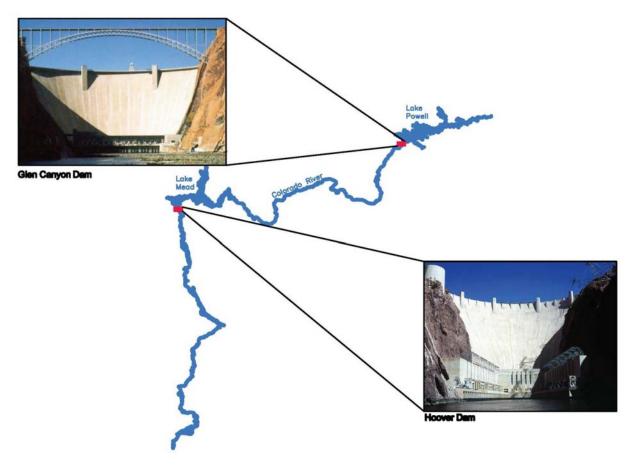
RECLAMATION

Managing Water in the West

Draft

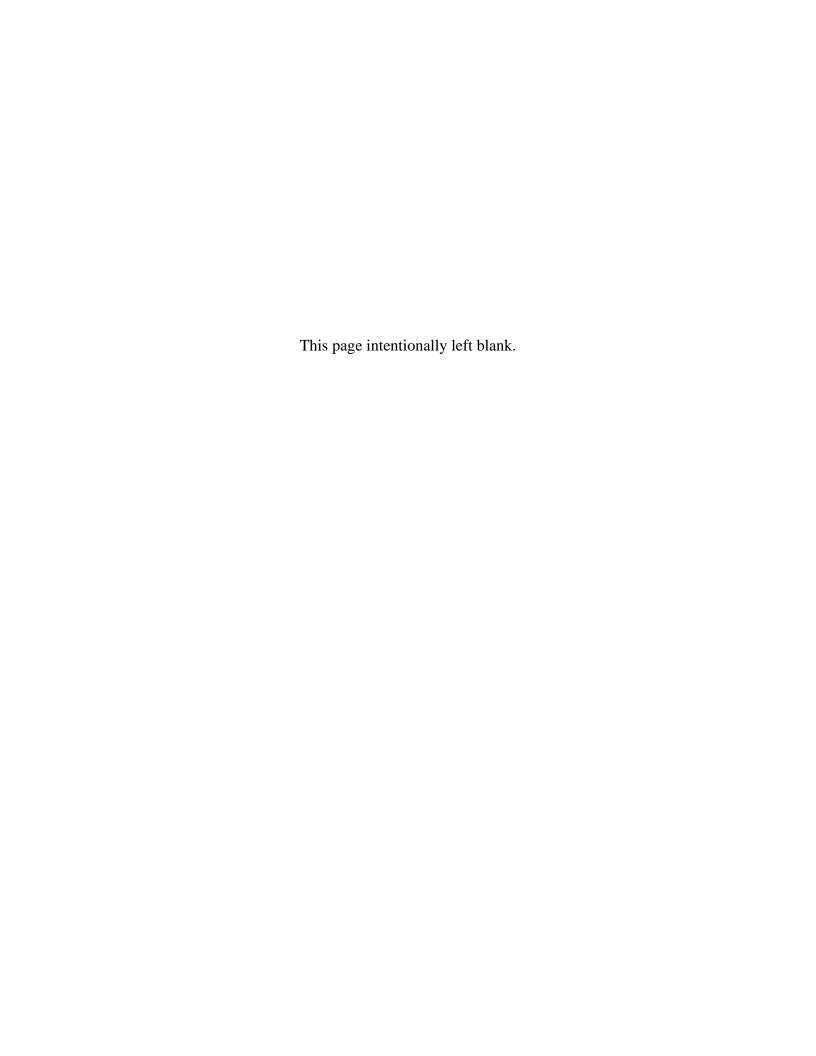
Environmental Impact Statement



Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead

Volume I





Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead

Draft Environmental Impact Statement

Volume I

U.S. Department of the Interior Bureau of Reclamation Upper and Lower Colorado Regions February 2007

Mission Statement

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead Draft Environmental Impact Statement

Lead Agency:

United States Department of the Interior Bureau of Reclamation Upper and Lower Colorado Regions

Cooperating Agencies:

Bureau of Indian Affairs
National Park Service
Western Area Power Administration
United States Fish and Wildlife Service
United States Section of the International Boundary and Water Commission

Abstract:

The Secretary of the Department of the Interior (Department), acting through the Bureau of Reclamation, proposes adoption of specific Colorado River Lower Basin (Lower Basin) shortage guidelines and coordinated reservoir management strategies to address operations of Lake Powell and Lake Mead, particularly under drought and low reservoir conditions. This action is proposed in order to provide a greater degree of certainty to United States Colorado River water users and managers of the Colorado River Basin by providing detailed, and objective guidelines for the operations of Lake Powell and Lake Mead, thereby allowing water users in the Lower Basin to know when, and by how much, water deliveries will be reduced in drought and other low reservoir conditions. The Department proposes that these guidelines be interim in duration and extend through 2026. The environmental impact statement (EIS) process will provide an opportunity to develop the information needed to analyze and consider tradeoffs between the frequency and magnitude of shortages, and to describe potential effects on water storage in Lake Powell and Lake Mead, and on water supplies, power production, recreation, and other environmental resources.

This Draft EIS has been prepared pursuant to the National Environmental Policy Act to address the formulation and evaluation of specific interim criteria and to identify the potential environmental impacts of implementing such criteria.

For further information regarding this Draft EIS, contact:

Bureau of Reclamation Attention: BCOO-1000

P.O. Box 61470

Boulder City, Nevada 89006-1470 Fax number: (702) 293-8156 Phone number: (702) 293-8500 E-mail: strategies@lc.usbr.gov

Comments Due:

Comments on the Draft EIS must be submitted to the above mail or E-mail address no later than Monday, April 30, 2007.

