Powell will periodically be governed by the objective to maintain, as nearly as practicable, active storage in Lake Mead equal to the active storage in Lake Powell. Because of this equalization provision in the LROC, changes in operations at Lake Mead will, in some years, result in changes in annual release volumes from Lake Powell. It is through this mechanism that delivery of surplus water can influence the operation of Glen Canyon Dam.

In acknowledgement that the operation of Glen Canyon Dam, as authorized, to maximize power production was having a negative impact on downstream resources, the Secretary determined in July 1989 that an Environmental Impact Statement (EIS) should be prepared. The *Operation of Glen Canyon Dam EIS* developed and analyzed alternative operation scenarios that met statutory responsibilities for protecting downstream resources and producing hydro power, while protecting Native American interests. A final EIS was completed in March 1995 and the Secretary signed a ROD on October 8, 1996. Reclamation also consulted with the U.S. Fish and Wildlife Service (Service) under the ESA and incorporated the Service's recommendations into the ROD. The ROD describes criteria and plans for dam operations and includes other measures and authorities to ensure Glen Canyon Dam is operated in a manner consistent with the Grand Canyon Protection Act of 1992. Among these are an Adaptive Management Program, beach/habitat-building flows (BHBF), beach/habitat-maintenance flow, and further study of temperature control. Pertinent information includes descriptions and analyses of aquatic and riparian habitats below Glen Canyon Dam, effects of Glen Canyon Dam release patterns on the local ecology, sedimentation processes associated with the maintenance of backwaters and sediment deposits along the river, and relationships between release patterns and the value of hydroelectric energy produced. Analyses of effects on other resources within the affected area are also included. Additional information concerning the operation of Glen Canyon Dam is contained in Section 3.3.

1.4.2.1 ADAPTIVE MANAGEMENT PROGRAM

The Adaptive Management Program (AMP) provides a process for assessing the effects of current operations of Glen Canyon Dam on downstream resources and using the results to develop recommendations for modifying operating criteria and other resource management actions. This is accomplished through the Adaptive Management Work Group (AMWG), a Federal advisory committee. The AMWG consists of stakeholders that are Federal and state resource management agencies, representatives of the seven Basin States, Indian Tribes, hydroelectric power

marketers, environmental and conservation organizations and recreational and other interest groups. The duties of the AMWG are in an advisory capacity only. Coupled with this advisory role are long-term monitoring and research activities that provide a continual record of resource conditions and new information to evaluate the effectiveness of the operational modifications.

1.4.2.2 BEACH/HABITAT-BUILDING FLOWS AND BEACH/HABITAT-MAINTENANCE FLOWS

BHBF releases are scheduled high releases of short duration that are in excess of power plant capacity required for dam safety purposes, and are made according to certain specific criteria as described in Section 3.6.2. These BHBFs are designed to rebuild high elevation sandbars, deposit nutrients, restore backwater channels, and provide some of the dynamics of a natural system. The first test of a BHBF was conducted in Spring of 1996.

Beach/habitat-maintenance flow releases are releases at or near power plant capacity, which are intended to maintain favorable beach and habitat conditions for recreation and fish and wildlife, and to protect Tribal interests. Beach/habitat-maintenance flow releases can be made in years when no BHBF releases are made.

Both beach/habitat-building and beach/habitat-maintenance flows, along with the testing and evaluation of other types of releases under the AMP, were recommended by the Service to verify a program of flows that would improve habitat conditions for endangered fish. The proposed interim surplus criteria could affect the range of storage conditions in Lake Powell and alter the flexibility to schedule and conduct such releases or to test other flow patterns. The significance of this reduction in flexibility will be evaluated for each interim surplus alternative. The results are presented in Chapter 3.

1.4.2.3 TEMPERATURE CONTROL AT GLEN CANYON DAM

In 1994, the Service issued a *Biological Opinion on the Operation of Glen Canyon Dam*. One of the elements of the reasonable and prudent alternative in the Biological Opinion was the evaluation of methods to control release temperatures and, if viable, implement controls. Reclamation agreed with this recommendation and included it in the *Final Environmental Impact Statement and ROD on the Operation of Glen Canyon Dam*.

Reclamation has issued a draft planning report and environmental assessment (EA) entitled *Glen Canyon Dam Modifications to Controls and Downstream Temperatures* (Reclamation, 1999). Based on comments to this draft EA, Reclamation is currently in the process of preparing a new draft EA on temperature control at Glen Canyon Dam.

Interim surplus criteria could result in new information related to temperature control at Glen Canyon Dam. Data and information made available from analysis related to interim surplus criteria will be utilized in the revised EA on temperature control at Glen Canyon Dam. Such information would also be considered in the selection of an appropriate design for a temperature control device.

