

CHRIS NORDBY
Principal Biologist
Nordby Biological Consulting

Education

San Diego State University, Master of Science, Biology
University of Northern Colorado, Bachelor of Arts, Zoology
Western Michigan University, Continuing Education, Federal Wetland Policy

Professional Experience

2008-present President and Principal Biologist, Nordby Biological Consulting, San Diego, California
1993-2008 Principal Biologist, Tierra Environmental Services, Inc., San Diego, California
1991-1993 Senior Project Scientist, Woodward-Clyde Consultants, San Diego, California
1990-1991 Senior Scientist, Science Application International Corporation, San Diego, California
1985-1990 Research Ecologist and Manager, Pacific Estuarine Research Laboratory (PERL), San Diego State University, San Diego, California
1984-1985 Senior Biologist, Mooney-Lettieri & Associates, San Diego, California
1982-1984 Wildlife Biologist, U.S. Fish & Wildlife Service, Ecological Services, Laguna Niguel, California
1980-1982 Sea Grant Trainee, San Diego State University, Biology Department, San Diego, California

Qualifications

Mr. Nordby has twenty-nine years of experience in the ecology of southern California estuaries and lagoons including development and implementation of restoration plans, habitat requirements of wetland associated endangered species, development and implementation of long-term monitoring programs, and wetland delineation. His regulatory experience includes CEQA and NEPA compliance, and environmental permitting/compliance pursuant to the Clean Water Act, the Endangered Species Act, the Coastal Zone Management Act, and the Fish and Wildlife Coordination Act. Mr. Nordby has worked as a research ecologist at the Pacific Estuarine Research Laboratory at San Diego State University; as a wildlife biologist for the U.S. Fish and Wildlife Service; and as a professional consultant. He is co-author of the *Ecology of Tijuana Estuary, California: An Estuarine Profile*, a detailed description of one of San Diego County's remaining coastal salt marshes, and has worked in lagoons and estuaries from Bahia de San Quintin in Baja, Mexico to Goleta Slough in Santa Barbara County, California. Relevant projects include:

Ballona Wetlands Restoration Project. The Ballona Wetlands Restoration Project addressed restoration of the last remaining wetland in Los Angeles County. The project included development of five alternatives for restoration of approximately 600 acres of degraded wetland habitat. Mr. Nordby served as Restoration Biologist for this project funded by the California Coastal Conservancy. Mr. Nordby's duties included the developing the biological components of a project feasibility and design report; developing criteria for assessing measures of change associated with each alternative relative to existing conditions; and developing a method of comparing each alternative involving selected target species. The project is scheduled for completion January 2009.

Tijuana Estuary - Friendship Marsh Restoration Feasibility and Design Study. The Tijuana Estuary - Friendship Marsh Restoration Feasibility and Design Study is a multi-discipline study of the restoration of the southern arm of Tijuana Estuary, located in extreme southwestern San Diego County. The study, funded by the California State Coastal Conservancy and directed by Mr. Nordby, examined restoration alternatives for approximately 250 acres of degraded habitat. Project constraints analyses included the hydrology and sediment budget of the Tijuana River, coastal processes such as sea level rise and estuarine hydrology, existing biological resources, existing cultural resources, and sediment characterization disposal options. Three project alternatives were developed and a preferred alternative identified. Preliminary engineering plans are currently being developed. The project was completed March 2008.

Tijuana Estuary Tidal Restoration Project, Model Marsh. The Model Marsh is a 20-acre intertidal salt marsh restoration project at Tijuana Estuary that was is the second phase of the Tijuana Estuary Tidal Restoration Program (TETRP). *This multi-phased program proposed to eventually restore approximately 500-acres of wetlands at Tijuana Estuary, reduced to 250 acres in the 2008 study presented above.* Mr. Nordby served as the Project Biologist for the project. His duties included project design, design and implementation of the sediment testing program, vegetation mapping, wetland delineation, permitting, endangered species surveys and consultations, agency coordination and construction management, and long-term monitoring.

Chula Vista Wildlife Preserve. The San Diego Unified Port District (Port) created the 35-acre Chula Vista Wildlife Preserve from dredge spoil as mitigation for marina construction. The preserve is located on San Diego Bay immediately north of the South Bay Electricity Generating Plant. After the dredge spoils settled, Mr. Nordby planted a number of "test marshes" to determine the suitability for full-scale restoration. Plantings included both low and high marsh species. Based on the success of these tests, the Port funded full-scale planting. Follow-up work included assessing the use of the created intertidal basins by fishes and invertebrates.

