

APPENDIX A:
ADAPTIVE MANAGEMENT WORKING GROUP
DESIRED FUTURE CONDITIONS

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The Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) Environmental Impact Statement (EIS) joint lead agencies have used the 2012 Glen Canyon Dam Adaptive Management Program (GCDAMP) Desired Future Conditions (DFCs) as a basis for the resource goals and objectives of the EIS as presented in Section 1.4 of the EIS. The resource goals and objectives are based on and consistent with the DFCs, but are more concise and direct relative to the LTEMP purpose and need of the proposed action. The following text is based on the document *Desired Future Conditions for the Colorado River Ecosystem in Relation to Glen Canyon Dam* (DFC Ad Hoc Committee 2012).

The DFCs were intended to be used within the GCDAMP to help guide the development of recommendations concerning management of Glen Canyon Dam operations and related activities and dam impacts on Grand Canyon National Park (GCNP) and Glen Canyon National Recreation Area (GCNRA). The DFCs focus on those conditions that can be accomplished through dam operations and also identify those conditions that might be achieved through non-operational measures.

The Secretary of the Interior (the Secretary) is authorized to consider and implement both operational and non-operational measures to address downstream effects of Glen Canyon Dam if those measures meet the Grand Canyon Protection Act's (GCPA's) goal of protecting, mitigating adverse impacts on, and improving the resources downstream of the dam. Section 1802 of the GCPA provides the following:

- a. *In General*—The Secretary shall operate Glen Canyon Dam in accordance with the additional criteria and operating plans specified in Section 1804 and exercise other authorities under existing law in such a manner as to protect, mitigate adverse impacts on, and improve the values for which GCNP and GCNRA were established, including, but not limited to, natural and cultural resources and visitor use.
- b. *Compliance with Existing Law*—The Secretary shall implement this section in a manner fully consistent with and subject to the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in *Arizona v. California*, and the provisions of the Colorado River Storage Project Act of 1956 and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development, and exportation of the waters of the Colorado River basin.
- c. *Rule of Construction*—Nothing in this title alters the purposes for which the GCNP or the GCNRA were established or affects the authority and

responsibility of the Secretary with respect to the management and administration of the GCNP and GCNRA, including natural and cultural resources and visitor use, under laws applicable to those areas, including, but not limited to, the Act of August 25, 1916 (39 Stat. 535), as amended and supplemented.

The Bureau of Reclamation (Reclamation) is charged with balancing a complex set of interests in operating the dam. Those interests include not only the endangered species below the dam, but also Tribes in the region, the seven Colorado River basin states, large municipalities that depend on water and power from Glen Canyon Dam, agricultural interests, GCNP, GCNRA, and national energy needs at a time when clean energy production is becoming increasingly important. The DFCs will assist the Glen Canyon Dam Adaptive Management Work Group (AMWG) in providing recommendations to the Secretary of the Interior for future decision-making. The DFCs have evolved from discussions during the entire 16-year history of the AMWG, and were generated in the following form from the concerted work of the DFC Ad Hoc Group and the federal agency regional leadership during 2010 and 2011.

The vision and mission of the AMWG (adopted on July 21, 1999) was developed to guide adaptive management of Glen Canyon Dam, and helps explain how and why definition of desired conditions is important:

The Grand Canyon is a homeland for some, sacred to many, and a national treasure for all. In honor of past generations, and on behalf of those of the present and future, we envision an ecosystem where the resources and natural processes are in harmony under a stewardship worthy of the Grand Canyon.

We advise the Secretary of the Interior on how best to protect, mitigate adverse impacts to, and improve the integrity of the Colorado River ecosystem affected by Glen Canyon Dam, including natural biological diversity (emphasizing native biodiversity), traditional cultural properties, spiritual values, and cultural, physical, and recreational resources through the operation of Glen Canyon Dam and other means.

We do so in keeping with the federal trust responsibilities to Indian Tribes, in compliance with applicable federal, state, and Tribal laws, including the water delivery obligations of the Law of the River, and with due consideration to the economic value of power resources.

This will be accomplished through our long-term partnership utilizing the best available scientific and other information through an adaptive ecosystem management process.

