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APPENDIX A:
ADAPTIVE MANAGEMENT WORKING GROUP
DESIRED FUTURE CONDITIONS

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1 responsibility of the Secretary with respect to the management and
2 administration of the GCNP and GCNRA, including natural and cultural
3 resources and visitor use, under laws applicable to those areas, including, but
4 not limited to, the Act of August 25, 1916 (39 Stat. 535), as amended and
5 supplemented.
6

7 The Bureau of Reclamation (Reclamation) is charged with balancing a complex set of
8 interests in operating the dam. Those interests include not only the endangered species below the
9 dam, but also Tribes in the region, the seven Colorado River basin states, large municipalities
10 that depend on water and power from Glen Canyon Dam, agricultural interests, GCNP, GCNRA,
11 and national energy needs at a time when clean energy production is becoming increasingly
12 important. The DFCs will assist the AMWG in providing recommendations to the Secretary of
13 the Interior for future decision-making. The DFCs have evolved from discussions during the
14 entire 16-year history of the AMWG, and were generated in the following form from the
15 concerted work of the DFC Ad Hoc Group and the federal agency regional leadership during
16 2010 and 2011.
17

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

22 *The Grand Canyon is a homeland for some, sacred to many, and a national*
23 *treasure for all. In honor of past generations, and on behalf of those of the*
24 *present and future, we envision an ecosystem where the resources and natural*
25 *processes are in harmony under a stewardship worthy of the Grand Canyon.*
26

27 *We advise the Secretary of the Interior on how best to protect, mitigate adverse*
28 *impacts to, and improve the integrity of the Colorado River ecosystem affected by*
29 *Glen Canyon Dam, including natural biological diversity (emphasizing native*
30 *biodiversity), traditional cultural properties, spiritual values, and cultural,*
31 *physical, and recreational resources through the operation of Glen Canyon Dam*
32 *and other means.*
33

34 *We do so in keeping with the federal trust responsibilities to Indian Tribes, in*
35 *compliance with applicable federal, state, and Tribal laws, including the water*
36 *delivery obligations of the Law of the River, and with due consideration to the*
37 *economic value of power resources.*
38

39 *This will be accomplished through our long-term partnership utilizing the best*
40 *available scientific and other information through an adaptive ecosystem*
41 *management process.*
42

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

1 inherent limitations. This fact does not diminish their value. These DFCs of the affected
2 resources have been identified by the stakeholders as appropriate goals for the AMP and are
3 based on information available at this time. As new information develops, the DFCs may need
4 further revision and refinement. Therefore, these DFCs are neither fixed nor final. This is
5 intended to be a “living document” that reflects advances in learning and understanding. This is
6 consistent with the process—and application—of adaptive management.
7

8 The Colorado River Ecosystem (CRE) is defined as the Colorado River mainstream
9 corridor and interacting resources in associated riparian and terrace zones, located primarily from
10 the fore bay of Glen Canyon Dam to the western boundary of GCNP. It includes the area where
11 the dam operations impact physical, biological, recreational, cultural, and other resources. The
12 scope of GCDAMP activities may include limited investigations into some tributaries (e.g., the
13 Little Colorado and Paria Rivers).
14

15 The majority of the CRE exists within the boundaries of two national parks and proposed
16 wilderness areas. Despite these protections, the CRE could be considered “a human-dominated
17 ecosystem, one whose aesthetic appeal, goods and services, and spiritual services are widely
18 used and appreciated and needed by a broad cross-section of society. Adaptive management of
19 the CRE has been adopted to ensure the sustainability of the natural environment with the least
20 impact on the goods and services the CRE provides to society. As such, and as information about
21 the CRE has increased, its stewardship is moving toward an ecosystem perspective, fully
22 recognizing the role of humans, and this approach is reflected in the structure of this document.”
23 (DFC Ad Hoc Committee 2012)
24