San Elijo Lagoon Enhancement Study. City of Encinitas. Mr. Nordby served as Project Biologist on this study that addressed the feasibility of restoring San Elijo Lagoon in northern San Diego County. The project evaluated several alternatives that included realignment of Highway 1 through the project area; constructing various bridges for Highway 1 to cross the lagoon; removing the berm for the current railroad crossing of the lagoon and constructing a new crossing on a bridge; combining the Highway 1 and railroad bridge crossings of the lagoon; moving the channel inlet from its current position; and dredging portions of the lagoon. The project included costs associated with each alternative, potential impacts to sensitive habitats and sensitive species; gains in tidal prism from dredging options; and the feasibility of permitting each alternative.

Wetland Restoration of the Napolitano Trust Property. Caltrans District 11 conducted this restoration of approximately 1.25 acres of former wetland filled adjacent to the Tijuana Estuary in Imperial Beach, California as a Supplemental Environmental Project. Mr. Nordby was retained by Caltrans to design the restoration project, oversee construction activities, and conduct a long-term monitoring and maintenance program for the site. Construction was initiated December 4, 1998 and was completed by February 15, 1999. The project received final sign-off from the permitting agencies in 2002.

Mission Bay South Shores - Phase III Development. The City of San Diego developed the Mission Bay South Shores Park on what was formerly salt marsh habitat fringing Mission Bay. Mr. Nordby developed the plans and specifications for mitigating project impacts and served as on-site construction manager

during park development. Mr. Nordby also served as construction manager for the salt marsh mitigation sites on Fiesta Island and adjacent to the San Diego River, also related to the South Shores project. His duties included supervision of grading, irrigation installation and planting, and monitoring the success of those sites.

Sewer Pump Station No. 65 Force Main Break, Los Penasquitos Lagoon. The City of San Diego was forced to repair this failed sewer line resulting in impacts to the sensitive coastal salt marsh habitats of the lagoon. Mr. Nordby served as Project Biologist for the mitigation program. His duties included inspection of plant material and supervision of the nursery stock; supervision of the contractor during planting; monitoring success of the restoration; and design of additional off-site salt marsh mitigation.

Impacts of Discharging Reclaimed Water to the San Diego River and Estuary. This analysis, performed as part of the City of San Diego's Clean Water Program, addressed the effects of modified hydrology and salinity regimes on all major population levels of the estuary including federal-endangered California least terns and light-footed clapper rails and state-endangered Belding's Savannah sparrow.

Biological Monitoring of San Elijo Lagoon. Mr. Nordby designed and implemented a long-term monitoring program to assist the County of San Diego, Department of Parks and Recreation in the management of the lagoon. Mr. Nordby conducted quarterly sampling of water quality, fishes, benthic invertebrates, salt marsh and soils. The project was conducted to develop a data base for comparing changes in the lagoon over time.

Biological Monitoring of Tijuana Estuary. Mr. Nordby conducted a five-year monitoring of fish and benthic invertebrate populations and water quality conditions at five sites within the estuary to assess the impacts of renegade sewage flows from cross border sources. The results, published in the journal *Estuaries*, showed substantial shifts in population structure from the sewage flows.

Physical, Chemical and Biological Monitoring of Los Penasquitos Lagoon. This three-year project entailed quarterly sampling of fishes and benthic invertebrates, water quality, and salt marsh and brackish marsh habitats. The project documented the many changes to the lagoon from increased urban run-off and inconsistent tidal flushing.

San Diego River Ocean Outfall. San Diego, CA. Mr. Nordby served as Project Biologist for this City of San Diego project. The City proposed an outfall directly off the San Diego River in approximately 200 feet of water. Mr. Nordby coordinated studies of ocean currents, estuarine biology, marine biology and marine geology for the project and managed the EIR for the project.

Point Loma Tunnel Outfall. Point Loma, CA. Mr. Nordby served as Project Biologist on this City of San Diego project. The outfall was designed to convey and discharge effluent from the North City Water Reclamation Plant and the Point Loma Wastewater Treatment Plant. The project proposed to construct a tunnel outfall parallel to the existing nearshore outfall. . Mr. Nordby coordinated studies of ocean currents, marine biology and marine geology for the project.

