A Proposal to Preserve and Enhance Habitat at the Salton Sea

submitted by the

PACIFIC INSTITUTE
FOR STUDIES IN DEVELOPMENT, ENVIRONMENT, AND SECURITY

654 13th Street
Preservation Park
Oakland, CA 94612

(510) 251-1600 (phone)
(510) 251-2203 (fax)
pistaff@pacinst.org
http://www.pacinst.org

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OVERVIEW

Recent discussions and legislative efforts at the state and federal level have again focused attention on the Salton Sea. These recent discussions, on the potential impacts on the Salton Sea of a proposed water transfer from Imperial Valley to the San Diego area, have highlighted the challenges faced by those working to address the current and future problems of the Sea, and the inadequacy of any temporary or piecemeal approach. Efforts to facilitate the proposed water effort are further hampered by indications that the federal/state Salton Sea restoration effort will be unlikely to achieve its own limited goals if the water transfer is implemented.

The current problems of the Salton Sea, manifested in frequent die-offs of fish and birds, arise from a complex set of human and natural factors. These include the high concentration of nutrients in agricultural run-off (creating an overly-productive system that can rob organisms of oxygen) and the combination of a hot arid climate, a below-sea level depression with no natural outlet save evaporation, and relatively salty Colorado River water that accumulates additional salts when used to leach fields. Fish and bird mortality at the Sea is more directly linked to nutrient inputs (exacerbated by the Sea's high salinity); the inexorable rise in salinity is a future problem, one that will ultimately prove intolerable to fish in the Sea, and largely eliminating the Sea as a resource for fish-eating birds. A reduction in inflows to the Sea, due to the proposed water transfer and various other current and proposed actions, would accelerate the Sea's transition to a water body unable to support fish.

In an effort to satisfy the dual objectives of addressing the ecological health of the Salton Sea and facilitating the proposed water transfer, the Pacific Institute for Studies in Development, Environment, and Security proposes a Salton Sea Habitat Enhancement Project. This project involves the construction of long dikes at the north and south ends of the Salton Sea, in conjunction with the development of constructed wetlands along the Alamo and New rivers and the implementation of management practices to reduce nutrient loads from agricultural, municipal, and industrial sources. The diked areas would capture inflows and maintain elevation near current levels, with excess waters flowing through pipes in the dikes to the main body of the Sea. These impounded north and south shore areas would transition to brackish, estuarine conditions, preserving and enhancing fisheries and assuring a food source for fish-eating birds such as brown and white pelicans and cormorants. The stability and lower salinity of the impounded areas would also promote increased recreation and economic development. This project builds upon the recommendation included in the Pacific Institute May 2000 comments on the Salton Sea Restoration Project draft EIS/EIR.

The proposed project offers the following benefits:

1. Compatible with water re-allocation efforts
2. Sustainable over the long term
3. Increases diversity of habitats at the Salton Sea
4. Preserves and enhances fisheries in impounded areas
5. Promotes increased recreational and economic development opportunities
6. Compatible with other off-site actions

The proposed action is not a simple fix, nor would it be inexpensive. Yet it is our belief that the Salton Sea merits attention and intervention, and should not be simply ignored. It is also our belief that state and federal authorities will not be interested in repeated, small-scale interventions that do not address the root causes of the current problems afflicting the Sea, and certainly will not be interested in projects that are incompatible with California's stated objective of reducing its dependence on the Colorado River.

BACKGROUND

The Salton Sea lies 35 miles north of the U.S.-Mexico border in one of the most arid regions in North America. The Sea has the largest surface area of any inland body of water in the state of California. Presently, the Sea is 35 miles long, 9 to 15 miles wide and has a volume of roughly 7.5 million acre-feet; its surface elevation lies approximately 228 feet below sea level. The Salton Sea is a terminal lake; the only outflow for its waters is via evaporation. As water evaporates, salts, nutrients, and other elements are left behind to concentrate in the Sea. Current salinity of the Sea is roughly 44,000 mg/L, about 25 percent saltier than ocean water.

The Salton Sea provides a host of ecological values that are important not only within the Imperial and Coachella valleys but also throughout the historic reach of the Colorado River delta and the length of the Pacific Flyway. The unusually high incidence of disease and mortality currently reported at the Salton Sea threatens these values. Although the Salton Sea is a product of human activity, the Sea and its environs provide a complex mosaic of habitats, ranging from open water, estuaries, and salt marsh to mud flats and riparian corridors. These and other habitats support more than 400 species of birds and a variety of other wildlife, including endangered species such as the desert pupfish and the Yuma clapper rail. These habitats are especially vital given the destruction of wetlands throughout most of southern California and the lower San Joaquin Valley and within the Colorado River delta itself.