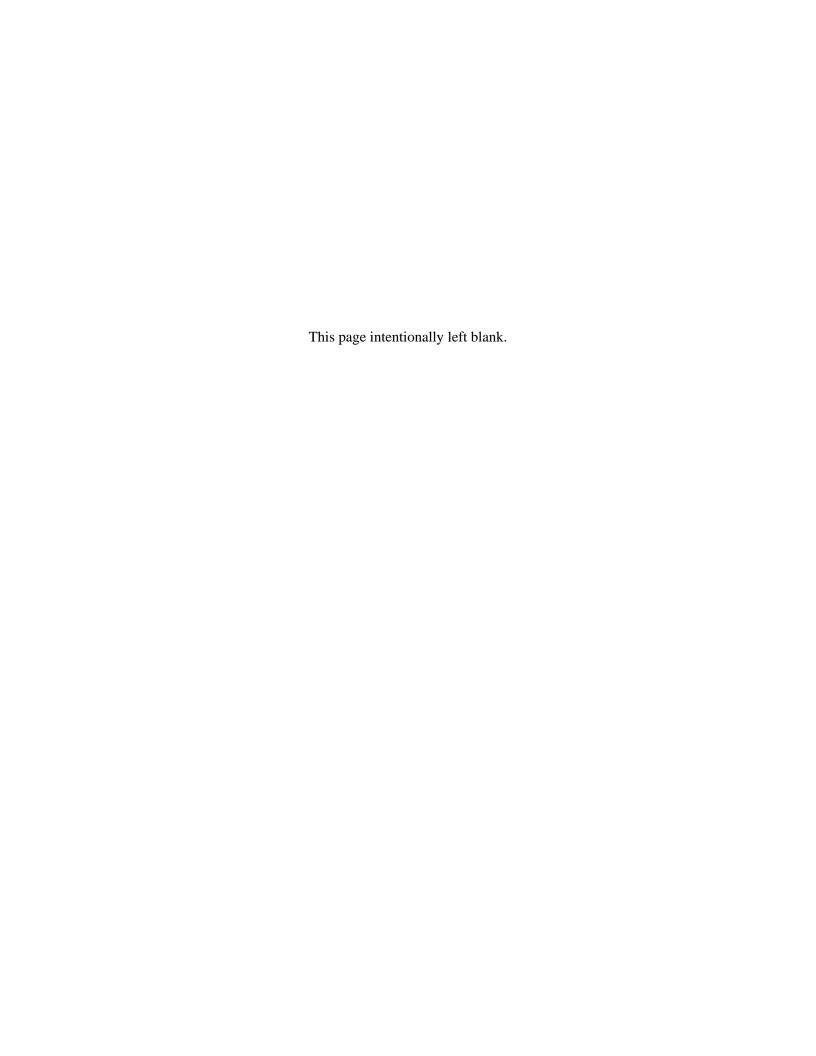
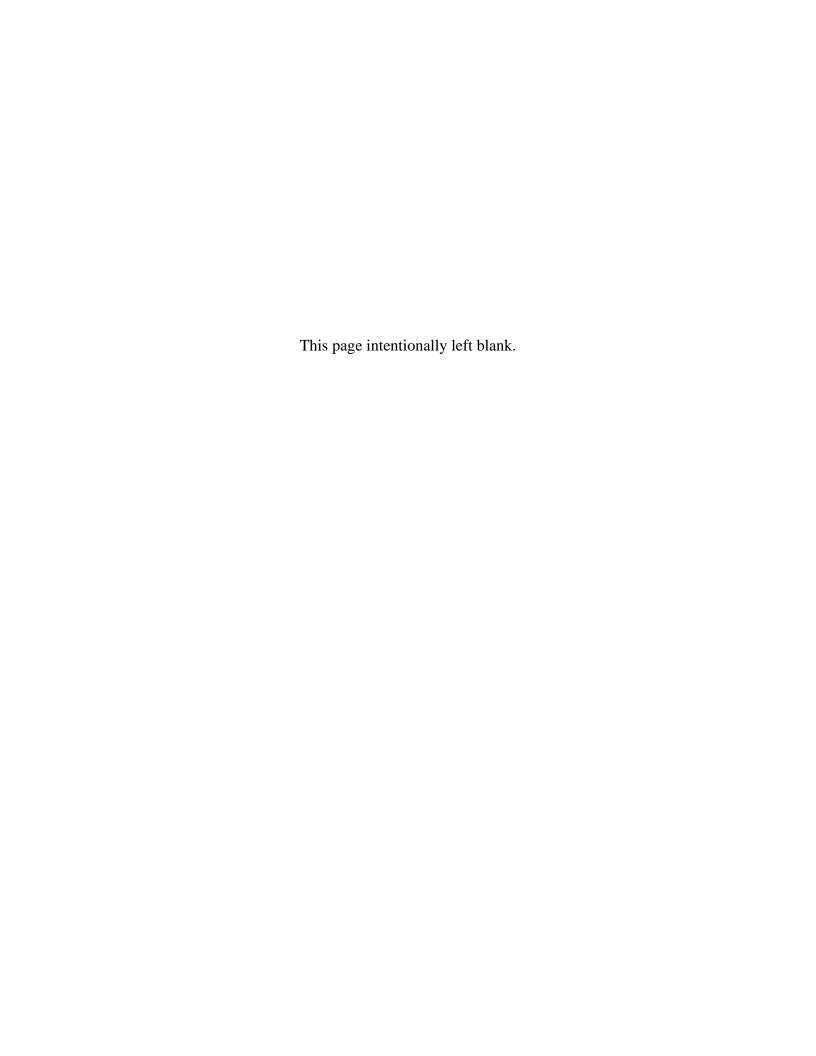


Table of Contents

1



EXECUTIVE S	SUMMARY	ES-1
ES.1 Ba	ckground	ES-1
ES.1.1	Purpose and Need for Action	
ES.1.2	Proposed Federal Action	
ES.1.3	Geographic Scope	
ES.1.4	Alternatives	
ES.2 Su	mmary of Potential Environmental Effects	ES-7
ES.2.1	Methodology	
ES.2.2	Hydrologic Resources	
ES.2.3	Water Deliveries	ES-10
ES.2.4	Water Quality	ES-11
ES.2.5	Air Quality	ES-12
ES.2.6	Visual Resources	ES-12
ES.2.7	Biological Resources	ES-12
ES.2.8	Cultural Resources	ES-14
ES.2.9	Indian Trust Assets	ES-15
ES.2.10	Electrical Power Resources	ES-15
ES.2.11	Recreation	ES-15
ES.2.12	Transportation	ES-16
ES.2.13	Socioeconomics and Land Use	ES-17
ES.3 Cu	mulative Impacts	ES-17
CHAPTER 1 P	URPOSE AND NEED	1-1
	duction	
-	osed Federal Action	
	ose of and Need for Action	
	and Cooperating Agencies	
1.5 Scop	e of the EISAffected Region and Interests	
1.5.2	Relevant Issues	
	nary of Contents of this Draft EIS	
	r Supply Management and Allocation	
1.7.1	Colorado River System Water Supply	
1.7.2	Apportionment of Water Supply	
1.7.3	System Reservoirs and Diversion Facilities	
1.7.4	Flood Control Operation	
1.7.5	Hydropower Generation	
1.7.6	Annual Operating Plan and Long Range Operating Criteria	
	ed Actions	
1.8.1	Operation of Glen Canyon Dam - Final EIS and ROD	

1.8.2	Off-stream Storage of Colorado River Water and Development and Release of Intentionally Created Unused Apportionment in the Lower	
	Division States	1-24
1.8.3	Interim Surplus Criteria - Final EIS and ROD - Colorado River Interim	1 2 4
1.0.4	Surplus Guidelines	1-24
1.8.4	Implementation Agreement, Inadvertent Overrun and Payback Policy,	
	and Related Federal Actions - Final EIS and ROD - Colorado River	1.05
405	Water Delivery Agreement	1-25
1.8.5	Lower Colorado River Multi-Species Conservation Program (LCR	
	MSCP) - Final Programmatic EIS/EIR and ROD - Lower Colorado	1.05
	River Multi-Species Conservation Plan	1-25
CHAPTER 2	DESCRIPTION OF ALTERNATIVES	2-1
2.1 Dev	relopment of Alternatives	2-1
	Action Alternative	
2.2.1	Shortage Guidelines	
2.2.2	Coordinated Reservoir Operations	
2.2.3	Storage and Delivery of Conserved Water	
2.2.4	Interim Surplus Guidelines	
	in States Alternative	
2.3.1 Das	Shortage Guidelines	
2.3.2	Coordinated Reservoir Operations	
2.3.3	Storage and Delivery of Conserved Water	
2.3.4	Interim Surplus Guidelines	
	servation Before Shortage Alternative	
2.4.1	Shortage Guidelines	
2.4.2	Coordinated Reservoir Operations	
2.4.3	Storage and Delivery of Conserved Water	
2.4.4	Interim Surplus Guidelines	
2.4.5	Funding Mechanisms	
	ter Supply Alternative	
2.5.1	Shortage Guidelines	
2.5.2	Coordinated Reservoir Operations	
2.5.3	Storage and Delivery of Conserved Water	
2.5.4	Interim Surplus Guidelines	
	ervoir Storage Alternative	
2.6.1	Shortage Guidelines	
2.6.2	Coordinated Reservoir Operations	
2.6.3	Storage and Delivery of Conserved Water	
2.6.4	Interim Surplus Guidelines	
	nmary Comparison of Alternatives	
	nmary of Potential Effects	