The DFCs are intended to be statements of qualitative goals and objectives for the GCDAMP, realistic and achievable through the operation of Glen Canyon Dam and related activities, subject to the Law of the River and other laws and authorities and consistent with the GCPA. These DFCs may not be entirely or collectively achievable; there will be tradeoffs and

inherent limitations. This fact does not diminish their value. These DFCs of the affected resources have been identified by the stakeholders as appropriate goals for the GCDAMP and are based on information available at this time. As new information develops, the DFCs may need further revision and refinement. Therefore, these DFCs are neither fixed nor final. This is intended to be a “living document” that reflects advances in learning and understanding. This is consistent with the process—and application—of adaptive management.

The Colorado River Ecosystem (CRE) is defined as the Colorado River mainstream corridor and interacting resources in associated riparian and terrace zones, located primarily from the fore bay of Glen Canyon Dam to the western boundary of GCNP. It includes the area where the dam operations impact physical, biological, recreational, cultural, and other resources. The scope of GCDAMP activities may include limited investigations into some tributaries (e.g., the Little Colorado and Paria Rivers).

The majority of the CRE exists within the boundaries of two national parks and proposed wilderness areas. Despite these protections, the CRE could be considered “a human-dominated ecosystem, one whose aesthetic appeal, goods and services, and spiritual services are widely used and appreciated and needed by a broad cross-section of society. Adaptive management of the CRE has been adopted to ensure the sustainability of the natural environment with the least impact on the goods and services the CRE provides to society. As such, and as information about the CRE has increased, its stewardship is moving toward an ecosystem perspective, fully recognizing the role of humans, and this approach is reflected in the structure of this document” (DFC Ad Hoc Committee 2012).

The DFCs are divided into four categories, including the CRE, Power, Cultural Resources, and Recreation. There are many direct, indirect, short-term, and long-term ecosystem responses to dam existence and operations. The DFCs are directly or indirectly linked to each other on short- and long-term bases through dam-related flows, sediment retention and distribution, hydropower production, fish and wildlife populations, recreation, and visitor experience. The following sections are excerpted from the 2012 DFC document.

A.1 DESIRED FUTURE CONDITIONS: COLORADO RIVER ECOSYSTEM

A.1.1 DFC Description

The term “ecosystem” refers to the combined physical and biological components of an environment. An ecosystem is generally an area within the natural environment in which physical (abiotic) factors and processes of the environment, such as geology, climate, and soil development, function along with interdependent (biotic) organisms, such as plants and animals, in the same habitat and create a dynamic and interconnected system. Ecosystems usually encompass a number of food webs. An ecosystem is a functional unit within a given area consisting of living things and the nonliving chemical and physical factors of their environment, linked together through nutrient cycle and energy flow.

A.1.2 DFC Background and Legislation

Glen Canyon Dam has had a profound impact on the aquatic and terrestrial domains of the CRE from lower Lake Powell downstream to Lake Mead. The CRE DFCs are designed to be consistent with the GCPA, Law of the River, and other appropriate laws and mandates. The CRE DFCs apply the requirements of the GCPA, and are the goals that AMWG members will consider when making recommendations to the Secretary.

A.1.3 Why the Colorado River Ecosystem DFCs Are Important

These CRE DFCs address the natural resource values for which the GCNP and the GCNRA were established. The DFCs aim to comply with the GCPA and describe the individual resource objectives sought with the realization that they may not be achievable in the process of finding the most desirable mix of resources in the CRE and the natural habitats, and natural ecosystem processes. Native and nonnative species are to be managed in accord with federal regulations, policies, and guidelines. The CRE described herein includes most of the native natural resources found in the Colorado River. Those resources are managed, consistent with the Law of the River, described in part in Section 1802(b) of the GCPA, under the National Park Service (NPS) Organic Act, the Redwoods Amendment, NPS 2006 Management Policies, the Wilderness Act, the Antiquities Act, the Endangered Species Act (ESA), the GCPA, the Fish and Wildlife Coordination Act, and other federal legislation. The health of the river ecosystem and the protection of the resource values of GCNP and GCNRA are important to the nation, many Native American Tribes, the economy of the Southwest, and the millions of visitors to the parks and the region.

The CRE DFCs will provide a foundation for and help define the components of the Core Monitoring Program under development by the Grand Canyon Monitoring and Research Center (GCMRC). The Core Monitoring Program ultimately will be essential to quantifying, measuring, and reporting the status of the natural resources, allowing the Secretary and the GCDAMP to track progress toward desired outcomes. DFCs will also provide foundation support in the development of other planning and management assignments associated with the GCDAMP.

