LOOKING TOWARD THE FUTURE: THE TIME HAS COME TO RESTORE GLEN CANYON

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I. INTRODUCTION

On April 11, 1956, Congress passed into law the Colorado River Storage Project Act ("CRSP")[1] to support development of water resources of the Upper Colorado River Basin. As stated in the Act, the purposes of the development were to: (1) regulate the flow of the Colorado River; (2) store water for beneficial consumptive use; (3) provide for the reclamation of arid and semiarid land; (4) control floods; and (5) generate hydroelectric power, incidental to other stated purposes.

At its core, the CRSP provided for the construction of Glen Canyon Dam and the loss of Glen Canyon. To conservationists, the decision by Congress in April of 1956 drew a battle line for the environmental movement and continues to serve as a reminder of the effect that compromises can have on the natural treasures of our nation.

Forty years later, in October 1996, the Glen Canyon Institute publicly called for the restoration of Glen Canyon.[2] This bold proposal reinvigorated the debate about Glen Canyon. The proposal to restore Glen Canyon by decommissioning Glen Canyon Dam elicited comments that have run from "lunacy" to "visionary." Certainly the proposal has been a stimulus for river and ecosystem restoration advocacy across the country. Glen Canyon was again the

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1. Colorado River Storage Project Act of 1956, Pub. L. No. 84-485, 70 Stat. 105 (codified as amended at 43 U.S.C. §§ 620–620o (1994)).

2. Richard Ingebretsen, Speech at the Glen Canyon Institute Fall Conference, University of Utah (Oct. 1996) (calling for the restoration of Glen Canyon Dam).

center of discussion in Washington, D.C. in 1997 when the 105th Congress held an oversight hearing on the proposal.[3]

What began as rivulets of water flowing downstream has evolved into a catalyst for change in the West. Ever since the first settlers saw the Colorado River there was a belief that their development future rested with control of the water. The result has been a "River of Controversy" and arguably the most disputed body of water in the country and possibly the world.[4]

This Article outlines several of the most important issues relevant to the discussion of restoring Glen Canyon. This discussion is a story about a river and its living systems, the desires of a relatively few politicians and water developers, and the roles that conservationists and the public will play in restoring the ecological integrity of the Colorado River system.

II. A CENTURY OF CONFLICT: GLEN CANYON AND THE COLORADO RIVER

To put into perspective the importance of Glen Canyon ecologically and culturally, it is necessary to understand the natural and political environment, and the resulting development frenzy that has dictated control over the river for the last century. As this discussion will make clear, the recent history of Glen Canyon includes political dealings, bureaucratic manipulation, and biological and cultural system loss.

A. Natural History of the River

As rivers go, the Colorado is a relatively young one. Geologically the Colorado River has been cutting its course only over the last five million years.[5] The Colorado River watershed composes an area of over 242,000 square miles, and the river flows for over 1400 miles from the Rocky and Wind River Mountains to the Sea of Cortez.[6]

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3. *See Oversight Hearings on the Sierra Club's Proposal to Drain Lake Powell or Reduce its Water Storage Capability: Hearings Before the Subcommittee on National Parks and Public Lands, Water and Power Resources of the House of Representatives*, 105th Cong. (1997) [hereinafter *Lake Powell Hearings*].

4. *See* Norris Hundley, Jr., *The West Against Itself: The Colorado River, an Institutional History*, *in* NEW COURSES FOR THE COLORADO RIVER: MAJOR ISSUES FOR THE NEXT CENTURY 9, 9 (Gary D. Weatherford & F. Lee Brown eds., 1986); Jared Farmer, *West Questions Its Big Dams*, IDAHO STATESMAN, Oct. 13, 1999, at 7B.

5. *See* BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, OPERATION OF GLEN CANYON DAM: FINAL ENVIRONMENTAL IMPACT STATEMENT 68 (1995) [hereinafter FEIS].

6. *See* U.S. BUREAU OF RECLAMATION, THE COLORADO RIVER: A NATURAL MENACE BECOMES A NATIONAL RESOURCE: A COMPREHENSIVE DEPARTMENTAL REPORT ON THE DEVELOPMENT OF THE WATER RESOURCES OF THE COLORADO RIVER BASIN FOR REVIEW PRIOR TO SUBMISSION TO THE CONGRESS 2 (1946) [hereinafter BOR COLORADO RIVER

The Colorado River is a dynamic river, dominated by variable flow regimes, extremes in temperatures, hostile and erodable landforms, and a unique endemic fish assemblage. Pre-development, the Colorado River annually ranged in flow from lows of 1000 cubic-feet-per-second ("cfs") to highs of over 400,000 cfs, with daily regimes varying during the summer and winter storm periods.[7] The seasonal and daily flow variability was complimented by large swings in the annual volumes of water that flowed down the Colorado River, ranging from 4.4 million-acre-feet ("maf") to over 22 maf.[8]

The combined force of the water and the sediment that it carried carved the intricate canyons of the Colorado River watershed, including Grand and Glen Canyons. Historic measurements reveal that between 85.9 and 195 million tons of silt, clay, and sand flowed through the system each year.[9] Thermal conditions of the natural river reflected the environment through which the river flowed and ranged from highs of 85°F during the summer to near freezing temperatures of 35°F in the winter.[10] From this dynamic river system evolved a landscape and faunal assemblage that is unique in the world.

Thirty-two species of fish were endemic to the Colorado River with six species specific to the Glen and Grand Canyon area.[11] The endemic fish of the Colorado River survived by developing life strategies that took advantage of the dynamic environment and were intrinsically linked to the history of evolving geology and climate. These fish are located nowhere else in the world and today represent the last of their breed, trying to find the niches necessary to survive.[12]

REPORT]. *See also* JOSEPH L. SAX ET AL., LEGAL CONTROL OF WATER RESOURCES: CASES AND MATERIALS 701 (2d ed. 1991).

7. *See* Edmund D. Andrews, *Glen Canyon Dam: Flood Flows and Adaptive Management in the Lower Colorado River Basin*, *in* DAMS: WATER AND POWER IN THE NEW WEST 1 (1997) (Eighteenth Annual Summer Conference of the Natural Resources Law Center, University of Colorado School of Law).

8. *See* David H. Getches & Charles J. Meyers, *The River of Controversy: Persistent Issues*, *in* NEW COURSES FOR THE COLORADO RIVER, *supra* note 4, at 51, 55.