CHAPTER 3	AFFECTED ENVIRONMENT	3-1
3.1 Intr	oduction	3-1
	ographic Scope	
3.2.1	Definition of Colorado River Reaches	
3.2.2	Colorado River Water User Service Areas	3-10
3.3 Hyd	drologic Resources	
3.3.1	Hydrologic Overview	
3.3.2	Lake Powell and Glen Canyon Dam	3-17
3.3.3	Glen Canyon Dam to Lake Mead	3-20
3.3.4	Lake Mead and Hoover Dam	
3.3.5	Hoover Dam to Davis Dam	3-23
3.3.6	Davis Dam to Parker Dam	3-24
3.3.7	Parker Dam to Cibola Gage	3-25
3.3.8	Cibola Gage to Imperial Dam	3-26
3.3.9	Imperial Dam to NIB	3-26
3.3.10	NIB to SIB	3-28
3.4 Wa	ter Deliveries	3-31
3.4.1	Apportionments to the Upper Division States	3-31
3.4.2	Apportionments to the Lower Division States and Water Entitlements	
	within Each State	3-32
3.4.3	Lower Division States Water Supply Determination	
3.4.4	Depletion Schedules for Lower Division States (Normal and Surplus)	3-35
3.4.5	Mexico's Allotment	
3.4.6	Distribution of Shortages To and Within the Lower Division States	
	ter Quality	
3.5.1	Salinity	
3.5.2	Temperature	
3.5.3	Sediment	
3.5.4	Nutrients and Algae	
3.5.5	Dissolved Oxygen	
3.5.6	Metals	
3.5.7	Perchlorate	
	Quality	
3.6.1	Federal Air Quality Requirements	
3.6.2	State and Local Air Quality Requirements	
3.6.3	Ambient Air Quality by River Reach	
	ual Resources	
3.7.1	Lake Powell and Glen Canyon Dam Reach	
3.7.2	Glen Canyon Dam to Lake Mead	
3.7.3	Lake Mead and Hoover Dam	
	logical Resources	
3.8.1	Vegetation	
3.8.2	Wildlife	
3.8.3	Special Status Species	3-69

3.9 C	ultural Resources	3-75
3.9.1	Undertaking Determination	3-75
3.9.2	Definition of the Area of Potential Effects and Identification Efforts	3-75
3.9.3	Lake Powell and Glen Canyon Dam	3-76
3.9.4	Glen Canyon Dam to Lake Mead	
3.9.5	Lake Mead and Hoover Dam	
3.9.6	Lake Mohave and Davis Dam	3-78
3.9.7	Davis Dam to Parker Dam	
3.10 In	dian Trust Assets	3-81
3.10.1	Introduction	3-81
3.10.2		
3.10.3	B Hydroelectric Power Generation and Distribution	3-89
3.10.4	4 Cultural Resources	3-89
3.10.5		
3.10.6	Other Potentially Affected Tribes Asserting Colorado River	
	Water Rights	3-90
3.11 El	lectrical Power Resources	
3.11.1	Overview	3-93
3.11.2	2 Lake Powell and Glen Canyon Dam	3-96
3.11.3		
3.11.4	Parker/Davis Projects	3-97
3.11.5	Other Small Hydropower Facilities	3-98
3.11.6		
3.11.7	Water Supply System	3-100
3.12 R	ecreation	3-103
3.12.1	Shoreline Public Use	3-103
3.12.2	Reservoir Boating	3-116
3.12.3	River and Whitewater Boating	3-119
3.12.4	4 Sport Fishing	3-120
3.13 Tı	ransportation	3-123
3.13.1	Ferry Service	3-123
3.14 Sc	ocioeconomics and Land Uses	3-127
3.14.1	Study Area	3-127
3.14.2	2 Water Use	3-128
3.14.3	Recreation	3-132
3.15 Eı	nvironmental Justice	3-135
3.15.1	Minority, Low-Income Populations, and Indian Tribes	3-135
CHADTED	A ENVIDONMENTAL CONCEQUENCES	11
CHAPIER	4 ENVIRONMENTAL CONSEQUENCES	4-1
	troduction	
	[ethodology	
4.2.1	Alternatives Modeled	
4.2.2	Period of Analysis	
4.2.3	Model Description	
4.2.4	Computational Procedures and Future Hydrology	4-4

4.2.5	Post-processing and Interpretation Procedures	4-5
4.2.6	Model Uncertainty	
4.2.7	Modeling Assumptions Common to All Alternatives	
4.2.8	Modeling Assumptions Specific to Alternatives	
4.3 Hy	drologic Resources	
4.3.1	Methodology	4-15
4.3.2	Lake Powell and Glen Canyon Dam	4-16
4.3.3	Glen Canyon Dam to Lake Mead	4-31
4.3.4	Lake Mead and Hoover Dam	4-38
4.3.5	Hoover Dam to Davis Dam	4-56
4.3.6	Davis Dam to Parker Dam	4-59
4.3.7	Parker Dam to Cibola Gage and Cibola Gage to Imperial Dam	4-65
4.3.8	Imperial Dam to NIB	4-74
4.3.9	NIB to SIB	4-74
4.3.10	Summary	4-78
4.4 Wa	ter Deliveries	4-81
4.4.1	Methodology	
4.4.2	Apportionments to the Upper Division States	4-81
4.4.3	Apportionments to the Lower Division States and Water Entitlements	
	within Each State	4-82
4.4.4	Lower Division States Water Supply Determination	
4.4.5	Total Water Deliveries to the Lower Division States	
4.4.6	Water Deliveries to Mexico	
4.4.7	Distribution of Shortages to and within the Lower Division States	
4.4.8	Summary	
4.5 Wa	ter Quality	
4.5.1	Introduction	
4.5.2	Methodology	
4.5.3	Salinity	
4.5.4	Temperature	
4.5.5	Sediment and Dissolved Oxygen	
4.5.6	Nutrients and Algae	
4.5.7	Metals	
4.5.8	Perchlorate	
4.5.9	Summary	
	· Quality	
4.6.1	Methodology	
4.6.2	Lake Powell and Glen Canyon Dam	
4.6.3	Glen Canyon Dam to Lake Mead, Lake Mead and Hoover Dam	
4.6.4	Summary	
	sual Resources	
4.7.1	Methodology	
4.7.2	Lake Powell and Glen Canyon Dam	
4.7.3	Glen Canyon Dam to Lake Mead	
4.7.4	Lake Mead and Hoover Dam	
4.7.5	Summary	160

4.8 Bio	logical Resources	4-161
4.8.1	Related Environmental Programs	4-161
4.8.2	Methodology	4-162
4.8.3	Effects on Vegetation and Wildlife	
4.8.4	Special Status Species	
4.8.5	Summary	
4.9 Cul	tural Resources	
4.9.1	Methodology	4-207
4.9.2	Lake Powell and Glen Canyon Dam	
4.9.3	Glen Canyon Dam To Lake Mead	
4.9.4	Lake Mead and Hoover Dam	
4.9.5	Hoover Dam to Davis Dam	
4.9.6	Davis Dam to Parker Dam	
4.9.7	Parker Dam to Imperial Dam	
4.9.8	Sacred Sites and Other Issues of Tribal Concern	
4.9.9	Summary	
	ian Trust Assets	
4.10.1	Water Rights and Trust Lands	
4.10.2	Hydroelectric Power Generation and Distribution	
4.10.3	Cultural Resources	
4.10.4	Biological Resources	
4.10.5	Summary	
	ctrical Power Resources	
4.11.1	Methodology	
4.11.2	Electrical Power Generation Facilities	
	reation	
4.12.1	Methodology	
4.12.2	Recreation at Lake Powell.	
4.12.3	Recreation from Glen Canyon Dam to Lake Mead	
4.12.4	Recreation at Lake Mead	
4.12.5	Recreation from Hoover Dam to SIB	
4.12.6	Summary	
	nsportation	
4.13.1	Methodology	
4.13.1	Lake Powell Ferry Service	4-257
4.13.3	Laughlin River Taxis and Tour Boats	
4.13.4	Lake Havasu Ferry Service	
4.13.4	Summary	
	ioeconomics and Land Use	
4.14.1	Methodology	
4.14.2	Agriculture	
4.14.2	Municipal and Industrial Water Uses	
4.14.3	Recreation	
4.14.4	Summary	
	rironmental Justice	
4.15.1	Methodology	4-289

