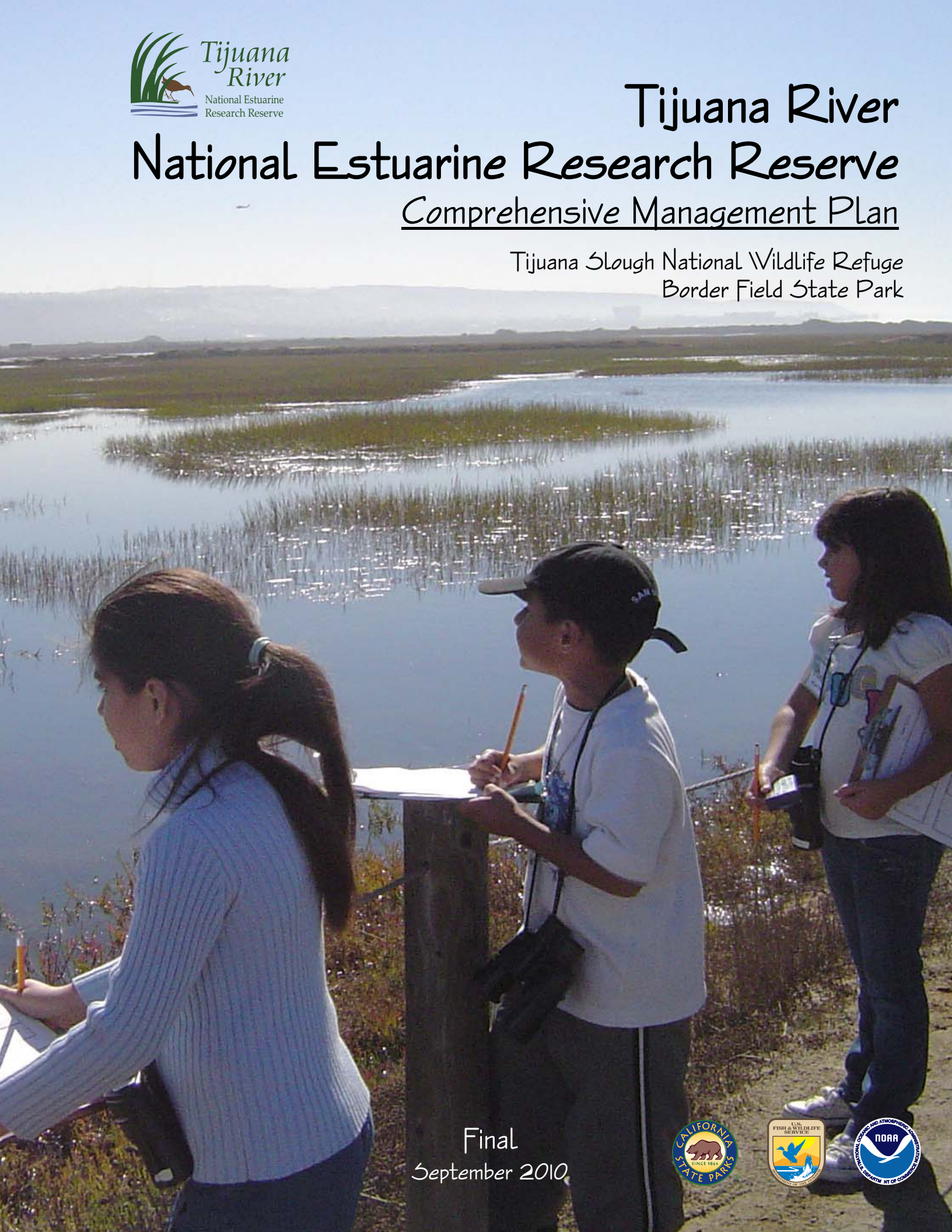
Tijuana River
National Estuarine
Research Reserve

Tijuana River National Estuarine Research Reserve

Comprehensive Management Plan

Tijuana Slough National Wildlife Refuge
Border Field State Park



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Tijuana River National Estuarine Research Reserve

Comprehensive Management Plan

Tijuana Slough National Wildlife Refuge
Border Field State Park
August 2010

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Tijuana River Valley- This color infrared aerial shows that the valley is an oasis in a sea of urban sprawl, with Imperial Beach, California to the north and Tijuana, Mexico to the south. Even at this elevation, the international boundary between Mexico and the USA is evident.

GLOSSARY OF ACRONYMS AND KEY TERMS USED

ADC	Animal Damage Control
APHIS-WS	Animal and Plant Health Inspection Service, Wildlife Services
APN	Assessor Parcel Number
BECC	Border Environment Cooperation Commission
CCC	California Coastal Commission
CDMO	Centralized Data Management Office
CSP	California State Parks
CESPT	Municipal Water Agency of Tijuana
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CEC	Commission on Environmental Cooperation
CMP	Comprehensive Management Plan
CNA	Federal Water Agency of Mexico
COLEF	Colegio de la Frontera Norte
CTP	Coastal Training Program
CZMA	Coastal Zone Management Act
EBZ	Ecological Buffer Zone
EO	Executive Order
ERD	Estuarine Reserve Division
ESZ	Endangered Species Protection/Preservation Zone
EYS	Extended Year Curriculum
FWS	United States Fish and Wildlife Service
GIS	Geographic Information System
GPS	Global Positioning System
GRZ	General Recreation Zone
IBWC	International Boundary and Water Commission
IWTP	International Wastewater Treatment Plant
LCP	Local Coastal Plan
lps	liters per second
MAB	Man and the Biosphere
MARSH	Marsh Awareness with Resources for Slough Habitats
MAU	Mounted Assistance Unit
mgd	million gallons per day
MMS	Maintenance Management System
MOU	Memorandum of Understanding
MWWD	San Diego Metropolitan Waste Water District
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NOAA	National Oceanographic and Atmospheric Administration
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
OCRM	Office of Ocean and Coastal Resources Management

O&M	Operations and Maintenance
PERL	Pacific Estuarine Research Laboratory
RONS	Refuge Operating Needs System
SBOO	South Bay Ocean Outfall
SBUSD	South Bay Unified School District
SDSU	San Diego State University
SCC	State Coastal Conservancy
SWIA	Southwest Wetlands Interpretative Association
TJVCWD	Tia Juana Valley County Water District
TRNERR	Tijuana River National Estuarine Research Reserve
USDA	U. S. Dept. of Agriculture
USEPA	United States Environmental Protection Agency
USN	United States Navy
WCZ	Wetland/Wildlife Conservation Zone
WOZ	Wildlife Orientation/Interpretation Zone
YCC	Youth Conservation Corps

Aquatic Adventures Planting Project on Monument Mesa; a 2 acre native plant garden was created in one morning by nearly 700 volunteers.

Tijuana Estuary Visitor Center – Completed in 1991, designed by noted architect Rob Quigley. Over 1.8 million people live within a 30 minute drive of the visitor center, making it a key opportunity to develop an environmental ethic in the general population.

A typically uncrowded beach scene along the western margins of the Research Reserve.

EXECUTIVE SUMMARY

This Management Plan has been prepared to guide Tijuana River National Estuarine Research Reserve (NERR) in fulfilling its mission of estuarine resource protection over the period 2010-2015. This plan also serves as the Comprehensive Management Plan for the Tijuana Slough National Wildlife Refuge, which comprises the northern portion of the Research Reserve.

The Tijuana River NERR encompasses approximately 2,293 acres of tidally flushed wetland, riparian, and upland habitats lying immediately north of the U.S. - Mexico border. These lands are owned and managed cooperatively by the California State Parks (CSP), U.S. Fish and Wildlife Service (FWS), the City of San Diego, the County of San Diego, and the U.S. Navy (USN).

The Tijuana River NERR is linked to two federal land preservation networks: the National Estuarine Research Reserve System, administered by the National Oceanic and Atmospheric Administration (NOAA), and the National Wildlife Refuge System (NWRS), administered by the U.S. Fish and Wildlife Service. NERRs are estuarine areas protected and managed through a federal-state cooperative effort for long-term research, education, and interpretation. At Tijuana River NERR, CSP is NOAA's partner in this federal-state cooperative effort. The Tijuana Slough National Wildlife Refuge (NWR and Refuge), located within the Reserve, is one of over 545 refuges included within the National Wildlife Refuge System (NWRS), the nation's largest system of public lands dedicated to the conservation of wildlife resources.

The Comprehensive Management Plan (CMP) prepared in 1999 for the Tijuana Slough NWR was developed using a consensus-based planning process involving the Tijuana River NERR Advisory Council, staff members of the Operating Agencies (CSP and FWS), and community members. This collaborative process marked an innovation in the preparation of NERR and NWR management plans and continues to reflect the planning agencies' commitment to public and community involvement in decision-making through the update process for this 2010 CMP document. See Appendix 8 for a summary of public comments associated with the 2010 Plan revision, as approved by the USFWS.

NOAA requires that Reserve management plans be updated every five years, while the Tijuana Slough NWR Comprehensive Management Plan (CMP) was intended to guide management of the Refuge for a period of 15 years. To comply with the requirements of the Reserve’s federal partner, NOAA, the Reserve Management Plan was updated in 2010. The update process did not however result in any substantive changes to the refuge goals or any of the proposed management actions for the Refuge as described in the 2000 CMP.

FIVE-YEAR VISION STATEMENT FOR TRNERR

This Plan revision builds on the previous Plan, completed in 2000, in that it emphasizes the Reserve's unique international significance. The Reserve is a largely undiscovered, biologically diverse open space on the Pacific Ocean, bordered in all terrestrial directions by

dense urbanized communities in the U.S. and Mexico. During that past 7 years, improvements have been made in the southern end of the Reserve to address major sedimentation problems. These efforts will continue with salt marsh restoration within the Reserve and an expansion of sediment control work within Mexico. In addition, the Reserve is looking to expand its influence beyond its borders in both education and research, for the betterment of coastal wetlands throughout the southern California / northern Baja biogeographic region. The vision statement and accompanying four Reserve goals are the overarching themes of this 5-year Plan, and are represented in all the program goals throughout the document.

The Five-year Vision Statement for the Tijuana River NERR is:

"The Reserve and its partner organizations will inspire among diverse audiences more effective estuarine and marine management, compatible use, and proper resource protection using innovative and coordinated research, education and conservation approaches, throughout the biogeographic region between Point Conception and San Quintín."

The Vision Statement is supported by the following four over-arching Management Plan Goals. In addition, the objectives and strategies set forth in each chapter of this document delineate the actions that will achieve one or more of the following goals, as it relates to the subject of the given chapter:

Goal I: "To <u>protect, restore and enhance</u> the viability of key coastal habitats and species and preserve the region's cultural heritage while encouraging compatible public use, education and research." The Reserve will address the long-standing and increasing resource degradation, particularly in the southern end of the Reserve. Historically this area has suffered more damage from natural events and human activity than the more accessible parts of the Reserve to the north. To address this, primary efforts will focus on controlling erosion in Los Laureles Canyon, maintaining and improving the Goat Canyon sediment basins, restoring salt marsh and upland habitat and promoting sustainable development practices in Los Sauces Canyon.

Goal II: "To fully <u>integrate</u> the Reserve's research, stewardship and education programs and provide a model of excellence in all three areas." It is essential that the decisions made in all Reserve programs continue to be based on the most current findings of the Research community.

Goal III: To engage coastal decision-makers and the general public in the Reserve's stewardship mission by <u>promoting awareness</u>, a sense of pride in the resource and an enhanced capacity to improve Tijuana River coastal and watershed ecosystems in general. The Reserve needs to continue to expand its advocates among government agencies and the general public, taking full advantage of its urban context to build a strong constituency for the Reserve, the NERRS, and estuary protection in general. Effective education (at all levels) leads to broad political support. This, combined with scientific knowledge, is the ultimate foundation for long-term funding and resource stewardship. This

Reserve has a unique opportunity to reach out to the general public on behalf of coastal wetlands: over 1.8 million people live within a 30 minute drive.

Goal IV: To assume a regional leadership role for science-based natural resource enhancement and urban ecosystem management. The agencies that have a stake in the management of the Reserve need to continue to improve coordination and expand partnerships in addressing the above-noted resource problems. Program needs exceed the capacity of any one agency to implement the programs through staff and/or contracts. In addition, the Reserve management needs to expand the Reserve's niche and influence in the larger binational and biogeographic context in the areas of education, research and monitoring, stewardship, and management. The Reserve's management believes the effort is well-timed and the on-site programmatic foundation exists to tackle these very challenging issues in this next era of Reserve operations.

The following section summarizes some of the key components of this Management Plan.

SEAMLESS RESERVE PRINCIPLE

A continuing principle of this Management Plan is to maintain a “seamless Reserve" while retaining the decision-making authority of each participating agency. This goal will continue to be achieved by integrating and coordinating staffing, facilities, and programs. Programmatic coordination and integration are woven throughout the plan. All programs will address habitat preservation, enhancement and restoration -- the primary emphasis of this next era of Reserve operations. The plan provides for the sharing of agency expertise with land stewards and citizens outside the Reserve, upstream in the Tijuana River Valley, and in Mexico to help preserve and improve the watershed.

Currently, California State Parks and the U.S. Fish and Wildlife Service (Refuges) are partners in implementing this “seamless Reserve” concept. Over the next 5 years, TRNERR and USFWS staff should investigate the degree to which we can we expand that level of partnership to the other land managers in the Tijuana River Valley, particularly San Diego County Parks and Open space.

ADMINISTRATIVE FRAMEWORK

Operational efficiency and financial management of both the FWS and CSP are critical components of this plan. Staffing objectives of the Management Plan articulate and pursue a more efficient staff structure and improve interagency coordination. The Plan:

- Changes the name of the Tijuana River National Estuarine Research Reserve Management Authority to Tijuana River National Estuarine Research Reserve Advisory Council. This change more accurately reflects the true role of the group and acknowledges the land management authority of each land management agency.
- Amends the Boundary of the Reserve to account for the condemnation of 53 acres by the Federal Department of Homeland Security for construction of the

Border Infrastructure System. The Reserve acreage is hereby reduced by 53 acres.

- Establishes the criteria for adding acreage within the Tijuana River Valley and enveloping other coastal wetlands within the biogeographic region as a designated component of the Reserve.
- Commits to pursue a number of staffing changes:
  - Strengthen staffing for both the Watershed Program and the Coastal Training Program.
  - Obtain long-term, full-time funding for the Volunteer Coordinator and Watershed Coordinator positions.
  - Seek additional funding to support Grant Writing activities
  - Upgrade the two hourly Education Specialists to permanent or permanent – intermittent positions
  - Expand Refuge staff
- Encourages the expansion of the Volunteer Program to:
  - Increase the effectiveness of all four core programs by supplementing paid staff with volunteer support
  - Expand the constituency of and regional support for the Reserve

RESOURCE PROTECTION, MANAGEMENT, AND RESTORATION PROGRAM

One important goal of this plan is to improve land stewardship. The plan presents a comprehensive proposal to improve land stewardship through law enforcement, large-scale habitat restoration, and monitoring human activities within and outside Reserve boundaries that may affect Reserve habitats. The plan recognizes that, since the mid-1980s, great progress has been made in the protection and management of NWR lands north of the Tijuana River. The Plan:

- Abandons the conceptual zoning scheme of the 2000 plan in favor of making situational decisions based on management plan goals, scientific data and site-specific issues.
- Establishes criteria for use of the Reserve as a mitigation site.
- Is open to expansion of the Reserve to adjacent lands in the Tijuana River Valley, South San Diego Bay, Torrey Pines State Beach and elsewhere consistent with NERRS regulations, 15 C.F.R. Part 921.
- Commits to sediment and trash management as a high priority. Work will include:
  - Changing land management practices in Mexico
  - Implementing maintainable sediment and trash collection devices (and promote cost-effective and environmentally-friendly disposal methods and long-term maintenance commitments)
  - Encourage natural sediment transport through expanding the tidal exchange (tidal prism) of the estuary.

- Commits to continuing to implement the Tijuana Estuary Tidal Restoration Program (TETRP), particularly the 250-acre project south of the river.
- Commits to an aggressive program for controlling invasive plant species, focusing on tamarisk, arundo and castor bean.
- Continues the predator management program and sets standards and criteria for its implementation.

RESEARCH AND MONITORING PROGRAM

The Reserve presents an invaluable site for research and monitoring of natural resources, given its location, integrity, and rich history of applied and basic science. The plan identifies current conditions of the TRNERR Research Program, highlighting the substantial changes that have occurred within the last several years. The plan also will detail steps necessary to both increase the ability of effective research to be conducted at the Reserve as well as ensure that this information is translated into management, education, and outreach.

The plan:

- Clarifies administration of research activities, particularly related to the role of a full-time Research Coordinator
- Discusses resources necessary to sustain research staff, especially related to GIS capabilities
- Identifies infrastructure needs, including:
  - Telemetry of logger sites
  - High-bandwidth, wireless infrastructure
- Recognizes the needs for high-resolution, current habitat maps
- Identifies the need for improved, web-based dissemination of data and research products
- Expands research activities and applications in both scope (e.g., biological monitoring) and geographic extent (e.g., coastal wetlands throughout the biogeographic region).

EDUCATION AND INTERPRETATION PROGRAM

The education staff at TRNERR has developed a **Scope of Interpretation**, or the areas of interpretation and education where the staff seeks to focus and excel. A survey of other providers was conducted in order to determine the areas in which the Reserve could best serve the community. They include providing quality hands-on estuarine education; college level educational opportunities for high school students; educational/interpretive programs about pre-contact Kumeyaay habitation, use of the region, and estuary; cutting edge, culturally sensitive, multi-cultural and bilingual programs at the Reserve and in the community at large; and unique arts programs to explore the interpretive themes of the

estuary. The Scope of Interpretation and NERRS Strategic Plan informed the Goals, Objectives, and Tasks in this plan.

The Plan:

- Increases the number of school programs each year through the partnership with the South Bay Union Elementary District and the High School program.
- Commits to providing programs that actively reach out to all ethnic groups. All educational programs will be bilingual (Spanish and English).
- Proposes implementation of an interpretive sign program that would result in consistency among all the signage within the Reserve.
- Expands the Docent program in interpretation and environmental education.
- Incorporates NERRS System-wide Monitoring (SWMP) data in the High School program and implements the Estuaries 101 System-wide High School Curriculum.
- Proposes the development of an Interpretive Master Plan for the whole Reserve and an Exhibit Plan for the visitor center and, if funding becomes available, design and installation of the exhibits. The Interpretive Master Plan will address unrealized opportunities for expanded interpretation in the south end of the Reserve, particularly using Monument Mesa for both expanded environmental education and interpretation of the historic international border.

COASTAL TRAINING PROGRAM

The Coastal Training Program (CTP) trains targeted groups of decision-makers, who have a wide range of expertise in various environmental issues, to understand the value of coastal and estuarine resources and its land-based connections. It accomplishes this through the transfer of scientific findings and techniques to resource managers, planners, and policy-makers in the region and promotes the practical application in areas such as wetland restoration permitting and other management processes. CTP works specifically with coastal decision-makers to develop a strong scientific and technical foundation from which to formulate and integrate policies at the local, regional, and binational watershed level.

Since its inception, CTP focused on the development of tools to create awareness among local authorities that had necessarily focused on pressing trans-boundary challenges. During this process, a number of small demonstration projects were implemented to facilitate the understanding of best management practices in the context of urban planning and city ordinances in Mexico.

Increasing environmental pressures, including that of climate change, calls for an expansion of CTP training. Through a revised needs assessment and market analysis, it will refine its suite of audiences and issues, and gain direction through a revised program strategy. The primary target audiences for these efforts will be coastal regulators and planners on both sides of the border, at municipal, state, and national levels. Elected officials, land use

planners, coastal managers, and recreational users are other key decision-makers who often are in need of access to relevant science-based information, training, or available technology. Benefits from the gathering, synthesis, and communication of information will facilitate science-based decision-making that affect TRNERR's most critical and threatened resources.

WATERSHED COORDINATION PROGRAM

Located at the terminus of the 1,700-square-mile binational watershed, the Tijuana River NERR is a natural center for many binational concerns relating to natural resources. The Reserve's role in supporting bilingual and cross-border environmental education is well-established and central to the Reserve's continuing mission. Projects will rely on an extensive network of partners (both governmental and non-profit) on both sides of the border.

The Plan:

- Embraces the Reserve's international role and strives to improve U.S./Mexico collaborations. Watershed-level planning supports the FWS ecosystem management approach in management of Tijuana Slough NWR.
- Specifies actions for the coordination of a binational watershed project with special emphasis on Goat Canyon (also known as the Cañon de los Laureles), Yogurt Canyon (Los Sauces) and Smuggler's Gulch (Matadero) subwatersheds. Projects will focus on conservation easements, water quality, trash management, erosion and sediment control, and stormwater management.
- Promotes best management practices using pilot projects as a vehicle for orderly, integrated, and comprehensive development throughout the watershed.

PUBLIC ACCESS, INVOLVEMENT, AND USE PROGRAM

The Reserve provides unique opportunities for the public to enjoy and appreciate estuarine resources such as tidal wetlands, riparian, and upland habitats. The plan is designed to enhance the visitor experience at the Reserve, plan for increased visitation as South San Diego County cities grow, promote wildlife-dependent recreational activities, and encourage other compatible recreational uses. The plan also increases public involvement in Reserve management and promotes volunteerism at the Reserve.

The Plan:

- Commits to restoring Monument Mesa to a highly visited all-season, all-weather destination that is popular for resource-dependent, environmentally-sensitive recreation and provides quality opportunities for estuarine education.

FACILITIES DEVELOPMENT PROGRAM

In the past, facilities at the Reserve were inadequate to support the essential functions of the Reserve and the anticipated increases in staffing and public use. Facilities completed in 2007 resolved much of this shortage. Increased public involvement in Reserve programs continues

to be a plan priority; therefore, increasing accessibility to the Reserve is an integral part of facility, trail design, and other improvements. Anticipated facility improvements include:

- A storage building and nursery compound near the Visitor Center complex,
- Trail system revisions that protect natural systems while maintaining and enhancing the long-term equestrian use of the Reserve, that is compatible with the approved land uses of respective agencies.
- Improvements to provide all-season vehicular access to Monument Mesa
- Renovation of public use and educational facilities and increased native plant landscaping atop Monument Mesa.

Monument Mesa at the U.S.A / Mexico Border, a significant historic and recreation site at the southwest corner of continental USA. The aerial view seen here has been changed with the installation of the Border Infrastructure System in 2008-2009. Completion required condemnation of the land between the solitary white building atop Monument Mesa and the Boundary. The U.S. side of Friendship Park (seen here as a half of the full circle completed by land in the US and Mexico) now exists within the fenced corridor of the Border Infrastructure System although some controlled public access to Friendship Park and its historic marker is provided at the discretion of the Border Patrol.

INTRODUCTION

Tijuana River National Estuarine Research Reserve (NERR) is part of a nationwide network of National Estuarine Research Reserves known as the NERR system, which was created by the Coastal Zone Management Act (CZMA) of 1972, as amended, 16 U.S.C. Section 1461, to augment the Federal Coastal Zone Management (CZM) Program. The CZM Program is dedicated to comprehensive, sustainable management of the nation's coasts.

The Reserve system is a network of protected areas established to promote informed management of the Nation's estuaries and coastal habitats. The Reserve system currently consists of 27 reserves in 22 states and territories, protecting over one million acres of estuarine lands and waters.

NERRs are protected and managed through a federal-state cooperative effort for long-term research, education, and interpretation. The management practices and priorities of each Reserve vary depending on each site's resources, level of use, ownership, and other factors. With its placement in a binational watershed, Tijuana River NERR faces a unique set of challenges that affect the resource protection, research, and education programs at the Reserve.

NOAA requires each NERR to prepare a written Management Plan, which identifies the Reserve's short- and long-term management issues and proposed actions. The plan must be approved by NOAA and periodically updated. Tijuana River NERR's initial management plan was prepared in 1986; this document is a revision of the plan dated July 2000.

The Tijuana Slough National Wildlife Refuge (NWR or Refuge), located inside the Reserve boundary, is a unit of the National Wildlife Refuge System (NWRS), part of a 92-million acre Refuge System, managed by the U.S. Fish and Wildlife Service (FWS). The FWS requires that a Comprehensive Management Plan (CMP), now referred to as a Comprehensive Conservation Plan (CCP), be prepared for each unit of the NWRS. The Comprehensive Management Plan prepared for the Tijuana Slough NWR in 2000 was done in conjunction with the Management Plan for the Tijuana River NERR and fulfills the mandate for a CCP. The 2000 CMP was the first management plan for the Tijuana Slough NWR. No substantive changes to the CMP as they relate to refuge management are included in this update of the Reserve Management Plan; therefore, the updated document will continue to serve as the approved CMP/CCP for the Tijuana Slough NWR through at least 2015.

THE CONTEXT OF THIS DOCUMENT AS A NATIONAL WILDLIFE REFUGE COMPREHENSIVE MANAGEMENT PLAN

Tijuana Slough NWR was established in 1980 under authority of the Endangered Species Act of 1973. The purposes of Tijuana Slough NWR are "...to conserve (A) fish or wildlife which are listed as endangered species or threatened species ... or (B) plants..." (16 USC 1534). Conservation of the endangered light-footed clapper rail was the primary impetus for the establishment of this Refuge.

The CMP for the Tijuana Slough NWR is intended to guide the management of Refuge operations, habitat management, and visitor services for a period of 15 years. Guidance is provided in the form of goals and objectives. Managing the Refuge in accordance with the CMP will ensure that actions implemented on the Refuge will be consistent with the purposes for which the Refuge was established, the mandates of the NWRS, and the Refuge goals and objectives. The goals and objectives for the Tijuana Slough NWR, and the individual strategies and actions to achieve them, are found throughout this document.

COOPERATIVE MANAGEMENT AT THE TRNERR

FWS agreed to include NWR lands in the Tijuana River National Estuarine Research Reserve when the NERR was established as a National Estuarine Sanctuary in 1982. Subsequently FWS endorsed the 1986 Reserve Management Plan, agreed to implement that plan as part of FWS management activities, and provided an easement to the California State Parks (CSP) to build and operate the Tijuana Estuary Visitor Center on Refuge land. In 1996, FWS signed a Letter of Agreement with CSP to cooperate in managing their lands as a seamless Reserve (Appendix 4).

The missions and goals of the Refuge System and Reserve System are generally complementary, but are not identical; some NERR top priorities are secondary uses on refuges. In any case of conflict, FWS/NWRS missions and policy as they relate to the protection of endangered species will supersede NOAA/NERR missions and policy on lands of Tijuana Slough NWR. However, a long history of cooperation between the NWR and NERR indicates that those conflicts will be rare.

The decision to prepare a joint document requires some flexibility in agency planning policy and some additional explanations, including the following:

- To enhance the reading and understanding of this plan, the use of the terms "Tijuana River NERR", “TRNERR” and "Reserve" throughout the document generally refer to all constituent land systems, including the NWR, Border Field State Park, and other lands of the Reserve. Where there are policies or other differences that apply to Tijuana Slough NWR, these differences are identified.
- A refuge CMP establishes goals, objectives, and strategies for that refuge. Approval of this CMP asserts FWS support of the goal statements in Chapters 4 - 12 as Reserve-wide goals, objectives and strategies. However, NWR goals are supported and funded through the Refuge Operating Needs System (RONS). Because of varied land ownerships, many Reserve-wide goals and projects are not appropriately funded through RONS. Approved NWR goals with a RONS nexus are indicated among Reserve-wide goals in bold type.
    - The complete RONS List of Proposed Projects for Tijuana Slough NWR is found in Appendix 2.

HISTORICAL PERSPECTIVE AND ACCOMPLISHMENTS AT TIJUANA RIVER NERR

When the local, state, and federal governments joined citizens in 1980 to propose the creation of the Tijuana River National Estuarine Research Sanctuary, the task was formidable and the resources were anything but pristine. Hard work by many individuals representing agencies, organizations, and cities during the 1980s, 1990s, and early 2000s resulted in the following achievements:

- Acquisition of approximately 2,500-acres of land within the Reserve boundary into public ownership;
- Establishment of Tijuana Slough NWR in 1980;
- Designation of the site as an Estuarine Research Sanctuary (later changed to "National Estuarine Research Reserve") in 1982;
- Inclusion of U.S. Navy lands in the Refuge in 1984 through MOU between FWS and USN;
- Transfer of lands within Reserve boundaries to public ownership;
- Construction of a visitor center with interpretive exhibits;
- Development of educational programs and curricula targeting school districts, decision-makers, and recreational users in both the U.S. and Mexican portions of the watershed;
- Implementation of long-term monitoring, which included completion of the first site profile in the national system, and installation and maintenance of automated data loggers to provide real-time monitoring of estuarine water quality;
- Implementation of a research program at the Tijuana Estuary that placed the Reserve in the international spotlight as a site for outstanding research on wetland ecology and restoration;
- Inclusion in a regional permit from the U.S. Corps of Engineers to dredge the mouths of the Tijuana River and Oneonta Slough in the event of closure during a major storm, as well as acceptance of the Tijuana River Slough dredging by the Coastal Commission as appropriate to coastal management considerations;
- Development of a long-range strategy for habitat restoration, resulting in the completion of the tidal linkage channel in the northern end of the Reserve, the 20-acre model marsh in the south and a feasibility study for a 250-acre salt marsh restoration in the Reserve's southern end;
- Development of Reserve-wide and watershed-wide Geographic Information System (GIS) to provide the first maps integrating natural resource and social data from both sides of the international border:
- Establishment and expansion of the Coastal Training Program, making significant partnerships with the City of Tijuana to educate decision-makers and

implement erosion-control projects in Los Laureles Canyon;

- Construction of the 60,000-cubic-yard Goat Canyon sediment retention basins and related restoration improvements in 2005.
- Designation, in 2005, by the International Ramsar Convention on Wetlands as one of only 25 “wetlands of international importance”.
- The 2006 establishment of a formal Volunteer Program that resulted in a ten-fold increase in the number of volunteers, affecting all program components with increased capabilities and expanding the Reserve’s constituents and advocacy pool.
- Visitor Center complex facility expansion in 2007 and 2008 that dramatically expanded conference space, office space, lab space and outdoor education space, using sustainable design approaches.

The managing agency vision of the Tijuana River NERR as a seamless Reserve has become a reality. Each agency's agenda is met and promoted by an integrated program for resource protection, education and outreach, research and monitoring, and public use.

These integrated programs have been vital to the Reserve's long-term ecological restoration and conservation strategy. Many challenges, including the regulatory constraints and different policies of state, local, and federal agencies, arise when integrating the jurisdictional mandates of three managing agencies (FWS, NOAA, and CSP), the restoration agenda of the State Coastal Conservancy, and the research interests of San Diego State University. A 4th managing entity is USN as it manages land within the national wildlife refuge per its MOU with FWS. Implementation of the program requires a tremendous amount of inter- and intra-agency flexibility and coordination. The Tijuana River NERR, while challenged by overlapping jurisdictions, is fortunate to have a mosaic of agencies with diverse strengths and capabilities that share many common conservation-oriented objectives.

THE CONTEXT AND NEED FOR RESOURCE PROTECTION AT TIJUANA RIVER NERR

The Reserve is an ecological oasis situated in an urban environment on an international border. The contrasts make it a stunning natural jewel within the highly-populated, highly-developed coastline. Its intact natural systems defy the resource-degrading activities that surround it and threaten it. The Reserve management team faces many challenges in protecting and enhancing the health of this coastal wetland. The Reserve has suffered from:

- Accelerated sedimentation from erosion on both sides of the border, smothering salt marsh and altering the estuary’s natural hydrologic processes;
- Continued encroachment of exotic plant species that displace native habitat. The three primary species targeted for eradication are tamarisk, castor bean and arundo;
- Flow of trash from across the international border, particularly tires and plastics;

- Chronic pollution from domestic and industrial discharges, and continuous freshwater flows that have threatened native species and their habitat; and
- Potential vandalism of signs, benches, research equipment, and facilities resulting from the Reserve's location in an urban environment.

FIVE KEY NEEDS AT TIJUANA RIVER NERR ADDRESSED IN THIS PLAN

In its 28 years, TRNERR has had significant ecological success in spite of the challenges outlined above, but many Reserve needs must still be addressed. This Management Plan articulates those needs and responds with a series of programmatic objectives and strategies for implementation.

First, through coordinated and concerted effort, the Reserve needs to address the long-standing and increasing resource degradation noted above, particularly in the southern end of the Reserve. Historically this area has suffered more damage from natural events and human activity than the more accessible parts of the Reserve to the north. To address this, primary efforts will focus on controlling erosion in Los Laureles Canyon, maintaining and improving the Goat Canyon sediment basins, restoring salt marsh and upland habitat and promoting sustainable development practices in Los Sauces Canyon.

Second, integration of research and monitoring programs with resource management, education, outreach, and stewardship must be strengthened to assure that the decisions made in all Reserve programs continue to be based on the most current findings of the Research community.

Third, the Reserve needs to continue to expand its advocates among government agencies and the general public, taking full advantage of its urban context to build a strong constituency for the Reserve, the NERRS, and estuary protection in general. Effective education (at all levels) leads to broad political support. This, combined with scientific knowledge, is the ultimate foundation for long-term funding and resource stewardship. This Reserve has a unique opportunity to reach out to the general public on behalf of coastal wetlands: over 1.8 million people live within a 30 minute drive.

Fourth, the agencies that have a stake in the management of the Reserve need to continue to improve coordination and expand partnerships in addressing the above-noted resource problems. Program needs exceed the capacity of any one agency to implement the programs through staff and/or contracts.

Fifth, the Reserve management needs to expand the Reserve's niche and influence in the larger binational and biogeographic context in the areas of education, research and monitoring, stewardship, and management. The Reserve's management believes the effort is well-timed and the on-site programmatic foundation exists to tackle these very challenging issues in this next era of Reserve operations.

THE 2010 TIJUANA RIVER NERR MANAGEMENT PLAN AND 2000 NWR CMP

This 2010-2015 Management Plan for the Tijuana River National Estuarine Research Reserve refines concepts presented in the original (1986) management plan and in the subsequent 2000 Plan and addresses many management issues that have developed since the early document was issued. This plan strengthens the Reserve's ability to provide stewardship, research, and education, and to meet the Refuge's wildlife purposes.

The plan reiterates the Reserve's commitment to estuarine stewardship, research, and education for local, governmental, scientific, and educational interests. It builds on programs successfully established under the 1986 plan and offers new means through which the Reserve can play a more active and public role in the local community, the watershed and the bioregion.

Although the Reserve Management Plan updates information provided in the 2000 document, it does not materially alter the vision and goals developed for the Tijuana Slough NWR. Therefore, no substantive changes to the CMP, as they relate to refuge management, are included in this update of the Reserve management plan. The updated document will continue to serve as the approved management plan for the Tijuana Slough NWR through at least 2015.

This plan was prepared in accordance with all relevant state, local, and federal regulations, and is consistent with the objectives of California Coastal Management Program and with state, local, and federal land-use plans, policies, and controls for the area under consideration.

This Management Plan is presented in 12 chapters. Each uses the structure below to frame issues and direct future management.

FORMAT OF THE PLAN

Introduction: Describes the program's primary purpose.

Policies: Describes relevant local, state, and federal policies that affect the program, and states any Reserve-specific policies established by the Advisory Council or the Operating Agencies.

Existing Conditions and Perceived Needs: Sets the context for the program, outlines current operations, and defines areas where improvements should be made.

Plan of Action: States the objectives of the program with specific strategies necessary for implementation.

CHAPTER ONE: NATURAL, PHYSICAL, CULTURAL AND HISTORICAL CONTEXT

INTRODUCTION

The Tijuana River National Estuarine Research Reserve (TRNERR) is unique in a local, regional, national, and international context. It offers one of the best and largest remaining examples of California's coastal wetland habitat, a habitat that has been largely lost due to urban development or seriously degraded elsewhere in southern California. This section includes a brief description of the importance of estuarine habitats and the natural resources protected within the Reserve.

I. THE NEED TO PROTECT ESTUARIES

A. DEFINITION

Estuaries are a hydrological and biological crossroads, defined as the portion of the earth's coastal zone where there is interaction of ocean water, freshwater, land, and atmosphere.

The specific plant and animal habitats that may be supported by an estuarine system are determined by conditions in the watershed and in the adjacent ocean. The rate at which fresh water enters the estuary, the amount and type of waterborne and bottom sediments, the degree of tidal flushing, and water depth (hence temperature and degree of sunlight), all combine to produce diverse biological communities in a dynamic and complex system. A significant physical change in any of those factors can trigger traumatic changes in the estuarine biologic community, greatly enlarging or reducing the size of various species' populations.

B. ESTUARINE FUNCTIONS

Estuarine wetlands provide a number of valuable ecological functions, or so-called "ecosystem services." Most broadly, there are sources of recreational and aesthetic benefits, as witnessed by the boom in industries such as eco-tourism. Also, they offer critical buffers between the sea, land, and freshwater. They can protect inland areas from ocean-borne waves and storm activity. Also, they also can help protect the ocean from watershed inputs, filtering and helping to purify water.

In a healthy estuarine system, the interaction of tides, unpolluted fresh water, and sediments creates some of the most productive systems on the planet. Sheltered shallow waters and soft mud or sand flats, regularly flooded by the tides, provide ideal conditions for abundant life. Among the most important estuarine species are microscopic photosynthetic organisms called phytoplankton. Phytoplankton, like green plants, make the energy of sunlight available to animals as food. Phytoplankton are consumed by microscopic and minute animals called zooplankton. These animals include small crustaceans such as copepods, and the larvae of fish, crabs, clams, and other species. These organisms themselves are part of the food supply for adults of their own or other species.

Marsh plants and eelgrass growing in shallow estuarine waters are critically important to estuarine animal life. Marsh vegetation not only provides cover for many animals, but also, as it dies back each season, creates detritus that feeds and houses the species on which larger species depend. The blades of eelgrass are homes for algae, snails, and other food for larger animals. Juveniles of many species reach adulthood by hiding among estuarine vegetation. In an undisturbed estuary, the wealth of food can support huge populations of immature and adult fish, crabs, shrimp, and other species. Those animals provide essential food for populations of birds and mammals, including people.

C. MODIFICATION OF ESTUARIES

Estuaries--characteristically flat land that offers sheltered access to the sea, and a profusion of fish and other seafood--offer attractive conditions for human habitation, agricultural production, and transportation. Estuaries on the west coast of the U.S. supported native peoples for thousands of years and, more recently, settlers from other parts of the globe.

Prior to the 1970s, the value and finite nature of estuaries were not fully appreciated. It was not recognized that estuaries are integral to ecological and human well-being. Destruction of estuaries was disastrously affecting water quality, commercial and recreational fisheries, and overall ecosystem health. Estuary-dependent plants and animal populations began to dwindle with lost habitat, food sources, and reproductive sites. Affected species included not only salmonids, crab, and clams, but also birds such as eagles and falcons, which feed on the tideflats. Increasing awareness of the value of estuaries triggered current efforts to preserve, conserve, and restore these fragile systems. Among the most significant of these efforts were passage of the Federal Coastal Zone Management Act in 1972 and the subsequent passage of the California Coastal Act in 1976.

II. THE TIJUANA RIVER NERR ENVIRONMENT

A. REGIONAL SETTING

1. Reserve Location and Boundaries

The Tijuana River NERR is located at the southwest corner of the continental United States in southern San Diego County, California (Figure 1). The area within existing Reserve boundaries represents about 2,500 acres in the downstream terminus of the Tijuana River watershed (Figure 2).

The western boundary of the Reserve follows the Pacific Ocean shoreline from the southern tip of Seacoast Drive to the newly created Border Infrastructure System on the U.S. - Mexico border. Along the northern part of the Reserve, the boundary extends along Seacoast Drive, Imperial Beach Boulevard, and connecting side streets, passing south of the Navy Outlying Landing Field. The eastern part of the Reserve falls within City of San Diego limits. Saturn Avenue marks the eastern extension of the Reserve into the agricultural lands of the Tijuana Valley. The southern boundary follows Monument Road and the U.S. - Mexico border, with the City of Tijuana located immediately south of the border.

Like most remaining wetlands in southern California, the Tijuana Estuary is located close to a large urban population. It is the only coastal lagoon in southern California that is not bisected by roads and railroads. This points to the pressures that have been and will continue to be placed on Reserve resources, but also establishes the need for information, local involvement, and educational programs aimed at increasing public awareness and compatible visitor use.

2. Regional Access

Access to the Reserve is possible from several directions. The areas most accessible to visitors are the northern and western parts of the Reserve, within the Tijuana Slough NWR. The beach and Seacoast Drive provide pedestrian and vehicular access to the western edge of the Reserve and Refuge. Access to the south is via Monument Road, the entrance to Border Field State Park. Visitors can enter the northern part of the Reserve along Imperial Beach Boulevard, at 5th and Iris, and other local roads. Elsewhere, access is restricted by the Navy Outlying Landing Field and private agricultural properties. Off-road vehicles are prohibited except for use by Reserve staff, law enforcement, and public safety officials. Hiking and equestrian use is accommodated by an extensive trail system. (See Chapter 8.)

3. Land Ownership

Tijuana River NERR is a composite of lands and waters owned by a variety of local, state, and federal agencies. The major federal landowners are the U.S. Fish and Wildlife Service and the U.S. Navy (USN). FWS owns a 505-acre parcel and the USN controls an additional 606.42 acres, part of the Naval Base Coronado Naval Outlying Landing Field Imperial Beach. Under a 1992 Memorandum of Understanding, FWS manages the 606.42 acres of Navy property for Wildlife Refuge purposes. Per the MOU, FWS assumes lead responsibility for the protection of resources and the USN assists in the preservation and management of resources and retains ownership rights. FWS fee lands, USN lands, and tidelands leased from the California State Lands Commission are all part of Tijuana Slough NWR that comprises the northern portion of the Reserve.

The State of California owns an 761-acre parcel--Border Field State Park--at the southern end of the Reserve. The park is operated by California State Parks (CSP). The location of Tijuana Slough NWR and Border Field State Park within the Reserve is shown in Figure 3. Both the County and the City of San Diego also own land within the Reserve. The ownership of lands within Tijuana River NERR is shown in Figure 3.

In 2007, the federal government condemned 53 acres of Border Field State Park to construct the Border Infrastructure Project, reducing the park from 841 acres to its present 761 acres. With this reduction, the total Reserve is 2,293 acres. This figure is based on a 2010 GIS analysis and represents an accurate update to the number shown in the 2000 version of the Comprehensive Management Plan.

B. RESERVE RESOURCES

The following synopsis draws from several resource overviews compiled in the past (Williams et al, 1996; RECON 1994; Zedler et al 1992; Entrix et al, 1991; Zedler, 1982d; U.S. Department of Commerce and California Coastal Commission, 1981; California Coastal Commission, 1978; McIlwee, 1970) and highlights the environmental conditions and resources contributing to the ecological significance of the site.

1. Environmental Conditions

The environmental conditions in the Reserve are described in the Site Profile (Zedler et al. 1992). Below key conditions are highlighted, based on that profile, subsequent publications, and the Reserve's research and monitoring program.

a. Watershed Topography, Geology, Soils and Paleontological Features

The Tijuana River is an ephemeral stream draining a 1,700-square-mile watershed, of which 73 percent lies in Mexico. The river originates at the confluence of Arroyo del Alamar and Río de las Palmas in Mexico. The lower Tijuana valley is a relatively wide and flat area confined to the south by high mesas and to the north by steep-sloped terraces. Several narrow canyons also drain into the lower valley. The topography of the site is shown in Figures 2 and 4.

The principal geological formations prevailing in the Reserve are quaternary and recent alluvial and slopewash deposits reaching depths of 130 feet. Sandstones, shales, and limestones underlie the unconsolidated deposits. Recent beach sand deposits occur along the shoreward length of the estuary. The lower valley is bound to the north, east, and south by sandstone and conglomerates that account for the mesa topography (City of San Diego, 1979; U.S. Department of Commerce and California Coastal Commission, 1981).

The mudflats at the mouth and lower parts of the estuary are occasionally covered by sands transported during storms from the beach. The saline Chino silt loams, considered highly erodible but suitable for agriculture, occur upstream from the flats. To the south, the fine sandy loams blanketing the mesas and terraces are also considered highly erodible and are contributing substantially to downstream sedimentation (City of San Diego, 1979). Marsh loss due to the massive sediment loads represents one of the major threats to the health of the estuary.

The Reserve encompasses many recorded paleontological localities associated with two fossil-containing formations: the San Diego formation and unnamed Pleistocene terrace deposits (Demere, 1984). The most significant aspect of these paleontological sites is the excellent preservation of the fossils. This is especially true for fossils from the San Diego Formation, which are preserved as original shell material. Some forms even retain color. The San Diego Formation (as studied in Chula Vista) also has a high potential for yielding important remains of fossil marine vertebrates, especially marine mammals. Marine mammal

fossils are poorly known, and any sites containing such remains should be considered potentially significant and thus protected (Demere, 1984).

b. Climate

Weather conditions are generally typical of a Mediterranean climate. Annual rainfall averages nine to ten inches. Recent studies have shown that the amounts and times of rainfall and stream flow in the entire watershed are more important for estuarine dynamics than total precipitation (Zedler et al, 1992). In general, most rains fall from January to March. Average temperatures reach annual lows of 46°'F (8°C) in winter and rise to 74°F (23°C) in summer. Prevailing winds come from the northwest in winter and from the southwest in summer. Weather is monitored at the Reserve as part of the NERR System-Wide Monitoring Program (SWMP), and real-time data is available on the internet.

c. Hydrology

As in many southern California rivers, annual streamflows of the Tijuana River can vary dramatically. Mean annual discharge for 44 years is based on upstream gauge readings of 29.1 cubic feet per second (cfs) (U.S. Department of Commerce and California Coastal Commission, 1981). The greatest peak flow on record was 75,000 cfs in 1916. In comparison, peak flows during the 1993 winter storms were 32,500 cfs. Based on records going back to 1973, the Tijuana River experiences low and high flows as frequently as intermediate class flows and thus has a regime very distinct from rivers such as the San Diego River (Zedler, Koenigs, and Magdych, 1984). The hydrography and estimated floodplain of the Reserve are shown in Figures 6 and 7, respectively. The flow of the Tijuana River is also regulated by three structures: the Morena Reservoir, the Barrett Reservoir, and the Rodriguez Dam on Rio de las Palmas, as well as the South Bay International Wastewater Treatment Plant (described below).