9. *See* Edmund D. Andrews, *Sediment Transport in the Colorado River Basin*, *in* COLORADO RIVER ECOLOGY AND DAM MANAGEMENT: PROCEEDINGS OF A SYMPOSIUM 54, 63 (1991). Under current conditions, with the dam in place, mean annual sediment load has been reduced to an estimated 11 million tons. *See id.* at 70.

10. *See* Andrews, *supra* note 7, at 2, 15.

11. *See* W.L. Minckley, *Native Fishes of the Grand Canyon Region: An Obituary?*, *in* COLORADO RIVER ECOLOGY AND DAM MANAGEMENT, *supra* note 9, at 124, 131–32.

12. For a discussion of the challenges threatening native fish in arid western environments, see W.L. Minckley & Michael E. Douglas, *Discovery and Extinction of Western Fishes: A Blink in the Eye in Geologic Time*, *in* BATTLE AGAINST EXTINCTION: NATIVE FISH MANAGEMENT IN THE AMERICAN WEST 7, 12–17 (W.L. Minckley & James E. Deacon eds., 1991) [hereinafter BATTLE AGAINST EXTINCTION].

B. Politics and the River

The desire to control of the Colorado River began when the pioneers and explorers first cast their eyes upon the water. Early visitors looked upon it as a potential transportation corridor,[13] and for irrigation and development.[14] In 1876, after the first successful run of the Colorado River through the Grand Canyon, Major John Wesley Powell published his seminal report and recommendations for development of the water resources of the West, including constraint and logic in the development of the water resources.[15] The seven Colorado River basin states viewed the Colorado River as both their salvation and nemesis, with control of the river essential.[16] Critical to their goals was ensuring that the water was indeed theirs to control through the "prior appropriation" mandate of water allocation.

Prior appropriation of water evolved from the gold fields of California and stated that those who claimed and beneficially used the water *first* had the primary right to the water.[17] Control of water resources is where political and economic power was in the West and the politicians and the courts ensured that the doctrine of prior appropriation was adopted in every state in the West.[18]

To control the "menace" of floods and meet competing demands for water and power, the states organized a group for developing an interstate agreement to control the Colorado River.[19] In August 1920, the League of the Southwest organized and passed a resolution calling for a state and federal commission to develop a comprehensive strategy for apportioning the Colorado River.[20] A year later the federal government gave its consent to the commission.[21] For the next sixteen months eight meetings were held and draft agreements were put forth; on November 24, 1922, the Colorado River Compact was signed with Chairman Herbert Hoover presiding over the agreement.[22] So began the political

13. *See* GEOFFRY SYKES, THE COLORADO DELTA 17 (1937).

14. *See* MARC REISNER, CADILLAC DESERT: THE AMERICAN WEST AND ITS DISAPPEARING WATER 122–23 (1993).

15. As noted by Reisner, *see id.* at 45, John Wesley Powell published his work, *A Report on the Lands of the Arid Region of the United States, with a More Detailed Account of the Lands of Utah*, in 1876.

16. The seven Colorado River basin states are Utah, Wyoming, Colorado, New Mexico, Nevada, Arizona, and California. *See* FEIS, *supra* note 5, at 68.

17. *See* CHARLES F. WILKINSON, CROSSING THE NEXT MERIDIAN: LAND, WATER AND THE FUTURE OF THE WEST 234 (1992). *See also* SAX ET AL., *supra* note 6, at 137–43 (describing the law of prior appropriation). The authors note that "there is a special fact about appropriation law that must always be kept in mind. The oldest rights are still the most valuable, and much controversy still turns on the validity and status of rights acquired many years ago...." *Id.* at 143.

18. *See* WILKINSON, *supra* note 17, at 235.

19. *See* REUEL LESLIE OLSON, THE COLORADO RIVER COMPACT 15 (1926).

20. *See id.*

21. *See id.*

22. *See id.* at 1, 16, 44; 43 U.S.C. § 617*l* (1994). *See also* Colorado River Compact of 1922, *reprinted in.* 70 CONG. REC. 324 (1928). While the Compact appeared to

and legal juggernaut that led to the proliferation of subsidized dams and irrigation projects throughout the Colorado River basin. The 1922 Compact divided the Colorado River water appropriators into two basins—the Upper Basin (Utah, Colorado, Wyoming, and New Mexico) and the Lower Basin (Arizona, California, and Nevada), with the point of division at Lee's Ferry. The compact assumed an average annual flow of 16 maf and required the Upper Basin to deliver 75 maf of water over a rolling ten-year period of time.[23] Importantly, Compact negotiators had greatly overestimated the amount of actual water available, making the development of reservoir capacity essential for the states to retain control of their water destiny.[24]

In 1928, the Boulder Canyon Project Act[25] provided for the initial mainstem development of the lower Colorado River for the direct benefit of the Lower Basin states. Hoover Dam was completed in 1935, creating a reservoir capable of storing more than two years of Colorado River flows and altering the geography of the region.[26] Hoover Dam was constructed with public money and provided subsidized water and power for the Southwest. Federal dams quickly cultivated a society that depended upon, and in many places expected, cheap power, free water, and the ability to sustain the American dream.[27]

The Upper Basin states desired financial support for water development and, most importantly, wanted to protect their water from California, Arizona, and Nevada.[28] The Upper Basin states began lobbying to get their own dams and the Bureau of Reclamation and Congress were willing to assist. On April 11, 1956, the Upper Basin got its wish, when the Colorado River Storage Project Act was approved, authorizing Glen Canyon Dam and the creation of a reservoir known as Lake Powell to store water for the Upper Basin.[29]

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safeguard water supplies for the Lower Basin states as against use by the Upper Basin states, Arizona believed that it was not protected from appropriation by users in California. *See* NORRIS HUNDLEY, JR., THE GREAT THIRST: CALIFORNIA AND WATER, 1770s TO 1990s, at 213 (1992). Only in 1944 did Arizona ratify the Compact. *See* SAX ET AL., *supra* note 6, at 707.

23. *See* Colorado River Compact of 1922, Art. III(d), *reprinted in* 70 CONG. REC. 324; SAX ET AL., *supra* note 6, at 703.

24. *See* REISNER, *supra* note 14, at 263; George Sibley, *A Tale of Two Rivers: The Desert Empire and the Mountain*, HIGH COUNTRY NEWS, Nov. 10, 1997, at 12, *available at* <www.hcn.org>.