4.15.2	Hydrology, Water Deliveries, and Socioeconomics	. 4-289
4.15.3	Water Quality	
4.15.4	Air Quality	. 4-290
4.15.5	Visual Resources	. 4-290
4.15.6	Biological Resources	. 4-290
4.15.7	Cultural Resources	. 4-290
4.15.8	Indian Trust Assets	. 4-290
4.15.9	Electrical Power Resources	. 4-290
4.15.10	Recreation	. 4-291
4.15.11	Transportation	. 4-291
4.15.12	Summary	. 4-291
CHAPTER 5	OTHER CONSIDERATIONS AND CUMULATIVE IMPACTS	5-1
5.1 Fed	eral Statutes and Policies	5-1
5.1.1	Endangered Species Act of 1973, as Amended (16 U.S.C. §§ 1531-	5 1
5.1.2	1544)	5-1
3.1.2		5 1
5.1.3	661-667d)	3-1
3.1.3	U.S.C. § 668dd)	5 1
5.1.4	Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§ 1271-1287)	
5.1.5	Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703-712)	
5.1.6	Migratory Bird Conservation Act of 1929 (16 U.S.C. § 715)	
5.1.7	Bald Eagle Protection Act of 1940 (16 U.S.C. § 668)	
5.1.8	Clean Air Act of 1963, as Amended (42 U.S.C. § 7506)	
5.1.9	Federal Water Pollution Control Act (Clean Water Act) of 1972, as	5
3.1.9	Amended (33 U.S.C. chapter 26)	5-3
5.1.10	River and Harbors Act of 1899 (33 U.S.C. §§ 401-403)	
5.1.11	National Historic Preservation Act of 1966, as Amended (16 U.S.C. §	5
0.1.11	470)	5-4
5.1.12	Native American Graves Protection and Repatriation Act of 1990 (25	
	U.S.C. §§ 3001-3013)	5-4
5.1.13	Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470)	
5.1.14	Farmland Protection Policy Act of 1981 (7 U.S.C. §§ 4201-4209)	
5.1.15	Executive Order No. 11988, Floodplain Management, May 24, 1977	
5.1.16	Executive Order No. 11990, Protection of Wetlands, May 24, 1977	
5.1.17	Executive Order No. 12898, Federal Actions to Address Environmental	
	Justice in Minority Populations and Low-Income Populations, February	
	11, 1994	5-5
5.1.18	Executive Order No. 13007, Indian Sacred Sites, May 24, 1996	5-5
5.1.19	Executive Order No. 12114, Environmental Impacts Abroad of Major	
	Federal Actions, January 4, 1979	5-5
5.1.20	Secretarial Order No. 3206, American Indian Tribal Rights, Federal-	
	Tribal Trust Responsibility, and the Endangered Species Act, June 7,	
	1997	5-6

	5.1	.21 SNWA Virgin River and Muddy River Surface Water Development	
		Project	5-7
	5.1	.22 SNWA Coyote Spring Well and Moapa Transmission System Project	
	5.1	1.23 SNWA Clark, Lincoln, and White Pine Counties Groundwater	
		Development Project	5-8
	5.1	1.24 SNWA Lake Mead Intake No. 3 Project	5-8
	5.1	1.25 Systems Conveyance and Operations Program	
		Lower Colorado River Multi-Species Conservation Program	
		1.27 Lower Colorado River Drop 2 Storage Reservoir Project	
		1.28 Long-Term Experimental Plan for the Operation of Glen Canyon Dam	
		and Other Associated Management Activities	5-11
	5.1	1.29 Cumulative Impacts by Resource	
	5.2	Relationship Between Short-term Uses of the Environment and Long-term	5 12
	3.2	Productivity	5-15
	5.3	Irreversible and Irretrievable Commitments of Resources	
	3.3	ineversible and inethevable commitments of Resources	5-10
C	НАРТБ	R 6 CONSULTATION AND COORDINATION	6-1
<u> </u>			
	6.1	Introduction	6-1
	6.2	General Public Involvement Activities	
	6.3	Cooperating Agency Involvement	
	6.3		
	6.3		
	6.3		
	6.3		
	6.3		0 0
		Commission	6-3
	6.4	Tribal Consultation	
	6.5	State and Local Water and Power Agency Coordination	
	6.6	Non-Governmental Organizations Coordination	
	6.7	Other Consultations	
	6.8	Consultation with Mexico.	
	6.9	Summary of Coordination and Consultation Contacts	
		Federal Register Notices	
	0.10	1 cdc1d1 Register 1 cdiecs	0 0
IN	DEX		.IND-1
•.	1222111		
R	EFERE	NCES CITED	REF-1
A	CRONY	/MS	ACR-1
G	LOSSA	RY	GLO-1
		PREPARERS	LOP-1
ا ا	15 I ()H	PKEPAKEKS	1.C)P.I

List of Figures

Figure ES-1	Geographic Scope	ES-4
Figure 1.7-1	The Colorado River Basin	1-10
Figure 1.7-2	Lees Ferry Gaging Station	
Figure 1.7-3	Upper and Lower Division States of the Colorado River	
Figure 1.7-4	Colorado River Reservoirs and Diversion	
Figure 1.7-5	Lower Basin Dams and Reservoirs	
Figure 2.2-1	Level 1 Shortage Trigger Elevations Under No Action Alternative	2-5
Figure 3.2-1	Geographic Scope	3-4
Figure 3.2-2	Colorado River Reaches	3-5
Figure 3.2-3	CAP Service Area	3-11
Figure 3.2-4	SNWA Service Area	3-13
Figure 3.2-5	MWD Service Area	3-14
Figure 3.3-1	Natural Flow of the Colorado River at Lees Ferry Gaging Station, Arizona, 1906 through 2004	3-16
Figure 3.3-2	Historic Annual Flow of the Colorado River at Lees Ferry Gaging	5 10
1 1guic 3.3 2	Station, Arizona, 1922 through 2005	3-17
Figure 3.3-3	Historic Annual Lake Powell Water Levels (Annual Highs and Lows)	
Figure 3.3-4	Historic Annual Lake Mead Elevations (Annual Highs and Lows)	
Figure 3.3-5	Water Routing from Imperial Dam to NIB, Deliveries to Mexico	5 21
1 18410 3.3 3	Pursuant to the 1944 Treaty	3-27
Figure 3.4-1	Upper Basin Scheduled Depletions, Years 2008 to 2060	
Figure 3.4-2	Arizona's Projected Colorado River Water Depletion Schedules Under	
1 18410 5.1 2	No Action Alternative	3-35
Figure 3.4-3	California's Projected Colorado River Water Depletion Schedules	5 55
1 18410 3.1 3	Under No Action Alternatives	3-36
Figure 3.4-4	Nevada's Projected Colorado River Water Depletion Schedules Under	5 50
1 18410 5.1 1	No Action Alternative	3-37
Figure 3.5-1	Historic Salinity Concentrations and Flows below Hoover Dam from	5 57
1 18410 3.5 1	1941 to 2005	3-44
Figure 3 5-2	Historic Salinity Concentrations and Flows below Parker Dam from	
1 18410 3.0 2	1941 to 2005	
Figure 3.5-3	Historic Salinity Concentrations and Flows at Imperial Dam from	
1 18410 3.0 3	1941 to 2005	3-45
Figure 3.5-4	Historic Elevation and Dam Release Temperatures at Lake Powell	
-	Historic Elevation and Dam Release Temperatures at Lake Mead	
_	Lake Powell Shoreline Access Points	
	Lake Mead Shoreline Access Points	
	Lake Mohave Shoreline Access Points	
	John Atlantic burr Ferry Route – Lake Powell	
	Laughlin River Taxi and Tour Boat Crossing	
	Lake Havasu Ferry Route	
_	Minority Population by County	
<i>-</i>	J 1 J	