Despite low rainfall flows that occur frequently during the summer, the Tijuana River mouth has generally remained open throughout the year (Zedler, Winfield, and Mauriello, 1978). In 1984, the mouth did close and had to be dredged open. Considerable ecological changes occurred during the mouth closure, and some organisms apparently affected by this closure event have been slow to recover (Zedler et al. 1992). Since that time, however, the estuary mouth has stayed open. It should be noted that one side slough, known South Slough, did close temporarily in 2010. This is considered an important characteristic of the Reserve, since other Southern California estuaries traversed by highways and railroads, which are typical, have decreased tidal exchange resulting in frequently or continuously blocked entrances (Zedler, 1983b). At the Tijuana site, the main river channel and the northern channel are normally flushed by mixed tides twice daily. Heavy ocean storm surges do have the potential to affect channel circulation and tidal exchange in the estuary, including constricting flows into the northern and southern channels.

Between 1852 and 1986, the estuary lost 80 percent of its daily tidal prisms (Williams and Swanson, 1987). Efforts to increase the tidal prism and help combat the sedimentation are described in Chapter 5.

d. Water Chemistry and Quality

Water chemistry in the open water channels of the Reserve is normally similar to the chemical composition of the ocean because of the small volumes of freshwater discharged from the Tijuana River during the spring, summer, and fall. During the winter, rains and releases from upstream storage and water treatment facilities can reduce the salinity in the estuary.

Deteriorated water quality represents a significant problem for the Tijuana Estuary, particularly in the river channel and along the ocean beach, and has necessitated periodic closures of parts of the Reserve for public health and safety. The main source of pollution is sewage flow in the Tijuana River, as has been occurring for decades. Since 1999, however, conditions have improved with the construction of the South Bay International Wastewater Treatment Plant (SBIWTP). Besides treating sewage, the plant also receives water diverted from the Tijuana River in Mexico, treats it to an advanced primary level, and discharges to the Pacific Ocean through the 4.5-mile long South Bay Ocean Outfall. There are also small diverters at Goat Canyon and Smuggler's Gulch that send low flows to the plant. The capacity of the plant is approximately 25 million gallons per day, which typically can treat all dry weather flows. During rain events, however, the capacity of the plant is exceeded and raw sewage flows through the River and into the TRNERR. Thus, conditions are often poor during rainy winter months. Up to date information on river flows and nearshore currents (which transport contaminated waters) can be found on the San Diego Coastal Ocean Observing System website (http://www.sdcoos.ucsd.edu/ibpier/). Archived flow information and treatment plant details can be found at the International Boundary and Water Commission website (http://www.ibwc.state.gov/html/sbiwtp.html). Present and past water quality data and beach closure information can be found at the Heal the Bay website: (http://www.healthebay.org). It should be noted that Tijuana has much greater wastewater coverage now than before and wet-weather flows should be of better quality.

2. Living Resources

The tidal flushing of the Tijuana Estuary maintains a variety of habitats, which in turn support a broad range of organisms. A listing of plant and animal species with state or federal listing as threatened or endangered is provided in Appendix 3. The following provides an overview of habitats and describes the status of regionally significant resources.

a. Habitat Overview

The Tijuana River National Estuarine Research Reserve includes the following coastal habitats (McIlwee, 1970):

- Sand dunes and beaches - Sand deposits are continually shifted during floods and sea storms, thus creating relatively unstable habitat. In recent years, the dune system has become very unstable, allowing sand to be blown into the tidal channels.
- Open tidal channels and mudflats - Sand, silty clay, and mixed substrates create a variety of subtidal habitats and intertidal mudflats (Zedler, Winfield, and

Mauriello, 1978). Loss of this habitat due to elevation increases caused by fill and sedimentation represent a major management concern.

- Salt marshes - Salt marshes have been estimated to comprise approximately 410 acres of the Reserve, including low marsh, middle marsh, and high marsh. These classes correspond to the shifts in species composition, community structure, soil salinity and texture, and tidal conditions that occur along the one-meter elevation gradient.
- Fresh-brackish marshes - Freshwater brackish marshes occur throughout the Reserve and are dominated by bulrushes and cattails.
- Riparian habitats - These encompass the entire span of habitats upstream from mean high tide, including freshwater marshes and upland areas.
- Coastal sage scrub - The bluffs adjacent to the international border along the southern boundary of the Reserve are classified as coastal sage scrub. This community is considered sensitive habitat throughout San Diego County and Southern California.
- Vernal pools - A few small vernal pools can be found in the Reserve. These shallow pools, which hold a few inches of water during the wet months, host the San Diego fairy shrimp, a federally endangered species.

Vegetation communities are shown in Figure 6. A key to vegetation communities is provided in Figure 6.

The northwestern part of the Reserve is generally considered to be healthier than the southern or eastern regions. Tidal exchange in the north is generally better and more mudflats are exposed at low tide at the northern end. In contrast, channel banks are steep, tidal flushing is restricted, and low elevation communities are rare in the Reserve's southern end (Crooks, pers. obs.).

b. Vegetation

The estuary's vegetation communities were important in the designation of the Reserve (U.S. Department of Commerce and California Coastal Commission, 1981). In addition to having regionally significant species, the Tijuana Estuary includes most of the plant communities found in other southern California wetlands (Zedler, 1982). The plant communities also have been monitored for over 30 years, giving long-term perspectives on patterns and changes in the ecosystem (Zedler and West 2007 and references therein).

Distributions of species at Tijuana Estuary are similar to those found in large marshes in southern California, such as Sweetwater Marsh (Mudie, 1970), Mission Bay (Macdonald, 1967), Upper Newport Bay (Vogl, 1966; Massey and Zembal, 1979), Anaheim Bay (Massey and Zembal, 1979), and Mugu Lagoon. The vegetation communities of the southern salt marshes are considered distinct from marshes north of Point Conception, because of much

more limited rainfall and hypersaline soils affecting plant growth rates and species composition (Zedler, 1983a).

Cordgrass *(Spartina foliosa)* forms robust stands along tidal channels in the northern reaches of the Reserve. Large stands of this species are rare in the other more disturbed southern California wetlands, and they are of particular importance as habitat for the endangered light-footed clapper rail (Jorgensen, 1975). Above the cordgrass-dominated community are found several succulents, including pickleweed *(Sarcocornia pacifica)* and saltwort *(Batis maritima)* as dominants, and annual pickleweed *(Salicornia bigelovii)* and sea blite *(Suaeda esteroa).* Alkali heath (*Frankenia salina*) is another dominant high-marsh plant. At higher elevations, these succulents grade into a dense matted cover of shoregrass *(Monanthochloe littoralis).* At the highest elevations, another species of pickleweed *(Salicornia subterminalis)* becomes co-dominant with shoregrass.
The low-growing, open canopies of vascular plants in southern California marshes allow light penetration to the soil surface and subsequent development of lush algal mats (Zedler, 1982d). Filamentous bluegreen and green algae and dozens of species of diatoms form mats up to one centimeter thick on moist soils. These occur at all intertidal elevations. The early studies on the composition of these marsh algal mats were performed at Tijuana River Estuary in the 1970s. These algal mats are about as productive as the overstory salt marsh plants (Zedler, 1980) and actually play a more important role as a food source in the estuarine food chain (Williams, 1981; Zedler, 1982c).

Reduced tidal circulation, natural flooding, prolonged excessive freshwater input, compaction by off-road vehicles, and the introduction of exotic species can cause changes in both salt marsh community structure and function (Zedler, 1982d). Of particular concern is the invasion of *Tamarix spp*. into high marsh habitats. Salt marsh bird's beak *(Cordylanthus maritimus)* was once a common plant of the upper marsh but is now listed as endangered under the Federal Endangered Species Act. This plant likely owes its endangered status to the filling and destruction of upper marsh habitat in California. At the Tijuana River Estuary, salt marsh bird's beak occurs near areas with slightly disturbed soil surfaces, such as along the edges of paths and roads, sparsely vegetated openings, and depressions.

In the past, an important source of disturbance to sensitive salt marsh vegetation has been the large number of undocumented immigrants from Mexico that enter the U.S. via the estuary. Until the mid-1990s, hundreds and occasionally thousands of individuals crossed the estuary every day, trampling the vegetation and creating numerous unnecessary trails. Although increased efforts by the U.S. Border Patrol have significantly diminished the foot traffic through the Reserve, the patrols have created a number of new roads, particularly in the southern portion. Some of these roads pass through some of the most sensitive habitat areas. Areas disturbed by foot or vehicle traffic are slow to recover.

c. Invertebrates

Invertebrates, which include intertidal organisms such as aquatic insects, worms, clams, and crabs, and terrestrial insects and spiders, are likely major consumers in the salt marsh food

chain and in turn are an important food source for the fishes and birds of the marsh (Zedler, 1982d).

Crabs are perhaps the most conspicuous invertebrates in southern California coastal salt marshes. This is also true of the Tijuana Estuary. Burrows of several species of crab occur throughout the lower marsh. Another common and conspicuous inhabitant of the estuary's tidal channels is the horn snail. Many other invertebrate species are just as numerous but less obvious because of their size or location within the sediments. These include several species of clams and mud worms.
Continuing recent studies have helped characterize the benthic community at the Tijuana Estuary. The species composition and dominance change with the distance from the River's mouth. Captellid and spionid polycheates are found in both the estuary's northern and southern arms. *Protothaca staminea and Tagelus californianus* are the most common bivalves in the tidal channels (Williams et al 1996). California horn snail *(Cerithidea californica)* is abundant especially in the winter.

Relatively little research has been done on the terrestrial invertebrates of the estuary and their ecological role, except for recent work on invasive Argentine ants conducted by a NERRS Graduate Research Fellow from 2004-2007. This non-native species forms extremely aggressive colonies, forcing out native ants and depleting the key food source of the horned lizard, which does not eat Argentine ants. Installation of new irrigation lines has been blamed for Argentine ant invasion, as the ants require a year-round water source. In general, as in other salt marshes, most insects here probably feed on vascular plants, algae, and decaying plants, while others are carnivores. They serve as a food source for birds and other marsh vertebrates. Marsh insects are also important to the pollination of marsh flowering plants. The endangered salt marsh bird's beak, for example, is pollinated by native bees (Zedler, 1982d).

Rove beetles *(Staphylinidae spp.)* burrow in mud and salt flats. They are abundant in the estuary and appear to play a role in aerating soils and in reversing soil compaction resulting from off-road vehicles. Studies suggest that the largest population of the wandering skipper *(Panoquina errans)* in the United States may be at the Tijuana Estuary (Zedler, 1982d). The estuary also supports a diverse and abundant population of coastal tiger beetles *(Cicindela sp.)*, of which four species may be threatened (U.S. Fish and Wildlife Service, 1982). The Reserve is also a location for the globose dune beetle *(Coelus globosus)*, a federal Category 2 species.

At least eleven species of salt marsh mosquitoes breed in the saline and brackish pools of the estuary (U.S. Fish and Wildlife Service, California Department of Parks and Recreation, and Department of the Navy, 1983). Three species *(Aedes taeniorhynchus, Anopheles hermsi, and Culex tarsalis)* are of particular concern because of their potential as pests and possible disease vectors. Currently, biochemical control methods (BTI) are being used to combat larvae and adults in areas where there is a high concentration of these mosquitoes. These methods are further discussed in Chapter 5.

d. Fish

The small tidal creeks and channels of the estuary support a relatively diverse population of fish including at least 29 species representing 19 families (U.S. Department of Commerce and California Coastal Commission, 1981; US. Fish and Wildlife Service, 1982, Zedler et al. 1992). Since 1987, fish assemblages have been sampled in the estuary. Catches are often dominated by topsmelt *(Atherinops affinis),* longjaw mudsucker *(Gillichthys mirabilis),* arrow goby *(Clevelandia ios),* and California killifish *(Fundulus parvipinnis).* Adult striped mullet *(Mugil cepalus)* are also common. Abundance varies year to year, but total density tends to peak in the summer and declines in the winter.

The tidal channels have been shown to function as a nursery for commercially important fish, such as the California halibut. Nordby (1982) found abundant eggs of the croaker family, topsmelt, and northern anchovy. Hence, the estuary appears to be providing nursery habitat for marine fishes; it may, therefore, be important for sport and commercial fisheries. Game fish such as kelp and sand bass, opaleye, and white croaker have also been found in the estuary (U.S. Department of Commerce and California Coastal Commission, 1981).

e. Reptiles and Amphibians

The habitats within the Reserve support at least 29 species of reptiles and amphibians (Espinoza 1991, USGS 2001). These include the San Diego horned lizard *(Phrynosoma coronatum blainvillei),* and the Coronado skink *(Eumeces skiltonianus interparietalis).* Both are species of special concern.

California kingsnakes *(Lampropeltis getulus californiae)* and San Diego gopher snakes *(Pituophis melanoleucus annectens)* are common in transition habitats, but are also found in the drier areas of the salt marsh. Side blotched lizards (*Uta stansburiana)* are abundant on the dry ground of the reconstructed dunes and other sandy areas. Dunes are also home to the San Diego horned lizard and silvery legless lizard *(Annielia pulchra pulchra).*

Riparian area and freshwater ponds are home to the California toad *(Bufo boreas halophilus)* and the Pacific tree frog *(Hyla regilla).* Coastal sage scrub is habitat for the San Diego alligator lizard *(Gerrhonotus multicarinatus webbi)* and the Great Basin fence lizard *(Sceloporus occidentalis biseriatus).*

Management of reptiles and amphibians focuses on protecting the remaining open space in the Reserve and restricting horse, vehicle, and foot traffic to designated areas. The maintenance of the few freshwater ponds is important to the life cycles of the amphibians (Espinoza 1991).

f. Birds

Bird populations have been an important factor in the special protective status attributed to the Tijuana Estuary. Over 370 bird species are reported for the area. Birds use the wide array of habitats present in the lower and upper estuary, including the ocean beach and dunes,

mudflats, mudbanks, salt marshes, and riparian areas. A complete list of birds observed at the Reserve can be obtained at the Visitor Center.

Six federally listed threatened or endangered birds occur regularly in the Reserve: the light-footed clapper rail *(Rallus longirostris levipes),* the California least tern *(Sternulae antillarum),* least Bell's vireo *(Vireo belli pusillus),* the California gnatcatcher, the western snowy plover *(Charadrius alexandrinus nivosus),* and the California brown pelican *(Pelecanus occidentalis californicus).* Belding's sparrow *(Passerculus sandwichensis beldingi)* is listed as endangered in the State of California. Other regionally or locally rare species include the elegant tern, black skimmer, and northern harrier. The light-footed clapper rail, California least tern, western snowy plover, least Bell's vireo, and Belding's savannah sparrow nest in the estuary. Their requirements and status are discussed further since these are the species most likely to be affected by management of the Reserve.

California Least Tern with chick (Endangered under the Federal and State Endangered Species Acts). This species nests on the beach and dune habitat of the Reserve and Refuge.

Light-footed Clapper Rail (Endangered under the Federal and State Endangered Species Acts. This elusive species is considered the signature bird of the Tijuana River National Estuarine Research Reserve.

The decline of the light-footed clapper rail population in southern California is associated with the encroachment and destruction of coastal salt marshes. The use of the estuary by this species has been described by Jorgensen (1975, 1980) and summarized by the U.S. Fish and Wildlife Service (1982) and Zedler (1982d). Recent censuses indicate that the entire U.S. population of this subspecies may be as low as 325. In recent years, 80-90 pairs were recorded at Tijuana Estuary, making it the second largest population of this endangered species in the United States.

A total of 305 California least tern pairs were reported in the Reserve for 2006, with 57-80 chicks fledged. Fences and temporary enclosures have been built to protect the nesting areas. However, nests and fledglings are vulnerable to vehicle, horse, and foot traffic on the beach. Tern reproduction can be severely impacted by predation from an array of predator species.

A small number of western snowy plover also nest in the river mouth areas and dunes from mid-March to mid-September. Peak nesting occurs from April through June. A total of 16 nests were attempted in 2006, with about 5 chicks fledged. Nest success, formerly reduced by trampling by undocumented immigrant traffic, is now limited by avian predators, such as gull-billed terns (*Sterna nilotica vanrossemi*), and extremely rare federally listed species.

Belding's Savannah sparrow uses the higher salt marsh habitats, particularly pickleweed communities, for nesting. Nesting occurs anywhere from March to August (Massey, 1979). In 2006, 169 Belding’s savannah sparrow territories were found in the Oneonta Lagoon section north of the River, and 105 were found south, although the extreme southern portion of the wetland below the beach trail were not surveyed. The long breeding season of this species, coupled with its sensitivity to disturbance, requires that human activities in the upper marsh be restricted for most of the year to avoid further declines in the population (Zedler, 1982b).

Least Bell's vireo nests in the riparian vegetation adjacent to intermittent streams and channels of the Tijuana River. Willow thickets are the main territorial sites both in the southern and eastern portions of the Reserve. A 2004 survey found there were approximately 300 pairs of least Bell's vireo in the Valley, with 9 pairs in Goat Canyon.

The Tijuana River Estuary is located along the Pacific Flyway and is used for migration and wintering habitat for a variety of waterfowl and shorebirds. Wintering waterfowl include pintail, cinnamon teal, American widgeon, surf scoter, and ruddy duck. Reserve wetlands are important habitats for a large number of shorebirds (shorebirds account for the majority of the migratory bird population). While about 20 species occur regularly along the sandflats and mudflats of the estuary, four species -- willet, dowitcher, western sandpiper, and marbled godwit -- account for most of the shorebird population throughout the year (Boland, 1981). Abundance and species composition fluctuate seasonally. Intertidal sand and mudflats support the largest numbers of individuals and species.

g. Mammals

The estuary supports a mammal population typical of fields and lowland habitats. Rodents, including mice, the California ground squirrel, and rabbits, are most common, providing an important food source for the raptor population of the upper estuary. Coyotes, raccoons, bobcats, striped skunks, and the long-tailed weasel are also present in the Reserve (Taylor and Tiszler, 1989). The San Diego black-tailed jackrabbit, a California species of special concern, inhabits the southern portion of the Reserve.

3. Cultural Resources, Historic and Prehistoric

a. Prehistoric Cultural Resources

A number of federally-listed historical and archaeological sites exist in the lower Tijuana River Valley. Local records document multiple archaeological sites in the nearby Border highlands area and along the coastal shore. Sites identified indicate past use by groups labeled “Archaic” (from 10,000 to 1300 years ago) to “Late Prehistoric” (from 1300 years ago to Spanish contact in 1542). Also used in the scientific literature are the labels “San Dieguito,” “La Jollan,” and “Yuman” phases of social evolution. The Kumeyaay Indian people of the estuary today consider all these populations to be ancestors. The earliest dated site of the lower estuary has a radiocarbon date of 7680 years of age. Most recent research has indicated that a Spanish land party came through Goat Canyon in a 1769 expedition, although scholarship through the last decades argued the Smuggler’s Gulch route.

b. Historic Summary of the Tijuana Estuary

Pleistocene Era

Forty thousand years ago, much of Earth's water was still trapped in polar ice sheets, and the estuary resembled river-bottom land, thick with trees and shrubs. The surf line was six miles to the west of its present location. About 10,000 years ago, at the end of the Pleistocene Era, the climate warmed. As the polar ice melted, the sea level rose and flooded coastal valleys. The land that is now the estuary was a bay, with minimal human habitation.

Prehistoric Times (10,000 years before present to 1542)

Archaeological sites both on upland bluffs and buried under modern sediments in the estuary drainage, as well as underwater sites located in or near what is today the Tijuana River Estuary reveal that Paleo-Indian people, labeled “Early Archaic” or “San Dieguito”, lived here during the Early Holocene period, dating from 10,000 to 8,000 years ago Big game hunters and fishers, they subsisted on large prey that are now extinct, as well as the ancestors of today's large game, such as deer, mountain sheep, and antelope. Prior to the introduction of ceramics or the bow and arrow, spear points and atl-atl darts, plus the evidence of lithic reduction areas, are rare and this is a controversial period of human development in the estuary area.

Mid-Holocene (8000 to 1300 years ago) time periods found the human populations of the estuary diversifying their diets to adapt to changes in the environment. Hypotheses as varied as over-hunting big game to dramatic climate changes are used to explain the more sedentary lifestyles estimated for these "Late Archaic", "Milling Stone" or "La Jollan" peoples. Employing *manos, pestles* and *metates* to grind seeds, these peoples added new foods and technologies through the use of animal byproducts and mineral pigments. Sea level stabilized around 3,500 years ago, creating a lagoon rich in shellfish and fish, surrounded by a fertile marsh and riparian woodlands. As the lagoon mouth filled up with sediments, these fisheries and bird sanctuaries were reduced, with a resultant loss of Indian populations residing around the Tijuana Estuary mouth.

As centuries passed, the climate became drier. The trees and grasslands receded. Drought-tolerant scrub and chaparral spread over the uplands and salt-tolerant species took over the expanding marshes. Sedimentation continued to increase, converting the lagoon into a mudflat and estuary. Around 1,300 years ago, in the Late Holocene, another group called the "Late Prehistoric" emerged. They occupied a coastal region that is similar to what we see today at and around the estuary – a diverse and resource-rich zone between the continent and ocean. Reed canoes allowed them to fish the Coronado Islands, and seasonal rounds of subsistence from the Cuyamaca Mountains to the Tijuana Estuary mouth were recorded by the Spanish settlers of the mid-18th century, a lifestyle that had existed for centuries prior to the time of Spanish settlement.

By the 1770s, an estimated 16,000 to 20,000 Kumeyaay Indian people lived in the area from the San Dieguito River to Ensenada. Historic Indian villages are documented by a Spanish land expedition at the mouth of Goat Canyon (Milejo) and at the base of the San Diego Harbor (Las Chollas).

Spanish Period (1542 – 1821)

Spanish explorer Juan Rodriguez Cabrillo must surely have passed the mouth of the Tijuana River in 1542. Sixty years later in 1602, another Spaniard named Sebastian Vizcaíno rediscovered and named San Diego Bay before continuing north. In 1769, a Franciscan friar, Junipero Serra set off with Gaspar de Portolá, northbound from Loreto in Baja California. In the same year, Captain Fernando Rivera y Moncada and Father Juan Crespi led another land expedition destined for San Diego. On May 12, 1769, the Rivera-Crespi land expedition, its numbers already thinned by starvation and desertion, spotted an enclave of Indians south of what is today Tijuana. The beleaguered band turned away from their route along the beach, probably where Tijuana's Las Playas community is today, and made their way up the gentle seaside slopes and across gorges. Soon, in the distance the estuary appeared below them. As the tide was rising, it looked as if the sea extended inland.

The party found what Father Crespi called a "handsome stream, running with a good-sized flow of water" which was probably the Tijuana River. They made their way across the valley full of tule, rush and sedge – "everything well grown with green grass. "Father Crespi's diary indicates that the explorers had seen a native village located in the river valley, possibly Milejo. Crespi wrote that the native men and children were naked and had long hair, a stark

contrast to the Spanish. From there, on May 14, 1769, after six hours of mostly rainy weather, they came in sight of the harbor and the ships**.** Soon thereafter, Father Junípero Serra's band followed, descending into the river valley through an arroyo that matches the description of modern day Goat Canyon.

The new Spanish culture near the San Diego River precipitated changes and unrest that significantly impacted the Indians living around the estuary, far to the south. Diseases, for which they had no immunity, and which had probably been introduced as early as the 1530s from the Spanish settlements in southern Baja California, decimated populations. In addition, the dependence on Spanish agricultural practices ultimately led to famine for these California Indian peoples.

Mexican Republic Period (1821-1848)

In 1810 mainland Mexico rebelled against Spain, in an independence movement joined by *Californios* and supported by some Indians and people of mixed Indian and Spanish heritage. The colonists finally won their independence in 1821 and the estuary, like all of Alta California, became part of the Republic of Mexico.

Alta and Baja California's missions were secularized in the early 1830s. The Franciscan padres were replaced by parish priests, and mission holdings, cattle, horses, and equipment were turned over to government-appointed administrators. Military garrisons were disbanded. Indian resistance mounted. Leading *Californio* families petitioned the Mexican government to grant them deeds to choice mission lands as *ranchos*, as a reward for past service in the military. Ranchos were granted to those best suited to oversee the land and its cattle. In 1829, Governor Augustin Melijo of Baja California granted Santiago Arguëllo nearly 26,000 acres in the Tijuana River Valley. It became Rancho Tia Juana.

Early American (1848-1900)

In November 1845 U. S. President James K. Polk's emissary to Mexico failed to secure boundary adjustments and the United States declared war on Mexico. After Americans took Mexico City, Mexico ceded roughly half its territories, including Alta California, San Diego and the estuary, to the United States. Most of the Tijuana River watershed upstream, however, remained in Mexican hands, a decision that continues to affect the estuary greatly today.

In the aftermath of war, Mexico and the United States signed the Treaty of Guadalupe-Hidalgo in 1848. It demanded a new 2,000-mile border between the two countries. The surveying would be a six-year process, complicated by poor equipment, underfunding, and political infighting. However, the border's westernmost position was clear. In 1851, the schooner *Annette* delivered a permanent boundary marker, made of Italian marble in New York. U.S. Army soldiers from New Town (today's downtown San Diego) escorted the three-piece obelisk to the border by gun carriages and ceremoniously erected the 15-foot high obelisk onto a four-foot thick, mortared brick base. The site officially became known as "Monument Mesa."

South of the border, on a portion of the former Argüello rancho, a small settlement of ranch houses, a customs house, and a few trading stores became the town of Tijuana. The town was officially incorporated on July 11, 1889, growing slowly until the 1920s when liquor prohibition in the United States jump-started the town's tourist industry.

On their way to Tijuana, American tourists often stopped off at Monument Mesa, the U.S.-Mexican boundary marker. Over a 100,000 tourists visited the monument in 1888 when the railroad connection between San Diego and Tijuana was completed.

The completion of the railway fed the speculative boom and increased visitation to the border. Speculators built hotels and other attractions, and businesses and homes lined the route of the railway. Lots at the "southwest corner of the United States" sold from $100 to $500. The boom went bust before so-called "Monument City" became a reality.

Early 20th Century Milestones (1900 – 1964)

1904 Border Patrol established to stem the flow of Chinese laborers who were entering the U.S. through Mexico.

1909 Initial development of Imperial Beach, a summer retreat for residents of Imperial Valley.

1910 Mexican Revolution resulted in U.S. troops stationed at camps near the monument. To help patrol the boundary, the army established Camp Hearn at Imperial Beach to the north of the estuary. The 11th Cavalry was stationed there until October 1931. An estimated 890,000 Mexicans crossed the border during the Revolution, many of them hired by railroads such as the San Diego and Arizona Railroad that connected to Imperial Valley.

1920s Tijuana became a tourist Mecca. Its hotels, brothels, casinos, and dog and horse racing tracks catered to a largely American clientele, anxious to escape the bans on horseracing and alcohol in the United States. San Ysidro became a jockey town. Breeders and owners kept horses at stables in the Tijuana River Valley, while others – many Anglo-Americans and some Chinese – ranched and farmed.

1929 The U.S. Eleventh Naval District began acquiring leaseholds on acreage just north of the border, an action that would ultimately secure the southern border of the estuary. The Navy called its first leasehold "Border Field" and used it as a machine-gun range and airborne gunnery range.

1941 The U.S. Navy leased 245 acres along the border and established Border Field Auxiliary Landing Field — an operation that included thirty-five buildings, one barracks, a galley and a machine-gun range.

The Navy used Border Field for gunnery training on five moving-target machine gun ranges. As part of the region's coastal defense system, the Army created a fire control station and

bunkers on Bunker Hill east of Monument Mesa. It erected a 50-foot tall radar tower on Monument Mesa.

Just north of the estuary the Navy also acquired a field and named it after Major W. R. Ream, an Army medical officer who was killed in a plane crash in 1918.

Situated on a floodplain and largely uninhabitable by humans, the border region seemed like an ideal site for training combat pilots. Pilots flying from either Ream or Border Fields flew low and practiced dive-bombing and air-to-air gunnery, shooting at drones above the estuary. They shot at stream-driven targets that moved along the sand dunes on rails called “rabbit tracks.”

1949 Ream Field closed but was re-commissioned on September 1, 1951 as part of the Naval Air Station, North Island. On July 1, 1955, it became fully independent, operating primarily as a helicopter landing field. Ream eventually became known as the "Helicopter Capital" since it was the home base for all helicopter squadrons of the Pacific Fleet.

1961 The Navy deactivated Border Field and transferred 377 acres to the Navy Electronics Laboratory for classified experimental work in fleet electronics.

Preservation Period (1964 – 1982)

In 1964, California voters approved money for Border Field's acquisition as a state park. However, there was still pressure to build a "Monument City". Developers were lobbying the federal government and local landowners with a plan to create an upscale marina in the estuary.

In his Environmental Address of February 1971, President Richard Nixon announced that Border Field would be developed for recreational use as part of his "Legacy of Parks" program. Exactly 372 acres became part of Border Field State Park. The southern flank of the estuary was preserved.

Developers and the City of Imperial Beach, aspiring to raise the depressed economic situation in the area, remained intent on the idea of dredging the Tijuana estuary. They wanted to get rid of what they called "muck" and create a marina the likes of which California had never before seen. Local biologists Joy Zedler and Paul Jorgensen knew that what developers called “muck” was the basis for estuarine ecology, with its related importance to water quality, air quality, ocean health, and many living systems outside the estuary, including humankind.

Dr. Mike McCoy, a wildlife veterinarian, was increasingly frustrated with his work in rehabilitating wounded wild animals. He understood from years of experience that the loss of wildlife always stemmed from a lack of adequate habitat. The need to preserve the Tijuana estuary habitat – what was truly one of the last remaining estuarine systems along the Southern California coast, where 90 percent of the wetlands have been destroyed – was dire. McCoy began to organize local environmentalists and Imperial Beach residents in 1971.

Together with Jorgensen and Zedler, McCoy's efforts resulted in broad government and public support for the estuary's preservation.

Concern about the environment mushroomed during the seventies, with the gradual passage of federal bills such as the Endangered Species Act and the Clean Water Act and state bills like the California Coastal Act. The passage of environmental legislation helped the activists and created many more hurdles for the marina project.

In 1980, the residents of Imperial Beach voted in favor of the marina project. Nevertheless, that same year, the U.S. Fish and Wildlife Service purchased the northern 500 acres of the estuary from the Helix land company and established the Tijuana Slough National Wildlife Refuge.

In 1982 – again in spite of heated opposition from developers – the estuary (both State Park and National Wildlife Refuge land) became part of the U.S. Department of Commerce's National Estuarine Sanctuary Program, later to be named the National Estuarine Research Reserve System.

Border Monument (late 1800s) – A popular tourist destination for nearly 150 years, as of January 2009, the DHS fenced corridor project restricts public access to this site, also referred to as Friendship Park.

Border Field military base (note Monument Mesa in background left) - This area is now a combination of freshwater marsh and salt marsh.

One of 3 World War II bunkers in Border Field State Park; as of January 2009, these remarkably intact, 2-story bunkers are off-limits to the public

CHAPTER TWO: PRINCIPLES of CORE AGENCIES

INTRODUCTION

This chapter articulates the agency core principles upon which the operation of the Tijuana River NERR is built. A summary of the statutory basis for the designation and the overarching mission of the site are provided first. Guiding principles for seamless operation and a five-year vision statement are discussed. The chapter also highlights a programmatic mission

I. STATUTORY BASIS FOR THE TIJUANA RIVER NATIONAL ESTUARINE RESEARCH RESERVE AND THE TIJUANA SLOUGH NATIONAL WILDLIFE REFUGE

The Reserve was established in 1982 under the provisions of Section 315 of the Federal U.S. Coastal Zone Management Act. Included within the Reserve is the Tijuana Slough NWR, which was established in 1980 under the provisions of the Endangered Species Act for the purpose of conserving endangered and threatened species, particularly the endangered light-footed clapper rail. The Reserve operates as one of 27 units of the NERR System, and one of three on the California coast. This Reserve is also a unique composite of lands that comprise parts of other public lands systems operated by California State Parks, San Diego County Parks, City of San Diego, the Fish and Wildlife Service (FWS), and the Navy. Accordingly, the Reserve's core mission is derived from the NERR and NWR system mission and program goals, and from the goals, policies, missions, and statutory requirements of the landowning agencies.

A. THE NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM PROGRAM MISSION AND GOALS

Mission

As stated in the NERRS regulations, 15 C.F.R. Part 921.1(a), the National Estuarine Research Reserve System mission is:

"The establishment and management, through Federal-state cooperation, of a national system of Estuarine Research Reserves representative of the various regions and estuarine types in the United States. Estuarine Research Reserves are established to provide opportunities for long-term research, education, and interpretation."

Goals

Federal regulations, 15 C.F. R. Part 921.1 (b), under the National Oceanic and Atmospheric Administration (NOAA), provide five specific goals for the NERR System:

1. Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;

2. Address coastal management issues identified as significant through coordinated estuarine research within the NERR System;

3. Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;

4. Promote federal, state, public, and private use of one or more Reserves within the NERR System when such entities conduct estuarine research; and

5. Conduct and coordinate estuarine research within the NERR System, gathering and making available information necessary for improved understanding and management of estuarine areas.

National Estuarine Research Reserve System Strategic Goals 2005 – 2010

The Reserve system began a strategic planning process in 1994 in an effort to help NOAA achieve its environmental stewardship mission to "sustain healthy coasts." In conjunction with the strategic planning process, ERD and Reserve staff has conducted a multi-year action planning process on an annual basis since 1996. The resulting three-year action plan provides an overall vision and direction for the Reserve system. As part of this process, the Reserve system developed a vision: Healthy estuaries and watersheds where coastal communities and ecosystems thrive; and mission: To practice and promote coastal and estuarine stewardship through innovative research and education, using a system of protected areas. The following goals are outlined in the 2005-2010 Strategic Plan.

Goals:

1. Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research and education.

2. Increase the use of Reserve science and sites to address priority coastal management issues.

3. Enhance peoples' ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

Biogeographic Regions

NOAA has identified eleven distinct biogeographic regions and 29 subregions in the U.S., each of which contains several types of estuarine ecosystems (15 C.F.R. Part 921, Appendix I and II). When complete, the Reserve system will contain examples of estuarine hydrologic and biological types characteristic of each biogeographic region. As of 2006, the Reserve system includes 27 reserves and two reserves in the process of designation (Figure 9). The reserves are listed by biogeographic region and subregion with their designation date denoted in parentheses.

B. NATIONAL WILDLIFE REFUGE SYSTEM MISSION AND GOALS

Mission

The Mission, as established by the Improvement Act of 1997, is:

"To administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."

Goals

The administration, management, and growth of the NWR System are guided by the following goals (Mission, Goals, and Purposes Policy, July 26, 2006):

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

C. CALIFORNIA DEPARTMENT OF PARKS AND RECREATION MISSION AND STRATEGIC INITIATIVES

"The Mission of the California Department of Parks and Recreation is to provide for the health, inspiration, and education of the people of California by helping preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation."

Strategic Initiatives

Of California State Parks' 9 Strategic Initiatives, the following three directly relate to its management of the Tijuana River National Estuarine Research Reserve:

- **Leaders In Natural Resource Management -** The natural resource mission for the System is to acquire, manage, and sustain representative and outstanding examples of California's natural resource values. The natural resource efforts of California State Parks will seek to provide better balance and consistency at the district level and greater awareness of priority natural resource needs among all interested parties. **Goal: Improve consistency, balance, and application of research within natural resource management programs, while ensuring priorities are well understood.**
- **Strengthening Relevant Urban Connections -** California State Parks must be willing to commit resources to urban outreach and the development of urban parks, and it must reinforce and look for opportunities to expand its current urban projects and programs. Finally, State Parks must continue to challenge itself to be meaningful to all Californians by aggressively seeking new and innovative strategies (projects, programs, leadership) to connect with urban and ethnic communities. **Goal: Develop new opportunities for residents of the state's most highly concentrated urban areas to connect with their California State Parks.**
- **Improving Interpretive And Educational Services -** It is important that State Parks continue to expand innovative uses of technology to reach into more classrooms. Through partnerships with the education community, nonprofit organizations, and private industry the effectiveness of this endeavor can be multiplied. **Goal: Expand use of technology in the delivery, management, and measurement of interpretation; and continue efforts to improve quality of interpretive programming, materials, and facilities.**

II. TIJUANA RIVER NERR MISSION

Because Tijuana River NERR is a composite of lands and waters owned by a variety of local, state, and federal agencies, it is important to discuss and consider the missions of those agencies in the Management Plan. All constituent agencies have agreed to support the concept of a seamless Reserve and the following mission statement for the Tijuana River National Estuarine Research Reserve:

"To preserve, protect, and manage the natural and cultural resources within the Research Reserve, enhance scientific understanding and education, ensuring compatible recreation and resource use for the benefit of present and future generations. This will be accomplished through partnerships with the community, educational institutions, and government entities working in the estuary, its binational watershed, and biogeographic region."

Management of the Reserve should also serve the missions of the NERR and NWR systems and landowning "operating" agencies CSP, FWS, and the USN (See Chapter 4).

III. THE TIJUANA RIVER NERR 5-YEAR VISION STATEMENT AND GOALS FOR THE 2010 PLAN

The 2010 Management Plan articulates a vision for the Reserve that emphasizes its interdisciplinary programs, its diverse outreach opportunities, and its geographic uniqueness, in the middle of both an international watershed and an international biogeographic region.

The five-year vision statement for the Tijuana River NERR is as follows:

"The Reserve and its partner organizations will inspire among diverse audiences more effective estuarine and marine management, compatible use, and proper resource protection through innovative and coordinated research, education and management approaches, throughout the biogeographic region between Point Conception and San Quintín."

The Vision Statement is supported by the following four over-arching Management Plan Goals. In addition, the objectives and strategies set forth in each chapter of this document delineate the actions that will achieve one or more of the following goals, as it relates to the subject of the given chapter.

Goal I: "To <u>protect, restore and enhance</u> the viability of key coastal habitats and species and preserve the region's cultural heritage while encouraging compatible public use, education and research." The Reserve will address the long-standing and increasing resource degradation, particularly in the southern end of the Reserve. Historically this area has suffered more damage from natural events and human activity than the more accessible parts of the Reserve to the north. To address this, primary efforts will focus on controlling erosion in Los Laureles Canyon, maintaining and improving the Goat Canyon sediment basins, restoring salt marsh and upland habitat and promoting sustainable development practices in Los Sauces Canyon.

Goal II: "To fully <u>integrate</u> the Reserve's research, stewardship and education programs and provide a model of excellence in all three areas." It is essential that the decisions made in all Reserve programs continue to be based on the most current findings of the Research community.

Goal III: To engage coastal decision-makers and the general public in the Reserve's stewardship mission by <u>promoting awareness</u>, a sense of pride in the resource and an enhanced capacity to improve Tijuana River coastal and watershed ecosystems in general. The Reserve needs to continue to expand its advocates among government agencies and the general public, taking full advantage of its urban context to build a strong constituency for the Reserve, the NERRS, and estuary protection in general. Effective education (at all levels) leads to broad political support. This, combined with scientific knowledge, is the ultimate foundation for long-term funding and resource stewardship. This Reserve has a unique opportunity to reach out to the general public on behalf of coastal wetlands: over 1.8 million people live within a 30 minute drive.

Goal IV: To assume regional leadership role for science-based natural resource enhancement and urban ecosystem management. The agencies that have a stake in the management of the Reserve need to continue to improve coordination and expand partnerships in addressing the above-noted resource problems. Program needs exceed the capacity of any one agency to implement the programs through staff and/or contracts. In addition, the Reserve management needs to expand the Reserve's niche and influence in the larger binational and biogeographic context in the areas of education, research and monitoring, stewardship, and management. The Reserve's management believes the effort is well-timed and the on-site programmatic foundation exists to tackle these very challenging issues in this next era of Reserve operations.

IV. GUIDING PRINCIPLES FOR TRNERR OPERATIONS

A. COOPERATION AMONG AGENCIES

The cooperative relationships between the missions of the NERR System, NWRS, California State Park System, and the landowning and regulatory agencies is a core principle of the Tijuana River NERR. The partnering agencies support and administratively coordinate to accomplish the Reserve's mission when compatible with their own agency's missions and goals for their lands within the Reserve. The Missions of the National Estuarine Research Reserve System, the National Wildlife Refuge System, and the California State Park System generally support each other. In rare instances of conflict during planning of proposed activities, it is agreed that careful negotiation will be undertaken and that the fundamental policies of the underlying landowning agency takes precedence. (See Chapter 4, Administrative Framework).

B. THE ADVISORY COUNCIL AS A CONSORTIUM THAT CREATES MUTUAL BENEFITS FOR TRNERR AND AGENCIES THROUGH JOINT EFFORTS

The Tijuana River NERR Advisory Council, changed from the "Management Authority" in this document, brings together the operating, landowning, regulatory, municipal, and law enforcement agencies, a research institution, and public interest groups in a structure that creates opportunities to advance the mission of the Reserve concurrent with the fulfillment of the missions of the respective agencies and organizations. While the Advisory Council cannot set binding policies for the landowning and Operating Agencies, it provides guidance for the Reserve as a whole and facilitates coordination and cooperation between agencies and a forum for public comment and involvement. It is through this alliance that the complex network of interests at the Reserve can develop lasting, stable agreements on how to best protect the Reserve's resources.

C. RESERVE-WIDE PRIORITIES FOR RESOURCE PROTECTION AND RESTORATION

Protection and, when necessary, restoration of the Tijuana Estuary and other coastal and marine environments within the biogeographic region, consistent with the policies of landowning and land-use regulating agencies, are the highest priority goals of the Reserve. This priority underlies many of the programmatic goals, objectives, and tasks put forward in

this Management Plan. The following approaches to implementing this priority are emphasized throughout the plan:

- Promote public awareness of and voluntary compliance with resource protection regulations through the Reserve's education programs.
- Coordinate resource protection activities among cooperating agencies.
- Implement the Tijuana Estuary Tidal Restoration Program and complementary projects to restore the tidal prism and representative populations of native fauna and flora to all degraded habitats, and to sustain high water quality in the Reserve.
- Avoid, minimize, and manage on-site natural and social disturbances to estuarine resources and other wetland and upland habitats.
- Identify, and where possible, minimize negative impacts to Reserve resources from point and non-point source pollutants and sediment carried to Reserve during storm water run-off events within the watershed.
- Coordinate with decision-makers in the watershed to promote public awareness and improve overall ecosystem health.

D. PARTNERSHIPS

Forming partnerships is essential to the accomplishment of the mission and goals of Tijuana River NERR. The Reserve exists in its most basic form, as a partnership among land-owning government agencies, NOAA and other government agencies that have jurisdictional authorities on the lands and waters within the Reserve. The primary funding source for the Reserve is NOAA and an Advisory Council counsels the Reserve. Partnerships are a guiding principle of the NWRS (E.O. 12996) and are part of the FWS' ecosystem approach to management.

This Management Plan recognizes the importance of partnerships in every facet of the Reserve's programs. Besides the internal partnership arrangement of the Advisory Council, partnering is encouraged as an integral part of Resource Protection, Research, Education, Watershed, and all Public Involvement, Access, and Use programs. The Advisory Council and Operating Agencies will strive to partner with neighbors, community organizations, and the private business sector; with academia and the public sector research community; with other federal, state, and local law enforcement agencies; with non-governmental organizations; with agencies not represented formally on the Advisory Council; with agencies and organizations in Mexico; and with other entities that can assist in accomplishing the Reserve's mission and goals.

The following principles will guide the Tijuana River NERR's partnership efforts:

- The Reserve's leadership role in the bioregion is expanded by reaching out to other groups who are engaged in similar efforts for collaboration and exchange of information.

Supporting strategies:

1. Through all four sectors, continue to provide opportunities for exchange of information and ideas with other estuaries in the bioregion, including tours, meetings, symposia, etc.

2. Use the unique natural setting of the Tijuana River Estuary as a focal point for public education days, school science projects, research exchange programs, public meetings, and events that involve the local community.

3. Provide written support to newly forming conservation areas, such the proposed Estero Punta Banda reserve in Mexico.

4. Seek out opportunities to demonstrate the value and uniqueness of this local resource through public presentations, traveling exhibits, and other offerings.

- Establishing linkages with sister National Estuarine Research Reserves, National Wildlife Refuges and other ecological reserves, particularly within our bioregion, result in effective collaboration and communication.

Supporting strategies:

1. Establish and improve personal contacts and regular communication with other Refuges and Reserves, placing particular emphasis on the Elkhorn Slough NERR, San Francisco Bay NERR, South San Diego Bay Wildlife Refuge, and the Channel Islands Marine Sanctuary.

2. Develop mechanisms to share ideas and information (on-line, newsletters, monthly conference calls, annual visits, etc.).

