Toward Comprehensive Watershed-Based Restoration and Protection for Great Salt Lake

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TABLE OF CONTENTS

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I. INTRODUCTION

> *Everything about Great Salt Lake is bizarre and contradictory. Remnant though it is, it is still the biggest lake west of the Mississippi. In a land where water is more precious than diamonds, this lake seventy-five miles long and fifty wide provides not a single oasis; it offers little recreation or refreshment, and though it has been on the map as long as America has been a nation, it remains almost unknown.*[1]

> *To geographers it is America=s Dead Sea. To geologists it is the shrunken remnant of a great Ice Age predecessor. To engineers it is an obstacle to travel and a menace to the works of man. Those who would profit from it regard it as a rich liquid mineral deposit. To tourists it is a natural wonder like Grand Canyon and Yellowstone Park to be viewed and experienced at least once.*[2]

Views about the value of Great Salt Lake (alternatively, Athe lake@)[3] have evolved over time, and perspectives on the uses of the lake vary considerably. These differences present a classic challenge in environmental and natural

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[1]Wallace Stegner, *The World=s Strangest Sea*, HOLIDAY, May 1957, at 76, 176.

[2]WILLIAM LEE STOKES, THE GREAT SALT LAKE 1 (1984).

[3]There is some difference of opinion and even inconsistency within a single agency on whether Athe@ should precede AGreat Salt Lake.@ *Compare* TED ARNOW, U.S. DEP=T OF THE INTERIOR, WATER-LEVEL AND WATER QUALITY CHANGES IN GREAT SALT LAKE, UTAH, 1847B1983 *passim* (using phrase AGreat Salt Lake@ throughout study), *with* TED ARNOW & DOYLE STEPHENS, U.S. DEP=T OF THE INTERIOR, HYDROLOGIC CHARACTERISTICS OF THE GREAT SALT LAKE, UTAH, 1847B1986, at 1 (1990) [hereinafter HYDROLOGIC CHARACTERISTICS] (periodically using phrase Athe Great Salt Lake@ in study). The unadorned version appears to have official sanction. *See* 1 U.S.G.S. TOPOGRAPHIC DIV., UTAH GEOGRAPHIC NAMES 147 (listing name as AGreat Salt Lake@). Credit for naming Great Salt Lake is given to Captain John C. Fremont. *See* RUFUS WOOD LEIGH, FIVE HUNDRED UTAH PLACE NAMES, THEIR ORIGIN AND SIGNIFICANCE 30B31 (1961); JOHN W. VAN COTT, UTAH PLACE NAMES 165 (1990).

resource law and policy. How should a public resource be managed in the face of divergent views on its appropriate uses and values?

These inherent conflicts are exacerbated by the highly diverse and inter-jurisdictional nature of land and water uses that affect the lake and its related ecosystems. The management and protection of shared natural resources within artificial geopolitical rather than natural boundaries is always problematic. This has generated a trend toward ecosystem management in general[4] and watershed

[4]*See* U.S. GEN. ACCT. OFFICE, ECOSYSTEM MANAGEMENT: ADDITIONAL ACTIONS NEEDED TO ADEQUATELY TEST A PROMISING APPROACH 4 (GAO/RCED-94-111, 1994) (arguing that additional measures must be taken to implement ecosystem management policies); THE KEYSTONE CTR., THE KEYSTONE NATIONAL POLICY DIALOGUE ON ECOSYSTEM MANAGEMENT, FINAL REPORT (1996) [hereinafter KEYSTONE POLICY DIALOGUE] (discussing importance of and ways to implement ecosystem management); Robert B. Keiter, *Beyond the Boundary Line: Constructing a Law of Ecosystem Management*, 65 U. COLO. L. REV. 293, 296 (1994) (discussing public movement toward ecosystem management).

management in particular.[5] A Awatershed@ can be defined as A[t]he entire surface drainage area that contributes water to a lake or river.@[6] A watershed management approach[7] considers and addresses the impacts and interactions of all human and natural conditions and activities within a watershed.

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[5]*See* Robert W. Adler, *Addressing Barriers to Watershed Protection*, 25 ENVTL. L. 973, 977B79 (1995) (discussing watershed management); Denise D. Fort, *Restoring the Rio Grande: A Case Study in Environmental Federalism*, 28 ENVTL. L. 15, 16B19, 43B51 (1998) (discussing watershed management and its effect on Rio Grande ecosystem); Barbara J.B. Green & Jon B. Alby, *Watershed Planning*, 1 WATER L. REV. 75, 75B76, 83B93 (1997) (discussing watershed planning and related issues). For detailed descriptions of ongoing watershed programs, see WATERSHED >96: MOVING AHEAD TOGETHER, TECHNICAL CONFERENCE AND EXPOSITION *passim* (1996); WATERSHED >93: A NATIONAL CONFERENCE ON WATERSHED MANAGEMENT *passim* (1993); and UNIVERSITY OF COLO., NATURAL RESOURCES LAW CTR., THE WATERSHED SOURCE BOOK 2B1 to 2B25 (1996).

[6]NATIONAL RESEARCH COUNCIL, RESTORATION OF AQUATIC ECOSYSTEMS, SCIENCE, TECHNOLOGY, AND PUBLIC POLICY 524 (1992). The U.S. Geological Survey (AUSGS@) defines the synonymous term Adrainage basin@ as the A[l]and area drained by a river.@ RICHARD W. PAULSON ET AL., U.S. DEP=T OF THE INTERIOR, NATIONAL WATER SUMMARY 1990B91, HYDROLOGIC EVENTS AND STREAM WATER QUALITY 579 (Water Supply Paper 2400, 1993). The term, however, is not limited to a river. *See* Charles A. Simenstad et al., *Impacts of Watershed Management on Land-Margin Ecosystems: The Columbia River Estuary*, *in* WATERSHED MANAGEMENT: BALANCING SUSTAINABILITY AND ENVIRONMENTAL CHANGE 266, 267 (Robert J. Naiman ed., 1992) (applying watershed concept to area drained by estuary).

[7]Because Great Salt Lake is an aquatic ecosystem, the watershed (as opposed to the more general ecosystem) management rubric is more appropriate here. *But see* Adler, *supra* note 5, at

1093B94 (noting that choosing which set of natural boundaries is most appropriate for ecosystem-based programs can be difficult).

Great Salt Lake presents an interesting, unusual, and challenging case study for the application of watershed principles. As North American watersheds go, the lake is quite unusual if not unique. While not the only saline lake in North America, it is the largest.[8] It is also the largest terminal lake on the continent, and the fourth largest in the world.[9] The size and depth of the lake have varied considerably over time.[10] Biological diversity is extremely low in the lake itself, but quite high in associated wetland, riparian, and terrestrial ecosystems.[11] Despite its lack of diversity, the lake=s overall biological productivity is among the highest in the world, and the lake is one of the most important bird habitats in the Western Hemisphere.[12]

The unusual characteristics of the lake may make it difficult to apply some of the watershed program lessons from elsewhere to Great Salt Lake (and vice versa). However, the atypical nature of the lake underscores one of the most compelling rationales for watershed-based approaches. Rather than using a one-size-fits-all strategy for which some national environmental programs are under attack, in a watershed approach, managers look carefully at the attributes of a particular water body, its associated tributaries, wetlands, and terrestrial ecosystems, and then develop and implement plans to achieve specific goals for the restoration and protection of that water body and its watershed.[13]

Part II of this Article describes the resource and the history of human uses of Great Salt Lake and their impacts. Part III discusses past and ongoing efforts to manage the lake and its resources, and outlines the diverse legal authorities that apply to the lake. Part IV analyzes the imperatives for a more comprehensive watershed approach[14] to restore and protect the lake, explores the

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[8]*See* Alan P. Covich, *Water and Ecosystems*, *in* WATER IN CRISIS: A GUIDE TO THE WORLD=S FRESH WATER RESOURCES 40, 44 (Peter H. Gleick ed., 1993) (noting that Mono Lake and Pyramid Lake are saline lakes). It is interesting to note that the Salton Sea, another saline lake in southern California, faces similar challenges. *See* MICHAEL J. COHEN ET AL., HAVEN OR HAZARD: THE ECOLOGY AND FUTURE OF THE SALTON SEA *passim* (1999) (discussing Aselection and implementation of environmentally sustainable and socially equitable restoration plan for the Salton Sea@).

[9]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 1. A terminal lake has no outlet to the sea. *See* Michael C. Blumm & Thea Schwartz, *Mono Lake and the Evolving Public Trust in Western Water*, 37 ARIZ. L. REV. 701, 704 (1995) (explaining why Mono Lake is a terminal lake).

[10]The size of the lake has ranged in historical times from about 1700 square miles when lake levels are low to approximately 2300 square miles when lake levels are high. *See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 1.

[11]*See infra* Part II.A.2 (describing ecological and biological resources of lake).

[12]*See infra* notes 61B80 and accompanying text (discussing number and diversity of birds that use lake).

[13]*See* Adler, *supra* note 5, at 983B86.

[14]*See id*. at 981B1003.

applicability of the watershed approach[15] to the specific governmental and management issues that apply to the lake, and critiques past and ongoing planning efforts involving the lake in light of evolving principles of watershed restoration and protection. The Conclusion proposes that a broader, more inclusive planning initiative be undertaken for the Great Salt Lake watershed through the creation of a Great Salt Lake Commission.

II. PHYSICAL, BIOLOGICAL, AND HUMAN HISTORY OF GREAT SALT LAKE

A. A Description of the Resource

[15] *See id*. at 1104B06.

> *Lake of paradoxes, in a country where water is life itself and land has little value without it, Great Salt Lake is an ironical joke of nature—water that is itself more desert than a desert.*[16]

1. Physical History and Properties

[16] DALE L. MORGAN, THE GREAT SALT LAKE 17 (Scribner 1995) (1947).

While Great Salt Lake itself is wholly within the boundaries of Utah, the land mass draining the lake (the watershed) includes parts of Utah, Idaho, Wyoming, and Nevada.[17] The lake itself is approximately 1700 square miles[18] at its average water height of 4200 feet above sea level,[19] making it the largest

[17]*See* GREAT SALT LAKE PLANNING TEAM, UTAH DEP=T OF NATURAL RESOURCES, THE GREAT SALT LAKE PLANNING PROCESS: DRAFT STATEMENT OF CURRENT CONDITIONS AND TRENDS 17 (Oct. 15, 1998) [hereinafter STATEMENT OF CURRENT CONDITIONS AND TRENDS] (featuring map of Great Salt Lake watershed or Adrainage basin@). An updated copy of this map, printed with permission of the Utah Division of Oil, Gas and Mining, is included herein as Appendix A.

[18]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 1.

[19]*See* Doyle W. Stephens, *Salinity-Induced Changes in the Aquatic Ecosystem of Great Salt*

body of water west of the Mississippi River.[20] The hydrological watershed, or the land area that actually contributes water to the lake, encompasses approximately 22,000 square miles[21]Croughly the size of West Virginia.[22] The

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Lake, Utah, *in* MODERN AND ANCIENT LAKES: NEW PROBLEMS AND PERSPECTIVES 1, 2 (Janet Pitman & Alan Carroll eds., 1998) (discussing cyclical nature of lake fluctuations). As explained below, the lake=s surface area varies significantly with the constantly fluctuating lake levels. *See infra* notes 43B51 and accompanying text.

[20]*See* DAVID E. MILLER, GREAT SALT LAKE, PAST AND PRESENT 7 (2d ed. 1969).

[21]*See* GREAT SALT LAKE COMPREHENSIVE MANAGEMENT PLAN, PLANNING PROCESS AND MATRIX 46 (September 1995) [hereinafter 1995 PLAN]. The actual size of the watershed is subject to some confusion. According to the USGS, A[t]he total land area that could drain to the lake is in excess of 35,000 square miles, but this includes nearly 14,000 square miles of arid land . . . that are virtually noncontributory.@ HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 1. Some would argue that the Great Salt Lake Desert is a separate drainage basin because, under most conditions, no water flows eastward from the Great Salt Lake Desert into the lake. *See* Manuscript Comments of Geologists Genevieve Atwood and Don R. Mabey (Feb. 8, 1999) (on file with author) [hereinafter Atwood and Mabey Comments]. Subtracting the 14,000 noncontributory square miles identified by the USGS from the estimated total (35,000 square miles) produces a similar figure of 21,000

Great Salt Lake Ahydroshed,@ however, has been expanded artificially now that water from the Colorado River basin is being diverted to the Wasatch Front region.[23] Moreover, the lake contributes in reverse to the large annual inflows from tributaries that originate in the Wasatch and Uinta Mountains.[24]

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square miles; although the map accompanying the 22,000-square-mile estimate in the *1995 Plan* appears to include the noncontributory area identified by USGS. *See* 1995 PLAN, *supra*, at 46.

[22]West Virginia covers 24,087 square miles. *See* ECONOMICS AND STATISTICS ADMIN., U.S. DEP=T OF COMMERCE, COUNTY AND CITY DATA BOOK 1994, at 2 (1994).

[23]*See* UTAH RECLAMATION MITIGATION AND CONSERVATION COMM=N, MITIGATION & CONSERVATION PLAN 2-23 to -25 (1998) [hereinafter URMCC PLAN] (explaining that Strawberry Aqueduct delivers water from Duchesne river system in Colorado River basin into Bonneville basin from which it flows to Wasatch Front). Similarly, a small amount of Bear River water is diverted from the Great Salt Lake watershed into the Snake River drainage through the Last Chance Canal; and water is diverted from the Snake River drainage into Great Salt Lake through the Malad River. *See* Atwood and Mabey Comments, *supra* note 21.

[24]The combination of moisture and salt in the lake, along with large temperature differences between air immediately above the lake and colder air above, contributes to the massive quantities

of snow that fall in the mountains east of the lake during most winters. *See infra* note 453 and accompanying text (discussing impact of lake on climate).

Great Salt Lake as we know it today, however, is but a remnant of its former glory. The current lake is the concentrated remains of Lake Bonneville,[25] a massive *fresh water* Pleistocene[26] lake that covered much of western Utah and small parts of southern Idaho and eastern Nevada.[27] Lake Bonneville also looked much different from its present-day successor. The lake itself harbored fish and some 70 species of molluscs.[28] What is now the sagebrush expanse of the semiarid Great Basin[29] was Agreen and inviting with forest and meadow.@[30] Where coyotes and mule deer now live, Lake Bonneville was grazed by woolly mammoths, musk oxen, giant ground sloths, and camels, which were hunted by giant bears and possibly saber-toothed tigers.[31]

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[25]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 6B7 (detailing history of Lake Bonneville). Captain Benjamin Louis Eulalie de Bonneville=s name is associated with the prehistoric version of Great Salt Lake due to a quirk of history. Bonneville was a U.S. Army officer sent to trap westward from Great Salt Lake in 1833. *See* MORGAN, *supra* note 16, at 99B101 (narrating travels of Bonneville and other explorers). While Bonneville himself never actually visited the lake, his subordinate Joe Walker did. *See id*. Nevertheless, when Bonneville drafted maps for the author Washington Irving in 1837, he Aplastered his name on the lake,@ causing Irving to name it Lake Bonneville in Irving=s famous work on the region. *See id*. at 105. While the name was not adopted officially for the modern lake, some 40 years later geologists used it instead to name the prehistoric lake. *See id*. at 107.

[26]The Pleistocene Epoch was the first in the Quaternary Period (the current period in geologic time), and is roughly coextensive with the Ice Ages; it lasted from approximately 1.8 million years ago to 11,000 years ago, when the Holocene (present) Epoch began. *See* WILLIAM LEE STOKES, GEOLOGY OF UTAH 209 (1986).

[27]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 6B7 (discussing physical structure of Lake Bonneville and including map). At its largest, Lake Bonneville covered approximately 20,000 square miles (52,000 square kilometers; 1 square mile = 2.6 square kilometers), and was up to 1000 feet deep. *See id*. at 6. This was almost as large as present-day Lake Michigan (57,800 square kilometers). *See* NATIONAL GEOGRAPHIC SOC=Y, NATIONAL GEOGRAPHIC ATLAS OF THE WORLD 234 (5th ed. 1981).

[28]*See* STOKES, *supra* note 26, at 223 (noting that fossil fish and molluscs have been found in Lake Bonneville sediment); Michael E. Nelson & James H. Madsen, Jr., *A Summary of Pleistocene, Fossil Vertebrate Localities in the Northern Bonneville Basin of Utah*, *in* GREAT SALT LAKE: A SCIENTIFIC, HISTORICAL & ECONOMIC OVERVIEW 97, 103 (J. Wallace Gwynn ed., 1980) [hereinafter GREAT SALT LAKE] (depicting now-extinct Bonneville cutthroat trout).

[29]*See* Edwin V. Rawley, *Wildlife of the Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 287, 287B88 (describing plant life and ecosystems surrounding lake).

[30]MORGAN, *supra* note 16, at 34 (noting that climate and habitat were more hospitable to humans at time Lake Bonneville existed).

[31]*See* STOKES, *supra* note 26, at 223 (describing Pleistocene fossils found near lake and in Wasatch Mountains); Nelson & Madsen, *supra* note 28, at 112 (summarizing mammal fossil remains from Lake Bonneville); Tom Wharton, *Utah=s Dead Sea Brims With Life, Myth and Mystery*, *in* THE GREAT SALT LAKE: UTAH=S AMAZING INLAND SEA 6 (SALT LAKE TRIB., Special Supp. 1992) (quoting University of Utah geologist Frank DeCourten).

Approximately 17,000 years ago, Lake Bonneville cut through a low point in the rim of the lake at Red Rock Pass in what is now southern Idaho.[32] Initially, Lake Bonneville drained rapidly in a prehistoric equivalent of Niagara Falls,[33] then shrank in a succession of stages until it reached its approximate current level about 8000 years ago.[34] Because much of this later shrinkage was caused by climate change and the resulting evaporation of the lake=s waters, fresh water Lake Bonneville evolved into Great *Salt* Lake.

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[32]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 6 (describing draining of Lake Bonneville).

[33]Lake Bonneville=s waters sped across the Snake River plain into the Columbia River basin, and from there to the Pacific Ocean. *See id*.

[34]*See id*. at 6B8 (describing shrinkage of Lake Bonneville); STOKES, *supra* note 26, at 212B13 (discussing geologic evidence showing levels of Lake Bonneville). The shores of former Lake Bonneville and its intermediate successors can be seen today in a series of Abenches@ along the slopes of the area=s mountains. *See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 6B8. Because of this subsequent shrinkage due to climate change, Lake Bonneville would have declined even if the breach at Red Rock pass never occurred. *See* Atwood and Mabey Comments, *supra* note 21.

Salinity, of course, is what distinguishes Great Salt Lake from most inland water bodies, including its fresh water upstream sister, Utah Lake.[35] As the remnants of Lake Bonneville evaporated, its natural salts[36] concentrated to the point where Great Salt Lake is now significantly more saline than the ocean.[37] This high salinity is the main defining characteristic of the lake=s unique and remarkable ecology.[38] It also explains the lake=s significant value as a resource for both extractive industries and tourism.[39]

High salinity levels in the lake, in turn, persist because Great Salt Lake is a terminal lake, meaning that it has no outlet to the sea or other downstream body of water. Water and other substances enter the lake via its major tributary streams, direct runoff, precipitation, and groundwater.[40] Water leaves the lake,

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[35]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 7 (map showing Great Salt Lake, Utah Lake, and Sevier Lake in the area formerly occupied by prehistoric Lake Bonneville). Unlike Great Salt Lake, Utah Lake is fresh because it is not a terminal lake, that is, it flows northward into the Jordan River and thence into Great Salt Lake. *See id*. at 10B11.Therefore, salts in waters that flow into Utah Lake are flushed out through the outflow, rather than being concentrated by evaporation. *See infra* notes 40B41 and accompanying text (discussing lake=s concentrated salts due to evaporation). Utah Lake is the largest freshwater lake in the western United States, and like Great Salt Lake, its wetlands are also recognized both locally and nationally due to their importance to fish and wildlife. *See* URMCC PLAN, *supra* note 23, at 2B7 (describing Utah Lake wetlands).

[36]Great Salt Lake has about 4.5 billion tons of salt, including compounds of sodium, potassium, magnesium, calcium, chloride, and sulfate; many of these salts are now commercially harvested. *See* J. WALLACE GWYNN, UTAH DEP=T OF NATURAL RESOURCES, BRINE PROPERTIES, MINERAL EXTRACTION INDUSTRIES, AND SALT LOAD OF GREAT SALT LAKE 1 & tbl.1 (Utah Geological Survey, Pub. Info. Series No. 51, 1997) [hereinafter BRINE PROPERTIES] (comparing water chemistries of Great Salt Lake, ocean, Dead Sea, and Utah=s Sevier Lake); *see also* DIVISION OF SOVEREIGN LANDS AND FORESTRY, UTAH DEP=T OF NATURAL RESOURCES, MINERAL LEASING PLAN, GREAT SALT LAKE 7B9 (June 27, 1996) [hereinafter MINERAL LEASING PLAN] (outlining plan for leasing and efficient development of mineral resources in Great Salt Lake, and estimating chemical composition of Great Salt Lake dissolved solids).

[37]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 1. The exact degree to which the lake=s salinity surpasses that of the ocean varies with the changing level of the lake, which causes changes in the lake=s salinity. *See infra* notes 43B51 and accompanying text (discussing variable levels of lake). In general, however, the lake is between two and eight times more saline than ocean water. *See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 1. Salinity levels also have been modified by artificial causeways and other structures. *See infra* notes 117B41 and accompanying text (discussing human-influenced changes in lake=s salinity).

[38]*See infra* Part II.A.2 (describing diverse ecology of lake).

[39]*See infra* notes 95B100, 144B49 and accompanying text (discussing industrial activity in and around lake).

[40]*See* Ted Arnow, *Water Budget and Water-Surface Fluctuations*, *in* GREAT SALT LAKE, *supra* note 28, at 255, 256 (discussing values for water-budget equation for Great Salt Lake). Inflows to the lake come from surface flows, which contribute about 66% of total inflows, direct precipitation onto the lake surface (31%), and relatively small contributions from groundwater (3%). *See id*. The principal tributaries are the Bear, Weber, and Jordan Rivers, which contribute

however, almost entirely through evaporation.[41] One major consequence of this characteristic is that, like natural salts, many substances that enter the lake stay there, and indeed are concentrated through evaporation.

59%, 20%, and 13%, respectively, to the lake=s total surface water inflows for a total of 92%. *See id*. Remaining flows come from ten other tributaries on the eastern and southern shores, and from sewage treatment plant discharges. *See id*. Water sources on the western side of the lake are small to nonexistent. Many tributaries to the west and northwest are dry by the time they reach Great Salt Lake. *See id*.; *see also* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 17 (depicting major surface water inflows to lake).

[41] *See* Arnow, *supra* note 40, at 256B60 (discussing water level and volume fluctuation in lake).

The second main ramification of the lake=s terminal status is variability. Lawyers and judges covet the stability of static descriptions of property. As discussed below, the legal status and human management of the lake certainly would be simpler if its size, salinity, and other properties remained relatively constant.[42] The lake itself, however, defies such a need for certainty. At any given time, the lake=s size and level can vary dramatically. Fortunately, historic changes in both lake level and salinity can be evaluated in light of remarkably consistent efforts by qualified professionals at the U.S. Geological Survey, the Utah Department of Natural Resources, and others (cited below) to monitor lake trends.

On an annual basis, lake levels rise and fall in a relatively predictable way. Lake levels begin to decline during the late summer months, when high temperatures increase the evaporation rate above the inflow rate.[43] Water levels begin to rise in autumn when temperatures decrease and water loss is exceeded by inflow, especially during the spring runoff peaks.[44] Thus, the lake=s volume and area tend to peak between March and July of every year.[45]

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[42]*See, e.g.*, Deseret Livestock Co. v. State, 171 P.2d 401, 403 (Utah 1946) (stating that Acourt will take judicial knowledge of the fact that Great Salt Lake . . . contains about 22 per cent salt in solution therein@).

[43]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 3; *see also infra* Part III (discussing past and ongoing management efforts for lake).

[44]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 3.

[45]*See id*.

These annual fluctuations in lake level, however, are dwarfed by much larger variations that occur over periods of years or decades.[46] At any given time, the size and level of the lake depend on the relationship between inflow and evaporation. Great Salt Lake increases in size and elevation during wet periods when inflow exceeds evaporation, and shrinks during drier periods when the opposite is true. Thus, in the relatively short period since records have been kept, lake level has varied approximately twenty feet.[47] Because the lake lies in the remnants of Lake Bonneville=s old bed, however, and has a relatively gradual slope, this variation in elevation results in a much greater change in the lake=s geographic size. At its historic low point, Great Salt Lake covers approximately just 950 square miles, while at its historic high point it is more than twice as large, or roughly 2300 square miles.[48] This dramatic variation in size and level causes an obvious but severe challenge to those who want to conduct activities, and especially to build Apermanent@ structures, along the lake=s shores.[49]

Even greater variation is limited, however, by the lake=s own system of self-regulation. When inflow exceeds evaporation and lake levels rise, the surface area of the lake increases as well.[50] This increase in area, in turn, along with an accompanying decrease in salinity, increases the rate of evaporation until evaporation once again offsets inflows. At that point, lake levels begin to fall. Surface area then gradually begins to decline, along with an accompanying increase in salinity and decline in evaporation, until the trend is reversed again in a periodic but not entirely predictable cycle of rising and lowering lake levels.[51]

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[46]Experts predict a series of shorter cycles superimposed on longer, 180-year cycles. *See* Lloyd H. Austin, *Lake Level Predictions of the Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 273, 274 (discussing complex long-term variability in lake levels).

[47]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 4 fig.3, 8B17 (discussing causes and effects of changing lake levels). The lake reached its historical high level of over 4211 feet in 1986. *See id*. at 14. It reached its historical low of approximately 4191 feet in 1963. *See id*. at 9. Geologic and archaeological evidence indicates higher levels over geologic time. *See* Genevieve Atwood & Don R. Mabey, *Flooding Hazards Associated with Great Salt Lake*, *in* UTAH GEOLOGIC ASSOC. PUBL. 24, ENVTL. & ENG=G GEOLOGY OF THE WASATCH FRONT REG. 483, 486 (William R. Lund ed., 1995) (discussing archaeological evidence of lake level at 4217 feet about 400 years ago and radiocarbon evidence of lake level at 4221 feet about two to three thousand years ago). Atwood argues that historic records alone provide an inadequate basis to understand the full scope of fluctuations in terminal lakes. *See* Genevieve Atwood, *Geomorphology applied to flooding problems of closed basin lakes . . . specifically Great Salt Lake, Utah*, 10 GEOMORPHOLOGY 197, 203, 216B17 (1994).

[48]*See* Stephens, *supra* note 19, at 2 (discussing varying size, depth, and salinity of lake).

[49]*See infra* notes 171B76 and accompanying text (describing hazards of building close to lake).

[50]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 3.

[51]*See id*.

2. Ecology and Biological Resources

> *ANo living thing of any kind lives in the lake.@*[52]

> *ATo most people, the Great Salt Lake is an apparently dead sea. . . . But actually it is full of incredible amounts of life.@*[53]

[52]Doyle W. Stephens, *A Summary of Biological Investigations Concerning the Great Salt Lake, Utah (1861B1973)*, 34 GREAT BASIN NATURALIST 221, 221 (1974) (quoting 1861 issue of SCIENTIFIC AMERICAN).

[53]Tom Wharton, *Wetlands: Earth=s Most Productive Ecosystems*, *in* THE GREAT SALT LAKE: UTAH=S AMAZING INLAND SEA, *supra* note 31, at 10 (quoting Westminster College botanist Ty Harrison).

The misconception that Great Salt Lake is dead is perpetuated even today in the minds of many casual observers, because the lake itself lacks the types of life that many humans covet, like bass or lake troutCin fact, like fish of any kind.[54] It is a colossal mistake, however, to think of Great Salt Lake as a ADead Sea.@ While the diversity of species in the lake itself is quite low, its primary biological productivity[55] is extremely high.[56] Moreover, both the diversity and productivity of the lake=s associated environments are extremely high, prompting some ecologists to believe that it in fact supports one of the world=s most interesting and important ecosystems.[57] However, the simplicity of the ecosystem in terms

[54]Fish do appear in the lake=s tributaries and nearby freshwater marshes, as well as at the artificially-created freshwater fringes of the lake. *See* Rawley, *supra* note 29, at 287 (noting that 23 species or subspecies of fish live in or around lake).

[55]APrimary productivity@ (or Aproduction@) is defined as the A[a]ssimilation (gross) or accumulation (net) of energy and nutrients by green plants and other autotrophs.@ ROBERT E. RICKLEFS, ECOLOGY 792 (1973). Autotrophs are organisms that convert light energy and inorganic matter to usable food. *See id*. at 782.

[56]*See* Stephens, *supra* note 19, at 2 (noting that hypersaline lakes have low species diversity but are highly productive). Annual primary production in the lake is approximately 145 grams of carbon fixed by photosynthesis per square meter. *See id*.

[57]*See, e.g.*, Rawley, *supra* note 29, at 288 (AThe marshes of Great Salt Lake are probably among the most important single breeding ground for waterfowl that now remains in the United

of its small number of species and relatively basic trophic structure might make it more vulnerable to environmental changes and disturbances than more complex systems.[58]

The lake=s high primary productivity is explained by high nutrient levels that support large populations, although low species diversity, of microscopic plants (phytoplankton).[59] The phytoplankton are consumed by just two species of brine fly and one species of brine shrimp, which comprise the only

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States.@).

[58]*See id.* at 287 (stating that lake habitat is Avery marginal for most species . . . [which] creates a delicate balance for the wildlife system of the Great Salt Lake area which must be given serious consideration when contemplating any plan that would tend to upset this balance@); Stephens, *supra* note 19, at 1 (stating that high populations but low species diversity reduce stability of ecosystem when faced with environmental changes).

[59]*See* Edwin A. Felix & Samuel R. Rushforth, *Biology of the South Arm*, *in* GREAT SALT LAKE, *supra* note 28, at 305, 305B08 (compiling information on microbiotic life in south arm); F.J. Post, *Biology of the North Arm*, *in* GREAT SALT LAKE, *supra* note 28, at 313, 320 (compiling information on microbiotic life in north arm). These plants include various species of bacteria, green algae, diatoms, and protozoans. *See* Stephens, *supra* note 19, at 2.

macroinvertebrates that live in the salty waters of the lake proper.[60] However, these three salt-tolerant species support, either directly or indirectly, a menagerie of larger animals.

[60]*See* Felix & Rushforth, *supra* note 59, at 306B10 (discussing food web in lake); Rawley, *supra* note 29, at 289B91 (same); Stephens, *supra* note 19, at 2 (same).

Most notable due to sheer numbers and diversity, as well as international significance, is the bird life of Great Salt Lake,[61] which was noted with wonder by the lake=s earliest explorers.[62] The lake and its surroundings are home to some 257 species of birds.[63] Almost half of these species are permanent residents of Great Salt Lake (or nesting species).[64] While bald eagles previously

[61]*See* Joseph R. Jehl, Jr., *Changes in Saline and Alkaline Lake Avifaunas in Western North America in the Past 150 Years*, *in* 15 STUDIES IN AVIAN BIOLOGY 258, 264 (1994); *see also* WETLANDS CONSERVATION PLAN: A PLAN FOR PROTECTION OF THE GREAT SALT LAKE WETLANDS ECOSYSTEM IN DAVIS COUNTY 55 (1996) [hereinafter DAVIS COUNTY WETLANDS PLAN] (AGreat Salt Lake is ornithologically the most impressive salt lake on the continent.@); *supra* note 57 and accompanying text (noting that lake is most important waterfowl breeding area remaining in United States).

[62]*See* WILLIAM H. BEHLE, THE BIRD LIFE OF GREAT SALT LAKE 164 (1958). A>The Salt Lake . . . was covered by immense flocks of wild geese and ducks . . . . [T]housands of acres, as far as the eye could reach, seemed literally covered by them.=@ *See id*. (quoting 1849 journals of explorer Howard Stansbury); *see also* MORGAN, *supra* note 16, at 211B12 (noting that Mormon pioneers found waterfowl and other birds in great Aabundance@); *id*. at 227 (noting that geologist Dr. James Blake described A>thousands of acres literally covered with wild geese, ducks and beautiful white swans=@); *id*. at 243 (noting that Stansbury expedition found Gunnison Island A>shores literally covered with pelicans and gulls=@); Jehl, *supra* note 61, at 262 (citing early observations by explorers Ogden, Fremont, and Stansbury).

[63]*See* Rawley, *supra* note 29, at 287.

[64]*See id*. at 298B99 (stating that 117 out of 257 species reportedly nest in Great Salt Lake

were identified mainly as overwintering species around Great Salt Lake,[65] more recently, renewed bald eagle nesting has been documented near the lake.[66]

habitat, including pied-billed grebes, Canada geese, and mallard ducks).

[65]*See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 55 (noting that more than 500 wintering bald eagles are associated with Great Salt Lake).

[66]*See* Brent Israelson, *Bald-Eagle Couple Decides S.L. Is Great Place to Raise a Family*, SALT LAKE TRIB., July 15, 1997, at B1 (describing return of nesting pair of eagles to lakeside to hatch eaglets).

The lake=s food resources are equally critical, however, to migratory bird species that visit the lake for only short periods of time. Over one-half million Wilson=s phalaropes, for example, roughly double their body weight during their brief stopover on the lake, enabling them to complete their migrations between North and South America.[67] As a result, Great Salt Lake has been designated as one of only nineteen sites in the Western Hemisphere Shorebird Reserve Network.[68] Fall waterfowl migrations peak at nearly three-quarters of a million birds, with annual waterfowl use exceeding three million birds, about thirty percent of all waterfowl in the Pacific and Central Flyways.[69] Annual shorebird use is estimated at between two and five million birds.[70] This amazing aggregation of migratory birds depends critically on the simple but supremely productive food chain in Great Salt Lake.

The sheer numbers of species and individual birds using Great Salt Lake, however, tell only part of the story. Even more telling is the significance of Great Salt Lake to particular categories and species of bird life. Indeed, the

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[67]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 42, 52B53 (noting lake=s importance as Amigration corridor@). A>It=s like a giant gas station for birds. . . . The Great Salt Lake is a unique place in the Western Hemisphere because large concentrations of birds visit there.=@ Tom Wharton, *Great Salt Lake: A Vital Filling Station for Fly-Loving Birds*, *in* THE GREAT SALT LAKE: UTAH=S AMAZING INLAND SEA, *supra* note 31, at 12 (quoting Gonzalo Castro, executive director of Western Hemisphere Shorebird Reserve Network). After refueling at Great Salt Lake, Wilson=s phalaropes fly 3000 miles in 60 hours nonstop en route to South America. *See id*.

[68]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 42, 52B53 (stating that Great Salt Lake, Alinked with other critical migration sites, forms a chain@ of migration stopovers between northern breeding areas and southern wintering areas).

[69]*See* Rawley, *supra* note 29, at 297.