25 The DFCs are divided into four categories, including the CRE, Power, Cultural
26 Resources, and Recreation. There are many direct, indirect, short-term, and long-term ecosystem
27 responses to dam existence and operations. The DFCs are directly or indirectly linked to each
28 other on short- and long-term bases through dam-related flows, sediment retention and
29 distribution, hydropower production, fish and wildlife populations, recreation, and visitor
30 experience. The following sections are excerpted from the 2012 DFC document.
31
32

33 **A.1 DESIRED FUTURE CONDITIONS: COLORADO RIVER ECOSYSTEM**

34 **A.1.1 DFC Description**

35
36
37
38 The term “ecosystem” refers to the combined physical and biological components of an
39 environment. An ecosystem is generally an area within the natural environment in which
40 physical (abiotic) factors and processes of the environment, such as geology, climate, and soil
41 development, function along with interdependent (biotic) organisms, such as plants and animals,
42 in the same habitat and create a dynamic and interconnected system. Ecosystems usually
43 encompass a number of food webs. An ecosystem is a functional unit within a given area
44 consisting of living things and the nonliving chemical and physical factors of their environment,
45 linked together through nutrient cycle and energy flow.
46

1 **A.1.2 DFC Background and Legislation**
2

3 Glen Canyon Dam has had a profound impact on the aquatic and terrestrial domains of
4 the CRE from lower Lake Powell downstream to Lake Mead. The CRE DFCs are designed to be
5 consistent with the GCPA, Law of the River, and other appropriate laws and mandates. The CRE
6 DFCs apply the requirements of the GCPA, and are the goals that AMWG members will
7 consider when making recommendations to the Secretary.
8
9

10 **A.1.3 Why the Colorado River Ecosystem DFCs Are Important**
11

12 These CRE DFCs address the natural resource values for which the GCNP and the
13 GCNRA were established. The DFCs aim to comply with the GCPA and describe the individual
14 resource objectives sought with the realization that they may not be achievable in the process of
15 finding the most desirable mix of resources in the CRE and the natural habitats, and natural
16 ecosystem processes. Native and nonnative species are to be managed in accord with federal
17 regulations, policies, and guidelines. The CRE described herein includes most of the native
18 natural resources found in the Colorado River. Those resources are managed, consistent with the
19 Law of the River, described in part in Section 1802(b) of the GCPA, under the National Park
20 Service (NPS) Organic Act, the Redwoods Amendment, NPS 2006 Management Policies, the
21 Wilderness Act, the Antiquities Act, the Endangered Species Act (ESA), the GCPA, the Fish and
22 Wildlife Coordination Act, and other federal legislation. The health of the river ecosystem and
23 the protection of the resource values of GCNP and GCNRA are important to the nation, many
24 Native American Tribes, the economy of the Southwest, and the millions of visitors to the parks
25 and the region.
26

27 The CRE DFCs will provide a foundation for and help define the components of the Core
28 Monitoring Program under development by the Grand Canyon Monitoring and Research Center
29 (GCMRC). The Core Monitoring Program ultimately will be essential to quantifying, measuring,
30 and reporting the status of the natural resources, allowing the Secretary and the GCDAMP to
31 track progress toward desired outcomes. DFCs will also provide foundation support in the
32 development of other planning and management assignments associated with the GCDAMP.
33
34

35 **A.1.4 Colorado River Ecosystem DFCs**
36
37

38 **A.1.4.1 Sediment-Related Resources DFCs**
39

40 High-elevation open riparian sediment deposits along the Colorado River in sufficient
41 volume, area, and distribution so as to provide habitat to sustain native biota and desired
42 ecosystem processes include the following:
43

- 44 • Nearshore habitats for native fish,
- 45
- 46 • 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.