3. Investigate and cooperate on bioregional projects as needs dictate (bird monitoring, water quality, etc.).

E. RESERVE DESIGNATION AND OPERATION

Under Federal law (16 U.S.C. Section 1461), a state can nominate and NOAA may designate an estuarine ecosystem for Research Reserve status so long as the site meets the following conditions:

1. The area is representative of its biogeographic region, is suitable for long-term research and contributes to the biogeographical and typological balance of the System;

2. The law of the coastal State provides long-term protection for the proposed Reserve's resources to ensure a stable environment for research;

3. Designation of the site as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation; and

4. The coastal State has complied with the requirements of any regulations issued by the Secretary [of Commerce].

Reserve boundaries must include an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation.

If the proposed site is accepted into the Reserve system, it is eligible for NOAA financial assistance on a cost-share basis with the state. The state exercises administrative and management control, consistent with its obligations to NOAA, as outlined in a memorandum of understanding. A Reserve may apply to NOAA's ERD for funds to help support operations, research, monitoring, education/interpretation, stewardship, development projects, facility construction, and land acquisition.

RESERVE RESPONSIBILITIES WITHIN SOUTHERN CALIFORNIA BIGHT

While many of the ecological and sociological challenges facing by the Tijuana River National Estuarine Research Reserve originate in the watershed, the TRNERR is also part of a larger entity that both influences and can be influenced by activities at the Reserve. This entity is known as the *bioregion*, or the California Bight, and it is defined by the area from San Quintín, Baja California, Mexico, to Pt. Conception, north of Santa Barbara. The bioregion is defined as an area characterized by relatively consistent floral and faunal assemblages, with areas of relatively steep species turnover at either end of the region, in the transition zones. Each Reserve is charged with representing and being a leader for similar programs and protected areas in its bioregion.

Our efforts to pursue regional coordination will seek to establish communication and cooperation between the Reserve and other programs, agencies, and governments with similar scientific, cultural, political, and land-use issues within the bioregion. This also includes collaboration with other NERR sites. San Diego County alone is home to 8 separately defined coastal wetland areas, and there are many more as one travels up the coast toward Point Conception and down toward San Quintín. The vast majority of these wetlands within the bioregion do not enjoy the same level of resource protection, programs and staffing, research and monitoring projects, restoration efforts and governmental support as does the TRNERR. By this reasoning, the Reserve is in a position to provide valuable support in the form of program ideas, training, monitoring and research results, restoration lessons, and many other resources that can multiply the benefits derived from NOAA's NERR Program funding and pave the way for better scientific knowledge, wetland protection and management throughout the bioregion. In particular, through its Education and Coastal Training Programs, the Reserve will strive to change the cultural mindset of the general public and decision-makers, both regionally and locally, to recognize the value of estuaries, thereby creating advocates for long-term coastal wetland protection and enhancement.

The TRNERR is more than just a land manager. It takes seriously the additional role of being a leader for estuary management throughout the California Bight. The Reserve can only expand influence regionally within the constraints of staffing and funding. Beyond its immediate borders and local area, the TRNERR is involved in research activities, consortia, technical advisory groups, regional action planning for natural resources, and internationally prominent organizations. However, the Reserve must also be cautious and strategic in its reach, without compromising local responsibilities.

F. NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM ADMINISTRATIVE FRAMEWORK

The Estuarine Reserves Division of the Office of Ocean and Coastal Resource Management (OCRM) administers the Reserve system. The Division establishes standards for designating and operating reserves, provides support for Reserve operations and system-wide programming, undertakes projects that benefit the Reserve system, and integrates information from individual reserves to support decision-making at the national level. As required by Federal regulation, 15 C.F.R. Part 921.40, OCRM periodically evaluates reserves for compliance with Federal requirements and with the individual Reserve's federally approved management plan.

The Estuarine Reserves Division currently provides support for three system-wide programs: the System-Wide Monitoring Program, the Graduate Research Fellowship Program, and the Coastal Training Program. They also provide support for Reserve initiatives on restoration science, invasive species, K-12 education, and Reserve specific research, monitoring, education and resource stewardship initiatives and programs.

Yellow-crowned night heron – A surprise visitor in 2006, normally found in east coast and Caribbean marshes

institutions, as well as the CTP Advisory Committee.

E. Program Results: Projects

One significant goal of this program is to improve the way the coastal and border region is managed by equipping decision-makers with progressive ideas and technical tools through workshops, training, and partnership building. TRNERR has embraced its unique challenges as opportunities to develop and implement new concepts, visions, and approaches for the region and ultimately, serve as a model for coastal community coordination and planning.

IX. REGIONAL CONNECTIONS

A. Ramsar Designation

The Reserve was designated a "Wetland of International Importance" on April 22, 2005. Ramsar, Iran was the site of the 1971 International Convention on Wetlands which resulted in an intergovernmental treaty (currently 158 nation parties) and a designation system of "wetlands of international importance". TRNERR is one of only 25 so designated in the United States. This designation provides greater visibility to the Reserve and opens the door to many new opportunities for information sharing, restoration, cooperative projects, and resource protection within and beyond the Reserve.

The TRNERR's Ramsar designation has already had a tangible benefit it terms of bolstering ProEsteros (a Mexican wetland conservation NGO based in Ensenada) in their efforts at establishing a key Baja California wetland, Estero Punta Banda, as another Ramsar designated site. This was successfully accomplished in February, 2006. There are efforts underway to also seek designation for San Quintín wetlands as well as South San Diego Bay. In addition, efforts are underway to potentially expand the Reserve's Ramsar designation to include Cañon Matadero and Cañon Los Sauces, making it a transboundary Ramsar site of global importance, and opening the door to protect and enhance these key upstream canyons located on the Mexican side of the border.

B. Southern California Wetlands Recovery Project (SCWRP)

The Reserve is an active participant in the County Task Force of the SCWRP, and the Research Coordinator sits on its Science Advisory Panel. SCWRP is perhaps the single-largest public funder of wetlands restoration work in the state of California.

X. VISITS, CONFERENCES, AND ACTIVITIES

The following is a partial list of site visits, conferences, and related activities hosted by the Reserve, or in which Reserve member agencies have actively participated.

- United Nations Association Environmental Subcommittee - Held annually
- Site visit by Department of the Interior Binational Subcommittee
- Site visit by the Undersecretary of Commerce

- International Art Exhibits/INSITE events
- Imperial Beach Bird Festival
- Natural History Lectures
- Ramsar Designation and Refuge Anniversary – 2005
- California Biodiversity Council – 2006
- Yokohama Sister City Delegate Visit
- Fiesta del Río Binational Conference - annual
- Reserve 25th Anniversary and Grand Reopening Celebration – 2007
- Governor's Border Council – 2008, 2009
- Annual Meeting of the National Estuarine Research Reserve System – 2009

Coastal Training Program at Earth Fair, 2006. The Reserve "tables" up to 20 events each year, primarily the CTP, Education, and Volunteer programs. Over 1600 public contacts were made in 2008.

TRNERR Mgt. Authority meeting held in Los Laureles Canyon in Tijuana, Sept. 2005. This is an example of the binational cooperation that is critical to effective resource protection. About 200 residents of Los Laureles Canyon attended.

Los Laureles Canyon, a significant source of sediment, trash and tires that flow directly into the Reserve. These houses made out of discarded materials such as used tires, metal from appliances and pallets. These materials get destroyed at every storm event. With no sewer or paved roads, these areas constitute one of our biggest challenges. The site is located at less than a mile from the TRNERR in Mexico.

CHAPTER FOUR: ADMINISTRATIVE FRAMEWORK

INTRODUCTION

The Tijuana River National Estuarine Research Reserve (NERR) is a state-federal partnership between NOAA and the California State Parks. Tijuana River NERR cooperates with the , U.S. Fish and Wildlife Service (FWS) in the activities of both the NERR and NWR. In addition, several regional agencies and local municipalities share ownership and management responsibilities at the Reserve.

The Advisory Council is the multi-agency body that coordinates policy and operations on a Reserve-wide basis. Through voluntary participation in the Advisory Council, member agencies advise on Reserve-wide policies, jointly promote Reserve programs, and cooperate to provide funding and staff to accomplish the missions of the Reserve and the constituent land systems.

The roles and responsibilities for the Advisory Council, the Operating Agencies, and affiliate organizations are defined in this chapter. This chapter also provides an action plan through which the Reserve can improve its administrative framework to better serve the public. As outlined in this chapter, the Reserve will strive for an administrative framework that emphasizes partnership, integration, leadership and innovative management as set forth in the Reserve Management Plan's 5-year Vision and Goals for 2010 – 2015.

I. POLICIES

A. RELATIONSHIP TO FEDERAL AND STATE GOVERNMENT

1. The National Estuarine Research Reserve System Administration

Each National Estuarine Research Reserve (NERR) is a partnership program jointly operated by a state and the federal government. The Federal interest is represented by NOAA. NOAA's mission is, "to understand and predict changes in the Earth's environment and conserve and manage coastal and marine resources to meet our Nation's economic, social, and environmental needs". NOAA's Estuarine Reserve Division (ERD) coordinates the NERR System nationally and administers NOAA grant funds to state partners at individual Reserves.

Although the management of a Reserve, including development of site-specific policies, is a state's responsibility, NOAA provides overall system policies and guidelines, partial funding, and program assistance. In addition, NOAA evaluates the reserves every three years. The purpose of the NOAA review is to ensure that a state is complying with NOAA/NERR goals, approved work plans, and Reserve management plans. In September 2005 and April 2009, week-long site evaluations were performed by a NOAA evaluation team in accordance with section 312 of the Coastal Zone Management Act. The team's findings from these evaluations are reflected throughout this management plan.

The state interest is usually represented through one or more state agencies or universities. Typically these are agencies charged with environmental, wildlife or coastal management responsibilities. States usually administer Reserve personnel and day-to-day Reserve management. At the TRNERR, the California State Parks (CSP) serves as the managing state agency.

2. National Wildlife Refuge System Administration (U.S. Fish and Wildlife Service)

The Tijuana River NERR is an atypical NERR because FWS is an additional federal partner. NOAA provides no funding for or oversight of NWR management. On the NWR portion of the Reserve, FWS, not the state, has primary authority. At the Reserve, FWS and CSP have agreed to cooperate in joint day-to-day Reserve management. In addition, the Tijuana Slough NWR is co-managed by the FWS/USN per a 1992 MOU.

Tijuana Slough NWR is a unit of the NWRS, administered by FWS. The FWS is the primary Federal agency responsible for conserving and enhancing the nation's fish and wildlife populations and their habitats. In accordance with requirements of the NWRS Improvement Act, the needs of wildlife and their habitats are to come first on refuges, in contrast to other public lands managed for multiple uses.

The Tijuana Slough NWR is one of four refuges of the San Diego NWR Complex. The Project Leader for the Complex represents the FWS on the Advisory Council. Budget and personnel ceilings for the Tijuana Slough are included in Complex allocations. The on-site Refuge Manager oversees day-to-day operations at Tijuana Slough, including coordinating the operating agency partnership with CSP, directing and supervising assigned staff, and planning and executing all Refuge programs at the Reserve.

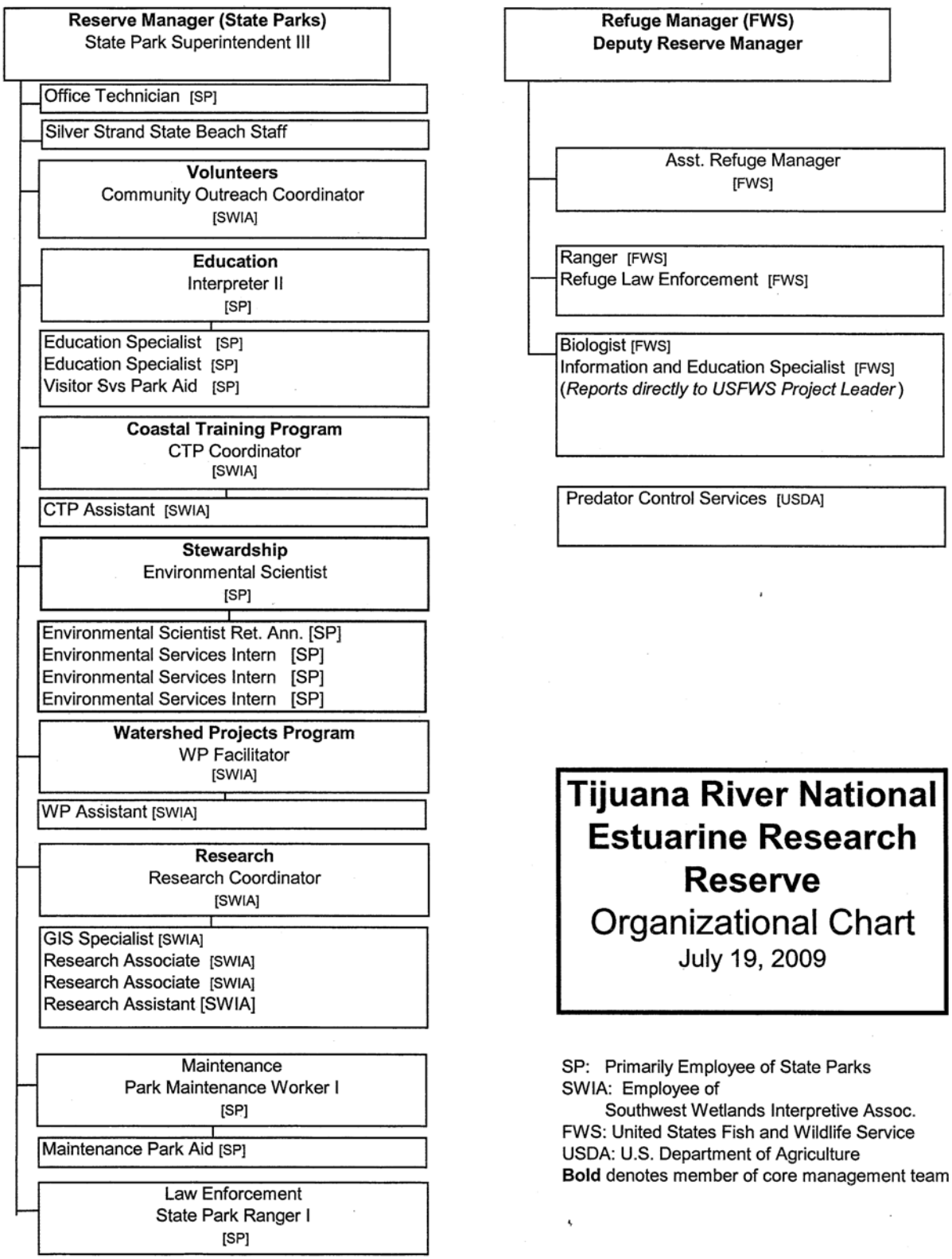
3. California State Parks Administration

CSP is the federally designated administrative lead agency at Tijuana River NERR. As the designated state agency in the NERR partnership, the state matches NOAA's financial contribution, primarily by providing staffing for the Reserve. Through an easement with FWS, CSP has management responsibility for the visitor center complex that lies within the boundaries of the Tijuana Slough NWR. As one of the major landowners within the Reserve, CSP also manages Border Field State Park as part of the overall state parks system.

California State Parks contains the largest and most diverse natural and cultural heritage holdings of any state agency in the nation. California State Parks manages more than 270 park units, which contain the finest and most diverse collection of natural, cultural, and recreational resources to be found within California. These treasures are as diverse as California: primeval redwood forests, vast expanses of fragile desert; lofty mountains, broad sandy beaches, Spanish missions, museums and a world-renowned 20th century "castle".

The Tijuana River National Estuarine Research Reserve (TRNERR) is managed as part of the South Sector of the San Diego Coast District of California State Parks. The South Sector Superintendent manages TRNERR, Border Field State Park (which is within TRNERR) and

Silver Strand State Beach, 8 miles up the coast. The South Sector headquarters are located at the visitor center complex within the Tijuana Slough NWR and the Reserve.



II. EXISTING CONDITIONS AND PERCEIVED NEEDS

A. OVERVIEW OF EXISTING ADMINISTRATIVE FRAMEWORK

The Reserve is unique among the 27 units of the NERR System in its composition and management. Unlike most NERRS, which are managed by a single state agency with state and NOAA funding, the Reserve is an aggregation of local, state, and federal lands subject to "hands-on" management by each landowning agency. In addition, a diverse staff works together at the visitor center complex for the benefit of the entire Reserve. They include federal FWS employees, state park employees, and employees of the Southwest Wetlands Interpretive Association (SWIA). Employees of SWIA report to the Reserve Manager.

CSP is the NERR-designated state agency that, with NOAA support, contributes significantly to the Reserve. The FWS contributes additional significant federal resources in this cooperative effort as part of their seamless day-to-day operation of the Reserve in partnership with CSP. Additional state resources are provided by the State Coastal Conservancy in funding many of the stewardship and research initiatives of the Reserve. Local governments, including the County of San Diego, the City of San Diego, and the City of Imperial Beach, each contribute to the Reserve program and coordinate policy with Reserve staff.

Within the Reserve, CSP owns and administers the 862-acre Border Field State Park. The Superintendent of Border Field State Park also serves as Reserve Manager and is responsible for administering NOAA funding and programs at the Reserve.

The FWS administers Tijuana Slough NWR, including fee lands of the FWS and U.S. Navy, and adjacent state tidelands under a lease from the California State Lands Commission.

The City of San Diego and County of San Diego also own and administer land within the Reserve. County lands are part of the San Diego County Parks System. City lands are currently operated and maintained by the County Park System under a City/County Memorandum of Understanding.

B. OVERVIEW OF ROLES AND RESPONSIBILITIES BY AGENCY CATEGORY

1. Roles and Responsibilities of the Advisory Council

The Advisory Council member agencies have joined together to coordinate policy, enhance communication, leverage resources, and achieve mutual Reserve-wide missions and goals. The responsibilities of the Reserve's Advisory Council are:

- to coordinate activities of the various constituent agencies;
- to provide Reserve-wide policy guidance;
- to oversee progress toward achieving NERR System requirements and Reserve goals; and
- to provide a forum for discussing complex issues and addressing conflict.

The Advisory Council meets quarterly, or as needed, to conduct Reserve business and obtain public input. In the rare situation where an agreement cannot be reached through the Advisory Council voting process, each agency retains the responsibility and authority to carry out its primary objectives on the property it owns or manages. Any activities carried out in the Reserve must, however, be consistent with this plan.

a. Composition of the Advisory Council

The Advisory Council consists of eleven permanent members and two term members, as described below. Once appointed, permanent and term members have equal status. Additional seats, whether permanent or term, may be created by the Advisory Council.

i. Permanent Members

Permanent members of the Advisory Council are appointed representatives of the major public landowning agencies, the cities, and the county where the Reserve is located, as well as state agencies with primary missions to protect coastal resources. The 11 permanent positions are held by the following agencies:

California Coastal Commission
California State Parks
U.S. Fish and Wildlife Service
State Coastal Conservancy
U.S. Navy
City of Imperial Beach
City of San Diego
City of Tecate
City of Tijuana
County of San Diego
U.S. Border Patrol
U.S. Environmental Protection Agency
In addition, NOAA Office of Ocean and Coastal Resource Management holds a permanent, nonvoting seat on the Advisory Council.

ii. Term Appointments

Two term positions are held by organizations that promote the mission of the Reserve. One position is held by a representative of a local university or research facility. A second position is held by a representative of a non-governmental organization with 501(c)(3) status and a stated mission that supports the Reserve. Terms last two years; there is no limit to the number of terms for each organization. The eleven permanent members of the Advisory Council are responsible for appointing the two term positions. The Advisory Council may offer term membership to universities or non-profit organizations based on the following criteria:

- an expressed interest in participating in the Advisory Council,
- a demonstrated commitment to the long term mission of the Reserve, and
- an assessment that the organization would provide a partnership that is beneficial to multiple Reserve programs.

Two-year term memberships continue to be renewed to San Diego State University (SDSU, a research institution) and Southwest Wetlands Interpretive Association (SWIA, a non-governmental organization).

2. Roles and Responsibilities of Advisory Council Committees

Four standing committees advise the Advisory Council in the conduct of its business:

- Research (and Stewardship) Advisory Committee: responsible for coordinating research, restoration, and scientific monitoring at the Reserve.
- Education and Interpretation Committee: responsible for environmental education and outreach activities of the Reserve.
- Trails (Public Access, Use, and Involvement Committee): responsible for recreation programs, law enforcement, signage and publications, and public affairs.
- Coastal Training Program (CTP) Advisory Committee: responsible for CTP and cross-border programs with partners in Mexico, and all binational issues affecting the Reserve, its resources, and its programs.

These committees assist the Advisory Council in accomplishing the goals of this plan. Committees consist of the Reserve staff and interested community members. Normally, the Committee Chair is the manager of the appropriate NOAA program sector: Education, CTP, Research, and Stewardship. At each quarterly Council meeting these program managers are responsible for updating the Council on the status of their respective program sector and its activities. Committees are charged with considering issues referred by the Advisory Council, developing options, proposing strategies, and making recommendations to the Advisory Council. An important function of the committees is to involve the public directly in the decision-making process at the Reserve. Committee chairs accept assignments from the Advisory Council and hold regular committee meetings. The committees may provide reports and recommended actions to the Advisory Council for their approval. Reports and recommended actions are to be provided to the Advisory Council in writing prior to the Advisory Council meeting.

Ad hoc committees are formed to address specific issues, such as visitor center exhibits, that fall outside the existing committee format.

3. Roles and Responsibilities of the Operating Agencies

Day-to-day management of Reserve programs, including resource protection, land management, and all public-use programs, is a joint responsibility of the Operating Agencies

(CSP and FWS). The Operating Agencies have agreed, through a "Letter of Agreement" (Appendix 4), to operate a seamless Reserve and to conduct their operations in a coordinated manner. Both Operating Agencies are equally committed and responsible for all Reserve programs.

The one exception to shared responsibilities for Reserve management is the relationship with NOAA, including administration of NOAA resources supporting the Reserve. By law, the Reserve manager is a state employee. At the Reserve, the state park superintendent serves as Reserve manager. The Reserve manager is the public voice for NERR System programs and is responsible for meeting NOAA reporting requirements, administering NOAA grants, and reporting on NOAA funding and reviews to the Advisory Council.

The Reserve manager and on-site Refuge manager constitute the Reserve management team. They are charged by their respective agencies and the Advisory Council with closely coordinating all Reserve programs, and ensuring that the Operating Agencies' efforts and leveraged resources are cooperative and directed at achieving the Reserve mission. While each agency administers its lands in accordance with agency policy, decisions on day-to-day program operations are reached jointly by the on-site managers of the Operating Agencies to the maximum extent possible.

While development, operations, and maintenance of Reserve facilities are the responsibility of the Operating Agencies, each agency will look for opportunities to support and enhance the other agency's programs. The Operating Agencies recommend Reserve-wide proposals to the Advisory Council. The Advisory Council will provide advice and act to advance the Reserve mission.

4. Roles and Responsibilities of the Cooperating Agencies

Cooperating Agencies serve on the Advisory Council but are not involved in the daily operation of the Reserve. They are as follows:

a. NOAA Office of Ocean and Coastal Resource Management (OCRM)

OCRM is the NOAA division responsible for implementing the NERR System in partnership with state and local governments, federal agencies, non-governmental organizations, and universities.

The NERR System is administered by the Estuarine Reserve Division (ERD) of OCRM within NOAA. This division is authorized under the Coastal Zone Management Act to make matching grants to states for acquisition, development, and operation of NERRs (not NWRS). As part of this authority, the ERD is responsible for ensuring that each Reserve is managed according to the NERR Regulations (15 CFR 921) and individual grant awards.

b. State Coastal Conservancy

The State Coastal Conservancy is responsible for implementing Reserve land acquisition and resource restoration programs outlined in the Management Plan. The Conservancy carries out its work in close coordination with each landowning agency and the Advisory Council. The Conservancy's emphasis is to facilitate planning across jurisdictional boundaries, both within the Reserve and other areas of the watershed. Work includes the analysis and planning necessary to support restoration and acquisition activities, and identifying and securing funds needed for implementation and management of projects.

c. California Coastal Commission (CCC)

The CCC is responsible for reviewing coastal development permits in areas of the coastal zone not covered by a local government's Local Coastal Program (LCP); monitoring the implementation of local government LCPS; enforcing violations of the California Coastal Act; and reviewing certain federal activities and federally funded or permitted projects for consistency with the State's approved coastal management program. The CCC also maintains a land-use planning role and works with local jurisdictions in development and amendments to their LCPS.

d. City of San Diego

As the majority the Tijuana River Valley is located within the San Diego corporate limits, the City has land use and regulatory responsibilities that may affect the Estuary. Throughout much of the Valley, the City has responsibilities for providing local services (police, fire, etc.); the permitting or construction and maintenance of new and existing infrastructure improvements (i.e. flood control); and ensuring compliance with federal floodway regulations. In addition, the City is a landowner, and holds approximately 200 acres of land within the Reserve boundary at this time. An agreement established in July of 1997 transferred ownership of lands south of the Tijuana River to Border Field State Park. Remaining City-owned parcels near the eastern boundary of the Reserve are managed by the County of San Diego under a 1996 agreement. The City has completed the construction of the International Wastewater Treatment Plant, the South Bay Ocean Outfall, the water reclamation plant, the replacement of the bridges at Dairy Mart Road and Hollister Street, mitigation associated with all projects, and the 100-year flood control berm at the Sunrise Development complex.

e. County of San Diego

The County of San Diego is responsible for land acquisition, restoration, resource protection, public use management, and environmental education on County Parks’ lands within the estuary and the Tijuana River Valley. The County provides matching funds and in-kind services, when available, and coordinates with other agencies. County of San Diego representatives also provide consultation and services related to ocean water quality testing, integrated pest management, hazardous materials management, mosquito control, and disease

prevention. The County shares the Reserve's challenges in preventing sediment from damaging the sensitive resources of the Tijuana River Valley.

f. City of Imperial Beach

The City of Imperial Beach owns no land within the Reserve, but has land-use responsibilities (as designated by their certified Local Coastal Plan) over portions of the Reserve. In addition, the City is exploring opportunities to promote eco-tourism and other resource-compatible public use in the Reserve.

g. U.S. Border Patrol

The United States Border Patrol seeks to prevent the entry of illegal immigrants, terrorists, drugs, and other contraband into the U.S. and is the most visible agency in the southern end of the Reserve. As a member of the Advisory Council, the Border Patrol is able to coordinate its patrol efforts with the advice of the Reserve's enforcement rangers and resource management program in order to contribute to resource protection efforts.

h. San Diego State University

The Reserve is an auxiliary field station for San Diego State University. In the past, the majority of the research conducted at the Reserve since its designation has been conducted by the university's Pacific Estuarine Research Laboratory and SDSU has a long history of research activities at the Reserve. However, in-house staff have taken on many of these research responsibilities.

i. Southwest Wetlands Interpretive Association

Southwest Wetlands Interpretive Association (SWIA) is a non-profit organization with 501(c)(3) status dedicated to preservation, restoration, and education in the Tijuana River Valley and its wetlands. It is member supported and works with federal and state resource agencies dedicated to the protection and enhancement and interpretation of wetlands. SWIA's primary objectives are protection of the Reserve, fundraising, and administration of grants for restoration of damaged wetlands, education and revegetation, and the preservation of threatened resources through land trust acquisitions. SWIA has also taken on a new and increasingly important role at the Reserve as employer for several key Reserve positions. SWIA currently receives approximately half of the Reserve's NOAA grant funding for research purposes and works in partnership with the two landowning agencies, CSP and USFWS.

j. The United States Navy

The USN owns 606.42 acres of land within the Reserve and is a member of the management authority. Through a 1992 MOU with the FWS, the USN assists in the preservation and management of the resources on their property, within the NWR. The USN contributes the

expertise of environmental staff to programs that steward the NWR.

C. ROLES AND RESPONSIBILITIES FOR STEWARDSHIP AND RESTORATION

1. TRNERR Advisory Council

The Advisory Council reviews and approves annual and long-term priorities for resource protection and restoration work within the Reserve as well as involvement of the Reserve in the Tijuana River watershed. The Advisory Council also develops new programs and funding sources to address new resource protection and restoration issues as they arise, and provides input to regulatory agencies that review off-Reserve projects within the watershed.

2. The Operating Agencies: CSP, FWS and USN

The Operating Agencies are each responsible for all resource protection and restoration activities that occur within the boundaries of their land units (State Park and National Wildlife Refuge shown in Figure 3). The Operating Agencies also develop plans for restoration projects and assist in preparation of environmental compliance documents for restoration work. In addition, as a landowner, the USN co-manages land within the Refuge and funds surveys and resource monitoring that occurs on these lands, as mandated by Federal regulations.

When possible, the Operating Agencies provide funding, technical assistance, and personnel to assist in planning, supervision, construction, monitoring, and maintenance of restoration and resource protection projects. The Operating Agencies also coordinate with the Advisory Council on all controversial or sensitive resource protection and restoration activities.

The Operating Agencies are the primary law enforcement agencies in the Reserve. CSP and FWS are both responsible for protection of resources in their jurisdictions, and for coordinating and cooperating with each other and with other law enforcement, including San Diego Police, San Diego County Sheriff, California Department of Fish and Game, and the U.S. Border Patrol.

3. The Cooperating Agencies

a. The State Coastal Conservancy

The State Coastal Conservancy is the primary agency responsible for planning and coordinating execution of Reserve-wide habitat restoration. The Conservancy provides funds and staffing, as available, to plan habitat protection and restoration projects. The Coastal Conservancy also seeks outside sources of funding for Reserve programs. The Coastal Conservancy serves as a liaison for agencies that regulate Reserve activities.

b. The California Coastal Commission

The California Coastal Commission is responsible for regulating coastal zone development in areas not covered by the certified Local Coastal Program (LCP), and as such must review

Reserve projects and provide permits for restoration projects. The Coastal Commission also monitors implementation of local government's LCPs and enforces violations of the Coastal Act. The Commission can play a significant role in supporting restoration projects by recognizing the ultimate resource improvements inherent in such projects and, thereby, allowing self-mitigation over the life of a restoration project.

c. The County of San Diego

The County is responsible for managing County and City of San Diego-owned lands of the Reserve consistent with county policy and this plan, and coordinates land use and resource protection activities that overlap the Reserve and Tijuana River Valley Regional Park.

D. ROLES AND RESPONSIBILITIES FOR EDUCATION, INTERPRETATION, AND THE COASTAL TRAINING PROGRAM

1. TRNERR Advisory Council

The Advisory Council reviews annual priorities for interpretation, education and the Coastal Training Program (CTP) to ensure consistency with NERR Strategic Plan and Three-Year Action Plan goals. The Advisory Council also evaluates progress toward achieving NERR and Reserve goals in these program areas and adjusts long-term priorities. The Advisory Council's Research and Monitoring, Education and Interpretation, CTP, and Public Access, Use, and Involvement committees each have responsibilities to study, review, and recommend changes and improvements to the education and interpretation programs.

2. Operating Agencies

CSP and FWS are jointly responsible for operational planning and execution of Reserve education and interpretation programs. The Reserve manager/park superintendent and the on-site Refuge manager agree to tailor their staff assignments to best meet program needs with minimal duplication of effort and maximum economy. Specific responsibilities will vary, depending on staffing levels and skills and abilities of staff.

As viewed by the Advisory Council and the Operating Agencies, the Interpretation and Education program includes formal environmental education to primary and secondary school students, staff-presented and self-guided interpretive programs, and teacher and docent training.

With NOAA funding, CSP will generally provide the Reserve’s Education Coordinator. FWS provides a public education and information specialist.

The CTP staff is employed by SWIA, but reports to the Reserve Manager. Unlike the general education program, the CTP is led by CSP and SWIA; there is no corresponding program with FWS.

3. Cooperating Agencies

a. Southwest Wetlands Interpretive Association (SWIA)

SWIA provides non-governmental support to the interpretation and environmental education programs of the Reserve and is the primary employer of the CTP staff. SWIA raises funds through procuring grants. These funds are partially used to enhance interpretation and environmental education programs. Requests for SWIA funding are submitted by the Reserve manager for review and approval by the SWIA Board of Directors.

b. Other Cooperating Agencies

The California State Coastal Conservancy, California Coastal Commission, County of San Diego, and City of San Diego may all provide technical assistance and funding (as available) to assist the Operating Agencies in implementing the public use, interpretation, and education programs of the Reserve.

E. ROLES AND RESPONSIBILITIES FOR RESEARCH AND MONITORING

1. Advisory Council/TRNERR Science Advisory Committee (SAC)

The SAC is designed to facilitate an exchange of information between the TRNERR and scientists with experience in estuarine science and management. Most committee members are in academic institutions, but other professionals in the private sector, government, and NGOs are also included. The responsibilities of the SAC include:

- Recommending priority research and monitoring needs, including those that are relevant to local, regional, national, and international issues of concern
- Identifying opportunities for collaborations
- Advising on research facilities
- Reviewing research and monitoring programs.

2. Operating Agencies

CSP and FWS are responsible for approval of research that occurs on State Park and National Wildlife Refuge (including Navy lands), respectively. Also, the Research Coordinator reports to the CSP Reserve Manager. All research on the Reserve must be approved and authorized under a special-use permit signed by the Reserve manager or Refuge manager. CSP and FWS will institute a joint permitting system to be used whenever practical. In addition, the USN has approval authority on Navy land. The USN also funds monitoring and surveys on the Navy property.

The Operating Agencies will coordinate closely with the Research Coordinator to ensure that research conducted on the Reserve is:

- compatible with the Operating Agency's mission

- compatible with resource protection and, when proposed on Refuge lands, is determined to be appropriate and compatible with Refuge goals and purposes;
- scientifically sound;
- compatible with existing public uses including interpretation, education, and existing research efforts; and
- whenever possible, contributory to NERR System goals.

The review of research applications will be a joint exercise led by the Research Coordinator and involving CSP and USFWS staff. Landowning agencies are ultimately responsible and have final approval over research proposed on their lands.

3. Cooperating Agencies

SWIA is responsible for implementing the NERR System Wide Monitoring Program (SWMP). This is accomplished by SWIA employing a Research Coordinator, Research Associates, and Research Assistants to carry out SWMP monitoring as well as the larger TRNERR Research Program. The Research Coordinator is responsible for overseeing the development of the research program, and for many research project areas, including SWMP monitoring, publications, Graduate Research Fellow Program, NERRS Science Collaborative grant proposals, maintaining relationships with other research institutions, training staff and volunteers, and representing Reserve interests in public and technical forums.

4. Affiliated Organizations and Researchers

a. San Diego State University

SDSU has been a long-time partner in the research program at the TRNERR. The Reserve is designated as an auxiliary field station of SDSU. The interaction between the SDSU Field Stations Program (FSP) and the TRNERR is designed to promote mutually beneficial opportunities leveraging the resources of both entities.

b. Researchers

Research personnel from all sources, including universities, government agencies, nongovernmental organizations, and private citizens are all welcome to apply to conduct scientific studies at the Reserve. Researchers are responsible for following the protocol established in Chapter 6 of this Management Plan, including meeting all deadlines for applications and meeting all permitting requirements. Failure to follow procedures or meet deadlines may result in rejection of applications or termination of permits.

F. ROLES AND RESPONSIBILITIES FOR PUBLIC ACCESS, INVOLVEMENT, AND USE

1. TRNERR Advisory Council

The Advisory Council coordinates Reserve-wide policies for public involvement, use, and access. The meetings of the Advisory Council provide a forum where the public can present comments and suggestions on Reserve operations. The committees of the Advisory Council are a vital link to the public; members of the public are recruited to lend their expertise to committees.

2. Operating Agencies

The Operating Agencies designate and maintain safe access to and through the Reserve. They encourage visitor use and involvement to the extent compatible with resource protection (and, where applicable, with Refuge purposes). They also staff the volunteer program and coordinate with independent volunteer groups. They foster increased awareness of and support for the Reserve and its mission to protect and enhance estuarine resources.

3. Cooperating Agencies

Individual agencies and organizations provide recommendations and funding for improved public access. In some cases, cooperating agencies own land adjacent to the Reserve boundary and can collaborate on trail linkages and regional recreational planning.

G. ROLES AND RESPONSIBILITIES FOR FINANCIAL MANAGEMENT AND FUNDING APPROPRIATION

1. TRNERR Advisory Council

The Advisory Council may make recommendations to the financial needs and priorities for spending at the Reserve, but has no specific financial reporting responsibilities. The Council provides an excellent forum for addressing project and funding needs. Such discussion will foster cooperative efforts to announce grant opportunities, complete joint grant applications, even offer match funding for projects that fulfill common objectives.

2. Operating Agencies

The responsibility for accurate financial tracking and reporting lies primarily with the Operating Agencies.

<u>a. CSP</u>

The Reserve manager is responsible for accurately budgeting operation needs and sending financial statements and performance reports to State Parks headquarters and NOAA.

Many Reserve projects are supported through grants or funding from cooperating agencies such as NOAA, SWIA, and the State Coastal Conservancy. Grant categories have included

operation and management, development, planning and construction, acquisition, education, and research and monitoring. In order to receive each financial assistance award, quarterly or semi-annual performance and financial reports are required.

In addition to submitting financial reports, the Reserve must "draw down" on federal funds available. This requires coordination between CSP's field office in San Diego and CSP's headquarters in Sacramento.

b. FWS

FWS funds operations and maintenance of Tijuana Slough NWR and, within the overall Reserve, is a major federal contributor of funds and staff resources. FWS receives no funding from NOAA and has no financial management responsibilities to NOAA. Funding of the Reserve is a responsibility of the NOAA/CSP relationship. Refuge and Reserve budgets and financial management are separate and are tied only through voluntary cooperation between FWS and CSP.

Refuge O&M funds are targeted and managed at the San Diego NWR Complex headquarters. The Refuge Complex Manager annually provides funds to the Refuge Manager, Tijuana Slough NWR, for staff salaries, supplies, equipment, programs, and contracts. The on-site manager is authorized to make most routine purchases required for day-to-day operation of the Refuge.

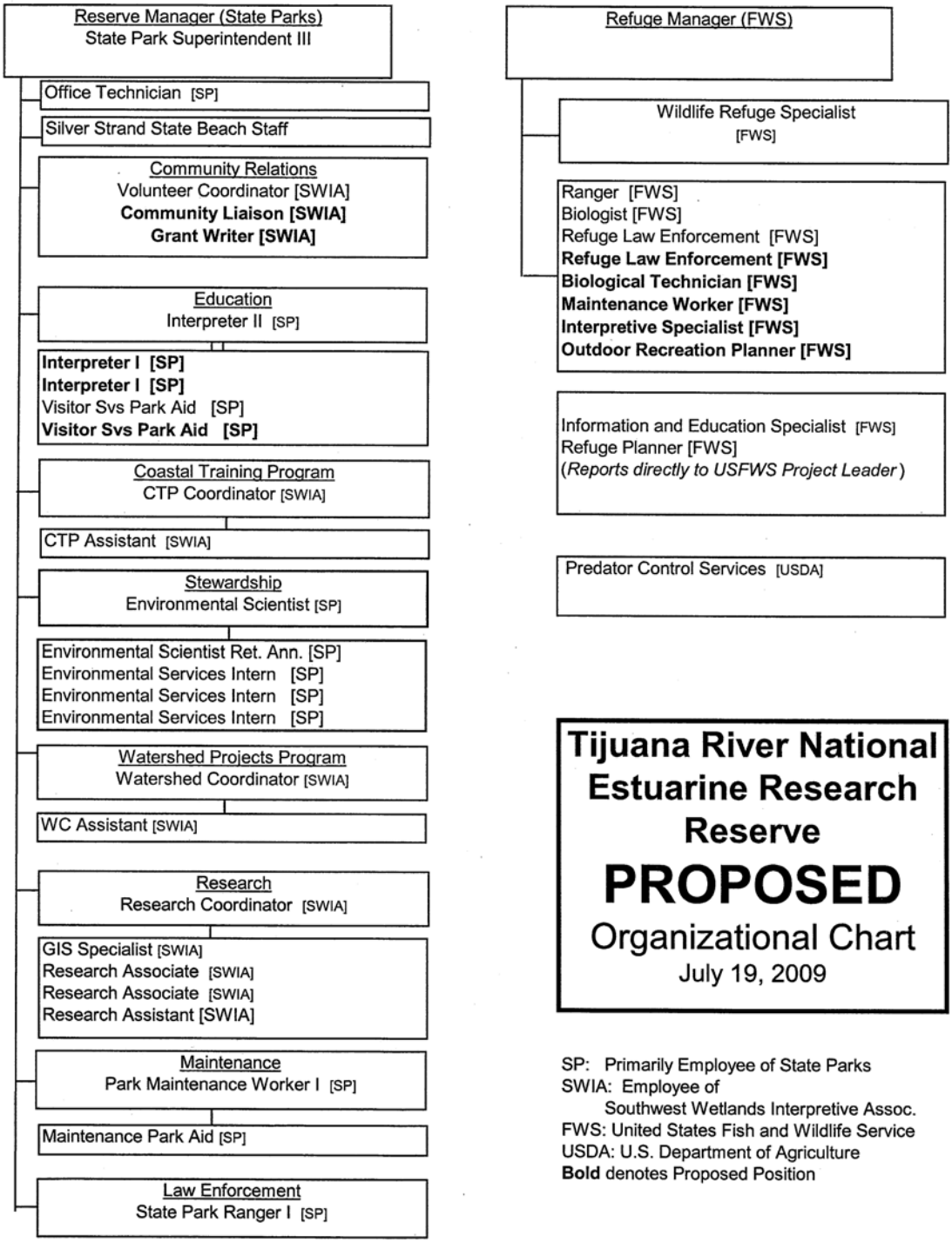
c. USN
The USN requests and funds monitoring and surveys as funding is available per regulatory requirements.

3. Cooperating Agencies

When possible, Cooperating Agencies seek funding from within their agencies to fund Reserve projects. Cooperating agencies may also seek grants from outside sources to fund projects at the Reserve.

H. TRNERR STAFFING

An overview of current staffing and vacant/proposed positions is provided on the following page.



1. Description of Additional Staff Positions (See chart above, note italicized (proposed) and bold (vacant) positions)

a. Staffing Needs for the Research Reserve (California State Parks and SWIA)

Watershed, Coastal Training and Education Programs

Prior to July 2009, the Reserve's CTP Coordinator served both as the NOAA-funded CTP Coordinator and as Watershed Coordinator for numerous binational watershed projects. However, in order to fully carry out both of these program areas, the Reserve and its non-profit partner, Southwest Wetlands Interpretive Association obtained a $900,000 grant from the USEPA to obtain additional staff. The current CTP Coordinator became the Watershed Coordinator to allow for increased focus on watershed coordination separate from coastal training. In addition, a Watershed Coordinator assistant was added.

In the Education Program, two new Interpreter 1 positions are proposed to replace existing hourly education support positions. An additional Visitor Services Park Aide would allow us to expand visitor center hours and increase our general interpretation to the public.

Volunteers, Community Outreach and Grants

In 2006, the Reserve added a volunteer coordinator. The incumbent's title expanded to Community Outreach Coordinator as she not only coordinated volunteers but also wrote grants and performed community outreach.

The scope of this position continues to grow as it allows the Reserve to expand its influence more broadly throughout its biogeographic region. For example, volunteer education docents will free up the paid education staff to do more strategic planning, outreach, and curricula development. Continued grant writing will increase the Reserve's funding base to allow it to expand each of the Program Sectors where most needed. As we reach out to the community, we gain advocates and political support for the Reserve's mission.

Like the CTP position, the existing Community Outreach Coordinator, by performing multiple jobs, is demonstrating the need for three distinct positions: Volunteer Coordinator, Grant Writer and Community Liaison (Public Information Officer), in that priority order.

b. Staffing Needs of the Tijuana Slough NWR

Law Enforcement Officer

Law enforcement needs are identified in the Resources Protection, Management, and Restoration section of this plan (see Chapter 5). The addition of another FWS law enforcement officer for the coastal refuges is necessary to address the many law enforcement issues such as trespass, homeless encampments, drug possession, and illegal dumping that is prevalent on urban refuges. This FWS law enforcement officer's primary responsibility would be the patrol of the Tijuana Slough NWR, although assistance would also be provided to the other refuges in the San Diego NWR Complex. Duties would include direct crime prevention, liaison for coordination with other agencies on law enforcement matters, development of law enforcement programs, and serve as the complex safety officer.

Biological Technician
A biological technician would be responsible for monitoring endangered species and shorebird populations on the Refuge and for assisting in expanded ecosystem monitoring and associated studies for the Reserve.

Maintenance Worker
Many of the programs currently implemented on the Refuge result in the need for periodic maintenance of refuge facilities and infrastructure. This includes trail maintenance, reconstruction of the sand barrier along the beach, and general cleanup and repair of signage, bridges, and parking areas. Additional duties would include monitoring and maintenance of debris accumulation in the salt marsh and the installation and maintenance of a channel boom to trap debris in storm runoff before it reaches the estuary.

Wildlife Refuge Specialist
To improve management capabilities and allow for more focused attention on individual refuge management needs, an additional Wildlife Refuge Specialist is needed for the southern coastal refuges. This will allow the existing Wildlife Refuge Specialist to focus solely on Tijuana Slough NWR. The proximity of the southern coastal refuges to urban levels of development results in the need for refuge staff to spend more time interfacing with the public, monitoring, maintaining, and repairing refuge facilities (e.g., signs, trails, bridges), and ensuring that general operational needs of the refuge are being met.

Outdoor Recreation Planner and Interpretive Specialist
To implement the education, interpretation, and other public use proposals described in the plan will require the skills of an outdoor recreation planner and an Interpretive Specialist. The duties of these two positions will overlap to some extent with the NWR Outdoor Recreation Planner and focus on the design and installation of trails as well as the structural design and construction of interpretive elements. The Interpretive Specialist would focus on developing the messages and interpretive themes to be presented and would work with other Reserve staff to develop and implement both interpretive and environmental education programs. Additional duties would also include operation and maintenance of the visitor center.