25. Boulder Canyon Project Act of 1928, Pub. L. No. 70-642, 45 Stat. 1057 (1928) (codified as amended at 43 U.S.C. §§ 617–617u (1994)).

26. *See* Scott K. Miller, *Undamming Glen Canyon: Lunacy, Rationality, or Prophecy?*, 19 STAN. ENVTL. L.J. 121, 139 (2000). *See also* PETER WILEY & ROBERT GOTTLIEB, EMPIRES IN THE SUN: THE RISE OF THE NEW AMERICAN WEST 18–19 (1982).

27. *See* DONALD WORSTER, RIVERS OF EMPIRE: WATER, ARIDITY, AND GROWTH OF THE AMERICAN WEST 239–335 (1985).

28. *See* REISNER, *supra* note 14, at 140–44.

29. *See* 43 U.S.C. § 620 (1994).

C. The Buildup of the Bureaucracy and Development

As the political initiative solidified for Colorado River development, the bureaucratic support quickly got in step. The vehicle for development was the Bureau of Reclamation (the "Bureau"). From its beginnings in 1902 as the Reclamation Service,[30] the Bureau built a reputation for planning and coordinating the construction of small and large dams across the western landscape. With the success of Hoover Dam and the insatiable demand for water and electricity in the West, the Reclamation Service began a dam-building crusade.[31] In 1946 it published its plan for Colorado River development subtitled *A Natural Menace Becomes a National Resource*.[32] What followed was what Charles Wilkinson defines as the "Big Buildup" of the West,[33] established around the damming and control of the Colorado River. In 1948 the Upper Basin states divided amongst themselves the share of Colorado River promised them under the 1922 Colorado River Compact[34] and convinced the Reclamation Service to assist them in getting congressional approval for the CRSP water development program.[35] The end result has been the spending of billions of dollars,[36] the ecological fragmentation of the remainder of the Colorado River system, and economically questionable water projects.

Glen Canyon Dam began its life when the first dynamite blast took down slabs of Navajo sandstone in 1957.[37] On January 23, 1963, workers at the dam closed the iron gates of the west river bypass and the waters, no longer able to flow downstream in a natural fashion, began to rise against the concrete and steel, searching for the route downstream.[38] On March 13, 1963, Reclamation closed the east diversion tunnel and all but 1000 cfs of water was captured.[39] Glen Canyon began to drown.

It took until June 22, 1980, for the reservoir to fill to its 27 million acre-feet ("af") capacity.[40] From its inception, Glen Canyon Dam and the reservoir

30. *See* REISNER, *supra* note 14, at 113–17.

31. *See* MARC REISNER & SARA BATES, OVERTAPPED OASIS: REFORM OR REVOLUTION FOR WESTERN WATER 17–21 (1990).

32. *See generally* BOR COLORADO RIVER REPORT, *supra* note 6.

33. CHARLES WILKINSON, FIRE ON THE PLATEAU: CONFLICT AND ENDURANCE IN THE AMERICAN SOUTHWEST 197 (1999).

34. *See* Upper Colorado River Basin Compact, Oct. 11, 1948, 63 Stat. 31 (1949) (allocating Colorado 51.75%, Utah 23%, Wyoming 14%, New Mexico 11.25%, and for the small portion of Arizona that is actually included in the Upper Basin, 50,000 af of the Upper Basin's annual entitlement under the Compact).

35. *See* RUSSELL MARTIN, A STORY THAT STANDS LIKE A DAM: GLEN CANYON AND THE STRUGGLE FOR THE SOUL OF THE WEST 49 (1989).

36. *See id.* at 54, 56.

37. *See id.* at 97–98.

38. *See id.* at 208–09.

39. *See id.* at 210.

40. *See id.* at 314.

behind it became the focus of debate and chest pounding and an icon for resources lost. Even before the ink was dry on the CRSP legislation, artists,[41] conservationists,[42] and the public questioned the logic of development and stressed the importance of place. The issues at Glen Canyon, coupled with the 1964 Reclamation proposal to build two more dams in Grand Canyon,[43] mobilized the conservation movement and helped create the climate necessary for passage of the National Environmental Policy Act ("NEPA"),[44] the Endangered Species Act,[45] and additional protective measures for the environment.

D. The Natural and Cultural Legacy Lost to the Rising Waters

Glen Canyon Dam and CRSP were authorized and developed prior to NEPA. As such, no environmental or cultural review was required. The only environmental studies completed were part of an archaeological salvage project organized by the National Park Service.[46] From 1957 to 1963, teams from the University of Utah and the Museum of Northern Arizona completed an archeological survey of the inundation area and surrounding plateaus.[47] The two teams eventually documented thousands of sites and artifacts that would be directly and indirectly affected by the project.[48]

As part of these cultural resource studies, the University of Utah conducted a basic ecological inventory of the area.[49] It documented an environment that supported a diverse ecological assemblage of fish, birds, amphibians, plants, and insects.[50] When the gates of Glen Canyon Dam closed, a free flowing river was transformed into a stagnant pool of water, choking the river downstream of the vital dynamics of water, sediment, and nutrients. Upstream canyons were drowned and converted into lifeless, sterile breeding grounds for speedboats, houseboats, and jet skis. The largest loss was the fragmentation of the Colorado River itself.

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41. *See generally, e.g.*, KATIE LEE, ALL MY RIVERS ARE GONE: A JOURNEY OF DISCOVERY THROUGH GLEN CANYON (1998) (reflecting on the events at the time of CRSP legislation).

42. *See generally, e.g.*, ELIOT PORTER, THE PLACE NO ONE KNEW: GLEN CANYON ON THE COLORADO (1968).

43. *See* REISNER, *supra* note 14, at 273–79.

44. National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4370d (1994).

45. Endangered Species Act of 1973, 16 U.S.C. §§ 1531–1544 (1994).

46. *See* JESSE JENNINGS, GLEN CANYON: AN ARCHEOLOGICAL SUMMARY 3 (1968).

47. *See id.* at 5.

48. *See id.* at 70–108.

49. *See id.* at 5–6.

50. *See generally* ANGUS WOODBURY, PRELIMINARY REPORT ON BIOLOGICAL RESOURCES OF THE GLEN CANYON RESERVOIR (1958). *See also* JENNINGS, *supra* note 46, at 17–50.