Figure 3.15-2	Low Income Population by County	3-137
Figure 4.3-1	Lake Powell End-of-July Elevations Under the No Action Alternative	
\mathcal{E}	90th, 50th and 10th Percentile Values	4-17
Figure 4.3-2	Lake Powell End-of-July Elevations Comparison of Action	
C	Alternatives to No Action Alternative 90th, 50th and 10th Percentile	
	Values	4-18
Figure 4.3-3	Lake Powell End-of-July Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Greater Than	
	or Equal to Elevation 3,695 feet msl	4-20
Figure 4.3-4	Lake Powell End-of-September Elevations Comparison of Action	
_	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,650 feet msl	4-21
Figure 4.3-5	Lake Powell End-of-September Elevations Comparison of Action	
_	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,626 feet msl	4-22
Figure 4.3-6	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,620 feet msl	4-24
Figure 4.3-7	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,588 feet msl	4-25
Figure 4.3-8	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,560 feet msl	4-27
Figure 4.3-9	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,555 feet msl	4-28
Figure 4.3-10	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,550 feet msl	4-29
Figure 4.3-11	Lake Powell End-of-March Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,490 feet msl	4-30
Figure 4.3-12	Glen Canyon Dam Water Year Releases Comparison of Action	
	Alternatives to No Action Alternative 90th, 50th and 10th Percentile	
	Values	4-33
Figure 4.3-13	Glen Canyon Dam Water Year Releases Comparison of Action	
	Alternatives to No Action Alternative Water Years 2009 through 2060.	4-34
Figure 4.3-14	Glen Canyon Dam 10-Year Running Total of Annual Releases	
	Comparison of Action Alternatives to No Action Alternative Years	
	2008 through 2060	4-37
Figure 4.3-15	Lake Mead End-of-December Elevations Comparison of Action	
	Alternatives to No Action Alternative 90th, 50th and 10th Percentile	
	Values	4-38

Figure 4.3-16	Lake Mead End-of-December Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Greater Than	
	or Equal to Elevation 1,200 feet msl	4-40
Figure 4.3-17	Lake Mead End-of-December Elevations Comparison of Action	
_	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 1,178 feet msl	4-42
Figure 4.3-18	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,175 feet msl	4-43
Figure 4.3-19	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,170 feet msl	4-45
Figure 4.3-20	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,125 feet msl	4-46
Figure 4.3-21	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,080 feet msl	4-48
Figure 4.3-22	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
_	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,050 feet msl	4-49
Figure 4.3-23	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,000 feet msl	4-51
Figure 4.3-24	Lake Mead End-of-July ElevationsComparison of Action Alternatives	
	to No Action Alternative Minimum Water Elevation Values (feet msl)	4-52
Figure 4.3-25	Lake Mead End-of-December Elevations Comparison of Action	
	Alternatives With Storage and Delivery Mechanism Removed to No	
	Action Alternative 10th, 50th, and 90th Percentile Values	4-54
Figure 4.3-26	Lake Mead End-of-December Elevations Comparison of Action	
	Alternatives With and Without a Storage and Delivery Mechanism	
	10th, 50th, and 90th Percentile Values	4-55
Figure 4.3-27	Hoover Dam Annual Releases Comparison of Action Alternatives to	
	No Action Alternative 90th, 50th and 10th Percentile Values	4-57
Figure 4.3-28	Hoover Dam Annual Releases Comparison of Action Alternatives to	
	No Action Alternative Years 2008 through 2060	4-58
Figure 4.3-29	Davis Dam Annual Releases Comparison of Action Alternatives to No	
	Action Alternative 90th, 50th and 10th Percentile Values	4-60
Figure 4.3-30	Davis Dam Annual Releases Comparison of Action Alternatives to No	
	Action Alternative Years 2008 through 2060	4-61
Figure 4.3-31	Colorado River Annual Flow Near Havasu NWR - RM 2423 (af)	
	Comparison of Action Alternatives to No Action Alternative 90th,	
	50th and 10th Percentile Values	4-62
Figure 4.3-32	Davis Dam Annual Releases Comparison of Action Alternatives to No	
	Action Alternative Annual Median (50th Percentile) Values (cfs)	4-64

Figure 4.3-33	Parker Dam Annual Releases Comparison of Action Alternatives to	
_	No Action Alternative 90th, 50th and 10th Percentile Values	4-67
Figure 4.3-34	Parker Dam Annual Releases Comparison of Action Alternatives to	
	No Action Alternative Years 2008 through 6020	4-68
Figure 4.3-35	Colorado River Annual Flow Upstream of CRIR Diversion - RM	
	180.8 (af) Comparison of Action Alternatives to No Action Alternative	
	90th, 50th and 10th Percentile Values	4-69
Figure 4.3-36	Colorado River Annual Flow Downstream of Palo Verde Diversion	
C	Dam - RM 133.8 (af) Comparison of Action Alternatives to No Action	
	Alternative 90th, 50th and 10th Percentile Values	4-71
Figure 4.3-37	Parker Dam Annual Releases Comparison of Action Alternatives to	
C	No Action Alternative Annual Median (50th Percentile) Values	4-73
Figure 4.3-38	Colorado River Annual Flow Below Mexico Diversion at Morelos	
\mathcal{E}	Diversion Dam - RM 21.1 (af) Comparison of Action Alternatives to	
	No Action Alternative 90th, 50th and 10th Percentile Values	4-75
Figure 4.3-39	Excess Flows Below Mexico Diversion at Morelos Diversion Dam	
\mathcal{E}	Comparison of Action Alternatives to No Action Alternative	
	Cumulative Distribution - Years 2008 through 2060	4-77
Figure 4.4-1	Involuntary Lower Basin Shortages Comparison of Action	
8	Alternatives to No Action Alternative Probability of Occurrence of	
	· · · · · · · · · · · · · · · · · · ·	4-83
Figure 4.4-2	Involuntary and Voluntary Lower Basin Shortages Comparison of	
8	Action Alternatives to No Action Alternative Probability of	
	Occurrence of Any Amount	4-85
Figure 4.4-3	Involuntary and Voluntary Lower Basin Shortage Comparison of	
8	Action Alternatives to No Action Alternative Average Shortage	
		4-87
Figure 4.4-4	Involuntary and Voluntary Lower Basin Shortages Comparison of	
C	Action Alternatives to No Action Alternative Years 2006 through	
	2026	4-88
Figure 4.4-5	Involuntary and Voluntary Lower Basin Shortages Comparison of	
	Action Alternatives to No Action Alternative Years 2027 through	
	· · · · · · · · · · · · · · · · · · ·	4-89
Figure 4.4-6	Involuntary and Voluntary Lower Basin Shortages Comparison of	
C	Action Alternatives to No Action Alternative Maximum Amounts	4-93
Figure 4.4-7	Involuntary and Voluntary Lower Basin Shortages Comparison of	
	Action Alternatives With and Without a Storage and Delivery	
	Mechanism Probability of Occurrence of Any Amount	4-94
Figure 4.4-8	Surplus Conditions Comparison of Action Alternatives to No Action	
	Alternative Probability of Occurrence	4-95
Figure 4.4-9	Partial Domestic Surplus Deliveries to Lower Basin States	
_	Comparison of Action Alternatives to No Action Alternative	
	Probability of Occurrence	4-96
Figure 4.4-10	Full Domestic Surplus Deliveries to Lower Basin States Comparison	
-	of Action Alternatives to No Action Alternative Probability of	
	Occurrence	4-97