1.4.3 ACTIONS RELATED TO THE BIOLOGICAL AND CONFERENCE OPINION ON LOWER COLORADO RIVER OPERATIONS AND MAINTENANCE

Reclamation prepared a Biological Assessment (BA) in accordance with Section 7 of the ESA, addressing effects of ongoing and projected routine lower Colorado River operations and maintenance (Reclamation, 1996). After formal consultation, a Biological and Conference Opinion (BCO) was prepared by the Service (Service, 1997). Both documents are described in Section 1.4.5, Documents Incorporated by Reference. Pursuant to the reasonable and prudent alternative and 17 specific provisions provided in the BCO, Reclamation is taking various conservation actions that benefit the riparian region of the lower Colorado River and associated species. In particular, conservation actions include: 1) acquisition, restoration, and protection of potential and occupied Southwestern willow flycatcher habitat; 2) extensive life history studies for Southwestern willow flycatcher along 400 miles of the lower Colorado River and other areas; and 3) protection and enhancement of endangered fish species through risk assessments, assisted rearing, and development of protected habitats along the lower Colorado River. This five-year BCO provides ESA compliance for Reclamation actions on the lower Colorado River until 2002.

The BA and BCO contain life histories/status of lower Colorado River species, descriptions of ongoing and projected routine operations and maintenance activities, the Secretary's discretionary management activities, operation and maintenance procedures, endangered species conservation program, environmental baseline, effects of ongoing operations, reasonable and prudent alternative, and supporting documentation useful in this DEIS. A separate Section 7 ESA consultation is being conducted for this DEIS.

1.4.4 LOWER COLORADO RIVER MULTI-SPECIES CONSERVATION PROGRAM

Following the designation of critical habitat for three endangered fish on nearly all of the lower Colorado River in April of 1994, the three Lower Basin states of Arizona, California and Nevada, Reclamation and the Service initiated the Lower Colorado River Multi-Species Conservation Program (LCRMSCP). The purpose of the LCRMSCP is to obtain long-term (50-year) ESA compliance for both Federal and non-Federal water and power interests. Concurrently, Reclamation acquired interim (5-year) ESA compliance for its ongoing and projected routine water and power

operations and maintenance via a 1996 BA (Reclamation, 1996) and a 1997 BCO (Service, 1997).

One of the reasonable and prudent provisions of the 1997 BCO was the development of the LCRMSCP. The 1996 BA and the 1997 BCO did not anticipate or address the effects of specific interim surplus criteria on the species considered.

The LCRMSCP is a partnership of Federal, state, Tribal, and other public and private stakeholders with an interest in managing the water and related resources of the lower Colorado River Basin. In August 1995, the Department of the Interior and Arizona, California and Nevada entered into a Memorandum of Agreement (MOA) and later a Memorandum of Clarification (MOC) for development of the Multi-Species Conservation Program (MSCP). The purpose of the MOA/MOC was to initiate development of an MSCP that would accomplish the following objectives:

- Conserve habitat and work toward the recovery of threatened and endangered species and reduce the likelihood of additional species listing under the ESA; and
- Accommodate current water diversions and power production and optimize opportunities for future water and power development.

The LCRMSCP is currently under development and it is anticipated that the final EIS-environmental impact report will be finalized in 2001. Once the MSCP is accepted by the Service, Reclamation and other Federal agencies will have achieved ESA compliance for ongoing and future actions.

Since the interim surplus criteria determination is scheduled to be completed prior to the completion of the MSCP, a separate Section 7 consultation will be conducted with the Service on the anticipated effects of implementing the interim surplus criteria.

1.4.5 DOCUMENTS INCORPORATED BY REFERENCE

During recent decades, a considerable amount of environmental information has been obtained and environmental analyses conducted concerning the operation of the Colorado River water supply system. Much of this information is contained in various documents prepared under NEPA and the ESA. These documents have been previously distributed to interested agencies and private parties. In the interest of avoiding duplication and undue paperwork, this DEIS incorporates by reference parts or all of several documents. These documents are briefly described below.

- *Description and Assessment of Operations, Maintenance, and Sensitive Species of the Lower Colorado River (Biological Assessment),* August 1996.

  This BA was prepared by Reclamation at Boulder City, Nevada, to develop an inventory of aquatic and marsh habitat along the lower Colorado River and to analyze the relationships between river operation and maintenance of threatened and endangered species and critical habitat. The BA was prepared to facilitate the formal Section 7 consultation with the Service, which resulted in the April 1997 BCO cited below. The pertinent parts of the BA are the ecology of aquatic and riparian habitat systems from Lake Mead to the Southerly International Boundary and the potential effects of ongoing operation and maintenance on listed species and critical habitat.

- *Biological and Conference Opinion on Lower Colorado River Operations and Maintenance,* April 1997.