Reports and Publications

Available Upon Request

I. INTRODUCTION

My name is Chris Nordby of Nordby Biological Consulting and I am an expert in the field of tidal wetlands restoration. Poseidon Resources Corporation asked me to prepare this statement to opine on the merits of the Marine Life Mitigation Plan (MLMP). Here follows that statement. I look forward to addressing any questions you may have at the February 11 meeting.

II. QUALIFICATIONS

Over the course of the past 29 years, I have worked on a number projects of relating to the ecology of southern California estuaries and lagoons. These projects have involved the development and implementation of restoration plans, habitat requirements for wetland-associated endangered species, development and implementation of long-term monitoring programs, and wetland delineation.

During this time, I have served in many capacities, including as a research ecologist at the Pacific Estuarine Research Laboratory at San Diego State University, as a wildlife biologist for the U.S. Fish and Wildlife Service, and as a professional biological consultant.

I am also a published author in the field of ecology. In 1992 I co-authored “The Ecology of Tijuana Estuary, California: An Estuarine Profile”—a detailed description of one of San Diego County's remaining coastal salt marshes. I acquired much of my expertise in the field of lagoon and estuary ecology through my involvement with wetland restoration projected from Goleta Slough in Santa Barbara County, California to Bahia de San Quintin in Baja, Mexico.

III. ROLE ON THIS PROJECT

In 2008, Poseidon Resources Corporation hired me as an independent consultant to help them develop and implement a wetlands restoration program that would offset any entrainment-related impacts associated with the Carlsbad Desalination Project (CDP). In that capacity I helped develop a wetland restoration plan at San Dieguito Lagoon in San Diego County to offset impacts to marine life associated with the CDP. I attended meetings with the California Coastal Commission to address the merits of that restoration plan and the Commission's mitigation requirements. I attended a meeting held with other state resource agencies to determine their concerns regarding the mitigation plan. Furthermore, I have analyzed the opportunity for Poseidon to mitigate at eleven wetland sites located within the southern California Bight in addition to the San Dieguito Lagoon site and attended public hearings on the project at the Regional Water Quality Control Board, California State Lands Commission, and the Coastal Commission.

IV. SUMMARY OF STATEMENT

The MLMP's site selection criteria, strict performance standards and continuous monitoring provisions ensure to a high degree of confidence that Poseidon will fully and

effectively offset all unavoidable entrainment-related impacts associated with the Carlsbad Desalination Plant. Moreover, by creating or restoring up to 55.4 acres of estuarine wetlands, the Plan will produce myriad ecological benefits that extend far beyond the project's stated goal of mitigating entrained species.

V. DISCUSSION

A. The site selection criteria guarantee that mitigation will restore habitat similar to the types of habitat that produced or supported the entrained organisms.

On November 14, 2008, the Coastal Commission approved the final MLMP and directed Poseidon to investigate restoration opportunities at a number of wetlands within the southern California bight. These sites included:

- Ormond Beach in Ventura County,
- Ballona Wetlands in Los Angeles County,
- Los Cerritos Wetlands in Los Angeles County,
- Santa Ana River in Orange County,
- Anaheim Bay in Orange County,
- Huntington Beach Wetlands in Orange County,
- Buena Vista Lagoon in San Diego County,
- Batiquitos Lagoon in San Diego County,
- Aqua Hedionda Lagoon in San Diego County,
- San Elijo Lagoon in San Diego County,
- San Dieguito Lagoon in San Diego County,
- Tijuana Estuary in San Diego County, and
- any sites considered "high priority wetlands restoration projects" by the California Department of Fish and Game (CDFG) – To date none have been identified by CDFG.

I added additional site(s) that I thought had merit. This included mitigation opportunities at the San Diego Bay National Wildlife Refuge in San Diego County.

While mitigation could conceivably be accomplished at any of these sites, each has site-specific constraints. Rather than commit to a specific site at this time, Poseidon has accepted a set of performance-based criteria that would be employed to determine project success. These criteria are stringent and complex, as presented below.