[70]*See* Wharton, *supra* note 67, at 12.

superlatives associated with Great Salt Lake avian life seem almost unbelievable: the lake provides habitat for the largest staging concentration of Wilson=s phalaropes in the world; the most American avocets and black stilts of any wetland in the Pacific Flyway; the only staging area for marbled godwits in the interior United States; the world=s largest assemblage of snowy plovers, over half the entire breeding population west of the Rockies; one of the three largest colonies of white pelicans in western North America; the world=s largest breeding populations of white-faced ibis and California gulls; the second-largest staging population of eared grebes in North America; one of the ten largest overwintering bald eagle populations in the lower forty-eight states;[71] and more than three quarters of the entire western population of tundra swans.[72]

[71]*See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 55; STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 42, 49B51.

[72]*See* 1995 PLAN, *supra* note 21, at 102; STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 42; Rawley, *supra* note 29, at 297.

While this avian mecca is supported by a wide range of diverse habitats,[73] three features in particular explain the tremendous diversity and size of Great Salt Lake=s bird populations. The first is the tremendous amount and diversity of food for both resident and migrating birds, in the form of brine flies and brine shrimp as well as other invertebrates, and emergent and submerged plants and seeds.[74] The second key feature is the remarkable complex of marshes and other wetlands that ring the lake along its northeastern, eastern, and southern shores (along with isolated marshes at other locations around the lake).[75] The third important lake feature is the isolated nesting habitat provided by the lake=s many islands,[76] which provide important refuge from both predators[77] and

[73]*See* 1995 PLAN, *supra* note 21, at 102 (noting that five unique, productive environments exist within lake=s overall ecosystem); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 53 (AThe most significant aspect of the Great Salt Lake ecosystem is the great diversity of specific habitats created from the integration or close association of fresh and salt water systems which creates a fluctuating >mosaic= of land forms, vegetative cover, water, and salinity.@).

[74]*See* 1995 PLAN, *supra* note 21, at 102 (discussing food bases in and adjacent to lake); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 44B46 (noting that huge numbers of brine flies are primary food source for many species); Tom Wharton, *Without Pesky Brine Fly, Great Salt Lake Would Die*, *in* THE GREAT SALT LAKE, UTAH=S AMAZING INLAND SEA, *supra* note 31, at 20 (stating that as many as five billion brine flies hatch each year, providing food for millions of birds).

[75]*See* 1995 PLAN, *supra* note 21, at 103 (AGreat Salt Lake area contains the single largest contiguous block of wetlands in Utah.@). The lake and its associated wetlands have been nominated for listing as a wetland of international significance by the Ramsar Convention on Wetlands of International Significance. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 42. While wetlands are relatively rare in Utah=s semi-arid climate, comprising just 1.5% of total land mass, three quarters of the state=s wetlands are along the shores of Great Salt Lake. *See* FARMINGTON BAY ADVOCATES, LEGACY/WEST DAVIS HIGHWAY: ANALYSIS OF ALTERNATIVES UNDER 404(B)(1) GUIDELINES 5 (1998) [hereinafter FARMINGTON BAY ADVOCATES] (describing natural wetlands surrounding lake). Moreover, these remaining wetlands are all the more critical given that total wetlands acreage in the state declined so significantly, although estimates of the magnitude of the decline vary. *See id*. at 9 (citing decline from about 1.2 million acres in 1964 to just 558,000 in 1974); THOMAS E. DAHL, U.S. DEP=T OF THE INTERIOR, WETLANDS LOSSES IN THE UNITED STATES, 1780S TO 1980S 6 (Table 1 showing Utah wetlands loss of 30%, from 802,000 acres to 558,000 acres); JUDY D. FRETWELL ET AL., U.S. DEP=T OF THE INTERIOR, NATIONAL WATER SUMMARY ON WETLAND RESOURCES 375 (Water Survey Paper 2425, 1996).

[76]The lake contains up to eight islands, but the exact number fluctuates with lake levels; some islands become reconnected with the mainland at lower water levels. *See* Wm. Lee Stokes, *Geologic Setting of Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 55, 60. Gunnison, Bird, Cub, and Egg Islands are principal rookeries for gulls and pelicans, but only Bird and Gunnison remain sufficiently isolated to provide security to sensitive species during low water periods. *See id*.

[77]*See* BEHLE, *supra* note 62, at 12 (noting that adults, young, and eggs benefit; lake islands are protected from mainland mammals and remote from predatory birds).

human disturbance.[78] These sources of refuge are perhaps most critical to the roughly 18,000 American white pelicans[79] that nest on Gunnison Island. While this species once was widespread throughout the western United States, Great Salt Lake in general and Gunnison Island in particular remains as only one of four significant breeding colonies in the country.[80]

Moreover, while the bird resources of Great Salt Lake draw the most attention, and while the saline waters of the lake itself support only a limited diversity of life, the flora and fauna in the surrounding aquatic and terrestrial environment are both rich and diverse.[81] Taken together, the lake=s tributaries, adjacent brackish waters, freshwater wetlands, and range of upland habitats support twenty-three species or subspecies of fish, eight species or subspecies of amphibians, two species or subspecies of snakes, and sixty-four species or subspecies of mammals.[82] Plant life is also diverse on both the lake=s islands and its adjacent lands.[83] In fact, the region is home to many unique species of salt-tolerant flora, such as greasewood, pickleweed, iodine bush, inkweed, and salt grass, that exist in few other places on earth.[84]

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[78]*See id*. at 3 (mentioning that herons and pelicans failed to return to islands after human presence). As early as 1896, observers noted that pelicans and herons did not return to Gunnison Island when human workers were present. *See id*. at 14B17 (noting that adverse effects occur from motor boats visiting islands during nesting seasons).

[79]*See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 55.

[80]*See* BEHLE, *supra* note 62, at 75, 80 (describing pelicans= restricted range due to encroachment of human development); *see also* EDWIN V. RAWLEY, STATE OF UTAH DEP=T OF NATURAL RESOURCES, GREAT SALT LAKE WILDLIFE REPORT 51B58 (1976) (noting that Gunnison Island is important breeding area for American white pelican).

[81]*See* 1995 PLAN, *supra* note 21, at 102 (identifying five unique environmental types); Seville Flowers & Frederick R. Evans, *The Flora and Fauna of the Great Salt Lake Region*, *in* SALINITY AND ARIDITY: NEW APPROACHES TO OLD PROBLEMS 367 *passim* (Hugo Boyko ed., 1966) (characterizing various life zones from saline lake to freshwater marshes and tributaries to various upland habitats); Rawley, *supra* note 29, at 287 (identifying three major life zones supporting different combinations of species).

[82]*See* Rawley, *supra* note 29, at 287.

[83]*See generally* Flowers & Evans, *supra* note 81, at 377B92 (discussing distribution of plant species on strand, playa, saline plains, and sand dunes).

[84]*See* Wharton, *supra* note 53, at 10 (citing Westminister College botanist Ty Harrison). Recent research suggests that cultivation of salt-tolerant plant species from places such as Great Salt Lake may play an increasingly important role in feeding the growing world population. *See* Edward P. Glenn et al., *Irrigating Crops with Seawater*, SCI. AM., Aug. 1998, at 76, 77B79 (discussing unique nature of saltwater vegetation).

B. History of Human Use and Impacts

AYour present location is designed to you for a city of refuge, a place of rest; therefore see to it that ye pollute not your inheritance, for if you do, you might expect that the judgment of heaven will be poured out upon you.@[85]

[85]MORGAN, *supra* note 16, at 207 (quoting epistle of Brigham Young, urging first Mormon settlers to plant crops and to build pools to store water, but to preserve timber and not to contaminate waters of City Creek).

Throughout most of its 10,000-year history, Great Salt Lake was Amanaged@ only by natural forces. While change is the norm in natural systems, changes in the lake=s size, level, prevailing flora and fauna, and other characteristics were determined by natural variables such as climate. While there is archaeological evidence of human habitation and other uses through much of this history,[86] there is little evidence that such uses caused any measurable

[86]The confirmed archaeological record dates back at least 12,000 years to the Paleo-Indian period (12,000 to 9000 B.P.), with evidence of early hunting of Pleistocene megafauna. *See* David B. Madsen, *The Human History of the Great Salt Lake Region*, *in* GREAT SALT LAKE, *supra* note 28, at 19, 21, 28. Three ensuing periods ranging from 8500 to 2500 years ago (Early Archaic, Mid-Archaic, and Late Archaic) were similarly characterized by only subsistence gathering of marsh and lake-edge resources and largely migratory hunting. *See id*. at 23B26, 28. Some sedentary village life occurred for a period of about one thousand years (from 1500 to 500 years

impacts,[87] unlike other parts of the world in which even early human settlements are thought to have caused widespread ecological changes.[88] Early European

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ago during the Sevier period), followed by a return to migratory hunting and gathering during the Proto-Shoshoni period, prior to the arrival of nonnative settlers. *See id*. at 26–28.

[87]In large part, this was due to the extreme scarcity of resources that rendered large human settlements and impacts impossible. *See* MORGAN, *supra* note 16, at 38 ("The desert country except in special situations would not allow large concentrations of population."). Utah writer Terry Tempest Williams has a different explanation:

> The Fremont oscillated with the lake levels. As Great Salt Lake rose, they retreated. As the lake retreated, they were drawn back. Theirs was not a fixed society like ours. They followed the expanding and receding shorelines. It was the ebb and flow of their lives.
>
> In many ways, the Fremont had more options than we have. What do we do when faced with a rising Great Salt Lake? Pump it west. What did the Fremont do? Move. They accommodated change where, so often, we are immobilized by it.

TERRY TEMPEST WILLIAMS, REFUGE 183 (First Vintage ed. 1992) (1991). The "Fremont" prehistoric culture lived in the vicinity of Great Salt Lake during two separate periods from three to twelve hundred years ago. *See id.*; *see also* DAVID B. MADSEN, EXPLORING THE FREMONT 7, 47–59 (describing Fremont culture around Great Salt Lake).

[88]*See, e.g.*, Lynn White, Jr., *The Historic Roots of Our Ecologic Crisis*, 155 SCI. 1203, 1203–07 (1967) (describing environmental impacts of early civilizations).

visitors, especially trappers, rapidly depleted many of the fur-bearing mammals from the area=s upstream environments.[89] While these early explorers also hunted and fished the area somewhat for subsistence purposes,[90] there is no indication that they had any effect on the hydrology or ecology of Great Salt Lake itself.

[89]*See* MORGAN, *supra* note 16, at 81 (describing Snake River expedition by British trappers as Aan instrument for sweeping the country of its furs@); *id*. at 95 (indicating that Athe first quick wealth@ of fur was stripped from Utah country just four years after Great Salt Lake was discovered); *id*. at 96B97 (by 1830 all mountain creeks of Wasatch and Uinta Mountains had been trapped).

[90]*See id*. at 113 (describing early explorer Osborne Russell finding plentiful game in Cache Valley in 1840); *id*. at 150 (describing Fremont expedition trip to Antelope Island for its abundant game supply).

This benign history of human impacts, or lack thereof, began to change after the arrival of western settlers in 1848. Almost immediately upon their arrival in the Salt Lake valley, Mormon pioneers began to dam and divert the waters of City Creek, Red Butte Creek, and other tributaries for human consumption and for irrigation.[91] At the same time, the pioneers began to transform the landscape from natural forests in the mountain canyons and grasslands in the valleys to cities,[92] homesteads, crop lands, orchards, and forage for herds of cattle and other livestock.[93] Early filling of wetlands and grazing

[91] *See* URMCC PLAN, *supra* note 23, at 2-3 (noting that Provo River diversions began in 1849); MORGAN, *supra* note 16, at 198 (indicating that Brigham Young sent men to dam City Creek immediately upon Mormon arrival in Salt Lake valley); MARC REISNER, CADILLAC DESERT 2 (Penguin Books 1993) (1986) (describing later history of water development by Mormons in Utah); Kurt Vedder, *Water Development in Salt Lake Valley: 1847–1985*, *in* WATERS OF ZION: THE POLITICS OF WATER IN UTAH 28, 28–29 (Daniel McCool ed., 1995) [hereinafter WATERS OF ZION] (noting that for "the first thirty years [of Mormon settlement], communities were small and were able to survive on the low creek flows that follow the spring runoff" but that as population grew, "there was a pressing need to provide more irrigation water").

[92] *See* MORGAN, *supra* note 16, at 207–08 (stating that "[t]he thronging Saints inundated the infant city"). Salt Lake City's population was nearly 5000 by the fall of 1848. *See id.* at 217. "The pressures of this population burst the bounds of the city at once." *Id*. The next step, then, was to create new cities to the north and south. *See id.* A century later, in 1947, Salt Lake City had nearly 150,000 residents; Provo 18,000; and Ogden 44,000. *See id.* at 21.

[93] *See id.* at 198 (noting that planting and irrigation began almost immediately); *id.* at 251–56 (detailing early grazing efforts by Mormon settlers). The Wasatch Front has been described as a major agricultural "oasis" due to its use for grains, sugar beets, fruit, garden crops, and forage for livestock, which later led to the establishment of canneries, dairies, meat packing plants, and other industrial accompaniments. *See id.* at 391.

reportedly destroyed native grasses, shrubs, and trees, which Adecreased the efficiency of the earth as watersheds,@ leading to increased runoff and impervious soils, as did the cutting of timber.[94]

[94]*Id*. at 315.

Other even more intensive and disruptive land uses, such as mining, smelting, and other heavy industry, began in the late nineteenth and early twentieth centuries.[95] It was the coming of the transcontinental railroad,[96] however, that transformed the region=s economy Aat a stroke.@[97] The railroad created an international market for the region=s ores,[98] generated a timber boom,[99] and otherwise opened Utah=s economy to both imports and exports. As explained below, the subsequent rerouting of the railroad across the lake itself caused perhaps the single most significant change in the ecology of Great Salt Lake.[100]

While it is difficult to assess the impacts of these early changes on the ecological health of the lake and its ecosystem, the twentieth century brought much more rapid population growth and even more intensive changes in the

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[95]*See id*. at 286B87 (discussing early mining in Oquirrh Mountains and first major smelter in Rush Valley); *id*. at 391B92 (noting that more intensive mining and smelting began at turn of century).

[96]The famous meeting of the Central Pacific and Union Pacific railroads, and the driving of the Golden Spike, occurred at Promontory Point on May 10, 1869. *See* MORGAN, *supra* note 16, at 295. Mormon settlers then built a railroad (the Utah Central) connecting the Pacific lines to Salt Lake City, with the last spike of this latter effort driven by Brigham Young on January 10, 1869. *See id*.

[97]*Id*. at 290B91.

[98]*See id*. at 291 (discussing fact that railroad contributed to shipping complex ores as far as Liverpool).

[99]*See id*. at 294 (noting that schooners on lake were used to transport railroad ties and telegraph poles).

[100]*See infra* notes 119B49 and accompanying text (discussing impacts of railroad causeway on lake).

landscape. The human population along the Wasatch Front skyrocketed to more than one and a half million by 1995, and state planners estimate that it will grow to about five million by the middle of the twenty-first century, similar to the size of the current Philadelphia area.[101] The anthropomorphic changes that accompanied this rapid population growth already have had demonstrably significant effects on the Great Salt Lake ecosystem, with even greater impacts likely as the region grows further still.

[101] *See* QUALITY GROWTH EFFICIENCY TOOLS TECHNICAL COMMITTEE, BASELINE SCENARIO 1, 3 (1997) [hereinafter WASATCH BASELINE SCENARIO]. Whether these alarming projections in fact will occur, of course, is hard to predict. Whether the lake and the region as a whole can sustain this onslaught is an even more difficult issue.

The construction of dams and water diversions from the lake=s tributaries proceeded at a more rapid pace during the twentieth century, and continues to this day. Many of these facilities are on the major sources of inflow to Great Salt Lake from the east side.[102] The cumulative impact of all existing water diversions is to reduce the lake=s level, with the magnitude of the change dependent on the lake=s volume at any given time.[103] Moreover, demand for water along the Wasatch Front is expected to grow dramatically well into the next century.[104] According to current plans, part of this increasing thirst will be met through completion of the Central Utah Project, a massive system of dams and diversions built with the aid of federal subsidies and designed to divert water from the Uinta Mountains in the Colorado River basin, over and through the Wasatch Mountains, to the Salt Lake valley and other users in the Great Salt Lake watershed.[105] Many of these facilities already have caused extensive damage to Great Salt Lake=s upstream riparian ecosystems.[106] Significant changes to upstream riparian ecosystems, including changes to hydrology as well as flora and fauna, are likely to cause downstream impacts on the lake and its adjacent wetlands as well.[107] Moreover, additional dams and water diversions are

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[102]*See id*. at 49 (depicting existing and proposed water storage, treatment, and delivery facilities along Great Salt Lake tributaries); Vedder, *supra* note 91, at 29B35 (discussing history of canals, irrigation ditches, and water exchange agreements in Salt Lake valley).

[103]Most sources indicate that current diversions reduce lake level by five feet. *See* 1995 PLAN, *supra* note 21, at 47, 49; Arnow, *supra* note 40, at 255. When lake levels (and therefore water volume) are high, however, the impact of diversions on lake level is smaller. *See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 17 (calculating difference of approximately 2.5 feet in 1986, when lake was very high).

[104]*See* WASATCH BASELINE SCENARIO, *supra* note 101, at 44, 47 (predicting that water demand in Greater Wasatch Front area will increase Afrom 699 thousand acre feet in 1995 to 954 thousand in 2020,@ despite expected decline in per capita use).

[105]*See id*. at 44, 49 (discussing Central Utah Project); Daniel McCool, *Update: The CUP Completion Act of 1992*, *in* WATERS OF ZION, *supra* note 91, at 180, 180B94 (same); Vedder, *supra* note 91, at 35B46 (same).

[106]*See, e.g.*, URMCC PLAN, *supra* note 23, at 2-3 to -7 (describing impacts to fish and wildlife habitat in lake watershed). There has been significant alteration of the Provo River and its adjacent wetlands from natural conditions that supported diverse wildlife to a Atranspor-tation channel for municipal, irrigation, industrial, and flood waters.@ *See id*. at 2-3. This alteration is due to blockage of migrating and spawning fish, dewatering, channelization and elimination of natural stream meanders, destruction of natural flood plains, increased flow due to shortening of channel length and increasing stream gradient, elimination of riparian vegetation, dredging and habitat inundation, and damming of upstream lakes. *See id*. at 2-3 to -7 (discussing impacts to Provo river watershed); *id*. at 2B18 (discussing impacts to Diamond Fork watershed); *id*. at 2-23 (discussing impacts to Strawberry/Duchesne River watershed); *id*. at 2-37 (discussing impacts to Jordan River watershed).

[107]*See generally* Adler, *supra* note 5, at 982B83 & nn.32B39 (explaining that watershed ecosystem must be viewed as single system for proper management). With respect to Great Salt

Lake in particular:

> Impacts on one component of the ecosystem will have impacts, perhaps unforseen, on other components of the system. For example, alterations of the Jordan River (a source of freshwater input into the lake) may change the salinity level and reduce the brine shrimp population. This in turn affects the brine shrimp industry and/or the birds which feed on brine shrimp.

1995 PLAN, *supra* note 21, at 78.

being proposed in the Bear River drainage and elsewhere in the immediate Great Salt Lake watershed,[108] which will further degrade Great Salt Lake=s tributary environment and might diminish inflow to the lake itself even further.[109]

[108]*See* WASATCH BASELINE SCENARIO, *supra* note 101, at 44B49 (predicting need for two new dams in lower Bear River watershed, completion of Central Utah Project, and additional storage, treatment, and distribution facilities throughout Wasatch Front).

[109]For each 100,000 acre-feet of human consumptive water use the average lake level is expected to decrease one additional foot. *See* 1995 PLAN, *supra* note 21, at 47B49. Current artificial depletion from the lake is 3000 acre-feet, but that is expected to grow to 5000 acre-feet by the year 2020. *See id*. In the long run, however, it is not clear whether increased human withdrawals alone actually will reduce inflow to the lake so long as the water is used within and returned to the watershed. Diversions out of the watershed, increased evaporation through new impoundments, or actual consumptive uses necessarily would reduce flows to the lake. *See* U.S. GEOLOGICAL SURVEY CIRCULAR 12000, ESTIMATED USE OF WATER IN THE U.S. IN 1995, at 4B5 (1998) (distinguishing between consumptive and nonconsumptive water uses).

The past century has also brought more direct impacts to the hydrology of the lake, in the form of causeways, dikes, and other structures that have modified the natural flow patterns of the lake and its tributaries. Some of these changes, such as those built at the Bear River Migratory Bird Refuge in the early part of the century[110] and in both publicly- and privately-owned marshes along the lake=s northeastern and eastern edges, were made in the name of fish and wildlife habitat enhancement.[111] Others were made for commercial or industrial development or for transportation. Examples include the series of resorts that dotted the lakeshore from the late 1800s to the mid-1900s,[112] the diking of Willard Bay into a freshwater arm of the lake for purposes of public water supply,[113] the massive series of dikes and ponds used to extract a wide range of minerals from lake waters,[114] and the causeway from Syracuse to Antelope Island to provide access for recreation and tourism.[115]

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[110]*See infra* notes 182B86 and accompanying text (discussing history and purpose of Bear River Refuge and other managed marshes along lake).

[111]*See* BEHLE, *supra* note 62, at 169, 191B92 (describing dike construction and management at Bear River, Ogden Bay, and Farmington Bay Refuges); Jehl, *supra* note 61, at 263 (describing impoundments for wildlife purposes); Rawley, *supra* note 29, at 289 tbl.1, 297B98 (describing over 150,000 acres of hydrologically-managed marshes around lake by federal and state governments and private duck clubs); Tom Wharton, *Clubs Contribute to Lake=s Wealth of Waterfowl*, *in* THE GREAT SALT LAKE, UTAH=S AMAZING INLAND SEA, *supra* note 31, at 28 (describing history of marsh Adevelopment@).

[112]*See* MORGAN, *supra* note 16, at 348B66 (detailing history of tourist visits to lake); Kenneth E. Travous, *Recreation on the Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 33, 33B45 (describing resorts built since July 4, 1851, when ABrigham Young led the first organized bathing excursion to the lake@). At the peak of their popularity, individual resorts attracted hundreds of thousands of visitors a year. *See id.* at 39B42 (stating that over 160,000 people visit Saltair Resort annually and that up to 200,000 people visited Silver Sands in 1965). The south shore of Great Salt Lake and Antelope Island received 1.5 million visitors in 1978. *See id.* at 43. While visitation virtually ended during the flooding of the 1980s, it recovered to over 624,000 visitors annually by 1994. *See* 1995 PLAN, *supra* note 21, at 88.

[113]Willard Bay was a project built by the Federal Bureau of Reclamation in 1965 to store spring runoff from the Ogden and Weber Rivers for domestic use. *See* 1995 PLAN, *supra* note 21, at 8. The bay has significant recreational use as well. *See id.* (describing North and South Marinas and noting Willard Bay=s convenient proximity to Wasatch Front cities).

[114]*See* BRINE PROPERTIES, *supra* note 36, at 1 (showing size and location of dikes, evaporation ponds, and processing facilities); Peter Behrens, *Industrial Processing of Great Salt Lake Brines by Great Salt Lake Minerals and Chemicals Corporation*, *in* GREAT SALT LAKE, *supra* note 28, at 223 (describing 80 ponds with 17,000 acres of evaporation area); John L. Clark & Norman Helgren, *History and Technology of Salt Production from Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 203, 203B14 (discussing use of settling ponds in salt production); Robert Toomey, *Production of Magnesium from the Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 219 (describing 25,000-acre system of evaporation ponds). Major mineral extraction industries together produced Anearly 2.8 million tons of products in 1995, valued at about $300 million.@ BRINE PROPERTIES, *supra* note 36, at 2; *see also* MINERAL LEASING PLAN,

supra note 36, at 9B15 (discussing history and impacts of mineral extraction and associated causeways, diking, and diversion operations in Great Salt Lake).

[115]The causeway was flooded during the 1980s, making Antelope Island inaccessible by car from 1983 to 1992, but reconstruction began in 1991. *See* 1995 PLAN, *supra* note 21, at 29, 91B92. A second causeway to Antelope Island from the south shore has been proposed as well, to stimulate more visitors. *See id*. at 92.

These changes, and the wide range of human activities that accompanied them, have contributed to cumulative impacts on the lake=s hydrology and ecology. For example, human activity and interference with bird colonies during the critical nesting season can cause more sensitive species, such as pelicans, cormorants, and herons, to abandon their nests to the competitive advantage of more gregarious species, such as gulls.[116] Experts report that the combination of dikes, causeways, and other major construction projects has caused major changes to the lake=s physical and chemical environment.[117] Lakeside industries that use or have been facilitated by road and rail access, dikes, and other major structures are sources of water pollution, although little is known about the impacts of these pollutants on the lake and its ecosystem.[118]

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[116]*See* BEHLE, *supra* note 62, at 15B17 (noting that gulls returned after human disturbance, but that herons and pelicans did not). This type of impact caused an authority on Great Salt Lake=s bird life to fear, over four decades ago, that

> there is danger that the islands of Great Salt Lake will be entirely abandoned by the colonial birds. Herons have already abandoned all their nesting sites on the lake. Cormorants persist at Egg Island but are barely holding their own from year to year. Pelicans faced a critical condition in 1935 and seem to be slowly recovering but still their existence is precarious.

Id. at 19.

[117]*See* J. Wallace Gwynn & Peter J. Murphy, *Recent Sediments of the Great Salt Lake Basin*, *in* GREAT SALT LAKE, *supra* note 28, at 83, 83 (ASince man began to populate the Great Salt Lake Basin and to alter the natural hydrologic conditions that existed within it, the environment of deposition within Great Salt Lake has changed significantly both physically and chemically.@). For example, the Bear River Bay causeway has reduced sediment flow into the lake proper, increased sedimentation of the bay area, and isolated the bay chemically and physically, causing the bay to reduce in both depth and size, and to make the chemical interface between the bay and the lake more abrupt. *See id*. at 86. Similar changes have occurred in Farmington Bay: Freshwater inflow now makes the bay less saline; and untreated wastes discharged into the bay Ahave severely altered both the physical and chemical characteristics of the bay=s water and bottom muds.@ *Id*. Ogden Bay, which was once a salt flat, is now a brackish swamp because diking caused sediment accumulation behind the dikes. *See id*. The Western Pacific Railroad causeway on the lake=s south shore causes the shoreline to be completely straight from Black Rock to the southwest corner of the lake when lake levels are above 4200 feet. *See* Wm. Lee Stokes, *supra* note 76, at 63. Some biologists, however, note that not all of these changes are necessarily harmful to all species. *See* Jehl, *supra* note 61, at 263 (indicating that some dikes provide nesting areas for gulls and waterfowl).

[118]*See* Paul L. Tayler et al., *Heavy Metals in the Great Salt Lake, Utah*, *in* GREAT SALT LAKE, *supra* note 28, at 195, 195 (stating that effluent from mining, milling, and refining operations, and other sources related to industrial development have discharged heavy metals to inflowing streams, although most metals are immobilized in sediments). However, currently there are no numeric water quality standards for the waters of the lake. *See* 1995 PLAN, *supra* note 21, at 60. Without these standards, there are no benchmarks with which to determine the impacts of current pollution levels on the lake=s biota. *See* 33 U.S.C. '' 1313(c), 1314(a)(1994)(explaining that purpose of water quality standards is to determine whether water uses are protected).

Probably the most significant changes to the lake itself, however, have resulted from the massive railroad causeway that bisects the lake from Bear River Bay on the east shore to Lakeside in the west.[119] This so-called ALucin cutoff@ was built in 1902, as a combination of solid fill and wooden trestle, to shorten the rail trip that previously wound up steep grades and curves over the Promontory Mountains north of the lake.[120] The wooden trestle portion of the

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Moreover, a brief study in 1985 showed that the sediments of Farmington Bay may be contaminated with toxic metals and organics, and concluded that more study of the bay and of sediments near Kennecott Corporation=s tailings pond and slag piles was needed before lake waters could be deemed safe for contact recreation. *See* 1995 PLAN, *supra* note 21, at 62. More extensive efforts are underway to monitor chemical containments in Great Salt Lake wetlands and wildlife. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 39.

[119]*See* Jehl, *supra* note 61, at 263 (describing changes caused by railroad as Amost profound . . . limnologically@); Stephens, *supra* note 19, at 3 (showing railroad causeway route).

[120]*See* MILLER, *supra* note 20, at 38B40. The cutoff reduced the rail trip by almost 44 miles, 3919 degrees of curvature, and 1515 feet of grade, resulting in a time saving of seven hours. *See id*. at 40. The original causeway was comprised of rock and gravel fill at the shallow ends, including the entire portion crossing Bear River Bay, with a 12-mile trestle and 600-foot bridge

causeway, which was permeable and therefore had no impact on the lake=s natural flows, was replaced in the 1950s by a solid rock and fill causeway running across the entire lake.[121]

over the deepest parts. *See id.* at 38.

[121]*See id*. at 40; Stephens, *supra* note 19, at 2B3.

The new causeway had the effect of dividing the lake into two distinct bodies of water C the south arm of the lake, or Gilbert Bay, and the north arm, called Gunnison Bay.[122] The solid fill causeway had two significant, related effects on the lake and its hydrology. Because the causeway inhibits flow between the two arms of the lake, and because most of the freshwater inflow to the lake is to the south arm, the causeway had the effect of creating a significant differential in the water levels of the two arms of the lake.[123] At the same time, the causeway virtually eliminated mixing of water across the structure. Combined with the difference in freshwater dilution,[124] this created a large salinity gradient between the two arms. While the lake=s salinity varies naturally with rising and falling lake levels, and hence the amount of water available for dilution, the causeway has resulted in extremely high salinities in the north arm, with very little variation over time.[125]

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[122]*See* Stephens, *supra* note 19, at 3. Actually, because the railroad causeway also separates Bear River Bay and Willard Bay from the main body of the lake, and because causeways to the north and south ends of Antelope Island isolate Farmington Bay from the rest of the lake, the lake is divided into four quadrants with salinity lowest in Bear River and Willard Bays, second lowest in Farmington Bay, second highest in Gilbert Bay (south arm), and highest in Gunnison Bay (north arm). *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 27B30 & map 5. However, the salinity differential between the main south and north arms is most significant ecologically. *See id*. at 29B30.

[123]*See* 1995 PLAN, *supra* note 21, at 31. This difference reached approximately 3.7 feet during the floods of the mid-1980s. *See id*.

[124]Virtually all of the freshwater inflow into the lake now goes only into the south arm, causing significant dilution of the brines in the south and concurrent concentration in the north. *See* Stephens, *supra* note 19, at 3. While two culverts (each 15 feet wide and 23 feet deep) initially allowed some mixing of south and north arm waters, those structures subsequently have been filled with debris, and the initially semipermeable causeway itself has settled, reducing the amount of water exchange through the body of the causeway itself. *See id*. Southern Pacific reportedly is studying ways to clean the culverts more effectively to enhance flow and mixture of lake brines. *See* Personal Communication with Doyle Stephens, Research Hydrologist, USGS (Oct. 7, 1998) (on file with author).

[125]*See* Stephens, *supra* note 19, at 2 tbl.1 (depicting changes in salinity and species diversity from 1963B97). Since the solid causeway was completed, south arm salinity has varied from between 6 and 9% during the high-water periods in the mid-1980s to 26% during the low levels during the early 1960s, and now ranges between 11 and 15%. *See id*. During the same period, north arm salinity has stayed at the saturation level of 28% nearly all of the time, with a brief period of depression to 17% during the mid-1980s flooding. *See id*.; *see also* 1995 PLAN, *supra* note 21, at 57B58 (explaining that salinity varies between north and south arms); Gwynn & Murphy, *supra* note 117, at 86 (same). Recently, in response to State suggestions that the causeway may have to be breached, companies that extract minerals from the dense brines of the north arm have claimed that salinity differences are caused by the lake=s cycles rather than the causeway. *See Company Blames Salinity on Great Lake=s Cycles*, SALT LAKE TRIB., Mar. 3, 1999, at C3 (citing statements by officials of IMC Kalium at Great Salt Lake Technical Team meeting).

At the State=s request, a 300-foot breach was inserted at the west end of the causeway in 1984 in an effort to reduce the difference in water level between the two arms, and therefore to reduce flooding along the shores of the south arm.[126] The breach was successful in reducing the height differential to less than one foot.[127] It did not dramatically affect the salinity differential, however, because the heavier brines in the north arm still do not mix significantly with those in the south arm.[128]

[126]*See* HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 12; 1995 PLAN, *supra* note 21, at 32.

[127]*See* 1995 PLAN, *supra* note 21, at 32.

[128]*See id*. at 57B59 (describing stratification of brine layers in north and south arms).

This division of the lake into two bodies of water that are distinct both hydrologically and chemically resulted in two separate ecosystems as well,[129] with different communities of microorganisms and significant impacts on the

[129] *Compare* Felix & Rushforth, *supra* note 59, at 305 (describing limited algae as only plant species consistently within lake, and examining impact of railroad causeway construction in causing two ecologically distinct bodies of water, with apparent decrease in species diversity in north arm and converse increase in south arm), *with* Post, *supra* note 59, at 313, 320 (describing biological community with low diversity but high populations due to the extreme stress of high salinity and low oxygen solubility).

brine shrimp population.[130] This, in turn, affects two other communities that rely on the brine shrimp for survivalCbird populations[131] and the human brine shrimp industry.[132] The precise composition of the lake=s phytoplankton community changes with lake level and the accompanying levels of salinity.[133] In general, saline lakes show decreasing species diversity at higher salinities, but high populations because of the resulting drop in predation and competition.[134]

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[130]As described below, changes in the lake=s phytoplankton community have adversely affected the brine shrimp population. *See infra* note 143 and accompanying text. Commercial harvest of shrimp eggs dropped from about 14.7 million pounds wet weight in the 1995B96 and 1996B97 seasons to 6.1 million pounds in 1997B98, when the Utah Department of Natural Resources (ADNR@) closed the season early. *See* Stephens, *supra* note 19, at 1.

[131]*See infra* note 149 and accompanying text (discussing impacts of decreasing brine shrimp population on avian population).

[132]*See infra* notes 142B48 and accompanying text (discussing impacts of decreasing brine shrimp population on brine shrimp industry).

[133]*See* Stephens, *supra* note 19, at 2 (AAssociated with changes in lake elevation are potentially large changes in the salinity of the water and these fluctuations profoundly affect the biota of the aquatic ecosystem.@).

[134]*See id*.