1 **Humpback Chub DFCs**

- 2
- 3 • Achieve humpback chub recovery in accord with the ESA and the humpback
 - 4 chub comprehensive management plan, and with the assistance of
 - 5 collaborators within and external to the GCDAMP.
 - 6
 - 7 • A self-sustaining humpback chub population in its natural range in the CRE.
 - 8
 - 9 • An ecologically appropriate habitat for the humpback chub in the mainstem.
 - 10
 - 11 • Spawning habitat for humpback chub in the Lower Little Colorado.
 - 12
 - 13 • Establish additional humpback chub spawning habitat and spawning
 - 14 aggregations within the CRE, where feasible.
 - 15
 - 16 • Adequate survival of young-of-year or juvenile humpback chub that enter the
 - 17 mainstem to maintain reproductive potential of the population and achieve
 - 18 population sizes consistent with recovery goals.
 - 19

20

21 **Rainbow Trout DFCs**

22

23 A high-quality trout fishery in GCNRA, as further described in the Recreation DFC that

24 does not adversely affect the native aquatic community in GCNP:

- 25
- 26 • Minimize emigration of nonnative fish from the Lees Ferry reach in GCNRA
 - 27 to downstream locations.
 - 28
 - 29 • Minimize emigration of nonnative warm water fish to the mainstem Colorado
 - 30 River.
 - 31

32

33 **Extirpated Species DFC**

34

35 Re-establish fishes extirpated from Grand Canyon, where feasible and consistent with

36 recovery goals for humpback chub and the recovery goals of those extirpated fishes. See the

37 linkages that follow for further information.

38

39

40 **Nonfish Biotic Communities DFCs**

41

42 Native non-fish aquatic biota and their habitats are sustainably maintained with

43 ecologically appropriate distributions:

- 44
- 45 • Populations of native non-fish species (invertebrates and vertebrates,
 - 46 including northern leopard frog).

- 1 • GCDAMP support, actions, and funding are limited to incorporation of dam
2 operations that are conducive to restoration of extirpated species.
3
- 4 • Minimize the abundance and distribution of nonnative species in the CRE.
5
- 6 • Sustainable dam-influenced aquatic, wetland, and springs plant communities
7 and associated biological processes, including those supporting threatened and
8 endangered species and their habitats.
9

10 **A.1.4.4 Colorado River Ecosystem Riparian Resource DFCs**

11 Native riparian systems in various stages of maturity are diverse, healthy, productive,
12 self- sustaining, and ecologically appropriate, as indicated by the following:
13

- 14 • Native, self-sustaining riverine wetlands, and riparian vegetation and habitat,
15 with appropriate mixture of age classes.
16
- 17 • Healthy, self-sustaining populations of native riparian fauna (both resident and
18 migratory).
19
- 20 • Habitat for sensitive species within the CRE.
21
- 22 • Encourage the resolution of the taxonomic status of the Kanab ambersnail
23 (e.g., completely describe the taxa and subspecies).
24
- 25 • Habitat for neotropical migratory birds, waterfowl, and other appropriate
26 native bird species.
27
- 28 • Ecological functions of tributary mouths and riverside springs, including
29 habitat for native species.
30
31
32

33 **A.1.5 Colorado River Ecosystem DFCs Additional Information**

34 **A.1.5.1 Colorado River Ecosystem Linkages**

35 Physical characteristics, including climate, site-specific geomorphology, dam-related
36 discharge and flow, and tributary flows, generally predominate over biological processes. The
37 aquatic and riparian components of the CRE are linked to fluvial habitat distribution and the
38 collection, composition, structure, and population dynamics of living organisms. “Lateral” bio-
39 ecological processes, such as competition, and “top-down” processes, such as predation,
40 parasitism, and decomposition, can influence some elements of these linkages over time.
41
42
43
44
45

1 In addition to physical and biological interactions, the CRE is linked to Native American
2 cultural resources such as archeological and cultural properties. Recreation benefits have resulted
3 from both dam operations and healthy ecosystem conditions.
4

6 **A.1.5.2 Colorado River Ecosystem Metrics**

7
8 These DFCs are intended to guide the gathering and analysis of data pertinent to the CRE
9 in GCNP and GCNRA. The CRE DFCs and the related documents will be used to provide
10 direction toward development of the core monitoring program under development by the
11 GCMRC. Through diligent and consistent monitoring, GCMRC may inform the Secretary as to
12 whether as to what degree these DFCs are being achieved. Such monitoring may include the
13 following:
14