A series of problems confronting the Salton Sea has captured the attention of the public and policymakers. These problems include the deaths of millions of fish and tens of thousands of birds, diminished interest in the Sea as a recreational destination, the loss of shoreline and property due to rising levels of the Sea, elevated nutrient levels in the Sea causing frequent algal blooms and subsequent fish kills, and increasing salinity.

The federal Bureau of Reclamation and California's Salton Sea Authority are the lead agencies in an effort to identify potential restoration alternatives for the Sea. In January 2000, these agencies released the draft Salton Sea Restoration Project Environmental Impact Statement/ Environmental Impact Report (DEIS). The U.S. Environmental Protection Agency (EPA) and the U.S. Fish and Wildlife Service, as well as a large number of NGOs (including the Pacific Institute) and private citizens, found the DEIS to be inadequate and unsatisfactory. The lead agencies are presently developing a new set of alternatives, which are expected to focus on evaporation ponds, to reduce and stabilize salinity.

The goals of the Restoration Project are:

1. Maintain the Sea as a reservoir for agricultural drainage;
2. Provide a safe, productive environment at the Sea for resident and migratory birds and endangered species;
3. Restore recreational uses at the Sea;
4. Maintain a viable sport fishery at the Sea; and
5. Enhance the Sea to provide economic development opportunities.

The Pacific Institute's February 1999 report entitled *Haven or Hazard: The Ecology and Future of the Salton Sea* set out a series of principles to guide any intervention at the Sea:

1. The primary goal of any restoration plan must be to provide for a healthy ecological system and protect human health.
2. Any restoration plan should be firmly grounded in a scientific understanding of the ecology of the Salton Sea and related ecosystems.
3. Any restoration plan should address all of the water quality factors responsible for the current problems at the Salton Sea.
4. Parties responsible for the current problems facing the Salton Sea and beneficiaries of its restoration should bear an equitable share of the costs.
5. Any restoration plan must be compatible with region-wide water conservation and voluntary reallocation programs.
6. Any restoration plan for the Salton Sea must be compatible with protection and restoration of the Colorado River delta, the upper Gulf of California, and other ecosystems in the region.
7. The Restoration Project must be transparent, inclusive, and fully integrated with other actions impacting the Salton Sea.

Inflows

Calculated annual inflows to the Salton Sea averaged 1.36 million acre-feet (MAF) from 1950-1997. An estimated 85 percent of these inflows come from agricultural sources. The Salton Sea Restoration Project DEIS (January, 2000) lists 19 past, present, and reasonably foreseeable future projects that could impact the quantity and quality of inflows to the Salton Sea, many of them due to the implementation of measures to conserve agricultural water. The actions that could reduce inflows to the Salton Sea include the Imperial Valley-San Diego area water transfer (the planned rate of transfer is expected to increase by 20,000 AF/year, to a minimum of 130,000 AF/y and a maximum of 300,000 AF/y), reductions in wastewater flows from Mexico (23,000 AF/y), and reduction in seepage from the lining of the All-American Canal (23,000 AF/y) and Coachella Canal. The net impact of these various actions would be to reduce the quantity of water flowing into the Salton Sea. The Salton Sea Reclamation Act of 1998 similarly recognizes the likelihood of such reductions, directing the Secretary of the Interior to

> apply assumptions regarding water inflows into the Salton Sea Basin that encourage water conservation, account for transfers of water out of the Salton Sea Basin, and are based on a maximum likely reduction in inflows to the Salton Sea Basin which could be 800,000 AF or less per year.

Elevation

The current surface elevation of the Salton Sea is about 228 feet below sea level (elevation fluctuates annually by as much as a foot due to seasonally varying inflows and evaporation rates). The Sea's current elevation supports an extensive array of shoreline habitats that in turn support a great diversity of birds and other wildlife. Reducing the elevation of the Sea could

adversely impact much of this habitat, and would also expose a land bridge connecting Mullet Island, an important rookery, exposing nesting birds and their chicks to predation. Reducing the elevation of the Sea could also isolate populations of pupfish in agricultural drains by limiting their ability to move back forth through the Sea. Some recreational uses of the Sea require a stable elevation, for the construction of recreational facilities such as piers and boat-loading ramps, though the actual elevation itself is less important. Economic development similarly requires a stable elevation, presumably one that would not reduce the value of existing properties.

Seismicity

The Salton Sea lies in a very seismically active region. Since 1900, 15 earthquakes measuring 6.0+ on the Richter scale and another 53 of estimated magnitude 5.0+ have occurred in or near the Salton Sea, according to the U.S. Geological Survey. The west side of the Salton Sea is moving at about 8 cm/year relative to the east side, and the ground level on the south shore of the Sea is subsiding at a rate of more than 2 cm/year. This would affect structures such as dikes built in the area, increasing maintenance costs and potentially compromising their long-term integrity and resilience in the face of earthquakes.