III. ADMINISTRATIVE PLAN OF ACTION

Objective 1. An effective administrative framework will be maintained that maximizes interagency cooperation and communication, provides continuity, and allows the Reserve to take full advantage of funding opportunities.

Strategies:

- Maintain cooperative management structure of the Reserve by the Refuge and Reserve managers and their staffs as detailed in the Letter of Agreement.
- Maintain and foster a positive, mutually rewarding relationship with NOAA's NERR System.
- Fulfill the mission and goals of the NWRS and the Tijuana Slough NWR

- Fulfill the mission and goals of the California Department of Recreation (CSP)

Objective 2. Adequate human resources will be in position to accomplish the mission, goals and objectives of the Reserve.

Strategies:

- Acquire funding for additional staff positions through funding agencies or grants.
- Continue to improve staff support by expanding the volunteer program.

Objective 3. An effective administrative structure that provides clear policy direction and guidance in the management of the Reserve will be established and maintained.

Strategies:

- Maintain the role of the Advisory Council as an advisory and policy-coordinating body that promotes discussion, cooperation and problem-solving amongst the 14-member representatives.
- Increase the level of decision-making done at the committee level, where opportunity for public involvement is greater.
- The Advisory Council will annually establish and prioritize a Reserve Projects list, in order to ensure successful implementation of the Management Plan and to have implementation-ready projects at hand as funding opportunities arise.

Objective 4. In cooperation with federal, state, and local partners, a seamless Reserve will be managed that addresses watershed and ecosystem-level concerns while meeting the established purpose of the Tijuana Slough NWR (Refuge Objective).

Tijuana River mouth, January 2010

CHAPTER FIVE: STEWARDSHIP: RESOURCE PROTECTION, MANAGEMENT, AND RESTORATION

INTRODUCTION

The Tijuana River National Estuarine Research Reserve resource protection, management and restoration programs provide coordinated, proactive responses to the unique opportunities and challenges to habitat protection the Reserve faces. Many of the protection, management, and restoration challenges, goals, and tasks emphasize the southern end of the Reserve where past degradation and current threats are greatest. However, significant restoration efforts, primarily for upland habitats, will continue to be implemented in the northern end of the Reserve as well. The proposed protection, management, and restoration actions will substantially improve the quality of the resources and the experience of Reserve visitors. The Plan of Action for this chapter confirms the overall 5-year vision statement and goals for the 2010-2015 TRNERR Management Plan and generally support preservation, protection, enhancement and restoration of the integrity of the Reserve's ecosystems through informed action in order to maintain biodiversity and migratory bird resources, and aid in the recovery of threatened and endangered species.

The Tijuana River NERR Resource Protection, Management, and Restoration program will be periodically reviewed and revised in response to changing watershed conditions and as new habitat management opportunities emerge. All actions will be based on the best technical information available.

I. POLICIES

A. GENERAL SUPPORT AND POLICY GUIDANCE

The role of the Advisory Council is to assist all the participating agencies to implement their policies in a coordinated fashion.

Through preparation of this Management Plan, all participants agree that the public lands of the Tijuana River Estuary are set aside for long-term protection of significant estuarine and other natural and cultural resources. Per the original intent of the NERR system, education and research are permitted. To the extent that certain recreational activities are compatible with resource protection and Refuge purposes, these may also be permitted. The following tools will be employed to enhance the protection, management, and restoration of Reserve resources:

- An active and integrated law enforcement program to reduce impacts to sensitive resources and reduce the incidence of unauthorized activities within the Reserve;

- A coordinated public education program intended to inform visitors about the importance of the resources within the entire Reserve and to promote stewardship of the Reserve's many natural and cultural resources;
- A public use management program to maintain and monitor existing public uses within the Reserve and to identify areas where added measures such as barriers and signage are needed to passively channel public use and discourage unauthorized entry into environmentally sensitive areas;
- Adaptive management principles (described in the Resources Management section of this chapter); and
- An Advisory Council that actively ensures coordination among individual land management agencies, as well as other agencies, such as the Department of Homeland Security and the Border Patrol, which also have an interest in the resources and/or activities occurring within the Reserve.
- Advisory Council members will seek funding to complete habitat restoration of all Reserve habitats. Habitat restoration that mitigates for damage to other habitats may be conducted at the Reserve only as directed by the policy provided in this chapter, and in compliance with land management agencies' policies and directives.
- Control of feral dogs and cats and other species that may cause impacts to endangered wildlife will be implemented. Management of native predator populations may also be required to protect endangered species. Invasive exotic plants degrade habitats and likewise require aggressive control efforts.
- All management activities, including the construction of new buildings and other facilities are subject to environmental compliance review under the National Environmental Policy Act (NEPA) or the California Environmental Quality Act (CEQA) as well as other state and federal laws and regulations as appropriate.
- Management of healthy, native habitats will be accomplished primarily through preservation, but may include manipulation of vegetation or hydrology. Active habitat management techniques, such as exotic plant removal, sediment retention structures and restoration techniques, will be applied to restore degraded ecological functions, protect endangered species, and to control exotic species of plants and animals.
- Vector control is necessary to curtail the possibility of mosquito-borne human disease. The Reserve places primary reliance on biological agents and seeks to minimize the use of chemical treatments. The County of San Diego holds a Refuge Special Use Permit allowing the use of certain compounds and actions for the control of mosquito populations on the Refuge.

B. LAND MANAGEMENT POLICIES

1. Introduction

The land management policies for the Reserve are based on the five-year vision for the Reserve and the goals of Tijuana Slough NWR. However, these policies also incorporate and acknowledge the mission and goals of the other agencies, including State Parks, which own and/or manage the lands within the Reserve. Although all of these agencies acknowledge the value of secondary uses within the Reserve, the specific definitions and policies regarding public use and other activities vary depending upon where a particular use is proposed to occur (i.e., Refuge lands, State Park lands).

2. Land Management Policies of the National Wildlife Refuge System (NWRS)

The operation and management of National Wildlife Refuges are guided by the mission and goals established for the NWRS, which are addressed in Chapter 2, and the designated purpose(s) for which each refuge was established. Refuge management is also influenced by other laws, treaties, and executive orders pertaining to the conservation and protection of natural and cultural resources, such as Executive Order 12996 (Management and General Public Use of the National Wildlife Refuge System), the Refuge Recreation Act of 1962, the Endangered Species Act of 1975, Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds), and the Fish and Wildlife Act of 1956.

The NWRS Improvement Act serves as an "organic" act for the NWRS and provides comprehensive legislation describing how the NWRS should be managed and used by the public. The Improvement Act establishes a strong and singular wildlife conservation mission for the Refuge System; requires that the Secretary of the Interior maintain the biological integrity, diversity and environmental health of the Refuge System; requires that public use of a refuge may be allowed only where the use is compatible with the mission of the System and purpose of the individual refuge; and sets forth a standard for determining whether such uses are compatible. It also recognizes that wildlife-dependent recreational uses involving hunting, fishing, wildlife observation, photography, environmental education, and interpretation, when determined to be compatible, are legitimate and appropriate public uses of the Refuge System.

The Improvement Act requires that the biological integrity, diversity, and environmental health of the System be maintained for the benefit of present and future generations of Americans. To implement this directive, the FWS has issued the Biological Integrity, Diversity, and Environmental Health Policy (Section 601 FW 3 of the FWS Manual), which provides policy for maintaining and restoring, where appropriate, the biological integrity, diversity, and environmental health of the NWRS. The policy provides for the consideration and protection of the broad spectrum of fish, wildlife, and habitat resources found on refuges and associated ecosystems. Further, it provides a refuge evaluation process the can assist refuge managers in developing management direction that when implemented would prevent further degradation of environmental conditions and, as appropriate, allow for the restoration of lost or severely degraded resources.

When evaluating the appropriate management direction for refuges, Refuge Managers will use sound professional judgment to determine their refuge's contribution to biological

integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, an understanding of the refuge's role within an ecosystem, and the knowledge of refuge resources, applicable laws, and best available science, including consultation with others both inside and outside of the Service. The priority public uses of the NWRS are not in conflict with this policy when they have been determined to be compatible. The directives of this policy do not envision or necessitate the exclusion of visitors or the elimination of visitor use structures from refuges; however, maintenance and/or restoration of biological integrity, diversity, and environmental health may require spatial or temporal zoning of visitor use programs and associated infrastructures.
Further guidance for providing opportunities for public use and other activities on National Wildlife Refuges is included in a series of policies that address appropriate refuge uses, compatible uses, and wildlife-dependent recreation. These policies are intended to ensure that wildlife comes first on National Wildlife Refuges and that recreational uses and educational activities that depend upon wildlife are given priority consideration.

The policy on appropriate use (Section 603 FW1) outlines consistent procedures for refuge managers to follow in deciding what recreational uses are appropriate for a particular refuge. Six recreational activities have already been identified as generally appropriate systemwide in the Improvement Act. These activities, which are to be given priority over other general public uses on national wildlife refuges include: hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

The Compatibility Policy (603 FW 2) provides guidance for determining if a use is compatible with the purposes for which the refuge was established. A compatible use is defined in the policy as, "a proposed or existing wildlife-dependent recreational use or any other use that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the NWRS mission or the purposes of the Refuge" (National Wildlife Refuge System Improvement Act of 1997 - Public Law 105–57—Oct. 9, 1997). When a determination is made as to whether a proposed use is compatible or not, this determination is provided in writing and is referred to as a compatibility determination. An opportunity for public review and comment is required for all compatibility determinations.

3. Land Management Policies of the California State Parks System

General land use policies for Border Field State Park are dictated by the Border Field State Park General Plan and by the unit's classification as a "State Park". California Public Resources Code 5019.53 states:

> *"State parks consist of relatively spacious areas of outstanding scenic or natural character, oftentimes also containing significant historical, archaeological, ecological, geological, or other such values. The purpose of state parks shall be to preserve outstanding natural, scenic, and cultural values, indigenous aquatic and terrestrial fauna and flora….*

Each state park shall be managed as a composite whole in order to restore, protect, and maintain its native environmental complexes to the extent compatible with the primary purpose for which the park was established.

Improvements undertaken within state parks shall be for the purpose of making the areas available for public enjoyment and education in a manner consistent with the preservation of natural, scenic, cultural, and ecological values for present and future generations. Improvements may be undertaken to provide for recreational activities including, but not limited to, camping, picnicking, sightseeing, nature study, hiking, and horseback riding, so long as such improvements involve no major modification of lands, forests, or waters. Improvements which do not directly enhance the public's enjoyment of the natural, scenic, cultural, or ecological values of the resource, which are attractions in themselves, or which are otherwise available to the public within a reasonable distance outside the park, shall not be undertaken within state parks."

4. Overall Land Management Policies for the Tijuana River NERR

The land management policies provided for the Reserve are intended to protect areas that contain sensitive habitats and endangered, threatened, or sensitive native species, therefore, the type and intensity of public use and resource management allowed within the Reserve will vary depending upon the sensitivity of the resources in a given area. Activities in areas within and/or adjacent to tidal channels, natural salt marsh habitat, and the back dunes, as well as riparian and coastal sage scrub habitats, will be limited to those activities that directly contribute to resource protection and restoration and to public uses that are determined to be compatible with the protection of sensitive resources. Such restrictions are necessary to maintain a natural and healthy estuarine ecosystem for the endangered and threatened species (i.e., light-footed clapper rail, California least tern, western snowy plover, least Bell's vireo, Belding's savannah sparrow, and salt marsh bird's beak) that are supported within these habitats. Due to its location, history of disturbance, and ease of access, the northern section of the Reserve has been identified as particularly appropriate for estuarine education and interpretation. This area offers visitors an opportunity to see the estuary and learn about its resources while minimizing visitor-related impacts.

Various areas of the Reserve, including Border Field State Park and the intertidal beach immediately fronting the ocean (but excluding the back dunes) have traditionally been used for compatible coastal-related recreation. Existing recreational activities include horseback riding, hiking, picnicking, and a variety of beach uses. These areas continue to be designated for such use in the future, however, temporary seasonal access restrictions may be employed in some of these areas when endangered species occur seaward of the dunes.

A conceptual zoning scheme was originally adopted for the Reserve in the 1986 Reserve Management Plan. This zoning scheme was based on the sensitivity of the natural resources within the Reserve. The zoning scheme was re-evaluated in 1997, and again in association with this 2010 update. Over the past ten years, the Reserve staff have found that agency missions, management plan goals, and scientific data are more effective and more relevant

for making land-use decisions than the conceptual zoning scheme. As a result, the zoning scheme has been eliminated from the plan. The Reserve Manager, the Refuge Manager, and both Restoration and Research committees of the Advisory Council all share responsibility for periodically reviewing the Reserve's overall land management policies. When significant changes in management policies related to access or public use are proposed, the public will be provided with an opportunity to comment on any such changes. A public use plan may be prepared as appropriate, subsequent to the completion of this plan update, and when significant changes in public use are being contemplated.

C. POLICIES REGARDING THE USE OF TRNERR AS A MITIGATION SITE

Requests for mitigation activity within the Reserve will be considered by the appropriate regulatory and land management agencies on a case by case basis. Projects will be evaluated for their compatibility with the Tijuana Estuary Tidal Restoration Program. Each proposal will be judged on whether it is appropriate in terms of existing Reserve policies, current conditions, and long-range restoration, research, public access and facilities development plans. Priority is given to proposed restoration and/or mitigation projects as follows:

Priority 1: Habitat restoration with no connection to off-site activities.

Priority 2: Habitat restoration to satisfy damage assessment or penalty

Priority 3: Compensatory mitigation.

Land owning agencies maintain authority for decisions to accept mitigation funds for activities on their lands. The Fish and Wildlife Service generally will not allow compensatory mitigation on National Wildlife Refuge System lands because these lands are already targeted for restoration and the Service will be restoring these lands in the future. However, the Service recognizes that under some limited and exceptional circumstances, compensatory mitigation on a National Wildlife Refuge may be appropriate. The Service will not support the use of National Wildlife Refuge System lands for establishment of mitigation banks. If compatible activities occurring on a National Wildlife Refuge require compensatory mitigation, this mitigation must occur within the boundaries of the National Wildlife Refuge being affected and must meet specific criteria. The Service may accept mitigation banks or mitigation projects as additions to the National Wildlife Refuge System subject to specific criteria. Where habitats have already been protected or restored under other Federal programs designed to increase the Nation's wetlands, the Service will not recommend, support, or advocate the use of such lands as compensatory mitigation, including mitigation banks, for habitat losses authorized under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), and /or Section 404 of the Clean Water Act of 1973 (33 U.S.C 1344)

Below is the Off-Site Mitigation Policy for CSP (Public Resources Code 0316.1.1)

"Mitigation that adds manageable lands with important resource values to the State Park System is acceptable and encouraged. The acquisition of lands with degraded resource value that are to be restored by the project proponent as a result of mitigation requirements is also acceptable. Mitigation that proposes to fund existing park operations is usually not in the

interest of the environment and is not supported. The Department generally will not approve the use of existing State Park System lands for off-site natural resource mitigation of non-CSP projects unless it can be demonstrated that there is a clear benefit to the impacted resources and to the State Park System and the project is supported by an appropriate regional conservation planning effort. Also to be considered are feasibility, sustainability, and financial commitment. Each mitigation proposal shall be reviewed and approved by the appropriate District Superintendent."

II. EXISTING CONDITIONS AND PERCEIVED NEEDS

A. RESOURCE PROTECTION

1. Land Acquisition Status

a. Context for Land Acquisition

A land acquisition program was initiated with the designation of the Reserve in 1981 and outlined in the final environmental impact statement (FEIS) prepared at that time. The specific properties to be acquired and program priorities are periodically reconfirmed by the Advisory Council. Acquisition has been undertaken exclusively on a "willing seller" basis.

TABLE 1: Lands Within TRNERR Boundary Recently Acquired

Property	Description	Acquisition History	Acreage
CC	Horwin parcel Riparian Scrub, vacant land	Purchased by County of SD with funding from Coastal Conservancy in Nov. 2003; to be conveyed to CSP	20.34
Seacoast Dr. parcel--	Oneonta Slough wetlands	Purchased by County of SD in Dec. 2003. To be conveyed to USFWS.	0.13
Seacoast Dr. parcel	Oneonta Slough wetlands	Purchased by County of SD in Dec. 2003. To be conveyed to USFWS.	0.13
J	Small parcel on Sunset	Purchased by County of SD in April 2002.	0.79
TOTAL			**35.69**

b. Assessment of Boundaries

Reserve boundaries were initially delineated in the FEIS based on the following principles (Department of Commerce and California Coastal Commission, 1981):

- Encompass the critical habitats and resource features of Tijuana River Estuary;
- Provide an "umbrella" for existing public ownership;
- Delineate Reserve boundaries in an area large enough to preclude direct threats of encroachment into critical habitat areas;

- Include enough of the watershed area for reasonable and consistent management of the immediate floodplain possible; and
- Facilitate compatible public access.

The National Estuarine Research Reserve Program Regulations (15 CFR Part 921) acknowledge that boundary changes may be required. Opportunities for public comment will be provided if changes are proposed.

Criteria for including new land parcels not currently within Reserve boundaries include:

- Parcels include land essential to the protection of endangered species, or those that lie immediately adjacent to lands classified as such;
- Parcels that become important for adaptation to climate change and effective management of a migrating estuary.
- Parcels judged essential for implementing key aspects of the management plan (i.e., estuarine restoration, watershed protection, education, and research);
- Parcels evaluated as having wildlife conservation value and acquired for National Estuarine Research Reserve purposes.

c. Possible Expansion of the TRNERR Complex Beyond Current Boundaries

Several informal proposals have surfaced suggesting the inclusion of upland and wetland habitat lands outside the current TRNERR boundary into an expanded TRNERR complex. Proposed areas include: eastern portions of the Tijuana River Valley, parts of South San Diego Bay/Silver Strand State Beach, Torrey Pines State Reserve/Los Peñasquitos Lagoon, and immediate upstream canyons of the Tijuana River Watershed located in Mexico, or Northern Baja California Wetlands. In addition, it has been suggested that leases of marine waters up to three miles offshore through the State Lands Commission may facilitate certain management opportunities, and this option will also be considered in the future (these leases currently are in effect at Silver Strand State Beach and Carlsbad State Beach). It is very likely that any or all of these proposals may result in expansions of the TRNERR within the next 5 years. The Advisory Council and the public will be actively involved in any discussion or decision related to Reserve boundary expansion or inclusion of other sites in the TRNERR complex.

d. Boundary Amendment

In 2007, the federal Department of Homeland Security condemned 53 acres of Border Field State Park for the construction of the Border Infrastructure System. As a result, the TRNERR has been reduced in size by 53 acres, as shown on the Reserve Boundaries Map (figure 3).

2. Law Enforcement and Surveillance Activities

Law enforcement is necessary at Tijuana River NERR to protect natural resources, ensure public safety, and protect private and public property. Enforcement is a critical part of Reserve and Refuge management. Law enforcement at the Reserve is a joint responsibility of the landowning agencies and the political jurisdictions in which the Reserve is located. A number of agencies have varying jurisdictions, authorities, and responsibilities related to law enforcement within the Reserve.

Following is a list of various law enforcement agencies within the Reserve and their responsibilities.

TABLE 2: Matrix of Law Enforcement Responsibilities at the Reserve

LAW ENFORCEMENT AGENCY	RESPONSIBILITIES
California - Department of Parks and Recreation (CSP)	CSP Rangers are responsible for patrol activities at Border Field State Park and for enforcement of State Park Regulations codified in Title 14, State of California Code. State Park Rangers and Superintendents with law enforcement authority are Peace Officers of the State of California and have full police powers throughout the state, including all federal, city, and county lands in the Reserve.
U. S. Fish and Wildlife Service (FWS)	Some FWS employees assigned to Tijuana Slough NWR are law enforcement officers of the National Wildlife Refuge System. Refuge Officers enforce Refuge regulations of Subchapter C, Title 50, Code of Federal Regulations, which apply only to Refuge lands. They are also able to enforce the Endangered Species Act, Migratory Bird Treaty Act, and other federal wildlife laws throughout the jurisdiction of the United States. Special agents of the FWS Division of Law Enforcement may be detailed to work on cases at the Reserve. Their legal authority is similar to Refuge Officers.
California Department of Fish and Game	State Game Wardens enforce wildlife regulations throughout the state. As California Peace Officers, they have full police power. However, no CDF&G officers are assigned full time to the Tijuana Valley, and their work there is generally on an on-call basis.
San Diego County Sheriff, and San Diego City Police	The Sheriff's Department also provides police services for the City of Imperial Beach. The San Diego City Police are responsible for general law enforcement within the City of San Diego, including city owned areas of the Reserve.

LAW ENFORCEMENT AGENCY	RESPONSIBILITIES
U. S. Border Patrol	The U.S. Border Patrol is now part of the U.S. Customs and Border Protection (CBP) within the Department of Homeland Security. CBP is charged with controlling the borders of the United States, including apprehension of persons entering the country without proper authorization. The Border Patrol has a large presence in the Tijuana River Valley. The 24-hour-a-day presence of many Border Patrol agents make them an integral part of the Reserve law enforcement community. In the Reserve, the Border Patrol uses a network of roads constructed to assist in surveillance.
San Diego County, Department of Parks and Recreation	San Diego County Park Rangers patrol County Parks, including Dept. of Parks and county lands in the Reserve, to enforce park regulations. County Park Rangers cannot make arrests or issue citations.

3. Construction of Fences and Barriers for Wildlife Protection

Physical barriers are needed in various locations in the Reserve to direct, control, or prevent human use that might damage natural resources. Barriers include wire fences, timber and rock barriers, and planted vegetation. Efforts are made to harmonize fence and barrier design with the natural environment and associated structures.

Temporary barriers are periodically needed at construction sites and in areas where access must be restricted to establish vegetation or protect sensitive species. Efforts will be made in the design and use of materials to harmonize with the natural environment. An exception is made where public safety or resource protection calls for use of bright colors or particular materials.

Currently, no permanent fencing protects the California least tern nesting colony site at Tijuana River NERR/NWR. Terns nest in different areas from year to year, and the dynamic nature of the dunes and estuary make fencing difficult, although temporary symbolic fencing is placed on a seasonal basis.

B. RESOURCE THREATS AND MANAGEMENT

1. Management of Habitats

a. Introduction to Habitat Management at TRNERR

The Tijuana River and its estuary are a dynamic system, like all wetlands and coastal ecosystems. Even before the arrival of Native Americans, the forces of flood, erosion, sedimentation, storm, and fire constantly changed the face of the river and the estuary and their habitats, flora, and fauna. The Tijuana River Estuary of today is unlike the one that

existed at the time of European settlement, and the system that existed in 1850 was different from what it was 100 or 1,000 years before that.

However, the changes produced by human activity since the mid-19th century are vast in both their scope and impact on native communities. Decades of disturbance to the watershed have significantly altered the environmental factors that control its habitats.

Since 1900, increased sedimentation, altered stream flows, and intentional wetland filling have all changed the face of the estuary, even eliminating some habitat types such as the dune-shrub community. In more recent decades, sewage flows have increased nutrients, lowered salinities, deposited contaminants, and threatened human health. As a result, the system is highly degraded and now requires active management and restoration.

The current habitat array of the Tijuana River and Estuary is altered from its natural conditions due to human impacts. However, although impaired, the river and estuary ecosystem still functions, and provides huge resource benefits that support many natural communities including hundreds, if not thousands, of native species.

The overall habitat management goal of the Reserve is to maintain and restore an array of naturally occurring habitats that will support the representative populations of all native plants and animals. The Operating Agencies recognize that the river and estuary retain dynamics that will cause change, regardless of management action. Between the flood and sedimentation potential of the watershed and the power of the Pacific Ocean, events will occur to alter, sometimes dramatically, the face of the Reserve.

b. Guiding Principles for Habitat Management at Tijuana River NERR

Following are guidelines shared by all agencies involved in the management of Tijuana River NERR:

- Management must be based on the best science available and must adapt to new conditions and new knowledge. Land management is also an art; research will never provide easy answers to every question.

- Storms and floods that close the mouth of the river to the Pacific Ocean will occur. Such closures will be addressed aggressively with immediate action to re-open the estuary to the tides. Pre-planning with regulatory agencies is ongoing to ensure quick response to a closure of the river mouth.

- Changes will occur, regardless of restoration/management. Restoration projects will be designed to work with nature while recognizing that no habitat array is permanent.

- It is not necessary to recreate the same proportions of different habitat types that occurred in 1850 or 1900. Management must only ensure that no communities vanish

through the action of humans, and that viable representative samples of each habitat type persist. This will ensure preservation of the ecological function of the system.

- A holistic, ecosystem approach to management will be used. "Single-species" management will also be employed. The presence of numerous federal- and state-listed endangered species requires that no action jeopardizes survival of those species; by law, this will remain a priority. These two seemingly conflicting approaches, ecosystem vs. single-species management, are in reality key components of a necessary strategy. In order to conceptualize management of this fragmented and disturbed ecosystem, one must understand that while working to restore ecological functionality, managers must also maintain the survivability of endangered species until such a time that they are recovered and no longer need our help to survive. This means that at times, controls on certain wildlife populations may be employed in an attempt to improve short-term survivability for endangered or threatened species populations.

- Restoration ecology is an imperfect art and science. No planned action will produce guaranteed results. However, science can inform the process and an iterative, adaptive approach produces the best chance for success.

c. Management for Habitats

Following is a qualitative description of the various habitat types within the Reserve and their recognized resource values and problems, based on recommendations in The Ecology of the Tijuana Estuary, California -- A National Estuarine Research Reserve (Zedler, et.al., 1992). Several of these habitats are represented in Figure 6.

i. Transition from Upland Habitat to Wetland

This transition habitat is a diminishing habitat in southern California and in urbanized coastal areas throughout the world. It functions as a buffer between wetland and urbanized areas, and is a foraging and cover area for many species of wildlife. Buffers act as a refuge during floods when many marsh-dwelling birds and animals are forced out of their normal habitat by high water. Habitats that are transitional between wetland and upland will be the wetlands of the future, as sea level continues to rise. Hence, a broad transition zone is needed to ensure persistence of this fringe community and the high marsh below it. Species of concern include sensitive birds (i.e., short-eared owls, black shouldered kites) and the coastal horned lizard. The rare plant *Frankenia palmeri* is a member of this habitat, and occurs in Tijuana Estuary within the native plant garden surrounding the Visitor Center, and in a few locations in the field.

The key problems facing the transition habitat are urban encroachment, feral animals and exotic species. Wetland filling, trash disposal, and vegetation trampling are also issues of concern. Associated impacts of urbanization are the invasion of native habitats by exotic weeds and the altered densities of native animals. In this habitat type, there is a need to remove fill, control visitor access, re-vegetate unofficial trails, control dumping of trash,

control feral and domestic animals, control exotic plants, and plant native perennials that are likely to have occurred here in the past.

ii. Salt Marsh

A widely valued attribute of the salt marsh is the habitat it provides for rare and endangered species. The cordgrass-dominated marsh is nesting and foraging habitat for the light-footed clapper rails; the pickleweed-dominated areas are important to Belding's savannah sparrows; and the upper marsh is the sole habitat for salt-marsh bird's beak. In addition, the marsh is essential habitat for a variety of other organisms, including many insects and other invertebrates, migratory birds, and fish. Salt marsh vascular plants and algal mats contribute substantially to the primary productivity base that supports estuarine food chains. Non-tidal conditions can reduce the natural diversity of plant communities, and some species do not recover well from such disturbance.

iii. Salt Pannes

The natural values of salt pannes are not often recognized, and proposals are often made to convert them to other uses. During both the wet and dry phases, salt pannes are important areas for insects, including rove beetles, and mudflat tiger beetles. When inundated, the areas serve as feeding grounds for migrant and resident birds. Species associated with the intertidal salt marsh and the transition to upland also use these areas.

iv. Brackish Marsh

Brackish marshes are valued for their augmentation of habitat and populations of clapper rails, Virginia rails, sora rails, black-necked stilts, American avocets, snowy egrets, and many other waterbirds. They also increase habitat diversity at the estuary and attract species that would not otherwise occur there (e.g., red-winged blackbirds.)

v. Tidal Channels and Creeks

The channel habitats at Tijuana River Estuary are important to nearly all estuarine animals. All of the endangered birds use tidal channels and creek areas for feeding. In previous years, there have been recreational shell fisheries and commercial bait fisheries. At present, both shellfish gathering and fishing are prohibited at the estuary.

The problems that affect the channels and creeks ultimately have an impact on the entire estuary, because the estuarine waters move throughout the system. Tidal closure, sedimentation, disturbance from dredging, and reduced water quality (waste water input, nuisance algal blooms, and reduced salinity) all require active management. Increased sedimentation rates have an impact on benthic organisms, and the associated turbidity affects water-column species.

The Tijuana Estuary Tidal Restoration Plan is aiming to make existing channels more suitable for fish and invertebrate use. Excavation of the intertidal marsh and channels should have beneficial effects downstream as increased flows erode the fine materials that have accumulated in the channel network. New channels constructed within former marsh and connecting existing tidal marshes as part of the Tijuana Estuary Tidal Restoration Program have expanded and will continue to expand this habitat type substantially.

vi. Sand Flats and Mudflats

The intertidal flats are closely associated with tidal channels and creeks, and the impact of disturbances and consideration for management are similar. The primary values attributed to these sites are their habitat for shorebird resting and foraging and feeding areas for the light-footed clapper rail and Belding's savannah sparrow.

vii. Beaches and Dunes

The aesthetic quality of beaches makes them the habitat most highly valued by the recreational public. Consequently, human use is extensive throughout the year. Ecologically, the habitats are valued for their support of native animals, including the globose dune beetle, sandy beach tiger beetle, sand dune tiger beetle, wandering skipper, and nesting birds including the California least tern and western snowy plover. Other species, such as the Belding's savannah sparrow, feed on dune and beach insects. The native plants are especially important to the ecosystem because they stabilize dunes, which in turn protect the estuary from sea storms.

Coastal erosion is the major problem facing the beach and dunes. Substantial losses of sand occur each winter, but not all is replenished each summer; a continual net loss is obvious from aerial photos from 1928 through present. The height and location of dunes has changed with recent storm overwashes, and stabilization is needed. In addition, exotic plants have invaded. Efforts at controlling the most problematic exotic plant of dune habitats, *Carpobrotus edulis*, have been successful in some dune habitats within the Reserve, but continued control of this species will be necessary into the future.

Fencing has helped to protect the dunes from trampling, but not all areas are protected by well maintained fences. It is widely agreed that additional dune stabilization is needed. Attempts to rebuild the dunes with dredge spoils began north of the river mouth in 1985. Although the reconstructed dunes helped protect estuarine channels from overwash during the 1986 storms, there was substantial erosion on the seaward side and dune crest, and most of the transplanted dune species died. Dune reconstruction south of the mouth was attempted but storms and drought ravaged the site before vegetation could stabilize the sand.

The activities underway include fencing to reduce trampling and stabilize the sand, thereby facilitating revegetation efforts. Dunes from the river mouth to Seacoast Drive have been rebuilt periodically in the fall to prevent overwash into Oneonta Slough. There is a need to continue these actions.

viii. River Channels

An ecological succession of developing riparian woodland occurred after a 1980 flood, and dense vegetation is now found within the Reserve. Currently, much of this habitat is federally listed critical habitat for the endangered least Bell's vireo (50 CFR 17.95). Many anthropogenic impacts at Tijuana Estuary may have their greatest effect on this habitat type. Determining the best management practices for this international river remains a major challenge. The cumulative impacts of denudations, sedimentation, mouth closure, drought, hypersalinity, trash deposition, and sewage spills significantly alter the estuary.

2. Water Quality and Treatment in the Tijuana River Valley and Nearshore Ocean Waters

a. Water Treatment Facilities

Sewage contamination problems in the Tijuana River have been chronic since the 1930s. The contamination has been the result of Tijuana's rapid population growth coupled with a lack of corresponding sewerage infrastructure.

Due to drainage patterns and the proximity of the City of Tijuana to the United States, sewage that is not captured and treated in Tijuana flows into the United States via the Tijuana River or through north-draining canyons and gullies. This raw waste stream contaminates surface waters and nearshore ocean waters and degrades the Tijuana River Estuary. A principal concern during the extended period of sewage contamination has been the reduction in salinity in the estuary and intertidal wetlands because of the wet season flows of contaminated fresh water and the extended season of freshwater flow. The extensive damage to the estuary from these flows has been documented by PERL (Estuary Profile, 1982).

Agreements reached between the U.S. and Mexican governments in the 1990s enabled the construction of the South Bay International Wastewater Treatment Plant, South Bay Ocean Outfall, and improvements and expansion to the existing Mexican infrastructure. Several of the facilities are located in the Goat Canyon area, including the underground outfall pipe which passes under Goat Canyon and areas to the west.

From 1996 to 1999, the International Boundary and Water Commission (IBWC) constructed the South Bay International Wastewater Treatment Plant (SBIWTP) and the South Bay Ocean Outfall (SBOO) to treat sewage overflows from Tijuana, Mexico for a cost of approximately $233 million (of which Mexico is obligated to pay $16.8 million in capital costs as well as 20% of the annual operating costs). The plant is designed to treat up to 25 million gallons per day at an advanced primary level, with secondary treatment planned for the future, pending final alternatives assessment. The SBOO discharges 3.5 miles offshore in 100 feet of water. It is 11 feet in diameter and 19,000 feet long. The overall project included the construction of canyon collectors at Smuggler’s Gulch, Goat Canyon, Canyon del Sol, Silva Drain, and Stewarts Drain to collect dry weather flows from areas of Tijuana and convey them to the SBIWTP. In addition, a river diversion structure located on the Tijuana River as it crosses into the United States catches dry weather sewage flows and diverts them

to the plant. Wet weather flows are of too high a volume to collect and treat via these collector systems, thus contamination still enters Reserve waterways during rain events and also when system breakdowns occur. In addition, the lack of secondary treatment at the SBIWTP has brought it into violation of the Clean Water Act and sparked fears about potential problems associated with SBOO effluent discharges 3.5 miles offshore. In December of 2004, a Draft Supplemental Environmental Impact Statement for Clean Water Act compliance was released, offering a range of secondary treatment and disposal options in the U.S. and Mexico. In November 2008, the IBWC awarded a contract to upgrade the SBIWTP plant to allow for secondary treatment. These upgrades are under-way and at the time of this writing are anticipated to be complete by January 2011.

The City of San Diego Metropolitan Waste Water District (MWWD) also has constructed a water reclamation plant near the intersection of Monument Road and Dairy Mart Road, just north of the international border and adjacent to an SBIWTP. The South Bay Wastewater Reclamation Plant, opened in May of 2002, treats 15 million gallons per day of local (U.S.) wastewater and provides reclaimed water to the South Bay. Water that is treated to a secondary level is discharged in the SBOO; water treated to a tertiary level is used for reclaimed purposes. A new bridge and road improvements replaced the old Dairy Mart Road and Bridge, providing all weather access to the treatment facilities and to the southern end of the Reserve.

b. Nearshore Ocean Water Quality and Monitoring Efforts

Contaminated storm runoff during the rainy season can bring about the closure of beaches all along the coast of San Diego County, including Imperial Beach. Requirements to monitor the water quality at California beaches began in July 1999, and weekly monitoring is now required from the months of April to October at all beaches with more than 50,000 annual visitors, or at all beaches located in areas adjacent to storm drains that flow during the summer.

Heal the Bay, a non-profit environmental organization, produces an "Annual Beach Report Card", covering beaches from Humboldt County to San Diego County. According to statistics from the 18th Annual Beach Report Card which covers the period from April 2007 to March 2008, dry-weather water quality in San Diego was generally good however, only two of the 55 sample sites in San Diego County received "fair-to-poor water quality marks during the year-round dry weather time period." These sites were the Tijuana River Mouth, which received an 'F', and a site just north of the Tijuana River Mouth, which received a 'C'. There were 27 beach closures due to sewage contaminated plumes from Tijuana Estuary, out of a total of 39 sewage-spill related closures for all of San Diego County.

A positive step toward improved water quality monitoring was taken in 2001 when Proposition 13 funds were approved for The Clean Beach Initiative Grants Program. The Scripps Institution of Oceanography, in partnership with Imperial Beach, San Diego County Department of Environmental Health, State Water Resources Control Board, and the Regional Water Quality Control Board, created a groundbreaking monitoring system called the San Diego Coastal Ocean Observing System (SDCOOS). The system tracks weather and

ocean conditions to provide real-time data for use by both system partners and the general public (www.sdcoos.ucsd.edu). Monitoring sites are located at Point Loma, Border Field State Park, Coronado Islands, and Imperial Beach. The system also adds data from weather radar and satellite from the National Oceanic and Atmospheric Administration. There are eight water quality-testing sites designed to carefully assess ocean conditions in and near Imperial Beach, and ocean currents are measured hourly to help track movement. This system greatly increases understanding of ocean dynamics as they interact with pollution, enabling authorities to respond more quickly to pollution events. The plume modeling has shown good agreement with on-site water quality measurements and has reduced the need for extensive bacteriological monitoring of South County beaches, a process that takes at least 24 hours to produce results. Further funding is needed, however, to ensure long-term viability of this effort. This will likely include more utilization of SWMP data within the TRNERR, in order to better understand estuary / ocean exchange.

3. Flood and Sediment Control Practices

Damage from floodwaters is a significant concern throughout the Tijuana River Valley, and the effects of the 1993 floods can still be observed in the Reserve. However, the most extensive flood damage to critical habitat has been from localized flooding and sedimentation from Goat Canyon Creek. Land-use activities throughout the watershed and particularly in Goat Canyon/Canon de los Laureles have accelerated sedimentation and resulted in the obstruction of tidal channels and the loss of wetlands. The reduced tidal exchange has triggered changes in vegetation communities and the habitat of several significant estuarine populations.

With seed funding provided to the State Coastal Conservancy and the U.S. EPA, an initial Enhancement Plan for the 4.6-square-mile Goat Canyon/Laureles watershed was undertaken in 1998, including strategies to reduce sediment flows to the estuary from both U.S. and Mexican sides of the watershed. SWIA, with Southern California Wetlands Recovery Project funding, took this plan to its subsequent levels of development, culminating in the design of sediment retention basins and an improved, elevated access road. Beginning in the Fall of 2003, CSP led the construction portion of the large-scale Goat Canyon Enhancement Project, consisting of two sediment retention basins in series within the upper floodplain of Goat Canyon, a new asphalt overlay and newly elevated sections of Monument Road, three on-site mitigation areas, a visual berm and a processing pad for reclaimed sediment. Construction costs are approximately $4.6M to date, with funding provided by the State Coastal Conservancy, CSP, the Wildlife Conservation Board, and NOAA.

The project was initially designed for a 100-year flood event, but due to rapid and dramatic degradation of the upper watershed in Mexico, the basins have completely filled with sediment deposited by only a few, albeit very large, storms (Winter of 2005). Construction was completed in May of 2005, with ongoing monitoring of mitigation sites for several years thereafter.

As a result of this project, sedimentation risk to marsh habitats has been significantly reduced and accessibility to BFSP greatly improved. However, by nature of their location at the

terminus of an extremely urbanized and erodible sub-watershed, the basins require regular maintenance to effectively protect the downstream habitats and ensure access to BFSP. A secure source of funding for materials removal and maintenance of the basins is needed, as is ongoing upstream work in Cañon de los Laureles in Mexico. This work will be coordinated with the Municipio de Tijuana Planning Department and will focus on stormwater management and slope instability problems. Reserve representatives and City officials have acknowledged the interrelationship of interests and seek to engage in a planning process that identifies strategies and specific projects to control erosion and enhance public safety. (See Chapter 10 for more specifics on these efforts.) The Reserve will be active in working to reduce or eliminate human-made sediment sources.

The storms of 2005 also dramatically reconfigured the terrain at Yogurt Canyon/Cañon de los Sauces, near Monument Mesa. The newly paved road became the low spot in the immediate areas (this portion of the road was allowed to be raised). With the slightest rain or a leaking pipe, the entrance road floods and closes Monument Mesa to vehicle access. The entrance road needs to be raised and the Reserve needs to continue its cooperative work with Tijuana to effectively manage water flows that result from the burgeoning development on the hillsides of Playas de Tijuana.

4. Exotic/Invasive Species Control and Predator Management

a. Invasive Plant Control

The control of exotic species is critically important to maintaining and enhancing resource values throughout the Reserve. Several severe invasions by exotic plant species threaten the viability of native habitats' ability to support species of special status at the Reserve. These include:

- Invasion of the coastal back dunes and upper marsh areas, especially at Border Field State Park, by the exotic succulent sea fig *(Carpobrotus edulis);*
- Invasion of the riparian corridor in the Tijuana River Valley by several species of tamarisk *(Tamarix* sp.), and giant cane *(Arundo donax);* and
- Invasion of the disturbed upland areas by a host of exotic grasses and annuals.

Volunteer groups occasionally pull and remove some of the more common exotics, but effective control of these exotics requires an organized effort by the managing agencies. In response, SWIA initiated the Tijuana River Valley Invasive Plant Control Program in 2002 to control invasive plants within the 3,600-acre river valley. Initial funding for the control program was provided by the State Coastal Conservancy ($500,000) and the FWS ($60,000). Additional and ideally consistent funding will be needed to sustain the successes of this program. The program targets three invasive plant species within the Tijuana River Valley: giant reed (*Arundo donax*), castor bean (*Ricinus communis*) and salt cedar (*Tamarix ramosissima*). These species degrade the habitats they invade by displacing native vegetation, lowering insect food supply for birds, reducing groundwater, and increasing flood and fire hazards.

Upper Los Laureles Canyon (circa 2005), upstream of estuary. The lack of vegetation makes the area extremely erosive and a major cause of over-sedimentation of the estuary.

A Bird's Eye View looking west: Border Field State Park. In the winter of 2005, sediment from Mexico filled the newly constructed Goat Canyon Sediment Basins, causing additional sediment to cover approx. 18 acres of Salt Marsh.

Sediment-laden stormflow crosses non-elevated park entrance road effectively smothering 18 acres of salt marsh in 2005.

Arundo, one of the big 3 invasives that displace native habitat in the Reserve.

The objective of the program is to enhance the native habitats of the valley, including willow woodlands, mulefat scrublands and salt marshes, by removing these damaging exotic species.

New mapping of target species distributions in the Tijuana River Valley showed that, although the target species are widespread in the valley, they are mostly a small component of the generally natural wild lands. A control plan was developed in consultation with a Technical Advisory Group, which included members from the resource agencies, land owning agencies and experts in the field of exotic plant control. The plan described the methods to be used to control the target invasive species and received tremendous support from land owners and managers in the valley.

By 2003, the program had obtained all the necessary environmental permits for invasives control in the valley: NEPA – Categorical Exclusion (U.S. Fish & Wildlife Service); CEQA – Negative Declaration (State Coastal Conservancy); and Streambed Alteration Agreement (California Department of Fish and Game). In order to comply with the conditions of these permits, all work associated with the program was restricted during the breeding seasons of the listed bird species known to occur in the Tijuana River Valley. Thus, the program has a "work season" from September 16 to early spring (February 14 or March 14, depending upon the habitat).

During the first work season, 2003-2004, control work was conducted on demonstration sites. These sites were scattered throughout the valley on land owned by different public entities and were located in all habitat types, including salt marsh, mulefat scrub and willow woodland. These relatively small areas were used to fine-tune various plant control techniques that have been used in other watersheds. The objective of these experiments was to determine which methods would be most effective in the Tijuana River Valley. These experiments have already provided information for the later program phases. These control efforts also resulted in the removal of the target species from more than 60 acres.

In 2004 SWIA obtained further funding from the State Water Resources Control Board to expand the program to more sites within the valley and to provide funding for 3 years of control ($1.1m). This funding also has public outreach and education components that resulted in the creation of an exhibit in the visitor center and development of a brochure, both on the effects of invasive species on the natural environment.

During the 2004-2005 work season, the program focused on controlling invasives within 127 acres of prime riparian and mulefat habitats in the central part of the valley. These habitats are valuable for many species including the least Bell's vireo (*Vireo bellii pusillus*). In spite of extensive flooding the season was a success. As a result, an adaptive invasive species management plan was completed.

In addition to the specific project described above, other invasive species control efforts are underway on an ongoing basis at the Reserve: CSP staff, on a limited budget, carry out regular cutting and spraying of invasives within the park; FWS staff have targeted tamarisk on Navy land near the inlet in both 2002 and 2004; a team of TRNERR, Scripps Institution of

Oceanography, and other researchers received Sea Grant funding in 2004 to look into the invasion and impacts of Tamarisk in Tijuana Estuary salt marshes, and ecosystem recovery after its removal; and, efforts are being undertaken by Reserve staff and restoration project managers to ensure plant propagules are collected on-site to avoid the transfer of aquatic invertebrates from other wetlands.

b. Predator Management

The Reserve is home to numerous federally listed threatened and endangered species (see Appendix 3). Conservation and recovery of those species is the highest priority of the Reserve. Unfortunately, the same land-use forces that resulted in species endangerment have also fragmented the ecosystem to a point where active management intervention is required to ensure survival and aid recovery of the light-footed clapper rail, California least tern, western snowy plover, and least Bell's vireo.

Maintenance, enhancement, and restoration of habitats are essential for the survival of these species. Research and monitoring data indicate that given the limited habitats available, predation of concentrated populations in remaining habitats is the greatest threat to the survival and recovery of some species of endangered birds. The Reserve represents a fragmented and reduced habitat that successfully supports endangered species. However, it is also adjacent to urbanized areas that support higher density populations of certain predator species than would be the case in large tracts of contiguous native habitat areas. In this case, management of predator populations becomes essential.