Before the railroad causeway was built, lake salinity fluctuated within a relatively narrow range (twenty to twenty-seven percent from 1900 to 1939), and supported a relatively stable population of some twenty species of bacteria, algae, diatoms, and brine shrimp.[135] Fluctuation in lake levels since then, along with the greatly reduced mixing of waters within the lake effected by the causeway, has caused much more dramatic accompanying shifts in salinity and species composition as well. In general, brine shrimp have been virtually eliminated from the north arm since the causeway was completed, due to increased osmotic stress and low oxygen levels.[136] The north arm community shifted to a smaller number of different species of algae, some of which contribute to the characteristic purple color of the north arm.[137] By contrast, metazoan species diversity increased in the south arm as lake levels increased and salinity dropped during the 1970s and 1980s.[138] At the same time, brine shrimp populations declined severely in the south arm as well, because cyst viability of Great Salt Lake brine shrimp declines at salinities lower than twelve to thirteen percent.[139] Moreover, because brine shrimp consume algae, decreasing shrimp populations result in increasing blooms of algae with further impacts on the lake=s ecosystem.[140] It should be noted, however, that brine shrimp populations and birds that feed on them actually shifted to the north arm of the lake during the high water years of the mid-1980s, causing some biologists to believe that the causeway has actually increased habitat diversity in the lake.[141]

While one might have expected the balance between the lake=s algae and brine shrimp populations to recover once the flood waters of the 1980s receded,

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[135]*See id*. Salinity was measured at 15% in 1869, when lake levels were high. *See* HYDROLIC CHARACTERISTICS, *supra* note 3, at 24B25. No information exists, however, on the impacts of this lower salinity on lake life. *See* Atwood and Mabey Comments, *supra* note 21.

[136]*See* Stephens, *supra* note 19, at 3B4 (indicating that shrimp are present in small numbers but are not able to reproduce, and that brine flies are uncommon as well).

[137]*See* Stephens, *supra* note 19, at 4. Pink algae contribute some of the color to the north arm. The dominant biomass, however, are photosynthetic sulfur bacteria with a purple-pink pigment. *See* Manuscript Comments of Doyle Stephens (Feb. 19, 1999) (on file with author) [hereinafter Stephens Comments].

[138]*See* Stephens, *supra* note 19, at 4B5 (noting that about 30 species existed in the south arm by 1987, when salinity dropped to 6%).

[139]*See id*. Commercial cyst harvest in the south arm declined from 45 tons in 1960 to 9 tons in 1981, with even more dramatic declines in later years. *See id*.

[140]*See id*. at 5 (AAs a consequence of reduced numbers of grazing artemia [brine shrimp], phytoplankton populations remained high throughout the year, light penetration of the water column decreased, and the effects of reduced salinity cascaded throughout the system.@).

[141]*See* Jehl, *supra* note 61, at 263 (describing increases in north arm populations of brine shrimp, Wilson=s phalaropes, and eared grebes from 1984 to 1988). Whether such changes reflect Aimprovement@ in the ecosystem is more of a value judgment than a biological fact.

in fact, the system has been characterized by significant change since that time. While brine shrimp populations have been relatively large in the south arm during some of these years, several factors have contributed to sharp declines in others.[142] Biologists hypothesize that the most recent declines in shrimp populations, resulting in early closures of the shrimp egg harvest in 1997, may have been caused by a shift in the phytoplankton community from smaller algae to larger diatoms, which brine shrimp in early life stages cannot digest.[143]

[142] *See id*. at 5B7 (describing lake water and salinity levels compared to brine shrimp harvests from 1982 to 1997).

[143] *See id*. at 6 (describing changes in algal species composition and relative ability of juvenile shrimp to ingest species of different sizes).

These effects are of immediate concern to the brine shrimping industry that has operated on the lake for the past three decades.[144] Initially, shrimpers harvested adult shrimp as food for aquarium fish.[145] Later, because of lack of profitability and difficulties in handling a frozen product, the industry began to harvest only shrimp eggs.[146] The changes in the lake=s salinity and ecosystem described above, however, have had serious effects on this industry. First, while shrimp and eggs were once harvested from both the northern and southern parts of the lake, now only the south arm is a viable fishery.[147] Moreover, as explained

[144]*See* Paul A. Sturm et al., *The Brine Shrimp Industry on the Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 243, 243 (describing origins of Great Salt Lake brine shrimp industry in early 1950s).

[145]*See id*. C.C. Sanders, founder of Sanders Brine Shrimp Company, found that Great Salt Lake brine shrimp (*Artemia salina*) were an excellent food source for tropical fish. *See id*. Based on this discovery, Sanders wrote an article in 1950 for *The Aquarium* magazine, and began getting orders. *See id*.

[146]*See id*. (indicating that Sanders had begun harvesting shrimp eggs as early as 1952).

[147]*See id*. at 243B44 map (showing past and present harvest locations). Before the causeway was built, the shrimp eggs were more concentrated at the north end of the lake due to the winds which stacked the eggs in windrows along the shore. *See id*. By 1962, the numbers of shrimp and eggs at the north end of the lake declined due to increasing salinity, and harvesting moved to the

above, changes in the ecosystem structure of the south arm now have jeopardized the shrimp community there as well.[148] Even more frightening, however, is the possibility that these severe changes in the brine shrimp community will have a secondary impact on the internationally-significant populations of waterfowl and shorebirds that migrate to Great Salt Lake each year for nesting, staging, and other purposes.[149]

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western shore of the south arm. *See id*. During the 1988 harvest, several companies took cysts from the north arm near the causeway breach; the quality of the cysts, however, is not known. *See* Stephens Comments, *supra* note 137.

[148] *See* Sturm et al., *supra* note 144, at 245. AUtah=s brine shrimp industry has been confronted with the changes that man and nature have created in the lake.@ *Id*. At times, these changes Anearly spelled disaster for the brine shrimp industry.@ *Id*.

[149] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 70 (stating that bird use of north arm has been virtually eliminated due to lack of brine shrimp).

Relatively less emphasis has been placed on the equally important role of brine flies to the lake=s ecology. As many as 5000 billion brine flies hatch in Great Salt Lake annually.[150] In addition to providing food for millions of birds, brine flies also remove 120,000 tons of organic matter from the lake each year.[151] This lack of attention has prompted calls for more study of the role of brine flies in the lake=s ecosystem, and a more considered effort to ensure their protection.[152]

[150]*See* Wharton, *supra* note 74, at 20.

[151]*See id*.

[152]*See* Letter from Tim Funk, Executive Director, HawkWatch International, et al., to James W. Carter, Executive Director, Great Salt Lake Planning Project, and Karl Kappe, Director, Division of Forestry, Fire and State Lands 2B4 (Mar. 27, 1998) (urging public trust approach to lake=s resources) (on file with author) [hereinafter Funk Letter]. The author of this Article was one of the signatories to, and a coauthor of, this comment letter.

Another major human change to the hydrology of Great Salt Lake is the West Desert Pumping Project.[153] The project was constructed in the mid-1980s, not without controversy,[154] as a second means of Acontrol@ over the rapidly-rising lake.[155] Increasing Aflooding@[156] during this period caused millions of dollars of damage to roads, railroads, recreational facilities, public utilities, and other structures.[157] It also had severe impacts on wildlife and wildlife habitat, especially the marshes that ring the lake=s eastern shore.[158] When breaching the

[153]*See* UTAH CODE ANN. '' 73-23-1 to -6 (1989) (authorizing legislation for project).

[154]Construction of the causeway resulted in a significant amount of litigation, because some commercial and industrial interests profited at the expense of others. *See, e.g.*, Great Salt Lake Minerals & Chem. Corp. v. Marsh, 596 F. Supp. 548, 551 (D. Utah 1984) (challenging U.S. Army Corps of Engineers= decision to allow discharge of dredge and fill material to construct causeway); Colman v. Utah State Land Bd., 795 P.2d 622, 624 (Utah 1990) (alleging that causeway interfered with operation of underwater brine canal on bed of Great Salt Lake). The latter case was brought because breaching the causeway might have the effect of increasing brine concentrations for south arm extraction industries at the expense of north shore firms. *See id*. Ironically, similar litigation was brought in reverse when the causeway was first built. *See* Hardy Salt Co. v. Southern Pac. Transp. Co., 501 F.2d 1156, 1159B60 (10th Cir. 1974) (seeking damages for dilution of brines in south arm of lake, which resulted from construction of causeway); Morton Int=l, Inc. v. Southern Pac. Transp. Co., 495 P.2d 31, 32 (Utah 1972) (same).

[155]*See* 1995 PLAN, *supra* note 21, at 36B37 (describing West Desert Pumping Project); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 25B27 (same). The idea of diverting rising lake waters into the west desert actually dates back more than a century. During the high water period in the 1870s, the Salt Lake County Commission sent a delegation to see whether the lake=s rising waters could be diverted westward into the Salt Desert. *See* MORGAN, *supra* note 16, at 24.

[156]Use of the term Aflooding@ itself is controversial to describe the lake=s natural, periodic fluctuations in level and size. The DNR uses the term Awhen the level of the lake begins to adversely affect structures and developments which are located within its flood plain.@ STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 21. When so-called Aflood levels@ can persist for two to three years, however, it would seem more appropriate to refer to high stages in the lake=s natural cycles. *See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 16; *see also* Atwood, *supra* note 47, *passim* (describing full range of lake level fluctuation due to natural cycles).

[157] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 21B24 (detailing impacts of flooding on roads, railroads, recreation, wildlife and wetlands, and utilities). From 1983 to 1987 flooding caused over $240 million (1985 dollars) in damages; officials estimate that damages would have been between $500 million to $1 billion (1985 dollars) had waters risen to where operation of the northern and southern railroad causeways and Interstate 80 were disrupted. *See id*. at 21B22.

[158]*See* 1995 PLAN, *supra* note 21, at 35. Most of the artificially-managed marshes were created in the 1930s and 1940s when water levels were relatively stable at 4198 feet. *See id*. According to one view, this flooding had the effect of destroying wildlife habitat: ADuring the flood years of the 1980s, nearly 300,000 of the 400,000 acres of marsh . . . were destroyed or rendered sterile due to deep water or salt intrusion,@ causing over $30 million in damages to marshes, dikes, water control structures, and other nearby features. *Id*. During this period, total

causeway provided only partial relief from the lake=s surging waters, the State elected pumping to the West Desert from among several other alternatives that either were more expensive or had questionable efficacy.[159] Pumping began on April 10, 1987, and increased the surface area of the lake by 320,000 acres (about 508 square miles, or twenty-six percent of the lake=s surface area), which increased the lake=s overall evaporation rate accordingly.[160] While too late to affect peak lake levels in 1987, pumping approximately 2.73 million acre-feet of brine westward caused lake levels to drop about fifteen inches.[161] The pumps were turned off in 1989, after which lake levels continued to decline naturally,[162] but remain as a defense net for whenever the lake next has the audacity to seek a high point in its natural cycle. At least one agency, however, the U.S. Army Corps of Engineers, has expressed concerns about the ecological effects of the project.[163] Moreover, two of Utah=s most respected geologists question the technical validity of the pumping decision:

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duck and geese use of these marshes dropped by 80%, fall swan use declined by over 90%, and total bird use fell by 90%. *See id*. From another perspective, however, fluctuations in lake level are an essential part of the lake=s natural ecological cycle: AAlthough potentially damaging to structures in wildlife management areas, fluctuations in lake water levels are beneficial to wildlife. Periodic flooding and drying events keep wetlands in young successional stages and increase their productivity.@ STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 24.

[159]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 25. Other options considered were to store more water upstream by building a dam on the Bear River at a cost of $100 million, but with minimal impacts on the flooding; to divert water northward into the Snake River watershed, in emulation of Lake Bonneville=s Pleistocene run through Red Rock Pass (cost $200 million); or to dike the entire eastern shore of Great Salt Lake (cost $500 million), or strategic portions thereof (cost $250 million). *See* WILLIAMS, *supra* note 87, at 58B60. The State chose a less costly and more expedient, but ultimately less effective, plan of pumping from the north rather than the south arm. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 25. Pumping from the north arm reduced the evaporation rate because of the higher salinity of north arm brines, and left larger amounts (an estimated 400 to 600 tons) of salt in the bed of the newly-created West Pond. *See id*.

[160]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 25 (explaining operation and hydrological effects of West Desert Pumping Project). To put the magnitude of this hydrological change in perspective, the artificially-created West APond,@ during its brief existence, would have qualified as the seventeenth-largest lake in North and Central America. *See* WATER IN CRISIS: A GUIDE TO THE WORLD=S FRESH WATER RESOURCES 162, 164 tbl.b.10 (Peter H. Gleick ed., 1993) (listing lakes in order of decreasing surface area, in square kilometers). At 508 square miles, the West Pond is approximately 1321 square kilometers (1 square mile = 2.6 square kilometers). *See id*.

[161]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 25; Atwood supra note 47, at 206 (noting that lake peaked shortly after pumps were started, and that pumping hastened rate of decline Abut had no appreciable effect on the maximum level reached@).

[162]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 25.

[163]*See id*. at 26B27 (stating that Corps of Engineers has Aindicated that a resumption of pumping . . . would likely trigger an evaluation@ of State=s permit to pump).

> The redesign of the West Desert Pumping Project is probably the best example of how not to make major decisions relating to Great Salt Lake. The decision to proceed with the hastily down-sized pumping project was made by a governor with little understanding of the lake supported by a handful of bureaucrats who either did not understand the lake or wanted to be supportive of the governor in Adoing something@ to keep the Southern Pacific Railroad route across the lake viable.[164]

[164]Atwood and Mabey Comments, *supra* note 21. Atwood was formerly the Utah State Geologist and Director of the Utah Geological and Mineral Survey. Mabey has been a geophysicist at the USGS, and Senior Geologist and Deputy Director of the Utah Geological and Mineral Survey. *See id*. They note further that while pumping had a minor impact on lake levels, Afull-fledged pumping was not started until the lake had begun a natural decline.@ *Id*.; *see also* Atwood, *supra* note 47, at 206 (arguing that governor=s decision was based mainly on information provided by industry regarding effects of losing railroad).

In the long run, however, perhaps the most significant threats to the health of the lake come from the less direct but more pervasive effects of creeping development. Land use in the Great Salt Lake watershed has spread and intensified, and promises to continue to do so for quite some time.[165] Moreover, development is projected to move closer and closer to the lake=s shore, especially along the lake=s eastern edge in Davis and Weber Counties and its southern edge in Salt Lake and Tooele Counties.[166] While some of this development will occur due to natural growth pressure and existing private land ownership, additional growth might be stimulated by public spending decisions. For example, construction of the proposed ALegacy Highway@ along the southern and eastern shores of the lake might catalyze additional or at least more rapid development by providing easier access to areas that were previously more remote.[167] Some of the areas slated for development constitute critical lakeside wetlands and flood plains.[168] Even construction in nearby uplands, however, will have demonstrable effects on wildlife habitat, and will further increase runoff and other pollution of the lake and its adjacent wetlands and tributaries.[169] As Great Salt Lake wildlife expert Edwin V. Rawley wrote almost twenty years ago, A[t]he factor contributing the most heavily to the demise of many of [the lake=s]

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[165] *See* WASATCH BASELINE SCENARIO, *supra* note 101, at 3 tbl. (stating in table, *Summary Baseline Statistics for the Greater Wasatch Area*, that 1995 urbanized area of 320 square miles is expected to grow to 590 in 2020 and 1350 in 2050). *See id*. at 5 map (depicting location of 1995 urbanized area and projected urbanization in 2020 and 2050 relative to Great Salt Lake).

[166] *See id*. at 54 & maps (comparing existing land use with potential areas for future urban expansion, and existing irrigated agricultural lands expected to convert to urban development).

[167] *See* COMMENTS OF THE SIERRA CLUB ET AL. ON THE LEGACY PARKWAY DRAFT ENVIRONMENTAL IMPACT STATEMENT 77 (1999) [hereinafter SIERRA CLUB COMMENTS] (arguing that proposed highway will induce additional development adjacent to lake); DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 23 (noting that development is stimulated by public infrastructure, such as sewers, water, access, and power). *But see* UTAH DEP=T OF TRANSP., LEGACY PARKWAY DRAFT ENVIRONMENTAL IMPACT STATEMENT AND SECTION 4(F), 6(F) EVALUATION 4-3 to 4-4 (1998) [hereinafter LEGACY PARKWAY DEIS] (arguing that development will occur with or without new road).

[168] *See, e.g.*, DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 6B7 (describing wetlands adjacent to Great Salt Lake); LEGACY PARKWAY DEIS, *supra* note 167, at 4-3 (predicting that from 571 to 760 acres of wetlands will be lost to development along proposed highway corridor).

[169] *See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 6B7 (noting that diversion of upstream water can cause drying up of wetlands); FARMINGTON BAY ADVOCATES, *supra* note 75, at 12B13, 24B30 tbl.3, tbl.4, fig.5 (cataloging both direct and indirect effects of proposed highway, including alteration of area hydrology, habitat fragmentation and displacement, increased erosion, water quality degradation, and induced growth and development, resulting in loss of open space and agricultural land); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 40 (noting that nonpoint source pollution, mainly from agricultural and urban runoff, is Amajor source@ of pollution in lake).

life forms is the loss or alteration of habitat by urbanization, industrialization, agriculture, flood control, and water development.@[170]

[170]Rawley, *supra* note 29, at 287; *see also id*. at 288 (stating that preservation of wildlife habitat Ais dependent entirely upon land use practices in the marsh areas and is subject to rapid and irreversible change by such practices as drainage and industrialization@); *see also* 1995 PLAN, *supra* note 21, at 61 (describing problem of agricultural and urban runoff pollution from developing areas to lake and its tributaries).

At the same time, however, history has shown that building closer and closer to the lake causes much harm to human interests as well.[171] Beach resorts that depended necessarily on proximity to the lake were alternately swamped by the lake=s rising stage or left high and dry when the lake receded.[172] High lake levels during the 1980s caused massive property damage and other economic losses, and experts predict that similar damage is likely in the future.[173] Moreover, building near the lake poses a series of severe geotechnical risks because nearby soils are unstable, are saturated with high groundwater tables, and are subject to Aliquefaction@ and ground acceleration due to earthquakes, among other construction problems.[174] In fact, some experts believe that an earthquake might actually tilt the plate that holds the lake bed eastward, causing a tidal-wave-like flooding of already-developed areas.[175] Despite these risks, plans continue to build closer and closer to the lake=s edge, like in so many other

[171] *See* 1995 PLAN, *supra* note 21, at 25 (stating that lake=s Awide cyclic fluctuation . . . has continually plagued those who have utilized its shores@); *id.* at 33 (finding that A[p]erhaps no single item has impacted recreation on Great Salt Lake to the extent that rising and lowering water levels have over the expanse of years@).

[172] *See generally* MORGAN, *supra* note 16, at 17 (AMen have attempted to force [the lake] into servitude of navigation; recalcitrantly it has withdrawn from their piers, leaving them high and dry, or has risen to inundate them entirely.@); RAYE CARLESON PRICE, BARRIER OF SALT, THE STORY OF GREAT SALT LAKE 13 (1970) (stating that lake=s fluctuating shorelines damaged resorts); Travous, *supra* note 112, at 33B45 (detailing history of Great Salt Lake shore resorts, including problems caused by lake=s variations).

[173] *See supra* notes 153B64 and accompanying text (discussing 1980s flooding and West Desert Pumping Project). On the likelihood of future damage, see Atwood & Mabey, *supra* note 47, at 490B91, in which the authors identify critical facilities likely to be inundated by future lake levels, including: the Salt Lake City International Airport; I-80 and I-15; the mainlines of two railroads; several sewage treatment plants; petroleum refineries and storage facilities; and electric transmission lines.

[174] *See* Bruce N. Kaliser, *Geotechnical Aspects of Development in the Vicinity of Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 353, 353B54. According to Kaliser, neglect of geotechnical problems near Great Salt Lake Acan spell economic disaster if not worse.@ *Id.* at 356. AUnder static conditions the near shore geologic environment is sensitive and must not be regarded as stable; under dynamic conditions, mobility and instability may be almost assured.@ *Id.*; *see also* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 75B77 (detailing geologic hazards of building on Salt Lake valley floors).

[175] *See* Kaliser, *supra* note 174, at 354; *see also* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 7 (defining lake=s flood plain). Even absent such tectonic deformation, earthquake-induced wave surges could inundate areas beyond the already high lake levels, and cause the failure of dikes designed to protect critical facilities. *See* Atwood & Mabey, *supra* note 47, at 491 (discussing earthquake induced surges and citing effects of 1909 earthquake on lakeshore facilities); Atwood, *supra* note 47, at 211B12 (same).

communities that have been willing to flirt with such dangers in other parts of the globe.[176]

III. PAST AND ONGOING MANAGEMENT EFFORTS FOR GREAT SALT LAKE

A. Management History Before 1975

> *The lake must be looked at as a body of water rather than a mine, or a beach, or a dumping ground. As a water entity it will tie all of its component interests together.*[177]

[176]*See generally* JOHN MCPHEE, THE CONTROL OF NATURE *passim* (1989) (describing development in dangerous flood plains of Mississippi River system, near volatile volcanoes in Iceland, and on erosion-prone slopes in mountains near Los Angeles).

[177]GREAT SALT LAKE STUDY LAND USE AND WATER COMMITTEE, WASATCH FRONT REGIONAL COUNCIL, LAKE COM REPORT A-89 (1973) [hereinafter LAKE COM REPORT] (abstracting and quoting Dennis L. Thompson, Unpublished Paper delivered at Utah Section, American Water Resources Association Conference, Salt Lake City, Utah (Nov. 30, 1972)).

Prior to 1975, many discrete management actions by the federal, state, and local governments affected the lake and its resources. These included, for example, early decisions by the State of Deseret regarding grazing of stock on the lake=s islands;[178] later decisions to lease lands in or around the lake for commercial or other purposes, including the Southern Pacific Railroad causeway[179] and various mineral extraction projects;[180] land transfers between

[178]*See* MORGAN, *supra* note 16, at 251B52 (explaining that leases were part of early Mormon fund-raising for emigration). On September 14, 1850, the legislature of the State of Deseret provided that: AThe Islands in the Great Salt Lake, known as Stansbury=s Island and Antelope Island, are hereby reserved and appropriated for the exclusive use and benefit of [the Perpetual Emigrating Company], for the keeping of stock, &c.@ *Id*. The Perpetual Emigrating Company (APEC@) was an arm of the then-named Church of Latter-Day Saints, to which many members donated livestock in lieu of cash. *See id*. at 251. Herding on the islands actually began in 1848. *See id*. at 252. Competition for grazing rights on the islands became so intense that the legislature later issued specific grants of grazing rights on Stansbury and Antelope Islands to Brigham Young on behalf of PEC, and to other early pioneers as well. *See id*. at 256. These grants were repealed, however, in 1860. *See id*.

[179]*See* Letter from Vernon D. Romney, Utah Attorney General, to Calvin T. Rampton, Governor (July 5, 1972), *in* LAKE COM REPORT, *supra* note 177, at A-142 to -147 (describing railroad lease and related legal problems).

[180]*See* Utah v. United StatesCSpecial Master=s Report, 1976 UTAH L. REV. 246, 273B74

the state and federal governments to facilitate water reclamation projects such as Willard Bay;[181] and similar arrangements leading to the creation of waterfowl areas around the lake, including the Ogden Bay Wildlife Management Area[182] and the Bear River Migratory Bird Refuge.[183] In retrospect, some of these actions reflect important milestones in the history of public land and water management. For example, some of the earliest water projects in the history of the American West involved the Great Salt Lake watershed, especially since Utah=s pioneers began to dam City Creek and other Wasatch tributaries of the lake virtually immediately upon their arrival in the Salt Lake Valley.[184] Similarly, the Public Shooting Grounds established at the north end of the lake apparently were the first artificial fresh water waterfowl marshes created in the United States,[185] and the Bear River Bird Refuge was the first unit in the National

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[hereinafter *Special Master=s Report*] (describing state mineral leases dating to 1910). The *Special Master=s Report* was not published in any official reporter.

[181] *See id*. at 275B76.

[182] *See id*. at 275.

[183] *See* BEHLE, *supra* note 62, at 168B72 (describing history of Bear River Refuge).

[184] *See supra* notes 91B94 and accompanying text (discussing impacts on lake tributaries from early settlers).

[185] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 63 (describing 11,843-acre Public Shooting Grounds Waterfowl Management Area, established in 1929, including desert uplands, wetlands, ponds, and mudflats).

Wildlife Refuge System when it was created by an act of Congress and presidential proclamation in 1928.[186]

A complete history of individual actions and decisions that had some impact on the lake could cover a huge range of governmental programs, and is entirely beyond the scope of this Article. Moreover, the main focus of this analysis is comprehensive, watershed-based planning and management for Great Salt Lake. Nevertheless, the historical review shows a number of early efforts at more comprehensive planning for Great Salt Lake. While these efforts were largely abandoned or ignored, they provide some useful insights for the current process.

[186] *See* BEHLE, *supra* note 62, at 168B69 (discussing establishment of Bear River Refuge).

In 1958, the Advisory Committee to the Utah State Road Commission prepared the Great Salt Lake Diking Study (ADiking Study@).[187] While ostensibly a multiple-use effort, the Diking Study was prepared by and for a single agency, and largely for a single main purpose, to propose a series of dikes to and between Antelope and Fremont Islands. This proposal was an outgrowth of several earlier proposals for extensive diking in the lake.[188] At the same time, the Diking Study presaged later proposals to Acontrol@ the lake by maintaining the level of freshwater Farmington Bay at a high level of 4204 feet.[189] The basic philosophy of the Diking Study, as was characteristic of the time,[190] was to

[187]*See* LAKE COM REPORT, *supra* note 177, at A-26. This study was authorized by an appropriation from the Utah Legislature in 1955. *See id*.

[188]*See id*. at A-26 to -30, A-56 to -57 (describing diking studies and proposals dating to the 1930s); *see also* MORGAN, *supra* note 16, at 30B31. An earthen causeway to the south end of Antelope Island was built in 1952. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 28. The causeway from Syracuse to the northern end of Antelope Island was completed in 1969. *See id*. The Antelope Island causeway was flooded in the 1980s, but was rebuilt, paved, and reopened in 1992. *See id*. at 22. More recent proposals to renovate and pave the second causeway from the south side of Antelope Island to the south shore of Great Salt Lake have faced opposition from environmental groups, and are currently on hold. *See* Personal Communication with Wayne Martinson, Utah Wetlands Coordinator, National Audubon Society (Jan. 15, 1998) (on file with author). However, the most recent set of proposed management alternatives for the lake includes, as one option: APeriodically evaluate the need for southern causeway [to Antelope Island].@ GREAT SALT LAKE PLANNING TEAM, UTAH DEP=T OF NATURAL RESOURCES, GREAT SALT LAKE PROJECT INFORMATION PACKET 11 (Jan. 20, 1999).

[189]*See* LAKE COM REPORT, *supra* note 177, at 11.

[190]*See infra* Part IV.A (discussing general imperatives for watershed restoration and

maximize human uses of the lake and its resources through engineered structures, and to Acontrol@ the lake to prevent flooding of other artificial structures. No attention was given to ecological or other nonutilitarian values.[191]

protection).

[191]Moreover, some experts now advise that efforts to Acontrol flooding@ through dikes actually exacerbates hazards associated with high lake levels in the event of dike failure due to earthquakes or other causes. *See* Atwood, *supra* note 47, at 217.

The first real effort to prepare a preliminary master plan for development of Great Salt Lake was conducted by the Great Salt Lake Authority (AAuthority@) in 1965.[192] While ostensibly a much broader effort than its 1958 predecessor, according to a later official review, the *1965 Preliminary Master Plan* was in fact merely a Aconfirmation of the Diking Study, since the same engineering firm was involved in both.@[193] The *1965 Preliminary Master Plan* had the same primary focus on diking and related development, but was more ambitious in scope, calling for a sixty-square-mile land reclamation project in Farmington

[192]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 6 (describing establishment and powers of Authority). The Authority had been created by the state legislature and appointed in 1963 to study the lake=s fluctuating condition (then at its lowest recorded levels) and development potential. *See id.*; MILLER, *supra* note 20, at 47; PRICE, *supra* note 172, at 88; *see also* ch. 161, 1963 Utah Laws 566 (creating Authority under H.B. 33). In 1966, however, the Utah Supreme Court declared the Authority unconstitutional because the enacting statute failed to define its geographical jurisdiction. *See* Great Salt Lake Auth. v. Island Ranching Co., 421 P.2d 504, 505 (Utah 1966). The defect was cured, however, and the Authority re-created, in 1967. *See* ch. 187, 1967 Utah Laws 528. The Authority was abolished as swiftly as it was re-created, however, when its functions were merged into the Division of Parks and Recreation within the new Utah DNR, also in 1967. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 7.

[193]LAKE COM REPORT, *supra* note 177, at 11.

Bay, recreational development on the lake=s southeast shore, and Astabilization@ of the lakeCthe hydrological equivalent of ProzacCat an even lower level of 4200 feet.[194] The *1965 Preliminary Master Plan* also proposed to divide the lake into three major use zones, including an Aagricultural-industrial land reclamation complex,@ Arecreational-wildlife@ development areas, and the rest of the lake for chemical extraction efforts.[195] Apparently, under this plan, no portions of the lake would simply be left alone.[196] Moreover, authors of the later *Lake Com Report*, while complimenting the work as Athe most comprehensive of the multiple-use efforts to date,@[197] implicitly criticized it as Astill heavily oriented to engineering solutions.@[198] Other contemporaneous commentators, however, expressed more generous views of the plan.[199]

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[194] *Id*.

[195] *Id*.

[196] As put by author Terry Tempest Williams in a related context: AEvidently, to do nothing is not an option.@ WILLIAMS, *supra* note 87, at 61.

[197] LAKE COM REPORT, *supra* note 177, at 11.

[198] *Id*. Apparently, a contemporaneous master plan for a small portion of the lake=s southeastern shore was prepared by a group called the Citizens League for the Protection, Planning and Development of Great Salt Lake, Utah. *See id*. at 11B12. This plan called for Aimproving

wildlife habitat@ as well as some of the other types of recreational proposals included in other plans. *Id*. at 11B12, A-19 to -21.

[199]For example, after describing the plan=s basic recommendations, Dr. David E. Miller, an authority on the lake=s history, noted: A[T]he future looks bright for recreational and industrial development in, on and around the lake.@ MILLER, *supra* note 20, at 48.

The 1960s also brought renewed federal interest in protection and management of some of the natural resources of Great Salt Lake. A series of studies were made to evaluate the potential use of Antelope Island as a National Monument,[200] leading to the introduction of federal legislation to this effect by Utah Senator Frank Moss.[201] The Moss bill passed the U.S. Senate in 1967[202] over the opposition of Utah=s other Senator, William Bennett Sr., but never passed the House of Representatives.[203]

Perhaps in response to the perceived narrow focus of the State=s *1965 Preliminary Master Plan*, and the fact that it was prepared by a single consulting engineering firm rather than by a more inclusive process, in 1971 the so-called *Lake Com Report* was commissioned by a coalition of federal, state, and local government agencies, as well as other interests.[204] Lake Com was given

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[200] *See* PRICE, *supra* note 172, at 88 (noting that Aoutstandingly significant scientific values worthy of preservation and interpretation@ exist on Antelope Island).

[201] *See* S. 25, 90th Cong. (1967); S. 25, 89th Cong. (1965); *Great Salt Lake National Monument: Hearings on S. 25 Before the Subcomm. on Parks and Recreation of the Comm. on Interior and Insular Affairs*, 90th Cong. (1967); *Great Salt Lake National Monument: Hearings on S. 25 Before the Subcomm. on Parks and Recreation of the Comm. on Interior and Insular Affairs*, 89th Cong. 5 (1966); 90 CONG. REC. 190, 1187, 1510, 18,888B89, 18,905 (1967); 89 CONG. REC. 167 (1965). For a brief history of the proposed legislation, see LAKE COM REPORT, *supra* note 177, at A-93 to -94.

[202] *See* 90 CONG. REC. 18,905 (1967).

[203] *See* LAKE COM REPORT, *supra* note 177, at A-93 to -94.

[204] *See id*. at 1B2.The Lake Com study was suggested first by representatives of the Tooele

the monumental task of collecting, reviewing, summarizing, analyzing, and drawing conclusions from all past, ongoing, and proposed studies of the lake, and making recommendations regarding Asteps to take for future planning of the Lake.@[205] After nearly two years of study, however, Lake Com confessed that it had evaluated only about 100 of the more than 550 identified studies and other documents relevant to its work, that its work was only partially finished, and therefore that it could reach only Alimited@ conclusions and recommendations.[206]

County Council of Governments, but later endorsed at a meeting of the Land Use Committee of the Wasatch Front Regional Council. *See id*. at 1. Members included representatives of several state agencies (Utah Geological Survey, Utah Division of Health, Utah Division of Parks and Recreation, Utah Division of Water Resources, Utah Highway Department), and several counties (Tooele, Salt Lake, Weber, and Davis). *See id*. at 2. There was also support and participation from the Federal Bureau of Reclamation and several other state and federal agencies, as well as several private interests such as Kennecott Corporation, Solar Salt Company, and N.L. Industries. *See id*. at 2B4.

[205] *Id*. at 3.

[206] *See id*. at 5B7.

Nevertheless, the brief findings of the *Lake Com Report* were both reminiscent of previous efforts and prescient about future studies and plans. The report identified Great Salt Lake as a substantial multiple-use resource, with a focus on water conservation, recreation, tourism, and industrial development.[207] It contained the familiar warnings: that additional study and information were needed before substantial modifications were made to the lake to avoid Aundesired and irremediable consequences,@ or even before a sound comprehensive plan could be prepared; that no approved goals and policies existed to guide both public and private actions; that some approved uses Aare in serious conflict with each other@; and that control of various aspects of lake management was Ascattered throughout state and local governments.@[208] In fact, the *Lake Com Report* went so far as to note, with apparent concern, that Athere is no established policy that the Lake should continue to exist.@[209] Based on these findings, it recommended that the state legislature employ an inter-agency team to complete Lake Com=s work,[210] with the ultimate goal of developing a Amaster plan@ for Great Salt Lake in accordance with the policy of House Joint Resolution 12,[211] which had been adopted during the 1973 legislative session,

[207] *See id*. at 7. Notably absent from this list of uses were ecological values. A somewhat unique reference was made, however, to the belief that large amounts of groundwater are stored beneath the lake. *See id*.

[208] *Id*. at 8. Federal management authorities were omitted from this conclusion. *See id*.

[209] *Id*.; *see also id*. at 9 (stating that Apresent long-range plans may not consider continuation of the lake as a necessity@). While this concern may seem spurious in light of subsequent events, including the major lake level rise of the 1980s, it must be remembered that less than a decade had passed since the lake=s nadir in 1963, and many at the time believed that continued increases in upstream water use eventually could cause the lake to disappear altogether. The report itself noted that some water studies had predicted that lake area might be reduced by two thirds by 2020. *See id*.

[210] *See id*.

[211] *See* Great Salt Lake Comprehensive Long-Range Plan, H.J.R. 12, 1973 Utah Laws 773.

while the Lake Com work was in process.[212] Perhaps most intriguing was the *Lake Com Report*=s closing question: AShould a single authority or a coordinating body be created to plan and administer the lake?@[213]

Throughout the 1960s and 1970s, however, these efforts to develop a comprehensive plan for Great Salt Lake proceeded in an environment that might be characterized as Apartly cloudy.@ During this period the federal and state governments were engaged in a pitched legal battle over who owned which parts of the resource to be managed. It was not until this dispute was resolved that management efforts could proceed with greater certainty of ownership and jurisdiction.