A.1.4 Colorado River Ecosystem DFCs

A.1.4.1 Sediment-Related Resources DFCs

High-elevation open riparian sediment deposits along the Colorado River in sufficient volume, area, and distribution so as to provide habitat to sustain native biota and desired ecosystem processes include the following:

- Nearshore habitats for native fish,
- Marsh and riparian habitat for fish (food chain maintenance),

- Cultural resource preservation, and
- Maintenance of camping beaches.

A.1.4.2 Water Quality DFCs

Water quality with regard to dissolved oxygen, nutrient concentrations and cycling, turbidity, temperature, and so forth, is sufficient to support natural ecosystem functions, visitor safety, and visitor experience to the extent feasible and consistent with the life history requirements of focal aquatic species including the following:

- Ecosystem-sustaining nutrient distribution, flux, and cycling.
- Hydro-physical conditions and characteristics of the CRE necessary to sustain aquatic biota.
- Acceptable water quality for human health and visitor experience.

A.1.4.3 Colorado River Ecosystem Aquatic Resource DFCs

Aquatic Food Base DFCs

- The aquatic food base will sustainably support viable populations of desired species at all trophic levels.
- Assure that an adequate, diverse, productive aquatic food base exists for fish and other aquatic and terrestrial species that depend on those food resources.

Native Species DFCs

- Native fish species and their habitats (including critical habitats) sustainably maintained throughout in each species' natural ranges in the CRE.
- Healthy, self-sustaining populations of other remaining native fish with appropriate distribution (flannelmouth sucker, bluehead sucker, speckled dace) so that listing under the ESA is not needed.

Humpback Chub DFCs

- Achieve humpback chub recovery in accord with the ESA and the humpback chub comprehensive management plan, and with the assistance of collaborators within and external to the GCDAMP.
- A self-sustaining humpback chub population in its natural range in the CRE.
- An ecologically appropriate habitat for the humpback chub in the mainstem.
- Spawning habitat for humpback chub in the Lower Little Colorado.
- Establish additional humpback chub spawning habitat and spawning aggregations within the CRE, where feasible.
- Adequate survival of young-of-year or juvenile humpback chub that enter the mainstem to maintain reproductive potential of the population and achieve population sizes consistent with recovery goals.

Rainbow Trout DFCs

A high-quality trout fishery in GCNRA, as further described in the Recreation DFC that does not adversely affect the native aquatic community in GCNP:

- Minimize emigration of nonnative fish from the Lees Ferry reach in GCNRA to downstream locations.
- Minimize emigration of nonnative warm water fish to the mainstem Colorado River.

Extirpated Species DFC

Re-establish fishes extirpated from Grand Canyon, where feasible and consistent with recovery goals for humpback chub and the recovery goals of those extirpated fishes. See the linkages that follow for further information.

Nonfish Biotic Communities DFCs

Native non-fish aquatic biota and their habitats are sustainably maintained with ecologically appropriate distributions:

- Populations of native non-fish species (invertebrates and vertebrates, including northern leopard frog).

- GCDAMP support, actions, and funding are limited to incorporation of dam operations that are conducive to restoration of extirpated species.
- Minimize the abundance and distribution of nonnative species in the CRE.
- Sustainable dam-influenced aquatic, wetland, and springs plant communities and associated biological processes, including those supporting threatened and endangered species and their habitats.

A.1.4.4 Colorado River Ecosystem Riparian Resource DFCs

Native riparian systems in various stages of maturity are diverse, healthy, productive, self-sustaining, and ecologically appropriate, as indicated by the following:

- Native, self-sustaining riverine wetlands, and riparian vegetation and habitat, with appropriate mixture of age classes.
- Healthy, self-sustaining populations of native riparian fauna (both resident and migratory).
- Habitat for sensitive species within the CRE.
- Encourage the resolution of the taxonomic status of the Kanab ambersnail (e.g., completely describe the taxa and subspecies).
- Habitat for neotropical migratory birds, waterfowl, and other appropriate native bird species.
- Ecological functions of tributary mouths and riverside springs, including habitat for native species.