Predator management is implemented on the Refuge pursuant to the FWS' endangered species management responsibilities and is part of an integrated wildlife damage control program that emphasizes non-lethal measures such as vegetation management, trash clean-up, the use of fencing and enclosures, and predator hazing or trapping and relocation, but also includes lethal removal of mammalian predators. In addition, lethal removal of individual problem avian predators may be implemented when non-lethal measures prove to be ineffective. The San Diego NWR Complex currently contracts with U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (APHIS – WS) to accomplish predator management on the Refuge.

An important component of the Refuge's integrated predator management program is annual monitoring of least terns, snowy plovers, and light-footed clapper rails to determine hatch and fledge rates for terns and plovers, as well as adult breeding population size for all three species. In addition, tern and plover nesting areas and clapper rail habitat are monitored for the presence of avian and mammalian predators. Information recorded during monitoring includes predator species observed, particular behaviors and habits of an individual or group of predators, and evidence of predation on tern, plover, or rail adults, eggs, chicks, or fledglings.

The procedures for controlling predator species are dependent upon several factors, including but not limited to the degree of threat from a particular species or from an individual predator to endangered species populations, native or non-native status of the predator, the

conservation status of specific predator species populations, and the condition of protected species nesting colonies. The presence of native species within the Refuge is desirable, as they contribute to the overall species diversity on the Refuge, however, intervention to address specific problem individuals may be required to ensure the recovery of those species threatened with extinction.

The predator management plan emphasizes the use of non-lethal control measures whenever possible and the majority of the control actions occur during the endangered species nesting season. During the rest of the year, predator management focuses on the control of feral dogs and cats and other mammalian predators that pose a threat to the endangered light-footed clapper rail, which is a permanent resident of the Refuge's coastal marsh habitat.

Some problem predators are live-trapped and removed from the area. Live, captured raptors and other avian predators that have been determined to pose a threat to listed species would be removed and held in a licensed/permitted rehabilitation or holding center until they can be released back into the wild. Release of these predators occurs at a suitable location after the endangered species nesting season is completed. Release site locations are left to the discretion of the Refuge Manager. Prior to release, these predators are banded with FWS permanent leg bands.

Hazing might also be used to discourage predators from entering endangered species nesting areas. Lethal control is implemented when non-lethal control proves ineffective and an individual problem predator is identified that poses an immediate threat to a listed species.

All domestic or feral dogs and cats, when feasible, are taken to an approved shelter facility operated by a cooperating local unit of government, humane society, or a veterinary care facility. Any non-target wildlife (an animal determined not to be a threat to listed species) that is captured unharmed is immediately released near the capture site or at a suitable location.

Specific control methods are conducted in accordance with Federal and State regulations and are discussed in detail in the full Predator Management Plan for Tijuana Slough National Wildlife Refuge provided in Appendix 6.

5. Impacts of Illegal Immigration and Immigration Enforcement to Resources along the U.S./Mexico Border and the Border Infrastructure System – Border Fence

In the past, illegal cross-border foot traffic has caused erosion of upland soils, trampling of sensitive upland, dune, wetland vegetation, as well as loss of threatened and endangered species. Since 1994, cross-border traffic has reduced dramatically at the Reserve such that it is no longer a significant factor in habitat destruction. However, control of foot traffic and equestrian use by legal visitors to the Reserve remains important to the Reserve's resource protection effort.

Border policing efforts in the mid-1990s resulted in a major increase of 4-wheel-drive vehicle use in the Reserve. Secondary roads and informal trails within the Reserve have been improved to facilitate policing. Road construction and off-road vehicle use is a major source

of soil loss through erosion, and can contribute to the loss of wetlands in the southern portion of the Reserve. Any additional access required for border policing will require a comprehensive public access and facilities assessment for the south end of the Reserve, including potential effects on cultural and natural resources. This assessment must necessarily be integrated with plans for sediment and erosion control and habitat restoration for degraded parcels in the same area.

A recently completed Border Infrastructure System has been a major focus of the U.S. Department of Homeland Security. Elements of this Project for the local region have been under construction for years. In the summer of 2008, following the transfer of 53 acres of land from the Reserve to U.S. Department of Homeland Security, major construction for the Border Infrastructure System was initiated in this region. As a result, a fortified fence and patrol road system was constructed to stop illegal crossings and allows for rapid Border Patrol Agent response along the length of the U.S. Mexico Border. Following its construction, the Reserve will continue to work with the Border Patrol to support its stewardship activities regarding the Border Infrastructure System, including re-vegetation, to maximize resource protection. In 2010, a technical advisory group of representatives from resource management agencies was convened by DHS/CBP to initiate the development of a re-vegetation plan for the Border Infrastructure System.

6. Water-borne Debris

Water-borne litter and trash accumulate in and degrade the habitat value of the Reserve's tidal wetlands. Huge amounts of plastic and other garbage collect in the marsh. While often hidden by marsh vegetation, the habitat in some locations is covered with an almost solid mat of garbage.

The trash enters the estuary from the watershed during flood and run-off events. Once in the tidal creeks, garbage gets trapped in vegetation and accumulates, posing a threat to wildlife from entanglements and ingestions. The volume of trash is great enough to impact vegetation germination, growth, and density.

The Goat Canyon sedimentation basins can remove a certain amount of trash from sensitive habitats, but debris from the main channel of the Tijuana River and from Smuggler’s Gulch will continue to be a problem during rain events. A series of "trash booms" in strategically located areas upstream of the estuary and within the Goat Canyon sediment basins would serve to reduce the accumulation of water-borne trash. In 2010, two different types of trash collection devices will be tested within the Goat Canyon sediment basins.

7. Fire Suppression

Wildfires are of great concern at the Tijuana River NERR. Although large wildfires (40 acres and larger) have not been documented in this area, fire occurrence is related to the amount of human use and activity that are occurring in the estuary. Small fires (under 40 acres) have been a part of the history of the area, with nearly all fires documented as human-caused. Many of the wildfires have been caused by illegal campfires created for cooking and warmth

by illegal immigrants or transients occupying the area. Routine fire patrols in high-activity areas during the summer months when fire danger is highest can minimize the number of these nuisance fires. The recent addition of addition field staff (funded by the USEPA grant) will increase staff presence in the park.

Fire suppression for the Reserve is conducted by agency resources and personnel as well as through assistance from local, state, and federal fire departments as needed. The FWS maintains administrative roads and trails that could serve as firebreaks during wildfire suppression. Defensible space is maintained around all Refuge facilities, and water sources are available for fire suppression needs.

The Refuge currently has a fire dispatch plan that addresses initial response to wildfires, as well as the procedure for requesting additional fire-fighting resources. In addition, a detailed Fire Management Plan has been prepared for the Refuge. The FWS may use prescribed pile burning as a tool to restore wildlife habitats, reduce fuel loads, and minimize wildfire hazards on Refuge property.

8. Mosquito Control

To protect public health and safety, mosquito abatement efforts are performed by the Vector Surveillance and Control Division of the San Diego County Department of Environmental Health, in coordination with the Operating Agencies. The Operating Agencies encourage the minimum use of chemical treatments.

The County currently holds a Refuge Special Use Permit for the application of a series of compounds within the Refuge for the purpose of controlling mosquito populations.

9. California Wildlife Action Plan

The California Wildlife Action Plan (WA Plan) (*California Department of Fish and Game 2006*) identifies the species and habitats at greatest risk in California; describes the major stressors affecting wildlife and habitats; and presents statewide and regional conservation actions needed to restore and conserve ecosystems and wildlife populations. Those recommended conservation actions that are applicable to the Tijuana River NERR include: improve the implementation of the Natural Community Conservation Plans, in this case the San Diego Multiple Species Conservation Program; protect and restore coastal wetlands; control invasive species; protect sensitive species and important wildlife habitats; institute fire management practices to restore ecological integrity, while minimizing loss of property and life; and provide recreational opportunities compatible with wildlife habitat needs. With respect to coastal wetland restoration, the WA Plan identifies the restoration of the south arm of the Tijuana Estuary as one of the most significant coastal wetland restoration projects being planned in California and recommends its implementation. The WA Plan also recommends that public agencies invest in efforts to protect and restore ecologically intact river systems with a focus on those drainages that remain largely unchannelized; those that support riparian vegetation communities; and those with functioning floodplains (or where construction and development in riparian areas is limited enough to reestablish functioning

floodplains). The WA Plan further recommends that public agencies adopt management policies that safeguard natural resources and wildlife habitat, even as they manage for multiple uses or for mandates that emphasize other objectives.

C. RESTORATION

1. Introduction to Restoration at Tijuana River NERR

In the 1980s, hydrological and biological studies were undertaken to begin developing an understanding of the estuary's natural resources and conditions. These studies were undertaken by a number of organizations, principal among them was the Pacific Estuarine Research Laboratory (PERL) at San Diego State University (SDSU), FWS, and various private consultants under contract. The studies documented extensive wetlands loss in the estuary during the past 50-100 years and extremely variable habitat quality in the existing wetland and riparian areas. Most significantly, studies indicated that the tidal flushing in the estuary, as indicated by the diurnal tidal prism, had been reduced by approximately 80 percent since 1852, primarily a result of human-induced sedimentation. Since 1981, a principal goal of the Reserve has been to protect, enhance, and restore the delicately balanced wetland ecosystem.

2. Habitat Enhancement Objectives

Upon presentation of the Tijuana Estuary Hydrologic Analysis (Philip Williams Associates, February 1987), the Reserve Management Authority (now the Advisory Council) declared restoration objectives for the lands within the Research Reserve. The objectives have been reviewed and modified to represent the current restoration priorities based upon updated information, new accomplishments, and the current extent of specific watershed impacts on neighboring jurisdictional plans and other factors.

a. Updated Objectives for Restoring the Estuary

1. An increase in the tidal prism will be encouraged in order to enhance removal of the sediment by the tides and to minimize the potential for channel closure. Specifically, the existing prism will be tripled from the current 290 acre-feet to 775-930 acre-feet by expanding the area of subtidal channel, intertidal salt marsh, and marsh plain in the southern end of the estuary.

2. Habitat for endangered species will be increased, to include light-footed clapper rails, Belding’s savannah sparrow, California least tern and shorebirds in general. Undisturbed transition zone habitat will be created for the recovery of the endangered salt marsh bird’s beak.

3. Future plans for continued functioning of the tidal system will consider future changes, including sea level rise, migration of the barrier beach, sedimentation, and changing river channel locations. Successful restoration of the tidal prism is predicated on reducing sedimentation rates and reducing the potential for dune overwash.

4. The negative effects that inland migration of the barrier beach can have on restored and existing wetland will be minimized by dune restoration.

5. The future loss of restored and existing wetland area by Tijuana River and Goat Canyon sedimentation will be minimized. Topographic relief may be built-in to prevent sudden loss of restored habitat from flood events.

6. Areas of former salt marsh, tidal channel, and mudflat affected by sedimentation will be restored to the maximum extent feasible. Some components of the restoration efforts will be over-excavated to reduce the potential for shifts in habitat type due to sedimentation

7. The disturbance of marsh plain areas in the north arm of the estuary will be minimized.

8. The barrier beach dune and vegetation will be restored by restricting public access and
coordinating appropriate plant community restoration projects. Suitable materials excavated from on-site wetland restoration projects will be utilized to provide barrier beach and dune nourishment.

9. A plant salvage operation will be planned and carried out as an integral part of implementing the enhancement plan. A list of existing resources will be made to support this effort.

10. Research findings and adaptive management will be integrated in the restoration effort.

11. Large projects will be accomplished in stages in order to manage the complexity of planning, financing and managing the complete project. A phased approach is also conducive to implementing adaptive management strategies.

12. Recreational access alternatives will be provided to the extent possible during restoration project implementation.

b. Objectives for Restoring the River Corridor

1. Exotic plant species invasions will be controlled.

2. A continuous native riparian woodland will be restored.

3. Flood hazards will not be increased.

4. The extraction of materials will be done such that benefits of sediment management and future creation of plant and wildlife habitats.

5. Restoration of the riparian corridor will consider benefits for future groundwater management.

6. Endangered species populations will be monitored. Least Bell's vireo mapping will take place every five years at a minimum to determine the population extent. Also, monitoring for cowbird parasitism will be monitored periodically.

3. Adaptive Management Design Approach

Restoration planning at Tijuana Estuary has been conceived in an adaptive management framework. This approach to restoration design and implementation acknowledges the numerous uncertainties in the restoration field and incorporates careful review of actions taken in a phased approach. Alternatives are often tested on a small scale before full-scale implementation. Results are then evaluated in selecting the approach for later project components. Inherent in adaptive management is the need for long-term, ecosystem level research and monitoring. In adopting this approach, the Advisory Council acknowledges that thorough integration of research and restoration is a basic tenet of the Reserve program.

4. Tijuana Estuary Tidal Restoration Program (TETRP)

The Tijuana Estuary Tidal Restoration Program (TETRP), a conceptual plan for wetland and estuarine restoration, was established in 1988 to achieve many of the restoration objectives listed above. More detailed planning and environmental review followed, culminating in certification of a programmatic EIR/EIS in October 1992.

The TETRP utilizes a modular approach to restoration efforts based on adaptive management principles. As each restoration module is conducted, research and monitoring is carried out, and the new insight gained is applied to the next phase of the program. This process provides scientific feedback to restoration practitioners, and the modular framework works well because it can be adapted based on given logistical and funding constraints. The TETRP area includes approximately 250-300 acres of intertidal wetland and estuarine channel restoration in the north and south arms of the Tijuana River Estuary. The first phase of the program consisted of two project areas; the Oneonta Tidal Linkage in the north of the estuary, and the Model Marsh in the south. The primary goal of the Restoration Program is to restore degraded natural habitats of the Reserve. Over the past 50 to 100 years, the Tijuana Estuary has experienced large-scale sedimentation events, dune overwash and channel constriction, localized diking and filling, and extended periods of sewage contamination.

The Tijuana Estuary Tidal Restoration Program is designed to increase salt marsh and intertidal mudflat habitat and restore tidal flushing to areas that have silted in over the past few decades. The following sections describe components of TETRP currently underway at Tijuana River NERR.

a. Oneonta Tidal Linkage

The first component of the multi-phased project, the Oneonta Tidal Linkage, was constructed in the north arm of the estuary in winter 1997 (shown in Figure 7, along with other completed restoration projects).

The Oneonta Tidal Linkage provides a hydrological connection between the northern part of Oneonta Slough and tidal lagoons located southeast of the Tijuana Estuary Visitor Center (see Figures 6 & 7). The channel enhances circulation in some 200 acres of intertidal salt marsh stabilizing the channel system in the north arm and reducing sedimentation in the tidal channels. The project includes a timber footbridge to maintain visitor access. The channel and bridge concentrate public use on the upland ridge immediately south of the Visitor Center. The Oneonta Slough salt marsh supports one of the most important surviving populations of the light-footed clapper rail. The project resulted in an increase of approximately 1.8 acres of salt marsh habitat immediately adjacent to the Visitor Center, thereby providing an excellent interpretive opportunity. An extensive research program was integrated into the project design, with a focus on assessing plant species accumulation on the newly created marsh plain. A primary finding was that pickleweed (*Sarcocornia pacifica*, formerly *Salicornia virginica*) recruits readily on its own, and effort should be devoted to planting other marsh plain species.

b. Friendship Marsh (Model Marsh)

A 20-acre intertidal wetland with tidal channels was constructed on a degraded marsh plain in the southern arm of the estuary (shown in Figure 7). The original site selected for the Model Marsh was adjacent to the existing Old River Slough channel. However, because of extensive sedimentation of Old River Slough by Goat Canyon Creek, project planners relocated it to an adjacent site on the South Arm Slough. Upon completion of the Model Marsh in 2000, the entire restoration area was renamed Friendship Marsh in honor of the cross-border connections that are an integral part of the geography and hydrology of the Tijuana Estuary.

The Friendship Marsh was designed to investigate the biotic and abiotic effects of excavating tidal creek networks on the marsh plain prior to planting. To accomplish this, the site was established with three replicate cells with tidal creeks and three without tidal creeks. Additional research in the Friendship Marsh has addressed the efficacy of various planting methodologies and functional assessments of marsh development. This has revealed that the use of soil amendments, such as kelp and vermiculite, greatly increase the success of cordgrass transplants. Also, it has been observed that marsh channels develop rapidly on their own, and some of the largest channels in the system now were not among those originally excavated. Therefore, it suggests that future efforts focus on creating relatively simple, started channels, rather than extensive networks.

The Friendship Marsh was intended to be the first component of approximately 500 acres of intertidal wetland restoration planned for the southern arm of the estuary as part of TETRP. Information gained from the Oneonta Tidal Linkage construction and the Friendship Marsh will be incorporated into future restoration project designs. In addition, TRNERR is able to apply adaptive principles to the planning process itself, and continue to revise and fine-tune the objectives of the TETRP given shifting stressors, constraints, and opportunities.

c. Subsequent Intertidal Restoration Components

Approximately 500 acres of restoration modules contiguous to the Friendship Marsh site were identified in the original Tijuana Estuary Tidal Restoration Program EIR/EIS. Subsequently, the project area has been reduced to approximately 200-250 acres, due to the results from multidimensional hydrological analyses that indicated a large portion of the previous design area was vulnerable to flood damage (Howard Chang, *pers. comm.*). While this vulnerability has reduced potential restoration acreage, the focus for future restoration modules will continue to be the southern area identified in the initial 1991 TETRP conceptual plan. This continued focus is due to the fact that reversing habitat loss caused by sedimentation and expanding wetlands in this area benefits the entire estuary and can be achieved with the least impacts to existing resources. The project build-out time is estimated to be 20 years, in phased implementation.

In 2007, a feasibility study was completed for the remaining 250-acre restoration site in the southern area of the Reserve, now referred to as "TETRP II". The plan determined that the project is feasible and lays the ground-work for the next planning phase: environmental compliance and regulatory permitting.

5. Other Restoration Programs

a. Dune Re-establishment and Stabilization

Prior to storms in recent decades, the barrier beach along Tijuana estuary consisted of sand dunes. Historical air photos of the area show that these dunes were originally stabilized by vegetation. Photos from the 1960s show extensive vehicle damage to the dunes. Together with foot traffic, these disturbances set the stage for massive erosion. During the winters of 1982-83 and 1988-89, storm waves washed over the beach and pushed enormous quantities of dune sand into the estuarine channels. The result has been a further reduction of the tidal prism and an ongoing threat that the ocean entrance will close.

Maintenance of the estuarine channels requires the re-establishment of the coastal dunes and their stabilization with native dune vegetation. Unless the dunes are stabilized, they will continue to be washed into the channels during storms. Native coastal dune vegetation has probably suffered a greater percentage of destruction than any other habitat in San Diego County. The following dune stabilization needs exist:

- Replacement of dune sand from estuarine channels back to the beach;
- Planting of native dune species over the dunes and removal of exotics;
- Irrigation of transplants to ensure establishment;
- Monitoring of dune vegetation and slope profiles to assess success; and
- Enforcement of trespass regulations, especially at night.

6. Restoration Needs

The large-scale restoration proposed for the Reserve has required and will continue to require a considerable investment of funds. Clearly, such a large program far exceeds the restoration budgets of the Reserve's Operating Agencies and member organizations. Implementation of the multi-million dollar program requires an innovative fundraising approach that targets a variety of funding sources, both public and private, as well as a careful eye toward the lessons learned so far. In addition to the more standard funding sources (grants, bonds, acts), there could also be opportunities to remove sediment in partnership with the U.S. military. The military may need to address any clean-up requirements associated with past military use of the estuary as a gunnery range.

Even considering its many resource management challenges, restoration at the Reserve has been a success story in recent years. This is particularly true from both a funding and biological standpoint, with regard to large-scale wetland and upland restoration. The TRNERR also serves a valuable role as a model and living laboratory for other wetland restoration projects in the bioregion. To continue along this path of habitat restoration and accomplish future restoration for the benefit of the Reserve and other estuaries with restoration needs, a similar or greater level of dedicated staff and partners, scientific expertise, and resourceful fundraising will undoubtedly be required.

III. STEWARDSHIP: RESOURCE PROTECTION, MANAGEMENT, AND RESTORATION PLAN OF ACTION

Objective 1. In protection, management and restoration of natural resources, utilize adaptive approaches, which couple science and management, wherever possible.

Strategies:

- Continue phased implementation of TETRP, using lessons learned from previous modules and more general studies.
- Continue adaptive invasive species management efforts, focusing on the development of an adaptive invasive species management plan.
- More fully document the many smaller-scale restoration projects (e.g., those around the Visitor Center), and incorporate these into efforts aimed at broader lessons learned.

Objective 2. Respond to ongoing watershed-based resource management problems, such as sedimentation and erosion, by establishing cooperative and integrated programs and approaches throughout the watershed, on both sides of the international border and, especially, within the Tijuana River Valley.

Strategies:

- Secure a stable funding source to ensure proper maintenance of the completed Goat Canyon Enhancement Project, including economical and environmentally friendly sediment disposal options. Such options include working with

- Establish relationships with land managers, municipalities, and others to promote land management practices in the U.S. and Mexico that improve the health of the Reserve.
- Coordinate with relevant government agencies to identify and generate strategies to avoid impacts of public works projects on downstream Reserve resources. Establish a program outline, goals and objectives, and task forces for initiating proactive resource protection work *outside* the Reserve.
- Initiate programs that build upon existing water quality monitoring and treatment programs in the watershed and nearshore ocean waters to bear direct benefits to the Reserve resources. Such monitoring should provide data on sediment movement, trash accumulation and habitat health.
- Work with landowning agencies and the U.S. Border Patrol to ensure that management activities, road building, and road maintenance activities have minimal impacts on downstream habitats and support the goals of the erosion control plan.

Objective 3: Preserve, restore, enhance and protect habitats to maintain biodiversity, maintain important migratory bird resources, and aid in recovery of threatened and endangered species. (Refuge Goal)

Strategy 1: Maintain effective law enforcement as well as fire and debris suppression programs that cover the entire Reserve and are well coordinated between agencies.

Tasks:

- Increase preventative law enforcement measures including high visibility patrols and increased communication with public users.
- Maintain funding for the fire-suppression crew.
- Develop a program to reduce illegal dumping at the southern end of the Reserve (coordinated with law enforcement program) that assigns responsibilities for removal of debris among landowning agencies and establishes a Reserve-wide policy for illegal dumping.
- Obtain funding for an additional full-time law enforcement officer.
- Establish communication system (e.g., radio frequencies) between Operating Agencies
- In order to curtail waterborne debris deposition, develop agreements with upstream land management entities to work cooperatively to develop mechanical infrastructure (such as litter booms) in appropriate locations such as the main Tijuana River channel, and to plan for cooperative upland watershed management actions. A subcommittee of the California Biodiversity Council, the biodiversity along the border committee has been formed to address this and

other issues. TRNERR Managers are active participants in this committee.

The California Biodiversity Council is semi-annual meeting of over 40 federal, state and local agencies. At the meeting, they discuss, coordinate, and assist in developing strategies and complementary policies for conserving biodiversity. Through the Council, members exchange information, resolve conflicts, and promote development of regional conservation practices. Members include California State Parks, Department of Fish and Game, State Water Resources Control Board, Cal Trans, U.S. Environmental Protection Agency, U. S. Forest Service, and local government associations. The Council is co-chaired by Resources Agency Secretary Mike Chrisman and Mike Poole, Regional Director of the Bureau of Land Management. In September 2006, the California Biodiversity Council (CBC) held its meeting in San Diego, with the intention of focusing on border-related environmental issues. Much of the tour and meeting was focused on the Tijuana River National Estuarine Research Reserve and Border Field State Park.

Nearly ¾ of the estuary's watershed lies within Mexico. As such, the Research Reserve (through its Coastal Training Program) has invested much time in improving land use practices within the City of Tijuana. Much of their initial focus has been on converting the community of San Bernardo to become a model of sustainable development in Tijuana. This community lies in the upper reaches of Los Laureles Canyon, a drainage that is the source of huge amounts of sediment that annually threaten to smother the estuary. With its non-profit partners and the California Coastal Conservancy, California State Parks (the Research Reserve) is working with the City of Tijuana to control erosion, replant slopes, introduce pervious paver roads, manage sewage disposal and improve the quality of life in San Bernardo.

In their tour, the CBC members got a first-hand look at the challenges of San Bernardo (and the entire watershed). State Parks Director Ruth Coleman participated in a ribbon-cutting ceremony for the first park to be established in the upper half of the canyon. Playground equipment donated by a U.S. developer was enormously popular with the children of San Bernardo. The Council concluded their tour by visiting Border Field State Park and the National Estuarine Research Reserve. They saw the effects of sedimentation and recognized the importance of preserving this internationally important wetland.

The results of the tour and the next day's CBC meeting continue to grow. The CBC has established a committee to identify specific actions and funding to: build sediment basins on both sides of the border; add small, pre-built sewage plants in San Bernardo; and manage tires and trash on both sides of the Border. California State Parks has partnered with different agencies to apply for 2 U.S.EPA grants totaling $1.7 million dollars. Most of the money would be directed toward improving conditions in Los Laureles Canyon. Organizations became aware of Los Laureles through media reports of the CBC meeting and are asking for ways to help. Engineers without Borders have pledged $50,000 to build a package sewage plant. The Integrated Waste Management Board anticipates granting up to $200,000 to develop a mechanism to consolidate trash at the lower sediment basin.

Strategy 2: Manage habitats, predators, pests and people to maximize recruitment of endangered species and other native species, while minimizing the proliferation of exotic species.

Tasks:

- Implement a comprehensive predator management program, including year-round control of feral dogs and cats and seasonal monitoring and management of native predators.
- Maintain annual, recurring monitoring efforts to document populations and production of endangered species (clapper rail spring call counts and winter high-tide counts; California least tern and western snowy plover nest monitoring; least Bell's vireo breeding survey; annual surveys on distribution and abundance of salt marsh bird's beak).
- Increase active enforcement of seasonal recreation areas and areas closed to protect endangered species.

Complement "Tern-Watch" and other wildlife educational efforts with sign announcing apprehension and prosecution of violators.

Continue to support the Tijuana River Valley Invasive Plant Control Program, which addresses three main species of exotic plants. Seek funding to add program components that address other species as needs dictate.

Continue to manage existing mosquito/vector control program with San Diego County Health Department and NOAA to identify ways in which to minimize use of chemical pesticides. County vector control activities are covered under the Refuge Special Use Permit #11681-04006.

- Operating Agencies will continue ongoing habitat management practices, such as dune re-establishment, as appropriate.
- Continue to coordinate with U.S. Border Patrol to minimize habitat impacts relating to border enforcement activities.

Strategy 3. Restore degraded habitats where appropriate, based on the goals and guidelines put forward in the Resource Protection, Management and Restoration chapter.

Tasks:

- The Research Advisory committee of the Advisory Council will maintain an updated and prioritized list of projects needed to restore degraded habitats.
- Acquire funding and work with agencies such as the U.S. Military to implement priority projects, including components of the TETRP, in a sequence determined by the design team and reviewed by the relevant committees of the Advisory Council.

- The Reserve and Refuge Managers will use criteria and priorities established in this plan to guide selection, approval and monitoring of restoration projects funded and/or performed by entities not affiliated with the Reserve

Strategy 4: Evaluate Reserve vernal pool habitats, evaluate upland sites for potential creation of new vernal pool habitats, and develop a plan for restoration and introduction of listed vernal pool species as appropriate.

Objective 4. Maximize protection offered to the Reserve and other areas of interest in the bioregion through national and international ecological and coastal special-area designation programs, such as Ramsar.

Strategy 1: Explore the potential benefits of the new Ramsar designation and possible expansion of the Ramsar site boundaries.

Strategy 2: Explore other possible designations.

Objective 5. Establish a set of criteria to assess the potential drawbacks and benefits of including other areas outside of the Reserve boundaries as part of a larger TRNERR complex, taking into consideration whether any of the options has community support, ecological validity or financial merit.

Model Marsh; completed in 2000, this 20 acre salt marsh has been a success as both a habitat restoration and as a laboratory of restoration techniques..

CHAPTER SIX: RESEARCH AND MONITORING PROGRAM

INTRODUCTION

The Reserve System provides a mechanism for addressing scientific and technical aspects of coastal management problems through a comprehensive, interdisciplinary, and coordinated approach. Research and monitoring programs, including the development of baseline information, form the basis of this approach. Reserve research and monitoring activities are guided by the Reserve System research and monitoring plan 2006-2011 which identifies goals, priorities, and implementation strategies. This approach, when used in combination with the education and outreach programs, will help ensure the availability of scientific information that has long-term, system-wide consistency and utility for managers and members of the public to use in protecting or improving natural processes in their estuaries. Research within the Reserves is designed to fulfill the Reserve System goals as defined in program regulations. These include:

- Address coastal management issues identified as significant through coordinated estuarine research within the System;
- Promote Federal, state, public and private use of one or more reserves within the System when such entities conduct estuarine research; and
- Conduct and coordinate estuarine research within the System, gathering and making available information necessary for improved understanding and management of estuarine areas.

Reserve System Research Funding Priorities

Federal regulations, 15 C.F.R. Part 921.50 (a), specify the purposes for which research funds are to be used:

- Support management-related research that will enhance scientific understanding of the Reserve ecosystem,
- Provide information needed by reserve managers and coastal ecosystem policy-makers, and
- Improve public awareness and understanding of estuarine ecosystems and estuarine management issues.

The Reserve System has identified the following five priority research areas to complement the funding priorities outlined above:

1. Habitat and ecosystem processes
2. Anthropogenic influences on estuaries

3. Habitat conservation and restoration
4. Species management
5. Social science and economics

The international scope of the Tijuana River watershed, the diversity of habitats, and the range of challenges facing the Reserve make it an area rich for study in both the life and social sciences. The Reserve serves as a site for research conducted by both Reserve staff as well as outside researchers. The Reserve's research and monitoring programs are guided by national plans such as the NERRS Strategic Plan and NERRS Research and Monitoring Plan, which identify goals, priorities, and implementation strategies for these programs, as well as research needs specific to the Tijuana River NERR. This approach, when used in combination with the education and outreach programs, helps ensure the availability of scientific information that has long-term, system-wide consistency and utility for managers and members of the public to use in protecting or improving natural processes in their estuaries. The research and monitoring programs also serve to improve the ability of resource managers to detect, quantify, predict and react to both short-term variability and long- term change in the health and viability of estuarine ecosystems. This chapter describes the goals of the research and monitoring programs of the Tijuana River NERR and concludes with a Plan of Action to promote and encourage research to the extent possible without compromising resource protection.

I. POLICIES

A. INTEGRATING NERR SYSTEM GOALS AND REFUGE SYSTEM GOALS INTO TIJUANA RIVER NERR'S RESEARCH PROGRAM

The NERR System research and monitoring programs are designed to facilitate and coordinate scientific understanding of estuarine systems, to establish benchmark conditions for intra- and inter-site comparisons, and to regularly monitor conditions over time for all estuaries in the System. In creating the NERR System, Congress required that research priorities, objectives, and methodologies should be coordinated nationally for the broadest application of research results and maximum use of the System.

The research program at Tijuana River NERR is designed to fulfill the NERR System goals as defined in the Code of Federal Regulations. As described in the 2005-2010 NERRS Strategic Plan, the NERR System goals are:

- Strengthen the protection and management of representative estuarine ecosystems to advance estuarine conservation, research, and education
- Increase the use of Reserve science and sites to address priority coastal management issues.
- Enhance people’s ability and willingness to make informed decisions and take responsible actions that affect coastal communities and ecosystems.

The NERR System-funded research and monitoring programs are intended to generate and supply information to state and local governments, such as wildlife management and land use

management/permitting agencies, as well as to various stakeholders and users of coastal resources. One of the Reserve's key roles in the area of research and monitoring is to make research and monitoring results available to those who can use the information in as timely a manner as possible.

The research program at Tijuana River NERR also incorporates Fish and Wildlife's (FWS) research mission: to understand endangered species and their habitats, without harm to the species or their habitats. Research results are one of the foundations upon which habitat or species recovery plans are developed.

B. SETTING PRIORITIES FOR RESEARCH AT TRNERR

There is, in general, wide latitude in the types of research allowed at the Reserve, with an emphasis on ensuring that research activities do not significantly compromise natural resources. Research by independent or Reserve staff scientists is typically directed toward addressing NERR and NWR goals, and is conducted under appropriate permit conditions. In practice, the topics investigated at the Reserve typically have been prioritized and funded by NOAA or FWS, or selected for study by individual research teams with external funding.

NOAA is a significant source of research funding for both independent and NERR staff researchers. NOAA encourages coordinated research among reserves and other scientists by funding research proposals on specific estuarine topics that it has identified as national priorities. This unified approach promotes the exchange of research findings among reserves, state and federal agencies, and members of the academic research community. Many other sources of funding are also available for research and monitoring at the Reserve. These include national programs such as the National Science Foundation, the US Fish and Wildlife Foundation, regional agencies, and NGOs such as the San Diego Foundation and County Fish and Wildlife Advisory Commission.

1. NERR System Research Priorities

Research priorities for Reserve-based research are based upon both national NERR program priorities and local needs. Excellent opportunities exist for researchers to interact with management activities at the Reserve (e.g., invasives removal and marsh restoration), and funds for these efforts can be used to leverage additional research dollars.

The Graduate Research Fellowship Program (GRF) supports students to produce high quality research in the reserves. The NERR System funds a total of two Graduate Research Fellowships per Reserve. The fellowship provides graduate students with funding for 1-3 years to conduct their research and gain hands-on experience by engaging with Reserve staff and participating in their host Reserve's research, stewardship, education, or coastal training programs. Projects must address coastal management issues identified as having regional or national significance; relate them to the Reserve System research focus areas; and be conducted at least partially within one or more designated Reserve sites. Reserve System research focus areas are:

- eutrophication, effects of non-point source pollution and/or nutrient dynamics
- habitat conservation and/or restoration
- biodiversity and/or the effects of invasive species
- mechanisms for sustaining resources within estuarine ecosystems
- economic, sociological, and/or anthropological research applicable to estuarine ecosystem management

TRNERR Graduate Research Fellows have focused on a wide range of topics, including terrestrial, marsh, and water column studies. This reflects both the attractiveness of the TRNERR as a study site for a rich variety of projects, as well as the NERR GRF proposal review process that limits directed funding toward specific issues. In general, the TRNERR will continue to focus on adaptive approaches to restoration and invasive species management.

2. NWR System Research Priorities

A guiding recommendation for managers of National Wildlife Refuges is to "identify management-oriented research needs for each refuge based on System, ecosystem, and refuge goals. Develop an effective process to identify and provide resources required, as well as involve partners to accomplish high priority research."

FWS funding for research at the Tijuana River NERR is limited, however the Refuge maintains a monitoring program that includes nesting season monitoring of least tern and snowy plover nest sites, as well as other population monitoring. Other wildlife population monitoring, surveillance and response work can be funded by the Refuge at the discretion of the Refuge Manager. Highest priority is given to projects that:

- Have direct implications for maintaining the environmental health of Refuge resources;
- Have management implications for federal trust resources (migratory birds, endangered species, marine mammals, and inter-jurisdictional fisheries, and wetlands); and
- Are part of long-term programs that have high probability of significantly increasing the body of scientific knowledge and understanding of relationships with regional management implications.

C. CRITERIA FOR EVALUATING RESEARCH PROPOSALS

For any research proposal to be considered, researchers must demonstrate that the project can be carried out with minimal resource impact. In general, it should be demonstrated that the potential value of research will outweigh any negative effects to habitats or species. In addition, the research topic should address one or several stated research goals of the Reserve as identified in this Management Plan.

Research proposals that involve on-site activities at the Tijuana River NERR are sent to the Research Coordinator. The Research Coordinator is responsible for ensuring that researchers obtain permits to work within the Reserve. This, at a minimum, will include use permits from the USFWS or State Parks, and often both. Additional permits (e.g. Fish and Game) may be necessary given the nature of the project, and researchers will be the responsible for obtaining these.

D. ACCESS AND RESPONSIBILITIES FOR RESEARCHERS

Qualified scientists, students, non-profit research organizations, and local, state, or federal agencies have conducted research at Tijuana River NERR. Any researcher with adequate scientific qualifications and financial support may request permission to conduct research within Tijuana River NERR, and such requests are typically granted if they meet the compatibility requirements of the Reserve.

Projects require advance approval by appropriate agency staff, such as CSP and FWS biologists, and the Reserve Research Coordinator. All visiting researchers are required to briefly summarize their proposed work methods and research site(s) within the Reserve in writing prior to receiving permission to access Reserve habitats. All researchers are responsible for complying with the terms of their Special Use Permits to use Reserve study areas, including removal of all sampling devices and property from the Reserve upon the completion of their study. Researchers are encouraged to submit reports to the Reserve, as well as any publications resulting from Reserve-based research. In practice, reporting has been low, and additional steps are needed to improve information transfer from researchers to the Reserve. These will likely include increased enforcement from permitting agencies and utilization of databases to track and manage reporting requirements.

All publications that result from work conducted at Tijuana River NERR must acknowledge the assistance of the Reserve, the landowning agency, and any funding provided by the Reserve or its member agencies. For graduate programs in which the Reserve is a primary study area, candidates will provide one copy of the thesis/dissertation to the Reserve library.

II. EXISTING CONDITIONS AND PERCEIVED NEEDS

A. INTRODUCTION

Research at the Reserve has encompassed many topics, including ecology, oceanography, restoration biology, invasion biology, and sociology. The primary aim of the research program is to adopt adaptive principles, where science is coupled with management actions to (1) learn lessons to be applied to future activities and (2) transfer those lessons to other interested parties. The salt marsh restoration and invasive species eradication efforts have been focal points for adaptive management actions (see Chapter 5). Findings from these efforts have informed future management actions such as focusing on the creation of simple starter channels for restoration rather than extensive networks.

To improve the planning for management projects, research efforts at Tijuana River NERR have addressed critical management issues such as

- the impacts of sewage on fish and plant communities,
- invasive species effects and control,
- effects of sedimentation on habitats, and
- wetlands dynamics.

Research is conducted by both staff and non-staff investigators and is coordinated by the Research Coordinator and FWS wildlife biologist, with the Reserve and Refuge Managers. Tijuana River NERR provides administrative, physical, technical, and informational support for estuarine research to scientists and students from universities, research institutions, and other organizations. The Reserve also offers access to long-term estuarine monitoring results from Tijuana River NERR and other estuaries in the NERR System through the System-wide Monitoring Program (SWMP). An overview of Graduate Research Fellow publications relating to research conducted at TRNERR is provided on the Tijuana River NERR website (www.trnerr.org).

Another critical component of the Reserve's research program is its additional monitoring activities. Until 2004, many of the research and monitoring activities at the Reserve were conducted by SDSU's Pacific Estuarine Research Laboratory (PERL). However, TRNERR staff researchers, hired through SWIA, now perform these functions. The monitoring strategy at Tijuana River NERR is based on the understanding that physical, chemical, and biological aspects of habitats and communities of organisms are excellent indicators of ecological conditions – providing so-called "vital signs" for the system. Disturbance, predation, and competition are expressed through change in habitat quality, species composition, population abundance and distribution. Accordingly, Tijuana River NERR monitors critical habitat parameters and the dynamics of selected communities to gain insights into ecosystem health. Key benefits of these monitoring efforts include:

- early warning of potential problems in the estuary (e.g., exotic plants and animals);
- baseline information to detect long-term changes, including direct anthropogenic impacts (e.g., changes in sewage inputs, stormwater runoff, fresh water inputs) and more gradual changes (e.g., El Niño, habitat shifts, sea-level rise);
- provision of data and methodologies which can be used in other estuarine systems; and
- documentation of rare and unusual species.

By providing documentation of changes in the estuary, the data from the monitoring program can provide the basis for generating hypotheses for future ecological research and for developing management strategies to address these changes. To date, the long-term monitoring has documented slow recovery of marsh diversity following severe disturbance,

as well as the tendency of certain native species (e.g. pickleweed) to rapidly dominate. Recent research efforts have thus addressed how to speed recovery and maximize native species diversity, especially through restoration. The invasion of exotic species, especially transition-zone plants, is also becoming a focus of the evolving monitoring efforts.

B. ADMINISTRATION OF THE RESEARCH PROGRAM

The research program is administered by the Reserve's Research Coordinator. The research coordinator's primary duties are to:

- develop and lead the Reserve-based research and monitoring program;
- serve as a point of contact for researchers using the Reserve, including the GRF Program;
- assist researchers in the development of research projects;
- maintain a Reserve research database;
- aid in disseminating research results
- advise and integrate with regional research forums;
- identify funding opportunities for research at the Reserve; and
- maintain a GIS program of the Reserve for managers and researchers.

At each meeting of the Advisory Council, time is allocated for a presentation on the status and results of Tijuana Estuary research and monitoring. This enables the Operating Agencies to adjust their management practices based on relevant and current research, and be informed about the biological status of the resources. In addition, by coordinating with the Coastal Training and Education Programs, research-derived messages are delivered to target audiences.

C. FACILITIES AND EQUIPMENT SUPPORT FOR RESEARCHERS

Tijuana River NERR facilitates research by providing access to the Reserve's habitats and facilities as well as making information available about historic and current conditions in the ecosystem. The recent construction of additional lab and research office space has helped alleviate some immediate space issues. Planned efforts addressing nursery needs and long-term storage will continue to improve the ability of researchers to effectively utilize Reserve resources.

D. INFORMATION SUPPORT FOR RESEARCHERS

Dissemination of information about ongoing and completed research is one of the most important functions of any NERR. The TRNERR Site Profile represents a comprehensive inventory of physical and biotic resources, and was completed in 1992 by Joy B. Zedler, Christopher S. Nordby, and Barbara E. Kus. It is entitled The Ecology of Tijuana Estuary - A National Estuarine Research Reserve. Although completed over 15 years ago, this work still provides a valuable synthesis of Reserve resources. In addition, restoration science that

has occurred at Tijuana River NERR is described extensively in Tidal Wetland Restoration: A Scientific Perspective and Southern California Focus, also by Joy Zedler et al. There is also a substantial body of work produced by scientists working individually over the years on a wide range of topics. Results from these research activities have been maintained in the Reserve library, although this needs updating and conversion to a digital resource. In addition, ERD maintains a digital database of more recent research done at the Reserve.

Tijuana River NERR actively shares technical information with specialized audiences, though this flow of information could be improved by increased used of electronic resources (e.g., web-based archives). Available information includes publications, reports, aerial photographs, and Geographic Information System (GIS) data layers and maps. Web development efforts are costly and additional funds are especially needed to ensure a fruitful and responsive GIS program. GIS-related products that would be valuable to update or develop include:

- current habitat and elevation maps
- projections of climate change impacts, including sea-level rise and changes in watershed inputs
- tools for invasive species management, including coverages and histories of treatment
- education and outreach tools, including interactive maps of habitats and species distributions

The Reserve currently has one part-time GIS coordinator, who focuses on responding to local mapping needs, providing information to researchers, and coordinating with other groups interested in GIS and remote sensing. Additional resources would allow more staff time to be devoted to this much-needed effort.

In addition, internet bandwidth is often limiting at the Reserve. It is thus desirable to increase data transfer speeds (both downloads and uploads). Furthermore, it would be valuable to increase wireless coverage in the Reserve (e.g. through a wireless internet "bubble"), which would allow a wide variety of instrumentation to be effectively deployed and electronically accessed. This would allow more effective data retrieval during times of limited access to field sites (e.g. high sewage flow); as well as increase data quality and quantity by alerting us to problems with deployed instrumentation.

E. ONGOING LONG-TERM MONITORING ACTIVITIES

A variety of monitoring activities occur at the Reserve. Table 3, on the following page, summarizes these.

TABLE 3: Ecological Monitoring Conducted at TRNERR

Parameters	Frequency	Lead Agencies
California Least Tern Breeding / Snowy Plover Colony	Annually	FWS
Light-footed Clapper Rails	Annually	FWS
Belding's Savanna Sparrow Populations	Periodically	FWS
Small mammal trapping survey	Periodically	FWS
Benthic Invertebrates	Bi-annually	NOAA / TRNERR / SWIA
Vegetation	Annually	NOAA / TRNERR / SWIA
Fish Community	Bi-annually	NOAA / TRNERR / SWIA
Water quality monitoring	Continuous	NOAA / TRNERR / SWIA
Weather	Continuous	NOAA / TRNERR / SWIA
Nutrients / Chlorophyll	Monthly	NOAA / TRNERR / SWIA

It is the policy of the Tijuana River National Estuarine Research Reserve to implement each phase of the System-Wide Monitoring Plan initiated by ERD in 1989, and as outlined in the Reserve System regulations and strategic plan:

- Phase I: Environmental Characterization, including studies necessary for inventory and comprehensive site descriptions;
- Phase II: Site Profile, to include a synthesis of data and information; and
- Phase III: Implementation of the System-wide Monitoring Program.

The System-wide Monitoring Program provides standardized data on national estuarine environmental trends while allowing the flexibility to assess coastal management issues of regional or local concern. The principal mission of the monitoring program is to develop quantitative measurements of short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective coastal zone management. The program is designed to enhance the value and vision of the Reserves as a system of national references sites. The program also takes a phased approach and focuses on three different ecosystem characteristics.

- Abiotic Variables: The monitoring program currently measures pH, conductivity, salinity, temperature, dissolved oxygen, turbidity, water level and atmospheric conditions. In addition, the program collects monthly nutrient and chlorophyll A samples and monthly diel samples at one SWMP data logger station. Each Reserve uses a set of automated instruments and weather stations to collect these data for submission to a centralized data management office.

The SWMP abiotic program is now well-established, and research staff has recently developed real-time availability of information that will allow better integration with Integrated Ocean Observing Systems (IOOS) such as the San Diego Coastal Ocean Observing System (SDCOOS).

- Biotic Variables: The Reserve System is focusing on monitoring biodiversity, habitat and population characteristics by monitoring organisms and habitats as funds are available.