B. The Ownership Battle in the U.S. Supreme Court

[212] *See infra* Part III.C (discussing 1975B76 planning process).
[213] LAKE COM REPORT, *supra* note 177, at 9.

> *Because* [*Great Salt Lake*] *is a navigable body of water its bed belongs to the state subject to the control of Congress for navigation in commerce . . .* [*and*] *the state as the owner of the beds of navigable bodies of waters is entitled to all valuable minerals in or on them.*[214]

The Utah Supreme Court=s 1946 finding that the State of Utah owned the lake bed, although ultimately prescient, was overly optimistic in the apparent confidence and finality of the pronouncement. The *Deseret Livestock* decision was not definitive in large part because of disagreement about what constituted the Abed@ of the lake, and ultimately, even about its basic premise that the State owned the bed of the lake.[215] In fact, there was a longstanding dispute between the State and the United States over who owned what parts of the lake, along with its minerals and other natural resources.[216] This dispute was not resolved for another thirty years.[217]

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[214]Deseret Livestock Co. v. State, 171 P.2d 401, 403 (Utah 1946).

[215]*Id*.

[216]*See* Utah v. United States, 394 U.S. 89, 90B96 (1969) (denying Morton Salt=s motion to intervene in ownership lawsuit between state and federal governments).

[217]For a more complete history of the dispute, see Richard L. Dewsnup & Dallin W. Jensen, *Legal Battle Over Ownership of the Great Salt Lake*, *in* GREAT SALT LAKE, *supra* note 28, at 15, 15B18; *see also Special Master=s Report*, *supra* note 180, at 246B326 (including general standards for determining navigability of lakes, discussion of meander lines, and legislative history).

The United States acquired Great Salt Lake (and most of its watershed) from Mexico in 1848 under the Treaty of Guadalupe Hidalgo following the Mexican-American War.[218] When Utah was admitted to the Union on January 4, 1896,[219] however, it acquired under the equal footing doctrine[220] title to the beds

[218] *See* Treaty of Peace, Friendship, Limits, and Settlement With the Republic of Mexico, May 30, 1848, U.S.-Mex., art. V, 9 Stat. 922.

[219] *See* 29 Stat. 876 (1896) (Utah Statehood Proclamation); *see also* United States v. Utah, 283 U.S. 64, 73 & n.3, 90 (1931) (quieting title to beds of Colorado, Grand, and San Juan Rivers based on findings of navigability).

[220] *See* Utah v. United States, 403 U.S. 9, 9B10 (1971) (concluding that because Utah was admitted on equal footing, Utah has claim to Great Salt Lake bed); *see also* Pollard=s Lessee v. Hagan, 44 U.S. 212, 224, 228B29 (1845) (holding that Alabama was admitted to Union on equal footing); Martin v. Waddell, 41 U.S. 366, 410, 416 (1842) (concluding that when New Jersey became sovereign, it held absolute right to navigable waters). The equal footing doctrine ensures that all new states are admitted under the same terms as the original 13 states. *See* United States v. Utah, 283 U.S. at 75 (holding that Aconstitutional principle of the equality of states@ passed navigable rivers to Utah when admitted to Union).

of all navigable waters, known in Utah as Asovereign lands.@[221] While the navigability of some waters in Utah was disputed between the federal and state governments,[222] until 1960, the navigability of the lake, and hence Utah=s basic ownership claims, does not appear to have been in serious dispute. This apparent agreement was reflected in dealings between the state and federal governments,[223] between the State and private parties,[224] and in rulings by the Utah Supreme Court.[225]

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[221]UTAH CODE ANN. ' 65A-1-1(5) (1996) (defining Asovereign lands@ as Athose lands lying below the ordinary high water mark of navigable bodies of water at the date of statehood and owned by the State by virtue of its sovereignty@).

[222]*See* United States v. Utah, 283 U.S. at 75.

[223]*See Special Master=s Report*, *supra* note 180, at 275B78 (describing transactions). The

federal government appeared to acquiesce in the State=s ownership of the lake bed in a number of transactions beginning in 1937, including various leases, purchases, and other payments that would not have been required if the United States retained the lands beneath the lake at the time of statehood. *See id*.

[224]*See id*. at 273B74 (describing transactions). The State began to lease certain lands below the surveyed meander line for commercial mineral extraction as early as 1911, without apparent challenge from the federal government. *See id*.

[225]*See Deseret Livestock*, 171 P.2d at 403 (holding that State owns water and salt therein); *see also* Utah State Rd. Comm=n v. Hardy Salt Co., 486 P.2d 391, 393 (Utah 1971) (holding that doctrine of reliction should not apply to natural, gradual, and imperceptible recission of waters); Robinson v. Thomas, 286 P. 625, 627B28 (Utah 1930) (holding that lands belonged to State because lands were within meander line at statehood).

The Federal Bureau of Land Management (ABLM@) set the stage for the ownership battle in 1960, however, when it announced that it would survey the lake to delineate the boundary between the State=s submerged lands claims and the uplands retained by the United States at the time of statehood.[226] BLM initially determined that the State=s ownership was limited to lands submerged at the time of statehood in 1896, when the lake level was 4201.8 feet.[227] The BLM decision was affirmed by the U.S. Department of the Interior (ADOI@),[228] although for different reasons. Rather than finding that the State=s original ownership claim was limited to the 1896 level, the United States claimed, under the common law doctrine of reliction,[229] all of the lands that were laid bare as the lake later shrunk in size.[230] Of course, the ramification of the federal reliction claim was that the ownership of the disputed lands would change almost continuously as lake levels rose and fell.[231]

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[226]*See* State of Utah, 70 I.D. 27, 31B32 (1963) (explaining that state land board objected to BLM survey); Dewsnup & Jensen, *supra* note 217, at 15. Reading between historical lines, BLM appears to have realized the value of the disputed lands as more and more commercial mineral leases were issued by the State.

[227]*See* Dewsnup & Jensen, *supra* note 217, at 15. Because the lake had receded substantially between 1855 and 1856, when portions of the lake=s meander line were first established, BLM claimed that the lands between the meander line and the lake level at the time of statehood, a difference of some 150,000 acres, belonged to the United States. *See id.*; *Special Master=s Report*, *supra* note 180, at 279. The surveyed meander line is not at a constant elevation around the lake, because different segments were surveyed at different times between 1855 and 1966. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 3. The meander line elevation, therefore, varies between 4202 and 4212 feet. *See id*. For a more detailed and technical explanation, including a history of the meander line, see *Special Master=s Report*, *supra* note 180, at 262B71.

[228]*See State of Utah*, 70 I.D. at 30 (concluding that AUnited States is entitled to alluvion formed by accretion and reliction to the uplands owned by the Federal Government@).

[229]*See* BLACK=S LAW DICTIONARY 1291 (6th. ed. 1990) (defining Areliction@ as an Aincrease of the land by the permanent withdrawal or retrocession of the sea or a river@); *see also* State Eng=r v. Cowles Bros., Inc., 478 P.2d 159, 161 (Nev. 1970) (holding that recission must be gradual and imperceptible).

[230]The reliction argument allowed the United States to claim even greater amounts of land, some 600,000 acres, because water levels in Great Salt Lake reached all-time lows in the early 1960s. *See* Utah v. United States, 394 U.S. at 90B91; Dewsnup & Jensen, *supra* note 217, at 15 (noting that DOI decision Acaused much concern in the State of Utah@); Stephens, *supra* note 19, at 1.

[231]*See* Dewsnup & Jensen, *supra* note 217, at 17.

> If the doctrine of reliction had been applicable to the Great Salt Lake as the United States contended, the title of the United States and other upland owners would follow the water=s edge as it moved from day to day or month to month. But if reliction did not apply, as Utah contended, the fluctuating water level would have no effect on title to the shorelands and the actual boundary, wherever located, would be stable and permanent.

Pending final resolution of the DOI administrative appeal, however, various members of Utah=s congressional delegation introduced legislation seeking to override the federal claims of title to the lake bed.[232] This led to enactment in 1966 of the Salt Lake Lands Act.[233] Rather than purporting to resolve the matter outright, however, the legislation was designed only to provide a mechanism by which the dispute could be decided. In short, the law allowed the State either to purchase the disputed lands at a price determined by DOI, or to litigate the

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Id.

[232]*See, e.g.*, S. 2810, 87th Cong. (1962) (original Senate legislation seeking to vest title to lake bed in State); H.R. 3535, 88th Cong. (1963) (original House legislation seeking to vest title to lake bed in State). For a detailed legislative history, see *Special Master=s Report*, *supra* note 180, at 281B94.

[233]*See* An Act to Authorize Conveyance of Certain Lands to the State of Utah Based Upon Fair Market Value, Pub. L. No. 89-441, 80 Stat. 192 (1966), *amended by* Pub. L. No. 89-592, 80 Stat. 349 (1966) [hereinafter Salt Lake Lands Act].

matter in an original action before the U.S. Supreme Court.[234] The State chose to litigate.

At first blush, the statute appeared to put the State in a win-win situation. It could litigate its claims under the statute, but even if it lost, still purchase them at the price determined by DOI. The State soon learned, however, that nothing in life or litigation is truly risk-free. Once the lawsuit was actually filed, the federal government decided to reverse the positions it had taken for decades and to challenge the State=s ownership interest in the lake outright. As a result of this strategy, the litigation proceeded in several stages, which took nearly a decade to resolve.

[234]The Salt Lake Lands Act directed that the official meander line around the lake be completed. *See id*. ' 1. It then ordered DOI to convey all federal Aright, title and interest@ to lands, minerals, and other resources beneath Great Salt Lake to the State by quitclaim deed, after the survey was completed and an agreement signed pursuant to the act. *See id* ' 6. The State was then given the option to pay fair market value for the lands so conveyed, as determined by DOI, and to convey to the United States all disputed lands upland of the meander line, or to litigate the competing ownership claims. *See id*. '' 3B5(b).

First, in its boldest move, the United States argued that Utah was not, in fact, entitled to any of the lands or resources in or underlying Great Salt Lake because the lake was not Anavigable@ at the time of statehood.[235] Accepting the findings of Special Master Judge J. Cullen Ganey, the Supreme Court rejected the federal claim, finding that the lake was navigable before and at the time of statehood.[236] Based on this ruling, the Court quieted title to the State=s ownership of the portion of the lake bed lying beneath the water=s edge on June 15, 1967, the date of the statutorily-mandated quitclaim deed.[237]

Having accepted the State=s presumptive ownership of lands lying beneath the lake at the time of statehood, the Court next addressed the validity of the federal government=s reliction argument.[238] Once again, the Supreme Court

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[235]*See* Utah v. United States, 403 U.S. at 10. Waters are considered navigable for purposes of the submerged lands doctrine Awhen they are used, or are susceptible of being used, in their ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water.@ *Id*. (quoting The Daniel Ball, 10 Wall. 557, 563 (1870)).

[236]*See id*. at 11B12. This ruling was based on evidence that boats were used on the lake before statehood to ferry livestock, passengers, ore, salt, cedar posts, and other freight. *See id*. at 11B12. The Court also rejected the United States= claim that the lake level had declined so much by 1886 that navigation was no longer practicable, based on the Master=s finding of a maximum depth of over 30 feet in 1886. *See id*. at 12. The United States also argued that even if the State owned portions of the lake bed, it did not thereby own the minerals in solution in lake brines. *See* Dewsnup & Jensen, *supra* note 217, at 16. This claim, however, was withdrawn before decision. *See id*.

[237]*See* Utah v. United States, 406 U.S. 484, 484 (1972).

[238]*See* Utah v. United States, 420 U.S. 304, 304B306 (1975).

ruled in Utah=s favor,[239] based on the recommendations of Special Master Judge Charles Fahy,[240] who found that the processes by which lands beneath Great Salt Lake are exposed as lake levels recede are neither gradual, nor imperceptible, nor permanent.[241]

[239]*See id*. at 306.

[240]Special Master Ganey died following the navigability hearings. *See* Dewsnup & Jensen, *supra* note 217, at 17.

[241]*See* Utah v. United States, 420 U.S. at 306; Dewsnup & Jensen, *supra* note 217, at 17.

Once these arguments were addressed, the remaining issue was reduced to precisely what BLM first alleged in 1960: whether the State owned, in addition to lands that were actually submerged at the time of statehood (when the lake level was 4201.8 feet), the additional acreage below the official meander line.[242] In 1976, the U.S. Supreme Court entered a final decree approving the findings of Special Master Fahy and finally confirming that the State of Utah owns all lands, brines, and other minerals within the waters of Great Salt Lake up to the official surveyed meander line.[243]

C. The 1975B1976 Great Salt Lake Planning Process

1. Legislative Authority

Even before the Supreme Court litigation was concluded, the Utah Legislature set into motion another attempt at comprehensive planning for Great Salt Lake. At the beginning of its 1975 session, the Utah Legislature was presented with the recommendations of the Great Salt Lake Policy-Advisory Committee (ACommittee@).[244] The Committee concluded that Adevelopment and utilization [of Great Salt Lake] will likely not be achieved until a single management entity becomes responsible for coordinating Lake-related activities of the various State and local entities presently authorized to initiate and develop specialized lake-related programs.@[245]

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[242]*See* Utah v. United States, 420 U.S. at 305 (stating that final issue should be referred back to Special Master); Dewsnup & Jensen, *supra* note 217, at 17; *Special Master=s Report*, *supra* note 180, at 250. The United States argued that the State=s interests should be limited to the area within the lake level on the date of statehood (4200.8 feet), or at most, the highest level during the first year of statehood. *See Special Master=s Report*, *supra* note 180, at 252. Utah maintained that the boundary should be determined by the official meander line. *See id*.

[243]*See* Utah v. United States, 427 U.S. 461, 461B62 (1976).

[244]*See* JAMES G. CHRISTENSEN & REED T. SEARLE, GREAT SALT LAKE POLICY-ADVISORY COMM., A SPECIAL REPORT FOR THE UTAH LEGISLATURE (1974) [hereinafter POLICY-ADVISORY

COMM. REPORT].

[245]Letter from Senator E. LaMar Buckner, Chairman, Great Salt Lake Policy-Advisory Comm., to Members of the Utah State Legislature (Jan. 2, 1975) (on file with author) (forwarding copies of POLICY-ADVISORY COMM. REPORT, *supra* note 244).

Based on this report and recommendation, the legislature passed and Governor Rampton signed the Great Salt Lake Division Act (ADivision Act@), creating within the DNR a Division of Great Salt Lake (ADivision@) and a Great Salt Lake Board (ABoard@), whose responsibilities included the preparation and implementation of comprehensive plans for the management of Great Salt Lake,[246] with assistance from an interagency Atechnical team@ comprised of representatives from various divisions within the DNR as well as county planning offices.[247] The Division Act furthered the goals of comprehensive lake management in several ways. It recognized the importance of coordination to reduce potential management conflicts given the complex, inter-jurisdictional, and multiple-ownership regime under which the lake is governed.[248] While still decidedly focused on resource use and extraction,[249] the Division Act departed from its predecessors by recognizing explicitly that Great Salt Lake is a Aunique natural resource of the State, locally and world renowned as a wonder of nature,@[250] and directed that activities be conducted in a manner that Aretain[ed] the lake=s basic identity as a unique, natural body of saline water.@[251] Unlike previous efforts, the Division Act expressly included protection of ecological and other natural values on an apparently coequal basis with resource development and extraction.[252] It demanded a more inclusive, interagency, and iterative approach.[253] Moreover, the Division Act took the bold but important

[246]*See* Great Salt Lake Division Act, ch. 127, 1975 Utah Laws 499 (amended 1979). According to two knowledgeable participants, Governor Rampton deserves much of the credit for taking a strong leadership role regarding the lake. *See* Atwood and Mabey Comments, *supra* note 21.

[247]*See* Great Salt Lake Division Act, ch. 127, ' 9, 1975 Utah Laws 499, 504B05.

[248]*See id*. ' 2, at 500B01.

[249]The statutory policies the plan was supposed to promote included stabilization of lake levels at 4202 feet; encouragement of future water development, although in ways that protect wildlife and recreational values; further extraction of mineral brines; and the development of an integrated industrial complex. *See id*. ' 8, at 502B04.

[250]*Id*. ' 2, at 500.

[251]*Id*. at 501.

[252]*See id*. ' 8, at 502B04. Among the other stated goals and policies to be included in the plan were constituting the lake=s flood plain as a hazard zone for development; regulating water quality in tributary streams and the lake itself; recognizing the lake=s marsh areas Afor the international importance to the waterfowl flyway system@ and maintaining existing state, federal, and private marshlands and rookeries; and identifying other areas suitable for wildlife protection and propagation and to protect them from Aundue encroachment by incompatible uses.@ *Id*.

[253]The Board itself was comprised of representatives of six state boards and five counties, and the Executive Director of the DNR. *See id*. ' 3, at 501. Plans were to be developed in ways that maximized the exchange of information among all levels of government, private concerns, and the general public. *See id*. ' 8, at 502B04. Cooperation was required with county planning

implementing step of requiring that A[a]ll actions by state, county, or local entities or agencies shall be in harmony with the comprehensive plan . . . once that plan has been adopted.@[254]

Despite these generally positive changes from prior planning and management approaches, the Division Act still lacked several key aspects of true, comprehensive watershed protection. It clearly reflected a *lake* management rather than a *watershed* management philosophy. The Division Act was directed only at the Alake@ itself, which was defined to include Aall waters and lands within that outer perimeter established by the 4,212 feet elevation meander lines.@[255] The effectiveness of the Aharmony@ provision cited above[256] was sharply limited given the accompanying provision, which provided with considerably duller teeth that the Board and Division need only Acooperate@ with state, federal, or local entities Ain relation to those lands and waters within the . . . influence of the lake, but beyond its boundaries as it may deem appropriate.@[257] Yet virtually all of the actions likely to be taken by other state, federal, and local entities would, because of the law=s narrow definitional coverage, be outside the boundaries of the lake. Similarly, while the legislation made considerable progress in moving toward a watershed approach by even recognizing the relationship between upstream water use, water quality, and the health of the lake itself, it immediately eliminated the ability of the Division to address such relationships by directing that the Division Ashall not in any manner interfere with or impair existing water rights nor shall it have any

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commissions and federal land agencies to define the lake=s flood plain, and with the state engineer and upstream water agencies, cities, and municipalities in considering the relationship between the lake and its tributaries. *See id*. Assistance from the DNR was to occur through an interagency technical group and county planning offices and the plan was to be revised and updated periodically with the same type of interagency and public involvement. *See id*. '' 8B9, at 502B05.

[254]*Id*. ' 12, at 505B06.

[255]*Id*. ' 1, at 500.

[256]*See supra* note 247 and accompanying text.

[257]Great Salt Lake Division Act, ch. 127, ' 12, 1975 Utah Laws 499, 505B06.

authority to administer water rights.@[258] As always in the West, water rights were inviolate, regardless of ecological impacts or realities.

2. The Planning Process and the 1976 Plan

[258] *Id*.

The *1976 Great Salt Lake Comprehensive Plan* (A*1976 Plan*@)[259] itself was developed in relatively short order, but was intended only as a Ageneral framework@ subject to ongoing modification and refinement.[260] The Board was appointed shortly after the Division Act was passed, comprising representatives from several state agencies and boards[261] and county commissioners from the five counties bordering the lake.[262] In addition, a technical team and several subcommittees were assembled with other public officials (including some from the federal government) and some academics, but no members of interest groups or the general public.[263] A preliminary plan was prepared by the Division and the various subcommittees and recommended to the Board, which adopted the *1976 Plan* after some twenty-five meetings during 1975 and 1976.[264] The *1976 Plan*

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[259]*See* BOARD OF GREAT SALT LAKE, DEPARTMENT OF NATURAL RESOURCES, GREAT SALT LAKE COMPREHENSIVE PLAN (1976) [hereinafter 1976 PLAN]. *See generally* Owen W. Burnham, *The Great Salt Lake Comprehensive Plan*, *in* GREAT SALT LAKE, *supra* note 28, at 47 *passim* (discussing 1976 PLAN).

[260]The *1976 Plan* was presented as a Afirst effort to establish a general framework for decisions on use and development of the Lake and to coordinate the activities of many public agencies and private interests on the Lake.@ 1976 PLAN, *supra* note 259, at 2.

[261]*See id*. at i. These included the DNR, the Board of Water Resources, the Board of State Lands, the Board of Industrial Development, the Board of Parks and Recreation, and the Board of Wildlife Resources. *See id*.

[262]*See id*. The five counties are Box Elder, Davis, Salt Lake, Tooele, and Weber. *See id*.

[263]*See id*. at iiBiii.

[264]*See id*. at 2. The *1976 Plan* was accompanied by a Great Salt Lake Environs Report, which summarized and graphically portrayed the Amost current, accurate and reliable data available concerning land use, land ownership, soils, vegetation, man-made structures, access ways, fresh water and utilities lying between the water=s edge . . . on January 1, 1976, and the [meander line].@ *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 8

identified four overarching goals, each of which was accompanied by a set of more specific policies, many of which tracked those specified in the legislation virtually verbatim, and a series of six major policy Aelements@ addressing different categories of lake uses.

(describing preparation of 1976 PLAN).

The first major goal was to establish a comprehensive plan via a continuing, participatory planning process that would be responsive to both current and future needs.[265] This goal reflected a major step forward toward sound planning for the future of the lake. Several limitations inherent in the authorizing legislation, however, inhibited full realization of this goal. These limitations included a jurisdiction that was constrained within the lake=s artificially-defined meander line, and the relegation of entities other than state and local governments to a cooperative rather than full partnership status.

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[265] *See* 1976 PLAN, *supra* note 259, at 7. The *1976 Plan* recognized:

> The Great Salt Lake is a constantly changing body of water, enlarging and shrinking during the seasons of the year and expanding and receding as wet and dry cycles of weather affect the Great Salt Lake Drainage Basin. Planning for the lake must be a long term, continuous process, concerned with the lake itself, the immediate environs, and the tributaries and their service areas.

Id. at 2. To accomplish this goal, the *1976 Plan* identified the need to seek cooperation from all interested groups, both public and private; to prepare and maintain the plan; to encourage the surrounding five counties Ato work harmoniously in the preparation of compatible comprehensive plans for the use of land surrounding the Lake and adopt ordinances and rules and regulations to effectuate those plans@; to develop guidelines Aaimed at pointing out the desirable direction of activities and operations for the Lake@; to adopt rules and regulations regarding operations at the lake; to define and identify the flood plain Aand recognize it as a hazard zone for management and development@; and to act as a central clearinghouse for studies, investigations, and activities about the lake. *Id*. at 7B8.

The second goal was to Apreserve, insofar as reasonable, the Great Salt Lake=s basic identity as a useable and unique natural body of saline water.@[266] As noted above, this goal at least recognized, in contrast to earlier efforts, the desirability of preserving the lake=s unique values.[267] The qualifying words Ainsofar as reasonable,@ however, lent an uncomfortable degree of uncertainty to the concept. Moreover, several of the subsidiary policies, such as efforts to maintain lake levels within prescribed bounds, suggest more artificial management and less preservation of natural hydrological and ecological variability.

[266]*Id*. at 8. Specific accompanying policies were to investigate the desirability and political feasibility of controlling lake levels but to recognize some variations in those levels; to recognize varying lake levels from natural wet-year and dry-year cycles; to Amaintain contact with various agencies having control of upstream water to insure a fore-knowledge of any radical changes of inflow@; to Aencourage@ upstream management to retain maximum water storage in wet years and to encourage releases in dry years; to evaluate alternatives for the modification or maintenance of the Southern Pacific railroad causeway; and to give special consideration to the effects of existing and future dikes and other structures on lake levels and salinity. *Id*.

[267]*See supra* note 250 and accompanying text.

The third major goal was to Aencourage, promote, and protect the harmonious and compatible development of recreation, industry, wildlife, aesthetic, and other multiple uses of the lake and its environs.@[268] This goal, along with its subsidiary policies, reflected classic multiple-use doctrine. Indeed, the six specific policy elements of the *1976 Plan* reflected a multiple-use approach. Each policy element addressed specific uses of the lake for either development or protection, as the case might be, of minerals, recreation, tourism, wildlife, transportation, and hydrology. Proper Azoning@ of the lake and adjacent lands would ensure compatible uses and avoid conflicts between such seemingly *incompatible* uses as oil and gas development and protection of the nesting and staging habitats of birds and other species that are highly sensitive to such development.[269] Thus, the lake could apparently both be used and protected at

[268]1976 PLAN, *supra* note 259, at 9. Accompanying policies were to advise existing interests and to advise future tenants of flood plain hazards and projected water levels; to identify areas on the lake and surrounding land for allocation of the most appropriate Aharmonious@ uses, Abut where necessary [to] identify areas which should be protected from encroachment of incompatible uses@; to identify and foster new compatible uses Ato broaden the industrial and recreational-tourism economy@; to support recreational development at Antelope Island, Farmington Bay, and the south shore; to evaluate the lake, adjacent lands, and related resources to identify the most desirable areas for future industrial development; to encourage oil exploration Aprovided the necessary safeguards are taken to protect the environment of the lake@; to support maintenance and expansion of existing state, federal, and private marshlands and rookeries; to identify additional areas (such as Gunnison, Cub, Carrington, Hat, and Dolphin Islands) that are potentially suitable for wildlife protection and to protect them from incompatible uses; to support better public access; to support appropriate off-limit zones around Gunnison and Cub Islands and other areas during the nesting season and the rest of the year; and to encourage and assist high standards of design, building, and landscaping for all developments. *Id*. at 9B10.

[269]At the time the *1976 Plan* was devised, about two thirds of the lake was leased for oil exploration. *See id*. at 13.

the same time. All interest groups would be happy. Specific choices would have to be made about where to allow each use (or nonuse) to occur. Any truly hard choices, like saying Ano@ to some uses that might not in fact be compatible with the protection of the lake as a healthy natural system, could be avoided. Whether or not such an optimal development and protection strategy could actually be achieved, however, especially given the tremendous existing uncertainties regarding the impacts of commercial, industrial, and recreational uses on the sensitive ecology of the lake, remained to be proven.

The fourth major goal of the *1976 Plan* was to Aencourage acceptable standards of health and safety of persons and property in the waters of Great Salt Lake and on adjacent shore lands.@[270] Included within this general rubric were both boating safety[271] and a somewhat hesitant focus on water pollution control.[272] Thus, while restoring and maintaining water quality has been the centerpiece of watershed protection programs in places like the Chesapeake Bay and the Great Lakes,[273] it was relegated to Amaybe@ status in the last of four major goals in the *1976 Plan*.

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[270]*Id*. at 10.

[271]*See id*. Boating safety was to be achieved through marinas, a navigational aid system, education, and appropriate search and rescue operations. *See id*.

[272]*See id*. The accompanying water pollution policies were to encourage more research on lake pollution Aand to assess the capacity of the Lake to receive waste@; and to consider the need for a lake water quality management program. *Id*. More research was clearly needed, given existing evidence of pollution problems in the lake. *See* Marvin H. Maxwell & Lynn M. Thatcher, *Coliform Bacteria Concentrations in Great Salt Lake Waters*, *in* GREAT SALT LAKE, *supra* note 28, at 323, 324 (noting that 1965 studies showed Apositive evidence@ of sewage pollution in lake). The *1976 Plan*=s focus on assimilative capacity, however, ran counter to the recently-adopted mandates of the 1972 Clean Water Act. *See* Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act), Pub. L. No. 92-500, 86 Stat. 816 (codified as amended at 33 U.S.C. '' 1251B1387 (1994 & Supp. III 1997)). The Clean Water Act focused more on pollution prevention at the source and less on the ability of a water body to absorb punishment. *See* EPA v. State Water Resources Control Bd., 426 U.S. 200, 202 (1976) (stating that congressional intent for Clean Water Act was to change focus to pollution prevention). *See generally* 1 WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW ' 4.1, at 260B62 (2d ed. 1994) (considering relationship between state and federal pollution control plans).

[273]*See* Adler, *supra* note 5, at 1071B75.

D. The Implementation Hiatus

Despite its limitations, the *1976 Plan* might have provided a reasonable beginning for an iterative, gradually-expanding and gradually-improving process. The plan itself recognized the critical need for both periodic updates and actual legislative authority, funding, and implementation of its recommendations.[274] Unfortunately, in most respects the *1976 Plan*=s recommendations simply have not been implemented, and efforts to revise and update them have been more than two decades in coming.

[274]*See* 1976 PLAN, *supra* note 259, at 47B48 (noting that A[e]ven after adoption the [1976] Plan will have little effect unless a program of action to make the plan work is vigorously pursued@).

This lack of implementation might be explained in part by chronic changes in the authorizing legislation and in the management structure governing the planning process. Just three years after the *1976 Plan* was developed, the Utah Legislature substantially modified the authorizing statute by passing the Great Salt Lake Management and Development Act (A1979 Development Act@).[275] Perhaps most significantly, the 1979 Development Act eliminated the Division, whose functions were transferred to other divisions within the DNR.[276] While the Board remained,[277] its authority was reduced from real to purely advisory in nature.[278] While seemingly just structural, these bureaucratic changes altered the basic process in two important ways. Staff functions were transferred from a dedicated division within the DNR devoted entirely to Great Salt Lake issues, to the Executive Director of the entire DNR, who might choose to give them high priority or none at all.[279] These functions were later transferred to the Division of State Lands and Forestry,[280] and then to the reorganized Division of Sovereign Lands and Forestry,[281] which was later renamed the reorganized Division of Forestry, Fire and State Lands (AForestry Division@).[282] Given the pace of this

[275]Great Salt Lake Management and Development Act, ch. 163, ' 1, 1979 Utah Laws 901, 902 (amended 1983).

[276]*See* 1995 PLAN, *supra* note 21, at 12.

[277]*See* Great Salt Lake Management Act, ch. 202, ' 1, 1983 Utah Laws 802, 802 (repealed 1988).

[278]*See* Great Salt Lake Division Act, ch. 127, ' 3, 1975 Utah Laws 499, 501 (amended 1979) (creating Division and Board for Athe purpose of establishing and coordinating programs@). The Board was given specific powers and duties to establish policies and promulgate rules and regulations. *See* UTAH CODE ANN. ' 65-8a-7 (1975). The Division=s role was to prepare and implement a specific plan for the lake. *See id*. ' 65-8a-8. Under the 1979 Development Act, the Board=s duties had Athe purpose of *advising* [the DNR] on establishing and coordinating programs.@ Great Salt Lake Management and Development Act, ch. 163, ' 2, 1979 Utah Laws 901, 902B03 (emphasis added) (reenacting UTAH CODE ANN. ' 65-8a-2 (1979)); *see also* UTAH CODE ANN. ' 65-8a-6 (1979) (relegating Board to purely advisory status). Some commentators also observe that because the Board consisted mainly of representatives of other state boards, *see supra* note 253, it lacked many individuals with a true interest in the lake itself. Therefore, the Board did not fulfill an Aadvocacy@ role on behalf of the lake. *See* Atwood and Mabey Comments, *supra* note 21.

[279]*Compare* Great Salt Lake Division Act, ch. 127, ' 1, 1975 Utah Laws 499, 500 (defining ADirector@ as AExecutive Director of the Division of Great Salt Lake@), *with* Great Salt Lake Management and Development Act, ch. 163, ' 2, 1979 Utah Laws 901, 902B03 (defining ADirector@ as Aexecutive director of the department of natural resources@).

[280]*See* Great Salt Lake Management Act, ch. 202, ' 1, 1983 Utah Laws 802, 802 (repealed 1988).

[281]*See* 1995 PLAN, *supra* note 21, at 3B4 (outlining planning procedure).

[282]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 1, 8. In 1994 and 1995, the agency was pared down to a bare minimum, with all authority concentrated within a single DNR Division. *See infra* Part III.E.1 (discussing 1994B95 planning process).

game of jurisdictional musical chairs, it is little wonder that little if any implementation of the *1976 Plan* was possible. Moreover, the benefits of a multi-jurisdictional board were minimized substantially by relegating them from a decision-making to a purely advisory role. In 1983, whatever residual power was left in the Board was diluted further when the Board was redesignated as the Great Salt Lake Advisory Council (AAdvisory Council@).[283]

[283]Great Salt Lake Management Act, ch. 202, ' 2, 1983 Utah Laws 802, 802B03. While there was not much actual authority left to eliminate, the Board at least was directed to meet regularly. *See* UTAH CODE ANN. ' 65-8a-5 (1979) (requiring that Board meet at least every two months). Under the 1988 version of the law, meetings were required only when called by the chairman or six members. *See* UTAH CODE ANN. ' 65-8a-5 (1988).

Moreover, the 1979 Development Act amendments included several fundamental changes in the substantive provisions of the 1975 Division Act. First, the provision of the Division Act that extolled Great Salt Lake as a Aunique natural resource@ and Aintrinsically valuable as a natural body of saline water,@ and that directed that management should be accomplished so as to Aretain the lake=s basic identity@ was deleted altogether.[284] Even if this language was hortatory rather than mandatory, it had important symbolic value and evidenced a legislative intent to balance the lake=s ecological values against its human uses. Moreover, the provision in the Division Act requiring other state, county, and local actions to be Ain harmony with the comprehensive plan for the lake,@ and encouraging cooperation with respect to lands and waters outside the lake proper, was similarly repealed.[285] While this provision might have been limited in its ultimate scope and effect, the concept that other governmental actions must conform if the plan was to have any real meaning was critically important. Moreover, several changes were made in the specific instructions governing the planning process, some of which suggested decidedly less of a

[284]Great Salt Lake Division Act, ch. 127, ' 2, 1975 Utah Laws 499, 500B01 (repealing UTAH CODE ANN. ' ' 65-8a-1 to -12 (1975); and reenacting UTAH CODE ANN. ' ' 65-8a-1 to -8 (1979)). The 1979 Development Act contained no provision similar to old section 65-8a-2 of the Utah Code, which had acknowledged the lake=s Aintrinsic[] valu[e].@ *See* Great Salt Lake Management and Development Act, ch. 163, 1979 Utah Laws 901 (amended 1983) (focusing on Adevelopment . . . , flood control, wildlife resources, industrial uses, and conservation@).

[285]*Compare* Great Salt Lake Division Act, ch. 127, '12, 1975 Utah Laws 499, 505B06 (promoting Aharmony@ between agencies and plan), *with* Great Salt Lake Management and Development Act, ch. 163, ' 2, 1979 Utah Laws 901, 902B03 (containing no similar provision).

focus on protection and more of a focus on development.[286] Most ominously, especially in light of subsequent hydrological events, the 1976 directive to Aminimize the chance of the level of the lake exceeding an elevation of 4202 feet@[287] was changed to a firmer command to Amaintain that level of the lake below an elevation of 4202 feet.@[288] Even if this last change was unrealistic in its hubris, it clearly demonstrated an important shift in the philosophy of the planning process.

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[286]*Compare* Great Salt Lake Division Act, ch. 127, ' 8, 1975 Utah Laws 499, 502B04, *with* Great Salt Lake Management and Development Act, ch. 163, ' 2, 1979 Utah Laws 901, 902B03. In particular, the 1979 Development Act directed the DNR to Aencourage@ and Apromote@ various forms of development, while the 1975 Division Act said only that the plan should Arecognize the necessity@ of such development. Moreover, the 1979 Development Act required the DNR only to Amaintain the lake and marshes as important to the waterfowl flyway system,@ while the 1975 Division Act also required planners to identify Aadditional areas that might be suitable for wildlife protection and propagation and that should be protected.@

[287]Great Salt Lake Division Act, ch. 127, ' 8(1)(a), 1975 Utah Laws 499, 503.