Figure 4.4-12	Flood Control Surplus Deliveries to Lower Basin States Comparison	
	of Action Alternatives to No Action Alternative Probability of	
	Occurrence	4-98
Figure 4.4-11	Quantified Surplus (70R Strategy) Deliveries to Lower Basin States	
	Comparison of Action Alternatives to No Action Alternative	
	Probability of Occurrence	4-98
Figure 4.4-13	Surplus Deliveries to Lower Basin States Comparison of Action	
	Alternatives With and Without a Storage and Delivery Mechanism	
	Probability of Occurrence	4-99
Figure 4.4-14	Probability of Normal Conditions Comparison of Action Alternatives	
	to No Action Alternative years 2008 through 2060	. 4-100
Figure 4.4-15	Surplus, Normal, and Shortage (Involuntary and Voluntary)	
_	Conditions Comparison of Action Alternatives to No Action	
	Alternatives Probability of Occurrence	. 4-101
Figure 4.4-16	Arizona Modeled Annual Depletions No Action Alternative 90th,	
C	50th, and 10th Percentile Values	. 4-103
Figure 4.4-17	Arizona Modeled Annual Depletion Comparison of Action	
C	Alternatives (Without Storage and Delivery Mechanism) to No Action	
	Alternative Years 2008 through 2026	. 4-104
Figure 4.4-18	Arizona Modeled Annual Depletion Comparison of Action	
<i>S</i>	Alternatives (Without Storage and Delivery Mechanism) to No Action	
	Alternative Years 2027 through 2060	. 4-105
Figure 4.4-19	Arizona Modeled Depletions Comparison of Action Alternatives With	
<i>S</i>	and Without Storage and Delivery Mechanism Years 2008 through	
	2026	. 4-106
Figure 4.4-10	Arizona Modeled Depletions Comparison of Action Alternatives With	
8	and Without Storage and Delivery Mechanism Years 2027 through	
	2060	. 4-107
Figure 4.4-12	California Modeled Annual Depletion No Action Alternative 90th,	
8	50th, and 10th Percentile Values	. 4-108
Figure 4.4-22	California Modeled Annual Depletion Comparison of Action	
8	Alternatives (Without Storage and Delivery Mechanism) to No Action	
	Alternative Years 2008 through 2026	. 4-109
Figure 4.4-23	California Modeled Annual Depletions Comparison of Action	10)
118010 20	Alternatives (Without Storage and Delivery Mechanism) to No Action	
	Alternative Years 2027 through 2060	. 4-110
Figure 4 4-24	California Modeled Annual Depletions Comparison of Action	
118010 2	Alternatives With and Without Storage and Delivery Mechanism	
	Years 2008 through 2026	4-111
Figure 4 4-25	California Modeled Annual Depletions Comparison of Action	
15010 111 23	Alternatives With and Without Storage and Delivery Mechanism	
	Years 2027 through 2060	4-112
Figure 4.4-26	Nevada Modeled Annual Depletions No Action Alternative 90th, 50th,	112
1 15u10 7.7-20	and 10th Percentile Values	4-113

Figure 4.4-27	Nevada Modeled Annual Depletions Comparison of Action	
	Alternatives (Without Storage and Delivery Mechanism) to No Action	
	Alternative Years 2008 through 2026	. 4-114
Figure 4.4-28	Nevada Modeled Annual Depletion Comparison of Action	
	Alternatives (Without Storage and Delivery Mechanism) to No Action	
	Alternative Years 2027 through 2060.	. 4-115
Figure 4.4-29	Nevada Modeled Annual Depletions Comparison of Action	
8	Alternatives With and Without Storage and Delivery Mechanism	
	Years 2008 through 2026.	4-116
Figure 4 4-30	Nevada Modeled Annual Depletions Comparison of Action	110
1 1guic 4.4 30	Alternatives With and Without Storage and Delivery Mechanism	
	Years 2027 through 2060	1 117
Figure 4.4.21	Mexico Modeled Annual Depletions No Action Alternative 90th, 50th,	. 4-11/
11guie 4.4-31	-	1 110
E: 4 4 22	and 10th Percentile Values	. 4-118
Figure 4.4-32	Mexico Modeled Annual Depletions Comparison of Action	
	Alternatives (Without Storage and Delivery Mechanism) to No Action	4 110
	Alternative Years 2008 through 2026	. 4-119
Figure 4.4-33	Mexico Modeled Annual Depetions Comparison of Action	
	Alternatives (Without Storage and Delivery Mechanism) to No Action	
	Alternative Years 2027 through 2060	. 4-120
Figure 4.5-1	Historic Data and CE-Qual-W2 Model Results for Lake Powell	
	Release Temperatures by Elevation	. 4-135
Figure 4.6-1	Lake Powell End-of-March Elevations Comparison of Action	
	Alternatives to No Action Alternative 90th, 50th and 10th Percentile	
	Values	. 4-150
Figure 4.6-2	Lake Mead End-of-December Elevations Comparison of Action	
C	Alternatives to No Action Alternative 90th, 50th and 10th Percentile	
	Values	. 4-153
Figure 4.11-1	Glen Canyon Powerplant Average Values of Annual Electrical Energy	
1184101	Production	4-219
Figure 4 11-2	Hoover Powerplant Average Values of Annual Electrical Energy	21>
11gaic 1.11 2	Production	4-222
Figure 4 11-3	Davis Powerplant Average Values of Annual Electrical Energy	
1 iguic 4.11-3	Production	1 226
Figure 4 11 4	Parker Powerplant Average Values of Annual Electrial Energy	.4-220
11guie 4.11-4	Production	1 226
Eigung 4 11 5		. 4-220
Figure 4.11-5	Headgate Rock Powerplant Average Values of Electrical Energy	4 220
T' 444 6	Production	. 4-229
Figure 4.11-6	Lake Powell End-of-March Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,490 feet msl	. 4-232
Figure 4.11-7	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,050 feet msl	. 4-232
Figure 4.14-1	Steps in Analyzing Changes in Agricultural Production and Resulting	
	Changes in Employment, Income, and Tax Revenue	. 4-262

Figure 4.14-2	Lake Powell End-of-September Elevations Comparison of Action Alternatives to No Action Alternative, 90th. 50th and 10th Percentile Values	. 4-268
Figure 4.14-3	Lake Mead End-of-July Elevations Comparison of Action Alternatives to No Action Alternative, 90th, 50th and 10th Percentile Values	
List of Tables		
Table ES-1	Matrix of Alternatives	ES-5
Table ES-2	Summary of Potential Effects of the Alternative	.ES-18
Table 1.5-1	Relevant Issues.	1-7
Table 1.7-1	Selected Documents Included in the "Law of the River"	
Table 2.2-1	Modeling Assumptions for Distribution of Shortages	2-5
Table 2.3-1	Basin States Alternative Lake Powell Equalization Elevations	
Table 2.3-2	Basin States Alternative Volume Limitations of Storage and Delivery	
	Mechanism	2-11
Table 2.4-1	Conservation Before Shortage Alternative Volume Limitations of	
	Storage and Delivery Mechanism	2-12
Table 2.6-1	Reservoir Storage Alternative Volume Limitations of Storage and	
	Delivery Mechanism	2-15
Table 2.7-1	Matrix of Alternatives	2-17
Table 2.7-2	Comparison of Alternatives – Lake Powell	2-18
Table 2.7-3	Comparison of Alternatives – Lake Mead	
Table 2.8-1	Summary of Potential Effects of the Alternatives	2-21
Table 3.2-1	Colorado River Reaches and Reach Limits	3-6
Table 3.2-2	CAP Water Users	3-12
Table 3.3-1	Glen Canyon Dam Release Constraints	3-19
Table 3.4-1	Upper Division States Apportionment	3-31
Table 3.4-2	Lower Division States Apportionment	3-32
Table 3.4-3	Volumes of Water Apportioned to PPRs in the Lower Division States	3-33
Table 3.4-4	Arizona Priority System for Mainstream Colorado River	3-39
Table 3.4-5	California's Seven-Party Agreement for Mainstream Colorado River	3-40
Table 3.4-6	Nevada's Priority System for Mainstream Colorado River	3-41
Table 3.5-1	Numeric Salinity Standards for the Colorado River	3-44
Table 3.6-1	Clean Air Act Prevention of Significant Deterioration Designations	3-51
Table 3.6-2	Clean Air Act Allowable Particulate Matter Concentration Increases	
	over the Baseline Concentrations	3-52
Table 3.6-3	National and State Ambient Air Quality Standards for	2 50
Toble 2 6 4	Particulate Matter	5-52
Table 3.6-4	State and Local Air Pollution Control Agencies Having Jurisdiction	2 52
Table 3.8-1	within the Lake Powell and Lake Mead Areas	
1 aute 3.6-1	Summary of vegetation Cover Types from Lake Mead to the SIB	5-59