Socioeconomics

According to a recent economic study from U.C. Riverside by Bazdarich, the total value in 1998 of all Salton Sea properties within ½ mile of the shoreline was $154.8 million. Total population within five miles of the Salton Sea, estimated from 1990 census tract data, is fewer than 15,000 people. Restoring recreational uses applies to a broad population base, potentially drawing visitors from San Diego and Los Angeles and points further. Recreational sites at the Salton Sea include various bird-watching, fishing, and duck-hunting areas around the Sea, as well as the Salton Sea State Recreational Area around the northeast of the Sea, and the Sonny Bono Salton Sea National Wildlife Refuge at the southeast end.

Salinity

The threat that increasing salinity poses to fish is one of the driving forces of the Salton Sea Restoration Project. Loss of all or parts of the Salton Sea fishery would have profound impacts on fish-eating birds, such as brown and white pelicans and cormorants, that rely on the Sea for food. Loss of fish from the Sea would also eliminate the sport-fishery and decrease opportunities for recreational and economic development. Yet increasing salinity is a natural phenomenon for terminal lakes such as the Salton Sea, meaning that efforts to reverse such increases will require continuous intervention and management.

Salinity of the Salton Sea is reported at 44,000 mg/L, roughly 25 percent saltier than ocean water. The salinity at which fish would no longer be able to survive in the Sea is not known, though it is probable that in the next 5-20 years, salinity will rise to the point where fish are no longer able to reproduce in the Sea, and eventually are unable to survive at all. The endangered desert pupfish reportedly can tolerate much greater salinity than the other species in the Sea, but eventually its salinity tolerance will be exceeded as well. The loss of the Sea's fishery would have profound impacts on the host of fish-eating birds that depend on the Sea as a stopover, including brown and white pelicans and cormorants.

Nutrient Loading

The Salton Sea suffers from the misperception that it is dying. The opposite is closer to the truth: the Sea is an extremely productive body of water. Local authorities claim that the Salton Sea may be the most productive fishery in the world. Several factors contribute to this productivity, the most important of these being the extremely high levels of nutrients present in the water flowing into the Salton Sea, creating eutrophic conditions. These nutrients are used in fertilizer and are also present in effluent from dairy and cattle operations, as well as in municipal and industrial effluent. Nutrient-rich conditions promote algal growth and conditions conducive to the transmission of disease. Algal respiration and the decomposition of dead algae consume large quantities of oxygen, decreasing concentrations of dissolved oxygen (DO) in the Sea, asphyxiating fish.

Selenium

Selenium toxicity can lead to reproductive failure, deformities, and death among aquatic organisms and birds, and can also adversely affect people. The Sea provides subsistence fishing for Native Americans and may also contribute to a significant portion of the diet of others in the area, despite the California Health Advisory Board's posted warning discouraging people from consuming more than four ounces of Salton Sea fish in any two-week period. Preliminary studies show increased selenium levels in white and brown pelicans, and that increased selenium levels may suppress the functioning of avian immune systems, making them more susceptible to disease.

The proposed project could exacerbate selenium-related problems at the Sea, due to the construction of the dikes. Such construction would disturb the Sea floor, resuspending selenium and other contaminants found there, some of which would enter the food chain.

THE DIKING ALTERNATIVE

The Salton Sea is a terminal body of water – it has no outlet. While water itself evaporates from the Sea, salts and nutrients and other contaminants are left behind to concentrate. Most of the proposed solutions for the Sea would create an outflow of some kind, via pipelines, evaporation ponds, or via impounded areas within the Sea itself. Diking options have been around for many years – they vary based on the size and number of dikes and impounded areas, but the basic principle is the same: provide an outlet from an impounded area to another area where contaminants will concentrate, creating a flow-through system for at least part of the Sea.

The proposed alternative involves constructing dikes within the Sea near the north and south shores to capture inflows and stabilize elevation at –230 feet. Water above elevation –230 feet would flow via gravity through pipes in the dikes to the main body of the Sea. Such a gravity-fed system requires a reduction in inflows. The impounded north and south shore areas would transition to brackish, estuarine conditions. Actual salinity in these impounded areas would depend on several factors, including the volume and salinity of inflows (salinity of the Alamo and New rivers is currently about 2,900 mg/l) and the total volume of the impounded area. Varying or reduced inflows would impact the central portion of the Sea, but would be expected to have lesser impacts on the impounded areas. The central portion of the Sea would transition

to a hyper-saline body, at a rate faster than would occur without the dikes. Such conditions would eliminate fish from the main body of the Sea, though invertebrates such as brine shrimp and brine flies would thrive there, providing a food source for many species of waterbirds.