- 15 • Percentage of critical habitat lost or gained;
- 16
- 17 • Condition of species variability (native population, abundance, distribution);
- 18
- 19 • Carrying capacity thresholds; and
- 20
- 21 • Population estimates.
- 22
- 23

24 **A.2 POWER DESIRED FUTURE CONDITIONS**

27 **A.2.1 Power DFC Description**

28
29 Hydroelectric power is generated by the release of stored water through Glen Canyon
30 Dam. The dam's eight generators can produce up to 1,320 megawatts: enough electricity to serve
31 1.3 million residential customers. The integration of hydropower and other resources provides an
32 efficient and flexible operation of this region's electrical resources. Releases of water from Glen
33 Canyon Dam are adjusted in part to follow customer loads.
34

36 **A.2.2 Power DFC Background and Legislation**

37
38 Glen Canyon Dam is an important component of the Colorado River Storage Project
39 (CRSP), which stores water, the Western United States' most vital resource, during wet years for
40 use in times of drought, much like a bank account. As part of the nation's critical infrastructure,
41 the water stored by Glen Canyon Dam is vital to the growing water needs of the Western
42 United States. More than 30 million people depend on the water stored behind the dam for
43 drinking, irrigation, and other municipal and industrial uses.
44

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

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

5
6 The Reclamation Project Act of 1939 provides that hydropower produced by Glen
7 Canyon Dam and other CRSP facilities be offered for sale first to municipalities, other public
8 corporations and cooperatives, and other nonprofit organizations financed in whole or in part by
9 loans made pursuant to the Rural Electrification Act of 1936. Customers include rural electric
10 associations, federal facilities, state agencies, universities, and 57 Native American entities.

11 12 13 **A.2.3 Why the Power DFC Is Important**

- 14 • Hydropower is an authorized purpose of Glen Canyon Dam.
- 15
16 • Hydropower produced by Glen Canyon Dam is under long-term contract to
17 not-for-profit entities and 57 Tribal entities.
- 18
19 • Power revenues are a significant funding source (providing an estimated
20 \$20 million/year) for the GCDAMP, Upper Colorado River and San Juan
21 River Endangered Fish Recovery Programs, and the Colorado River Salinity
22 Control Program.
- 23
24 • Hydropower is a renewable resource that is an important component in the
25 Western Electricity Coordinating Council (WECC). Hydropower production
26 is a national objective to help meet the nation's needs for reliable, affordable,
27 and environmentally sustainable electricity.
- 28
29 • Glen Canyon generation has the ability to “ramp up” to meet system reliability
30 obligations that are important when regional power shortages or
31 power/transmission system disruptions occur.
- 32
33

34 35 **A.2.4 Power DFCs**

- 36 • Glen Canyon Dam capacity and energy generation is maintained and
37 increased, so as to produce the greatest practicable amount of power and
38 energy, consistent with the other DFCs.
- 39
40 • Ensure continued delivery of Glen Canyon Dam hydropower to the existing
41 customers who have entered into long-term firm power contracts with the
42 Western Area Power Association (WAPA).
- 43
44 • Ensure sufficient and efficient production of Glen Canyon Dam hydropower
45 in order to provide the revenues to support the CRSP facilities and purposes.
- 46

- 1 • Maintain the operational flexibility (including but not limited to load
2 following capability, ramp rates, and emergency operations allowances) that
3 enable Reclamation and WAPA to meet the system operating and other
4 regulatory requirements of WECC, North American Electric Reliability
5 Corporation, and the Federal Energy Regulatory Commission, as well as
6 emergency operating criteria for safety and human health situations.
7
- 8 • Maximize the environmental benefits of hydropower generation at Glen
9 Canyon Dam.
- 10
- 11 • Minimize carbon emissions through hydropower generation at Glen Canyon
12 Dam.
13
14