[288]Great Salt Lake Management and Development Act, ch. 163, ' 2, 1979 Utah Laws 901, 902B03.

In part, the hiatus in the planning process was understandable given the lake=s own hydrological intervention during the massive floods of the mid-1980s,[289] which generated a major planning crisis of its own, as state and local officials scrambled to decide how best to Acontrol@ the lake within acceptable boundaries.[290] As water levels continued to rise in 1983, the Forestry Division developed the Great Salt Lake Contingency Plan, which sought to accomplish the DNR=s legislative mandate of maintaining lake levels below 4202 feet.[291] Of course, this plan erroneously predicted that the lake would peak that year at 4203 feet, when in fact it continued to rise to almost 4212 feet four years later.[292] Moreover, as described above,[293] considerable effort was devoted during this period to evaluating alternative ways to prevent the lake from rising yet further, and to implementing those strategies.

In 1987 and 1988, after lake waters began to recede, another plan, called the *General Management Plan*, *Great Salt Lake*, was prepared for the Advisory Council.[294] The title of this so-called Ageneral plan,@ however, was highly misleading. Along with a companion effort by the Utah Division of Comprehensive Emergency Management (AUDCEM@), this five-year plan was designed primarily to evaluate strategies to avoid flood-related impacts during expected high-water conditions in the ensuing years.[295] While efforts to plan for flood protection were certainly understandable given the events of the previous years, it was hardly the type of Ageneral@ or comprehensive plan envisioned by the statute. Moreover, planning to accommodate flood-level waters would have been far more effective had it been completed as lake levels rose, not as they were on the decline.

While it is easy to criticize the fact that the *1976 Plan* largely collected dust, clearly attention was focused elsewhere, rendering a continued planning and implementation effort unlikely. Nevertheless, the stated intent of the *1976 Plan* was to serve as a mere starting point for later refinements. These changes did not materialize for almost another two decades. Moreover, given the

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[289] *See supra* notes 153B64 and accompanying text (describing effects of flooding and West Desert Pumping Project).

[290] When the West Desert pumps were inaugurated, Utah=s then governor, Norm Bangerter, reportedly said: AWe are finally in control.@ WILLIAMS, *supra* note 87, at 247.

[291] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 8.

[292] *See id*.

[293] *See supra* notes 153B64 and accompanying text.

[294] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 9.

[295] *See id*. The UDCEM recommended in 1985 that development be limited within the 4217-foot elevation contour (the so-called ABeneficial Development Area@ (ABDA@)) to limit future flood losses. *See* Atwood & Mabey, *supra* note 47, at 491. Similar efforts were adopted as part of the *1986 Salt Lake City Master Plan* and by Davis County. *See id*.

realization that Great Salt Lake is prone to dramatic periodic changes in size, the very fact that the 1976 effort failed to consider the ramifications of diverse lake levels reflected a serious flaw in thinking. Clearly, future planning efforts must come to grips with the lake=s dynamic nature.

E. The Current State Planning Process

In the past several years, the Great Salt Lake planning process has been rejuvenated under the same basic planning provision used to write the *1976 Plan*, as amended in 1979, 1983 and 1988.[296] The renewed planning effort has proceeded in fits and starts, however, with little clarity about the coordination and relationship between the new effort and the *1976 Plan*, and between various documents that have been prepared over the past several years. Since 1995 at least three separate planning documents have been prepared, but as yet there is little clarity about how they fit together in an integrated way. Moreover, in the interim, the legislative delegation of authority has changed once again.

1. The 1995 Great Salt Lake Comprehensive Management PlanCPlanning Process and Matrix

As of 1988, authority to prepare, adopt, amend, and implement a plan was concentrated within a single state agency (the DNR, through what was then called the Division of State Lands and Forestry)[297], with advisory input from the Advisory Council[298] and the Great Salt Lake Technical Team (ATechnical Team@).[299] In 1992, the Technical Team began work on revisions to the *1976 Plan*.[300] Specifically, each of the thirty-two members of the Technical Team at that time[301] was asked to Aprepare and present to the team input, from the perspective of the member=s affiliation,@ on problems, opportunities, issues, and recommendations regarding the lake.[302] These issues were then evaluated by the team as a whole, and compiled into a series of recommendations.[303] The degree of public input into this planning process appears to have been quite limited.[304]

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[296]*See* UTAH CODE ANN. ' 65A-10-8 (1996).

[297]*See* Trust Land Management Act, ch. 121, ' 11, 1988 Utah Laws 548, 562B63 (amended 1994).

[298]*See id*.

[299]*See id*.

[300]*See* 1995 PLAN, *supra* note 21, at ii

[301]Members included representatives of federal, state, and local agencies and governments, and economic interests such as brine shrimping, mineral extraction, tourism, and transportation. *See id*. A full list is included in the *1995 Plan*=s Appendix A. *See id*. app. a. Notably absent was

any representation from environmental groups, nonbusiness lake users (such as hunters, boaters, or other recreation users), or the general public. *See id*.

[302]*Id*. at ii.

[303]*See id*. at iii.

[304]The only statement in the document about public participation is rather equivocal: APublic input received by the process, at whatever level or stage of planning, is incorporated in the plan, where applicable, and included in recommendations for action.@ *Id*. at 5. However, no information is provided on the nature and amount of public participation opportunities that were provided. A later DNR document acknowledges that input was sought from lake industries, but does not mention other user groups or the public at large. *See* MINERAL LEASING PLAN, *supra* note 36, at 25.

This work culminated in 1995 in the *Great Salt Lake Comprehensive Management Plan—Planning Process and Matrix* (the *1995 Plan*), which was prepared by the Technical Team for the Division of Sovereign Lands and Forestry (at the time, the DNR Division delegated responsibility for the lake planning process) and the Board of State Lands and Forestry.[305] By this time, however, the state legislature had once again amended the Great Salt Lake planning statute by eliminating the Advisory Council altogether, thus further concentrating control over the process within the Forestry Division with advice from the Technical Team.[306]

The precise legal status of the *1995 Plan* under the planning statute, and how it related to the existing plans, is not entirely clear. The *1995 Plan* itself explained:

> The last revision of the [1976] plan was in 1987. That plan was completed during the 1982–1987 flooding experienced by Utah. The previous plan (1976) was completed during a severe drought. These plans reflected more of

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[305] *See* 1995 PLAN, *supra* note 21, at ii–iii. The document was signed by the chairman of the technical team, and somewhat curiously, reviewed and approved the same day by the Sovereign Lands Unit Manager and the Director of the Division respectively. *See id.* cvr. Obviously, the DNR staff were sufficiently involved with the ongoing process that this review and approval step was a mere formality.

[306] *See* State Lands Amendments Act, ch. 267, 1995 Utah Laws 864 (repealing UTAH CODE ANN. ' 65A-10-4 (1994)); *see also* School and Institutional Trust Lands Management Act, ch. 294, 1994 Utah Laws 1304 (repealing UTAH CODE ANN. '' 65A-10-5 to -7 (1988)). At the same time, however, the more generic Forestry, Fire and State Lands Advisory Council was created to advise the Division of Sovereign Lands and Forestry on planning and management of all state sovereign lands. *See* UTAH CODE ANN. '' 65A-1-2 to -3 (1994). Apparently, according to one participant in the process, at least one version of the *1995 Plan* was reviewed by the Advisory Council before that body was eliminated. *See* Manuscript Comments of Wayne Martinson 5 (Mar. 3, 1999) (on file with author) [hereinafter Martinson Comments].

the current events of those years, with input from a very limited group of members.[307]

[307] 1995 PLAN, *supra* note 21, at ii.

This language gives the appearance that neither the 1976 Aplan@ nor the 1987 Aplan@ was still considered to be effective. While never formally repealed, perhaps they were simply deemed void through lack of implementation. Elsewhere, the text suggests that the Technical Team had spent the previous three years Aupdating@ existing management plans,[308] suggesting that the earlier plans were still in effect, and were merely revised by the 1995 document. Such ambiguities in the text create uncertainty about the status of the plan. For example, it is not clear whether management of Great Salt Lake is still guided by the broad set of goals and policies enumerated in the *1976 Plan*.[309]

Even the title of the *1995 Plan* is confusing. The main titleC*Great Salt Lake Comprehensive Management Plan*Csuggests that it is a *plan*. At various places the text identifies the document as a standalone plan, or at times *the* Comprehensive Management Plan.[310] The subtitle, howeverC*Planning Process and Matrix*Csuggests that it is merely a framework for a continuing process, with a formal revision or replacement to the *1976 Plan* to follow. Perhaps this subtitle appropriately reflects an iterative approach to planning for the lake, as reflected by the following explanation: AThe plan is an ongoing document with completed implementations of recommendations being added as part of this matrix, and new issues and opportunities addressed as they arise. It will be reviewed periodically and updated as needed.@[311] The lack of clarity about the nature of the document itself, however, and its relationship to and the continuing viability of the earlier plans, left the status of the planning process quite unclear.

The applicability and enforceability of the *1995 Plan* are also somewhat unclear. At one point, the document states that it A*applies* to federal, state, and local governments and private land owners and users.@[312] Of course, the portions of the planning statute that addressed the legal applicability of the plan to outside entities had been repealed in 1979, rendering the enforceability of the *1995 Plan* to those outside the DNR questionable at best.[313] Perhaps the word Aapplies@ was not intended to imply enforceability. Elsewhere, in fact, the document more clearly acknowledges its limited role: providing analysis and

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[308] *Id*.

[309] *See* 1976 PLAN, *supra* note 259, at 7B10 (listing goals and policies); Great Salt Lake Division Act, ch. 127, 1975 Utah Laws 499 (amended 1979) (including legislative determination that lake is Aunique natural wonder@ and Aintrinsically valuable@ and provision that Aall actions of state, county, or local entities or agencies shall be in harmony with the comprehensive plan@); *supra* notes 265B73 and accompanying text (discussing goals and policies of 1976 PLAN).

[310] *See* 1995 PLAN, *supra* note 21, at 2B3.

[311] *Id*. at 3.

[312] *Id*. (emphasis added).

[313] *See supra* notes 275B83 and accompanying text (describing jurisdictional changes from 1976 to 1979).

recommendations to the DNR as well as other governmental and private interests.[314]

[314]*See* 1995 PLAN, *supra* note 21, at 2 (stating that purpose of plan is to Aassist decision-makers by providing analyses of situations and alternatives and by making recommendations to meet identified needs, solve problems, resolve issues and potential conflicts, achieve goals, protect existing authorized uses, and otherwise prepare for future potential uses with as little conflict as practical in the multi-faceted management of the lake=s multiple resources@).

Substantively, the *1995 Plan* reflected a somewhat broader focus than earlier plans, although the manner in which major issues were treated separately demonstrated the same lack of an integrated approach as did the earlier efforts. First, the document purports to apply to the lake Aand the inclusion conceptually of enough area beyond the surveyed meander line to consider appropriate interrelationships.@[315] While the exact degree to which the plan actually considers and affects lands outside the lake=s meander line is not clear, at least this language properly recognizes that land use and activities in the watershed are critically important to the health of the lake itself.[316] However, the legal basis for planning outside the meander line was not clear. The statutory definition of Great Salt Lake as including all lands and waters within the meander line,[317] and the concomitantly narrow limitation of planning authority, was eliminated when the state land statutes were amended and reorganized in 1988.[318] These changes may have been unintentional, since unfortunately there is no evidence that the legislature intended to *broaden* the scope of the planning process to include the lake=s watershed rather than the lake itself. Moreover, the specific statutory limitation with respect to Great Salt Lake could have been viewed as redundant and superfluous, because the DNR=s jurisdiction is limited to sovereign lands

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[315]*Id*. at 2B3.

[316]*See infra* Part V (proposing development and implementation of comprehensive watershed-based management for lake).

[317]*See* Great Salt Lake Management Act, ch. 202, ' 1, 1983 Utah Laws 802, 802 (retaining legal definition of Great Salt Lake).

[318]*Compare* Great Salt Lake Management Act, ch. 202, ' 1, 1983 Utah Laws 802, 802 (retaining legal definition of Great Salt Lake), *with* Trust Land Management Act, ch. 121, ' 2, 1988 Utah Laws 548, 548B50 (excluding definition of Great Salt Lake). The specific statutory provision limiting the planning process to the surveyed meander line was repealed in 1994 and 1995, when the statutory authorization for the Great Salt Lake Advisory Council was repealed. *See supra* note 306 and accompanying text.

owned and managed by the State,[319] which in this case consists only of lands up to the official meander line.[320]

[319] *See* UTAH CODE ANN. ' ' 65A-10-1 to -3 (1996).

[320] *See supra* note 221 and accompanying text (describing legal definition of sovereign lands).

Second, the *1995 Plan* affirmatively recognized statutory and other legal directives and procedures that govern the planning, management, use, and protection of Great Salt Lake besides the lake-specific statutory planning provision and statement of policies.[321] These broader legal authorities included the common law and state constitutional public trust doctrines, discussed below,[322] and general state public land statutes and regulations. However, the manner and extent to which such authorities actually influenced the process and resulting recommendations is not evident.

[321]*See* 1995 PLAN, *supra* note 21, at 14B16 (discussing lake management interests and statutory lake management authority).

[322]*See infra* notes 324B28 and accompanying text.

The public trust doctrine, a derivative of early Roman law and later English common law, provides that lands beneath navigable waters are held by the government in trust for the community.[323] The doctrine is recognized specifically in the Utah Constitution,[324] and has been applied judicially to protect ecological values on public lands[325] and waters[326] in the state. While initially limited to

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[323]*See generally* Illinois Cent. R.R. v. Illinois, 146 U.S. 387, 455–56 (1892) (holding that act by Illinois Legislature divesting vast parts of bed of Lake Michigan to private railroad offended public trust doctrine); Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 489–91 (1970) (arguing that public trust doctrine is useful tool for resolving resource management problems).

[324]*See* UTAH CONST. art. XX, ' 1. State lands Aare hereby accepted, and declared to be the public lands of the State; and shall be held in trust for the people.@ *Id*.

[325]*See* National Parks and Conservation Ass=n v. Board of State Lands, 869 P.2d 909, 919 (Utah 1993) (stating that A[t]he >public trust= doctrine . . . protects the ecological integrity of public lands and their public recreational uses for the benefit of the public at large@). The *National Parks* court, however, recognized the distinction between sovereign lands, which are fully subject to the public trust doctrine, and School Lands, which must be used to maximize economic returns for the benefit of the state public school system. *See id*. at 919–21.

[326]*See* Colman v. Utah State Land Bd., 795 P.2d 622, 635–36 (Utah 1990) (holding that State=s action to breach causeway in Great Salt Lake furthered public trust responsibilities,

protection of commerce, navigation, and fisheries on navigable waters, courts more recently have expanded the doctrine to include ecological and other public values as well.[327] According to the DNR, these trust uses also have been expanded legislatively Ato include industrial development to enhance the state=s economy@ via the Great Salt Lake planning statute.[328] While it is certainly permissible for the state legislature to define other appropriate uses on state lands if fully consistent with the underlying common law and constitutional public trust uses, it is hard to see how a legislative enactment lawfully could undermine or conflict directly with those uses.

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rendering State not liable for damages to mineral companies caused by breach). *See generally* Teresa Mareck, *Searching for the Public Trust Doctrine in Utah Water Law*, 15 J. ENERGY NAT. RESOURCES & ENVTL. L. 321, 333B34 (1995) (examining Utah decisions applying public trust doctrine to public lands and water appropriations).

[327]*See, e.g.*, National Audubon Soc=y v. Superior Ct., 658 P.2d 709, 723B24 (Cal. 1983) (holding that private water rights are held subject to public trust in favor of people=s common heritage of streams, lakes, marshes, and tidelands); Matthews v. Bay Head Improvement Ass=n, 471 A.2d 355, 364B66 (N.J. 1984) (upholding right of public access to and use of sandy beaches above high tide for recreational purposes).

[328]1995 PLAN, *supra* note 21, at 71; *see* UTAH CODE ANN. ' 65A-10-8 (1996) (requiring Great Salt Lake planning process to take steps to encourage economic development as well as protection of lake resources).

General state land statutes also were identified in the *1995 Plan* as applicable to Great Salt Lake planning.[329] The Forestry Division is responsible for management of all Asovereign lands,@[330] including those owned by the State below the Great Salt Lake meander line pursuant to the U.S. Supreme Court litigation.[331] As noted in the *1995 Plan*, the statutory directives governing the Forestry Division=s management of these lands include a statutory recognition of the public trust doctrine,[332] as well as authority to set aside public lands for public or recreational use[333] and to develop plans to resolve boundary disputes involving sovereign lands.[334] However, the *1995 Plan* did not explicitly acknowledge the potential applicability of other general authorities for the planning, management, and use of state lands.[335] It is not clear whether this exclusion was an oversight, or whether the planners believed that the specific authorities dictating the uses and policies for which Great Salt Lake was to be managed overrode these more general provisions.[336] Finally, the *1995 Plan* identified a DNR regulation stating the management objectives for sovereign

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[329]*See* 1995 PLAN, *supra* note 21, at 14B16 (discussing lake management interests and authority).

[330]ASovereign lands@ are Athose lands lying below the ordinary high water mark of navigable bodies of water at the date of statehood and owned by the state by virtue of its sovereignty.@ UTAH CODE ANN. ' 65A-1-1(5) (1996). In 1996, management of sovereign lands by the Forestry Division was separated from management of state school trust lands, which are now administered for more specific purposes under the School and Institutional Trust Lands Management Act. *See id.* '' 53C-1-101 to -5-104 (1997 & Supp. 1998).

[331] *See id.* ' 65A-1-4 (1996); *see also supra* Part III.B (discussing U.S. Supreme Court litigation).

[332]*See* 1995 PLAN, *supra* note 21, at 15; *see also* UTAH CODE ANN. ' 65A-10-1 (1996) (authorizing Forestry Division to manage and sell limited quantities of sovereign lands Afor the purposes as serve the public interest and do not interfere with the public trust@).

[333]*See* UTAH CODE ANN. ' 65A-10-2 (1996).

[334]*See id*. ' 65A-10-3.

[335]Other potentially applicable authorities included general procedures for developing land management plans for all state plans and a general mandate to Aadminister state lands under comprehensive land management programs using multiple-use sustained yield principles.@ *Id.* '' 65A-2-1, -2, -4. AMultiple use@ is defined as Athe management of various surface and subsurface resources in a manner that will best meet the present and future needs of the people of this state.@ *Id*. ' 65A-1-1(3). At first blush it may seem hard to reconcile the simultaneous applicability of statutory multiple-use doctrine with public trust concepts on the same lands. Given the constitutional underpinnings of public trust doctrine, however, the only way to reconcile these ideas is to allow multiple-use principles to apply only where consistent with the public trust.

[336]Another possible reason for this omission is that chapter 10 of title 65A of the Utah Code, cited in the *1995 Plan*, applies to sovereign lands, whereas chapter 2 applies to Astate lands.@ However, Astate lands@ are defined as Aall lands administered by the division,@ which therefore include sovereign lands as well as other state lands. *Id.* ' 65A-1-1(6).

lands. The regulation seeks to balance public trust uses against economic uses, without clearly specifying which uses take priority.[337]

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[337] *See* 1995 PLAN, *supra* note 21, at 15; *see also* UTAH ADMIN. R. 652-2-200 (1996 & Supp. 1997).

> The state of Utah recognizes and declares that the beds of navigable waters within the state are owned by the state and are among the basic resources of the state, and that there exists, and has existed since statehood, a public trust over and upon the beds of these waters. It is also recognized that the public health, interest, safety, and welfare require that all uses on, beneath or above the beds of navigable lakes and streams of the state be regulated, so that the protection of navigation, fish and wildlife habitat, aquatic beauty, public recreation, and water quality will be given due consideration

Like the *1976 Plan*, the *1995 Plan* effort was divided into a series of specific issues, each of which included information, analysis, and a large number of specific recommendations. These issues were similar but not identical to the planning Aelements@ in the *1976 Plan*[338] and included geological hazards, hydrology, industry, sovereign lands management, tourism and recreation, and wildlife.[339] While it is not feasible to repeat all of the many recommendations in the *1995 Plan* document,[340] the following discussion addresses the most significant or controversial aspects of each section.

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and balanced against the navigational or economic necessity or justification for, or benefit to be derived from, any proposed use.

UTAH ADMIN. R. 652-2-200.

[338]1976 PLAN, *supra* note 259, at 13. The *1976 Plan*=s policy elements were minerals, wildlife, recreation, tourism, transportation, and hydrology. *See id*.

[339]*See* 1995 PLAN, *supra* note 21, at tbl. of conts.

[340]The *1995 Plan* report would be far easier to digest and evaluate, and more useful as a tool for public and agency guidance and information, if the recommendations were collated, summarized, and restated at the end of the entire document.

The geologic hazards section, which overlaps considerably with the hydrology section, addresses the fact that there is currently no clear policy on when to use the West Desert Pumping Project when lake levels are on the rise. The *1995 Plan* proposes that the pumps be modified so they can begin to be used when lake levels are projected to reach 4205 feet, and to pump from the south rather than the north arm of the lake.[341] This proposal, of course, reflects the persistent philosophy that the lake is something to be Acontrolled,@ rather than a fluctuating natural entity that should be accepted on its own terms.[342] At the same time, the *1995 Plan* includes a somewhat inconsistent set of recommendations about development in the flood plain. On the one hand, the *1995 Plan* recommends that all agencies and local governments should strive to Acontrol[] development on a coordinated basis@ below the 4217-foot flood plain level agreed to by the Utah Division of Comprehensive Emergency Management (ACEM@) and the Federal Emergency Management Agency (AFEMA@).[343] At the same time, however, the *1995 Plan* states: AWithin the elevation interval between 4191.4 and 4217 feet, city, county or state development take place in a manner that will encourage the maximum use of land for the people of Utah while avoiding unnecessary disaster losses.@[344] Thus, while advising some

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[341] *See* 1995 PLAN, *supra* note 21, at 37. As explained above, the pumping project was originally designed to pump from the more dilute south arm to maximize the resulting evaporation rate, but was modified to pump north arm brines instead to save money and to expedite construction. *See supra* notes 153B64 and accompanying text (discussing flooding and West Desert Pumping Project).

[342] The *1995 Plan* purportedly Aaccepts the cyclic fluctuations of the lake,@ but clearly only within very narrow bounds, given its recommendation to begin pumping when lake levels are projected to reach 4205 feet. 1995 PLAN, *supra* note 21, at 37.

[343] *Id*. at 38. Specifically, the plan recommends that agencies and local governments adopt zoning ordinances and other procedures allowing development below the 4217-foot level only on a Acase-by-case basis.@ *Id*.

[344] *Id*. at 42 (citation omitted).

caution in development below the lake=s anticipated flood level, the *1995 Plan* still would allow some development to occur. The *1995 Plan* then proposes that such development be protected by pumping at a relatively low threshold and additional diking after pumping begins.[345] To put these various recommendations in perspective, Table 1 relates various regulatory provisions to actual lake levels over time.

TABLE 1: GREAT SALT LAKE LEVELSCREAL AND REGULATORY

LAKE ELEVATION (feet above sea level)	**ACTUAL OR REGULATORY SIGNIFICANCE**	**REFERENCE**
4191.35	Historic Low Elevation (1963)	HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 9
4200	AStabilization@ LevelC1965 Preliminary Master Plan	LAKE COM REPORT, *supra* note 177, at 11
4202	AStabilization@ LevelC1976 Great Salt Lake Division Act	Note 249, *supra*
4202B4212	Range of Surveyed Meander Line	Note 226, *supra*
4211.85	Historic High Elevation (1986)	HYDROLOGIC CHARACTERISTICS, *supra* note 3, at 14
LakeB4217	1985 Proposed ABeneficial Development Area@	Note 295, *supra*
4194B4217	1995 Proposed AMaximum Use@ Zone	Text at note 344, *supra*
	Archaeological Evidence of Lake	

[345] *See id*. at 39 (noting that, depending on conditions, A[p]umping may not keep ahead of the rising waters@).

TABLE 1: GREAT SALT LAKE LEVELSCREAL AND REGULATORY		
4217	Level (400 years B.P.)	Note 47, *supra*
4221	Radiocarbon Evidence of Lake Level (2000B3000 B.P.)	Note 47, *supra*

The hydrology component of the *1995 Plan* reiterates the recommendations in the geologic hazards section about pumping, diking, and general development limits.[346] That section acknowledges but does not address, however, the serious impacts that causeways and other hydrological barriers have had on the salinity and ecology of the lake.[347] Similarly, the plan recognizes that far too little is known about water pollution and other impacts on the lake and its biota, but recommends only a status quo approach to water pollution control programs, along with more study.[348]

[346]*See id*. at 50, 53, 59.

[347]*See supra* notes 119B41 and accompanying text (discussing impacts from causeway and development). The *1995 Plan* recommends only that A[t]he state should continue to monitor the lake itself, and more specifically the effects of all causeway and major diking and dredging operations on the salinity profile of the lake, to determine what actions, if any, should be initiated to protect the resources involved.@ 1995 PLAN, *supra* note 21, at 59.

[348]*See generally* 1995 PLAN, *supra* note 21, at 60B62 (recommending more comprehensive water quality analysis; continuation of existing water quality program as is despite lack of numeric water quality standards; continued monitoring of nonpoint source pollution control program Ato

assure that it is effectively addressing the problem@; and further study of sediment toxicity). This laissez-faire approach to water pollution is best exemplified by the following quotation:

> Little is known about aquatic biota and food chain relationships in the lake, but the brine shrimp industry and others are significant, and from an economic standpoint, require some level of protection from degradation by pollution on a case-by-case basis. Ecologic interdependencies between aquatic and terrestrial organisms within the lake are also not well understood, except that fluctuations in the lake level have demonstrated extreme impacts on adjacent freshwater wet lands and associated fish and wildlife habitat.

Id. at 63B64.

The industry section of the *1995 Plan* is rather brief and extremely vague in its recommendations, which nonetheless generally support development of various industries consistent with the need to balance those interests with protection of the lake and its resources. Industrial siting, for example, should be done in coordination with fish and wildlife agencies, and in areas with the least environmental impacts.[349] Grazing permits should continue to be issued on a case-by-case basis absent Aaccess, environmental or habitat concerns.@[350] Additional research and monitoring should be done to evaluate the effects of pollution and harvesting on brine shrimp and bird populations.[351] Both mineral extraction and oil and gas development should be promoted, consistent with environmental protection and public trust objectives.[352] Such vague pronouncements are generally consistent with the multiple-use mandate for management of the lake and its resources, but are hardly useful as a planning tool. Given the large amount of industrial and resource extraction activity already occurring on the lake,[353] planners should identify specifically the areas that are suitable for resource development and those that require absolute or partial protection through use and timing restrictions and specific operating conditions and requirements.

The sovereign lands management component of the *1995 Plan* recognized the State=s duty to manage its lands and resources consistent not only with the enabling statute, but also with the public trust doctrine.[354] While the proper interpretation of this mandate remains an open question, this recognition of the State=s obligation reflects significant progress from the days when the value of the lake=s continued existence was in question. More specifically, however, this section of the *1995 Plan* proposed five distinct land use classifications to Azone@ the lake for different uses.[355] Class 1 lands are to be managed Ato protect existing resource development uses.@[356] Class 2 lands are to be managed

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[349]*See id*. at 66.

[350]*Id*. at 67.

[351]*See id*. at 68.

[352]*See id*. at 70B71.

[353]For an itemization of existing uses and leases, along with their locations, see STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at app. b.

[354]*See* 1995 PLAN, *supra* note 21, at 71 (discussing public trust and lake bed management); *see also infra* notes 324B28 and accompanying text (discussing public trust doctrine).

[355]*See* 1995 PLAN, *supra* note 21, at 71B72 (listing six management classes). State regulations specifically allow for the classification of state lands for different uses. *See* UTAH ADMIN. R. 652-70-200 (1996) (listing six management classes for land around lake).

[356]1995 PLAN, *supra* note 21, at 71. Class 1 lands included those around Antelope Island State Park, Great Salt Lake State Park, and Aexisting mineral extraction lease areas under special use lease for brine shrimp cyst harvest activities.@ *Id*. Such lands were proposed to be open to oil and gas leasing but not to surface occupancy. *See id*.

Ato protect potential resource development options.@[357] Class 5 lands are to be managed Ato protect potential resource preservation options.@[358] Class 6 lands are to be managed Ato protect existing resource preservation uses.@[359] Class 3 lands included the rest of the lake, Ato be managed as open for consideration of any use.@[360]

[357] *Id*. at 72. Class 2 included the Rozel oil field and shoreline areas westward from Stansbury Island and north along the west side of the lake, and would be open to mineral leasing, developed recreation, and other development. *See id*.

[358] *Id*. Class 5 included lands authorized by the Utah Legislature for wildlife purposes, and a one-mile buffer around islands in the north arm. *See id*. While no surface occupancy for oil and gas exploration would be allowed in Aestablished@ wildlife areas, presumably other encroachments would be permitted, and surface occupancy would be allowed in areas authorized but not yet established for wildlife purposes. *Id*.

[359] *Id*. Class 6 included wildlife management uses, and were to be open to oil and gas leasing without surface occupancy. *See id*.

[360] *Id*. There is no mention of a Class 4. Presumably this classification was reserved for some undesignated purpose. *See id*.

While the *1995 Plan* identified some of these lands with some specificity, it did not include a map to help the reader understand the amount and location of land in each classification.[361] Moreover, the classification system is confusing and disturbing in several respects. For example, lumping state parks and mineral extraction lands in the same category (Class 1) because they both illustrate Aexisting resource development uses@ hardly reflects the vastly different character of use and appropriate types of management and protection. More disturbingly, under this system, every single classification is open for resource extraction uses of some sort,[362] regardless of the importance and sensitivity of the area for ecological and other values. Even if one accepts the applicability of a multiple use doctrine to an international ecological treasure like Great Salt Lake, multiple use does not mean that all uses must be accommodated in all parts of the lake, especially given the admonition of several eminent biologists that absolute protection is appropriate for several critical environmental amenities in the region.[363]

The sovereign lands component of the *1995 Plan* also includes a number of recommendations for land use controls in the counties surrounding the lake. These recommendations include emulating the language in the *Davis County Wetlands Plan*, which prohibits development below 4217 feet;[364] further limiting land uses surrounding the lake to avoid contamination; limiting beneficial private land uses to those that will protect the lake from contamination; managing flood

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[361]Such a map was included, however, in a more recent draft planning document. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at map 7 (depicting lands by classification).

[362]1995 PLAN, *supra* note 21, at 71B72; *see also supra* notes 355B60 and accompanying text (discussing 1995 PLAN classification system).

[363]*See, e.g.*, BEHLE, *supra* note 62, at 20 (calling for full legal protection of lake=s bird resources); Rawley, *supra* note 29, at 297 (calling for sanctuaries in Gunnison Island and protection of lake=s wetlands).

[364]*See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 16, 30 (noting that 100-year flood elevation is 4217 feet and that flood-proofing with armored fill would be needed to prevent damage to buildings, roads, and utilities below that elevation).

plains in conjunction with state wetlands policies; and preserving buffer zones for flood plains and wetlands complexes.[365] Such proposals properly reflect the earlier recognition that protection of the lake itself requires appropriate restrictions on adjacent land uses that adversely affect the lake=s runoff water quality and the hydrology of the lake=s adjacent wetlands and flood plains. While the authors of the *1995 Plan* had no direct authority over the adjacent counties and other local governments, the fact that representatives of all five counties were part of the planning process made such recommendations both possible and credible.

[365] *See* 1995 PLAN, *supra* note 21, at 86B87.

The tourism and recreation component of the *1995 Plan* contains quite specific recommendations for the further management and development of state, federal, and other recreational facilities in and near the lake. Some of these recommendations involve site development of facilities and services that would enhance the attractiveness of the lake=s amenities to visitors.[366] Undoubtedly these proposals would increase public knowledge and appreciation of the lake and its resources.[367] At the same time, however, substantial increases in visitation can have significant impacts on wildlife and wilderness resources. Visitors may disturb sensitive wildlife and increase noise, traffic, litter, and other forms of pollution in and around the lake. Some of the other proposals to increase tourism and recreation, however, such as the proposed road causeway to the southern end of Antelope Island, could result in even greater impacts to the lake=s hydrology and ecology.[368]

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[366]*See, e.g.*, *id*. at 97B101 (recommending that tourist facilities be developed, including: Great Salt Lake Visitor and Education Center; visitor services and trails in Antelope Island State Park; removal of unnecessary visual barriers around lake; additional beach facilities; additional tourism attractions and facilities at places such as Black Rock Cave, Stansbury Island, Promontory Point, Hogup Indian Cave, and private marinas).

[367]In similar projects, such beneficial public awareness has resulted in support for more funding and better protection. *See* Adler, *supra* note 5, at 1002 & nn.158B59 (describing impact of public education on willingness to pay for additional protection of Chesapeake Bay).

[368]*See supra* notes 119B41 and accompanying text (discussing hydrological and ecological impacts of existing causeways).

The last component of the *1995 Plan*Cone hopes without the accompanying implication that it is the least importantCis wildlife. This part of the *1995 Plan* identifies a broad range of existing and potential threats to the magnificent wildlife resources of the lake and its environs.[369] Given the nature and magnitude of these threats, and of the resources at stake, the recommendations included in the wildlife portion of the *1995 Plan* are remarkably brief and vague. The *1995 Plan* proposes to preserve the status quo in certain areas: the Amanagement@ of existing wetlands, the plan and Adesign@ of Aadditional wetland developments@ to minimize potential future flood damage, and continued support for improved water quality consistent with state wetlands policy.[370] While the goal of more wetlands and more wetlands protection is laudable, this recommendation appears to perpetuate the bias in favor of developing artificial marshes, rather than protecting the integrity of natural wetlands. Other vaguely-worded recommendations include encouraging prospective public or private developers or land users to consult with appropriate agencies to mitigate impacts on wetlands and other lake habitats and resources, including threatened and endangered species, and additional study of potential impacts to brine shrimp and other lake resources.[371] Not only are these recommendations vague and relatively unhelpful; much of the recommended consultation is already required by existing law prior to receiving necessary permits.[372]

Together, the separate elements of the *1995 Plan* address a broad array of issues, given the inherent jurisdictional restrictions of a process limited to the lake=s meander line and perhaps nearby areas. The *1995 Plan* is notable, however, in its apparent lack of significant coordination between the various issues. Different portions of the *1995 Plan* were assigned to different members of the team, although each proposal was reviewed and revised by the team as a

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[369] *See* 1995 PLAN, *supra* note 21, at 103B09. These threats include reduced inflow volumes; increased water pollution from irrigation return flows, stormwater runoff, untreated industrial effluent, and toxics; loss of adjacent wetlands; grazing and other agricultural encroachment; and changes in the lake=s salinity levels. *See id.*

[370] *Id.* at 105B06.

