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GLEN CANYON DAM LONG-TERM EXPERIMENTAL AND MANAGEMENT PLAN
FINAL ENVIRONMENTAL IMPACT STATEMENT

Joint-Lead Agencies
Bureau of Reclamation
National Park Service

Cooperating Agencies
Department of the Interior
Bureau of Indian Affairs
U.S. Fish and Wildlife Service
U.S. Department of Energy
Western Area Power Administration
Arizona Game and Fish Department
Colorado River Board of California
Colorado River Commission of Nevada
Upper Colorado River Commission
Havasupai Tribe
Hopi Tribe
Hualapai Tribe
Kaibab Band of Paiute Indians
Navajo Nation
Pueblo of Zuni
Salt River Project
Utah Associated Municipal Power Systems

ABSTRACT

The U.S. Department of the Interior (DOI), through the Bureau of Reclamation and National Park Service (NPS), proposes to develop and implement a Long-Term Experimental and Management Plan (LTEMP) for operations of Glen Canyon Dam. The LTEMP would provide a framework for adaptively managing Glen Canyon Dam operations over the next 20 years, consistent with the Grand Canyon Protection Act of 1992 (GCPA) and other provisions of applicable federal law. The LTEMP would determine specific options for dam operations, non-flow actions, and appropriate experimental and management actions that will meet the GCPA’s requirements and minimize impacts on resources within the area impacted by dam operations, including those of importance to American Indian Tribes.

The Final Environmental Impact Statement (FEIS) was developed in accordance with the National Environmental Policy Act of 1969, as amended (NEPA), and followed the implementing regulations developed by the President’s Council on Environmental Quality in Title 40 Code of Federal Regulations (CFR) Parts 1500 to 1508 and DOI regulations implementing NEPA in 43 CFR Part 46. The FEIS analysis draws on the scientific information that has been collected under the Glen Canyon Dam Adaptive Management Program over the last 20 years to identify the potential environmental effects associated with taking no action, as well as a reasonable range of alternatives to no action for implementing the proposed federal action. Seven alternatives were considered and analyzed for the LTEMP EIS—a no action alternative (Alternative A), a hydropower-focused alternative (Alternative B), three condition-dependent alternatives (Alternatives C, D, and E), and two steady flow alternatives (Alternatives F and G). These alternatives incorporated a broad range of operations and experimental actions that together allowed for a full evaluation of possible impacts of the
proposed action. Based on the impact analyses conducted, DOI has chosen Alternative D as both the preferred and the environmentally preferred alternative. Alternative D is expected to result in an improvement in conditions for humpback chub, trout, and the aquatic food base; have the least impact on vegetation, wetlands, and terrestrial wildlife; improve sandbar building potential and conserve sediment; sustain or improve conditions for reservoir and river recreation; improve preservation of cultural resources; respect and enhance Tribal resources and values; and have limited impacts on hydropower resources.

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ACRONYMS AND ABBREVIATIONS

ac acre(s)
ac-ft acre-foot (feet)
ACHP Advisory Council on Historic Preservation
AML abandoned mine land
AMSL above mean sea level
AMWG Adaptive Management Work Group
AOP Annual Operation Plan for Colorado River Reservoirs
APE Area of Potential Effect
Argonne Argonne National Laboratory
ASMR Age-Structured Mark Recapture Model
AZGFD Arizona Game and Fish Department
AZ-SGCN Arizona Species of Greatest Conservation Need

BA Balancing Authority (in Chapter 3 only)
Biological Assessment (in all other sections)
BGEPA Bald and Golden Eagle Protection Act of 1940
BIA Bureau of Indian Affairs
BO Biological Opinion

C Celsius
CAA Clean Air Act
CAAA Clean Air Act Amendments
CAEDYM Computational Aquatic Ecosystem Dynamics Model
CCC Civilian Conservation Corps
CEQ Council on Environmental Quality
CFMP Comprehensive Fisheries Management Plan
CFR Code of Federal Regulations
cfs cubic feet per second
CH4 methane
CO carbon monoxide
CO2 carbon dioxide
CO2e carbon dioxide equivalent
CPUE catch per unit effort
CRBC Colorado River Board of California
CRCN Colorado River Commission of Nevada
CRD Colorado River Discovery
CREDA Colorado River Energy Distributors Association
CRMP Colorado River Management Plan
CRSP Colorado River Storage Project
CRSPA Colorado River Storage Project Act of 1956
CRSS Colorado River Simulation System
CSU Colorado Springs Utilities
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<td>DEIS</td>
<td>Draft Environmental Impact Statement</td>
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<tr>
<td>Deseret</td>
<td>Deseret Generation and Transmission Cooperative</td>
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<tr>
<td>DFC</td>
<td>desired future condition</td>
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<tr>
<td>DO</td>
<td>dissolved oxygen</td>
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<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
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<tr>
<td>DOI</td>
<td>U.S. Department of the Interior</td>
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<tr>
<td>DPS</td>
<td>Distinct Population Segment</td>
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<tr>
<td>EA</td>
<td>Environmental Assessment</td>
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<td>eGRID</td>
<td>Emissions &amp; Generation Resource Integrated Database</td>
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<td>EIA</td>
<td>Energy Information Administration</td>
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<td>EIR</td>
<td>Environmental Impact Report</td>
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<td>EIS</td>
<td>Environmental Impact Statement</td>
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<tr>
<td>ELCOM</td>
<td>Estuary, Lake and Coastal Ocean Model</td>
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<td>EMS</td>
<td>emergency medical services</td>
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<td>E.O.</td>
<td>Executive Order</td>
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<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>EPT</td>
<td>Ephemeroptera, Plecoptera, and Trichoptera</td>
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<td>ESA</td>
<td>Endangered Species Act of 1973, as amended</td>
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<tr>
<td>F</td>
<td>Fahrenheit</td>
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<tr>
<td>FCPP</td>
<td>Four Corners Power Plant</td>
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<td>FES</td>
<td>Firm Electric Service</td>
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<td>FONSI</td>
<td>Finding of No Significant Impact</td>
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<td>FR</td>
<td><em>Federal Register</em></td>
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<tr>
<td>ft</td>
<td>foot (feet)</td>
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<td>FWS</td>
<td>U.S. Fish and Wildlife Service</td>
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<td>FY</td>
<td>fiscal year</td>
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<td>GCDAMP</td>
<td>Glen Canyon Dam Adaptive Management Program</td>
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<td>GCM</td>
<td>general circulation model</td>
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<td>GCMRC</td>
<td>Grand Canyon Monitoring and Research Center</td>
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<td>GCNP</td>
<td>Grand Canyon National Park</td>
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<tr>
<td>GCNRA</td>
<td>Glen Canyon National Recreation Area</td>
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<tr>
<td>GCPA</td>
<td>Grand Canyon Protection Act of 1992</td>
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<td>GHG</td>
<td>greenhouse gas</td>
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<td>GMP</td>
<td>General Management Plan</td>
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<tr>
<td>GW</td>
<td>gigawatt(s)</td>
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<tr>
<td>GWh</td>
<td>gigawatt-hour(s)</td>
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<td>GWP</td>
<td>global warming potential</td>
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<td>H2S</td>
<td>hydrogen sulfide</td>
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<td>HBC</td>
<td>humpback chub</td>
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<td>HFC</td>
<td>hydrofluorocarbon</td>
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<td>HFE</td>
<td>high-flow experiment</td>
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<td>hr</td>
<td>hour(s)</td>
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HRR Hualapai River Runners