Historically, the endemic fishes used the Colorado River and the canyons as a habitat continuum and corridor for moving from spawning to breeding to rearing habitats.[51] With the river blocked with concrete, the species either had to retreat to isolated islands of habitat or perish. The Colorado pikeminnow, humpback and bonytail chubs, and razorback sucker were summarily relegated to an inevitable death in habitats that did not match their complete life history requirements.[52]

With the dams came a water management change throughout the Colorado River system, which further modified the character and dynamic of the river. Today, the Colorado River is defined by multiple regulations and managed cooperatively by consensus reached between the Bureau of Reclamation and the seven Colorado River basin states.[53] Control of the Colorado River is balanced between water conservation, downstream delivery schedules, and hydroelectricity; in addition, the 1995 environmental impact statement for the operation of Glen Canyon Dam proposes to manage for specific environmental purposes, such as management of sediment, water quality, endangered species, cultural resources, and aquatic habitats.[54] The loss of habitats, coupled with changing water quality and the introduction of hundreds of exotic fish, plants, and birds has modified the biological integrity of the Colorado River. Downstream, at the mouth of the Colorado River, the loss has been more severe.[55] The delta, once described by Aldo Leopold as a wealth of fowl and fish supporting a dynamic ecosystem,[56] now supports only baking salt flats and isolated saline sumps.[57]

Rivers are continuums of life, from headwaters to their mouths, and the Colorado River is no different. Fragmentation of the river system by dams, abuse of the watershed through unorganized development, and the loss of primary ecosystem functions of sediment and nutrient cycling have crippled the biological integrity of the Colorado. Ecological diversity of rivers is defined as a continuum with the middle sections, such as Glen Canyon, considered the most ecologically diverse.[58]

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51. *See* Minckley, *supra* note 11, at 136–41 (describing the historic habitat of the fish community).

52. *See id.* at 149 ("The prognosis for native fishes in the Colorado River basin is poor.").

53. *See* MILTON NATHANSON, U.S. DEP'T OF THE INTERIOR, UPDATING THE HOOVER DAM DOCUMENTS 1–28 (1978).

54. *See* FEIS, *supra* note 5, at 8, 177.

55. *See* PACIFIC INSTITUTE, THE SUSTAINABLE USE OF WATER IN THE LOWER COLORADO RIVER BASIN 21–23 (1996).

56. *See* ALDO LEOPOLD, A SAND COUNTY ALMANAC 141–48 (1966).

57. *See* PHILIP FRADKIN, A RIVER NO MORE: THE COLORADO RIVER AND THE WEST 323 (1981).

58. *See* 1 THE RIVERS HANDBOOK 163–281 (Peter Calow & Geoffrey Petts eds., 1992).

E. Conservation Takes a Turn

In 1956, when Congress authorized the construction of Glen Canyon Dam, only a handful of people understood the uniqueness and importance of Glen Canyon. When David Brower and the Sierra Club realized the price that had been paid to protect Echo Park, it was too late.[59] Brower and Eliot Porter diligently captured the beauty of Glen Canyon in *The Place No One Knew: Glen Canyon on the Colorado River*,[60] while people like Edward Abbey[61] and Katie Lee[62] began their battle against the "Bureau of Wreck the Nation." Ultimately, due to a mobilized public, reacting in part to the losses suffered at Glen Canyon, plans for proposed dams in the Grand Canyon were defeated, and the era of the Bureau of Reclamation's big dam building came to an end.[63] Nevertheless, as a result of the dam-building frenzy, approximately 75,000 dams exist today in the United States.[64] In a hopeful reversal of a bygone mentality, over 140 dams are now being evaluated for decommissioning.[65]

III. THE PROPOSAL TO RESTORE GLEN CANYON: THE FACTS POINT TO THE NEED

Glen Canyon represents more than a place where water creates a reservoir and produces electricity for a small percentage of the American public. It represents an opportunity to reassess our relationship to the environment, our commitment to future populations, and the need to define a logical and supported balance for the future. There are many issues related to the restoration of Glen Canyon, five of which are discussed below.

A. Water, Water Everywhere?

Proponents of dams on the Colorado River sold the idea to Congress on the assumption that the Southwest needed water to survive and develop. Dams were the quick and easy solution. Today, every drop of water in the Colorado

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59. *See* David Brower, *The Year of the Last Look*, SIERRA CLUB BULL., June 1962, at 7. Brower put his efforts into protecting Echo Park and Dinosaur National Monument, while the fight for Glen Canyon was left to a few river runners and hikers. *See* MARK HARVEY, A SYMBOL OF WILDERNESS: ECHO PARK AND THE AMERICAN CONSERVATION MOVEMENT 280–82 (1994).

60. *See generally* PORTER, *supra* note 42.

61. Abbey's disapproval of the dam is a major theme expressed in the novel EDWARD ABBEY, THE MONKEY WRENCH GANG (1975).

62. *See generally* LEE, *supra* note 41.

63. See REISNER, *supra* note 14, at 285–90, for a description of the fight to prevent dams in the Grand Canyon.

64. *See* U.S. GEOLOGICAL SURVEY, 1 STATUS AND TRENDS OF THE NATION'S BIOLOGICAL RESOURCES 64 (1998).

65. Ross Mollenhauer, Unpublished Findings of Research Performed for Ecosystem Management International (1999) (report on file with Author).

River is used and abused by irrigation, municipal, recreation, and industrial users. The prolonged potential for drought in the Colorado River basin has not materialized, and studies completed by the U.S. Geological Survey have shown that long-term records are inconclusive as to an extended lack of water.[66]

From the initial calculations of available water in the Colorado River[67] to studies conducted by the U.S. Geological Survey,[68] the actual amount of water saved in the reservoir behind Glen Canyon Dam is less than originally claimed. Calculations made in 1957 indicated that the increase in storage provided by the reservoir was nearly offset by increases in evaporation.[69] Recent studies indicate that the annual evaporation levels from the reservoir range from 570,000 af[70] to 1 million af per year.[71] Pre-reservoir evaporation is estimated to have been 102,000 af per year.[72] A conservative 550,000 af of annual loss from reservoir evaporation alone represents enough water to have supported over 2.2 million people each year.[73]

Equally important is the loss of water by seepage into the Navajo sandstone of Glen Canyon. Reservoir storage began in 1963, with the cumulative seepage volume in the Navajo sandstone reaching 11 million af in 1983.[74] The sandstone around the reservoir is predicted to reach equilibrium in approximately 1400 years, when a total of 21.6 million af of water will be stored in the rock, unavailable for use downstream.[75]

Based on these calculations, it is anticipated that restoring Glen Canyon and draining the reservoir will provide over 1 million af per year of additional water for downstream use. This water could be used on a short-term basis for municipal users and could provide much needed water to Mexico and the Colorado delta.