B. The performance standards are stringent and explicit.

The performance standards embodied in the MLMP are modeled after those imposed upon Southern California Edison for their mitigation for the San Onofre Nuclear Generating Station (SONGS) at San Dieguito Lagoon. The performance standards are scientifically rigorous and provide a high degree of certainty regarding final

success of the mitigation plan by relegating the determination of success to the Regional Board and the California Coastal Commission (“Comission”) and the Executive Director. They provide numerous checks and balances for the Regional Board and Commission over the operating life of the CDP. The standards require:

- Poseidon to select a final mitigation site that complies with the minimum standards and objectives listed in the final MLMP;
- Achieve performance standards measured relative to approximately four reference sites, which shall be relatively undisturbed, natural tidal wetlands within the southern California Bight.
- The standard of comparison, i.e., the measure of similarity between Poseidon’s selected mitigation site and the reference sites, shall be within the 95% confidence interval for selected plant and animal taxa listed below. The 5% confidence interval dictates that mitigation success will be defined as no more than 5% variation in the numbers and densities of selected wetland plants and animals supported by Poseidon’s final mitigation site compared to the plants and animals supported by the combined four reference sites, including:
 - Fish, macroinvertebrates and birds that utilize the wetlands;
 - Total vegetative cover of the salt marsh of each wetland;
 - Percent algae cover within the salt marsh and mudflats of each wetland;
 - Cordgrass (*Spartina foliosa*) canopy cover and equivalent proportion of stems over 3 feet in height supported by each wetland;
 - Reproductive success of certain plant species at each wetland;
 - Food chain support for birds, as indicated by feeding activity at each wetland
 - Control of exotic (non-native) species.

The funding necessary for the Regional Board and the Commission to perform their responsibilities pursuant to these directives will be provided by Poseidon.

The Executive Director will convene and conduct a duly noticed public workshop regarding the mitigation during the first year of the project and every other year thereafter for the life of the project (30 years) unless the Executive Director deems it unnecessary.

C. The monitoring provisions ensure that the Plan will be successfully implemented.

The monitoring and success criteria presented above are stringent and very explicit. They leave little room for scientific interpretation other than that specified, such as qualitative assessment of health and vigor of the restored system, which may also offer insight to potential remediation and adaptive management measures. The determination of project success is deferred to the Commission’s Scientific Advisory Panel and the Executive Director. Remediation measures to correct for failure to meet these rigid requirements is not specified (and has not been specified for

SONGS) but is deferred to the discretion of the Executive Officer. By accepting these standards, Poseidon is committed to the highest degree of scientific scrutiny regarding successful restoration of tidal wetlands.

D. The restoration/creation of wetlands will provide a wealth of incidental benefits beyond.

Coastal wetlands provide energy for wetland and terrestrial animals, provide nursery habitats for fish and invertebrates, facilitate ground water discharge, and filter water impurities. The restoration plan proposed by Poseidon will result in an increase of these important functions on a regional basis.

Coastal wetlands, in particular salt marshes, are among the most productive ecosystems in the world. The reason for this high productivity is that there are two major groups of primary producers in salt marshes (i.e., organisms that produce energy from sunlight) at the base of the food chain – algae (including phytoplankton and macro-algae) and vascular plants. The energy produced by these two groups is readily and efficiently transferred to higher order consumers.

The food chain in salt marshes is shortened which makes the high primary productivity available directly to other trophic levels. For example, the California horned snail (*Cerethidia californica*) feeds directly on macro-algae and, in turn, are preyed upon by higher order consumers, such as the endangered light footed clapper rail (*Rallus longirostris levipes*). In this example, the food chain is a three-step process and is very efficient at transferring energy from one trophic level to the next.

The interface between tidal channel and salt marsh increases energy transfer by making algae and detritus available to invertebrates and small fishes. The irregular plant/water interface also provides structure and protection for juvenile fishes, thereby serving a nursery ground for many fish species.

Coastal wetlands support a high diversity of plant and animal taxa ranging from the algae and vascular plants discussed above to marine and terrestrial invertebrates, fishes, birds, herpetofauna and mammals. This highly diverse assemblage of organisms is a function of the high productivity, efficient energy transfer, and nursery function that typifies salt marshes. Restoration/creation of coastal salt marsh habitat is highly desirable from an ecological perspective. The mitigation proposed by Poseidon provides an opportunity to recover these functions and values and enhance the region's biodiversity.

VI. ATTACHMENTS

A. Curriculum Vitae