[371] *See id.* at 106, 109B10.

[372] *See* 33 U.S.C. ' 1344 (1994) (requiring dredge and fill permit from U.S. Army Corps of Engineers prior to building in wetlands); 16 U.S.C.A. ' 1537 (West Supp. 1998) (requiring agency consultation with U.S. Fish and Wildlife Service before issuing permits that may cause harm to threatened and endangered species).

whole.[373] As a result, some portions of the *1995 Plan* overlap,[374] while others conflict.[375]

As with the *1976 Plan*, the main problem with implementation of the *1995 Plan* has been the lack thereof. Under the matrix aspect of the *1995 Plan*, Acompleted implementations . . . [were to be] added as part of [the] matrix, and new issues and opportunities addressed as they arise.@[376] While the recommendations were only in place for about two years before the planning process began anew in 1997, apparently no such ongoing process was maintained. According to a more recent DNR planning document: ASeveral of the recommendations have been acted upon by divisions of the Department of

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[373]*See* 1995 PLAN, *supra* note 21, at 5.

[374]*See id*. at 25, 46. For example, both the geological hazards and hydrology sections address the controversial issue of the water levels at which the West Desert pumps should be restarted. *See id*.

[375]*See* James Carter, Executive Director, Great Salt Lake Planning Team, Remarks at Monthly Meeting of Friends of Great Salt Lake (Feb. 2, 1998) [hereinafter Carter Remarks] (indicating that one reason for current planning process is unresolved conflicts between various recommendations in 1995 PLAN).

[376]1995 PLAN, *supra* note 21, at 3.

Natural Resources, including development of the *Mineral Leasing Plan* by the Division of Forestry, Fire and State Lands. *The fate of other recommendations is not known*.@[377] The sad reality that most of the *1995 Plan* became an Aacademic exercise@ that, for the most part, was simply Aparked somewhere,@ has been confirmed by DNR officials publicly.[378]

2. The 1996 Mineral Leasing Plan

[377]STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 9 (emphasis added). The *Statement of Current Conditions and Trends* does not specify what recommendations other than the *Mineral Leasing Plan* have been implemented.

[378]*See* Carter Remarks, *supra* note 375.

On June 27, 1996, after a public process that included consultations with mineral extraction companies, environmental groups like Friends of Great Salt Lake, and others,[379] the new Division of Sovereign Lands and Forestry[380] adopted a final *Mineral Leasing Plan* for Great Salt Lake. This plan is part of a comprehensive planning process for state leasing of minerals on sovereign lands in the Great Salt Lake, Utah Lake, Bear River, Bear Lake, Colorado River, and Green River regions; the Great Salt Lake plan is the first component of this process to be completed.[381] It Areviews the history of mineral ownership and leasing, inventories mineral resources, and examines the existing conflicts on the lake@ and then Azones the lake bed for mineral commodity production, and specifies new mineral leasing procedures.@[382]

From one perspective, the *Mineral Leasing Plan* was designed to integrate mineral leasing with overall planning for Great Salt Lake. As explained by the Division:

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[379]*See* MINERAL LEASING PLAN, *supra* note 36, at 28; Martinson Comments, *supra* note 306, at 6.

[380]*See supra* note 330 and accompanying text (noting that Division of Sovereign Lands and Forestry was created to manage sovereign lands separate from state school trust lands).

[381]*See* MINERAL LEASING PLAN, *supra* note 36, at 1. In January 1995, the Division withdrew all sovereign lands from mineral leasing pending the preparation of these comprehensive management plans. *See id*.

[382]STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 10; *see also* MINERAL LEASING PLAN, *supra* note 36, at 1, 37B49.

Management plans were prepared for Great Salt Lake in 1976 and 1987. However, planning for mineral resources was not full incorporated into those plans because mineral leasing was administered by the Division of State Lands and Forestry while planning and coordination were done by the Division of Great Salt Lake (1976B1979) and then by the Department of Natural Resources (DNR) (1980B1988).[383]

[383]MINERAL LEASING PLAN, *supra* note 36, at 1.

Moreover, the *Mineral Leasing Plan* confronts directly the challenge of meeting the State=s mineral leasing goals while still fulfilling its public trust mandate to protect the lake=s fish and wildlife and other public values.[384] In an effort to reconcile these conflicting uses, the *Mineral Leasing Plan* identifies specific conflicts between mineral leasing and other uses,[385] and takes them into account in decisions about where to allow mineral leasing and under what terms and conditions.[386]

From a different perspective however, the preparation of this resource development plan while other recommendations in the *1995 Plan* lie dormant does more to fragment than to integrate the Great Salt Lake planning process, and poses a real danger that resource protection needs will be compromised because development planning is so far ahead of planning for ecological and recreational uses and needs. The Division=s effort to integrate mineral leasing policy with the rest of the Great Salt Lake planning is laudable, as are its specific

[384]*See id*. at 6 (setting one of MINERAL LEASING PLAN=s goals to integrate mineral resource planning with resource planning); *id*. at 24 (recognizing that Apersistent challenge in managing resources on Great Salt Lake has been to manage many resources under the authority of many agencies under dynamic environmental and economic conditions@ and that Great Salt Lake has many competing uses); *id*. at 29 (acknowledging that other demands on lake=s resources Apose conflicts with mineral development@); *id*. at 30 (identifying specific conflicts with Ascenic vistas, navigation for commercial, recreational or rescue operations, brine shrimp harvesting facilities, and waterfowl and shorebird resting areas@).

[385]*See id*. at 30B37.

[386]*See id*. at 37B49.

efforts to reconcile extractive and nonconsumptive uses. It is difficult to understand, however, how this process could have been completed with adequate understanding of other lake needs and uses before the same type of detailed research and evaluation is completed for those resources.

3. The Current Planning Process (from 1997 to the Present)

In August 1997, the DNR Aassembled the Great Salt Lake Planning Project Team . . . to develop a resource management plan for the [DNR] and all its divisions.@[387] As explained by James Carter, the former director of the team,[388] former DNR Executive Director Ted Stewart[389] had several reasons for initiating a new planning process so soon after the *1995 Plan* was developed. First, as was true during the 1992 to 1995 process, Mr. Stewart believed that the plans developed in 1976 and 1988 were developed only with consideration of drought and flood conditions, respectively.[390] Second, the *1995 Plan*, which was developed by groups of stakeholders representing different interests using a highly segmented approach, failed to address conflicts between the various sets of recommendations.[391] Instead, Mr. Stewart asked the new planning group to develop a departmental resource allocation plan, including a Azoning plan@ to delineate which activities could occur on which portions of the lake, that would result in a department-level document to coordinate policy and provide an issue resolution mechanism between different divisions within the DNR.[392] In addition, Mr. Stewart believed that two important issues in particular required clear and expeditious resolution: the lake levels and conditions under which the West Desert pumps should be used; and resolution of serious problems caused by the salinity gradient resulting from the railroad causeway.[393]

The new process differs from prior planning efforts in several notable ways. First, the new planning team, unlike the Technical Team that developed the *1995 Plan*, is comprised entirely of DNR personnel, with representation from each

[387] *Id*. at 12.

[388] Mr. Carter recently left the DNR and was replaced as Director of the Great Salt Lake Planning Project by Ms. Brenda Landureth.

[389] Mr. Stewart has since left the DNR to become Chief of Staff to Utah Governor Michael Leavitt. Ms. Kathleen Clarke is the new DNR Executive Director.

[390] *See* Carter Remarks, *supra* note 375. Mr. Stewart=s position supports the view that those earlier plans are defunct for practical purposes even if still legally in effect.

[391] *See id*.

[392] *See id*.

[393] *See* Interview with James Carter, Executive Director, Great Salt Lake Planning Team, in Salt Lake City, Utah (Feb. 13, 1998) [hereinafter Carter Interview].

DNR division.[394] By including every DNR division directly in the process, it is apparently hoped that a true consensus-based, department-wide coordinating plan will be developed, rather than one in which the Forestry Division appears to dictate policy to other DNR divisions with jurisdiction over some lands, resources, and activities on or near the lake.[395] From the DNR=s internal perspective, the new process seems somewhat more inclusive than the old.

At the same time, however, the 1997 planning effort continues the trend toward de-emphasizing the role of other governmental and private entities who either use, govern, or otherwise have an interest in the lake and its diverse uses and values. Moreover, because all DNR divisions *as well as* representatives of other interests participated in the 1995 planning process as part of the Technical Team,[396] the new process concentrates rather than expands control over the plan.[397] While the views of these other interests will be solicited throughout the process through various public participation mechanisms,[398] they will no longer

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[394]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 12.

[395]*See id*. at 2 (calling for, *inter alia*, Aunifying Department of Natural Resources management objectives and policies for Great Salt Lake trust resources@).

[396]*See* 1995 PLAN, *supra* note 21, at app. a.

[397]This is not to say that the *1995 Plan* effort was adequately inclusive. As discussed earlier, the Technical Team included an inappropriately narrow range of interest groups, which should be expanded as part of a truly inclusive process. AThe [1995] three year planning process involved state and local governmental agencies as well as representatives from lake industries . . . .@ MINERAL LEASING PLAN, *supra* note 36, at 25; *see also* discussion *infra* Parts IV.B, IV.C.2.

[398]*See infra* note 500 and accompanying text.

sit at the table as full players in the planning process. This is a stark change from each of the many earlier planning processes described above.

Unlike the *1995 Plan*, the new process invokes the general state planning provisions, as well as those specific to Great Salt Lake, as applicable to the development and substance of the plan.[399] It is not clear whether, by citing these provisions, the DNR seeks to shift the substantive focus of the plan from public trust to multiple use doctrine, or whether it merely wants to rely on the somewhat more detailed planning process outlined in the general statute and regulations.[400] At one point, the preliminary planning document in this process is reassuring in this regard:

> [T]he overarching management objectives of the Division of Forestry, Fire and State Lands and the Department of Natural Resources are to protect and sustain the trust resources of the Great Salt Lake, and to provide for reasonable beneficial uses of those resources, consistent with their long-term

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[399] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 1, 10, 12 (identifying sections 65A-2-1, 65A-2-4, and 65A-10-8 of Utah Code as applicable to current Great Salt Lake planning process).

[400] Section 65A-2-2 of the Utah Code required the DNR to develop planning procedures for state lands. *See* UTAH CODE ANN. ' 65A-2-2 (1996). Section 65A-2-4(1) of the Utah Code required the DNR to adopt rules regarding public participation and consultation with Athe general public, resource users, and federal, state, and local agencies.@ UTAH CODE ANN. ' 65A-2-4(1) (1996); *see also* UTAH ADMIN. R. 652-90 (1996) (providing implementing rules for planning procedure).

> protection and conservation. What these statements mean, of course, is open to discussion, but any beneficial use of public trust resources is subsidiary to long-term conservation of the resource.[401]

Elsewhere, however, the document is either less insistent that traditional public trust uses receive priority, as opposed to statutory development uses,[402] or it is

[401] STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 1.

[402] *See id*. at 4 (indicating that traditional public trust uses have been augmented with statutory uses, such as availability of brines to extraction industries and availability of appropriate areas for brine extraction, minerals, chemicals, and petrochemicals for economic development purposes).

disturbingly vague on the issue.[403] Ultimately, the position the final plan takes on this issue will be significant.[404]

[403] *See id*.

> The Public Trust Doctrine has been, and will continue to be, flexible to accom-modate changing demands for public trust resources. There is no particular hierarchy of uses, but when there are competing public benefits, the public trust requires that those benefits that best preserve the purpose of the public trust under the circumstances should be given a higher priority.

Id.

[404] *See* Funk Letter, *supra* note 152, at 2B4.

The geographical scope of the new plan remains constrained by the lake=s official meander line.[405] The current generation of DNR officials is more cognizant of the strong relationships between land uses far outside the meander line and the status and health of the lake and its resources.[406] However, they are equally concerned about the existing statutory limits on their geographical jurisdiction.[407]

[405] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 2B4 (including map depicting official meander line around lake); Carter Remarks, *supra* note 375.

[406] *See* Carter Interview, *supra* note 393 (indicating that then DNR Director Ted Stewart recognizes problems inherent in geographically-limited plan and supports idea of broader effort).

[407] *See id*.

While the current planning process was initiated in August 1997, public involvement began with various public notices published in February 1998, followed by an internal and external scoping process. The scoping process was designed to identify, through contacts with other state agencies as well as a wide range of other governmental entities and other public and private interests, the full range of issues and perspectives that should be considered in the process.[408] Unrealistically, DNR officials initially hoped that this preliminary scoping process would be completed in February or March of 1998 and that a draft plan would be available for public comment by April 1998.[409] Later, the DNR decided that at least one or two interim steps would be needed to support a sounder planning effort. First, based on input received during the planning process, the DNR issued a *Statement of Current Conditions and Trends* designed to Aassemble[] the information available which is relevant to good management of the Great Salt Lake.@[410] Based on the *Statement of Current Conditions and Trends* and additional comments received on that document,[411] the DNR recently issued a set of *Draft Management Alternatives* for the lake.[412] A draft management plan then will be circulated for public review and comment,[413] followed by a *Recommended Management Plan* for review and approval by the Forestry Division and by the DNR as a whole.[414]

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[408]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 12B13 (describing series of scoping meetings involving other state agencies, public meetings in each of five counties surrounding lake, and series of meetings with federal agencies, local governments, citizens= and industry groups, and individuals interested in Great Salt Lake management).

[409]*See* Carter Remarks, *supra* note 375. Mr. Carter indicated that while DNR Director Stewart was aware that this time line was extremely fast, he also believed that some issues facing the DNR were too pressing to allow a longer process. *See id*.

[410]STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 13.

[411]Memorandum from DNR Great Salt Lake Planning Team to Great Salt Lake Technical Team (Oct. 22, 1998) (indicating public comment period ending November 23, 1998). The comment deadline was later extended to December 11, 1998, and was followed by a series of general public meetings, individual stakeholder group meetings, a public presentation to the Technical Team, and a general public open house. *See* GREAT SALT LAKE PLANNING PROJECT SCHEDULE OF EVENTS (Dec. 9, 1998) (on file with author) [hereinafter SCHEDULE OF EVENTS].

[412]*See* GREAT SALT LAKE PLANNING TEAM, UTAH DEP=T OF NATURAL RESOURCES, GREAT SALT LAKE PROJECT INFORMATION PACKET (Jan. 20, 1999) [hereinafter MANAGEMENT ALTERNATIVES]. The *Management Alternatives* are included in matrix form and narrative form separately numbered. *See id*. at 1-1.

[413]The new draft *Great Salt Lake Comprehensive Management Plan* is now scheduled to be released on April 14, 1999, and will be followed by a forty-five-day public comment period. *See* Personal Communication with Lynn de Freitas, President, Friends of Great Salt Lake (Mar. 17, 1999) (on file with author).

[414]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 14. The final plan is now scheduled to be released on June 1, 1999. *See* SCHEDULE OF EVENTS, *supra* note 411.

The *Draft Management Alternatives* are divided into a discrete set of issues,[415] much like earlier planning efforts,[416] and recapitulate many of the same issues as were addressed in the earlier plans. For example, the document sets forth alternatives for each of the following issues: when and how to restart the West Desert Pumping Project to alleviate future high lake levels, how to address the salinity differential between different parts of the lake, whether to develop numeric water quality standards for the lake, how to classify sovereign lands for various uses, whether to open more of the lake area to mineral development, whether and how to provide more access for various recreational uses, and whether to allow more causeway construction.[417] Unlike previous planning efforts, this round provided members of the general public a range of management options for comment before the proposed plan is drafted.

[415]The *Management Alternatives* address hydrology, water chemistry, water quality, air quality, biology, land, minerals, recreation and tourism on land and water, commercial and industrial uses, agriculture and transportation. *See* MANAGEMENT ALTERNATIVES, *supra* note 412, matrix at 1-11.

[416]*See supra* notes 265B73, 338B72 and accompanying text.

[417]*See* MANAGEMENT ALTERNATIVES, *supra* note 412, matrix at 1-11. Altogether, the document sets forth alternatives for 34 separate issues within 16 categories. *See id*.

On the other hand, the ongoing planning process can be criticized in a number of ways, both procedural and substantive. As noted above, it is proceeding with remarkable rapidity given the complexity and importance of the issues to be decided. Although the public has been given several opportunities to comment as the plan unfolds, the management options themselves were drafted by bureaucrats in a single state department, despite the multijurisdictional and multiple interest nature of the issues to be decided. As a result, environmental groups commenting on the management options have protested that the effort remains disjointed, and lacks an overall strategic focus without Aan overall vision and framework for managing the Lake and all of its resources.@[418]

Moreover, the document brackets each issue with one set of options dubbed ACommodity@ (Alternative C) designed to please development interests, a second called AAmenity@ (Alternative B) and crafted to the leanings of environmentalists, and a third entitled AEnlibra@ (Alternative A), which is clearly designed as the State=s preferred set of options that strikes a balance between the two more extreme positions.[419] AEnlibra@ refers to a recent policy embraced by the Western Governor=s Association generally and Utah Governor Michael Leavitt in particular to promote broad, consensus-based decisions that strike a balance between various interest groups on important environmental and natural resource issues.[420] The approach taken in the *Draft Management Alternatives*, however, does not serve this proposed goal. As explained in the next section, broad-based consensus and compromise is not reached on difficult public resource decisions through an artificial process in which a government agency Adefines@ the positions of different interest groups and then proclaims that somewhere in between must reflect appropriate policy.[421] Rather, AEnlibra@

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[418]Letter from W. Cullen Battle, Farmington Bay Advocates, to Brenda Landureth, Great Salt Lake Planning Project, Utah Department of Natural Resources (Feb. 24, 1999) (on file with author) (critiquing draft management alternatives for absence of comprehensive framework); *see also* Letter from Lynn de Freitas, President, Friends of Great Salt Lake, to Brenda Landureth, Great Salt Lake Planning Project, Utah Department of Natural Resources (Mar. 1, 1999) (on file with author) (same).

[419]*See generally* MANAGEMENT ALTERNATIVES, *supra* note 412, at 1B2. All three alternatives are compared to the Acurrent situation.@ *See id*.

[420]*See* Western Governors= Ass=n, Policy Resolution 98-001, *Principles for Environmental Management in the West* (Feb. 24, 1998) <http://www.westgov.org/wga/policy/98001.htm>; Western Governors= Ass=n, *Enlibra* (visited Apr. 6, 1999) <http://www.westgov.org/Enlibra/>; Michael O. Leavitt, *The Environment: A Down to Earth Approach* (June 29, 1998) <http://www.westgov.org/wga/initiatives/enviro-w.htm> (written comments submitted by Governor Leavitt to Western Governor=s Association in conjunction with Plenary Session on Shared Environmental Doctrine).

[421]*See* Brandon Loomis, *>Enlibra= Makes Official Debut in State Government*, SALT LAKE TRIB., Feb. 4, 1999, at A1 (quoting this author=s opinion that DNR approach reflects

is achieved by allowing affected interest groups to sit down and work together to explore alternative policies that maximize the collective goals sought by each group.[422]

In the next section, this Article urges a far broader, and more inclusive, watershed-based approach to restoration and protection of Great Salt Lake and its resources. In the interim, however, or in the event that such a process is rejected, this author hopes that some of the ideas presented herein will contribute in the more limited ongoing DNR plan development process.

IV. TOWARD A MORE COMPREHENSIVE WATERSHED RESTORATION AND PROTECTION PROGRAM FOR GREAT SALT LAKE

AGoldilocks@ approach to public decisions; that is, if Alternative B is too hot and Alternative C is too cold, the State=s preferred Alternative C, conveniently labeled Aenlibra,@ must be just right).

[422]Indeed, Governor Leavitt=s written statement advocating the Enlibra doctrine advises:

> Successful environmental policy implementation is best accomplished through balanced, open and inclusive approaches at ground level, where interested public and private stakeholders work together to formulate critical issue statements and develop locally based solutions to those issues. Collaborative approaches often result in greater satisfaction with outcomes, broader public support, and lasting productive working relationships among parties.

Leavitt, *supra* note 420, at 3.

You are my bird of hope for the future of Great Salt Lake.[423]

A. Introduction: Imperatives for Watershed Protection and Restoration

[423]ELLA SORENSON, SEDUCTIVE BEAUTY OF GREAT SALT LAKE 88 (1997).

Much has been written debating the benefits and problems of watershed-based management,[424] under which environmental and natural resource problems are resolved on the scale of whole watersheds,[425] within natural rather than geopolitical boundaries.[426] In addition to the academic literature, renewed use of watershed approaches has been encouraged by a wide range of public and quasi-public studies and reports.[427] Whether inspired by this official urging or by grassroots support and action, there has been a groundswell of watershed-based initiatives throughout the country in recent years, ranging from citizen-led initiatives at the scale of small urban or headwater streams to massive programs covering some of the largest watersheds in the country, such as the Chesapeake Bay, the Great Lakes, and the Columbia River.[428]

These relatively recent watershed programs contrast sharply with the Awhole watershed@ or Acomprehensive river basin@ programs of the Progressive Era and the New Deal, which focused on optimal use and development of water resources and primarily engineered solutions to water resource issues, such as

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[424]*Compare* Adler, *supra* note 5, *passim* (arguing that modern watershed programs, if properly designed, can lead to substantial improvements in U.S. water policy), *with* William Goldfarb, *Watershed Management: Slogan or Solution?*, 21 B.C. ENVTL. AFF. L. REV. 483 *passim* (1994) (questioning whether modern watershed programs will succeed where century of past watershed-based programs have not). *See also* Denise D. Fort, *supra* note 5, *passim* (reviewing merits and problems of local and national watershed management through case study of Rio Grande watershed).

[425]*See* Adler, *supra* note 5, at 1088B92 (discussing appropriate scale of watershed restoration and protection efforts).

[426]*See id*. at 1093B94 (discussing appropriate boundaries of watershed programs).

[427]*See, e.g.*, U.S. EPA & U.S. DEP=T OF AGRIC., CLEAN WATER ACTION PLAN: RESTORING AND PROTECTING AMERICA=S WATERS 73B88 (1998) (prepared in response to Clean Water Initiative announced in President Clinton=s 1998 State of Union Address); COMM. ON WATERSHED MGMT., NATURAL RESOURCES COUNCIL, NEW STRATEGIES FOR AMERICA=S WATERSHEDS 15B20 (forthcoming 1999) (discussing stages of watershed management plans); JO CLARK, W. GOVERNORS= ASS=N, WATERSHED PARTNERSHIPS: A STRATEGIC GUIDE FOR LOCAL CONSERVATION EFFORTS IN THE WEST 6B12 (1997) (discussing different types of watershed plans and suggesting process for forming watershed partnerships); W. WATER POLICY REVIEW COMM=N, WATER IN THE WEST: CHALLENGE FOR THE NEXT CENTURY 6-5 to -8 (1998) (reviewing watershed plans in western United States); WATER ENV=T FED=N, WATER QUALITY 2000: A NATIONAL WATER AGENDA FOR THE TWENTY-FIRST CENTURY: PHASE III REPORT xviii (1992) (concluding that Anew national water policy is needed to integrate planning and management to protect surface and groundwater resources with related societal activities under a watershed framework@); Sarah F. Bates et al., *America=s Waters: A New Era of Sustainability, Report of the Long=s Peak Working Group on National Water Policy*, 24 ENVTL. L. 125, 133B34 (1994) (recommending changes in national approach to water management).

[428]*See, e.g.*, WATERSHED >96, *supra* note 5, *passim* (identifying ongoing watershed programs around United States); WATERSHED >93, *supra* note 5, *passim* (same); THE WATERSHED SOURCE BOOK, *supra* note 5, *passim* (same).

dams, levies and channelization, and large treatment facilities.[429] In tandem with increased understanding of water pollution and disturbing declines in the health of aquatic ecosystems,[430] more recent initiatives have been driven more by the goal of watershed restoration and protection than optimal resource use and development.[431]

[429] Adler, *supra* note 5, at 1003B37.
[430] *See id*. at 987B88.
[431] *See id*. at 1099B1101.

In an earlier article urging a return to watershed restoration and protection generally, this author argued that there are four types of Aimperatives@ that strongly suggest the need for more comprehensive watershed approaches to water resource restoration and protection: ecological, institutional, economic, and sociological.[432] Ecological imperatives include: the nature of aquatic ecosystems which suggest critical connections that cannot be addressed through source-specific programs alone;[433] and the nature of the major remaining sources of aquatic ecosystem impairment, none of which is addressed well by existing source-specific pollution control and resource management programs.[434] Institutional imperatives are driven by the fact that the existing system for protecting and managing water resources in the United States is so complicated and fragmented.[435] Economic imperatives are suggested by issues of both economic equity[436] and efficiency,[437] because watershed-based programs can

[432]*Id*. at 981B1003.

[433]These connections include interactions between land and water resources; links between water quantity and water quality; ties between groundwater and surface water; and the heterogeneity of aquatic ecosystems, which suggest the need for site-specific, watershed-based attention in addition to national, regional, state, and local programs. *See id*. at 981B86.

[434]These sources of impairment include habitat loss and alteration; polluted runoff (nonpoint source pollution); and declining instream flows. *See id*. at 989B91.

[435]Programs are characterized by political fragmentation, or overlapping and conflicting responsibilities; issue fragmentation, the artificial division of related water issues into separate programs to address water quality and quantity; land and water use; and surface and ground water. *See id*. at 991B95.

[436]Historically we have required significant pollution control contribution from some sources of impairment (like sewage treatment plants and factories), but little or nothing from others (such

better target limited resources to more focused solutions, and ensure that all who contribute to watershed degradation do or pay their fair share toward watershed restoration and protection. Sociological imperatives, or what this author has called Abioregionalism and the conservation ethic,@ are based on the fact that place-based programs draw energy and support from the realization that people are more willing to take actions and make sacrifices to protect and restore a special *place* than the abstract idea of environmental quality.[438]

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as farm runoff). A key goal of a watershed approach is to identify all sources of impairment in the watershed and to ask each source to do its fair share to protect the shared resource. *See id*. at 995B98.

[437]Public and private resources are inadequate and increasingly scarce. Watershed programs allow us to tailor programs to the needs and conditions of particular watersheds. *See id*. at 998B1000.

[438]*Id*. at 1000B03.

As explained in more detail below, Great Salt Lake exhibits many of these same imperatives. Except where the transition between land and water has been delineated artificially through dikes and other structures, the point at which land ends and water begins varies by hour, by day, by season, by year, by decade, and beyond, and a wide range of upstream uses and activities affect the health of the lake itself.[439] Under a panoply of separate laws, regulations, and policies, a mind-boggling array of sometimes overlapping or conflicting public and private entities are responsible for use and management decisions that affect the lake and its resources.[440] A large number of entities profit from activities in or near the lake, or in its watershed, but do not necessarily do their fair share to protect its integrity.[441] And while the forces of bioregionalism have largely fueled watershed programs in places like the Great Lakes, Chesapeake Bay, and the Columbia River, they could be harnessed in the Great Salt Lake watershed as well. As Utah writer Terry Tempest Williams has stated:

> We live alongside the Great Salt Lake, one of the most extraordinary natural features in North America. I do not believe we, as a community, have honored its rarity. Our lack of intimacy toward this inland sea is not out of neglect, but of ignorance. We do not know the nature of this vast body of water that sparkles and sings. If we did, the shores of the Great Salt Lake would look different.[442]

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[439] *See infra* Part IV.C.1 (urging broader management focus on entire watershed, not just lake).

[440] *See infra* Part IV.C.2 (urging shift from single-agency to multiple-entity planning).

[441] *See infra* Part IV.C.3 (urging shift from resource use and allocation to resource restoration and protection).

[442] Terry Tempest Williams, *Salty Paradox: It=s Been Here Forever; It=s Never What It Seems*, *in* THE GREAT SALT LAKE, UTAH=S AMAZING INLAND SEA, *supra* note 31, at 2. Similar sentiments were expressed a century earlier by unsuccessful Gunnison Island homesteader Alfred Lambourne:

> Under certain conditions, a place becomes a part of us, we own it. We absorb it into our lives. It cannot be taken from us. It is ours, and without title or deed. We are associated with a certain spot of earth, we have our lives shaped by it, or, if that be not the case, we stamp the place with our individuality. THIS PLACE IS MINE.

PRICE, *supra* note 172, at 68 (1970).

B. A General Model for Watershed Approaches

There is no single way to implement the type of broadly-focused watershed restoration and protection program suggested above. In fact, one of the touchstones of watershed programs and other place-based environmental initiatives is the flexibility to address local or regional problems in ways that best suit the needs of those places, while still ensuring minimum environmental protections and compliance with baseline environmental standards. However, a standard but flexible model for watershed protection (gleaned from a wide range of current watershed programs at various scales all over the country) is evolving.[443]

First, a process must be established to make decisions collectively. Wherever possible, decisions should be made by consensus among all affected interest groups, including both economic and noneconomic users and beneficiaries of the resource as well as all relevant decision makers, in a way that ensures commitment to implementation. Professional alternative dispute resolution methods and personnel should be used where necessary to assure that fair but binding consensus is reached by the participants. Lack of active participation by key interest groups, or Astakeholders,@ will lead to legal and political resistance and lack of implementation.

Second, the process should include comprehensive, *watershed-wide* resource inventories and evaluations as a basis for program design. The

[443]The following discussion is adapted from this author=s earlier article. *See* Adler, *supra* note 5, at 1104B06. Because of the inherent flexibility of watershed programs, it is possible to outline the basic principles of watershed planning in a number of different and equally legitimate ways. *Compare* THE WATERSHED SOURCE BOOK, *supra* note 5, *passim* (discussing watershed management strategies), *with* KEYSTONE POLICY DIALOGUE, *supra* note 4, at 5 (same). The organization of steps laid out below, while not exclusive, is merely useful as a framework for making recommendations about the Great Salt Lake planning process.

evaluation should consider the status of the resource; the past, current, and potential future health of the watershed; existing sources of impairment; and all of the potential solutions to those problems. This step cannot rely only on existing studies and data where that information is inadequate to characterize the key issues properly. Available data and analysis should be used where appropriate, but additional studies should be designed, funded, conducted, and incorporated as the iterative planning process develops. Large-scale watershed efforts can make use of a wide range of modern technical and scientific tools to aid this process, such as Geographic Information Systems (AGIS@), satellite imagery, and computer modeling.

Third, specific goals and objectives should be developed for the watershed as a whole. Wherever possible, numeric or other objective performance standards should be used, and program implementation and evaluation should be tied to the attainment of those standards. Goals should include positive ecological measures, such as the Aproperly functioning condition@ or Adesired future condition@ of the watershed, rather than purely bureaucratic measures, such as numbers of permits issued. Such ecological goals, of course, must be tied realistically to site potential as determined through the studies described above. While such measures can be modified over time to reflect changing conditions, values, or policy decisions, specificity is critical to program accountability.

Fourth, solutions should be selected, designed, and implemented to achieve the defined program goals, with available resources allocated based on careful targeting. Given that financial, personnel, and other resources are typically scarce, it is important to prioritize programs and solutions so that those with the greatest chance of success and the greatest benefit to the watershed are implemented first.

Fifth, the process must be iterative rather than static to account for changing environmental and artificial factors, including changing values and policies as well as evolving knowledge. This dynamic approach requires ongoing evaluation of program implementation and results, so that programs and strategies can be modified or retained as needed.

C. Application of Comprehensive Watershed Principles to Great Salt Lake

Over the past three and a half decades, no fewer than five Acomprehensive plans@ for the use, management, and protection of Great Salt Lake have been prepared by an ever-shifting cast of institutional characters, along with several more narrowly-focused planning efforts.[444] Irrespective of the substantive merit of each of these plans, it is hard to escape the conclusion that each effort failed. None was implemented more than sporadically. While each claimed to be the beginning step in an iterative process, the ensuing iterations invariably replaced rather than refined the preceding plan.

There is cause for optimism that the current Great Salt Lake planning process will be taken more seriously than previous efforts.[445] Measured against the attributes of successful watershed programs around the country, however, the process still leaves much to be desired. Both to improve the plan=s substantive content and to enhance the likelihood of public acceptance and long-term implementation, there are five ways that the current process should be broadened or improved over time. Some of the following recommendations could be undertaken with existing legislative authority. Others will require legislative action, in particular to expand the jurisdiction of the current planning process.

1. Broaden the Geographic Focus from the Lake to the Watershed of the Lake

[444] *See supra* Part III (discussing past and ongoing management efforts for lake).

[445] *See* Carter Remarks, *supra* note 375. DNR officials have expressed publicly a serious intent to develop a plan that will be implemented, and not just gather dust on the shelf. *See id*.

The current planning process, as with all of its predecessors, is limited mainly to the area within the lake=s official meander line.[446] It is a plan for the lake rather than the Great Salt Lake watershed. Until recently, this jurisdictional limitation was set by statute.[447] Because the formal statutory meander line boundary was repealed in 1995,[448] it is possible to argue that the DNR has the discretion to expand the planning process beyond the lake itself.[449] There is still considerable doubt, however, as to the DNR=s authority to expand the scope of the planning process in this way absent expanded statutory authority.[450] Moreover, even if the DNR or the Utah State Legislature expand the scope of the planning process within Utah, much of the watershed is in other states, and is the source of thirty percent of the lake=s total inflow.[451]

Nevertheless, given the precedent of so many successful whole watershed planning processes in virtually every other part of the country, the DNR and

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[446]*See supra* notes 405B07 and accompanying text (discussing geographic boundaries of current planning process). As discussed earlier, while all of the prior plans recognized to some degree the interactions between upland land and water use and the status of the lake, none had clear jurisdiction to incorporate actions and requirements in those areas into the plan for the lake itself. *See supra* notes 315B20 and accompanying text (discussing prior plans and their jurisdictional and geographic limitations).

[447]*See supra* note 254 and accompanying text (discussing legislative restriction on jurisdiction of lake management).

[448]*See supra* note 306 and accompanying text (explaining that statutory authorization of Advisory Council was repealed).

[449]Of course, even if the DNR does have such authority, it would be quite foolish as a matter of both policy and politics to do so without a far more inclusive process. *See infra* Parts IV.C.2, V (proposing and discussing shifts in jurisdiction of planning entities).

[450]While the DNR is a statewide agency, the Forestry Division has the specific authority only to prepare management plans for state lands generally, and sovereign lands in particular. *See* UTAH CODE ANN. ' 64-34-3 (1997) (stating that DNR is statewide agency); *id.* '' 65A-2-2 to -4, -10-1 to -3 (1986) (stating that Forestry Division has authority to manage state and sovereign land). The fact remains that only lands within the meander line are in state sovereign lands ownership. *See supra* Part III.B (explaining Supreme Court=s resolution of dispute over ownership of lake lands). Moreover, the specific planning authority for Great Salt Lake is still arguably limited to the Alake,@ even if that term is no longer defined. *See supra* notes 446B49 and accompanying text (explaining uncertainty over planning authority). There is no evidence that by repealing the statutory definition of the lake as part of a general statutory reorganization in 1994 and 1995, the legislature intended to broaden the Division=s mandate and jurisdiction. *See supra* notes 306, 448 and accompanying text (explaining that statutory authorization of Advisory Council was repealed). This issue is of particular concern given that the Utah Supreme Court invalidated the first Great Salt Lake Authority statute due to its failure to delineate the Authority=s jurisdiction. *See* Great Salt Lake Auth. v. Island Ranching Co., 421 P.2d 504, 505B06 (Utah 1966); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 6 (noting that Athe Utah Supreme Court declared that the Division Act creating the Authority was unconstitutional as it failed to define the Authority=s geographical jurisdiction@).