A.1.5 Colorado River Ecosystem DFCs Additional Information

A.1.5.1 Colorado River Ecosystem Linkages

Physical characteristics, including climate, site-specific geomorphology, dam-related discharge and flow, and tributary flows, generally predominate over biological processes. The aquatic and riparian components of the CRE are linked to fluvial habitat distribution and the collection, composition, structure, and population dynamics of living organisms. “Lateral” bio-ecological processes, such as competition, and “top-down” processes, such as predation, parasitism, and decomposition, can influence some elements of these linkages over time.

In addition to physical and biological interactions, the CRE is linked to Native American cultural resources such as archeological and cultural properties. Recreation benefits have resulted from both dam operations and healthy ecosystem conditions.

A.1.5.2 Colorado River Ecosystem Metrics

These DFCs are intended to guide the gathering and analysis of data pertinent to the CRE in GCNP and GCNRA. The CRE DFCs and the related documents will be used to provide direction toward development of the core monitoring program under development by the GCMRC. Through diligent and consistent monitoring, GCMRC may inform the Secretary as to whether as to what degree these DFCs are being achieved. Such monitoring may include the following:

- Percentage of critical habitat lost or gained;
- Condition of species variability (native population, abundance, distribution);
- Carrying capacity thresholds; and
- Population estimates.

A.2 POWER DESIRED FUTURE CONDITIONS

A.2.1 Power DFC Description

Hydroelectric power is generated by the release of stored water through Glen Canyon Dam. The dam's eight generators can produce up to 1,320 megawatts: enough electricity to serve 1.3 million residential customers. The integration of hydropower and other resources provides an efficient and flexible operation of this region's electrical resources. Releases of water from Glen Canyon Dam are adjusted in part to follow customer loads.

A.2.2 Power DFC Background and Legislation

Glen Canyon Dam is an important component of the Colorado River Storage Project (CRSP), which stores water, the Western United States' most vital resource, during wet years for use in times of drought, much like a bank account. As part of the nation's critical infrastructure, the water stored by Glen Canyon Dam is vital to the growing water needs of the Western United States. More than 30 million people depend on the water stored behind the dam for drinking, irrigation, and other municipal and industrial uses.

Revenues from the sale of hydropower generation from Glen Canyon Dam and other CRSP facilities are used to repay reimbursable costs and interest on the interest-bearing costs of

the federal investment in the CRSP, and are also used to repay over 85% of the irrigation costs of CRSP federal irrigation projects. These revenues are also used, instead of annual federal appropriations, to pay for the yearly operation, maintenance, and replacement costs of Glen Canyon Dam and other CRSP facilities.

The Reclamation Project Act of 1939 provides that hydropower produced by Glen Canyon Dam and other CRSP facilities be offered for sale first to municipalities, other public corporations and cooperatives, and other nonprofit organizations financed in whole or in part by loans made pursuant to the Rural Electrification Act of 1936. Customers include rural electric associations, federal facilities, state agencies, universities, and 57 Native American entities.

A.2.3 Why the Power DFC Is Important

- Hydropower is an authorized purpose of Glen Canyon Dam.
- Hydropower produced by Glen Canyon Dam is under long-term contract to not-for-profit entities and 57 Tribal entities.
- Power revenues are a significant funding source (providing an estimated \$20 million/year) for the GCDAMP, Upper Colorado River and San Juan River Endangered Fish Recovery Programs, and the Colorado River Salinity Control Program.
- Hydropower is a renewable resource that is an important component in the Western Electricity Coordinating Council (WECC). Hydropower production is a national objective to help meet the nation's needs for reliable, affordable, and environmentally sustainable electricity.
- Glen Canyon generation has the ability to “ramp up” to meet system reliability obligations that are important when regional power shortages or power/transmission system disruptions occur.

A.2.4 Power DFCs

- Glen Canyon Dam capacity and energy generation is maintained and increased, so as to produce the greatest practicable amount of power and energy, consistent with the other DFCs.
- Ensure continued delivery of Glen Canyon Dam hydropower to the existing customers who have entered into long-term firm power contracts with the Western Area Power Association (WAPA).
- Ensure sufficient and efficient production of Glen Canyon Dam hydropower in order to provide the revenues to support the CRSP facilities and purposes.

- Maintain the operational flexibility (including but not limited to load following capability, ramp rates, and emergency operations allowances) that enable Reclamation and WAPA to meet the system operating and other regulatory requirements of WECC, North American Electric Reliability Corporation, and the Federal Energy Regulatory Commission, as well as emergency operating criteria for safety and human health situations.
- Maximize the environmental benefits of hydropower generation at Glen Canyon Dam.
- Minimize carbon emissions through hydropower generation at Glen Canyon Dam.