15 **A.2.5 Power DFC Additional Information**

16 **A.2.5.1 Power Linkages**

- 17
- 18
- 19
- 20 • Operational changes, including experimentation and management actions,
21 which include changes to volumes; release limitations (minimum and
22 maximum); ramp rates; and hourly, daily, monthly, and seasonal variability,
23 all potentially impact this resource.
24
- 25 • The above-identified parameters could have impacts to the CRE resources as
26 well as recreational and cultural resources, depending on the operational
27 design.
28
29

30 **A.2.5.2 Power Metrics**

- 31
- 32 • Valuation (measurement characterization for an average year):
 - 33 – Electric generating capacity (MW);
 - 34 – Electric generating energy (MWH);
 - 35 – Load following capability (MW/hr);
 - 36 – Ramp rate capability (MW/hr);
 - 37 – CO₂, SO₂, and NO_x emissions (tons);
 - 38 – Power plant water consumption (acre-feet); and
 - 39 – Costs (\$ millions).
- 40
- 41

1 **A.3 CULTURAL RESOURCES DESIRED FUTURE CONDITIONS**
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4 **A.3.1 Cultural Resources DFC Description**
5

6 Preservation and appropriate management of cultural resources are vital at many levels.
7 At the most basic level, cultural resources are our history; they define and reaffirm us, and
8 provide a tangible record of who we are and where we have been. Their importance may be to
9 the nation as a whole, to a local community, or to a group traditionally associated with the area.
10 This includes resources within the Grand Canyon region, such as resources along the river
11 corridor in Glen and Grand Canyons.
12
13

14 **A.3.2 DFC Background and Legislation**
15

16 Recognition of the importance of cultural resources is codified through numerous statutes
17 and executive orders that mandate protection, consideration, and preservation of cultural
18 resources. Because of the structure of federal law, particularly the National Historic Preservation
19 Act of 1966 (NHPA), cultural resources will be considered below in two broad groupings:
20 (1) those that fall within the purview of the NHPA (*National Register of Historic Places* [NRHP]
21 eligible historic properties); and (2) all other resources of traditional cultural importance. This is
22 done for purely pragmatic reasons; there are specific legal requirements for cultural resources
23 that fall under the NHPA umbrella that do not apply to the second class of cultural resources.
24 The Cultural Resources DFCs apply the requirements of the Grand Canyon Projection Act to
25 “protect, mitigate adverse impacts to, and improve the values for which GCNP and Grand
26 Canyon National Recreation Area (GCNRA) were established,” including cultural resources, and
27 are the goals that AMWG members will consider when making recommendations to the
28 Secretary.
29
30

31 **A.3.3 Why the Cultural Resources DFCs Are Important**
32

33 The cultural resources of the Grand Canyon provide a record of human history in the
34 area. They also encompass the traditional cultural use and significance of the Grand Canyon.
35 Maintaining these resources is important to the nation as a whole so we can better understand the
36 long history of the people who came before us and to the traditional groups that consider this
37 area to have traditional significance to them. A number of Native American groups believe the
38 Grand Canyon is their place of origin. These DFCs will help to maintain compliance with
39 relevant cultural resource laws, maintain traditional cultural linkage with the Grand Canyon, and
40 maintain traditional cultural access to and use of resources in the Grand Canyon in accordance
41 with applicable law.
42
43

1 **A.3.4 NRHP Eligible (or Potentially Eligible) Historic Properties DFCs**
2

3 These resources are historic properties that are eligible or potentially eligible for
4 inclusion in the NRHP. The criteria for inclusion are defined in the NHPA, and are described in
5 more detail in *National Register* Bulletins 15 and 38. Resources in the Grand Canyon include the
6 following:
7

- 8 • Prehistoric archaeological sites (including trails, petroglyphs, and
9 pictographs);
- 10
- 11 • Historic sites (boats, mining, European exploration, river running); and
- 12
- 13 • Traditional Cultural Properties—for the Grand Canyon, these include:
 - 14 – Archaeological sites,
 - 15 – Traditional resource use areas,
 - 16 – Sacred sites,
 - 17 – Landmarks/geographic features,
 - 18 – Springs,
 - 19 – The Colorado River,
 - 20 – Ethno-ecological resources,
 - 21 – Significant event locations, and
 - 22 – The Grand Canyon itself.
- 23
- 24