[451]*See supra* Part II.A.1.

others now have an opportunity to persuade the Utah Legislature to broaden the vision of the Great Salt Lake planning effort. Moreover, a number of physical, hydrological, and ecological interconnections suggest that an interstate, watershed-based approach to Great Salt Lake planning is necessary and appropriate.

For example, the hydrology, water chemistry, and ecology of the lake are linked in part to water use and development upstream in the watershed.[452] Lake levels, of course, are affected by a number of factors. While periodic changes in climate, especially regional precipitation, are responsible for the largest fluctuations in lake levels,[453] hydrologic models show that reductions in inflow

[452] *See supra* Part II.B (explaining ways in which development impacts lake).

[453] *See supra* notes 42B51 and accompanying text (explaining effects of climate on lake). This relationship works in reverse as well: Great Salt Lake itself has an impact on the region=s weather patterns. *See* Mark E. Eubank & R. Clayton Brough, *The Great Salt Lake and Its Influence on the Weather*, *in* GREAT SALT LAKE, *supra* note 28, at 279, 279 (stating that Athe lake does alter local temperatures, precipitation, and wind patterns@). For example, the lake=s large mass of water moderates the area=s air temperatures, explaining why large fruit crops can be grown along the lake at elevations of up to 5000 feet. *See id*. Similarly, the temperature differential between the lake and the air above, combined with salt and moisture in the lake itself, are

from the lake=s major tributary streams already have lowered the lake=s level by about five feet at average lake volumes, and that future planned dams and water diversions will reduce lake levels even further.[454] While these changes, ironically, might be welcome to those who fear the inundation of human structures that results whenever lake levels rise dramatically, the nature and impact of these changes on the lake=s ecosystem will change depending on where the lake stands in its natural cycles. At a minimum, such impacts must be considered carefully as the region plans for upstream water use and development.

responsible for the heavy snowstorms that support the region=s thriving ski industry. *See id*. at 279B81 (describing so-called Alake effect@).

[454]*See supra* notes 102B09 and accompanying text (noting that past dams impact lake and future dam plans).

Varying water levels have a dramatic impact on the lake=s hydrology and water chemistry, and consequently its ecology.[455] In particular, Great Salt Lake brine shrimp populations suffer at both ends of the salinity gradient.[456] Lower water levels concentrate the lake=s brines, which at extremely high salinity levels affect brine shrimp survival and reproduction.[457] Higher water levels dilute the lake=s brines, which in turn alter the communities of algae and other microorganisms at the bottom of the lake=s food web.[458] These changes, together with the alteration of the lake=s natural flow and mixing patterns due to dikes, causeways, and other structures,[459] apparently have resulted in changes in the mixture and population densities of species in both the lake=s north and south arms.[460] Some scientists suspect that those changes may cause or contribute to recent severe declines in the brine shrimp populations in the south arm,[461] because populations of the brine shrimp=s preferred food supply are significantly depressed. This, in turn, might have serious adverse effects on the

[455]*See supra* notes 41B51 and accompanying text (explaining how water level variation affects lake).

[456]*See* Sturm et al., *supra* note 144, at 245 (explaining that construction of causeway has produced poor environment for brine shrimp).

[457]*See id.*; *see also supra* note 136 and accompanying text (noting disparity in brine shrimp populations between north and south arms).

[458]*See supra* note 138 and accompanying text (explaining changes in species populations in south arm).

[459]*See supra* notes 119B28 and accompanying text (discussing human-made structural impediments to flow between arms).

[460]*See supra* notes 129B41 and accompanying text (stating that construction of railroad causeway impacted lake=s species diversity).

[461]Brine shrimp populations in the north arm have been suppressed dramatically for quite some time due to the saturation salinity levels caused by the railroad causeway. *See supra* note 136 and accompanying text (explaining changes in brine shrimp population in north arm).

bird populations that rely on the lake=s rich brine shrimp and brine fly populations as a major source of food.

Lake levels, and hence upstream water diversions, also affect the integrity of the massive and ecologically-crucial wetlands complex that rings the lake, its tributaries, and its sister lakes to the south (Utah Lake) and north (Bear Lake).[462] Wetlands constitute the transition zone between land and water, and therefore fall along a spectrum from deep water to upland habitat.[463] The wetlands around Great Salt Lake shift from deep water to transitional to ephemeral as one moves farther away from the main bodies of water.[464] Moreover, in the case of Great Salt Lake wetlands, the size and location of the transition zone changes along with natural fluctuations in lake level.[465] Some of these changes benefit wildlife habitat by enhancing wetlands productivity.[466] If water levels remain artificially low, the upper reaches of this wetlands complex might not receive enough water for this dynamic process to occur. Conversely, during the flooding caused by record-high lake levels in the mid-1980s, areas that were either dry or simply saturated by groundwater during lower water levels were transformed to deepwater habitat.[467] The wetlands that ring the lake moved farther out, as did the wildlife species that rely on those habitat types.[468] Development in these

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[462]*See, e.g.*, URMCC PLAN, *supra* note 23, at 2-2 to -44 (discussing impact of upstream water diversion on ecosystem as whole, especially on Provo River/Utah Lake watershed, Diamond Fork watershed, Great Salt Lake/Jordan River watershed, and Strawberry/Duchesne River watershed, and proposing statewide watershed management plan); MILLER, *supra* note 20, at 8 (noting that Bear, Weber, and Jordan Rivers are lake=s principal tributaries). Protection of these wetlands is essential to a Afunctioning Great Salt Lake ecosystem.@ URMCC PLAN, *supra* note 23, at 2-34.

[463]*See* NATIONAL RESEARCH COUNCIL, WETLANDS: CHARACTERISTICS AND BOUNDARIES 21B24 & fig.2.1A, 41B42 (1995).

[464]*See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at app. b fig.1 (depicting Davis County wetlands from National Wetland Inventory maps).

[465]*See* FARMINGTON BAY ADVOCATES, *supra* note 75, at 5 (noting that Anatural wetlands . . . move back and forth across the flood plain with changing cycles of the lake@).

[466]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 24 (stating that A[p]eriodic flooding and drying events keep wetlands in young successional stages and increase their productivity@).

[467]*See* FARMINGTON BAY ADVOCATES, *supra* note 75, at 5B6 (AThe vulnerability of these wetlands to the Lake=s cycles was demonstrated in the mid 1980s when the Lake rose to levels that destroyed most of the dikes; the wetlands were flooded with salt water that killed off most of their vegetation.@); URMCC PLAN, *supra* note 23, at 2-34 (explaining that during high water levels in 1980s, over 300,000 of 400,000 acres of wetlands associated with Great Salt Lake were rendered temporarily useless because of deep water and saltwater intrusion).

[468]*See* FARMINGTON BAY ADVOCATES, *supra* note 75, at 5B6 (noting that 112 of 257 avian species that use Great Salt Lake ecosystem associate exclusively with lake=s wetland area, while 117 species inhabit lake=s periphery).

higher-elevation habitats would leave wildlife with no refuge when lake levels are particularly high. Further reduction in inflows also would have particularly adverse impacts on some of the lake=s wetlands and managed marshesCsuch as the Bear River Migratory Bird Refuge (ARefuge@)Cthat require adequate freshwater flows in order to provide the necessary habitat for some species of waterfowl and shorebirds.[469] Similarly, the hydrological health of the lake=s adjacent wetlands is linked to the supply of groundwater that feeds them, yet groundwater resources around the lake are overappropriated and declining.[470]

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[469]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 66 (noting that Refuge water supplies are rarely at optimum water levels, and because shortages are detrimental to wetlands and wildlife, U.S. Fish and Wildlife Service would like to augment summer flows); *see also id*. at 90 (indicating that one key issue facing Refuge is Asafeguarding a dependable fresh water flow throughout the year@).

[470]*See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 20B21 (finding that wetlands have decreased by 5000 acres and that shift in water use from agricultural to municipal and industrial uses has resulted in diminishing irrigation return flows that affect wetland ecosystem); *see also* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 63, 72 (discussing Locomotive Springs Waterfowl Management Area, and problems that development near lake poses to sub-irrigation groundwater return flows). Some experts suggest that groundwater pumping from as far away as Idaho may be affecting water flows from Locomotive Springs. *See* Atwood and

Mabey Comments, *supra* note 21.

The lake=s tributaries are also linked to the health of the lake due to currently unknown impacts of upstream water pollution. Unfortunately, very little is known about the impacts of pollution in general on the health of the Great Salt Lake ecosystem as a whole, or on individual places within the system. While some past studies gave cause for concern,[471] few follow-up investigations have been conducted, especially in recent years.[472] Moreover, assessment of water quality impacts is hampered by the lack of numeric water quality criteria by which to judge the severity of pollution levels in the lake.[473] Yet a number of experts warn that water pollution might have unknown adverse effects on the lake and its biota.[474] A comprehensive planning effort for the lake should at least evaluate the impacts on the lake of pollution from upstream urban and agricultural runoff, discharges from factories and sewage treatment plants, and

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[471] *See supra* note 118 (discussing brief 1995 study showing that Farmington Bay sediments may be contaminated).

[472] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 34 (indicating that little work has been done to identify impacts of nonnatural pollutants on Great Salt Lake ecosystem); *id*. at 38B40 (identifying limited number of studies of water quality in and around Great Salt Lake since 1960s, most of which were geographically limited).

[473] *See supra* note 118 (discussing lack of numeric water quality criteria). The absence of numeric water quality criteria for the lake, along with inadequate information about lake water quality, impedes application of the watershed-based pollution control strategy mandated by section 303(d) of the Clean Water Act. *See* 33 U.S.C. ' 1313(d) (1994) (requiring states to develop Atotal maximum daily loads@ (ATMDLs@) for impaired water bodies). *See generally* Robert W. Adler, *Integrated Approaches to Water Pollution: Lessons From the Clean Air Act*, 23 HARV. ENVTL. L. REV. 203 *passim* (1999) (discussing use of TMDLs to promote whole watershed pollution control). The TMDL process could be used for impaired tributaries for which numeric criteria and adequate data exist.

[474] *See supra* note 118 and accompanying text (citing experts who believe water pollution may have unknown effects on lake).

other sources. If such impacts are found to exist, they could be remedied through a comprehensive watershed protection plan for the lake, while falling outside the jurisdiction of the existing, more limited process.

It is also not possible to plan comprehensively for the restoration and protection of Great Salt Lake without considering the wide range of land uses in the watershed that may affect the health of the lake through changes to adjacent habitat zones, erosion, runoff and other pollution, and hydrology.[475] Many experts, in fact, believe that the biggest threats to the health of the lake and its overall ecosystem are posed by the region=s rapid growth and development.[476] Sprawl growth, especially along the lake=s eastern and southern shores, will eliminate or degrade the area=s wetlands and associated uplands habitat,[477] as will changes in the area=s hydrology that accompany up-gradient development, water use, and diversion.[478] Increased development also results in increases in the types of uncontrolled polluted urban runoff that can have cumulative, long-term adverse impacts on water quality in the lake, as well as in its tributaries and adjacent complex of wetlands.[479] Other land uses can affect the health of the lake as well, however, such as logging, grazing, mining, and industrial

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[475] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 72 (stating that A[o]ne of the challenges in managing sovereign lands is that the biological and physical systems of the Great Salt Lake do not observe property boundaries, and management decisions on sovereign lands affect, and are affected by, uses and activities on adjoining lands@).

[476] *See supra* Part II (discussing impact of human use in, on, and around lake).

[477] The wetlands alone do not provide adequate habitat for the migratory bird and other species they support. Rather, these species are sustained by a complex of adjacent wetland and upland habitat. *See* Rawley, *supra* note 29, at 287B88 (explaining that adjacent bodies of marsh, vegetation, sagebrush, and grass types provide habitat and sustain life for number of species); *see also* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 6B7 (stating that Amosaic@ of wetland and upland habitat is needed); LEGACY PARKWAY DEIS, *supra* note 167, at 3-63 (discussing importance of wetland habitats in supporting plants and wildlife, and noting crucial relationship between upland and wetland habitats in overall watershed ecosystem); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 72 (finding that A[a]s development moves lakeward, the uplands no longer provide a buffer to the lake wetlands@); URMCC PLAN, *supra* note 23, at 2-34 (exploring need for wetland and upland corridor along lake). Habitat fragmentation caused by highways and related development also disrupts important wildlife migration patterns. *See* FARMINGTON BAY ADVOCATES, *supra* note 75, at 12.

[478] *See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 6 (commenting that Athe diversion of water for agriculture or urban uses often dries wetlands, including tributary streams, and renders them nonfunctional@); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 72 (noting that A[a]s development moves lakeward, the uplands no longer provide a buffer to lake wetlands, [and] diminishing irrigation return flows affect the wetland ecosystem@).

[479] *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 40, 72 (finding that major source of pollution to Great Salt Lake and other state waters is nonpoint source runoff, primarily from agricultural and urban runoff).

development.[480] It makes little sense, therefore, to develop a plan for the lake without addressing in a comprehensive way the many land uses in the watershed that affect the health of the entire interstate watershed ecosystem.[481]

[480] *See supra* Part II.B (discussing history of human use and impacts on lake).

[481] As an interim step towards this goal, the DNR could begin by developing an integrated plan for all sovereign lands within the Great Salt Lake watershed, including Utah Lake, the Jordan River, Bear River, and Bear Lake, as well as the Great Salt Lake. *See* Martinson Comments, *supra* note 306, at 1B2, 7. While not the preferred whole watershed approach, this would represent significant improvement over the current, even more narrowly-defined effort.

Similarly, the current narrow focus of planning for the lake does not take into account the fact that many of the birds that use the Great Salt Lake ecosystem are affected by the health of related components of the watershed.[482]American white pelicans, for example, nest in large numbers on remote Gunnison Island to take advantage of the island=s relative security from predators during nesting periods.[483] The main body of the lake itself, however, being devoid of fish, provides no food for the adult pelicans or their young.[484] Instead, adults make round trips of up to one hundred miles, to freshwater tributaries, Utah Lake, and other water bodies, to find fish to feed themselves and their young.[485] Thus, colonies of pelicans cannot be protected by considering nesting habitats in isolation from foraging habitat elsewhere in the watershed. Similarly, wildlife habitat in the lake and its adjacent wetlands is linked to the adjoining mountains through linear riparian corridors.[486]

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[482]Many of the migratory species that use Great Salt Lake are part of even larger hemispheric flyways as well. During the periods that species reside in the Great Salt Lake environs, even if for seasonal or even shorter periods, all components of the lake=s watershed and ecosystem that are relevant to their welfare should be considered as part of a comprehensive planning process. Moreover, efforts, are under way to link shorebird habitats in Great Salt Lake to those in other regions, including Canada and Mexico. *See* Martinson Comments, *supra* note 306, at 7.

[483]*See* BEHLE, *supra* note 62, at 8, 12B13 (discussing presence of American white pelicans on Gunnison Island and reasons why they would congregate there when food supply is low).

[484]*See id*.

[485]*See id*.

[486]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 41 (finding that Alake is tied to the Wasatch Mountains by ribbons of riparian habitat which, in the desert west, are critical migratory and breeding habitats for a wide variety of wildlife@).

2. Shift the Focus from Single-Agency to Multiple-Entity Planning

A comprehensive planning effort should involve, as active players and decision makers, the full range of public and private entities whose actions and interests are affected by decisions about the lake and its watershed. This is not meant as criticism of the DNR, that is, to imply that the DNR lacks the personnel and expertise to address a wide range of issues affecting the lake.[487] It means, rather, that the issues that affect the lake transcend not just the DNR but any single agencyCin fact, any combination of government agencies.[488]

[487]Indeed, the DNR itself recognizes that the Apersistent challenge in managing resources on Great Salt Lake has been to manage many resources under the authority of many agencies under dynamic environmental and economic conditions.@ MINERAL LEASING PLAN, *supra* note 36, at 24.

[488]A similar critique has been made of efforts to restore the ecosystem of the Salton Sea. *See* COHEN ET AL., *supra* note 8, at 47.

There is a broad array of public and private interests whose actions affect the lake, or whose own uses and interests are affected by those activities and by governmental decisions about management of the lake. Land owners in the lake and its immediate vicinity include the U.S. Forest Service, the U.S. Bureau of Land Management, the U.S. Fish and Wildlife Service, the U.S. military, the U.S. National Park Service, the State of Utah (with management control by a similar array of subentities),[489] county and local governments, and a wide array of private entities.[490] As characterized by the DNR, ALand use around Great Salt Lake consists of a mix of residential, commercial, agricultural, recreational, and industrial uses common to population centers.@[491] In or immediately around the lake itself, these uses include salt and other mineral extraction and processing;[492] recreation, tourism, and cultural resources;[493] brine shrimp harvesting;[494] grazing;[495] transportation;[496] and other industries.[497] When the focus is expanded

[489]*See id*. at map 6. Landowners around the lake include the Forestry Division, with principal management responsibility for state sovereign lands; the Division of Wildlife Resources, which manages state refuges and wildlife management areas; and the Division of Parks and Recreation, which manages Antelope Island State Park, Willard Bay State Park, and Great Salt Lake State Park and Marina. *See id*. at 10B11.

[490]*See id*. at 72B73 & map 6.

[491]*Id*. at 72.

[492]*See id*. at 80. Six firms conduct these activities: Magnesium Corporation of America (MAGCORP), Cargill Salt (formerly AKZO Salt Co.), Morton Salt Co., North American Salt/Great Salt Lake Minerals (GSLM), IMC Kalium Ogden Corp., and the North Shore Ltd. Partnership/Mineral Resources International. *See id*. at 81B82 & map 3. Together, these companies extracted over $231 million worth of minerals in 1997, of which just over $1 million (0.61%) was paid to the State of Utah (which owns the minerals) in royalties. *See id*. at 84B85 & fig.6. Mining, smelting, and processing by Kennecott Utah Copper in the nearby Oquirrh Mountains, and in wetlands adjacent to the lake also can have significant impacts on the lake and its ecosystem. *See, e.g.*, UTAH DIV. OF WATER RESOURCES, UTAH DEP=T OF NATURAL RESOURCES, UTAH STATE WATER PLAN: JORDAN RIVER BASIN 2-1, 12-2 (1997) [hereinafter JORDAN RIVER WATER PLAN] (identifying Kennecott Utah Copper tailings pond as source of pollution of Jordan River and Great Salt Lake).

[493]Activities include boating, hiking, cycling, camping, off-road vehicle use, birding and other wildlife observation, hunting, fishing, and sightseeing; and occur in state parks; state, federal, and private wildlife refuges and management areas; and similar locations. *See* STATEMENT OF CURRENT TRENDS AND CONDITIONS, *supra* note 17, at 88B99.

[494]As of the 1997B98 harvest season, 32 companies harvested brine shrimp from Great Salt Lake. *See id*. at 101B02. Harvest peaked at almost 15 million pounds (unprocessed biomass) in 1995B96 and 1996B97, but dropped sharply again to just over six million pounds in 1997B98. *See id*. at 102.

[495]Grazing is the only agriculture currently allowed on sovereign lands. *See id*. at 105.

[496]Major transportation facilities include two railroad causeways, Interstate 80 along the south shore, and the road causeway to Antelope Island (Davis County causeway). *See id*. at 89, 105. They also include Salt Lake City International Airport, the operation of which can have water quality impacts on the lake. *See id*. at 36B37 (outlining procedures to be followed when

to the entire watershed, this list of owners expands considerably, along with the range of associated land uses.[498] Moreover, there are large numbers of groups and individuals who are interested in the lake=s nonconsumptive or noncommercial uses, and in restoring and protecting its hydrological and ecological integrity for its intrinsic as opposed to personal values.[499]

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operational problems and accidental discharges occur).

[497]For example, Thiokol Corporation owns and operates a rocket facility near the lake. *See id*. at 100. A much larger range of municipal sewage industrial facilities have potential upstream impacts on the lake as well. *See e.g.*, UTAH DIV. OF WATER RESOURCES, UTAH DEP=T OF NATURAL RESOURCES, UTAH STATE WATER PLAN: UTAH LAKE BASIN 2-1 (1997) [hereinafter UTAH LAKE WATER PLAN] (identifying point source discharges to Utah Lake and tributaries); JORDAN RIVER WATER PLAN, *supra* note 492, at 12-1 to -10 (identifying pollution sources in Jordan River).

[498]These uses would include, for example, residential, agricultural, industrial, and commercial uses, transportation, and recreational development. *See* JORDAN RIVER WATER PLAN, *supra* note 492, at 3-7 to -11.

[499]For example, Friends of Great Salt Lake is a nonprofit organization whose mission is to Apreserve and protect the Great Salt Lake ecosystem and to improve public awareness and appreciation of the lake through education, research and advocacy.@ *Friends of Great Salt Lake* (visited Apr. 6, 1999) <http://www.xmission.com/~fogsl/index.html>. Other nonprofit groups that have been involved in Great Salt Lake issues include the National Audubon Society, The Nature Conservancy, Ducks Unlimited, Pheasants Forever, and the Utah Wetlands Foundation. *See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 34 (listing private organizations and individuals active in the area). Further, a broad coalition of groups has expressed opposition to the proposed Legacy

Highway in favor of revised and integrated land use and transportation planning for the region. *See* FARMINGTON BAY ADVOCATES, *supra* note 75, at 1 & n.1 (stating that AFarmington Bay Advocates represents the interests of conservationists, hunters, birdwatchers, ranchers, private property owners, and others who are dedicated to preserving the remaining wildlife habitat and open space along the southeast shore of the Great Salt Lake@); SIERRA CLUB COMMENTS, *supra* note 167, at 1B2 (listing names of organizations that oppose Legacy Highway plan and its potential effects on regional environment).

These interests certainly can make their views known through the types of public participation currently being used by the DNR to develop the new management plan.[500] Commenting from the outside, however, is a far cry from sitting at the planning table in person to help iron out consensus values and goals, and to identify and agree upon specific implementation most likely to achieve those goals. A key lesson learned from this type of consensus process is that individuals and entities are far more likely to abide by rules and actions when they have participated in their formulation than when they are simply dictated by others.[501]

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[500]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 12B13 (discussing current planning process and its Aexternal@ and Ainternal@ scoping process designed to facilitate participation by federal agencies, local governments, citizens, and industry groups).

[501]The *Davis County Wetlands Plan*, for example, while nonregulatory in nature, assumes that successful implementation will occur if a common plan is supported by local governments, government agencies, nonprofit conservation groups, and private landowners. *See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 10B11 (acknowledging that Aimplementations of the plan will require negotiation with individual landowners to achieve mutually acceptable goals@); *see also* Adler, *supra* note 5, at 1002B03 (arguing that cultivating Asense of place@ by extending social conscience and promoting Aindividual responsibility for the health of the land@ through inclusive watershed process can be used to encourage enhanced Aconservation ethic@ in region).

A truly comprehensive effort to construct a rational management structure for Great Salt Lake also must come to grips with the remarkable patchwork of federal, state, and local legal authorities that govern the lake and its resources, as well as upstream land and water uses within the watershed, and the diverse groups of agencies and officials that implement them.[502] Through either land ownership and management, regulation, or both, control of the lake and its resources is governed or affected significantly by a large number of state agencies in Utah,[503] as well as the three other states in the watershed (Wyoming, Idaho, and Nevada), numerous federal agencies,[504] five Utah counties that border

[502]It would be a significant task to catalog every legal authority and implementing body within the Great Salt Lake watershed that has a significant impact on the lake. While such an effort should be undertaken as part of a comprehensive watershed program for the lake, the examples listed here suffice to make the point that they are many and diverse.

[503]These state agencies include the DNR and several of its divisions, which are responsible for sovereign lands management (Forestry Division); protection and management of wildlife (Division of Wildlife Resources); ownership and management of state parks (Division of Parks and Recreation); appropriation and distribution of water rights from the lake as well as its tributary waters and associated groundwater resources (Division of Water Rights); regulation of mineral exploration, development, and reclamation (Division of Oil, Gas and Mining); collection and dissemination of information on geology, brine and mineral resources, and geologic hazards (Utah Geological Survey); and water resources planning, conservation, development, protection and preservation (Division of Water Resources). *See* 1995 PLAN, *supra* note 21, at 14B24 (outlining current management responsibilities); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 10B12 (same). Other relevant state agencies include the Department of Environmental Quality (ADEQ@), which is responsible for water quality, air quality, and hazardous waste regulation; the Utah State Tax Commission, which administers and collects royalties for the brine shrimp harvest; and the Utah Department of Transportation (AUDOT@), which builds, maintains, and manages state roads and other transportation facilities, and oversees construction and operation of other transportation facilities by local governments and private entities. *See* UTAH CODE ANN. ' 19-1-205 (1998) (discussing responsibilities of DEQ); *id.* ' 72-1-201 (1998) (listing duties and responsibilities of UDOT); STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 102B04 (explaining Tax Commission=s role in collecting royalties from brine shrimp harvest).

[504]These federal agencies include all of the federal land owners identified above, as well as regulatory agencies such as the EPA, which has authority over a wide range of programs to regulate air and water pollution as well as solid and hazardous waste disposal; the U.S. Army Corps of Engineers (ACorps@), which administers the wetlands program under the Clean Water Act; the U.S. Fish and Wildlife Service (AService@), which implements the Endangered Species Act, the Federal Migratory Bird Treaty Act and other fish and wildlife protection programs; the Bureau of Reclamation (ABOR@), which operates or supervises the operation of federal water projects such as Willard Bay and the Central Utah Project; USGS, which conducts a considerable amount of monitoring and research about the lake and its resources. *See* CONGRESSIONAL QUARTERLY, INC., FEDERAL REGULATORY DIRECTORY 45B47 (8th ed. 1997) (discussing responsibilities, powers, and authority of EPA); *id.* at 46, 437B39 (discussing responsibilities and powers of Corps and legislation Corps enforces); *id.* 495B99 (explaining responsibilities and powers of Service and legislation Service enforces); *id.* at 504B05 (discussing responsibilities and powers of BOR); *id.* at 500B03 (discussing authority of USGS); *see also* U.S. Dep=t of the Interior, *Bureau of*

the lake and several more within the watershed,[505] and a large number of municipal and intergovernmental entities.[506] These entities regulate or manage the lake and its resources through a large array of laws and regulatory programs at local,[507] state,[508] and federal levels.[509]

Reclamation website (visited Feb. 7, 1999) <http://dataweb.usbr.gov/cib-bin/redirect.pl?projects=%2Fhtml%2Fcupoverview.html> (discussing BOR=s participation in Central Utah Project); USGS, *Programs in Utah website* (visited Feb. 7, 1999) <http://water.usgs.gov/pubs/FS/FS-044096/> (listing USGS programs in Utah).

[505]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 73B74 & map 1. Counties contiguous to the lake are Box Elder, Weber, Davis, Salt Lake, and Tooele. *See id*. A number of other Utah counties are also in the Great Salt Lake watershed, including Cache, Rich, Morgan, Summit, and Wasatch. *Compare* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at map 2 (depicting Great Salt Lake Drainage Basin), *with* UTAH DEP=T OF TRANSP., OFFICIAL HIGHWAY MAP (delineating county boundaries).

[506]Intergovernmental entities affecting the lake include county and municipal governments that have control over zoning and land use planning as well as various environmental health and safety issues, and intergovernmental or regional planning entities such as the Wasatch Front Regional Council and the Mountainlands Council of Governments; water purveyors such as the Salt Lake Water Conservancy District or the Central Utah Water Conservancy District, which manages the Central Utah Project; and the Utah Reclamation Mitigation and Conservation Commission (AURMCC@), which is responsible for restoration and mitigation projects to offset environmental harm caused by the Central Utah Project. *See Wasatch Front Regional Council* (last modified June 27, 1997) <http://www.wfrc.org/> (stating purpose and goals of Wasatch Front Regional Council); *Central Utah Water Conservancy District* (visited Apr. 6, 1999) <http://www.cuwcd.com/> (outlining Central Utah Water Conservancy District=s mission). In addition, such operations as spill control, cleanup, and similar emergency services that relate to water quality and other environmental impacts involve entities such as local fire departments, local health departments, and airport authorities. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 37B38.

[507]Local ordinances and regulations include planning and zoning codes. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 73B75 (explaining county zoning adjacent to lake). Further, other relevant health, safety, and welfare requirements include tax policies designed to promote land conservation. *See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 22B23 (setting out zoning ordinances and tax ordinance modifications).

[508]Major Utah laws and regulatory schemes include UTAH CONST. art. XVII (addressing water rights); *id*. art. XX (mandating that all public land be held in trust by State); and several titles of the Utah Code, including UTAH CODE ANN. ' ' 41-1-1 to -39-502 (1995 & Supp. 1998) (Utah Agricultural Code); *id*. ' ' 19-1-101 to -8-118 (1998) (Environmental Quality Code); *id*. ' ' 23-13-1 to -23-14 (1998) (Fish and Game); *id*. ' ' 40-1-1 to -10-30 (1998) (Mines and Mining); *id*. ' ' 59-1-1 to -23-8 (1996 & Supp. 1998) (Revenue and Taxation); *id*. ' ' 65A-1-1 to -11-1 (1996 & Supp. 1998) (State Lands); and *id*. ' ' 73-1-1 to -26-507 (1989 & Supp. 1998) (Water and Irrigation).

Provisions with particular applicability or significance to Great Salt Lake include *id*. ' 23-21-5 (1998) (authorizing Wildlife Board to use unsurveyed lands below lake meander line for wildlife management areas, fishing waters, and recreational activities); *id*. ' 23-21-6 (1998) (granting consent by State to sell lands to United States for bird refuges, which facilitated Bear River Migratory Bird Refuge); *id*. ' ' 23-21a-1 to -6 (1998) (Pelican Management Act); *id*. ' ' 19-5-101

to -120 (1998) (Water Quality Act); *id*. '' 19-6-301 to -325 (1995) (Hazardous Substances Mitigation Act); *id*. '' 59-23-1 to -8 (Supp. 1998) (Brine Shrimp Royalty Act); *id*. ' 65A-10-8 (1996) (Great Salt Lake management planning); *id*. '' 73-10f-1 to -2 (1989 & Supp. 1998) (Bear River Development); *id*. '' 73-16-1 to -5 (1989 & Supp. 1998) (Amended Bear River Compact); and *id*. '' 73-23-1 to -6 (1989) (West Desert Pumping Project).

[509]Major federal regulatory programs include the Clean Water Act, 33 U.S.C. '' 1251B1387 (1994); the Endangered Species Act, 16 U.S.C. '' 1531B1544 (1994); the National Environmental Policy Act, 42 U.S.C. '' 4321B4370d (1994); the Safe Drinking Water Act, 42 U.S.C. '' 300f to 300j-26 (1994); the Solid Waste Disposal Act, 42 U.S.C. '' 6901B6992k (1994 & Supp. II 1996); the Clean Air Act, 42 U.S.C. '' 7401B7671q (1994); the Comprehensive Environmental Response, Compensation and Liability Act (Superfund), 42 U.S.C. '' 9601B9675 (1994 & Supp. II 1996); the Federal Land Policy and Management Act, 43 U.S.C. '' 1701B1784 (1994 & Supp. II 1996); and the Migratory Bird Treaty Act, 16 U.S.C. '' 703B719 (1994).

Moreover, planning for Great Salt Lake cannot be done in isolation from several other ongoing planning efforts that will have significant impacts on the lake and its ecosystem. For example,[510] URMCC has developed a five-year plan to restore, protect, and conserve fish, wildlife, and recreation resources in Utahcin particular, resources affected over the years by federal reclamation projects in Utah.[511] As part of this effort, the *URMCC Plan* encourages partnerships by defining a set of adesired future conditions for fish, wildlife and recreation resources in watersheds throughout Utah.@[512] The URMCC was

[510]Again, it is not the author=s intent to catalog every ongoing federal, state, local, and intergovernmental planning process that might have some impact on Great Salt Lake. Rather, the examples identified in the text simply serve to demonstrate that comprehensive Great Salt Lake planning should be integrated with these other efforts, and vice versa.

[511]*See* URMCC PLAN, *supra* note 23, at 1-1 (outlining URMCC=s overall planning process).

[512]*Id*.

created in part to design and implement a comprehensive and integrated program rather than mitigation spread among different agencies.[513] Moreover, Congress intended the URMCC to adopt an ecosystem-based approach, which has been accomplished through a watershed-based approach to restoration.[514] It would make far more sense to integrate planning for Great Salt Lake and its watershed with the URMCC planning process (including URMCC=s work in other parts of the Great Salt Lake watershed, such as Utah Lake and the Provo and Jordan

[513]*See id*. (finding that opportunity for Aimproved coordination and cooperation under the Commission=s umbrella authority is enormous@).

[514]*See id*. at 2-1 (finding that Congress intended to give priority to restoration and maintenance of Abiological productivity and diversity within ecosystems,@ thus directing water-based approach). Strictly speaking, the URMCC=s approach is not entirely a watershed-based approach. For example, URMCC Ahas limited the definition of the Great Salt Lake watershed to the area immediately adjacent to the lake. This in no way diminishes the importance or value of the tributaries. The tributaries are critical to bringing fresh water and hydrologic function to the wetlands of the Great Salt Lake.@ *Id*. at 2-32. Nevertheless, the *URMCC Plan* identifies the Adesired future conditions@ of specific watersheds affected by federal reclamation projects, and designs restoration programs targeted to meet those needs. *See supra* notes 510B13 and accompanying text (explaining URMCC five-year plan to restore, protect, and conserve fish, wildlife, and recreation resources in Utah).

Rivers), to ensure that common goals and objectives are being pursued through complementary rather than potentially conflicting strategies.[515]

[515]Similar ecosystem restoration plans are being pursued on a smaller scale. For example, in 1996 Davis County prepared a plan to protect and conserve wetlands within the Great Salt Lake ecosystem in Davis County. *See* DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 1-8. A similar plan is in process in Box Elder County. *See* SWCA, INC., ENVIRONMENTAL CONSULTANTS, BOX ELDER COUNTY COMPREHENSIVE WETLANDS MANAGEMENT PLAN 1-1 (1998) (working draft). Moreover, each of the state-managed wildlife or waterfowl management areas on or around Great Salt Lake is in the process of developing habitat management plans. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 59. Efforts are also underway to develop a Utah Shorebird Management Plan under the guidance of an interagency team, which will be coordinated with the National Shorebird Management Plan currently being developed through a grant from the U.S. Fish and Wildlife Service to the Western Hemisphere Shorebird Reserve Network. *See* Manuscript Comments of Don Paul, Utah Division of Wildlife Resources (Feb. 24, 1999).