Glen Canyon does provide the Upper Basin states with a sense of water and development security. The 24 million af of storage available to the Upper Basin states represents over forty percent of the Upper Basin's water right and

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66. *See* H.E. THOMAS ET AL., U.S. GEOLOGICAL SURVEY, EFFECTS OF DROUGHT IN THE COLORADO RIVER BASIN: DROUGHT IN THE SOUTHWEST, 1942–56, at F1–F49 (1963).

67. *See* REISNER, *supra* note 14, at 262–63.

68. *See* Walter Langbein, *Water Yield and Reservoir Storage in the United States*, GEOLOGICAL SURVEY CIRCULAR No. 409, at 4 (1959).

69. *See id.*

70. *See* THOMAS MYERS, GLEN CANYON INSTITUTE, WATER BALANCE OF LAKE POWELL: AN ASSESSMENT OF GROUNDWATER SEEPAGE AND EVAPORATION 3 (1999).

71. *See* David R. Dawdy, *Hydrology of Glen Canyon and the Grand Canyon*, *in* COLORADO RIVER ECOLOGY AND DAM MANAGEMENT, *supra* note 9, at 40, 45.

72. *See* MYERS, *supra* note 70, at 3.

73. I am assuming that one af of water supports a family of four for one year.

74. *See* MYERS, *supra* note 70, at 2.

75. *See id.*

over three years of downstream delivery requirements.[76] Currently, the Lower Basin states have over 28 million af of storage, enough to meet nearly four years of allocations.[77] Studies completed by the Environmental Defense Fund for congressional hearings in 1997 indicate that, based on present upstream storage and climate conditions, the Upper Basin states would not be able to meet their water delivery requirements only one percent of the time if the reservoir were not in place.[78] Consequently, in the short term, neither the Upper nor the Lower Basin would loose the ability to develop if the reservoir were drained. In fact, there could be an overall gain in available water supply. What would be required is a more coordinated management and allocation process for the Colorado River.

Currently, the Upper Basin states use approximately 4 million af, or fifty-three percent, of their compact allocation.[79] With development, use in the Upper Basin is projected to reach approximately 5 million af by the year 2030.[80] The primary concern to the Upper Basin states is the potential for long-term drought and the need to have the reservoir available to meet compact delivery requirements. With over eighty percent of Colorado River water being used for agriculture,[81] the effects of drought likely would force the implementation of water conservation measures.

B. Sediment and Storage

The Colorado River watershed is comprised predominantly of marine and aeolian sediments deposited over millions of years.[82] The flow of water from the headwaters to the Sea of Cortez captured and mobilized the sediments as an erosion factor. Annually, before Glen Canyon Dam, an average of 65 million tons of sediment flowed down the Colorado through Grand Canyon.[83] One of the reasons used in support of building Glen Canyon Dam was the need to trap some of this sediment and prolong the lifespan of the reservoir created by Hoover Dam.[84] With over thirty-five years of storage behind Glen Canyon Dam, approximately one-fifth of the reservoir capacity has already been lost to sediment

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76. *See* DALE PONTIUS, COLORADO RIVER BASIN STUDY: FINAL REPORT 9 app. B (1998).

77. *See* Miller, *supra* note 26, at 177.

78. *See* SPRECK ROSECRANS, THE EFFECT OF DRAINING LAKE POWELL ON WATER SUPPLY AND ELECTRICITY PRODUCTION 4 (1997).

79. *See* PONTIUS, *supra* note 76, at 14.

80. *See id.* at 16–18.

81. *See id.* at 13.

82. *See* FEIS, *supra* note 5, at 68.

83. *See* Andrews, *supra* note 7, at 1–2.

84. *See Colorado River Storage Project, Hearing Before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, U.S. Senate*, 83d Cong. 2d Sess. (1954).

accumulation above Bullfrog basin.[85] With the current sediment accumulation rate of 50,000 af per year,[86] it could be as little as 175 years before the reservoir basin fills with sediment.[87] Within as little as 125 years, based on the current sedimentation rates, sediment will begin affecting the hydroelectric capacity of the dam.[88] As reservoir capacity decreases, its benefit as a storage facility necessarily will diminish.

C. Hydroelectricity and Glen Canyon

The generation of hydroelectricity was to be an incidental purpose for the construction of the dam.[89] Inevitably, however, the eight generators at the dam became essential as the revenue flow from the sale of hydroelectricity supported the continued development of water projects. Approximately 5000 gigawatthours ("GWh") of electrical capacity and energy can be marketed from Glen Canyon Dam each year.[90]

Currently, there is a significant amount of surplus electrical energy and capacity available within the Colorado River watershed.[91] The Environmental Defense Fund estimates that Glen Canyon Dam provides approximately three percent of the electrical energy of the combined needs of Colorado, Utah, New Mexico, and Arizona.[92] This equates to approximately 1.7 million customers that would be directly affected by the loss of Glen Canyon Dam.[93] Most of the impacts would presumably be to small utilities that have the preferred contracts from Glen Canyon Dam.

The loss of Glen Canyon revenue needs to be balanced against the anticipated increase that could be generated from utilities selling surplus capacity and energy from additional generation at Hoover Dam. Opponents may be concerned with the potential loss of Navajo Generating Station located outside of Page, Arizona. Navajo Generating Station currently uses 34,000 acre-feet of water

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85. *See* THOMAS MYERS, GLEN CANYON INSTITUTE, SEDIMENT HYDROLOGY ON THE COLORADO RIVER: THE IMPACTS OF DRAINING LAKE POWELL 1 (1998).

86. *See* LOREN D. POTTER & CHARLES L. DRAKE, LAKE POWELL: VIRGIN FLOW TO DYNAMO 176 (1989).

87. Glen Canyon Institute, Unpublished Research Findings (on file with Author).

88. *See id. See also* Miller, *supra* note 26, at 186 ("In a few hundred years, it is likely that accumulated sediments will completely eliminate power production from Glen Canyon Dam.").

89. *See* 43 U.S.C. § 620 (1994).