25 **A.3.4.1 Prehistoric Archaeological Sites and Historic Sites**
26

27 To the extent feasible, maintain significance and integrity through preservation in place:
28

- 29 • If preservation in place is not feasible or reasonable, then implementation of
30 appropriate preservation treatments will be implemented to ensure reduction
31 or elimination of threats consistent with NPS management policies, Tribal
32 traditional values, and historic preservation law.
- 33
- 34 • Public access to historic properties on Tribal lands is managed by the
35 respective Tribes. On lands administered by the NPS, access to some sites for
36 users of the river corridor is maintained as long as integrity of the sites is not
37 compromised.
- 38
- 39

40 **A.3.4.2 Traditional Cultural Properties (TCPs)**
41

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

- 1 intangible elements that link the resource to ongoing traditional cultural
2 practices.
3
- 4 • The ability of traditionally associated people to maintain access to and use of
5 the resources is preserved, in accordance with applicable law.
6
 - 7 • Culturally appropriate conditions of resources are maintained based on
8 traditional ecological knowledge; integration of the desired condition is
9 included in relevant monitoring and management programs.
10
 - 11 • Maintain ongoing consultation with the groups for whom the resource has
12 traditional value. Because the desired condition of a TCP needs to be
13 determined by the group for whom it has the traditional value, ongoing
14 consultation is necessary to assess the condition of the resource.
15
 - 16 • Mitigate impacts that affect the integrity of the TCPs. How and if effects can
17 be mitigated will need to be determined in conjunction with the traditionally
18 associated peoples for whom the resource holds value.
19
20

21 **A.3.5 NRHP Eligible (or Potentially Eligible) Historic Properties DFC** 22 **Additional Information** 23

24 **A.3.5.1 NRHP Eligible (or Potentially Eligible) Historic Properties Linkages** 25

26 The goals for the following all have the potential to directly or indirectly affect the
27 condition of the NRHP eligible properties (including some examples of effects):
28

- 29 • Flow
30 – Direct inundation
31 – Levels of sediment deposition
32 – Fluctuation frequency and range
33
- 34 • Sediment
35 – Distribution (laterally and vertically)
36
- 37 • Vegetation
38 – Species composition
39 – Density
40
- 41 • Recreation
42 – Camping locations
43 – Recreational visitation
44 – Trailing
45
46

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

3
4
5 **A.3.5.2 NRHP Eligible (or Potentially Eligible) Historic Properties Metrics**

- 6
7 • Erosion (or deposition) rates of substrates in which the sites are contained, and
8
9 • Impacts at sites that will affect eligibility.

10
11
12 **A.3.6 Resources of Traditional Cultural Significance but Not NRHP Eligible**

13
14 These are resources of cultural significance to traditional peoples, often Native American
15 Tribes, that do not meet some aspect for eligibility for inclusion in the NRHP. A common reason
16 that a resource does not meet NRHP eligibility requirements is that the resource lacks a clearly
17 defined boundary or does not remain in a fixed location.

18
19 Resources that have the potential to be considered of traditional cultural significance in
20 the Grand Canyon include the following:

- 21
22 • Animal resources,
23
24 • Geologic materials,
25
26 • Landscapes,
27
28 • Plant resources,
29
30 • Soundscapes,
31
32 • Viewscapes, and
33
34 • Water.

35
36
37 **A.3.7 Resources of Traditional Cultural Significance DFCs**

- 38
39 • Maintain the ability of traditionally associated peoples to access and use the
40 resource in accordance with applicable law.
41
42 • Maintain culturally appropriate resource conditions based on traditional
43 ecological knowledge and integrate this desired condition into monitoring and
44 management programs.
45

- 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

1 Canyon and Glen Canyon have increased greatly since the construction of Glen Canyon Dam.
2 The Recreation DFC applies the requirements of the GCPA to “protect, mitigate adverse impacts
3 to, and improve the values for which GCNP and Grand Canyon National Recreation Area
4 (GCNRA) were established,” including visitor use/recreation, and the goals that AMWG
5 members will consider when making recommendations to the Secretary.
6
7