Considerable effort is also devoted to comprehensive planning for the water resources of the Great Salt Lake and other watersheds through the state water planning process. A statewide water plan was prepared in 1990 to provide the Astatewide foundation and direction@ for more detailed plans to be developed for each of the state=s eleven hydrologic basins.[516] To date, six of these basin-wide water plans have been developed, including four within the Great Salt Lake watershed.[517] Moreover, allocation, use, and future development of the Bear River basin is governed in part by the amended Bear River Commission through an interstate planning process pursuant to the Bear River Compact between Utah, Idaho, and Wyoming.[518] Planning for Great Salt Lake must take into account proposals for future water use in upstream watersheds, and vice versa.

[516]JORDAN RIVER WATER PLAN, *supra* note 492, at 2-1.

[517]These watersheds include the Bear River, Weber River, Jordan River, and Utah Lake basins. *See* UTAH LAKE WATER PLAN, *supra* note 497, at 2-1 (explaining that Utah Lake basin watershed plan is sixth such plan and that 11 more are in progress).

[518]*See* UTAH CODE ANN. ' 73-16-2 (1989 & Supp. 1998) (reproducing text of Amended Bear River Compact).

Furthermore, the Wasatch Front region is in the throes of a major quasi-public planning process known as Envision Utah.[519] Four alternatives have been prepared for long-range growth and development in the region, and the public has been asked to Avote@ on their preferences[520] based on projected impacts in terms of population density, land consumption and use, transportation, air quality, water, and infrastructure costs.[521] Given the close relationship between ongoing land use changes in the watershed and the health of the lake itself,[522] it makes far more sense for these processes to be integrated rather than separate.

Previous Great Salt Lake planning efforts have included varying degrees of input from different advisory bodies, such as the Technical Team[523] and the Advisory Council.[524] These mechanisms for multi-interest planning, however, suffered from two serious flaws. First, none of the advisory groups represented the full range of relevant interests. Most notably, none included representation from environmental groups or other noncommercial users of the lake, such as hunters, fishers, boaters, birders, photographers, or other recreational users of the lake. Second, each of these groups had purely advisory power. These two problems, of course, are related. It would be highly inappropriate to cede any governmental power to an entity that does not fairly represent all affected interests.

Retaining policy-making power within governmental bodies, of course, arguably lessens the possibility that the public interest might be sacrificed to private gain. However, governmental bodies themselves are not immune from

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[519]*See* ENVISION UTAH, QUALITY GROWTH EFFICIENCY TOOLS, SCENARIO ANALYSIS: EXECUTIVE SUMMARY *passim* (1998) [hereinafter ENVISION UTAH SUMMARY] (outlining alternative plans for growth and development throughout Wasatch Front).

[520]A four-page insert describing the Envision Utah process and including a citizens= ballot was included in major Wasatch Front newspapers on Sunday, January 10, 1999. *See, e.g.*, Brandon Loomis, *Envision Utah Seeks Your Voice on Growth Strategies for Region*, SALT LAKE TRIB., Jan. 10, 1999, at A1, A9 & insert (outlining Envision Utah process and providing public survey). This material and additional information is also available on Envision Utah=s online site. *See Envision Utah: A Partnership for Quality Growth* (visited Apr. 6, 1999) <http://www.envisionutah.org/>.

[521]*See* ENVISION UTAH SUMMARY, *supra* note 519, at 4-12 (outlining four scenarios and projected impacts of each on land use, development, transportation, air quality, and infrastructure costs).

[522]*See supra* notes 91B176 and accompanying text (discussing effect of land use and development on lake, and lake=s effect on landowners).

[523]*See supra* notes 247, 297B306 and accompanying text (explaining composition of Technical Team and its role within DNR in planning lake development and conservation).

[524]*See supra* notes 283, 297B306 and accompanying text (discussing Advisory Council and its role, both individually and with DNR, in planning lake development and conservation); *see also* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 8 (explaining duties of Advisory Council).

such ills, and the chance of this result is minimized *if* a decision-making body properly represents all interest groups (for example, by avoiding Atoken@ representation by certain interest groups that are not in favor with the prevailing political interests), and if fair, open, consensus decision-making procedures are used. Moreover, as mentioned above, ceding such authority to a representative body might be the essential price to pay for difficult decisionsCfor example, about changes in land use and water policyCthat would not enjoy adequate public support absent such a process.

3. Shift the Focus of Efforts from Resource Use and Allocation to Resource Restoration and Protection

As was true of many so-called watershed management programs developed over the past century, previous plans for the Great Salt Lake focused heavily on development and use of the lake and its resources,[525] although most sought to strike some sort of balance between resource development and protection of the lake=s wildlife and other environmental values.[526] In part, this approach was due to the manner in which the statutory directives for the lake were written, which included significant directives to promote commercial and industrial development while simultaneously protecting the lake=s wildlife and other environmental resources.[527]

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[525]*See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at 6. For example, the Authority=s 1965 plan was baldly titled *A Preliminary Master Plan for the Development of Great Salt Lake Over a Period of the Next 75 Years*. *See id*. While later plans were not quite so overt about their principal focus, as discussed above, they tended to be quite specific about issues such as mineral leasing and extraction and rather vague about issues like water quality and wildlife protection. *See supra* Part III (surveying planning projects and proposals from 1975 to present, and noting their focus on mineral leasing and extraction). As one telling example, the only major element of the *1995 Plan* that was actually implemented was the development of a mineral leasing plan for the lake. *See supra* notes 377, 381 and accompanying text (noting that 1995 PLAN discusses only implementation of mineral leasing portion). Ongoing efforts to manage the Salton Sea have been criticized for the same reason. *See* COHEN ET AL., *supra* note 8, at 39.

[526]*See supra* Part III (surveying planning projects and proposals from 1975 to present).

[527]*See supra* Part III.C (discussing original legislative authority for lake planning, enacted in 1975B76, and noting its problems and inconsistencies). The current version of the planning statute directs the DNR to prepare a comprehensive lake plan that encourages lake development, including brine, mineral, and petrochemical extraction and use. *See* UTAH CODE ANN. ' 65A-10-8(1)(b) (1996) (encouraging lake development in manner consistent with preservation, extractive industries, protection of wildlife, and recreational facilities); *id*. ' 65A-10-8(1)(e) (promoting Adevelopment of lake brines, minerals, chemicals, and petro-chemicals to aid the State=s economy@); *id*. ' 65A-10-8(1)(f) (encouraging Ause of appropriate areas@ for brine, mineral, chemical, and petro-chemical extraction); *id*. ' 65A-10-8(1)(h) (encouraging Adevelopment of an integrated industrial complex@). At the same time, it strives to promote recreational uses, some of

which could cause damage to the lake=s ecosystem as well. *See id*. ' 65A-10-8(1)(i) (advocating promotion and maintenance of recreational areas on and surrounding lake); *id*. ' 65A-10-8(1)(j) (encouraging promotion of safe boating on lake); *id*. ' 65A-10-8(1)(*l*) (providing public access to lake for recreation, hunting, and fishing). Simultaneously, it aims to preserve the lake; maintain the lake=s flood plain as a hazard zone; protect wildlife resources generally as well as marshlands, rookeries, and wildlife refuges specifically; and promote water quality management of the lake and its tributaries. *See id*. ' 65A-10-8(1)(b) (encouraging both development and preservation of lake); *id*. ' 65A-10-8(1)(c) (providing for maintenance of lake=s flood plain and hazard zone); *id*. ' 65A-10-8(1)(d) (promoting water-quality management for lake as well as lake=s tributary streams); *id*. ' 65A-10-8(1)(g) (maintaining lake and marshes and recognizing their importance to Awaterfowl flyway system@); *id*. ' 65A-10-8(1)(k) (calling for maintenance and protection of marshlands, rookeries, and wildlife refuges).

Extractive and consumptive uses of the lake do benefit the state=s economy, inevitably will continue, and must be considered as part of the lake=s planning process. And those who benefit economically from those uses must be part of a broader planning process. But our economic interests in the lake are no more important than those of the pelicans or the eagles, or of the microbiological species at the bottom of the food web that helps to support them.

While the DNR accepts the applicability of the public trust doctrine to the lake and its resources, the Great Salt Lake planning statute reflects classic multiple use doctrine. The DNR seeks to reconcile these two competing management regimes by arguing that the state legislature simply has added industrial development to the list of appropriate public trust use. Legally, this theory is quite suspect. From a practical perspective, the DNR=s view transforms the public trust doctrine into the Amultiple use doctrine.@ Thus, it fails to observe the doctrine by changing its essential character. More important, to the extent that the public trust doctrine has constitutional underpinnings, the legislature cannot constitutionally enact a law that compromises trust uses.[528]

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[528]Some have argued that the federal public trust doctrine has constitutional as well as common law weight. *See* Charles F. Wilkinson, *The Headwaters of the Public Trust: Some Thoughts on the Source and Scope of the Traditional Doctrine*, 19 ENVTL. L. 425, 453B71 (1989) (outlining possible sources of traditional trusts). *But see* James L. Huffman, *A Fish out of Water: The Public Trust Doctrine in a Constitutional Democracy*, 19 ENVTL. L. 527, 528, 545B55 (1989) (rejecting constitutional foundation for public trust doctrine as historically unrelated). Moreover, as discussed above, the state public trust doctrine is acknowledged specifically in Article XX of the Utah Constitution. *See* UTAH CONST. art. XX; *see also supra* note 324 and accompanying text (discussing Utah constitutional requirement that state-owned land be held in trust for public). While the state constitutional provision does not define public trust uses, it should be construed in light of the prevailing understanding of the public trust doctrine at the time

Thus, protection of the lake=s ecological attributes, as well as the integrity of its navigation and public access to its fisheries (in this case, brine shrimp harvesting), must have precedence over commercial and industrial development.

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the Constitution was written and ratified. Notably, just four years before Utah=s Constitution was adopted in 1896, the U.S. Supreme Court defined the scope and purpose of the doctrine for purposes of submerged lands granted to all states at the time of admission into the Union. *See* Illinois Cent. R.R. Co. v. Illinois, 146 U.S. 387, 436B37 (1892) (described *supra* note 323 and accompanying text). Moreover, while subsequent judicial expansion of public trust uses was fully consistent with the traditional uses, industrial uses might not be, and by virtue of the Supremacy Clause, must give way to those uses and values.

It is not the author=s intent in this Article to resolve this troublesome legal conflict definitively. There is, however, a more pragmatic reason to urge that a comprehensive watershed program for Great Salt Lake be driven by principles of watershed restoration and protection rather than resource use and development. The most recent (1995) version of the *Great Salt Lake Management Plan* shows how much easier it is to formulate specific goals, objectives, and implementing strategies for industrial development than for ecological protection.[529] The result is a significant imbalance among the competing uses identified in the planning statute and in the plan itself. Specific goals, like leasing identified portions of the lake for mineral development or building a specified road or causeway, are readily implemented, while vague pronouncements about preserving ecological integrity merely look good in the plan.

As proposed in the following section, ecological restoration and protection goals and strategies should be delineated in the plan, and implemented with at least as much specificity as economic development activities. This solution alone, however, still leaves us with the multiple use dilemma: What happens when uses and values within the plan conflict?

A more complete solution is to revise the Great Salt Lake watershed planning philosophy to focus most heavily on restoration and protection of the watershed and its natural resources and values. Those who promote the lake=s economic uses undoubtedly will protest that this approach biases an open, objective planning process with one set of values over another. This criticism is valid, and certainly a principal focus of a renewed and expanded planning effort should be to hammer out consensus on the overall goals and objectives of the program.

Nevertheless, giving watershed restoration and protection top billing in the planning process is actually the best way to preserve and protect all uses and values. First, so long as the nature and structure of our economy is maintained, economic uses always will have their own natural impetus. Resource development activities will occur where there is a market for the products and services provided, and where those uses are permitted by sound laws and regulations. By contrast, ecological uses and values–especially those values that are primarily public in nature–only receive adequate protection through concerted public effort.

Second, the long-term ecological health of the lake and its watershed is the basic foundation upon which human uses and activities, economic and otherwise, are sustained. Establishing and achieving the hydrological integrity and ecological health of the watershed will allow compatible economic uses to occur.

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[529] *See supra* Part III.E.1 (discussing 1995 PLAN).

While a sound economy undoubtedly provides the fiscal resources and general economic prosperity that are essential to environmental protection, providing first for economic uses of the lake does not similarly ensure that ecological uses and values will be protected.

Consistent with this approach, it makes sense to focus an overall watershed planning process on ecological integrity, while allowing local, regional, and state plans to provide as well for economic uses that are compatible with the shared goals and strategies of the watershed program. Thus, for example, the type of ongoing State-driven planning process that seeks to reconcile multiple uses of the State=s sovereign lands and related resources within the lake=s official meander line can continue within the umbrella of an overall watershed planning process that focuses on restoration and protection of natural values. However, the State=s agreement to make its lake planning process consistent with the consensus goals and strategies developed in the watershed planning process will better ensure that those watershed goals are actually met than if economic uses continue to maintain relative priority.

Great Salt Lake is an international ecological treasure of incalculable intrinsic value.[530] Already, experts have warned about serious existing and potential threats to the health and integrity of the ecosystem.[531] Planning for the

[530] *See supra* Part II.A (explaining lake=s physical and biological characteristics and noting resources lake contains).

[531] *See supra* Part II.B (discussing history of human uses and impacts on lake). The most imminent of these potential threats, and the one that appears to have had the most acute and immediate effect on the lake=s biological resources, is the substantially altered salinity gradient caused mainly by the Southern Pacific Railroad causeway. *See supra* notes 119B52 and accompanying text (explaining history of causeway and noting causeway=s impact on lake and surrounding industry). Some experts hypothesize that these changes are responsible in part for

Great Salt Lake watershed will mean little if the lake=s basic values are not restored and protected.

4. Develop Specific Goals, Targets, and Implementing Actions for the Watershed

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major declines in brine shrimp populations since the causeway was built, and in particular for recent population declines that caused early closure of the annual brine shrimp harvest for two consecutive years. *See supra* notes 135B49 and accompanying text (discussing impact of causeway specifically on brine shrimp industry). These impacts present an even greater concern given the role of brine shrimp in supporting the lake=s remarkable bird populations. *See supra* note 149 and accompanying text (noting potential impact of brine shrimp decline on avian populations). A longer-term but perhaps equally or more significant threat to the wildlife of Great Salt Lake is the tremendous pressure to develop in the lake=s critical and sensitive adjacent wetlands and flood plain. *See supra* notes 165B76 and accompanying text (noting potential impact of future development in wetlands adjacent to lake).

Past planning efforts for Great Salt Lake have been replete with vague statements of goals and objectives that often did little more than repeat the directives in the statutory planning mandate.[532] Often the only specificity added to those goals was more study.[533] The most successful watershed programs around the country have been those that moved beyond platitudes and identified more precise goals for watershed health, along with specific targets and actions to achieve those goals.[534]

Watershed goals should proceed from broadly-focused statements of ecological health to more precise objectives and requirements for individual attributes or components of the ecosystem in order to achieve those overriding watershed goals. It should be noted that Great Salt Lake lacks even some of the most basic standards for the health of aquatic ecosystems, such as numeric water quality standards to determine whether water quality is within acceptable bounds to protect the lake=s beneficial uses.[535]

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[532] *See supra* Parts II.CB III.E (surveying various lake planning proposals and comparing them to original 1975B76 planning mandate).

[533] *See id*.

[534] *See generally* Adler, *supra* note 5, at 1075B77 (explaining, for example, how Chesapeake Bay Program establishes numeric nutrient reduction targets in watershed; Great Lakes Program sets specific consistent, watershed-wide water quality standards and identifies specific remedial action plans; and Long Island Sound Program identifies source-specific pollution-reduction requirements necessary to meet restoration goals).

[535] *See supra* note 118 and accompanying text (noting lack of numeric water quality criteria in lake management). Under the Clean Water Act, water quality standards consist of designated beneficial uses of the waterway, and water quality criteria necessary to protect those uses. *See* 33 U.S.C. ' ' 1313(c)(2)(a), 1314(a) (1994); 40 C.F.R. ' 131.2 (1998). Great Salt Lake has its own Aunique class@ of water quality standards, and designated uses consisting of recreation (swimming and boating), mineral extraction, and brine shrimp harvesting. *See* 1995 PLAN, *supra* note 21, at 20 (stating that AGreat Salt Lake is in its own unique class. . . . Permits for waste-water discharges to the lake are established on a case-by-case basis. The beneficial uses of the lake are recreation (swimming, boating, etc.)[,] mineral extraction, and brine shrimp harvesting.@). The State Division of Water Quality has argued that numeric water quality criteria (WQC) are difficult to derive because of the high salinity levels in the lake, and instead issues waste discharge permits on a case-by-case basis. *See id*. (stating that Athe water is so unique that it is very difficult to develop numeric water quality criteria@). There are several problems with this case-by-case approach. First, water quality standards are used both to regulate individual discharges and to establish a benchmark for overall ambient water quality. *See* 40 C.F.R. ' 131.2 (stating that water quality standards Aserve the dual purposes of establishing the water quality goals for a specific water body and serve as the regulatory basis . . . for water-quality-based treatment controls and strategies@). Second, the Federal Clean Water Act itself does not specifically mandate the use of numeric as opposed to purely narrative water quality standards for all pollutants for all waters. *See* Environmental Def. Fund, Inc. v. Costle, 657 F.2d 275, 288 (D.C. Cir. 1981) (noting that Aneither the [Clean Water Act] itself nor the regulations require any numeric criteria be established@). However, EPA regulations do require that states adopt water quality criteria sufficient to protect the designated uses. *See* 40 C.F.R. ' ' 131.5(a)(2), 131.6(c) (1998). Criteria Amust be based on

sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use.@ *Id*. ' 131.11(a). No such showing has been made with respect to the lake. Moreover, the fact that the lake is unique and that derivation of criteria will be difficult merely means that site-specific study and analysis will be needed to develop criteria that are unique to the ecosystem. *See* ENVIRONMENTAL PROTECTION AGENCY, WATER QUALITY STANDARDS HANDBOOK 3-38 to -45 (1994) (discussing need for and noting requirement of site-specific aquatic life criteria); *see also* 40 C.F.R. ' 131.11(b)(1)(ii) (1998) (stating that criteria may be Amodified to reflect site-specific conditions@).

Increasingly, however, ecological planners have been moving from sole reliance on discrete criteria for individual components of the ecosystem to more broadly-defined statements of affirmative ecological health, such as definitions of the Aproperly functioning condition@ or the Adesired future condition@ of a watershed or other ecosystem. The *URMCC Plan*, for example, includes a series of definitions of Adesired future conditions for fish, wildlife and recreation resources in watersheds throughout Utah.@[536] To date, these statements consist entirely of narrative statements rather than more specific details.[537] Nevertheless, they represent an important beginning toward more detailed articulation of ecological goals for the region.[538]

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[536]URMCC PLAN, *supra* note 23, at 1-1. ACollectively these desired future conditions create a vision of where the mitigation program *cumulatively* should be taking us.@ *Id*. at 2-1.

[537]*See, e.g.*, *id*. at 2-6 (setting forth statement for desired future condition of Provo River/Utah Lake watershed); *id*. at 2-35 (setting forth statement for desired future condition of Great Salt Lake ecosystem); *id*. at 2-38 (setting forth statement for desired future condition of Jordan River watershed).

[538]For example, the *URMCC Plan* defines the desired future condition for the Great Salt Lake ecosystem as follows:

> A wetland and upland corridor, composed of wetlands owned by state, federal or local governments or private organizations, along the shoreline of the Great Salt Lake has been preserved that allows dynamic fluctuations of lake level. Resident wildlife and migratory shorebirds in the Western Hemisphere and waterfowl in the Pacific Flyway are assured resting, feeding and nesting habitat during the normal lake fluctuations, as well as a buffer when the lake level fluctuates more extremely.

Wetland hydrology is maintained in perpetuity and access for compatible recreation is available.

A commitment to preserve the ecological function and values of the GSL and associated wetlands exists among state and local governments and private industry.

Diverse educational opportunities are available that promote general understanding of the complexity and value of the Great Salt Lake wetland ecosystem as well as public and political support for the Lake=s wetland, wildlife and intrinsic values.

Id. at 2-35.

A relatively recent but increasingly popular tool to help define the desired health of aquatic ecosystems with quantitative, as opposed to purely qualitative or narrative, methods is the development and use of biological water quality criteria, or Abiocriteria.@[539] Biocriteria establish an affirmative statement of desired ecological attributes by reference to such indicators as population, species diversity, and trophic level structure and function.[540] Biocriteria typically compare these indicators in the subject water body to historical conditions, or to those indicators in a similar reference water whose condition is deemed to be as close as possible to natural.[541] Given the relatively unusual nature of Great Salt Lake, with its unique hydrology, ecology, and water chemistry, obviously it would be extremely difficult, and more likely impossible, to find an appropriate reference water body. It might be more possible, however, to determine some quantitative goals for the lake by reference to available historical data.[542]

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[539]*See generally* BIOLOGICAL ASSESSMENT AND CRITERIA: TOOLS FOR WATER RESOURCE PLANNING AND DECISION MAKING 3B6 (Wayne S. Davis & Thomas P. Simon eds., 1995) (outlining use of biocriteria as environmental indicators).

[540]*See id*.

[541]*See id*. (explaining process of analysis using biocriteria).

[542]For example, the trophic structure and species composition of lake biota prior to construction of the railroad causeway is relatively well understood. *See* Stephens, *supra* note 19, at 2. This type of effort would present quite a challenge as well. So many variables affect the number, type, and relative densities of species in the lake=s microorganism community that even if the causeway were dismantled altogether, it is doubtful that the original mix and relationship of species would be replicated. *See* Personal Communication with Doyle Stephens, *supra* note 124. Moreover, given the constantly-shifting nature of the lake=s ecosystem with changing lake and salinity levels and other variables, it is not possible to fix a single Acorrect@ or Anatural@ set of conditions. *See id*. Nevertheless, using these data and our increasing understanding of the relationship between different types of algae and other species and brine shrimp and other populations, it might be possible to define a range of healthy community characteristics that could

serve as a reasonable gauge of system health. *See id*.

Along with this type of broad definition of ecosystem health, successful watershed and ecosystem programs also define more specific objectives for ecosystem restoration and protection.[543] For example, it is useful and appropriate for the *URMCC Plan* to call for the maintenance of a wetland corridor along the Great Salt Lake shoreline, as well as preservation of the natural habitat and hydrology of those wetlands. It would be even more useful as a planning tool, however, to specify that an acceptable level of habitat and hydrological and ecological functions would be achieved if a defined percentage of the historical acreage of wetlands around the lake were restored and maintained in a biologically and hydrologically functional state. Such specificity would allow planners to identify how many acres of wetlands currently are preserved in public or private ownership, and how many unprotected acres are vulnerable to development, in order to assess their relative and cumulative degree of function, and to prioritize and target areas for purchase or protection. Similarly, once currently-degraded wetlands are identified, agencies with limited restoration resources could rank them in order of priorities for restoration based on their potential value and function if restored, the cost and feasibility of restoration, and the likelihood of restoration success. Moreover, identification of specific wetlands or other areas to target for restoration and protection, as opposed to more generic goals, assures that the most important habitats receive attention in a coordinated rather than isolated fashion.[544]

In addition to specific goals and objectives, sound watershed programs must include firm, and where possible binding, commitments to implementation.[545] Watershed and ecosystem planners around the country have learned the lesson of impressive-looking plans that did little more than collect dust on the shelves of government offices. Such was the fate of ambitious watershed planning programs, for example, under section 208 of the Clean Water Act[546]

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[543]The Long Island Sound Program, for example, has established specific goals for pollution reduction from individual sewage treatment plants in order to meet specified goals for reduced total discharges to the Sound, in order to increase dissolved oxygen in the water by set goals. *See* Adler, *supra* note 5, at 1076–77. Similarly, the Chesapeake Bay Program has been touted as a particular success because it established specific goals for the reduction of nutrient pollution of the Bay, and other environmental goals such as the restoration of specific acreage of submerged aquatic vegetation. *See id*. at 1071–72.

[544]*See, e.g.*, DAVIS COUNTY WETLANDS PLAN, *supra* note 61, at 8, 10, 12–13 (demonstrating Davis County=s attempt to approach wetland conservation from coordinated system, including multiple Amunicipalities, landowners, state and federal agencies, conservation groups, and land developers,@ while looking at entire Davis County portion of lake=s wetland ecosystem).

[545]*See* KEYSTONE POLICY DIALOGUE, *supra* note 4, at 13–14 (suggesting ways for groups to successfully implement ecosystem management initiatives); Adler, *supra* note 5, at 1105 (identifying commitments to implementation as essential to watershed program success).

[546]33 U.S.C. ' 1288 (1994); *see* Adler, *supra* note 5, at 1042–44 (discussing problems with

and the River Basin Planning Program of the Water Resources Development Act of 1965.[547] Unfortunately, it has also been the fate of all previous Great Salt Lake planning efforts.[548]

Obviously, insistence on implementation as opposed to paper planning is easier to say than to do. It requires funding, personnel, and most important, the political will to follow through on decisions once they are made. This, however, is the most important rationale for using an inclusive, consensus-based process, rather than one dictated by a single governmental agency. The broader the base of public and political support for the plan once completed, the greater the likelihood that it will be translated into action.

5. Shift from Short-Term to Long-Range, Iterative Planning

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section 208 of Clean Water Act).

[547]Pub. L. No. 89-80, 79 Stat. 244 (1965) (codified as amended at 42 U.S.C. ' 1962 (1994)); *see* Adler, *supra* note 5, at 1009B13 (discussing history and problems of Water Resource Development Act).

[548]*See supra* Part III (discussing past and ongoing management efforts for lake and efforts= problems).

The current Great Salt Lake planning process is proceeding rather quickly, in part to resolve specific questions about the salinity differential in the lake and its apparent impact on brine shrimp populations, as well as questions about when and if the West Desert pumps should be used.[549] While progress on these short-range problems is commendable, the current planning effort should be just the beginning of a much longer, more iterative and adaptive process.

Similar programs around the country proceed on the principle of Aadaptive management,@ which consists of planning, implementation, monitoring, reassessment, replanning, additional implementation, and so on, until the goals of the program are met.[550] Although it is natural to hope for rapid progress on even difficult issues and problems, it should be remembered that other successful large watershed programs have succeeded primarily through slow but steady progress, with constant reassessment and revision of goals and strategies along the way, and with significant amounts of federal, state, and other funding. The Chesapeake Bay Program dates back to at least 1983; the Great Lakes Program began in 1972.[551] Both have made significant progress; but both still have a long way to go. Both began with initial goals, plans, and recommendations; but both

[549] *See supra* notes 393, 417 and accompanying text (discussing two important lake issues requiring clear and expeditious resolution).

[550] *See generally* KEYSTONE POLICY DIALOGUE, *supra* note 4, at 14B16 (illustrating that adaptive management encourages participation in planning, implementation, monitoring, and redirection phases of process); Adler, *supra* note 5, at 1104B06 (finding that successful watershed programs share principles of adaptive management planning, and noting that such principles date back to Progressive Era and Theodore Roosevelt administration).

[551] *See* Adler, *supra* note 5, at 1071B75 (pointing out longevity of Chesapeake Bay and Great Lakes programs).

have been modified and improved substantially along the way. Both include Aplans@ that could be treated like static views of reality; but both are more than thatCthey are iterative planning processes that allow for change, trial and error, and adaptation.

In short, while proponents of a broader watershed-based planning effort for Great Salt Lake should support the current, more limited planning effort, it has to be just the beginning of a much longer, more iterative and adaptive process.

V. CONCLUSION: A PROPOSAL FOR A GREAT SALT LAKE COMMISSION TO DEVELOP AND IMPLEMENT A COMPREHENSIVE, WATERSHED-BASED PLAN FOR THE RESTORATION AND PROTECTION OF GREAT SALT LAKE

Great Salt Lake is used by people for a wide range of activities, from relatively passive pursuits such as hiking and birdwatching to more intrusive uses such as harvesting of brine shrimp, the industrial extraction of valuable minerals, and the construction of massive dikes and causeways that have changed the lake=s fundamental character. Many of these uses inevitably conflict. Moreover, serious questions persist about the ability of the Great Salt Lake ecosystem to withstand the onslaught of additional human impacts, particularly as development creeps toward the lake=s shore, slowly filling its critical buffer of wetlands and changing the patterns of water flow that maintain the lake=s hydrological and ecological integrity.

The State of Utah has recognized these conflicts and challenges for more than three decades, and has tried to address them through a series of ostensibly comprehensive planning efforts. Each of these efforts failed to produce any significant change. They failed because they were not adequately inclusive. They did not provide all who have a real stake in the lake=s health and welfare with a true voice in its future. They did not address the full range of activities and interactions that affect the lake. A renewed, ongoing planning effort is promising, but suffers from most of these same flaws.

Meanwhile, communities, states, and regions throughout the country have provided a promising model for a new type of planning for the restoration and protection of the nation=s rivers, lakes, wetlands, and coastal waters. These watershed-based programs have succeeded where previous Awatershed@ or Ariver basin@ programs failed because, while each has unique features appropriate to its individual water body and community, each shares certain fundamental attributes. They address the full range of ecological connections within a watershed, links that run from upstream to downstream, from groundwater to the surface, from water quality to water quantity, and from land to water. They seek cooperation rather than conflict or overlap between the innumerable agencies and institutions responsible for water resources and related land use policies within the watershed. They promote economic efficiency by targeting limited public and private resources to the best solutions to the most pressing problems within the watershed, and economic equity by asking all who use or harm the aquatic resource to contribute fairly to its restoration and protection. They educate the public about the values to be protected in the watershed, and draw support and energy from a renewed sense of place, a

growing realization that people are willing to contribute to the protection of their special water bodies,

Watershed programs around the country are diverse in scale, specific format, and mission. They also share certain organizational features, however, that contribute to their success. They seek collective decisions by consensus among all legitimately affected interests. They are based on comprehensive, watershed-wide information and analysis about the state of the resource, the sources of its impairment, its past and future potential, and a full range of viable solutions. They develop both overall goals for watershed health, and specific, measurable objectives to meet those goals. They target solutions to meet those goals and objectives, but use an iterative rather than a static process to encourage experimentation and revision until the best solutions are found and until program goals and objectives are met. They accommodate all legitimate economic uses and activities within the watershed, and recognize that a sound regional economy is essential to the program=s restoration and protection goals, but ensure that those actions are compatible with the long-term sustainability of the aquatic ecosystem.

Such a process could be replicated for Great Salt Lake by creating a quasi-public legislative body to be called the Great Salt Lake Watershed Commission (ACommission@).[552] This type of entity should include full and balanced representation from all of the major interest groups that have a major stake in the health and welfare of Great Salt Lake, including those who use the lake for both consumptive and nonconsumptive uses. In addition to major private interests, membership should include all relevant local, state, and federal regulatory decision makers and landowners. Such a Commission obviously could not (and should not) divest individual governmental entities of their otherwise lawful power over the wide range of issues and activities that affect the lake. It could, however, be given legal authority to adopt a comprehensive watershed plan that establishes goals, objectives, and strategies for the lake. It could also adopt goals, objectives, and strategies for land and water uses and policies within the Great Salt Lake watershed that have significant impacts on its health and welfare. Each of the participating entities, as the price for being given a seat at the table, would agree to make its own plans and decisions consistent with the overall watershed plan. Both plan development and compliance would be by

[552]For most purposes, the specific name chosen for this institution is far less important than its structure, composition, and mission. Whatever the ultimate name chosen for this body might be, however, use of the term Awatershed@ is important both to distinguish the new group from the many that preceded it, and to underscore the expanded focus and nature of the effort.

consensus rather than fiat, thus enhancing the probability that the plan will actually be implemented. The Commission could also be given a staff and the funding necessary to implement activities identified in the plan that cross agency or jurisdictional boundaries.

Optimally, the two other states with significant hydrologic involvement in the watershed[553] should be included in this process as well. Such involvement, however, would require an interstate compact or some other similar mechanism, rather than pure intrastate legislation. Given that Idaho and Wyoming are included in the watershed only through the Bear River, one option would be to amend the Bear River Compact, in which all three states are represented,[554] to include consideration of Great Salt Lake issues and impacts. Amending the Compact, of course, would represent a major expansion of its purpose, which currently is focused largely on water use, development, and allocation.[555] Another option would be to negotiate a separate compact or other arrangement under which Idaho and Wyoming were represented on the Great Salt Lake Watershed Commission in proportion to their involvement and interest in the watershed.

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[553]The two other states with significant involvement in the watershed are Idaho and Wyoming. *See* STATEMENT OF CURRENT CONDITIONS AND TRENDS, *supra* note 17, at map 2 (illustrating geographic scope of lake). Nevada has only small amounts of land within the watershed. *See id*. Moreover, this land is in the westernmost reaches of the largely noncontributory areas to the west and northwest of the lake. *See id*. Thus, while Nevada technically is in the watershed, its participation is far less important.

[554]*See* UTAH CODE ANN. ' 73-16-2 art. 2 (1989 & Supp. 1998) (reproducing text of Amended Bear River Compact).

[555]*See id*. at art. 1.

The proposal to establish a Great Salt Lake Watershed Commission with decision-making as opposed to purely advisory authority might seem heretical to the State of Utah. After all, the State owns the waters, brines, and submerged lands and other resources of Great Salt Lake, having won a hard-fought legal battle with the federal government. It cannot, and should not, divest itself of the legal authority to manage its sovereign lands consistent with its public trust responsibilities[556] and other applicable legal requirements. The idea of a Great Salt Lake Watershed Commission, however, does not mean that the State could not continue its efforts to develop a comprehensive plan for the use and management of its lands and waters within the meander line of the lake (and other State-owned or managed lands and waters within the watershed). Indeed, such nested planning would be essential to the proper implementation of the overall watershed plan, just as similar nested plans would be required for each of the counties, federal land managers, and other jurisdictions whose actions will affect the overall plan. By participating actively in the Commission process, however, the State would both have significant control over the outcome, and agree to make its lake use and management plans fully consistent with the plan developed by the Commission.

Unbeknownst to many Utahns, Great Salt Lake is one of the globe=s great ecosystems. While some believe that it is virtually devoid of life, in fact it supports immense populations of an impressive diversity of species. Aggregations of waterfowl, shorebirds, and colonial water birds during its spring and fall migrations and its summer staging seasons are among the great wildlife spectacles to be seen anywhere around the world. Because of its extreme conditions, its large periodic fluctuations in size and salinity, and the relatively small diversity at the very base of its food web, however, the ecosystem on which this ecological bounty depends is quite vulnerable to any additional stresses imposed by human activities.

Serious recent declines in the lake=s brine shrimp population may reflect a temporary condition, but the declines may portend more significant illness in the Great Salt Lake ecosystem. Failure to restore and protect this resource could have tragic consequences, with ramifications for hemispheric bird populations. A comprehensive, inclusive, watershed-based planning process provides the best

[556]*See* UTAH CONST. art. XX; *see also supra* notes 324, 528 and accompanying text (discussing public trust doctrine and its application in Utah to lake watershed management).

opportunity to balance the needs of this ecological treasure against legitimate human uses of the lake and its resources.

APPENDIX A: GREAT SALT LAKE DRAINAGE BASIN