A.2.5 Power DFC Additional Information

A.2.5.1 Power Linkages

- Operational changes, including experimentation and management actions, which include changes to volumes; release limitations (minimum and maximum); ramp rates; and hourly, daily, monthly, and seasonal variability, all potentially impact this resource.
- The above-identified parameters could have impacts to the CRE resources as well as recreational and cultural resources, depending on the operational design.

A.2.5.2 Power Metrics

- Valuation (measurement characterization for an average year):
 - Electric generating capacity (MW);
 - Electric generating energy (MWH);
 - Load following capability (MW/hr);
 - Ramp rate capability (MW/hr);
 - CO₂, SO₂, and NO_x emissions (tons);
 - Power plant water consumption (acre-feet); and
 - Costs (\$ millions).

A.3 CULTURAL RESOURCES DESIRED FUTURE CONDITIONS

A.3.1 Cultural Resources DFC Description

Preservation and appropriate management of cultural resources are vital at many levels. At the most basic level, cultural resources are our history; they define and reaffirm us, and provide a tangible record of who we are and where we have been. Their importance may be to the nation as a whole, to a local community, or to a group traditionally associated with the area. This includes resources within the Grand Canyon region, such as resources along the river corridor in Glen and Grand Canyons.

A.3.2 DFC Background and Legislation

Recognition of the importance of cultural resources is codified through numerous statutes and executive orders that mandate protection, consideration, and preservation of cultural resources. Because of the structure of federal law, particularly the National Historic Preservation Act of 1966 (NHPA), cultural resources will be considered below in two broad groupings: (1) those that fall within the purview of the NHPA (*National Register of Historic Places* [NRHP] eligible historic properties); and (2) all other resources of traditional cultural importance. This is done for purely pragmatic reasons; there are specific legal requirements for cultural resources that fall under the NHPA umbrella that do not apply to the second class of cultural resources. The Cultural Resources DFCs apply the requirements of the Grand Canyon Protection Act to “protect, mitigate adverse impacts to, and improve the values for which GCNP and Grand Canyon National Recreation Area (GCNRA) were established,” including cultural resources, and are the goals that AMWG members will consider when making recommendations to the Secretary.

A.3.3 Why the Cultural Resources DFCs Are Important

The cultural resources of the Grand Canyon provide a record of human history in the area. They also encompass the traditional cultural use and significance of the Grand Canyon. Maintaining these resources is important to the nation as a whole so we can better understand the long history of the people who came before us and to the traditional groups that consider this area to have traditional significance to them. A number of Native American groups believe the Grand Canyon is their place of origin. These DFCs will help to maintain compliance with relevant cultural resource laws, maintain traditional cultural linkage with the Grand Canyon, and maintain traditional cultural access to and use of resources in the Grand Canyon in accordance with applicable law.

A.3.4 NRHP Eligible (or Potentially Eligible) Historic Properties DFCs

These resources are historic properties that are eligible or potentially eligible for inclusion in the NRHP. The criteria for inclusion are defined in the NHPA, and are described in more detail in *National Register* Bulletins 15 and 38. Resources in the Grand Canyon include the following:

- Prehistoric archaeological sites (including trails, petroglyphs, and pictographs);
- Historic sites (boats, mining, European exploration, river running); and
- Traditional Cultural Properties—for the Grand Canyon, these include:
 - Archaeological sites,
 - Traditional resource use areas,
 - Sacred sites,
 - Landmarks/geographic features,
 - Springs,
 - The Colorado River,
 - Ethno-ecological resources,
 - Significant event locations, and
 - The Grand Canyon itself.

A.3.4.1 Prehistoric Archaeological Sites and Historic Sites

To the extent feasible, maintain significance and integrity through preservation in place:

- If preservation in place is not feasible or reasonable, then implementation of appropriate preservation treatments will be implemented to ensure reduction or elimination of threats consistent with NPS management policies, Tribal traditional values, and historic preservation law.
- Public access to historic properties on Tribal lands is managed by the respective Tribes. On lands administered by the NPS, access to some sites for users of the river corridor is maintained as long as integrity of the sites is not compromised.