Table 3.8-2	Summary of Vegetation Cover Types from Lake Mead to the NIB (acres)	3-60
Table 3.8-3	Summary of Vegetation Cover Types in the United States from NIB	
	to SIB	3-60
Table 3.8-4	Native and Non-Native Fish Species Present in the Study Area	
	by Reach	3-61
Table 3.8-5	The Fifteen Generally Most Common Terrestrial Breeding Bird	
	Species Found in Riparian Habitats Along the Colorado River in	
	Grand Canyon	3-67
Table 3.8-6	The Ten Generally Most Common Overwintering Aquatic Bird	
	Species Encountered During Surveys Along the Colorado River below	
	Glen Canyon Dam.	3-67
Table 3.8-7	Special Status Species Potentially Affected by the Proposed	
	Federal Action	3-70
Table 3.10-1	Colorado River Mainstream Diversion Entitlement (Water Rights) in	
	Favor of Indian Reservations	3-82
Table 3.10-2	Central Arizona Project Indian Tribal Diversion Entitlements	
	(Water Rights)	
Table 3.11-1	Generation Capability in WECC Areas	
Table 3.12-1	Glen Canyon National Recreation Area Recreational Visitors	3-104
Table 3.12-2	Glen Canyon National Recreation Area Visits by Visitor Segment for	
	2003	
Table 3.12-3	Critical Elevations for Lake Powell by Boating Facility	3-106
Table 3.12-4	Number of Camping Beaches by Camp Size for High- and	
	Low-Water Camps	
Table 3.12-5	Lake Mead National Recreation Area Recreational Visitors	3-109
Table 3.12-6	Lake Mead National Recreation Area Visits by Visitor Segment	
	for 2003	3-109
Table 3.12-7	Critical Elevations and Surface Area for Lake Mead by	
	Recreational Facility	
Table 3.12-8	Visitation at Arizona's Lake Havasu and Cattail Cove State Parks	
Table 3.12-9	Estimates of Watercraft Use in Glen Canyon National Recreation Area	
	by Month in 2001	
Table 3.14-1	Central Arizona Irrigated Agricultural Land in 2002	
Table 3.14-2	Southern Nevada (Clark County) Agricultural Land in 2002	3-130
Table 3.14-3	Southern California Agricultural Land in the Seven-County Study	
	Area (2004)	3-131
Table 3.14-4	Glen Canyon National Recreation Area Economic Impacts of Visitor	
	Spending by Sector for 2003	3-133
Table 3.14-5	Lake Mead National Recreation Area Economic Impacts of Visitor	
	Spending by Sector for 2003	
Table 4.2-1	Modeling Assumptions for Distribution of Stage 1 Shortages	
Table 4.2-2	Modeling Assumptions for Distribution of Stage 2 Shortages	4-10
Table 4.2-3	Modeling Assumptions for Storage and Delivery of Conserved	
	System and Non-System Water	4-13

Table 4.3-1	Lake Powell End-of-July Elevations (feet msl) Comparison of Action	
	Alternatives to No Action Alternative 90th, 50th, and 10th Percentile	
	Values	4-19
Table 4.3-2	Lake Powell End-of-July Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Greater Than	
	or Equal to Elevation 3,695 feet msl	4-20
Table 4.3-3	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,650 feet msl	4-22
Table 4.3-4	Lake Powell End-of- September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,626 feet msl	4-23
Table 4.3-5	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,620 feet msl	4-24
Table 4.3-6	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,588 feet msl	4-26
Table 4.3-7	Lake Powell End-of- September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,560 feet msl	4-27
Table 4.3-8	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,555 feet msl	4-28
Table 4.3-9	Lake Powell End-of-September Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,550 feet msl	4-30
Table 4.3-10	Lake Powell End-of-March Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 3,490 feet msl	4-31
Table 4.3-11	Glen Canyon Dam Water Year Releases Probability of Occurrence of	
	Different Size Annual Releases Comparison of Action Alternatives to	
	No Action Alternative Water Years 2009 through 2060	4-32
Table 4.3-12	Average Daily Glen Canyon Dam Releases (cfs) Corresponding to	
	Various Annual Release Volumes	4-35
Table 4.3-13	Minimum Hourly Glen Canyon Dam Release (cfs) Corresponding to	
	Various Annual Release Volumes	4-35
Table 4.3-14	Maximum Hourly Glen Canyon Dam Release (cfs) Corresponding to	
	Various Annual Release Volumes	4-36
Table 4.3-15	Lake Mead End-of-December Elevations (feet msl) Comparison of	
	Action Alternatives to No Action Alternative 90th, 50th, and 10th	
	Percentile Values	4-39
Table 4.3-16	Lake Mead End-of- December Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Greater Than	
	or Equal to Elevation 1,200 feet msl	4-41

Table 4.3-17	Lake Mead End-of-December Water Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less than or	
	Equal to Elevation 1,178 feet msl	4-42
Table 4.3-18	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,175 feet msl	4-44
Table 4.3-19	Lake Mead End-of- July Elevations Comparison of Action	
	Alternatives to No Action Alternative Percent of Values Less Than or	
	Equal to Elevation 1,170 feet msl	4-45
Table 4.3-20	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,125 feet msl	4-47
Table 4.3-21	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,080 feet msl	4-48
Table 4.3-22	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,050 feet msl	4-50
Table 4.3-23	Lake Mead End-of-July Elevations Comparison of Action Alternatives	
	to No Action Alternative Percent of Values Less Than or Equal to	
	Elevation 1,000 feet msl	4-51
Table 4.3-24	Lake Mead End-of-December Elevations Comparison of Action	
	Alternatives to No Action Alternative Minimum Elevation Values	
	(feet msl)	4-53
Table 4.3-25	Increase / Decrease () in Lake Mead Elevations (feet msl) Resulting	
	From a Storage and Delivery Mechanism Comparison of Action	
	Alternatives With and Without a Storage and Delivery Mechanism	
	90th, 50th, and 10th Percentile Values	4-55
Table 4.3-26	Hoover Dam Annual Releases Probability of Occurrence of Different	
	Annual Release Volumes Comparison of Action Alternatives to No	
	Action Alternative Calendar Years 2008 through 2060	4-59
Table 4.3-27	Colorado River Annual Flow Near Havasu NWR - RM 242.3 (maf)	
	Comparison of Action Alternatives to No Action Alternative 90th,	
	50th, and 10th Percentile Values	4-63
Table 4.3-28	Davis Dam Annual Median Releases Differences of Action	
	Alternatives Compared to No Action Alternative1 (cfs)	4-65
Table 4.3-29	Colorado River Annual Flow Upstream of CRIR Diversion - RM	
	180.8 (mafy) Comparison of Action Alternatives to No Action	
	Alternative 90th, 50th, and 10th Percentile Values	4-70
Table 4.3-30	Colorado River Annual Flow Downstream of Palo Verde Diversion	
	Dam - RM 133.8 (maf) Comparison of Action Alternatives to No	
	Action Alternative 90th, 50th, and 10th Percentile Values	4-72
Table 4.3-31	Parker Dam Annual Median Releases Differences of Action	
	Alternatives Compared to No Action Alternative1, (cfs)	4-73