Dikes would be constructed along the -240 foot contour at the north end of the Sea to impound the Whitewater River, and along either the -240 foot or -245 foot contour at the south end of the Sea, to impound waters from the Alamo and New rivers, San Felipe Creek, and agricultural drains. Determination of the preferred location would be influenced by biological and cost considerations: further investigation is required to determine the additional benefits associated with a fifteen foot deep (at -245') versus a ten foot deep (at -240') impoundment. The eastern extent of the southern dike could join the shoreline either near Bombay Beach (protecting Mullet Island), or further south, near Wister. The western extent of the dike could be configured to exclude San Felipe Creek, limiting predation of desert pupfish that use that habitat. For an indeterminate period, desert pupfish would be expected to colonize a Sea that exceeds the salinity tolerance of other fish.

The following table shows the estimated length of the dikes, and the area and volume of water that they would impound, and estimated costs of each.

Dike Location	Length (miles)	Impounded Area (acres)	Impounded Volume (AF)	Est. cost ($)
North End	7	2,000	9,000	$42,000,000
South End at -240'	29	10,500	47,000	$175,000,000
at -245' to Wister	28	20,500	143,000	$250,000,000
at -245' to Bombay Beach	38	26,000	181,000	$340,000,000

Costs are based upon estimates included in Parsons' *Analysis of Salton Sea Restoration Plans* and in the Salton Sea Restoration Project draft EIS/EIR and should be considered as preliminary at best. The Parsons report recommends a dike with a crest width of 20 feet, 5 feet of freeboard (above the water surface), and sunk 5 feet into the sea floor. Parsons also recommends a slope of 3.5:1 for in-Sea dikes, to increase stability in the face of earthquakes. The crest of the dike could be built to allow bicycle and pedestrian traffic, and potentially motor vehicle access to bird-watching sites, fishing piers, and boat docks at appropriate areas. The Salton Sea Authority and the Bureau of Reclamation have identified potential borrow sites in nearby areas for the estimated material required for the dikes.

The resulting impounded areas behind the dikes would be coupled with treatment wetlands, to reduce nutrient and selenium loading, and with the implementation of management practices to reduce nutrient loads from agricultural, municipal, and industrial sources. Because the proposed diking alternative is not dependent on existing quantities of inflows, such treatment wetlands would not have a harmful impact on the Sea itself. A series of constructed wetlands along the lengths of the Alamo and New rivers would improve the quality of water entering the Sea. Additionally, the impounded areas would be more amenable – because of the smaller size of the water body itself and the increased ability to flush accumulated nutrients from the sub-system – to the proposal to treat inflows with alum, binding phosphates (the limiting nutrient at the Sea).

Treatment wetlands would serve the additional function of reducing the amount of sediment deposited into the Sea. The implementation of on-farm conservation efforts and reductions in

inflows are expected to reduce the volume of sediments entering the Sea by as much as a third over time, increasing the time before sediments fill the impounded areas. To further reduce the inflow of sediment to the Sea, small weirs could be constructed at appropriate locations along the Alamo and New rivers, promoting deposition of sediment behind the structures, potentially aerating water that flows over the weir, and encouraging the growth of emergent wetlands.

Considerations

The impounded areas within the Sea, and the constructed wetlands, would require monitoring and management to ensure that contaminant levels do not rise to dangerous levels. Such impounded areas would strand most of the existing shoreline communities and the State Recreation Area as the elevation of the main body of the Sea decreases, potentially necessitating compensation for property owners. A large seismic event could cause a major rupture in the dike, potentially sufficient to allow some or all of the impounded water to flow into or mix with the central portion of the Sea. Repairing the ruptured area would permit the re-filling (or flushing, if water from the central portion of the Sea mixed with the impounded area) of the impounded area. The loss of most of the fishery would decrease the availability of food for open-water fish-eating birds, such as pelicans and cormorants, though the impounded areas would continue to provide a source of fish for these birds.

Conclusion

The objective of the proposed diking alternative is a project that is sustainable over the long-term, preserves and enhances ecological values and promotes recreational and economic development opportunities, while being compatible with water re-allocation efforts and other actions that could reduce inflows to the Sea. If implemented, such a plan could result in a southern impoundment with a variety of recreational opportunities, including fishing, duck hunting, and bird-watching, across a huge expanse of open water. Shoreline habitat would be preserved; the estuarine conditions could promote increased productivity and support a greater diversity of marine species, linking to vibrant riparian corridors and wetland habitats in the Alamo and New rivers. The northern impounded area could support similar diversity, or could be managed to stabilize at a different salinity, potentially sustaining a different array of species. The central portion of the Sea could transition to a water body with a productive invertebrate system, feeding a host of other waterbirds.

Such a limited approach would satisfy a narrow interpretation of the stated goals of the Salton Sea Restoration Project and the Reclamation Act, though it would not address the condition of the Sea as a whole. Yet such a limited approach, if implemented in conjunction with efforts to limit inflows of nutrients and selenium, could preserve a significant amount of avian habitat and promote recreational and economic development in the immediate area.