90. *See* NATIONAL RESEARCH COUNCIL, RIVER RESOURCE MANAGEMENT IN THE GRAND CANYON 167 (1996) [hereinafter RIVER RESOURCE MANAGEMENT IN THE GRAND CANYON].

91. *See id.* at 169.

92. *See* ROSECRANS, *supra* note 77, at 290.

93. *See* RIVER RESOURCE MANAGEMENT IN THE GRAND CANYON, *supra* note 90, at 169–70.

from the reservoir for cooling.[94] Maintaining the generating station after the reservoir is drained would require either extending the cooling water intake to the river, developing a more efficient cooling system for the generation station, developing a closed cycle cooling system, or some combination of these methods. It would raise the short-term cost of power from the Navajo Generating Station but would not require the plant to be closed down. Most likely, other economic or coal supply problems will drive that decision.

Decommissioning Glen Canyon Dam likely would raise the short-term power costs associated with finding alternative sources for electrical capacity and energy, although present privatization of the power industry and the current surplus of capacity and energy may offset these potential impacts.[95]

D. Biological System Relationships

Glen Canyon used to be and again can be the physical and biological heart of the Colorado River system. Glen Canyon Dam caused the fragmentation of the river system and drowned eighteen thousand acres of riparian habitat.[96] In so doing, the construction of the dam compromised the ecological integrity of the Grand Canyon and the Colorado River. The primary environmental impacts associated with dams have been well documented.[97] The most important impacts at Glen Canyon Dam have been articulated by the Glen Canyon Environmental Studies,[98] the National Research Council,[99] and other scientific studies.[100] In general, impacts related to the existence of the dam and reservoir include: (1) transformation of a river ecosystem into a reservoir; (2) trapping of sediments in the reservoir; (3) changes in downstream water temperature, nutrient load, turbidity, and concentrations of heavy metals and mineral; and (4) modification of the biodiversity due to blockage of movement of organisms and subsequent

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94. *See* Miller, *supra* note 26, at 185. *See also* WILKINSON, *supra* note 17, at 215–20.

95. *See* Miller, *supra* note 26, at 188–89.

96. *See* MYERS, *supra* note 85, at 5.

97. *See, e.g.*, PATRICK MCCULLY, SILENCED RIVERS: THE ECOLOGY AND POLITICS OF LARGE DAMS 30 (1996). *See generally* THE ECOLOGY OF REGULATED STREAMS (James V. Ward & Jack A. Stanford eds., 1979).

98. For a description of the many reports of the Glen Canyon Environmental Studies research program, see David L. Wegner, *A Brief History of the Glen Canyon Environmental Studies*, *in* COLORADO RIVER ECOLOGY AND DAM MANAGEMENT, *supra* note 9, at 226, and Duncan T. Patten, *Glen Canyon Environmental Studies Research Program: Past, Present, and Future*, *in* COLORADO RIVER ECOLOGY AND DAM MANAGEMENT, *supra* note 9, at 239.

99. *See generally, e.g.*, RIVER RESOURCE MANAGEMENT IN THE GRAND CANYON, *supra* note 90.

100. *See, e.g.*, STEVEN W. CAROTHERS & BRYAN T. BROWN, THE COLORADO RIVER THROUGH THE GRAND CANYON: NATURAL HISTORY AND HUMAN CHANGE 1–16 (1991).

changes to the water quality, sediment, and nutrient conditions.[101] Superimposed on the impacts related to the dam and reservoir itself are those related to dam operation. In general, these impacts include: (1) changes in downstream hydrology; (2) changes in downstream morphology and habitats; (3) changes in downstream water quality due to altered flow patterns; and (4) modification of the riverine, riparian, floodplain habitat diversity primarily due to the elimination of floods.[102]

Regulation of water has a detrimental impact on riverine fishes, especially those that require flowing water.[103] Within the Colorado River system, there are presently seventy-four species of fish, birds, mammals, and plants listed on the endangered species list and another twenty-five on the threatened list.[104] Currently, five of the eight native fish species that lived within the Glen and Grand Canyons of the Colorado River are either extinct or endangered.[105] Only one, the humpback chub (*gila cypha*) remains as a reproducing species, but this may be due to the Little Colorado River, a major tributary to the Colorado River in the Grand Canyon, which is undammed and available for spawning.[106]

The reasons for the decline in native fish species are complex and include the introduction of exotic species, the fragmentation of habitat, and the alteration of water quality, quantity, and temperature.[107] Some argue that Glen Canyon Dam is necessary to protect the last remaining population of self-sustaining humpback chub.[108] In the short term, Glen Canyon Dam is a barrier to the movement of exotic fish into the Grand Canyon. However, this protection comes with a price: the continued destruction of the remainder of the Grand Canyon aquatic environment, the loss of the potential for restoring habitats upstream for native fish species, and the further constraint of available habitat for other native fish throughout the Colorado River system.

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101. *See supra* notes 7–12, 49–58, 82–88 and accompanying text; *infra* notes 103–120 and accompanying text.

102. *See supra* notes 7–12, 49–58, 82–88 and accompanying text; *infra* notes 103–120 and accompanying text.

103. *See* Paul B. Holden, *Ecology of Riverine Fishes in Regulated Stream Systems with Emphasis on the Colorado River, in* THE ECOLOGY OF REGULATED STREAMS, *supra* note 97, at 57, 70.

104. ROSS MULLENHAUER, GLEN CANYON INSTITUTE, ENDANGERED SPECIES OF THE COLORADO RIVER SYSTEM 1–2 (1999).

105. *See* Minckley, *supra* note 11, at 131–32; FEIS, *supra* note 5, at 114.

106. *See* Minckley, *supra* note 11, at 131. *See also* FEIS, *supra* note 5, at 117–18 (discussing tributary reproduction).

107. *See* U.S. BUREAU OF RECLAMATION, GLEN CANYON DAM MODIFICATIONS TO CONTROL DOWNSTREAM TEMPERATURES: PLAN AND DRAFT ENVIRONMENTAL ASSESSMENT 23–27 (1999) [hereinafter GLEN CANYON DAM MODIFICATIONS]; Miller, *supra* note 26, at 195–97.

108. *See, e.g.*, Steven W. Carothers & Dorothy A. House, *Decommissioning Glen Canyon Dam: The Key to Colorado River Ecosystem Restoration and Recovery of Endangered Species?*, 42 ARIZ. L. REV. 215, 233 (2000); Minckley, *supra* note 11, at 146.