Across the NERR System, a goal for each site is to monitor two fundamental features of its estuarine ecosystem: (i) basic community structure in major estuarine habitat types (e.g., uplands, emergent wetlands, benthos, etc.); and (ii) population trends of important "target species" including those of commercial, recreational, or conservation significance (e.g., submerged aquatic vegetation, marsh plants, wading birds, endangered species, etc.). Biomonitoring of emergent marsh was piloted at the TRNERR in 2005-2006, focusing on Tier 1 assessment (i.e. remote-sensing) of emergent marsh using remotely-sensed imagery. This pilot effort provided valuable information for future remote-sensing, including the relatively high costs for such efforts as well as the value of establishing partnerships.

- Watershed and Land-use Classifications: In recognition of the profound influence of land and water use on estuarine resources, the NERR SWMP program will compile existing and new data on major patterns of habitat classification and land use within NERR System watersheds. The main objective is to examine the links between watershed land use activities and coastal habitat quality.

Data gathered from a variety of state and federal sources will be updated periodically and used to monitor significant changes in watershed uses and impacts on Reserve resources. Also, habitat mapping within Reserve boundaries is currently being implemented across the NERR system, using a uniform NERR habitat classification scheme. Implementation of habitat mapping at the TRNERR will occur by 2012.

These data are compiled electronically at a central data management “hub”, the Centralized Data Management Office (CDMO) at the Belle W. Baruch Institute for Marine Biology and Coastal Research of the University of South Carolina. They provide additional quality control for data and metadata and they compile and disseminate the data and summary statistics via the Web (http://cdmo.baruch.sc.edu) where researchers, coastal managers and educators readily access the information. The metadata meets the standards of the Federal Geographical Data Committee.

This data can be used by researchers and by coastal ecosystem managers to track long-term trends across the NERRS national system or at any one of the Reserves. One function of the Tijuana River NERR monitoring program is to provide benchmark information to researchers, coastal communities, and ecosystem managers. Change in regional estuarine ecosystems can be measured by comparison to known, regularly monitored conditions in the Reserve.

Currently, the TRNERR maintains four water quality sites. Two sites are in the north arm of the Tijuana Estuary, representing conditions near the mouth and further up a well-flushed tidal channel. Monitoring of other sites in the TRNERR has been suspended indefinitely due to excessive sedimentation (resulting in waters too shallow for datalogger deployment). The TRNERR is now conducting SWMP monitoring in nearby South San Diego Bay (outside TRNERR boundaries), in partnership with the FWS. One site is in a pond within a larger salt works system, which will be restored to tidal flushing and vegetated as part of an upcoming restoration effort. The other site represents a reference site in the extreme southern end of San Diego Bay

In addition, TRNERR staff also participates in monitoring activities outside the Reserve. A parallel long-term monitoring effort that serves as a reference site to the monitoring in the TRNERR occurs in Los Peñasquitos Lagoon where SWMP protocols are used to assess water quality and other parameters. This effort is driven in part by the direct need for assessing lagoon conditions during periods of mouth closure. As a permit requirement for mechanical mouth opening, low oxygen conditions must be documented. In addition, the Reserve has also participated in the multi-agency, cross border Flood Warning System, although this effort needs revitalization (see Chapter 10).

The primary needs of the broader TRNERR monitoring program are primarily related to basic costs associated with maintaining equipment (e.g. dataloggers and installed telemetry) and supporting staff, given the challenging budgets of recent years. In addition, given the demonstrated benefits of telemetry in terms of increasing data quality and availability, it is desirable to add telemetry to the three SWMP sites that currently do not have it.

F. ONGOING RESEARCH ACTIVITIES

Effective long-term monitoring, as described above, is often at the core of research. For example, biotic and abiotic monitoring at the Reserve has been used as reference data for efforts related to restoration (e.g. at San Dieguito Lagoon) and monitoring sites have often served as study sites for other researchers, given the history of data for the area. More recently, NERR SWMP protocols have been utilized for a region-wide estuarine eutrophication study being led by the Southern California Coastal Water Research Project (SCCWRP). TRNERR staff is conducting the abiotic and biotic monitoring associated with the SCCWRP study at 8 San Diego systems, including 3 SWMP sites.

As highlighted earlier, research in the Reserve (especially by TRNERR staff) utilizes adaptive principles wherever possible. Currently, Reserve staff are focusing on issues related to invasive species ecology and management. Publications resulting from these efforts include collaborative papers in peer-reviewed journals (Whitcraft et al. 2007, 2008), as well as a book representing the first synthesis of invasions in global marine ecosystems (Rilov and Crooks, 2009). A related research emphasis is the role of habitat modifying species, called ecosystem engineers, in estuarine systems (Talley and Crooks 2007, Crooks 2009).

The primary needs for the research program at the Reserve again relate to the ability to sustain staff given challenging budgets.

G. GRADUATE RESEARCH FELLOW PROGRAM

The NERR system administers the Graduate Research Fellowship (GRF) program which provides funding for graduate students to carry out research related to the reserves. The funding is currently $20,000 per year, with up to three years of support. 30% of the total research project costs must come as non-federal match (waived overhead is permissible). Generally non-federal match is supplied by the student's academic institution. GRF students may be asked to fulfill a work commitment of up to 15 hours / week at the Reserve, at the discretion of the Research Coordinator. Each Reserve is funded by NOAA for a maximum of two GRFs. Potential fellows need to apply directly to NOAA, although prior communication with the Research Coordinator is strongly encouraged. All GRF proposals are reviewed by an external reviewers, selected by the Research Coordinator or Reserve Manager according to guidelines established by NOAA. A list of past and current GRF projects is available on the Tijuana Estuary website (www.trnerr.org).

H. NERRS SCIENCE COLLABORATIVE

The Science Collaborative is a NERRS program that focuses on integrating science into the management of coastal natural resources. Currently administered through the University of New Hampshire, the program integrates and applies the principles of collaborative research, information and technology transfer, graduate education, and adaptive management with the goal of developing and applying science-based tools to detect, prevent, and reverse the impacts of coastal pollution and habitat degradation in a time of climate change. The program is designed to enhance the NERRS ability to support decisions related to coastal resources through collaborative approaches that engages the people who produce science and technology with those who need it. In so doing, the NERRS Science Collaborative seeks to make the process of linking science to coastal management decisions, practices, and policies more efficient, timely, and effective.

I. INTERACTION WITH LOCAL ESTUARINE RESEARCH PROGRAMS

Tijuana River NERR is fortunate to be located near several universities, research institutions, and other entities that devote considerable resources to estuarine research and management. The TRNERR partners with many of these agencies, in order to exchange ideas and help the TRNERR achieve its local and regional scientific and outreach goals. Some examples of collaborative efforts include:

1. Research and Monitoring in Los Peñasquitos Lagoon

Currently, the TRNERR research program, through SWIA and the LPL Foundation is contracted to conduct ecosystem monitoring in Los Peñasquitos Lagoon, located some 25 miles north of Imperial Beach in Del Mar. Monitoring is parallel to that conducted in the Reserve, and builds upon twenty of years study started by PERL. As most of LPL is in the

State Park system, this presents a good opportunity for increased collaboration and sharing of resources.

Similarly, the research program has, working with the USFWS, instituted SWMP monitoring in the south San Diego Bay Wildlife Refuge., in the Wildlife Refuge. The application of SWMP protocols at both sites will serve a mutual benefit for the TRNERR and USFWS programs.

2. San Diego State University (SDSU)

In 1997, SDSU designated the Tijuana River NERR as an Auxiliary Field Station, and in recent years there has been increasing collaboration with the Field Stations Program at SDSU. Students and faculty from SDSU represent one of the most active users of the Reserve. In addition, the Research Coordinator is adjunct faculty in the College of Sciences at SDSU, and has served on several SDSU graduate student committees.

3. University of California, San Diego (UCSD)

UCSD, including the Scripps Institution of Oceanography (SIO), represents another major academic partner at the Reserve. Students and faculty actively use the Reserve, and the Research Coordinator is a Research Associate at SIO and UCSD. The Southern California Coastal Ocean Observing System is run out of SIO, and the Research Coordinator is a Senior Advisor in this program. In addition, the Reserve has an active partnership with the undergraduate Environmental Systems program and hosts interns from this program.

4. Southern California Wetlands Recovery Project (SCWRP)

This is a multi-agency state-funded organization that is focused on facilitating restoration of Southern California Wetlands. Reserve staff currently attend the local San Diego County task force meetings (Research Coordinator and CTP Coordinator) and TRNERR has received many millions of dollars in funding from the SCWRP for restoration work. This organization is on the forefront of nearly all wetland restoration work going on locally and is an ideal forum for discussion of restoration goals and dissemination of lessons learned through projects in the region. The Research Coordinator is also a member of the Science Advisory Panel for the SCWRP.

Recently, the SCWRP has funded three major Reserve projects. In 2003, they provided over $200,000 for a Los Laureles Canyon Feasibility Study, looking at options and recommendations for erosion control and stormwater management in this immediate sub-watershed, located in Mexico. The results of the study have now been folded into the more comprehensive City of Tijuana-funded Canyon Laureles Work Plan, a blueprint for implementation. (More details in Chapters 10 and 11.) In addition, the SCWRP has provided significant funding ($3.8 million) for the Goat Canyon Enhancement and Habitat Restoration Project. The key feature of this project is the protection of estuarine resources from upstream sediment flows through the construction of a series of sediment retention basins. This was completed in 2005. Finally, SCWRP provided funds for the Tijuana Estuary Tidal Restoration Program, Phase II in 2007. TETRP Phase II included a feasibility

study of future salt marsh restoration in the Reserve. (See Chapter 5 for more details on these last two projects.)

5. Southern California Coastal Water Research Project (SCCWRP)

SCCWRP is a joint-powers public agency and research institute that addresses a wide range of issues related to estuarine and nearshore habitats within the Southern California Bight. The TRNERR has a number of partnerships with them, including active involvement on the Wetlands Recovery Project's Science Advisory Panel and the regional-scale eutrophication study (called Bight '08), conducted during 2008-2009.

6. San Diego Coastkeeper

The San Diego Coastkeeper is a non-profit focusing on protection of watershed, beaches, and coastal waters. The TRNERR partners with Coastkeeper on volunteer activities, including a citizen-based pollution monitoring program.

7. California Sea Grant

California Sea Grant is NOAA program supporting marine research, extension services, and education. They have funded a variety of projects in the TRNERR, including a number of Sea Grant fellows who have utilized Reserve resources, and acted as partners in advisory and outreach activities.

7. North American Marine Protected Area Network (NAMPAN)

Established by the Commission for Environmental Cooperation (CEC) (which itself was established as part of the North American Free Trade Agreement (NAFTA)), NAMPAN is a network of marine protected area in the United States, Mexico, and Canada. The TRNERR has been involved in several capacities, including representing the NERR system. In addition, the TRNERR was a pilot site for a consensus-based "vital signs" assessment, where Reserve conditions were scored based on expert opinion. This process continues to be quite informative, and could be a good model for NERR sites in general. The TRNERR will continue to participate in future NAMPAN efforts

8. Other Schools

The TRNERR serves as an important site for research opportunities and internships for a number of other local schools. Students and faculty from schools such as Mar Vista High School, Southwestern Community College, Point Loma Nazarene University, and University of San Diego continue to carry out projects at the Reserve.

J. APPLYING RESEARCH to RESOURCE PROTECTION, EDUCATION, and OUTREACH

As an overarching goal of the TRNERR Research Program, and the NERR System itself, is translating science into effective stewardship, education, and outreach activities, Thus there

is active coordination among the Reserve's core staff. For example, the Research Coordinator routinely conducts high-school teacher training, and is actively incorporating TRNERR SWMP data into high school lesson plans. Also, State Parks education staff are also employed part-time as research staff, facilitating transfer of information among programs.

There is a high degree of coordination with stewardship efforts, including restoration and invasive species management. Many conservation activities are conducted as large-scale experiments that are designed to better increase understanding of estuarine management, Chapter Five provides details of these efforts and initiatives in TRNERR.

Outreach to decision-makers occurs both through the Coastal Training Program (CTP), as well as direct participation of the Research Coordinator in a variety of venues. The Research Coordinator currently sits on a variety of important committees, including: The City of San Diego's Wetlands Advisory Board (a mayoral appointment), the WRP County Task Force Executive Committee, the WRP Science Advisory Panel, and the Southern California Coastal Ocean Observing System Senior Advisory Committee. Information sharing and research translation is currently being carried out based on research results and restoration science at the Reserve. Future growth of CTP will improve the capacity of this important function.

III. RESEARCH AND MONITORING PLAN OF ACTION

Objective 1. Conduct research and monitoring that serves to enhance the body of scientific information available for understanding, managing, and restoring coastal ecosystems.

Strategies:

- Continue to fund and staff a Reserve-based research and monitoring program, using NOAA and external funds as needed.
- Modify the existing physical and biological monitoring effort, as needed, to address current management and research needs, both locally throughout the Southern California Bight
- Continue developing a database of species in the Reserve, focusing initially on species of special conservation interest such as endangered or exotic species
- Develop a better understanding of anthropogenic impacts to Reserve habitats from sources within and beyond the Reserve's boundaries, with a particular emphasis on the restoration of ecological habitats and invasive species
- Create mechanisms to a) perform timely assessment of changes created by significant natural events or human activity and b) respond to these changes.

Objective 2. Facilitate Reserve-based projects by outside researchers that address local, regional, and national goals.

Strategies**:**

- Implement and make readily available streamlined, consistent, and Reserve-

wide protocols for research use of the Reserve, including assurances that Reserve resources are not adversely impacted by research activities.

- Provide adequate lab, computer, and office space for visiting researchers.
- Maintain and distribute a current research "wish list" that describes management issues and potential research projects that may be helpful in resolving these issues.
- Focus on projects that take advantage of the unique social and geographical setting of the TRNERR.
- Encourage use of the TRNERR by Mexican researchers, including joint U.S.-Mexico research projects.
- Involve students and the public in monitoring as a means to promote citizen involvement in stewardship.
- Continue to engage the volunteer coordinator to oversee intern and volunteer activities related to research and monitoring.
- Work with NOAA and external researchers to increase the number of NSC projects carried out at the Reserve or within its watershed.

Objective 3. Continue to expand the Reserve-based GIS / remote sensing program, focusing on habitats and land cover within the Reserve and watershed.

Strategies:

- Using the Reserve's GIS capabilities, characterize and monitor the environment of estuarine habitats under the management of the Reserve, including acquiring and maintaining current vegetation, habitat, and elevation maps.
- Seek additional funding to develop and use in-house capabilities for Reserve-based GIS projects.
- Further develop partnerships to expand capacity to use GIS and remote-sensing tools
- Develop a web-available inventory of map and GIS products, including links to other such resources.
- Complete data collection, field inventory, and habitat assessment necessary to update the data dictionary for the GIS system.

Objective 4. Cultivate and expand academic linkages, focusing on universities and programs within southern California.

Strategies:

- Further develop the relationship with the SDSU Field Stations Program as well as other local universities
- Continue to promote the GRF program and attract top-notch graduate students
- Further develop the formal student internship program (e.g., UCSD

Environmental Systems, SIO IGERT, Aquatic Adventures, and Mar Vista HS Poseidon Academy programs), including seeking funding for intern stipends.

Objective 5. Continue to develop regional, national, and international roles for the expertise developed through the TRNERR research program.

Strategies:

- Continue leadership in wetland restoration science in the bioregion and beyond.
- Develop leadership in invasive species ecology and management.
- Promote the use of the Reserve as a "reference" site for other restoration and monitoring activities.
- Coordinate and share data with other monitoring efforts, including the Southern California Coastal Ocean Observing System (SCCOOS).
- Play an active role in participating in and facilitating research activities in the binational Tijuana River Watershed.
- Continue to represent TRNERR on various committees in the bioregion.

Objective 6. Maximize the availability of all research and monitoring results utilizing electronic and web-based resources, especially in coordination with the Reserve's education, CTP, and stewardship efforts.

Strategies:

- Develop real-time water and weather data gathering and dissemination capabilities at all SWMP sites.
- Rehabilitate the database of research material at the Reserve, and convert this to a web-based platform.
- Begin conversion of historical documents to PDF files.
- Provide links to outside web pages with research information associated with the Reserve.
- Prepare and make available on the web an annual description of research within the Reserve, including summaries of work by Reserve staff and outside researchers.
- Continue publications by Reserve staff in peer-reviewed journals.
- Partner with CTP to conduct workshops on research-related activities.
- Better enforce the reporting requirements by external researchers, including descriptions of how their work may be translated into improved management of resources.

CHAPTER SEVEN: EDUCATION AND INTERPRETATION PROGRAM

INTRODUCTION

Environmental education (EE), according to the California's *Education and the Environment* plan, focuses on environmental literacy: learning about and caring for the total environment, understanding how humans interact with natural ecosystems, and developing critical thinking skills to resolve environmental issues. Environment-based education uses the environment (in this case an estuary) to engage students through "real world" learning experiences.

Environmental education is an integral component of programming that serves educational goals in the resource protection and ecosystem management at Tijuana River National Estuarine Research Reserve (TRNERR). In order to develop lasting solutions for problems ranging from habitat destruction by visitors to upstream water pollution, education on the value of estuarine and wildlife resources is required. At the Reserve, education and outreach are viewed as powerful tools that the Operating Agencies, CSP and FWS, use in overseeing the human aspect of resource management.

The education and outreach programs at Tijuana River NERR strive to go beyond providing information to resource users, as information alone does not protect the resources. To affect behavior change that has a positive effect on the resources, education programs must instill knowledge and overcome the barriers to performing positive behaviors. In an effort to accomplish this broad goal, the Education and Interpretation Program, in accordance with the Reserve's 5-year vision statement and goals for 2010-2015, seeks to provide interactive, hands-on, science-based, bilingual environmental education to local and regional students and the community through partnerships with local schools, community groups, and government agencies of the region in order to promote and support estuarine stewardship by an informed and active citizenry.

Tijuana Estuary is surrounded by Imperial Beach, California to the north and Tijuana, Baja California, Mexico to the south. It is the only NERR on an international boundary. Tijuana Estuary is committed to serving the under-served community of Imperial Beach (which is heavily Hispanic and low-income) as well as our Spanish-speaking neighbors to the south, in our kindergarten through twelfth grade (K-12) and community education programming. The Reserve capitalizes on its unique environmental education niche, providing high quality science-based environmental education to these under-served communities in order to build their capacity to positively impact the valuable ecosystems within the Reserve. In addition, the TRNERR is likely the most urban Reserve in the NERR system. With over 1 million people within a 30-minute drive of the Reserve (that number includes the U.S. side only), the TRNERR education program has a truly unique opportunity to reach a great number of people with the NERR message.

A formal needs assessment and market analysis has not been developed by education staff. An informal market analysis of other coastal providers of environmental education was

completed by the education staff in 2003 and it informs this management plan. TRNERR has developed a **Scope of Interpretation**, or main area of educational focus, based on the 2003 informal market analysis of other providers and a determination of areas where the Reserve could best serve the community. This Scope, listed in detail later in this chapter, has significantly informed the Goals, Objectives and Tasks in this plan

I. POLICIES

A. NERR SYSTEM EDUCATION AND INTERPRETATION POLICIES

The Reserve System provides a vehicle to increase understanding and awareness of estuarine systems and improve decision-making among key audiences to promote stewardship of the nation's coastal resources. Education and interpretation in the Reserves incorporates a range of programs and methodologies that are systematically tailored to key audiences around priority coastal resource issues and incorporate science-based content. Reserve staff members work with local communities and regional groups to address coastal resource management issues, such as non-point source pollution, habitat restoration and invasive species. Through integrated research and education programs, the reserves help communities develop strategies to deal successfully with these coastal resource issues.

Formal and non-formal education and training programs in the NERRS target K-12 students, teachers, university and college students and faculty, as well as coastal decision-maker audiences such as environmental groups, professionals involved in coastal resource management, municipal and county zoning boards, planners, elected officials, landscapers, eco-tour operators and professional associations.

K-12 and professional development programs for teachers include the use of established coastal and estuarine science curricula aligned with state and national science education standards and frequently involves both on-site and in-school follow-up activity. Reserve education activities are guided by national plans that identify goals, priorities, and implementation strategies for these programs. Education and training programs, interpretive exhibits and community outreach programs integrate elements of NERRS science, research and monitoring activities and ensure a systematic, multi-faceted, and locally focused approach to fostering stewardship.

The National Estuarine Research Reserve System's mission includes an emphasis on education, interpretation, and outreach. Education policy at Tijuana River National Estuarine Research Reserve is designed to fulfill the Reserve System goals as defined in the regulations (15 C.F.R Part 921(b). Goals of the Education Program are include:

- Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;
- Conduct and coordinate estuarine research within the system, gathering and making available information necessary for improved understanding and management of estuarine areas.

Reserve System Education Objectives

Education-related objectives in the Reserve System Strategic Plan 2005-2010 include:

1. People are aware of the ecological, economic, historical, and cultural importance of estuarine resources.
2. People understand how human choices and natural disturbances impact social, economic, and estuarine ecological systems.
3. People apply science-based information when making decisions that could impact coastal and estuarine resources.

The plan also has Strategies to meet these objectives:
• Provide educational opportunities that increase students' understanding of estuarine science and technology.
• Implement and participate in public programs and events to raise awareness and understanding about estuaries and the NERRS.
• Produce and distribute educational materials and web-based products that raise public awareness about estuaries, the NERRS, and NERRS education products.
Train teachers to educate students about coastal watersheds and estuaries.
• Deliver monitoring and observing data to diverse user groups in a useful format.
• Improve the willingness and ability of communities to restore and protect coastal ecosystems.
• Provide science-based information and training to individuals and organizations.
• Assist restoration practitioners in developing and applying effective restoration techniques.
• Implement volunteer programs to engage local citizens in advancing the goals of the reserves.
• Conduct programs to encourage people to make personal choices that reduce their impact on coastal resources.
• Evaluate programs to determine how people apply information and knowledge.
• Build and maintain educational facilities and interpretive displays.

B. CALIFORNIA STATE PARKS EDUCATIONAL POLICIES

The primary interpretive policy of the State Parks is to heighten and increase public understanding, appreciation, and enjoyment of the natural, cultural, and recreational values of California as represented in the state park system; and to increase public understanding and concern for people's place in their environment and thereby awaken an increased desire to protect and enjoy the natural and cultural heritage of this state (Department Operations Manual, 1300.2, April 1986).

C. EDUCATION AND INTERPRETATION IN THE NATIONAL WILDLIFE REFUGE SYSTEM

At Tijuana Slough NWR, an urban Refuge, the FWS provides visitors an opportunity to understand and appreciate fish and wildlife resources. Through environmental education and interpretation -- priority uses of the NWRS (16 USC 668 dd et.seq) -- and recreation, FWS

offers activities compatible with Refuge purposes. FWS continues to seek public input on ways to enhance those compatible uses.

II. EXISTING CONDITIONS AND PERCEIVED NEEDS

A. INTERPRETIVE AND EDUCATIONAL TOPICS FOR ALL PROGRAMS

In 1995, the Reserve developed a number of interpretive topics for its educational and interpretive programs. The topics are divided into three main groups: 1) Wetlands and Water; 2) Ecosystem Relationships; and 3) Human Interaction. The topics are provided as Appendix 5. Some programs focus on a specific subtopic; other programs present several topics to emphasize the relationships between different aspects of the ecosystem. An Interpretive Master Plan needs to be developed for Tijuana River NERR to further develop existing themes and the scope of the interpretive program. The Interpretive Master Plan is an outcome of this management plan.

B. GEOGRAPHIC SCOPE FOR EDUCATIONAL AND INTERPRETIVE PROGRAMS

The Reserve's interpretive and educational programs are targeted towards the local community, the watershed, and the San Diego region.

1. Local Community

The visitor center is located in the South Bay Union School District (SBUSD) in the City of Imperial Beach. Approximately three-fourths of the families in the district live on incomes below the poverty line. About 60 percent of the elementary school students in the district are Latino. The Reserve works closely with SBUSD and middle and high schools from Sweetwater Union School District.

2. Tijuana River Watershed and San Diego Region

Because pollution and ecosystems stretch beyond political boundaries, the Reserve's education programs target school systems and communities on both sides of the border. Reserve staff served on the Environmental Education Council of the Californias, the oldest bi-national coalition of environmental educators along the border. The Reserve’s education program has influence throughout the watershed and County of San Diego. The Reserve also serves schools outside the watershed in San Diego County.

C. EDUCATIONAL PROGRAMS

The Reserve offers a wide range of interpretive and educational programs attended by students and the general public.

TABLE 4: Visitation at TRNERR

Program Category	**Visitors**				
	2005	**2006**	**2007**	**2008**	**2009**
Visitor Center Visitation	5925	9482	8747	8726	9542
School Group	1811	1541	951	1188	1364
Junior Rangers After-School Program	174	244	260	156	202
Special Events+	1818	2702	2858	4266	2165
Guided Walks for Families	798	310	208	293	246
University Groups	273	254	347	344	400
Miscellaneous Groups		116			1683
Total	10799	14649	13371	14973	15,657

1. School-Based programs

The Reserve has placed significant effort and emphasis on its educational and interpretive school programs. Participants in these programs make up one of largest groups of visitors to the Reserve.

a. Field Trips and Teacher Workshops

Approximately 125 school classes visit the Reserve each year. Most visiting classes are from elementary schools. Before bringing their students to the Reserve, elementary school teachers are required to attend either a two-hour or four-hour (depending on the program) workshop presented by Reserve staff. High school teachers must attend an eleven-hour training. The trainings orient the teachers to the Reserve, present information on the history and mission of Reserve, and provide pre- and post-visit curricula and activities for the teachers to use in their classrooms. Bilingual programs are available, as well as those accommodating special education classes and students with physical disabilities. From 2005-2007 the number of school groups and students decreased in part from pressures related to the No Child Left Behind Act. As a result, the number field trips decreased because principals would not allow classes to go prior to standardized testing. However, in 2008, the number of K-12 school programs increased by 35% and the number of students by 25%, thanks in part to our partnership with the South Bay Elementary District.

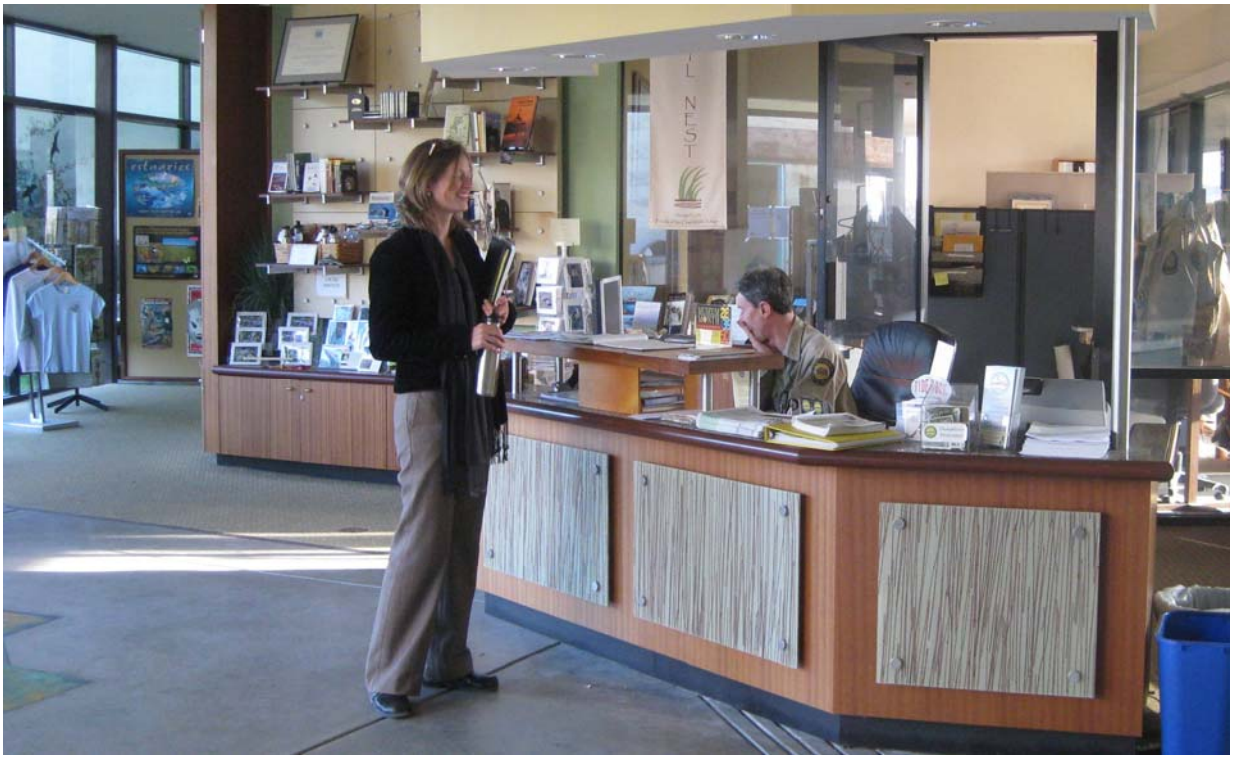
Central Elementary School student participating in one of the Reserve's school programs, 2008.

Visitor Center School Program

Fiesta del Río 2005 – Historic Play related to the estuary. Held annually near the Imperial Beach Pier, the event has grown in popularity with over 3000 participants in 2008.

Estuary mural at Fiesta del Río, 2006

Visitor Center Diorama and Exhibits, installed in 1994.



Visitor Center Gift Shop ("The Clapper Rail Nest") and Reception Area, installed in 2005 using sustainable materials.

b. Collaboration with Local Schools

The education program at the Reserve has a successful history of collaboration with elementary schools. Elementary students from several schools in the South Bay District participate in the Marsh Awareness and Resources for Slough Habitats (M.A.R.S.H.), Tijuana Estuary Explorers, and Habitat Heroes field-based programs. The staff recently developed a partnership with Mar Vista High School and the Sweetwater Union School District in 2005. The result of the partnership was the Tijuana Estuary High School Teachers' Guide that was premiered in Fall 2005.

The Tijuana Estuary Explorers program and the new high school classroom and field-based program are effective programs, but the Reserve is mainly working with elementary schools on the coastal side of the Interstate 5 corridor. While the Reserve does not want to compete with the school programs of the Chula Vista Nature Center, there remain a great many schools that are untouched by any estuarine program within 30 minutes of the Reserve. While most NERR sites are remote and have to draw from schools an hour or more away, the TRNERR has a unique opportunity to influence a great number of students. The tools, programs and staff exist, and with a growing volunteer program, qualified docents will eventually be able to lead visiting classes. For instance, if in the coming years a minimum of two Tijuana Estuary Explorer programs were added per week, thousands more students would receive the NERR message. In an effort to increase the number of school visits, the TRNERR must also pursue funding options for transportation from schools, often the only barrier to field trips.

c. Materials Used for School-Based Educational Programs

Several sets of curricula and a wide range of activities are used in the educational program. Reserve staff strives to coordinate the content of Reserve materials with the school group's own classroom curriculum and with the State Science Framework, State Content Standards, and Benchmarks for Science Literacy. The Reserve has written or assembled the following materials for school-based educational programs:

- **Preschool/kindergarten (non-reader) curriculum and activities.** A packet of classroom activities and lessons for non-readers was developed for use in the South Bay Headstart program. South Bay Headstart trains all of its teachers to bring students to the Reserve.

Elementary curriculum and activities. The Reserve has developed two elementary school programs that provide teachers with activities for students and information on wetland ecology, M.A.R.S.H. and Tijuana Estuary Explorers. M.A.R.S.H. was developed by the Reserve with NOAA funding and is available in English and Spanish. A packet of pre- and post-field trip lessons and activities assembled from M.A.R.S.H. and other sources are also available. Tijuana Estuary Explorers was developed in cooperation with USFWS and California State Parks using primary funding from the San Diego Zoological Society and Chevron. All materials are available in English and Spanish. Teachers are trained on the use of both curricula before bringing their classes to the Reserve. The Reserve hosts Habitat

Heroes field trips. Habitat Heroes was developed with Reserve staff, the Endangered Habitats League, and the USFWS as the lead. The Reserve does not coordinate this program but it hosts the field trips.

- **High School Teachers' Guide.** The only field-based estuary science high school program in the County, the Tijuana Estuary High School Teachers' Guide came out in Fall 2005. The Teachers Guide is on the website. State Parks and the Friends of San Diego Wildlife Refuges partnered with the National Park Service to create a quality, inter-disciplinary High School Teachers' Guide that is aligned to State Content Standards, to help educate students about the valuable Tijuana River Estuary natural and cultural resources. The Research Coordinator was involved in all stages of development of this curriculum. Teachers must attend a teacher training on the curriculum prior to conducting their first field trip to the Reserve.
- **Posters.** The following posters are available free to teachers: *Estuaries, Where Rivers Meet the Sea* (provided by NOAA); *Estuaries, Scenes of Transition* (provided by NOAA); *Salt Marsh Food Chain*-English; and *Salt Marsh Food Chain*-Spanish.
- **Videos.** The following videos are available for loan to teachers: Waterlines (English and Spanish versions), The Coastal Wetlands of San Diego, The Amazing Journey of Migrating Shorebirds, Tijuana River Watershed (with subtitles in Spanish and English), Hidden Treasures, and Fabulous Wetlands. Teachers can send a request to the Education Department and pick-up the video at visitor center for a month loan period.
- **Activities.** The following games and activities are available for loan to teachers: Watershed Model, Watershed Story, Competitive Feeding Game, and Water Quality Monitoring Kits (teachers must complete training before use). Teachers can send a request to the Education Department.

d. Needs for School-Based Programs

The following needs have been identified for the school-based programs:

- A classroom lab for school-based programs of all levels.
- Recruit and organize a core group of 5-8 trained education docents to work with school groups.
- Seek transportation funding to expand the range and number of schools that regularly visit the TRNERR.
- Make all program materials available in English and Spanish.
- Develop activities and curriculum for middle school students.
- Periodically update or revise current evaluation surveys for teacher workshops and school field trips.

2. Non-School-Based Programs

The non-school-based programs are designed to target a diverse audience. These programs play a vital role in obtaining public support in the protection and preservation of the Reserve.

a. Interpretive Walks and Special Events

The Reserve currently offers six scheduled interpretive walks per month, and more frequently on a seasonal basis, based on availability of staff and volunteers. About half a dozen people attend each walk.

A variety of special events are offered throughout the year, including, Earth Day, International Migratory Bird Day, beach clean-ups, and Fiesta del Río, which celebrates National Estuaries Day and National Wildlife Refuges Week.

Outreach for these events are conducted through fliers and press releases to more than a dozen local media outlets (newspapers, magazines, newsletters, television, and the internet).

b. Interpretive Signs on Trails

Interpretive trail signs exist at the south Seacoast Drive overlook and at the Border Field State Park overlook. Additionally, there are identification plaques for plants in the visitor center's native plant garden.

c. Junior Rangers After-School Program

The Reserve conducts weekly Junior Ranger programs for elementary-aged children. These programs serve mainly local children, and some children attend every week. Constraints on the program have been a lack of sufficient classroom space and the difficulty of working with a group of children of mixed ages (age 7 to 12). Evaluation of the program thus far has been quantitative (e.g., numbers of children attending) and based on informal feedback, rather than formal and qualitative.

d. Artist-in-Residence

The Reserve has a history of hosting an artist-in-residence, co-sponsored by the California Arts Council, who offers art workshops at the Reserve and in local schools, focusing on wetland themes. This program is currently on hold due to lack of funding.

e. Needs for Non-School-Based Programs

- Additional interpretive signage on the trails is needed. In the short- to medium-term, this need could be met with printed interpretive handouts, with information on the handouts coordinated with a series of numbered signs installed on the trails. Not only is this much less expensive than installing

interpretive panels, but it allows for timely and seasonal interpretation, as well as inexpensive translation into Spanish.

- As the southern part of the Reserve becomes more accessible, there will be opportunities for increased education and interpretation. The public park atop Monument Mesa offers an excellent vantage point to explain the estuarine processes, significant wildlife and habitat values and to talk about historic and prehistoric stories. Specifically, Monument Mesa, at the southwest corner of the continental United States provides a unique opportunity to communicate the many rich and controversial stories associated with the U.S / Mexico border.

- The Reserve's website needs to be updated on a regular basis.

3. Visitor Center Services and Exhibits

The visitor center provides an array of educational and interpretive exhibits and services that are jointly funded by NOAA, CSP, and FWS.

a. Exhibits

Phase I of the visitor center exhibits was completed in June 1994. A second phase was completed in 1997. Many exhibits are designed for hands-on use. They address the following topics:

Tides
Migration
Food Chains
Clapper Rails
Bird Beak Adaptations Geology
Habitats
Wetlands
Land-Use Management
Plant Adaptations to Salt
Tijuana River Watershed
Seasonal Changes at the Estuary
Real-time Station for weather and data loggers (future)

Additionally, a three-dimensional diorama of a salt marsh scene is on exhibit at the visitor center.

All exhibit text has been translated into Spanish. A binder with photos and the translation has been developed for the public’s use and is available on request in the visitor center.

b. Printed and Visual Interpretive Materials

The following materials are available to Reserve visitors:

- Reserve brochure -- a general brochure on the Reserve (*English and Spanish*)
- Your Native Plant Garden -- a description of the visitor center native plant garden
- Bird checklist
- San Diego National Wildlife Refuge Complex -- a general brochure on the wildlife refuges in San Diego (*English and Spanish*)
- Education programs -- a multi-page flyer about the various programs offered at the Reserve
- Jr. Ranger program flyer -- a one-page flyer describing the program and its activities with dates
- Newsletter -- a quarterly newsletter that highlights Reserve programs, projects and special events
- Special Events flyer -- a one-page flyer listing the special events for the year
- Monthly calendar of all events

The Reserve offers several video, DVD, and slide programs. The Reserve also maintains a resource library of approximately 500 titles available to the public if requested. Currently a database is being developed to organize and reference these materials.

c. Needs for Visitor Center Exhibits and Services

The following needs have been identified for visitor center services and exhibits:

- The library needs to be catalogued and an electronic check-out system needs to be established.
- There is a need for permanent or semi-permanent exhibits on: the cultural history of the Reserve and the region; real time SWMP data, and the different land management systems operating at the Reserve (including FWS and CSP).
- Existing exhibits must be maintained in good working order.
- Funding needs to be identified to develop and install outdoor exhibits that will line the pathway to the visitor center and embellish the exiting amphitheater.

D. INTEGRATION OF EDUCATION WITH OTHER PROGRAMS

The Reserve education program integrates research, education, interpretation, and stewardship into programs that meet site and national estuarine management goals. To meet the particular needs of improving water quality, increasing biodiversity, and restoring habitat, the Reserve aims to engage various audiences with effective programs that incorporate information developed by educators and researchers through estuarine monitoring. Key steps to this integration of programs include forming staff teams to develop specific programs that

integrate education, interpretation, monitoring, and research to address problem issues. Program integration is greatly facilitated at TRNERR by the fact that our Education Specialists also serve as Research Assistants, there-by bridging the two programs

E. STAFFING AND ADMINISTRATION

1. Current Educational and Interpretive Staff

The current staffing of the Education and Interpretation Program is as follows:

- Education Coordinator -- Permanent, full time
- Education Specialist – Full time, hourly
- Education Specialist –Full time, hourly

2. Education Committee of the Advisory Council

The Education Committee of the Advisory Council meets quarterly each year to provide advice and ideas to the education program, and to report to the Advisory Council on activities of the education program. The Education Committee has been in existence off and on for over fifteen years. Quarterly reports on the education program are provided to the Advisory Council via the Reserve manager. The Education Committee will also serve to promote integration with other program areas, such as research, resource management, and watershed management. The Education Committee is especially helpful in program development and problem solving because many of the members are classroom teachers.

3. Docents

The docent program was re-developed, and now includes a ten-week docent-training course. The first courses were offered in February/March 2007 and were repeated in 2008, 2009, and 2010. Currently, docents lead the bird and nature walks and assist with Junior Rangers, elementary, and high school field trips. As of 2010, there are five docents that can work independently and two that can assist in high school programs.

4. Education and Interpretation Program Needs for Staffing and Administration

The following needs to exist within the staffing of the Reserve's education and interpretation program:

- Create permanent status for Education Specialists.
- Recruit and train docents for school field trips, Junior Rangers, and special events.

F. PARTNERSHIPS IN EDUCATION

Successful educational and interpretive programs coordinate with other organizations to share ideas and resources and to avoid duplication of efforts. The Reserve has worked with the following organizations and groups:

- **Southwest Wetlands Interpretive Association (SWIA).** The Reserve staff works with SWIA to reach the local community and obtain funding for interpretive and education programs.
- **South Bay Union School District (SBUSD).** The Reserve established a formal partnership that began in January 2007 with the involvement of staff in the selection of the new District Science curriculum. Beginning in the Fall of 2007 lead/ambassador teachers at most of the twelve SBUSD schools attended special Tijuana Estuary Explorers training (four per year) and started recruiting other teachers to attend trainings as well. Reserve staff will conduct one in-service at each partnering SBUSD school per school year.
- **Sweetwater Union High School District (Sweetwater).** The Science Resource Teacher and Professional Development Director of Sweetwater assist the Reserve staff in recruiting teachers to attend the High School Teacher Training of our curriculum and Estuaries 101. The Science Resource Teacher did the content standards alignment for all the science lessons in the curriculum.
- **City of Imperial Beach Public Works Department.** This partnership centers on water quality monitoring training and annual pollution prevention activities.
- **U.S. Fish and Wildlife Service** and the **Endangered Habitats League** with **Habitat Heroes,** a program that educates about the impacts of invasive plants and animals and the benefits of restoration.

III. EDUCATION AND INTERPRETATION PLAN OF ACTION 2010/2015

The education staff at TRNERR has developed a **Scope of Interpretation**, or the areas of interpretation and education where the staff seeks to focus and excel. A survey of other providers was conducted in order to create the Scope of Interpretation and to determine the areas in which the Reserve could best serve the community. The areas of focus include:

- Provide quality hands-on estuarine education
- Provide college level educational opportunities for high school students
- Provide educational/interpretive programs about pre-contact Kumeyaay habitation, use of the region, and estuary
- Provide cutting edge, culturally sensitive, multi-cultural and bilingual programs at the Reserve and in the community at large
- Provide unique arts programs to explore the interpretive themes of the estuary

The Scope of Interpretation informed the Goals, Objectives and Tasks in this plan.

Objective 1. Maintain, strengthen and expand high-quality, interpretive and school-based environmental education programs offered through the visitor center and outdoor classroom sites. (Refuge Objective)

Strategy 1: Maintain and expand high-quality programs developed for each grade level, including curricula and programming for middle and high school students.

Tasks:

- Fully implement the NERRS System-wide K-12 Estuarine Education Program (KEEP) which includes Estuaries 101 and Teachers on the Estuary (TOTE). A Needs Assessment and Market Analysis will be completed as the first step to implementation.
- Continue the high school internship program with Mar Vista High School focusing on Hispanic/Latina (o) girls and boys.
- Continue to develop the high school curriculum along with local adaptations of Estuaries 101 and expand their use in local classrooms. Use Estuaries 101 and our local SWMP lesson plans to expand and improve the use of SWMP data in the classroom.
- Work with science teachers and research coordinator to design a practical state-of-the-art science education lab (where the AV room is now) to be installed after expansion is finished. Get a proposed budget. Implement the plan.
- Develop a middle school curriculum that aligns with State and district standards.
- Expand the Tijuana Estuary Explorers to serve primary grades (K-2).
- Increase the number of school programs provided each year for all grade levels.
- Aggressively pursue funds for transportation (buses) as an incentive for school participation.
- Develop a distance learning program with State Parks and the County Office of Education.

Strategy 2: Improve structure for receiving feedback and assessment of programs from teachers and develop qualitative methods for program evaluation.

Tasks:

- Evaluate education specialists and park aides at least twice a year.
- Develop an evaluation tool that measures qualitative objectives.

Strategy 3: Increase the number of components of the educational program available in Spanish, translating curriculum and exhibit text into Spanish and training more bilingual volunteers.

Tasks:

- Recruit bilingual volunteers.

- Purchase highly-regarded relevant curriculum in Spanish that can be provided for use or for purchase to partners in Mexico/US.

Strategy 4: Revise TRNERR educational programs to better coordinate with California State Science Framework, School Curriculum Articulation, and Benchmarks for Science Literacy.

Tasks:

- Continue to rate highly on teacher evaluations with Tijuana Estuary Explorers and M.A.R.S.H. Programs.
- Blend M.A.R.S.H. with Tijuana Estuary Explorers.
- Continue to improve and update the Jr. Rangers program curriculum, include content standards in curriculum where possible and provide alternative activities for different themes including rainy day activities.

Strategy 5: Assess the feasibility of bringing more schools from Mexico to visit the Reserve. Explore in particular the opportunities to pair Mexican school children with U.S. school children during visits.

Strategy 6: Improve the outdoor facilities for the Tijuana Estuary Explorers program, especially in the salt marsh activity area by removing invasives from paths to provide consistent access.

Strategy 7: Provide thematic and fun Special Events to further the goals of the education program and build relationships with the community.

Tasks:

- Plan and implement 2 special events including International Migratory Bird Day, and Fiesta del Río (National Estuaries Day).

Objective 2: Maximize beneficial partnerships within the education and environmental community to leverage and expand the Reserve's ability to provide environmental education throughout the San Diego / Tijuana region.

Strategy 1: Increase teacher services and expand the communication network with area educators.

Tasks:

- Work with South Bay and Sweetwater Districts to ensure that the Tijuana Estuary Explorers and High School program teacher training can be included in the teachers' Professional Development Plans.
- Enhance or change the training as needed to meet the requirements and needs of the Districts.
- Expand these offerings to other districts through canvassing, networking and presentations to district administrators.