  This BCO, prepared by the Service at Phoenix, Arizona, through formal consultation with Reclamation at Boulder City, Nevada, addresses the critical habitat for endangered species along the lower Colorado River that is related to the operation of the river for delivery of water to the Lower Division states and Mexico. The report identifies a reasonable and prudent alternative for the avoidance of adverse effects of river operation. The pertinent parts of the conference and opinion are the life histories of various species, their habitat descriptions, and relationships with river operations.

- *Operation of Glen Canyon Dam Final Environmental Impact Statement,* March 1995, and *Record of Decision,* October 8, 1996.

  The Final Environmental Impact Statement (FEIS) was prepared by Reclamation at Salt Lake City, Utah, to evaluate alternative plans for the water releases at Glen Canyon Dam and Powerplant and the ecological effects on the Colorado River corridor downstream to Lake Mead. The FEIS was based on an extraordinary depth of analysis, involving numerous work groups with specialists in various disciplines from other agencies and private practice. The pertinent parts of the FEIS are the aquatic and riparian habitats below Glen Canyon Dam, the relationships between Glen Canyon Dam and Powerplant release patterns and their ecology, and the sedimentation processes associated with the maintenance of backwaters and beach belts along the river. The relationships between release patterns and the value of hydroelectric energy produced were also pertinent.

  The ROD adds commitments in the following areas: establishment of an adaptive management program, monitoring and protecting cultural resources, flood frequency reduction measures, BHBF releases, establishment of a new population of the humpback chub, further study of selective withdrawals from

Lake Powell, and emergency operation criteria to respond to various emergency situations.

- *Glen Canyon Dam Modification to Control Downstream Temperatures Plan and Environmental Assessment*, January 1999.

  This draft planning report and EA was prepared by Reclamation at Salt Lake City, Utah, to consider alternatives for modifying the intakes to the power penstocks to permit the selective withdrawal of water at various temperatures in Lake Powell. The pertinent parts of the report are the sensitivity of downstream fish species, particularly endangered species, to temperatures of Colorado River water downstream from the dam and the degree of temperature control that could be achieved by the modifications. Based on comments on the draft EA, Reclamation is in the process of preparing a new draft EA on temperature control at Glen Canyon Dam.

- *Final Biological Opinion, Operation of Glen Canyon Dam as the Modified Low Fluctuating Flow Alternative*, December 1994.

  This Biological Opinion was prepared by the Service at Phoenix, Arizona, through consultation with Reclamation at Salt Lake City, Utah. The document addresses Glen Canyon Dam operations and the critical habitat for endangered species in the Colorado River from Glen Canyon Dam to Lake Mead and identifies a reasonable and prudent alternative for the avoidance of jeopardy. The document also provides environmental baseline and status of species in the action area related to the preferred alternative.

- *Glen Canyon Adaptive Management Work Group Charter*, December 8, 1998.

  This charter outlines the membership and duties of the AMWG. The duties are to establish operating procedures, advise the Secretary in meeting environmental and cultural commitments of the Glen Canyon Dam FEIS and ROD, recommend a framework for adaptive management program policy, goals and direction; develop recommendations for modifying dam operations and operating criteria; define and recommend resource management objectives for a long-term monitoring plan; review and provide input to the Secretary on required reports; facilitate input and coordination of information from stakeholders to the Secretary; and monitor and report on compliance of all program activities with applicable laws, permitting requirements, and the Grand Canyon Protection Act.

- *Quality of Water, Colorado River Basin, Progress Report No. 19*, January 1999.

  This report is the latest of a series of biennial reports to Congress, prepared by Reclamation at Salt Lake City, Utah, that summarize progress of the Colorado River Water Quality Improvement Program in controlling Colorado River

salinity. The pertinent parts of the report are those which discuss the mechanisms that contribute dissolved salts to the river system, the relationships between dissolved salt concentrations and abundance of basin water supply, and the effects of dissolved minerals on uses of Colorado River water.

- *Southern Nevada Water Authority Treatment and Transmission Facility Final Environmental Impact Statement,* September 1996, and *Record of Decision,* November 1996.

  This EIS and ROD contain pertinent information concerning the influence of the Las Vegas Valley drainage on the water quality in Lake Mead's Boulder Basin and the resulting quality of water pumped from the reservoir by the SNWA's intake facilities. Critical intake elevations are identified in the documents.

- *Final Programmatic Environmental Assessment for Rulemaking for Offstream Storage of Colorado River Water and Development and Release of Intentionally Created Unused Apportionment in the Lower Division States*, October 1999.

  This document and the BA analyze the environmental effects of potential changes in reservoir and river operations that could occur if a Lower Division state diverts and stores water for the benefit of another Lower Division state for future use (interstate offstream storage). The BA contains aquatic and marsh habitat descriptions, and the relationships between changes in diversions from Lake Mead and Lake Havasu and downstream aquatic and marsh habitat maintenance. The relationships between release patterns from Hoover Dam and the value of hydroelectric energy are also useful for this analysis.