8 **A.4.3 Why the Recreation DFC Is Important**

9

10 **A.4.3.1 Grand Canyon National Park**

11

12
13 The Grand Canyon is a unique place in the world. Its natural beauty, challenging
14 environment, fascinating history, wilderness character, biodiversity, and sheer size offer a rare
15 and valuable experience. The river corridor is at the heart of the Grand Canyon. The river
16 corridor and the canyon are worthy of the greatest possible respect, treatment, and protection that
17 can be afforded them. They must be kept vital and intact for future generations.
18
19

20 **A.4.3.2 Glen Canyon National Recreation Area**

21

22 The river corridor through the GCNRA provides opportunity to enjoy outdoor beauty
23 with relatively easy access. It supports a valuable and high-quality trout fishery and offers
24 excellent outdoor opportunities that are more accessible and less demanding than those of the
25 Grand Canyon. It is deserving of respect and protection, while also providing the recreational
26 opportunities for which it was established.
27
28

29 **A.4.4 Recreation DFCs**

30

31 The recreation DFCs have been divided in to four subcategories, each corresponding to a
32 different section of the overall ecosystem or type of use.
33
34

35 **A.4.4.1 River Recreation in Grand Canyon National Park**

36

- 37 • Stewardship worthy of the Grand Canyon so that it can be passed from
38 generation to generation in as natural a condition as possible.
- 39
- 40 • Provide maximum opportunity to experience the wilderness character of the
41 canyon.
- 42
- 43 • Wilderness experiences and benefits available in the canyon include solitude,
44 connection to nature, personal contemplation, joy, excitement, the natural
45 sounds and quiet of the desert and river, and extended time periods in a unique
46 environment outside the trappings of civilization.

- 1 • A river corridor landscape that matches natural conditions as closely as
2 possible, including extensive beaches and abundant driftwood.
3
- 4 • A river corridor ecosystem that matches the natural conditions as closely as
5 possible, including a biotic community dominated in most instances by native
6 species.
7
- 8 • A dynamic river ecosystem characterized by ecological patterns and processes
9 within their range of natural variability.
10
- 11 • Numerous campable sandbars distributed throughout the canyon.
12
- 13 • Recreational and wilderness experiences minimally affected by research and
14 management activities.
15
- 16 • River flows that continue to be within a range that is reasonably safe, given
17 the inherent risks involved in river recreation.
18

19 **A.4.4.2 River Recreation in Glen Canyon National Recreation Area**

- 20
- 21
- 22 • A quality recreation experience in Glen Canyon.
23
- 24 • Camping beaches suitable for recreational use.
25
- 26 • A setting and ecosystem that is as close to natural conditions as possible.
27
- 28 • Quality river running and angling recreation opportunities.
29

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

- 31
- 32
- 33 • A high-quality sustainable recreational trout fishery in the river corridor in
34 GCNRA, while minimizing emigration of nonnative fishes.
35
- 36 • Operate Glen Canyon Dam to achieve the greatest benefit to the trout fishery
37 in GCNRA without causing excessive detriment to other resources.
38

39 **A.4.4.4 River Corridor Stewardship**

- 40
- 41
- 42 • Management of Glen Canyon Dam that is significantly driven by concern for
43 the cultural values and ecological integrity of the river corridor through the
44 Grand Canyon, with preservation and protection considered over the long
45 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.

- 1 • River running visitation metrics.
- 2
- 3 • Water quality variables that influence river recreation.
- 4
- 5 • Other river running safety issues.
- 6
- 7

8 **A.5 REFERENCE**

9

10 DFC Ad Hoc Committee, 2012, *Desired Future Conditions for the Colorado River Ecosystem in*
11 *Relation to Glen Canyon Dam*. Available at [http://www.usbr.gov/uc/rm/amp/amwg/pdfs/](http://www.usbr.gov/uc/rm/amp/amwg/pdfs/recltr_12April30.pdf)
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