Strategy 2: Maintain partnerships with South Bay Union School District and Sweetwater Union School District and other environmental education entities.

Tasks:

- Continue to meet with District Staff of South Bay and Sweetwater to discuss current Tijuana Estuary programs and how we can meet their needs better (programs, teacher professional development, etc.)
- Work with the FWS to continue to implement and organize Habitat Heroes with Tijuana Estuary Explorers.
- Work with California Regional Environmental Education Community (CREEC), California Environmental Education plan, and San Diego State University (SDSU) Field Stations to promote environmental education on a more regional basis (see last page for acronyms).

Strategy 3: Partner with the Municipality of Tijuana (and Tecate), teacher groups such as PROBEA, and Mexican school groups to extend the impact of educational programs.

Tasks:

- Collaborate with CTP Coordinator (and Watershed Coordinator) on K-12 and community-based elements of projects in Mexico (e.g. Laureles Canyon).
- Strengthen the relationship with EECC, and Grupo Ecologista Gaviotas to provide mutual benefit for programming in Mexico.
- Work with PROBEA to develop age-appropriate interpretive themes for doing programs in Mexico that align with school curriculum.

Objective 3: Improve and expand the interpretive services in the Reserve.

Strategy 1: Create a Reserve-wide interpretive sign plan as a joint effort of the managing agencies and obtain funding

Strategy 2: Continue to improve the web site and ensure that the Reserve is a link on other relevant websites.

Strategy 3: Update, improve, and create new exhibits in the visitor center.

Tasks:

- Work with partners including the FWS to plan and implement an Interpretive Master Plan as well as a new Exhibit Plan for the visitor center.
- Design and install the new exhibits.
- Create a new (or more than one) Reserve video that meets the needs of a large age range.

Strategy 4: Expand and diversify interpretive programs and services within the Reserve.

Tasks:

- Design and implement horseback interpretive programs, in conjunction with Tijuana River Valley Equestrian Association and Mounted Assisted Unit.

- Develop informal education partnerships with Boys and Girls Club, Sports Park, Camp Surf, and Jr. Lifeguards to promote the educational themes of the Reserve and partners.
- Complete a Visitor Guide to sell in the bookstore.

Strategy 5: Provide unique arts programs to explore the interpretive themes of the estuary by re-establishing and developing partnerships with the arts community.

Tasks:

- Revitalize the Artist in Residence program by selecting an Artist and developing a program.
- Initiate dialogue with the INSITE Border Arts program.
- Select an artist and install sculptures in the native plant garden.
- Increase efforts to employ music as a tool in the educational programs, especially Junior Rangers.

Objective 4. Refine existing and develop new interpretive and educational programs at TRNERR to support restoration efforts and important cultural resources in the southern portion of the Reserve.

Strategy 1: Develop strategies to integrate Goat Canyon and TETRP restoration initiatives into educational programs.

Tasks:

- Repair and create new interpretive panels for Border Field State Park highlighting Goat Canyon and TETRP restoration initiatives.

Strategy 2: Develop new interpretive programs on the cultural history of the Tijuana Estuary area; continue the Fiesta that commemorates the May 13th campsite of the Portolá expedition in 1769.

Objective 5. Ensure that a complete and well-trained staff is in place to implement the educational and interpretive programs.

Strategy 1: Secure long-term sources of funding for staffing.

Strategy 2: Hire a permanent staff person to assist Education Coordinator.

Strategy 3: Two full-time permanent Education Specialists should be secured.

Strategy 4: Recruit and train a dependable corps of education volunteers and continue to develop docent training program.

Objective 6. Integrate educational and interpretive programs with other Reserve Programs, particularly the research program.

Strategy 1: Integrate research results in the school-based and non-school based programs.

Strategy 2: Centralize research information, in conjunction with the Research Coordinator.

Strategy 3: Provide current research information to staff and volunteers in the educational and interpretive programs, and to the public.

Tasks:

- Continue to incorporate NERRS System-wide Monitoring (SWMP) data in High School program and implement the Estuaries 101 System-wide High School Curriculum.
- Education specialists assist research or stewardship coordinators regularly in order to be more informed on resource issues.
- Education coordinator will meet regularly with research coordinator.
- Host a speaker regularly to include relevant resource issues.
- Make real time data and research findings available in the exhibit area in some form, and highlight research in the Reserve newsletter.

Strategy 4. Relate water quality monitoring to programs in the watershed, the bioregion, and beyond.

Tasks:

- Work with teachers to develop water quality projects at the Reserve for students.
- Develop a database with Research Coordinator of water quality results and make database available to the public and staff.

Strategy 5. Relate water quality monitoring to programs in the watershed, the bioregion, and beyond.

Tasks:

- Work with teachers to develop water quality projects at the Reserve for students.
- Develop a database with Research Coordinator of water quality results and make database available to the public and staff.

Objective 7. Change the cultural perspective on the value of coastal wetlands to create a passionate constituency that will support estuary protection and enhancement.

Tasks:

- Expand the TRNERR education program to school districts throughout the San Diego Region.
- Develop and distribute estuarine science curriculum that can be used by agencies and schools throughout the biogeographic region (also provide training support as needed). Adaptable material may also be developed and shared by the Coastal Training Program.

Acronyms:

CREEC: California Regional Environmental Education Network
CA EE Plan: California Environmental Education Strategic Initiative
EECC: Environmental Education Council of the Californias (bi-national)
MSCP: Multi-Species Conservation Plan
SDSU: San Diego State University

Multi-Agency Visioning Workshop, 2010

Community Workshop in Los Laureles, 2004

CHAPTER EIGHT: COASTAL TRAINING PROGRAM

INTRODUCTION

Decisions made by coastal communities can have profound, long-term consequences for estuarine and coastal environments. With significant development pressures on coastal communities on both sides of the U.S./Mexico border and the resulting impacts to coastal resources, it is imperative that coastal decision-makers have sound information on which to base often delicate decisions. The primary target audiences for these efforts will be coastal regulators and planners on both sides of the border, at national, state and municipal levels. Elected officials, land use planners, regulatory personnel, coastal managers, and recreational users are key decision-makers who often are in need of access to relevant science-based information, training, or available technology to make informed decisions affecting the watershed and coast. Additionally, adaptive management and collaborative learning will allow for inclusion of additional audiences identified by a revised Needs Assessment and Market Analysis.

The Coastal Training Program (CTP) provides up-to-date scientific information and skill-building opportunities to coastal decision-makers who are responsible for making decisions that affect coastal resources. Through this program, NERRS can ensure that coastal decision-makers have the knowledge and tools they need to address critical resource management issues of concern to local communities.

CTPs connect social science with reserve-based research, monitoring and stewardship activities. Programs target a range of audiences, including land-use planners, elected officials, regulators, land developers, community groups, environmental non-profits, business, and applied scientific groups. These training programs provide opportunities for professionals to network across disciplines and develop new collaborative relationships to solve complex environmental problems. Additionally, CTP provides a critical feedback loop to ensure that professional audiences inform local and regional science and research agendas. Programs are developed in a variety of formats ranging from seminars, hands-on skill training, participatory workshops, lectures, and technology demonstrations. Participants benefit from opportunities to share experiences and network in a multidisciplinary setting, often with a reserve-based field activity.

Partnerships are important to the success of the program. Reserves work closely with State Coastal Programs, Sea Grant College extension and education staff, and a host of local partners in determining key coastal resource issues to address, as well as the identification of target audiences. Partnerships with local agencies and organizations are critical in the exchange and sharing of expertise and resources to deliver relevant and accessible training programs that meet the needs of specific groups.

CTP at TRNERR has a robust history working on urgent issues facing the Estuary. Through the establishment of CTP in 2003, TRNERR joins a system-wide effort to build capacity to address these information and technology needs through targeted training and education programs at the local level. TRNERR is uniquely positioned to assume a lead role in local

decision-maker training due to its staff dedicated to applied research and education; as a place-based protected area, the Reserve provides a site for field experiences and technical training. Lastly, Reserve staff has a long history of working on a regular basis with communities and coastal decision-makers in the San Diego/Tijuana region, and has developed close relationships, credibility, and a broad understanding of local and regional needs.

Planning for "Look Back to Look Ahead - a Five Year Milestone" (a revised Needs Assessment, Market Analysis, and subsequent Program Strategy) is a comprehensive approach to assess how the program has matured since its initial Needs Assessment in 2005 and how it will continue to grow and address emerging issues, using 2010 as a secondary baseline. Implementing methodology that will enable the CTP Coordinator to assess the impact of workshops and other training opportunities will continuously fine tune the program.

I. POLICIES

A. NOAA CTP POLICY DIRECTIVES

Per the directives from NOAA, CTP will accomplish program objectives by enhancing the capability at reserves to:

- Systematically assess the science-based knowledge and skill gaps and needs of decision- makers and environmental professionals located in coastal communities within each Reserve's biogeographic region;
- Identify and/or develop information products and technical resources relevant to audience needs, training delivery and follow-up;
- Design and conduct technical training programs for decision-makers and environmental professionals, ranging from seminars and workshops to field-based courses and distance learning forums tailored to regional needs; and
- Evaluate the effectiveness of training programs and continuously assess priority information needs for local coastal communities.

B. PHASED IMPLEMENTATION OF CTP

CTP is a voluntary program. For those reserves choosing to participate, implementation is on a phased basis, depending on each Reserve's level of readiness to take on new projects, staff, and commitments. Phased implementation consists of three phases--*pre-operational, operational, and fully operational*.

Once operational, participation in CTP requires a systematic program development process, involving periodic review of the Reserve niche in the training provider market, audience assessments, development of a three to five year program strategy, a marketing plan and the establishment of an advisory group for guidance, program review, and perspective in program development. CTP implements a performance monitoring system; staff report data

in operations progress reports according to a suite of performance indicators related to increases in participant understanding, applications of learning, and enhanced networking with peers and experts to inform programs.

Since hiring a full-time CTP Coordinator in 2002, TRNERR has completed the major project milestones and is considered fully operational. Prominent key milestones include:

2004

- The establishment of a *CTP Advisory Group* and a description of its structure and operating procedures; regular *CTP Advisory Group* meetings
- A completed *Market Analysis* or equivalent, defined here as a systematic tool for assessing the specific abilities and priorities of the Reserve (services), other local and regional programs that offer the same or similar services, and the identification of potential audiences for the TRNERR's services

2005

- A *Needs Assessment* of specific target audiences, defined here as assessments of target audience knowledge, skills, and attitudes relevant to proposed training topics
- A *Program Strategy* to guide implementation

2009-2010

- "Look Back to Look Ahead - a Five Year Milestone"- a revised *Needs Assessment, Market Analysis,* and subsequent *Program Strategy*

Ongoing

- Well-established relationships with support and logistical partners, as well as partners with areas of training expertise (researchers, specialists, etc.)
- Documented success stories and actual on-the-ground projects that have resulted from CTP efforts and partnerships
- A *Marketing Plan* that outlines promotion, advertising, and outreach for the program, and utilization of standardized graphics
- Phased implementation of revised *Program Strategy* and *TRNERR Management Plan*
- Program evaluation and necessary adjustments

C. GEOGRAPHIC AND THEMATIC SCOPE FOR CTP

The Reserve's CTP is targeted toward the Bight of the Californias, also known as the Southern California Bight, which encompasses coastal marine environments that extend from Point Conception, north of Santa Barbara, to San Quintín on the Baja California Coast some 190 miles south of the border. Within the Bight, the local bi-national sub-region includes the major urban areas of San Diego, Tijuana, and Ensenada and a regional population of some

four million. The bi-national region is characterized by rapid population and economic growth that has significant impacts on the marine environment through exploitation of marine resources and through land-based pollution that affects the marine ecosystem. However, the regional economy is, at the same time, linked significantly to the marine environment, through harvesting of ocean products, recreation, and tourism.

While the stated focus of TRNERR's CTP is the Bight of the Californias, there is some latitude in the program to emphasize geographic and thematic areas that are most problematic and challenging for each specific Reserve. In the case of TRNERR, it is clearly the bi-national border issues, such as sediment, sewage, and trash that pose the greatest threats as well as furnish the greatest opportunities for training, outreach and partnership. These relationships have been key in helping the Reserve take decisive steps toward ameliorating the upstream risks presented by the immediate canyons along the border.

Revisiting the Needs Assessment, Market Analysis, and Program Strategy (see 'Phased Implementation') developed in 2005 will mark 2010 as an important 5-year milestone program strategy update "Look Back to Look Ahead - a Five Year Milestone" to reflect on successes, but also identify key performance measures and fortify the core NERRS program. As bi-national watershed projects continue to gain momentum, there will be a growing need to expand CTP beyond the immediate border and look north (or, in some cases, further south along the coastline and east, along the border) and expand the program's potential audience into San Diego County. In doing so, the knowledge gained by working in an international, multicultural watershed can be brought to those who can utilize this expertise to help solve their own regional challenges.

The CTP coordinator will maintain well-established cross-border relationships, develop relationships that expand CTP beyond the immediate border area, and facilitate partnership-building. The training of key decision-makers is a significant goal of the current Management Plan and one which will facilitate collaborative project implementation, an accomplishment that can serve as a training ground for other multi-jurisdictional watershed areas.

II. LOOKING BACK TO LOOK FORWARD

A. PROGRAM OVERVIEW

1. Staffing

Currently, the TRNERR CTP consists of one full time program coordinator. Depending on the topic and issue, additional staff and partner support, as well as volunteers and academic interns, could provide specific program assistance.

TRNERR CTP Coordinator responsibilities include:

- Collaborating with CTP community to identify common challenges, opportunities, and approaches at sector and national meetings and through peer-to-peer communication to support the goals of the Reserve

- Coordinating the CTP Advisory Committee
- Identifying partners and developing partnerships in the United States and Mexico
- Identifying needs and facilitating access to instructional design and expertise for target audiences to address priority issues identified by needs assessments
- Evaluating programs and incorporating feedback to improve future programs
- Conducting an ongoing audience needs assessments to identify or refine priority issue areas and market analyses to address training gaps
- Developing and distributing training materials
- Grant writing and funding CTP
- Marketing and promoting CTP services to target audiences

CTP Assistant – At present, due to budget constraints, this position is not funded. A part time, contracted position could expand as the program is augmented. This position would be responsible for the overall support of CTP and Coordinator and could include workshop planning and registration, administrative support, public relations, and web-development. A CTP assistant could also focus on addressing training needs in Mexico.

TRNERR Staff - TRNERR staff regularly provides skills and expertise needed to fulfill our CTP objectives. Information sharing is achieved through staff meetings, briefings, and scheduled (when necessary) "shadow" appointments where staff can get an in-depth understanding by attending supplemental programs. This includes the TRNERR Core Management Team as well as CA State Parks and USFWS staff.

Partnerships – Partners of CTP periodically offer and provide assistance and guidance to the program.

Volunteers and Interns – Volunteers regularly provide assistance to the program. Academic interns assist the CTP in research and program support.

2. CTP Advisory Committee

All Reserves participating in CTP are required to create an advisory or steering committee to guide and oversee ongoing and future CTP activities. The CTP Advisory Committee at TRNERR meets in person bi-annually and has regular correspondence through e-mail, meetings, and other activities. Committee efforts include oversight on planning documents and procedures, workshop development, strategic input, and program integration. Representatives from the Cities of Tijuana and Tecate, Mexico are also active members of the committee. Below is a list of the historical organizational makeup of the CTP Advisory Committee. Modifications to the composition of the Advisory Committee are anticipated due changing needs and organizational structure.

- TRNERR Core Management Staff

  - Reserve Manager
  - CTP Coordinator
  - Education Coordinator
  - Research Coordinator
- California Sea Grant representative
- California Coastal Conservancy representative
- City of Tijuana representative
- City of Tecate representative
- USFWS representative
- TRNERR Education Specialist
- Southwest Wetlands Interpretive Association representative
- City of Imperial Beach representative
- UCSD representative
- SDSU representative
- Southern California Wetlands Recovery Project representative

The Advisory Committee will be especially critical in consultation of the development and review of "Look Back to Look Ahead - a Five Year Milestone" ensuring that stakeholder needs are considered and reflected.

B. CTP ACTIVITIES

1. Program Development

All necessary planning documents were submitted to the national NOAA CTP Advisory Committee and approved in 2005. This includes a Market Analysis, Needs Assessment, and Advisory Committee description. A needs assessment is currently being revised, and target audience and topics revisited in partnership with the California Coastal Conservancy.

"Look Back to Look Ahead - a Five Year Milestone" will build on these planning documents to transition the CTP program and guide it through its next five years.

2. Communications and Outreach

At the heart of the CTP is the goal of providing decision-makers with science-based data and first-hand knowledge so that they can make informed decisions. Towards that end, the program provides workshops, presentations, media tools, and tours for decision-makers. Meetings to facilitate communication between U.S. and Mexican coastal decision-makers will be vital to program success. Effective marketing of CTP offerings will supplement these efforts.

The CTP Coordinator attends and presents at meetings and conferences for professional development and to expand the knowledge base for development of CTP offerings. In the past, these have included regional conferences including those held at University of California San Diego and international conferences. Attendance at coastal management and estuarine conferences will benefit the CTP Coordinator through inter-agency collaboration and information sharing at a national level. Copies of all the presentations are available in the TRNERR electronic archives.

Alongside TRNERR's major website overhaul, CTP pages will also be largely modified to reflect new planning documents, program offerings, registration, and other pertinent information.

3. Training

Issues of Local Importance to the Reserve and CTP:

The following priority areas for current and future CTP efforts and will be evaluated in a revised needs assessment. Categories *include but are not limited to*:

- Wetland ecology and estuarine science
- Regulatory permitting for coastal wetland restoration and research projects
- Resource management
- Coastal management
- Land use management
- Managing the impacts of human use
- Information and analysis
- Monitoring and modeling
- Ocean and coastal policy
- Climate change and adaptation
- Communication and outreach
- Program and project development and evaluation
- Coordination with coastal protected areas throughout the California Bight region
- Cross-border communication and cooperation on watershed projects

To build upon watershed programs that have traditionally and necessarily focused on challenges in Mexico, CTP training offerings will undergo an evaluation to assess and meet the needs of local coastal decision-makers through mechanisms such as technical assistance, logistical support, and toolkits in key training topics that *include but are not limited to*:

- Ecosystem based management/collaborative learning
- Erosion control
- Pollution and trash control
- Water quality and human health
- Stormwater/wastewater management
- Water dependency/Southwest drought
- Nutrient fate and transport
- Habitat restoration
- Vulnerability assessments/sea level rise (SLR) and flood mapping
- Ecosystem valuation
- Marine spatial planning
- Urban use planning/green building/sustainable communities
- Fisheries management and Marine Protected Areas
- Endangered species management and invasive species control
- Birding and ecotourism
- Science communications/behavior change

Intended audiences will include but are not limited to:

- Cities within San Diego County
  - Community Development staff
  - City Planning staff
  - Public Works staff
  - Environmental staff
- County of San Diego
- Local and state officials
- Port Commissioners
- Federal agencies and respective regional offices
- U.S. Navy
- Mexican government
- NGOs (U.S. & Mexico)
- Human health entities
- Urban use planners and developers
- Environmental engineers

- Consultants and contractors
- Property owners
- Businesses and industry (commercial fishers, farmers, and ranchers, tourism service providers)
- Recreational users (boaters, fishers, equestrian)
- Academic institutions
- Tribal

Delivery Method

In addition to classroom training in the on-site Training Center, distance learning mechanisms such as internet seminars, "go-to-meetings", streaming video, independent online instruction and other emerging technologies will be explored to supplement traditional training. The training resources NOAA's Coastal Services Center provides will be utilized.

In support of CTP efforts, the CTP Coordinator provides interpretive tours of the Reserve and surrounding areas. The tours are an effort to visually highlight the unique setting and challenges including transboundary coordination. Tours will highlight wastewater, trash, and sediment flow among other issues that affect the Estuary and put relevant CTP programming into context through on-the-ground experiential learning.

C. PARTNERSHIPS

Partnerships on both sides of the border are an essential component in developing a robust TRNERR CTP, namely through reaching key audiences, providing technical and logistical support, identifying and securing funding opportunities, and building bi-national credibility as a trusted source of sound scientific information. CTP is implemented bi-nationally in the County of San Diego as well as the Tijuana/Tecate Region of Mexico, which makes this region and Reserve unique.

Using 2010 as baseline, CTP program is focused on expanding partnership-building efforts in the U.S that will serve the needs of Reserve programs and address coastal issues in the San Diego and Tecate/Tijuana regions. CTP will explore historical partners and new partners through management of effectively leveraged resources and identification of expertise in identified areas. Existing strong partnerships and potential partners are outlined below and CTP plans to identify additional partners through its updated market analysis. New information garnered will direct a revised program strategy.

Partners may include but are not limited to:

- Federal Agencies (NOAA, EPA, USFWS, FEMA, DHS, CDC)
- U.S. Navy
- Tijuana River Valley Recovery Team

- Tijuana River National Estuarine Research Reserve Management Authority
- Tijuana River Watershed Task Force
- San Diego Association of Governments - SANDAG
- California State Parks
- California Coastal Commission
- California Coastal Conservancy
- NGOs/Non-Profits (SWIA, Friends of San Diego Wildlife Refuges, Surfrider, Wildcoast, The San Diego Foundation, San Diego Coastkeeper, Earth Island Institute, Center for Ocean Solutions)
- Academia (UCSD, USD, SDSU, Scripps Institute of Oceanography, SeaGrant))
- Urban Land Institute
- ICLEI Local Governments for Sustainability

D. NEEDS

As the CTP program matures, there is a growing need to increase CTP programming, engaging decision-makers in the greater bioregion. By fostering collaboration between the CTP Coordinator and Watershed Coordinator, urgent environmental issues above, below, and along the border can be addressed thoroughly.

Work planning, monitoring, and evaluation are critical pieces to the evolution of the program and progress in the next five years.

III. CTP PLAN OF ACTION 2010/2015

Recognizing the immediate need for revised program evaluation and planning will take precedence followed by interim goals to bring CTP into its next phase.

Short-term objectives

- Collaborate with NOAA ERD and CTP community in piloting a revised Needs Assessment and Market Analysis
- Disseminate and analyze Needs Assessment and Market Analysis to inform Program Strategy
- Increase training workshops with expanded focus on north of the border issues and decision-makers
- Continue partnership building and establish points of contact among key decision-makers
- Update TRNERR website architecture to include CTP
- Expand CTP opportunities at community events such as Fiesta del Rio

Long-term objectives:

Objective 1. Through grant funding, such as EPA grants, expand the CTP program to cover a broader geographic and topical area

Strategies:

- Increase grant-writing skills through training
- Hire an assistant or place an intern with grant-writing skills
- Seek out opportunities through networking and grants.gov

Objective 2. Further the system-wide CTP objectives through TRNERR representation on advisory councils and workgroups that provide technical expertise to elected officials and other decision-makers

Strategies:

- Participate in regionally relevant meetings and extend assistance at these meetings
- Respond to requests to serve on advisory councils and workgroups

Objective 3. Provide ongoing technical support for tangible projects in the region that result from successful coastal training efforts.

Strategies:

- Develop trainings that produce outcome-based results (i.e. manuals, technical papers, policy documents)
- Dedicate support to facilitating the execution or application of outcome-based results
- Respond to technical inquiries with resources or expertise

Objective 4. Implement a more interactive CTP toolkit and "course catalogue" for decision-makers available through website

Strategies:

- Increase course offerings
- Develop trainings to be replicable
- Redesign website for online registration and establish a database management system
- Consider offering course accreditation

Objective 5. Continue to carry out updated needs assessments on a regular basis

Strategies:

- Deliver Needs Assessment in partnership with California Coastal Conservancy
- Analyze results, adapt, and tailor to deliver again for more specific audiences

Objective 6. Continue to develop assessment methodology to determine the specific impacts of training activities

Strategies:

- Use post-workshop surveys as a mechanism of measureable evaluation to assess effectiveness, intent to apply, satisfaction, and areas for improvement

Objective 7. Continue to expand and cultivate the network of bi-national partnerships

Strategies:

- Work with Watershed Coordinator to gather institutional knowledge
- Conduct a needs assessment(s) in Mexico to better understand training needs and preferred mechanisms
- Attend binational meetings and conferences to increase CTP presence in binational issues

Objective 8. Work on improved media relations, public outreach, and media events so that CTP efforts can be showcased and spread beyond current audiences

Strategies:

- Increase marketing of CTP through social media mechanisms
- Develop marketing materials
- Build contact database for targeted mailings and information dissemination

Objective 9. Serve as a model for coastal community coordination and planning by continuing to provide high-quality, relevant, adaptive, and results-driven targeted workshops to a variety of decision-makers, with an emphasis on high-level officials who directly make the decisions that affect coastal resources

Strategies:

- Establish a set of training topics that resonate with local community using results from needs assessments
- Increase collaboration with local and regional government entities through increased outreach
- Build local and regional partnerships to build credibility and community presence
- Be proactive in determining emerging issues and addressing them

The San Bernardo Community in Upper Los Laureles Canyon (2005)

Two young girls meet across the international boundary at the historic monument at Monument Mesa.

California Biodiversity Council field trip, September 2006, Los Laureles Canyon; celebrates a partnership between the Reserve and the City of Tijuana that created a public park with sustainable design features such as pervious pavers

CHAPTER NINE: WATERSHED COORDINATION

INTRODUCTION

Many of the ecological challenges that the Tijuana River National Estuarine Research Reserve encounters originate in the 1,700-square-mile, binational, Tijuana River Watershed--an area that stretches well beyond the Reserve's borders. While the connections between upstream activities and their effects on Reserve lands can be observed in many locations, the Reserve has no formal mandate to influence land use beyond its boundaries, particularly within the country of Mexico. Recently, however, the Reserve has been making real progress in its efforts to influence and encourage better land management practices in the sub-basins that drain from Tijuana and Tecate, Mexico into the lower watershed and estuary.

A successful Watershed Coordination Program is critical to the success of Coastal Training Program (CTP) and vice versa; the two programs are mutually supporting. While NOAA, through the Reserve's annual Operations Grant, financially supports the CTP, the Reserve needs a staff focus on watershed coordination as well. In 2009, the Reserve secured a $980,000 grant from the U.S.E.P.A. to, among other things, hire a full-time Watershed Coordinator.

The Watershed Coordination Program seeks to establish and maintain regular communication and cooperation between the Reserve and other programs, organizations, and government entities whose actions influence the long-term health of the Reserve. The following Watershed Coordination chapter and subsequent Plan of Action describes the Reserve's efforts to influence and respond to activities in the watershed and to build partnerships that promote the sustained health of the watershed and the Reserve.

The goal of this three year, TRNERR/U.S.E.P.A. project is to further develop programs aimed at restoring and protecting the water quality, habitat, and environment of the Tijuana River Watershed. We will be conducting on-the-ground watershed improvement projects in Mexico and the U.S. and spearheading larger, longer-term efforts to expand the ability of regional agencies to manage sediment in coastal ecosystems.

I. POLICIES

By nature, a watershed covers many jurisdictions and thus, watershed coordination requires compliance with the policies of many managing agencies and other stakeholders scattered throughout the watershed. This is even more complex in a binational watershed. In an effort to bring these groups together, address the unique dynamics of the region, and set policies for project needs and implementation, several councils or workgroups have been established. The Reserve's Watershed Coordinator has taken an increasingly active role in these groups. The first is the Environmental Protection Agency's Border 2012 Water Workgroup. This group received EPA funding to create a full-color GIS-based Tijuana River Watershed Atlas as well as a Vision document for the future of the watershed. Applications for additional EPA grants have been submitted (see Goat Canyon/Laureles section). Another organization that endeavors to address cross-border issues is the Committee for Binational Regional

Opportunities (COBRO), sponsored by the San Diego Association of Governments (SANDAG). The Reserve Manager is now a member of COBRO and the Watershed Coordinator is a member of the advisory arm of COBRO that provides insight and information to elected officials on such topics as transportation, housing, and environment.

II. EXISTING CONDITIONS AND PERCEIVED NEEDS

A. PROGRAM OVERVIEW

The Tijuana Estuary has become a focal point for enhanced communication across the border. Federal, State and local governments are utilizing the Reserve and its facilities as a binational mechanism to address environmental issues in the Region. Despite many challenges, the Reserve has made real advances over the years in building working relationships and collaborations within the watershed. While these efforts started small, at a grassroots level with a focus mainly on education, the addition of new staff, namely the Watershed Coordinator, has enabled the list of watershed projects and contacts to significantly expand in recent years.

The Tijuana River Watershed Geographical Informational System (TRW GIS) project opened the door for greater involvement of and cooperation with Mexican officials (in this case, the Municipality of Tijuana) in watershed planning efforts. Since the TRW GIS was first created and made available on a binational basis, many projects have been born of the simple fact that these hi-tech, eye-opening maps do not stop at an artificial, man-made line called the international border. A list and description of current watershed-based projects is below.

B. CURRENT WATERSHED COORDINATION PROJECTS

The Watershed Coordination Program staff is conducting the following projects as a result of a successful grant proposal under the U.S. EPA. The grant proposal is entitled Facilitating Watershed Improvement Projects in Mexico and the U.S. This support has enabled the Reserve to more fully focus on the following areas which are elaborated on in the below sections:

- Control Erosion in Los Laureles Canyon and Promote Models in Other Locations
- Prevent Sediment from Entering the Reserve
- Secure Conservation Easements in Urban Canyons in Mexico
- Tire Reutilization Designs
- Trash Consolidation and Tire Recycling
- Real-Time, Remote Erosion Monitoring And Outreach Pilot
- Mexico’s National Public Radio Program

The program has leveraged funding from multiple grant sources to connect essential infrastructure with critical outreach by linking the flood warning system and the Real-time, remote erosion monitoring with an outreach pilot in Los Laureles Canyon, Tijuana, Mexico..

Moreover, the radio show has been, since 2006, a window of opportunity for the Reserve's watershed concerns, reaching thousands of people in the border region. By speaking about the benefits of having a wetland nearby, and the ways in which local residents can do their part to preserve their watershed and protect their marine environment from pollution, the Reserve is sending its message to an audience that is very difficult to reach otherwise. The radio station has recently asked that a series of short informational pieces or "capsules" on similar themes be recorded by Reserve staff and then used throughout the day during other programming.

1. Control Erosion In Los Laureles Canyon

Los Laureles Canyon is a watershed sub-basin in Tijuana that drains directly into the Reserve. During heavy rains, runoff erodes the canyon and brings very large sediment loads across the border into the Tijuana River Estuary. This excess sediment chokes out valuable salt marsh.

Pervious pavement and native vegetation can help to control erosion in Los Laureles Canyon. Pervious pavers will allow water to percolate through the blocks and channel remaining runoff into storm drains. Native vegetation will reduce the rapid erosion of bare slopes. The WC staff will coordinate with local residents and the City of Tijuana to establish a work plan for constructing and installing the pervious pavers, as well as revegetating the hillsides. The vast majority of labor for this effort will come from community volunteers working in partnership with the WC staff. This project, which may include other sediment management tools, will serve as a model for soil erosion prevention projects throughout the Tijuana River Watershed, particularly in Mexico. This activity will build upon the projects already initiated by the Reserve's CTP and the Earth Island Institute, a nonprofit organization that is providing match for this project.

2. Prevent Sediment From Entering The Reserve

In addition to the main river channel, three south-north canyons in Tijuana cross the border and drain directly into the Reserve: Matadero (Smugglers' Gulch), Los Laureles (Goat Canyon), and Los Sauces (Yogurt Canyon). During heavy rains, runoff erodes the canyons and brings very large sediment loads across the border into the Reserve. This excess sediment chokes out valuable salt marsh.

Regional landowning agencies (on both sides of the border) need to install and maintain sediment basins that will capture sediment before it enters the Reserve. Two basins, constructed in 2005 currently exist in the Reserve at Goat Canyon but additional basins are needed on both sides of the border to maximize protection of the estuary from sediment flows. While additional basins cannot be funded through the current EPA grant, other funding opportunities are being pursued by WC staff. Efforts will focus on planning for the installation of a series of sediment basins in key locations throughout the lower watershed, including Smuggler's Gulch, Yogurt Canyon, and key locations in the City of Tijuana. The WC staff will coordinate with regional agencies to facilitate the development of plans to effectively manage sediment loads coming from the urban canyons in Tijuana.

3. Secure Conservation Easements In Urban Canyons In Mexico

Property in Tijuana's urban canyons along the U.S.-Mexico border has been denuded of vegetation and developed at an alarming rate in recent years. This decreases the ability of the canyons to filter pollution and sediment from heavy storm flows and urban runoff, negatively impacting the health of the Reserve.

Open space in these canyons could provide a vegetated buffer near the border to filter storm water and sediment before it crosses the border in the U.S. Conserving canyon properties near the border will provide recreational space for Tijuana residents and retain a vegetated buffer near the border to help filter storm water and sediment before it enters the Reserve. The City of Tijuana has not designated open space areas before, making this a model project for future conservation easements in the city and larger watershed. Because these are conservation easements and not land acquisitions, the current owners of the land (including municipal, state, federal, and private owners) will continue to be responsible for their individual properties and, through the easements, will collaborate to provide for the long-term care and maintenance of the areas.

4. Tire Reutilization Designs

Residents of various *colonias* in Tijuana use waste tires to build foundations and retaining walls for their homes. During storms, large numbers of tires dislodge from the foundations washing down hills and canyons and ending up in undesirable locations in the watershed. Some years, up to 4,000 tires are removed from the river, sediment basins, and sensitive habitats of the Reserve.

Designing and building retaining walls and other civil engineering projects from waste tires will reduce the number of tires washing down the canyons and help to control erosion. The WC staff will plan and facilitate workshops to train a variety of audiences to use waste tires in civil engineering projects. It is expected that workshops will be attended by local residents, community leaders, community organizations, and City of Tijuana planning and public works staff. The tire reutilization workshops will include information about the various uses for scrap tires and hands-on training for specific projects (for example, using tires for retaining walls or foundations). Project partners in Mexico will include municipal, state, and federal government agencies, along with local organizations that specialize in tire reutilization activities. The WC staff will also promote this technology and various tire reuse opportunities to be replicated in other locations throughout Tijuana.

5. Trash Consolidation & Tire Recycling

Plastic trash is scattered throughout the Goat Canyon Sediment Basins, where it mixes with the sediment and therefore requires sorting. When rain is heavy, water carries the plastic trash over the top of the basins and scatters it in the Reserve, where it breaks down over time, releasing toxic pollutants. In addition, tires that are collected in the basins and other locations within the Reserve must be disposed of in landfills because there is no tire recycling plant in the County of San Diego.

Trash booms or other capture devices can separate out plastic trash prior to reaching natural habitat, where removal becomes more problematic and costly. The WC staff will develop strategies to consolidate trash as it enters the Tijuana River Valley (including the use and maintenance of trash booms) and manage removal. The WC staff will also promote

commercial tire recycling, it is uncertain at this time who would take the lead in creating a facility. In working closely with both the County of San Diego and the California Integrated Waste Management Board, the WC staff will explore the range of possibilities.

6. Real-Time, Remote Erosion Monitoring And Outreach Pilot

During coastal storm events, the effect of raw sewage, sediment, and trash generated upstream, such as in the U.S./Mexico border community of Los Laureles Canyon, located in Tijuana, Mexico, is pronounced and not only impacts Tijuana, but directly impacts the water quality of U.S. and Mexico coastal and ocean resources.

The real-time remote erosion monitoring and outreach pilot program combines real-time sedimentation monitoring technology and educational outreach efforts in Los Laureles Canyon to comprehensively address this binational pollution problem in the Tijuana River Watershed. Strategies used in the Los Laureles Canyon community will enhance the resiliency of vulnerable low-income populations to coastal storms and have a high potential for application in northwestern Mexico and Southern California where similar steep canyons and low-income communities exist.

Locally, the communities of Los Laureles Canyon, Tijuana, and Imperial Beach benefit from this study by being included as part of the binational cooperative solution to a problem posing risks to human health, welfare and the environment in both countries. Community involvement and outreach currently underway by CTP and Watershed Coordination at TRNERR will be leveraged to expand stakeholders and provide an alert system for potential flood/pollution hazards.

For the Los Laureles Canyon community, the benefits of understanding the physical processes that trigger erosion and runoff in the Los Laureles Canyon will help in understanding the causes of the problem. An indirect social benefit of implementing the monitoring technology at the project site is that the technology implemented for receiving data from the sensors will be used to provide a community internet access point to provide outreach and dissemination of educational information on the hazards, particularly caused by coastal storm events. The implementation of an advanced warning system and emergency evacuation plan that involves local community members will also assist in ultimately saving lives during coastal storm events. By integrating real-time data collection at Los Laureles, with existing NOAA flood warning stations and additional data sources provides a more comprehensive picture of the problems and possible solutions to the excessive erosion/sedimentation and pollution problem at the border area.

7. Mexico's National Public Radio Program

Mexico's National Institute for Radio, similar to the United States' National Public Radio, is a government-funded but independent organization. Tijuana's local affiliate, 102.5 FM "Fusion", invited the Reserve's Watershed Coordinator to be a regular speaker on their Monday morning "Mar sin fronteras" ("Ocean without borders") program. While Tijuana is a coastal city, most residents feel little connection to the ocean, for a variety of cultural and geographic reasons. The radio show endeavors to raise the awareness among Tijuana residents about water, ocean, and environmental themes. Topics such as water pollution, fisheries economics, turtle conservation, and heavy metals are introduced and then developed

over a period of four segments. Callers may call in with comments and questions and thematically appropriate books are given away.

The Watershed Coordinator Radio Show "Ocean without borders" is now available on line at: http://fusion.imer.com.mx/ click the "Escucha en linea" button. Monday's at 10:00 Pacific Standard Time.

C. RESERVE PARTICIPATION ON WATERSHED AND CROSS-BORDER PLANNING GROUPS

Tijuana River Valley Recovery Team

A coalition of twenty federal, state, and local agencies whose mission is to bring together the government administrative, regulatory, and funding agencies in tandem with advice from the scientific community, the environmental community, and affected stakeholders to protect the Tijuana River Valley from accumulations of trash and sediment; identify, remove, recycle or dispose of existing trash and sediment; and restore the Tijuana River floodplain to a balanced wetland ecosystem.

EPA Border 2012 Program

Currently, the TRNERR is involved with four regional workgroups formed through the EPA's Border 2012 program. TRNERR presence in these workgroups supports the goals and objectives laid out in this management plan. The groups that the Reserve is currently involved with are:

- **The San Diego - Tijuana Air Quality Task Force** - was created under the new U.S.-Mexico Border 2012 Environmental Program to implement bi-national environmental projects that are consistent with the program's mission: "To protect the environment and public health in the U.S.-Mexico border region, consistent with the principles of sustainable development."
- **Binational Environmental Health Workgroup** - The binational EHWG was established under the Border XXI Program (now U.S.-Mexico Border 2012). Since then, the EPA and the SEMARNAT (EPA's Mexican partner in Border 2012) have been working with federal agencies, border states and communities to reshape a new program for environment and environmental health concerns along the border.
- **Tijuana River Watershed Task Force** - The task force participates in the development of a binational vision, or ideal state, for the Tijuana River Watershed and helps to devise strategies and options for implementing that vision and to meet the goals and objectives of Border 2012.
- **Southwest Center for Environmental Research and Policy (SCERP)** - TRNERR and SCERP have a long history as partners in watershed and regional coordination. SCERP is a university consortium dedicated to applied environmental research of the U.S.-Mexican border region.
- **Regional Workbench Consortium** - The RWBC, based out of the University of California San Diego (UCSD), is a collaborative network of university and

community partners dedicated to enabling sustainable development. They promote multidisciplinary research and service learning aimed at understanding how problems of environment and development interrelate across local, regional and global scales. The RWBC focuses on the Southern California-Northern Baja California transborder region - especially the San Diego-Tijuana city-region and coastal zone. The Superfund Basic Research Program and the National Institute of Environmental Health Sciences are the main sources of funding for the RWBC.

D. PERCEIVED NEEDS IN WATERSHED COORDINATION

To address current needs, and take full advantage of existing opportunities, it is critical for the Watershed Coordination Program to expand in the following areas:

1. Monitor watershed-related projects and planning issues. This includes identifying which groups or agencies are responsible for different developments and changes in land use, assessing positive and negative effects of different projects on the Reserve, and determining how Reserve staff and volunteers can take an active role and have a voice in key projects. This also includes coordinating with public and private landowners in the Tijuana River Valley in order to enhance project effectiveness and foster cooperative efforts for the benefit of the Reserve.

2. Compiling and updating relevant research data that connects Reserve health to the watershed and then making this data accessible to staff, researchers, and project leaders. This would include updating the GIS database of the Reserve, collecting relevant watershed data from Mexican agencies, compiling water quality data from various sources across the watershed, and utilizing NOAA-funded researchers to address information gaps.

3. Sharing information on erosion/sediment issues. This includes collecting information on the erosion/sediment process, forming connections with potential partners in Mexico and in the Border Patrol, and formulating an action plan, project proposals, and funding options for restoration work and sediment prevention.

4. Tackling pollution issues such as sewage, industrial waste, street runoff, and trash. Investigation is needed where effort, education, public information meetings, and future funding might be most effectively applied to formulate project proposals and funding options to support research, clean-up, restoration, and prevention.

5. Assessing immigration issues. Continue to work with Border Patrol and other interests north and south of the border on how best to avoid negative effects on natural resources associated with undocumented immigrants and Border Patrol activities. The nature and location of impacts from immigration have changed in recent years, with fewer direct impacts to Reserve resources as a result of immigrant traffic. But, immigration to Tijuana from other parts of Mexico, or from other countries, is a serious problem for the Reserve in the form of expanding squatters' villages, all lacking sewage service, on the eroding hillsides of Tijuana Watershed

6. Focusing on the bioregion. Expand research and form connections with others involved in natural resource management, other ecological reserves, and regional preservation agreements.

To expand this program, additional funding is needed to carry out specific projects and to assist with key planning efforts in the watershed. Beyond available funding from the Operating Agencies and from NOAA, possible funding sources to carry out elements of the Watershed Coordination Plan are the EPA, Border 21, Commission on Environmental Cooperation (CEC), Border Environment Cooperation Commission (BECC), Border Patrol, the Port District, California Department of Education, Cal Trans, State Parks Foundation, State Coastal Conservancy, and private foundations.

III. PLAN OF ACTION

Objective 1: Control erosion in Los Laureles communities by installing pervious pavers and planting native vegetation.

Strategies:

- Coordinate with local residents and the City of Tijuana to develop a work plan for erosion control projects in Los Laureles Canyon, including a plan for the large scale production and installation of pavers, and revegetation of bare soil.
- Engage community members and volunteers in the revegetation of bare soil.

Objective 2: Protect the natural functions of the Tijuana River Estuary by stopping the sediment flow from hillsides and canyons located upstream from the estuary.

Strategies:

- Research all possible sediment basin locations.
- Prepare presentation about sediment basin installation along the U.S.-Mexico border.
- Establish relationships with decision-makers at regional agencies, and give presentations about basins to regional agencies and decision-makers.
- Meet with local and regional agencies who may be interested in installing sediment basins.
- Encourage agencies to assign staff and other resources to develop plans for this project.

Objective 3: Promote areas for conservation easements located in Los Sauces, Los Laureles, and Matadero Canyons, all of which drain from Tijuana into the Reserve.

Strategies:

- Arrange meetings and facilitate discussions between landowners, the City of Tijuana, the State of Baja California, and appropriate agencies in the Mexican federal government.
- Engage legal and real property assistance as needed, including the creation of a due diligence checklist that will assist in identifying any potential issues of concern on the properties.

Objective 4: Reduce the number of tires that enter the Reserve and develop a better way to dispose of tires collected in the Reserve.

Strategies:

- Coordinate with local and state entities in both the U.S. and Mexico to secure tire reutilization designs.
- Plan a series of tire reutilization workshops, recruit volunteer trainers, recruit participants, and ensure proper implementation.
- Promote the establishment of a tire recycling plant in the California – Baja California border region.

Objective 5: Reduce the amount of trash that enters the Reserve.

Strategies:

- Coordinate with local and state entities in the U.S. to investigate and develop trash consolidation options at key nodes within the watershed.
- Encourage regional agencies to develop plans for these options.

Objective 6: Provide researchers and community stakeholders on either side of the U.S.-Mexico border a mechanism to evaluate and implement best management practices to reduce risk to human health and the environment.

Strategies:

- Quantify the amount of sediment, slope failure, and flooding that may be traveling from this upstream location to the Tijuana Estuary, located in the U.S.
- Installation and implementation of a weather station and web cameras in the of Los Laureles Community.
- Use of analog weather measurements in each of the sub communities of Los Laureles to involve the community in data collection and understanding of the potential hazards.
- Setup of an emergency evacuation plan with leaders in each community with input from community leaders on the execution of such a plan.

Birdwatching from the front of the Visitor Center, 2009

Family hike near the Visitor Center

CHAPTER TEN: PUBLIC ACCESS, INVOLVEMENT, AND USE PLAN

INTRODUCTION

Fostering an appreciation of the Reserve is dependent upon providing opportunities for the public to experience the estuary. While the primary uses of the Refuge and Reserve are for wildlife habitat conservation, preservation, and research, the Tijuana River National Estuarine Research Reserve provides exceptional opportunities for the public to access and use the estuary for compatible recreational purposes. Coming enhancements to the south end of the Reserve such as a shade structure, picnic areas, and proposed improvements to Monument Road, will further increase access, complement recently completed improvements on the northern end of the Reserve and result in greater visitation. This chapter puts forward a plan that will accommodate this increased visitation, enhance the visitor experience, and foster a sense of stewardship and appreciation for the unique Reserve resources, while providing protection for sensitive habitats and species.