in. inch(es)
IPM Integrated Pest Management
IRP integrated resource plan
ISM Indexed Sequential Method

kaf thousand acre-feet
kWh kilowatt-hour(s)

lb pound(s)
LCRMSCP Lower Colorado River Multi-Species Conservation Program
LMM Lake Mead Model
LMNRA Lake Mead National Recreation Area
LROC Long-Range Operating Criteria
LTEMP Long-Term Experimental and Management Plan
LTEP Long Term Experimental Plan
LTF long-term firm

maf million acre-feet
MAMB miscellaneous algae, macrophytes, and bryophytes
MBTA Migratory Bird Treaty Act
MCL maximum contaminant level
mi mile(s)
MLFF Modified Low Fluctuating Flow
MMt million metric tons
MOA Memorandum of Agreement
MT metric ton(s)
MW megawatt(s)
MWh megawatt-hour(s)

N$_2$O nitrous oxide
NAAQS National Ambient Air Quality Standards
NAU Northern Arizona University
NC no change
NEPA National Historic Preservation Act
NM national monument
NO$_2$ nitrogen dioxide
NO$_3$ nitrate-nitrogen
NOI Notice of Intent
NO$_x$ nitrogen oxides
NPS National Park Service
NPV  net present value
NRHP  National Register of Historic Places
NTUA  Navajo Tribal Unit Authority
O&M  operation and maintenance
O₃  ozone
OPAC  Office of Planning and Compliance
OSMRE  Office of Surface Mining Reclamation and Enforcement
PA  Programmatic Agreement
Pb  lead
PEPC  Planning, Environment, and Public Comment
PFC  perfluorocarbon
P.L.  Public Law
PM  particulate matter
PM₂.₅  particulate matter ≤2.5 μm in aerodynamic diameter
PM₁₀  particulate matter ≤10 μm in aerodynamic diameter
POM  particulate organic matter
PSAR  preventative search and rescue
PSD  Prevention of Significant Deterioration
RA  resource available
Reclamation  Bureau of Reclamation
RM  river mile
RMP  Resource Management Plan
ROD  Record of Decision
RSG  Reserve Sharing Group
SAAQS  State Ambient Air Quality Standards
SBM  Sand Budget Model
SCP  Salinity Control Project
SD  standard deviation
SDA  Structured Design Analysis
SE  standard error
Secretary, the  Secretary of the Interior
SF₆  sulfur hexafluoride
SHPO  State Historic Preservation Officer
SLCA/IP  Salt Lake City Area Integrated Projects
SO  Secretarial Order
SO₂  sulfur dioxide
SPC  Southern Paiute Consortium
SRP  Salt River Project
SRSG  Southwest Reserve Sharing Group
TCD  temperature control device
TCP  traditional cultural property
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<td>TDS</td>
<td>total dissolved solids</td>
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<tr>
<td>THPO</td>
<td>Tribal Historic Preservation Officer</td>
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<tr>
<td>TL</td>
<td>total length</td>
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<td>TMF</td>
<td>trout management flow</td>
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<td>Tri-State</td>
<td>Tri-State Generation and Transmission Association</td>
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<td>TWG</td>
<td>Technical Working Group</td>
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<td>UAMPS</td>
<td>Utah Associated Municipal Power Systems</td>
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<td>Utah Board of Water Resources</td>
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<td>Upper Colorado River Commission</td>
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<td>UMPA</td>
<td>Utah Municipal Power Agency</td>
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<td>United States Code</td>
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<td>U.S. Geological Survey</td>
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<tr>
<td>VOC</td>
<td>volatile organic compound</td>
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<td>WACM</td>
<td>Western Area Colorado-Missouri Region</td>
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<td>Western Area Upper Great Plains West Region</td>
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<td>YOY</td>
<td>young-of-year</td>
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<td>yr</td>
<td>year(s)</td>
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<td>ZHHPO</td>
<td>Zuni Heritage and Historic Preservation Office</td>
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