Table 4.3-32	Colorado River Annual Flow Below Mexico Diversion at Morelos	
	Diversion Dam - RM 21.1 (maf) Comparison of Action Alternatives to	
	No Action Alternative 90th, 50th, and 10th Percentile Values	4-77
Table 4.4-1	First Year of Occurrence of Involuntary Shortage Comparison of	
	Action Alternatives and No Action Alternative	4-83
Table 4.4-2	Probability of Occurrence of Any Amount of Involuntary Shortage	
	Comparison of Action Alternatives to No Action Alternative	4-84
Table 4.4-3	First Year of Occurrence of Involuntary or Voluntary Shortage	
	Comparison of Action Alternatives to No Action Alternative	4-85
Table 4.4-4	Probability of Occurrence of Involuntary and Voluntary Shortages of	
	Any Amount Comparison of Action Alternatives to No Action	
	Alternative	4-86
Table 4.4-5	Distribution of Shortages, Year 2017	
Table 4.4-6	Distribution of Shortages, Year 2026	
Table 4.4-7	Distribution of Shortages, Year 2027	
Table 4.4-8	Distribution of Shortages, Year 2040	
Table 4.4-9	Distribution of Shortages, Year 2060	
Table 4.4-10	Maximum Occurrence of Involuntary and Voluntary Shortage to the	
	Lower Basin (af) Comparison of Action Alternatives to No Action	
	Alternative	4-93
Table 4.4-11	Shortage Allocation to Arizona (af)	
Table 4.4-12	Probability of Occurrence of Shortages Less Than or Equal to, Years	
	2008 through 2026 (percent)	. 4-122
Table 4.4-13	Probability of Occurrence of Shortages Less Than or Equal to, Years	
	2027 through 2060 (percent)	. 4-122
Table 4.4-14	Maximum Shortage Allocation to Arizona (af)	
Table 4.4-15	Distribution of Shortages Among Arizona Entities (af)	
Table 4.4-16	Shortage Allocation to California (af)	
Table 4.4-17	Maximum Shortage Allocation to California (af)	
Table 4.4-18	Shortage Allocation to Nevada (af)	
Table 4.4-19	Maximum Shortage Allocation to Nevada (af)	
Table 4.4-20	Shortage Distribution to Mexico (af)	
Table 4.4-21	Maximum Shortage Allocation to Mexico (af)	
Table 4.5-1	Projected Colorado River Salinity in 2008	
Table 4.5-2	Projected Colorado River Salinity in 2026	
Table 4.5-3	Projected Colorado River Salinity in 2060	
Table 4.5-4	Lake Powell July Elevations and Release Temperatures 90th, 50th, and	
	10th Percentile Values	. 4-136
Table 4.5-5	Lake Powell October Elevations and Release Temperatures 90th, 50th,	
	and 10th Percentile Values	. 4-137
Table 4.5-6	Colorado River at Little Colorado River Confluence July Water	
	Temperatures 90th, 50th, and 10th Percentile Values	. 4-138
Table 4.5-7	Colorado River at Little Colorado River Confluence October Water	
	Temperatures 90th, 50th, and 10th Percentile Values	. 4-139
Table 4.5-8	Colorado River Below Diamond Creek July Water Temperatures 90th,	
	50th, and 10th Percentile Values	. 4-140

Table 4.5-9	Colorado River Below Diamond Creek October Water Temperatures	
	90th, 50th, and 10th Percentile Values	4-141
Table 4.5-10	Relationship of Glen Canyon Dam Annual Release Volumes to	
	Sediment Transport	4-142
Table 4.5-11	Comparison of Sediment Export among Alternatives (Normalized to	
	8.23 maf annual releases) 2008	4-143
Table 4.5-12	Comparison of Sediment Export among Alternatives (Normalized to	
	8.23 maf annual releases) 2016	4-143
Table 4.5-13	Comparison of Sediment Export among Alternatives (Normalized to 8.23 maf annual releases) 2026	4-144
Table 4.6-1	Lake Powell End-of-March 10th Percentile Elevation and Exposed	
	Shoreline (Rounded to Nearest Whole Number)	4-151
Table 4.6-2	Lake Mead End-of-December 10th Percentile Elevation and Exposed	
	Shoreline (Rounded to Nearest Whole Number)	4-154
Table 4.8-1	Vegetation and Wildlife Impact Summary	
Table 4.8-2	Lake Powell Special Status Species Impact Summary	4-175
Table 4.8-3	Months When Water Temperatures may be Adequate to Support	
	Growth of Fish Under the No Action Alternative	4-178
Table 4.8-4	Glen Canyon Dam to Lake Mead Special Status Species Impact	
	Summary	4-187
Table 4.8-5	Lake Mead Special Status Species Impact Summary	
Table 4.8-6	Davis Dam to Lake Havasu Special Status Species Impact Summary	
Table 4.8-7	Parker Dam to NIB Special Status Species Impact Summary	
Table 4.8-8	NIB to SIB Special Status Species Impact Summary	
Table 4.11-1	No Action Alternative Values at Glen Canyon Powerplant	
Table 4.11-2	Change in Glen Canyon Powerplant Annual Energy Generation	
	(MWh)	4-218
Table 4.11-3	Percent Change in Glen Canyon Powerplant Annual Generation	4-218
Table 4.11-4	Change in Glen Canyon Powerplant Generation Capacity	
Table 4.11-5	Change in Glen Canyon Powerplant Generation Capacity (Percent)	4-220
Table 4.11-6	Change in Glen Canyon Powerplant Total Economic Value of	
	Electrical Power Generation (PV 2008 \$ million)	4-220
Table 4.11-7	Change in Glen Canyon Powerplant Total Economic Value of	
	Electrical Power Generation (Percent)	4-221
Table 4.11-8	No Action Alternative Values at Hoover Powerplant	
	Change in Hoover Powerplant Annual Electrical Energy Generation	
	(MWh)	4-221
Table 4.11-10	Change in Hoover Powerplant Annual Electrical Energy Generation	
	(Percent)	4-222
Table 4.11-11	Change in Hoover Powerplant Monthly Generation Capacity (MW)	4-223
	Change in Hoover Powerplant Monthly Generation Capacity (Percent).	
	Change in Hoover Powerplant Total Economic Value of Electrical	
	Power Generated (PV 2008 \$ million)	4-223
Table 4.11-14	Change in Hoover Powerplant Total Economic Value of Electrical	
	Power Generated (Percent)	4-224
Table 4.11-15	No Action Alternative Values at Parker and Davis Powerplants	4-224

Table 4.11-16	Change in Parker and Davis Powerplants Annual Electrical Energy	
	Generation (MWh)	4-225
Table 4.11-17	Change in Parker and Davis Powerplants Annual Electrical Energy	
	Generation (Percent)	4-225
Table 4.11-18	Change in Parker and Davis Powerplants Monthly Generation	
	Capacity (MW)	4-225
Table 4.11-19	Change in Parker and Davis Powerplants Total Economic Value of	
	Electrical Power Generation (PV 2008 \$ million)	4-227
Table 4.11-20	Change in Parker and Davis Powerplants Total Economic Value of	
	Electrical Power Generated (Percent)	
Table 4.11-21	No Action Alternative Values at Headgate Rock Power Plant	4-228
Table 4.11-22	Change in Headgate Rock Powerplant Annual Electrical Energy	
	Generation (MWh)	4-228
Table 4.11-23	Change in Headgate Rock Powerplant Annual Electrical Energy	
	Generation (Percent)	4-228
Table 4.11-24	Change in Headgate Rock Powerplant Total Economic Value of	
	Electrical Power Generated (PV 2008 \$ million)	4-229
Table 4.11-25	Change in Headgate Rock Powerplant Total Economic Value of	
	Electrical Power Generated (Percent)	4-230
Table 4.11-26	Change in Navajo Generating Station Intake Electrical Power	
	Requirements at Lake Powell	4-237
Table 4.11-27	Change in City of Page Intake Electrical Power Requirements at Lake	
	Powell	4-237
Table 4.11-28	Change in Estimated SNWA Pumping Costs	4-238
	Summary Comparison of Action Alternatives to No Action Alternative	
	Mean Values for Electrical Energy Generation, Generation Capacity,	
	and Economic Value	4-239
Table 4.12-1	Water Temperature Tolerances of Rainbow Trout	4-246
Table 4.12-2	Life History of the Rainbow Trout, Phases by Months	4-246
Table 4.13-1	Range of Probabilities of Lake Powell Elevations Less Than or Equal	
	to Elevation 3,550 feet msl	4-257
Table 4.14-2	Estimated Change in Agricultural Production Value Resulting from	
	Involuntary Land Fallowing in Arizona under Various Levels of	
	Shortage for Various Years	4-270
Table 4.14-3	Estimated Changes in Employment as a Result of Shortages to	
	Agricultural Lands for the No Action, Basin States, and Conservation	
	Before Shortage, Water Supply and Reservoir Storage Alternatives, by	
	Selected Years and Shortage Amounts	4-272

Volume II: Appendices

See Volume II Table of Contents

Table of Contents Volume I This page intentionally left blank.