What has been learned from other river systems throughout the world is that aquatic species' *long-term* sustainability is dependent upon establishing a dynamic, naturalized river flow regime.[109] Restoring the natural flow dynamics to the Colorado River will provide the seasonal high flows (floods), hydrographs necessary for shallow-water habitats, and low flows necessary for exposure of sediments for plant recruitment.[110] Some non-native fish species likely will be able to retain their presence in the Colorado River system even if Glen Canyon Dam is not regulating flows. Catfish and carp in particular still will have certain habitats available to them. An aggressive sport and commercial fishing effort for the non-native species, perhaps similar to the pre-impoundment eradication programs[111] can be implemented to reduce the competitors until the native species have regained their habitats. More naturalized conditions would provide native fish with the habitats and water quality essential to their long-term survival.

Some may be concerned that the removal of Glen Canyon Dam would have a negative impact on the downstream ecosystem of the Grand Canyon. Studies conducted in the Grand Canyon in the 1980s and 1990s have identified an extensive riparian zone that has evolved since dam closure in 1963 and the species that utilize it.[112] What has been forgotten is the extensive amount of riparian habitat that existed in the hundreds of side canyons and along the 180 miles of the mainstem of the Colorado River through Glen Canyon before it was inundated.[113] Bird and amphibian species that lost habitat due to the flooding of Glen Canyon likely will move back into the area as the side canyons and main channel areas are reestablished.[114] The return of the seasonal floods and natural flow regime in the Glen and Grand Canyons will limit the near-shore riparian habitat and support the high-water zone of plants. Exotic tamarisk, which has taken over the near shore area along the river through the Grand Canyon,[115] will be forced to compete with native plants more typical of pre-dam habitats, which provide greater long-term ecological balance.

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109. *See, e.g.*, Phillip M. Bender, *Restoring the Elwha, White Salmon, and Rogue Rivers: A Comparison of Dam Removal Proposals in the Pacific Northwest*, 17 J. LAND, RESOURCES & ENVTL. L. 189, 192–97 (1997); N. LeRoy Poff et al., *The Natural Flow Regime: A Paradigm for River Conservation and Restoration*, 47 BIOSCIENCE 769, 769–84 (1997).

110. *See* RIVER RESOURCE MANAGEMENT IN THE GRAND CANYON, *supra* note 90, at 109.

111. *See* Holden, *supra* note 103, at 69–70.

112. *See* CAROTHERS & BROWN, *supra* note 100, at 111–29; FEIS, *supra* note 5, at 75.

113. *See generally* WOODBURY, *supra* note 50.

114. William Wolverton, Presentation at the Glen Canyon Institute Fall Conference (Oct. 1998).

115. *See* CAROTHERS & BROWN, *supra* note 100, at 113–22.

Discussions regarding water quality conditions downstream of Glen Canyon Dam have largely focused on temperature.[116] Of additional concern are potential future impacts related to increases in heavy metal (selenium and mercury) and hydrocarbon levels.[117] Leaching from uranium tailings, located under the waters of the reservoir, also may be reaching the overlying water and groundwater, causing potential water quality problems.[118] Motor oil and gasoline spilled on the surface of the reservoir are additional major sources of pollution.[119] Furthermore, over the last several years, due to the large amount of human waste dumped into the reservoir, isolated beaches now must be periodically closed to protect human health.[120]

Developing and sustaining the long-term biological integrity of the region and river system requires reassessing the ecological importance of historic habitats and flow conditions. Continued fragmentation of the Colorado River system limits the ability and opportunity for native fish to migrate, utilize historic habitats, and maintain self-sustaining populations.

E. Economics of Recreation and Hydropower

Glen Canyon Dam generates hydroelectricity, which is sold within the integrated electricity grid in the western United States.[121] Glen Canyon Dam provides electric power to approximately 180 public power utilities in the Southwest with retail rates set to cover the federal system operation and capital costs.[122]

Recreation both upstream and downstream of Glen Canyon Dam has increased since 1963.[123] Reservoir uses include houseboats, ski boats, jet skis, and shoreline users which number approximately 4.0 million visitor-days per year (2.5

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116. *See, e.g.*, GLEN CANYON DAM MODIFICATIONS, *supra* note 107, at 33; Miller, *supra* note 26, at 196.

117. *See* U.S. GEOLOGICAL SURVEY, TRACE ELEMENTS IN STREAMBED SEDIMENT AND FISH LIVER AT SELECTED SITES IN THE UPPER COLORADO RIVER BASIN, COLORADO, 1995–1996, at 17 (1998).

118. *See* TOM DANSIE, GLEN CANYON INSTITUTE, A STUDY OF THE WHITE CANYON MILL TAILINGS AT HITE, UTAH 2–3 (1999).

119. *See* Britt Arneel, *Group Wants to Drain Reservoir, Restore Canyon Ecosystems*, DESERET NEWS, May 10, 1999, at C5. It is estimated that every 4.4 years, enough gas is spilled in the reservoir to equal the *Exxon Valdez* oil spill. *Id.*

120. *See* Denis M. Searles, *Loving a River to Death: Recreation a Huge Industry, But at What Cost?; Recreation Poses Problems Along Colorado*, SALT LAKE TRIB., May 26, 1997, at A1.

121. *See* WESTERN AREA POWER ADMINISTRATION, ANNUAL REPORT 1997, at 24–25 (1997).

122. *See* FEIS, *supra* note 5, at 172–73.

123. *See* POTTER & DRAKE, *supra* note 86, at 278.

million visitors and 1.5 million boater nights each year).[124] The busiest gas station in Utah floats on the reservoir at Dangling Rope Marina,[125] and the estimated value of the boats themselves at Lake Powell is $191 million.[126] Tourists contribute $400 million annually to the local economy.[127] Downstream Glen and Grand Canyon concessionaires provide a unique river-running experience controlled by the National Park Service. Concessionaires' annual gross revenues alone surpass the $140 million in revenues from hydropower.[128]

Economically and recreationally, decommissioning Glen Canyon Dam would have an impact. This impact could be offset partially by shifting to different types of recreation and redistributing opportunities to other regional water bodies. The downstream river season through the Grand Canyon would change due to seasonal water levels. Due to the current ten year waiting list for private river permits in the Grand Canyon and the extensive interest in commercial river trips, it is unlikely that any economic impact detrimental to Grand Canyon recreation interests will occur.[129] A drained reservoir would provide areas useable by recreationists such as river runners, day hikers, and backcountry advocates, who would likely make up for the 1.5 million boater days. A restored Glen Canyon still would provide outstanding recreational and visual value to tourists.