A.3.4.2 Traditional Cultural Properties (TCPs)

- Attributes are maintained; for example, NRHP eligibility is not compromised. These attributes will be specific to traditionally associated peoples and will need to be identified by the federal agencies in consultation with those groups. Attributes may include aspects of location or physical integrity, and may be

- intangible elements that link the resource to ongoing traditional cultural practices.
- The ability of traditionally associated people to maintain access to and use of the resources is preserved, in accordance with applicable law.
 - Culturally appropriate conditions of resources are maintained based on traditional ecological knowledge; integration of the desired condition is included in relevant monitoring and management programs.
 - Maintain ongoing consultation with the groups for whom the resource has traditional value. Because the desired condition of a TCP needs to be determined by the group for whom it has the traditional value, ongoing consultation is necessary to assess the condition of the resource.
 - Mitigate impacts that affect the integrity of the TCPs. How and if effects can be mitigated will need to be determined in conjunction with the traditionally associated peoples for whom the resource holds value.

A.3.5 NRHP Eligible (or Potentially Eligible) Historic Properties DFC Additional Information

A.3.5.1 NRHP Eligible (or Potentially Eligible) Historic Properties Linkages

The goals for the following all have the potential to directly or indirectly affect the condition of the NRHP eligible properties (including some examples of effects):

- Flow
 - Direct inundation
 - Levels of sediment deposition
 - Fluctuation frequency and range
- Sediment
 - Distribution (laterally and vertically)
- Vegetation
 - Species composition
 - Density
- Recreation
 - Camping locations
 - Recreational visitation
 - Trailing

In addition, management and research actions have the potential to directly or indirectly impact these resources.

A.3.5.2 NRHP Eligible (or Potentially Eligible) Historic Properties Metrics

- Erosion (or deposition) rates of substrates in which the sites are contained, and
- Impacts at sites that will affect eligibility.

A.3.6 Resources of Traditional Cultural Significance but Not NRHP Eligible

These are resources of cultural significance to traditional peoples, often Native American Tribes, that do not meet some aspect for eligibility for inclusion in the NRHP. A common reason that a resource does not meet NRHP eligibility requirements is that the resource lacks a clearly defined boundary or does not remain in a fixed location.

Resources that have the potential to be considered of traditional cultural significance in the Grand Canyon include the following:

- Animal resources,
- Geologic materials,
- Landscapes,
- Plant resources,
- Soundscapes,
- Viewscapes, and
- Water.

A.3.7 Resources of Traditional Cultural Significance DFCs

- Maintain the ability of traditionally associated peoples to access and use the resource in accordance with applicable law.
- Maintain culturally appropriate resource conditions based on traditional ecological knowledge and integrate this desired condition into monitoring and management programs.

- Maintain effective consultation with the groups for whom the resource has traditional cultural significance.

A.3.8 Resources of Traditional Cultural Significance Linkages

The goals for the following resources all directly or indirectly affect the condition of resources with traditional cultural significance:

- Flow,
- Sediment,
- Vegetation, and
- Recreation.

In addition, management and research actions have the potential to directly impact these resources.

A.3.9 Resources of Traditional Cultural Significance Metrics

Because culture defines the roles resources play in that culture, only members of that culture can assess the status or health of the resources. Therefore, measures for resource status or health and appropriate management will need to be determined individually by federal agencies in consultation with the traditionally associated peoples.

A.4 RECREATION DESIRED FUTURE CONDITIONS

A.4.1 Recreation DFC Description

The Recreation DFCs are meant to describe goals and objectives for human use of the CRE through GCNRA and the GCNP. They are intended to include not only traditional recreational activities such as whitewater rafting, camping, and fishing, but also such things as educational activities, spiritual engagement, and other appropriate activities and values. Grand Canyon and Glen Canyon offer many ways for people to experience, appreciate, and learn from them, even to those who never visit in person.

A.4.2 DFC Background and Legislation

Recreational use on the Colorado River began before there were any dams there, although its exact beginnings are unknown. Recreational and other activities and values in the Grand

Canyon and Glen Canyon have increased greatly since the construction of Glen Canyon Dam. The Recreation DFC applies the requirements of the GCPA to “protect, mitigate adverse impacts to, and improve the values for which GCNP and Grand Canyon National Recreation Area (GCNRA) were established,” including visitor use/recreation, and the goals that AMWG members will consider when making recommendations to the Secretary.

A.4.3 Why the Recreation DFC Is Important

A.4.3.1 Grand Canyon National Park

The Grand Canyon is a unique place in the world. Its natural beauty, challenging environment, fascinating history, wilderness character, biodiversity, and sheer size offer a rare and valuable experience. The river corridor is at the heart of the Grand Canyon. The river corridor and the canyon are worthy of the greatest possible respect, treatment, and protection that can be afforded them. They must be kept vital and intact for future generations.

A.4.3.2 Glen Canyon National Recreation Area

The river corridor through the GCNRA provides opportunity to enjoy outdoor beauty with relatively easy access. It supports a valuable and high-quality trout fishery and offers excellent outdoor opportunities that are more accessible and less demanding than those of the Grand Canyon. It is deserving of respect and protection, while also providing the recreational opportunities for which it was established.

A.4.4 Recreation DFCs

The recreation DFCs have been divided in to four subcategories, each corresponding to a different section of the overall ecosystem or type of use.

A.4.4.1 River Recreation in Grand Canyon National Park

- Stewardship worthy of the Grand Canyon so that it can be passed from generation to generation in as natural a condition as possible.
- Provide maximum opportunity to experience the wilderness character of the canyon.
- Wilderness experiences and benefits available in the canyon include solitude, connection to nature, personal contemplation, joy, excitement, the natural sounds and quiet of the desert and river, and extended time periods in a unique environment outside the trappings of civilization.

- A river corridor landscape that matches natural conditions as closely as possible, including extensive beaches and abundant driftwood.
- A river corridor ecosystem that matches the natural conditions as closely as possible, including a biotic community dominated in most instances by native species.
- A dynamic river ecosystem characterized by ecological patterns and processes within their range of natural variability.
- Numerous campable sandbars distributed throughout the canyon.
- Recreational and wilderness experiences minimally affected by research and management activities.
- River flows that continue to be within a range that is reasonably safe, given the inherent risks involved in river recreation.

A.4.4.2 River Recreation in Glen Canyon National Recreation Area

- A quality recreation experience in Glen Canyon.
- Camping beaches suitable for recreational use.
- A setting and ecosystem that is as close to natural conditions as possible.
- Quality river running and angling recreation opportunities.

A.4.4.3 Blue Ribbon Trout Fishery in Glen Canyon National Recreation Area

- A high-quality sustainable recreational trout fishery in the river corridor in GCNRA, while minimizing emigration of nonnative fishes.
- Operate Glen Canyon Dam to achieve the greatest benefit to the trout fishery in GCNRA without causing excessive detriment to other resources.

A.4.4.4 River Corridor Stewardship

- Management of Glen Canyon Dam that is significantly driven by concern for the cultural values and ecological integrity of the river corridor through the Grand Canyon, with preservation and protection considered over the long term (multiple generations).

- A well-informed public, confident that high-quality scientific information is being used for best stewardship practices in the CRE.

A.4.5 Recreation DFC Additional Information

A.4.6 Recreation Linkages

- A natural, healthy, and protected ecosystem is a fundamentally key element to the recreation experience and wilderness character of the river corridor.
- Cultural resources within and near the river corridor:
 - The history of human habitation and use is an important part of the recreation experience. Individual sites are valuable whether they are open for visitation or designated off-limits.
 - Outfitters and guiding opportunities.
 - Local businesses.

A.4.7 Recreation Metrics

- Socioeconomic value of river recreation in GCNP.
- Socioeconomic value of the river corridor visitation and the Grand Canyon itself, as a whole.
- Economic effects of Grand Canyon tourism.
- Factors that make up the “wilderness character” of the river corridor.
- Number and size of campable beaches, safe flows for an optimal recreation experience.
- Socioeconomic value of river recreation in GCNRA.
- Socioeconomic value of the river corridor itself in GCNRA.
- Socioeconomic value of the fishery in GCNRA.
- Effect of the trout on the ecosystem in GCNP and the social and economic costs of mitigation.
- Characteristics most valued for the fishery; for example, the number, condition, and size of fish, and the ease or challenge of catching them.

- River running visitation metrics.
- Water quality variables that influence river recreation.
- Other river running safety issues.

A.5 REFERENCE

DFC Ad Hoc Committee, 2012, *Desired Future Conditions for the Colorado River Ecosystem in Relation to Glen Canyon Dam*. Available at http://www.usbr.gov/uc/rm/amp/amwg/pdfs/recltr_12April30.pdf. Accessed July 24, 2015.

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