The outstanding nonuse value of natural environments has been identified for ecosystems in the Grand Canyon and across the West.[130] Providing natural flow regimes and dynamic environmental conditions will provide the highest probability for sustaining the remaining ecological components and provide the opportunity for restoring physical and biological processes critical to the ecosystem.

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124. *See Lake Powell Hearings*, *supra* note 3. *See also* FEIS, *supra* note 5, at 159.

125. *See* Bob Thomas, *Dangling Rope in Full Swing: Ice, Food, Record Gasoline Sales Buoy Up Marina*, ARIZ. REP., Oct. 6, 1999, at T5. *See also* POTTER & DRAKE, *supra* note 86, at 276.

126. *See* Searles, *supra* note 120, at A1.

127. *See Lake Powell Hearings*, *supra* note 3 (statement of Eluid L. Martinez).

128. *See* Andrews, *supra* note 7, at 3.

129. *See* FEIS, *supra* note 5, at 32–33.

130. *See* FEIS, *supra* note 5, at 175–76; John B. Loomis, *Measuring the Economic Benefits of Removing Dams and Restoring the Elwha River: Results of a Contingent Valuation Survey*, 32 WATER RESOURCES RESEARCH 441, 441–47 (1996). For another interesting study, see generally Pete Morton, *The Economic Benefits of Wilderness: Theory and Practice*, 76 DENV. U. L. REV. 465 (1999).

IV. THE QUESTION AT GLEN CANYON: ARE WE STRONG ENOUGH TO ASK IT?

The Glen Canyon Institute has articulated the desire to restore Glen Canyon. This desire is based on three important issues:

- Data collected through the Glen Canyon Environmental Studies from 1983 through 1996 indicate that modifying operations at Glen Canyon Dam is required to sustain the remaining biological and physical resources.[131]
- The 1996 experimental flood in the Grand Canyon was successful administratively and experimentally, and showed promise for enhancing the long-term sustainability of the habitats and beaches in the Grand Canyon.[132]
- Natural flow regimes provide the best opportunity to restore critical ecosystem processes.[133]

Millions of dollars are being spent on the protection of limited Colorado River aquatic habitats impacted by upstream dam and flow diversion controls. These programs may have localized success, but they do not provide for system-wide restoration of critical physical and biological components.[134]

Restoring Glen Canyon will not be easy and it will not be quick. Draining the reservoir could take up to twenty years and should be coupled with extensive scientific studies, educational opportunities, and a public restoration and clean-up program.

For the most part, the American public was not consulted in the original decision to construct Glen Canyon Dam. In the 1950s, there were neither environmental safeguards nor public debates about the need to provide water and electrical support for subsidized crops, fountains in Las Vegas, golf courses in Phoenix, or the influx of millions of people into the Southwest. Granted, growth will continue to occur. The question is whether the growth should be at the expense of the environment, without adequate conservation protections. The American public should be part of the process now to determine if the public investment in Glen Canyon Dam is still in the best interest of society. The objective is to engage in a public debate on the value of a restored Glen Canyon, a

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131. *See* RIVER RESOURCE MANAGEMENT IN THE GRAND CANYON, *supra* note 90, at 219–20.

132. *See generally* THE CONTROLLED FLOOD IN GRAND CANYON (Robert H. Webb et al. eds., 1999) (providing a presentation of numerous reports on vegetation, biological, and geomporphic responses and implications of the 1996 experimental, controlled flood).

133. *See* Poff et al., *supra* note 111, at 781.

134. *See* Richard S. Wydoski & John Hammil, *Evolution of a Cooperative Recovery Program for Endangered Fishes in the Upper Colorado River Basin*, *in* BATTLE AGAINST EXTINCTION, *supra* note 12, at 123, 125–35.

discussion on the value of Glen Canyon Dam, and the importance of Glen Canyon to the ecological integrity of the Colorado River.

We have incrementally and cumulatively fragmented and modified our river systems and the ecosystems they support. We now can incrementally begin restoring these systems, with resulting improvements to many ancillary physical and biological processes. It is clear from a review of water, power, environmental, recreational, economic, and administrative issues that some of the perspectives used to support the initial construction of the dam were flawed and should be reassessed in an open, public process. Today many of the traditional approaches to managing Colorado River water are being reassessed as the true costs of water development become known.[135] The actual cost of restoration cannot be accurately calculated until a thorough and open study is completed. Now is the time to initiate that process, due to the continued decline of the Colorado River's biological species, the increasing level of sedimentation in the reservoir, and the timing of the payoff on the mainstem dams.

Representative Hansen was correct in his 1997 statement that Glen Canyon Dam is a public dam.[136] Since it is a public dam, built with public money and used to subsidize the development of the Colorado River basin, it is only right that the public be consulted on Glen Canyon's future. Former Secretary of Interior Stewart Udall,[137] former Senator Barry Goldwater,[138] and others have questioned their decisions in 1956 to support Glen Canyon Dam.[139] We cannot replace the ecosystem that existed before the dam. What we can *restore* are the natural processes that define and sustain a river and biological system. We owe it to the people of the Colorado River basin, the nation, the world, and future generations to look at the data, the issues, and the intrinsic value of the "place no one knew" and make a wise decision on the restoration of Glen Canyon.

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135. *See* Offstream Storage of Colorado River Water and Interstate Redemption of Storage Credits in the Lower Division States, Notice of Proposed Rulemaking, 62 Fed. Reg. 68,492 (1997); Bruce Babbitt, *Secretary's Remarks to the Colorado River Water Users Association, Las Vegas, December 17, 1998*, (visited on Feb. 15, 2000) <http://www.doi.gov/secretary/cowater.htm>.

136. *See Lake Powell Hearings, supra* note 3 (statement of Representative James Hansen).

137. *See* TIM PALMER, ENDANGERED RIVERS AND THE CONSERVATION MOVEMENT 79 (1986).

138. *See* Bruce Babbitt, *A River Runs Against It: America's Evolving View of Dams*, OPEN SPACES Q., Fall 1998, *available at* <www.open-spaces.com>. ("Barry Goldwater ruefully acknowledged that his support for the dam was the one vote of his career that he most regretted.").

139. *See* Dan Beard, *Dams Aren't Forever*, N.Y. TIMES, Oct. 6, 1997, at A1.