I. POLICIES

A. RESERVE-WIDE POLICIES FOR PUBLIC ACCESS, INVOLVEMENT, AND USE

It is the policy of the Reserve and the constituent landowning agencies to encourage compatible recreation activities, including fishing, wildlife observation, photography, environmental education and interpretation. Some forms of non-wildlife-oriented recreation such as hiking, horseback riding, and beach use are also encouraged wherever they are compatible with the missions and goals of the Reserve and the Refuge.

Fishing is permitted along the beach, in accordance with state regulations. Fishing is not authorized within the tidal channels. Seasonal fishing closures may be enacted for the protection of endangered species. Hunting, shooting, off-road vehicle operation, and overnight camping are not authorized. Dogs, where permitted, must be kept on leashes 6-feet long or less at all times to reduce disturbing wildlife and habitat.

The discussion of land use management policies, included in Chapter 5, provides general guidance for public access. Some areas of the Reserve contain more sensitive resources than others. Where sensitive resources could be adversely affected by human activity, the type and intensity of public use and access, as well as resource management actions, will be limited. In less sensitive areas, activities will be managed to provide for resource protection while ensuring appropriate access and recreational opportunities.

Approved trails within the Reserve as illustrated in the Reserve brochure are shown in Figure 5. All authorized trails will be posted to designate authorized modes of use (equestrian, foot, and/or bicycle).

The Reserve is open to the public from 30 minutes before sunrise to 30 minutes after sundown, except by special authorization from the landowning agencies. Vehicle access to BFSP varies and is dependent on staffing availability and the condition of the entrance road at Yogurt Canyon.

B. NATIONAL WILDLIFE REFUGE SYSTEM PUBLIC USE POLICY

1. General

Public involvement is a guiding principle of NWRS management. This includes providing regular opportunities for the public to comment on refuge management plans and operations.

All secondary uses of a NWR, including public access and recreation, must be compatible with the purposes for which the refuge is established (see Appendix 1).

Partnering and volunteer programs are very important to many aspects of NWR management and have full support of the FWS.

2. Wildlife-Dependent Recreation

Executive Order 12996 and The NWRS Improvement Act of 1997 designated the following six forms of wildlife-dependent recreational activities as priority public uses of the NWRS:

- Hunting
- Fishing
- Wildlife Observation
- Wildlife Photography
- Environmental Education
- Interpretation

The Secretary of Interior has directed FWS to provide expanded opportunities for these priority uses of refuges when they are compatible and consistent with sound principles of fish and wildlife management and are otherwise in the public interest.

At Tijuana Slough NWR, wildlife observation and photography, environmental education, and interpretation have been determined to be compatible uses of the Refuge and are actively promoted by facilities, programs, and this plan.

There have been no known requests or proposals for a Refuge hunting program at Tijuana Slough NWR. There are no big game species in the Refuge; small game and waterfowl are present. However, the entire Refuge is located within the corporate limits of San Diego and Imperial Beach, both of which prohibit the discharge of firearms. Finally, due to potential hunter/recreationist conflicts, the sensitivity of the habitat, and presence of endangered species, the Refuge has not been open to hunting.

Fishing is authorized in the Pacific Ocean on the beach areas adjacent to the Reserve. All fisheries located in the Refuge are located in state tidelands that are operated as part of the NWR under provisions of California State Land Commission Lease No. PRC 5938.9. The lease specifies that public access and use of the beaches and strand between the ocean and estuary will not be unreasonably restricted.

At Tijuana Slough NWR, emphasis is placed on enhancing and expanding compatible opportunities for wildlife observation and photography, and environmental education and interpretation. Public input is encouraged, and the Reserve enters into partnerships with other federal, state, and local agencies and private entities towards conservation and management of the unique estuarine habitat.

II. EXISTING CONDITIONS AND PERCEIVED NEEDS

A. PUBLIC INVOLVEMENT

1. Visitor Center

In 1991, the Tijuana River achieved one of the major goals established in the 1986 Management Plan: constructing a visitor center in the northern section of the Reserve on a FWS easement provided to the California State Parks. The visitor center has contributed greatly to the public's awareness of the Reserve by providing a centralized location where the public can turn for information, education, interpretation, and general involvement with the Reserve. Over the years, numerous public events have taken place in and around the visitor center, and with the recently completed interpretive plaza, this will no doubt increase. By providing a unique space for meetings and gatherings, the visitor center provides a valuable service to Imperial Beach and surrounding communities in San Diego County and Northern Baja California. This adds to the positive image of the Reserve as an asset worthy of protection. A training center (multi-purpose room) with offices next to the existing restrooms was completed in May of 2007.

2. Public Involvement with Management and Decision-Making

Current opportunities for public involvement in management and decision-making at the Reserve include involvement at the committee level of the Advisory Council, public comment during Advisory Council meetings, public comment on a variety of large-scale projects going on at the Reserve, a public meeting during NOAA’s 312 evaluations of the Reserve, and the suggestion box at the Visitor Center. While progress has been made, there continues to be a need to improve understanding and awareness in the local community about the Reserve, its goals, and what it can provide to the public in terms of enjoyment of nature, recreation, education, etc. Responses to this need are listed in the plan of action at the end of this chapter.

3. Cooperating Associations

Two cooperating organizations, both having non-profit 501(c)(3) status, currently serve the Reserve.

Friends of San Diego Wildlife Refuges operates the visitor center bookstore, actively supports all Reserve and Refuge events by contributing time and funding. Additionally, the group monitors Congressional actions that might impact the operation of the Reserve and/or the Refuge System. They are advocates in the community for the work of the Reserve, participate and/or administer various programs, such as "Tern Watchers," grants, and various community partnerships.

The *Southwest Wetlands Interpretive Association* (SWIA) is a non-profit organization dedicated to preservation, restoration, and education in the Tijuana River Valley and its wetlands. SWIA's members support and work with federal and state resource agencies dedicated to the protection, enhancement, and interpretation of wetlands. SWIA's primary objectives are protection of the Reserve, fundraising, and administration of grants for restoration of damaged wetlands, education and revegetation, invasive and exotic species control, and the preservation of threatened resources through land trust acquisitions. SWIA has also taken on a new and increasingly important role as recipient of federal NOAA funding, which it uses to employ several key Reserve staff positions in accordance with 15 CFR 921 that dictate the regulations by which all National Estuarine Research Reserves are operated.

4. Volunteer Program

Volunteers at the Tijuana River NERR extend the staffing capacity of the Reserve's core programs and serve as community ambassadors. They are an invaluable asset because they share their enthusiasm for and knowledge of the Reserve with onsite visitors, family, friends, and the community at large. This enhances public awareness and interest, ultimately securing the future of the Reserve. Reserve staff members strive to offer volunteers a rich and rewarding experience. By cultivating strong relationships with volunteers, the Reserve is able to encourage more community members to contribute their time and talent to help accomplish the Reserve's mission of fostering a sense of stewardship toward and appreciation of its unique resources.

In August 2006, SWIA hired a part-time Volunteer Coordinator to help the Reserve expand, energize, and formalize its volunteer effort. The Volunteer Coordinator has overall responsibility for the Reserve's volunteer program and seeks to offer volunteer support to each of the Reserve's core programs. The program endeavored to establish itself by:

- Producing a volunteer needs assessment;
- Writing duty statements for each volunteer position or function;
- Streamlining the policies and procedures for recruiting, screening, and placing volunteers;
- Determining volunteer recognition procedures and award scales;
- Developing volunteer orientation and training programs, including a comprehensive docent training program;

- Tracking and reporting volunteer hours; and
- Recruiting new volunteers through outreach to schools, non-profits, civic organizations, and businesses in San Diego County.

By establishing and expanding the volunteer program, the Volunteer Coordinator increases the Reserve's involvement and recognition in the community. The TRNERR's Operating Agencies oversee its volunteer program, which draws upon the system-wide volunteer programs of CSP and NWRS. The Reserve has laid the groundwork for a successful volunteer program that offers comprehensive training, support, and recognition to its volunteers. In 2007, the Volunteer Coordinator expanded to a full-time position. In 2008, the Reserve and SWIA obtain a grant from the USEPA that provided 3 years of funding for the Volunteer Coordinator and the position's title was revised to Community Outreach Coordinator to reflect the increased breadth of the position's responsibilities. . Currently, the Volunteer Coordinator recruits volunteers for the positions described in Table 5.

TABLE 5: Volunteer Opportunities at Tijuana River NERR

Job Title	Purpose
Administrative Volunteer	Contribute to the smooth operation of the Reserve's office by offering general administrative support to staff as needed.
Beach Cleanup Volunteer	Improve the quality of the ocean and shoreline by disposing of trash found on the beaches of the Reserve.
Bilingual Docent	Promote and interpret the natural history and environment of the Reserve to visitors in order to encourage exploration and preservation of coastal resources. Lead tours when Spanish speakers visit the Reserve.
Bird Monitoring Volunteer	Estimate marsh bird population trends at the Reserve in order to inform bird population and habitat management strategies.
Docent	Promote and interpret the natural history and environment of the Reserve to visitors in order to encourage exploration and preservation of coastal resources.
Field & Lab Research Volunteer	Contribute to the research conducted at the Reserve in an effort to improve scientific knowledge of estuarine habitat and inform habitat management strategies.
Graffiti & Litter Removal Volunteer	Enhance the visitor experience and improve habitat by removing graffiti and litter from the Reserve.
Habitat Restoration Volunteer	Help restore biological diversity and ecological function at the Reserve.
Mounted Assistance Unit Volunteer	Supplement regular ranger coverage of the Reserve (including Border Field State Park); assist staff by patrolling areas that are easily accessible by horseback and reporting observations and interactions with the public.

Job Title	Purpose
Nursery Volunteer	Produce quality local native plant stock for the Reserve's watershed restoration efforts.
Photography & Videography Volunteer	Educate the public on issues and activities concerning the Tijuana River Watershed by documenting the activities, projects, and special events of the Reserve through photographs and video.
Plant Atlas Volunteer	Improve scientific knowledge and documentation of the flora of Reserve.
Plover Patrol / Tern Watcher Volunteer	Protect and preserve the habitat of the western snowy plover and California least tern by educating Reserve visitors about the importance of following regulations that have been implemented to protect these endangered birds.
Radio Program Volunteer	Educate the public on issues and activities concerning the Tijuana River Watershed and coastal area through the 102.5 FM Mexican public radio program, "Oceans without Borders," which broadcasts throughout San Diego County and Northern Baja California.
Spanish Translator	Ensure that educational materials, informational materials, and presentations at the Reserve are accessible and understandable to Spanish speaking visitors.
Special Event Volunteer	Improve outreach to and communication with coastal decision-makers, educators, and other members of the community by helping to coordinate and run special events for the Reserve.
Trail Maintenance Volunteer	Ensure the safe use, enjoyment, and long-term success of Tijuana River National Estuarine Research Reserve's trails by performing routine maintenance and stewardship of the trails.
Visitor Center Gardener	Help restore biological diversity and habitat at the Reserve by establishing, restoring, and maintaining the native plant gardens surrounding the Tijuana Estuary Visitor Center.
Watershed Outreach Volunteer	Ensure that coastal decision-makers in both the U.S. and Mexico have the knowledge and tools they need to address critical resource management issues by helping to conduct outreach to sectors of the community in the U.S. and Mexico who have an impact on the Tijuana River Watershed.
Youth Education Docent	Encourage youth participation and inquiry at the Tijuana River National Estuarine Research Reserve by assisting in and conducting interpretive activities for school groups and young visitors.

REI Planting Project 2007

Cactus Salvage in advance of construction of Border Infrastructure System, 2008

Cactus Salvage

REI planting day atop Monument Mesa, 2006

B. PUBLIC PERCEPTIONS AND PUBLIC ACCESS

Visitors to the Reserve are also important and valued components of the NERR/NWR. The Reserve recognizes the need to address the compatibility of public uses to serve the broad range of interests of those visiting the Reserve.

With the construction of the visitor center, the Reserve made great strides towards its established goal of creating a northern public entrance that is welcoming and inviting. Despite this accomplishment and the visitor center improvements that have followed, there is a need to strengthen the Reserve's identity for visitors and the general public both locally and regionally. While those familiar with the Reserve realize its unique value, years of sewage contamination, flooding, dumping, unchecked immigration, crime, and other negative impacts have tarnished the reputation of the Tijuana Estuary in the eyes of many outsiders. Significant strides have been made in recent years to correct these longstanding issues, including the South Bay International Wastewater Treatment Plant, canyon sediment and trash collector basins, Operation Gatekeeper (started in 1994), as well as the improvements to Monument Road and BFSP access. NERR/NWR conditions for visitors are markedly enhanced and continue to improve, but there is still work to be done in fostering a sense of understanding, appreciation, and stewardship for this island of estuarine wilderness surrounded by urbanization to the north, south, and east. The Plan of Action section discusses how the Reserve will address public perception issues.

As access improves and residents of the fast-growing cities of South San Diego County seek recreational and nature experiences nearby, visitation will undoubtedly increase. The Reserve needs to plan for this increase, especially as it will impact the facilities and natural resources of Border Field State Park and surrounding lands south of the Tijuana River. Signage, trail coordination and maintenance, communication with equestrians and stables, coordination with Border Patrol, interpretive elements, and user facilities are in need of improvement, replacement, or expansion to accommodate the anticipated influx of new users. The Reserve also recognizes that, more visitation portends greater potential impacts to endangered species, hence careful attention will be required to ensure that all existing and proposed recreational use, particularly on the Refuge, are compatible with resource protection.

C. PUBLIC USE

1. Types of Public Use

The majority of public use at Tijuana River NERR takes place on Refuge lands and the beaches of Border Field State Park. Visitation and use of the site has increased steadily since the construction of the visitor center and the expansion of Reserve programs. See Chapter 7, Table 4, for a list of TRNERR visitation numbers from 2005-2008.

2. Use of Hiking Trails System

Authorized hiking trails are depicted in Figure 5. Hiking trails on Tijuana Slough NWR north of the Tijuana River are well marked, well maintained, and frequently used by the public for wildlife observation due to the proximity of these routes to the visitor center. These trails include the McCoy Trail, the 5th and Iris Trail, and the Oneonta PERL Trail from Seacoast Drive past the visitor center to Grove Street. The 5th and Iris trail is also posted for equestrian and bicycle use.

These trails are a valuable tool for reaching the public, and, with proper signage, they provide additional opportunities for interpretation and wildlife observation. While these trails are generally well maintained and marked, sign maintenance and replacement is needed on a regular basis.

Dogs are permitted in only three areas of the Reserve and must remain under control on a leash 6-foot or less at all times. Dogs on leashes are permitted (1) along the beach north of the Tijuana River mouth on the west side of the dunes, (2) on the marked 5th and Iris trail in the Refuge, and (3) in the parking/picnic area on Monument mesa within Border Field State Park.

Border Patrol activities south of the river mouth have significantly expanded the network of trails and roads but not necessarily made them more user-friendly to the visitor. With the completion of the Border Infrastructure System (fenced corridor) the Border Patrol has, by its own admission, a decreased need for the current network of patrol trails.

3. Use of Equestrian Trails System

Horseback riding has a long history in the Tijuana River Valley. The beaches south of the Tijuana River mouth to the Mexican border are one of the few places in Southern California where the public can ride next to the Pacific Ocean. Some members of the equestrian community have demonstrated a commitment to the Reserve through active participation in many volunteer and community-action programs. The Operating Agencies view horseback riding as a key part of the Reserve's public-use program that is important and should be maintained as a cultural and recreational experience..

Authorized equestrian trails listed in the Reserve’s current brochure are depicted in Figure 5. Horseback riding in the Reserve is restricted to designated trails. Dogs are not allowed on equestrian trails. In many cases, trails used by equestrians are maintained by organized equestrian groups and individual users. Many trails are deliberately kept narrow and primitive, both to satisfy users' preferences and to minimize habitat disturbance.

Because many equestrian trails are located in the floodplain of a braided river, trails are subject to flooding and subsequent damage by siltation and erosion. Following floods, Reserve staff will consult with user groups to determine if former trails should be rehabilitated or relocated. Major trail rehabilitation or relocation requires consultation with the FWS Division of Ecological Services to ensure compliance with the Endangered Species

Act, as some trails wind through designated critical habitat for least Bell's vireo, a federally-listed species.

Equestrian users recognize that these beaches also provide significant breeding habitat for the endangered California least tern and both breeding and wintering habitat for the threatened western snowy plover. Plover and tern chicks are not confined to the nesting site after hatching and my stray below the high tide line. Plover chicks in particular require undisturbed access to foraging sites. The beach wrack line is a primary foraging site for the plover as they feed on flies and crustaceans associated with kelp and other marine debris. Both plover and tern chicks will either run away or freeze in place as a response to disturbance. This behavior makes them susceptible to being stepped on by pedestrians, horses, or run over by off-road vehicles – either of which constitutes a 'take' violation under the Endangered Species Act (ESA). During the tern and plover breeding season, horses must travel below the mean high tide line, close to the edge of the surf, to minimize the possibility of an endangered species take occurrence (which, under the ESA, includes harassing, harming, wounding, or killing an endangered animal). Depending on annual distribution of tern nests, temporary closure of some trails may be necessary in order to avoid "take" of endangered species. The Operating Agencies are required by federal law to protect endangered species. Where trails must be closed to protect endangered species, every effort will be made to provide alternative public trails for hikers and equestrians.

Balancing endangered species protection with public recreation is a critical and challenging function of Reserve management. If endangered species distribution requires closures of public access trails, such as the trail extending west off Monument Road, alternative route signs directing equestrians to trails further south must be posted at the same time trail closure signs are posted. The Operating Agencies will call regular meetings of the Trails Committee from March through September of each year, as needed, to keep the trail-using public informed of the progress of the tern nesting season. In the event that endangered species distribution requires temporary closure of a trail, the Reserve or Refuge Manager will immediately notify the public via signs and press releases. The Operating Agencies will call an immediate meeting of the Trails Committee to discuss the closure.

The Volunteer Mounted Assistance Unit (MAU) is a group of active equestrians that assists with trail maintenance, provides first responder assistance in emergencies, including first aid, maintains radio communication capabilities, and reports violations and incidents to law enforcement personnel, including the Border Patrol. The MAU also provides a valuable public information and education service by informing visitors of Reserve regulations. MAU members coordinate regularly with law enforcement rangers of the CSP and FWS to inform the Operating Agencies of trail conditions, violations, and maintenance needs.

4. Bicycle Use at TRNERR

All roads in Border Field State Park accessible to motorized vehicles are also open to bicycle traffic, unless otherwise marked. In Tijuana Slough NWR, bicycles are allowed on the 5th and Iris multi-use trail that provides access to the estuary and a viewpoint of the river mouth, dunes, and excellent bird-watching locations.

Bicycles are not allowed on existing foot/equestrian trails in the riparian habitat areas of the NWR. The Operating Agencies will work with San Diego County Regional Park authorities to provide appropriate connectivity of trail systems, and access to the coast, in the State Park portion of the Reserve.

5. Public Use Needs

a. Hiking Trail Needs

In the northern end of the Reserve, an improved trail is needed along the eastern boundary between Grove Street and the 5th & Iris trailhead kiosk.

Also in the northern end of the Reserve, a trail connection is needed from the Visitor Center to the border. River and wetland flow patterns may dictate that some of this future alignment will need to be designated outside of the Reserve and even through urban areas. This corridor would be an important contribution to the City of Imperial Beach's efforts to enhance eco-tourism. In addition, this connection would become an important contribution to the ongoing efforts to establish a California Coastal Trail

In the southern end of the Reserve, many improvements are needed. As mentioned, major access improvements have been made, and this will necessitate the enhancement of other visitor facilities, such as well-marked trailheads, parking areas, and improved directional and interpretive signage. While there are occasional hikers on trails in the southern end and the Reserve is nearing completion of an improved directional signage system for its current trails, incorporation of interpretive and cultural resource elements as well as establishing a linkage between trails in the northern and southern ends of the Reserve should be investigated as part of a larger visitor accommodation plan.

As with the MAU there is a need to continue to expand the pool of volunteers to maintain hiking trails, especially in the southern part of the Reserve.

b. Equestrian Use Needs

To continue adequate access, enhance enjoyment of equestrian use in the Reserve, and meet resources protection goals, the following actions regarding equestrian trails are needed:

1. The Operating Agencies, landowning agencies, the Tijuana River Valley Equestrian Association, and the Mounted Assistance Unit may need to revise the current memorandum of understanding (MOU) relating to trail routing, maintenance, and use (see Appendix 7).

2. An improved trail linkage from the area of Border Patrol headquarters to the west end of Sunset Avenue is needed and should be designated, in a manner that is compatible with the protection of endangered species.

3. Existing river crossings need to be evaluated and improved (or eliminated) so that they provide safe passage.
4. Wetland restoration projects in the southern end of the Reserve should integrate trail and access needs in their engineering plans, as appropriate and where feasible.

5. Corral and latrine facilities in Border Field State Park need to be upgraded.

6. Proposals for any new recreation uses of the Reserve (e.g., mountain biking) must be carefully analyzed to ensure they are compatible with agency mandates, resource protection, and with existing authorized uses such as hiking and horseback riding.

7. The Operating Agencies and San Diego County Parks need to negotiate a Special Use Permit system for any commercial operators to ensure protection of natural and historic resources and to minimize conflicts with other users.

8. The Operating Agencies should organize a training program for any business owners and their guides to orient them to the purpose, rules, and regulations of the Reserve.

III. PUBLIC ACCESS, INVOLVEMENT, AND USE PLAN OF ACTION

Objective 1. Encourage public involvement in Reserve governance and management.

Strategies:

- Continue to encourage public participation in Advisory Council meetings and committees.
- Continue to expand outreach to Mexican officials, organizations, and individuals regarding TRNERR events and programs.
- Ensure that meeting notices and minutes are circulated to the appointing bodies of the Advisory Council members and staff of all elected officials representing portions of the Research Reserve.
- Continue to distribute a periodic Reserve newsletter and keep Tijuana Estuary website updated with current information and programs
- Schedule open houses at the Reserve where questions and concerns from the community can be raised so that these can be discussed with Advisory Council members and Reserve staff.
- Biannually convene evening meetings (one in the spring, and one in the fall) of the Advisory Council where at least one full hour is allocated for public comment.
- Continue the Trails Committee. This Committee should meet at least quarterly to encourage the participation of local business owners with equestrian interests.
- Continue to grow the volunteer program to provide collateral benefits such as increased community awareness (and support for) the Reserve.

Objective 2: Expand and Provide opportunities for volunteer activities in educational, research assistance, recreational, and cultural programs at the Reserve.

Strategies:

- Continue to develop the newly created volunteer/community outreach coordinator position to administer an effective volunteer program; seek sustainable, permanent full-time funding.
- Create work teams among volunteer and agency staff that enable volunteers to participate in day-to-day operations of the Reserve.
- Expand opportunities for volunteers to conduct activities for the public (e.g., school group nature walks).
- Develop an on-going, on-the-ground, service learning component for volunteers and for students, so that volunteer education and outreach programs become an integral part of habitat restoration, conservation, and management of the Reserve.

Objective 3. Improve public access and public use experiences across the entire Reserve to the extent compatible with resource protection that inspire among diverse audiences an enhanced appreciation for and ownership of the unique resources at the Reserve.

Strategies:

- **Improve Park Access:** Complete the elevation of Monument Road. This action must also incorporate creation of a bridge/causeway and a tidal channel or some mechanism to allow positive drainage to the ocean. Incorporate equestrian uses and general trail safety concerns in the completed design.
- **Enhance and Increase Signage:** Install improved signage and add interpretive signage to (1) clarify Reserve boundaries and access points, (2) to explain habitat, restoration activities and cultural history, (3) to provide protection for sensitive habitats and species, and (4) to direct visitors to the Reserve via Routes 3 and 75. Work with all parties, to include the City of San Diego and County of San Diego in the development of a Tijuana Valley-wide standardized signage system.
- **Maintain and Upgrade Facilities:** Provide basic day-use equestrian facilities at the base of Monument Mesa. Continue to upgrade visitor interpretive, recreational, and wildlife-viewing facilities at upper BFSP, as needed, and provide regular maintenance and patrols.
- **Assess, Rehabilitate, and Enhance Trails:** Establish recreational guidelines for low-impact use of the Reserve. Review potential impacts of proposed new trail uses to ensure they are compatible with resource protection, and with existing authorized uses. Work with Border Patrol to minimize negative impacts to trails and to trail-use experience. Provide interpretive experiences for trail users. Conduct a Reserve-wide review of existing trails, focusing on location, linkages, resource protection, and public safety. Rehabilitate existing

- **Continue to Plan and Host Events:** Continue to develop community outreach programs such as guided walks, films, talks, and equestrian activities. Continue Reserve-sponsored equestrian activities such as trail maintenance projects, Adopt-a-Trail Programs, and guided (birding) rides. Provide for communication and coordination among all relevant agencies when an outside organization proposes an event on Reserve lands.
- **Continue Collaboration with Equestrians:** Continue regular meetings and interaction with equestrians to ensure that they are fully informed of Reserve regulations. Involve regular equestrian trail users in volunteer activities such as trail maintenance and assistance with posting and monitoring of tern colonies. Prepare an educational flyer summarizing relevant Reserve regulations (e.g., leash laws, avoiding sensitive habitats) for distribution to visiting and local equestrians. This flyer would be paired with a map and distributed at trailheads. Conduct workshops to promote resource sensitive trail use and address topics such as the "Leave No Trace" program.

Objective 4. Emphasize and expand opportunities for wildlife-dependent recreational uses, particularly observation and photography. (Refuge Objective)

Strategies:

- Promote programs such as ecotourism visits by intercession/school groups and the Imperial Beach Bird Fest.
- Develop at least one accessible wildlife observation/photography blind in NWR.

Equestrian use at Border Field State Park, along the beach trail looking east toward Spooner's Mesa.

Southern half of the Reserve (Border Field State Park), looking north from Monument Mesa.

Northern half of the Reserve (Tijuana Slough National Wildlife Refuge), looking south toward the hills of Mexico in the distance.

CHAPTER ELEVEN: FACILITIES PLAN—BUILDINGS, TRAILS, AND ROADS

INTRODUCTION

The other sections of this document introduce the Reserve-wide programs. These programs are designed to protect and manage the Tijuana River NERR resources, to enhance research and monitoring of the resources, to educate the public on resource values, to assist in wetland and watershed preservation in the bioregion, and to share the Reserve resources with the public. This chapter identifies the physical structures intended to advance the goals of those programs.

In the south end of the Reserve, significant large-scale projects for facilities enhancement have been underway. Most notably, these efforts include the Goat Canyon Enhancement Project, comprised of elements that include stormwater and sediment management basins, habitat restoration, and improved public access via the reconstructed and partially elevated entry road (Monument Road). State Parks continues to upgrade visitor facilities at Monument Mesa, including a new group picnic area and landscaping at the top of the mesa as well as new bathrooms and parking lot/picnic area improvements at the base of the mesa. A new entry kiosk at the border of the Reserve on Monument Road has also been constructed.

On the north end of the Reserve, an outdoor interpretive amphitheater has been added to the visitor center and a 2000-square-foot multi-purpose room addition with added office space was completed in May 2007. In addition, a 1400-square-foot office structure next to the garage was also installed in May 2007. Taken together, these facilities and those planned for in the future are tools by which the Reserve can accomplish its mission, carry out it overall goals, and provide excellence in its various program areas.

I. POLICIES

A. GENERAL POLICIES FOR FACILITY DESIGN AND CONSTRUCTION

The Reserve will identify future needs and seek funding for facilities that would serve to significantly enhance Reserve programs with a minimum impact to native flora and fauna. Facilities are constructed and operated to support the Tijuana River NERR programs and achieve the Reserve's goals. Accordingly, Tijuana River NERR is guided by the following principles in facility development.

1. Policies applicable to all Tijuana River NERR construction

- All construction activities on Refuge lands will first be determined to be appropriate and compatible in accordance with Operating Agencies' mandates.
- Facilities and access routes will minimize visual impact or view obstruction both within and beyond the Reserve's administrative boundaries.

- Facilities will be designed and located to support multiple Reserve goals, whenever appropriate.
- Facility siting will consider impacts from increased site use, including transportation, parking, stormwater, wastewater, and sewage disposal.
- Construction techniques shall be adapted for minimal environmental impact in recognition that the Reserve maintains habitat for threatened and endangered species.
- To the greatest possible extent, construction will minimize run-off, soil erosion, and compaction.
- Site facilities will encourage pedestrian access.
- The public will be encouraged to participate in the planning of new facilities.

2. Policies for Reserve trails

- Interpretive trails will be designed to accommodate both educational groups and individual visitors.
- Trail construction and maintenance will make use of the best available technical information and adopt techniques for minimal environmental impact.
- Trail construction crews will receive instruction in ecologically appropriate trail construction techniques.
- Trail design will anticipate and discourage "short cuts", or other off-trail excursions.
- In developing new trails, decisions regarding location will take into consideration the valley-wide trail system now being developed in partnership with other Valley landowners

II. EXISTING CONDITIONS, CURRENT PROJECTS, AND NEEDS

A. BUILDINGS

1. Tijuana Estuary Visitor Center

The visitor center, located along the northern border of the Reserve, is strongly associated with the Reserve's public identity and is frequently used by school groups. The visitor center is used by both CSP and FWS staff members.

The visitor center houses a large public area for interpretive exhibits, a reception desk with a small bookstore, an audio-visual room, a classroom, a small library, public restrooms, and staff office space. The audio-visual room is designed for formal presentations and is also frequently used as a community meeting room. The large classroom/lab is used for Geographic Information System mapping projects and water quality monitoring program. The entire public area is fully accessible.

Staff members work in three areas: a shared common area within the main visitor center building, a stand-alone building known as the "block house" near the main visitor center and office/lab/garage space in an outlying building to the south of the visitor center parking lot. The staff area in the main visitor center consists of three offices and a staff common area.

Oneonta Slough with the Tijuana Estuary Visitor Center. This 2 acre restoration of a tidal linkage was completed in 1995.

Operations Building (Garage, Lab and 2007 Operations Building) Note rooftop sustainable design features: Solar Tubes for daylight office lighting and Solar Panels for energy generation.

Amphitheater at the Visitor Center (prior to 2007 shade structure).

Evidence of the need for additional research work space (2006) prior to the construction of the 2007 Operations Building and Dry Lab.

New 2007 Training Center. The courtyard is used for special events. The larger building can hold up to 100 people for a lecture and the offices are used by the Coastal Training Program.

Training Center conference room during the 2007 25th Birthday Party for the Reserve.

A shade structure added in 2007 expanded the usability of the amphitheater

2. Storage Facilities

A garage for storage of vehicles and landscaping equipment is located across the parking lot from the visitor center. In the original design, part of this building was designated for use as a small research laboratory. That laboratory as well as three additional offices and a common work area were built in recent years as an add-on to the garage. The office spaces currently house Reserve maintenance and law enforcement staff, as well as Reserve biological and information technology staff.

3. Other Buildings

One restroom building currently exists atop Monument Mesa. In addition, a restroom has recently been constructed at the base of Monument Mesa.

4. Implementation of Facilities Improvements--Buildings

During the last planning period, the most significant building construction or acquisition identified was for additional office space and a classroom/community room. This need was met by the construction of the new multi-purposed room (training center) completed in May 2007.

Also in this last planning period, a variety of facilities improvements were planned, and to date, they have all been accomplished. These include: a remodeled visitor center; additional office space (added to garage); improvements at BFSP; a small research lab attached to the garage; and an interpretive plaza, constructed just outside the visitor center.

B. TRAIL MAINTENANCE AND CONSTRUCTION

1. Existing Trails

The trail system at Tijuana River NERR serves the following functions:

- Provides the public an opportunity to experience the Reserve;
- Supports the Stewardship Program by controlling pedestrian and equestrian access within the Reserve to minimize visitor impacts on sensitive resources; and
- Provides access for research and educational activities.

Since 1983, volunteer labor from California Conservation Corps, Youth Conservation Corps, scouting groups, Southwest Wetlands Interpretive Association (SWIA), and others have built about four miles of trail. Tijuana River Valley Equestrian Association has contributes to their maintenance. The Tijuana River trail surfaces are predominantly earthen. The locations of all Reserve trails are shown in Figure 8.

Trails within the boundaries of the Tijuana Slough NWR are designated primarily for pedestrian use and are maintained cooperatively by both Operating Agencies. All other trails

within the Reserve are designated for mixed use.
Both pedestrian and mixed-use trails may be closed during times important to the protection of endangered species and their habitats. These closures are coordinated and enforced by the Operating Agencies. For more description on the public use of the trails, please refer to Chapter 8.

2. Trail Needs

The equestrian community has recommended several improvements regarding access and signage. The Operating Agencies and equestrian community meet periodically to assess potential realignments, improvements and closing of unauthorized equestrian trails (See MAU, Chapter 8).

C. ROADS, PARKING, AND OTHER INFRASTRUCTURE

1. Existing Roads and Parking

Two main roads provide access to the Reserve -- Caspian Way, which leads to the Visitor Center, and Monument Road, which offers access to Border Field State Park. Emergency vehicles also use the 5th & Iris trails and several other trails in the southern end of the Reserve.

In the areas of the Reserve near the U.S.-Mexico border, U.S. Border Patrol activity has resulted in some new roads and trails being established and widening of many existing trails. These roads and trails have caused erosion and deterioration of habitat. Operating Agencies are now working with U.S. Border Patrol to ensure that road-building techniques minimize potential impacts to habitat. Road placement, the use of erosion control measures, and seasonal factors are all considerations that help limit the damage caused by building roads.

2. Needs for Roads and Parking

The major road improvement at the Reserve that has been many years in the making is the reconstruction of Monument Road and accompanying sediment retention basins. Beginning in the Fall of 2003, CSP led the construction portion of the large-scale Goat Canyon Enhancement Project, consisting of 2 sediment retention basins in series within the upper floodplain of Goat Canyon, a new asphalt overlay and newly elevated sections of Monument Road, 3 on-site mitigation areas, a new entrance kiosk, a visual berm and a processing pad for reclaimed sediment. Construction costs were over $5 million, with funding provided by the Coastal Conservancy, California State Parks, the Wildlife Conservation Board and NOAA. The project was initially designed for a 100-year flood event but, due to rapid, dramatic, and unforeseen degradation of the upper watershed in Mexico, the basins completely filled with sediment deposited by only a few, albeit very large, storms in the winter of 2005. The basins have provided valuable protection for the estuary from sedimentation caused by storm flows but, due to the degraded state of the upper the upper watershed in Mexico, the basins require annual cleaning to maintain and the need to fund a yearly contract for removal.

While accessibility to BFSP is greatly improved due to the new road, and sedimentation risk to marsh habitats has been reduced by the basins, these facilities, by nature of their location at the terminus of an extremely urbanized and erodible sub-watershed, will require constant maintenance if they are to do their jobs. A secure source of funding for this purpose is needed, as is ongoing upstream work in Cañon de los Laureles in Mexico (see Chapter 10).

To date, Monument Road is only partially elevated, a ¾ mile portion of the entrance road was not allowed to be raised by regulatory agencies during project implementation. As a result of the substantial storms in winter of 2005, approximately 18 acres of salt marsh was smothered by sediment-laden stormwater which broke through this lower portion of the road. The magnitude of these storms deposited so much sediment, particularly from Yogurt/Los Sauces Canyon, that the lower portion of Monument road is now the lowest elevation in the vicinity and consequently even small amounts of rainfall or pipe leakage in Mexico cause the road to flood, closing down Monument Mesa to vehicle access for extended periods of time. Until this final section of entrance road is raised with positive drainage out toward the river mouth, Border Field State Park and Monument Mesa will continue to experience uncertain public vehicular access.

3. Border Infrastructure System

The U.S. Department of Homeland Security (DHS) has completed and now implements a Congressionally mandated fence corridor parallel to the existing fence known as the Border Infrastructure System. The Reserve continues to work with DHS to assure that the project is implemented in the most environmentally sensitive manner as possible.

III. FACILITIES PLAN OF ACTION

Objective 1: Provide and maintain trails throughout the Reserve that accommodate uses compatible with the goals of conserving the natural resources of the Reserve, while also increasing the public's awareness of the need to protect these resources.

Strategies:

- Coordinate trail closures for protection of special-status species or their habitat.
- Publicize trail closures and share enforcement responsibilities.
- Install improved signage and add interpretive signage to clarify Reserve boundaries and access points, to explain habitat, restoration activities and cultural history, to provide protection for sensitive habitats and species., and to direct visitors to the Reserve via Interstate 5 and Highway 75. In addition, the Reserve and neighboring agencies should work together to implement a sign program that would notify drivers that they are entering "the Watershed for the Tijuana Estuary." Work with all parties, to include the City of San Diego and County of San Diego to develop a Tijuana Valley-wide system of standardized signage.

- Operating Agencies and the Advisory Council will review public proposals for new trails and meet with the equestrian community to assess the potential realignment of equestrian trails.
- Provide hiking trails at the north end of the Reserve that maximize, to the extent possible, accessibility for all potential visitors.

Objective 2: On existing roads, maintain appropriate vehicular access with minimum ecological impact. Provide adequate parking for trail access and visitor use. Avoid the creation of new roads.

Strategies:

- Work with U.S. Border Patrol to minimize road-building impacts and decommission roads whenever possible. With the completion of the Border Infrastructure System (spring 2009), the Border Patrol is expecting to reduce their "footprint" of patrol activities within the entire river valley. The Reserve management will take full advantage of that expectation to reverse the impacts of extensive Border Patrol use within the Reserve.
- Assess all vehicular roads in the Reserve and designate roads to be maintained, improved, or retired.

Objective 3: Complete improvements to Goat Canyon and Monument Road to provide accessibility throughout the year to BFSP and to enhance the visitor experience. Seek reliable funding source for long-term maintenance of basins and road.

Objective 4: Explore linkages with the Tijuana River Valley Regional Park trails system. San Diego County Parks has received approval from their Board of Supervisors on a new trail plan for the valley. Reserve staff will continue to coordinate trail linkages with the County's trail plan.

FIGURE 1. REGIONAL SETTING OF TRNERR

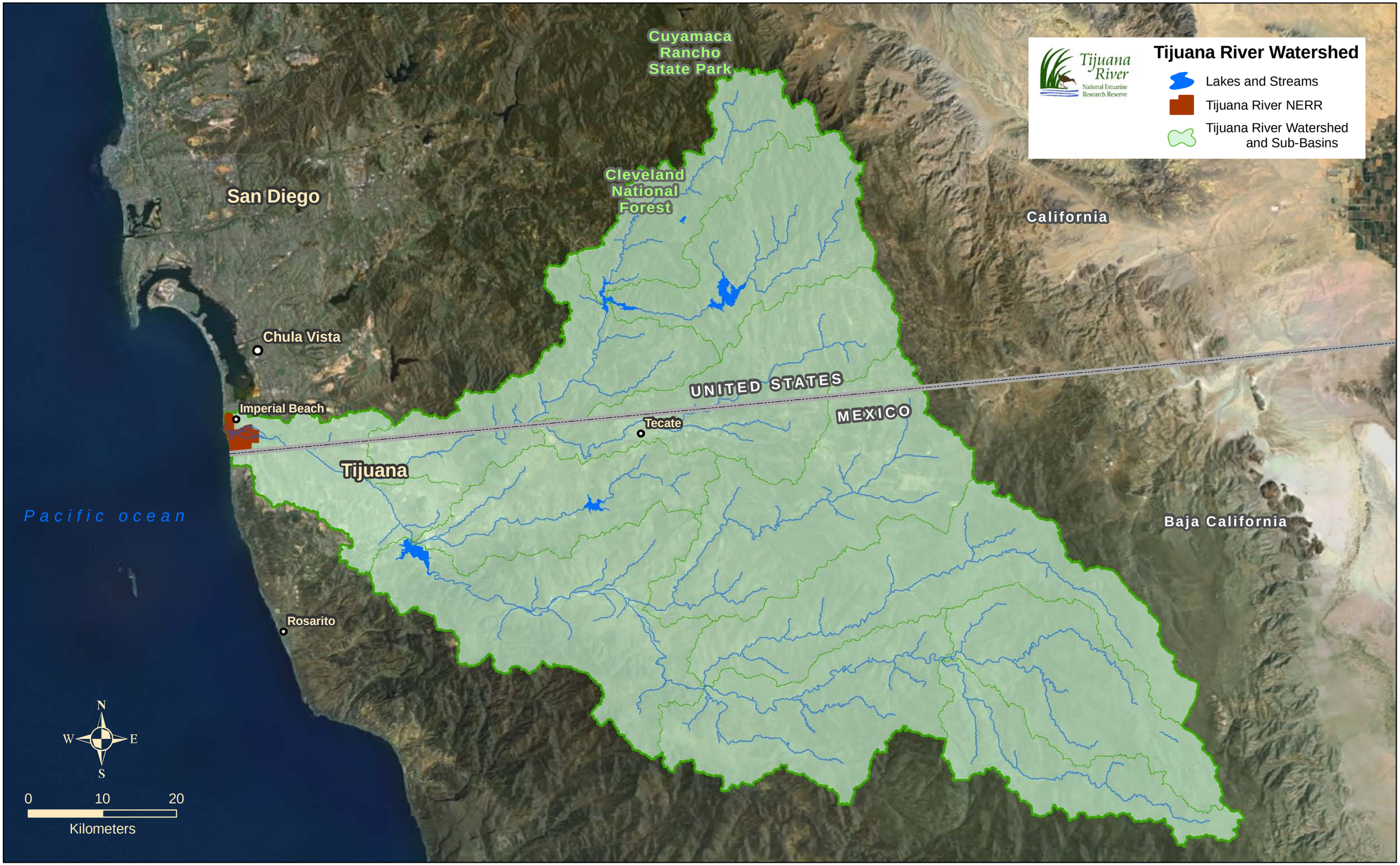


FIGURE 2. THE TIJUANA RIVER WATERSHED

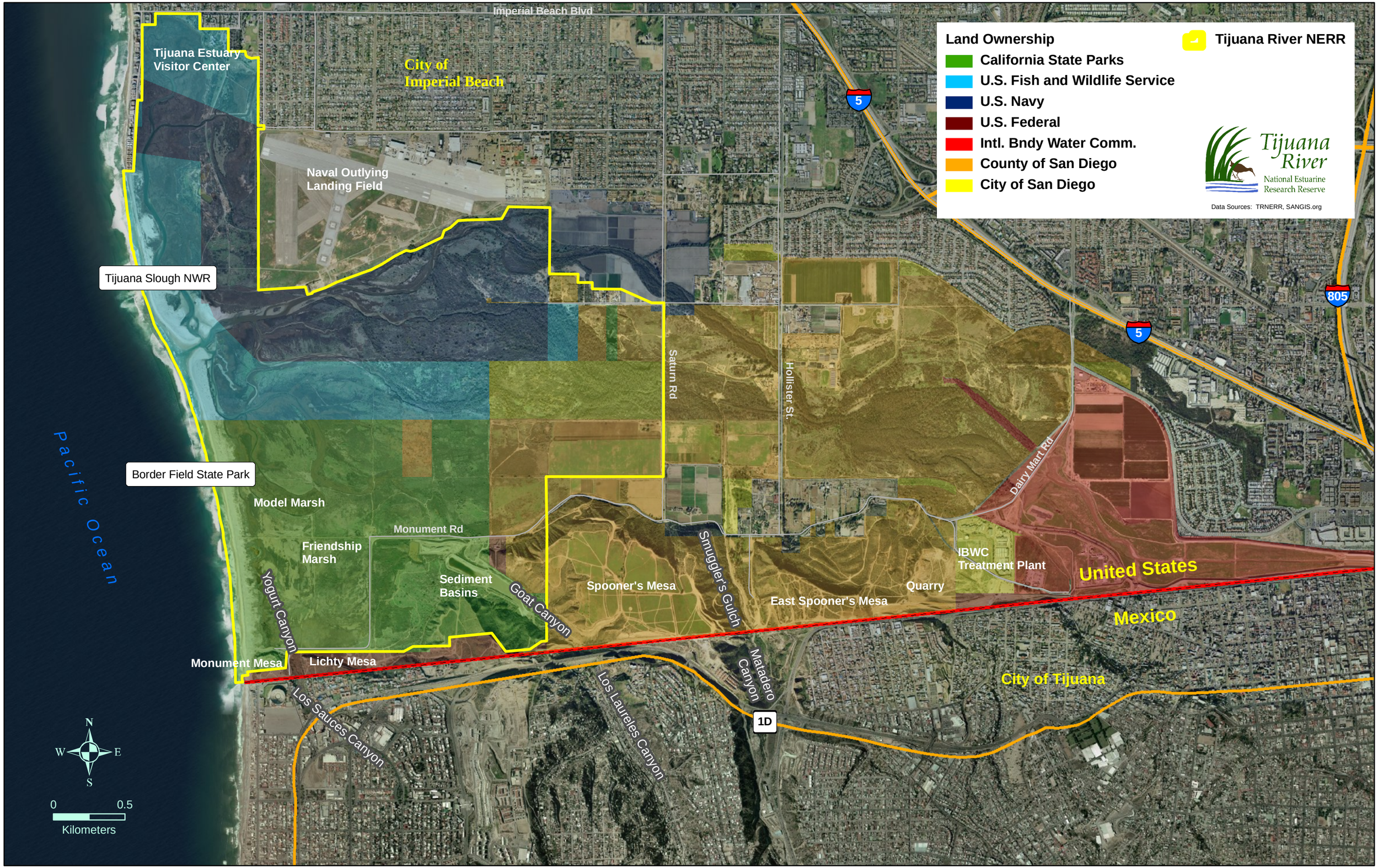
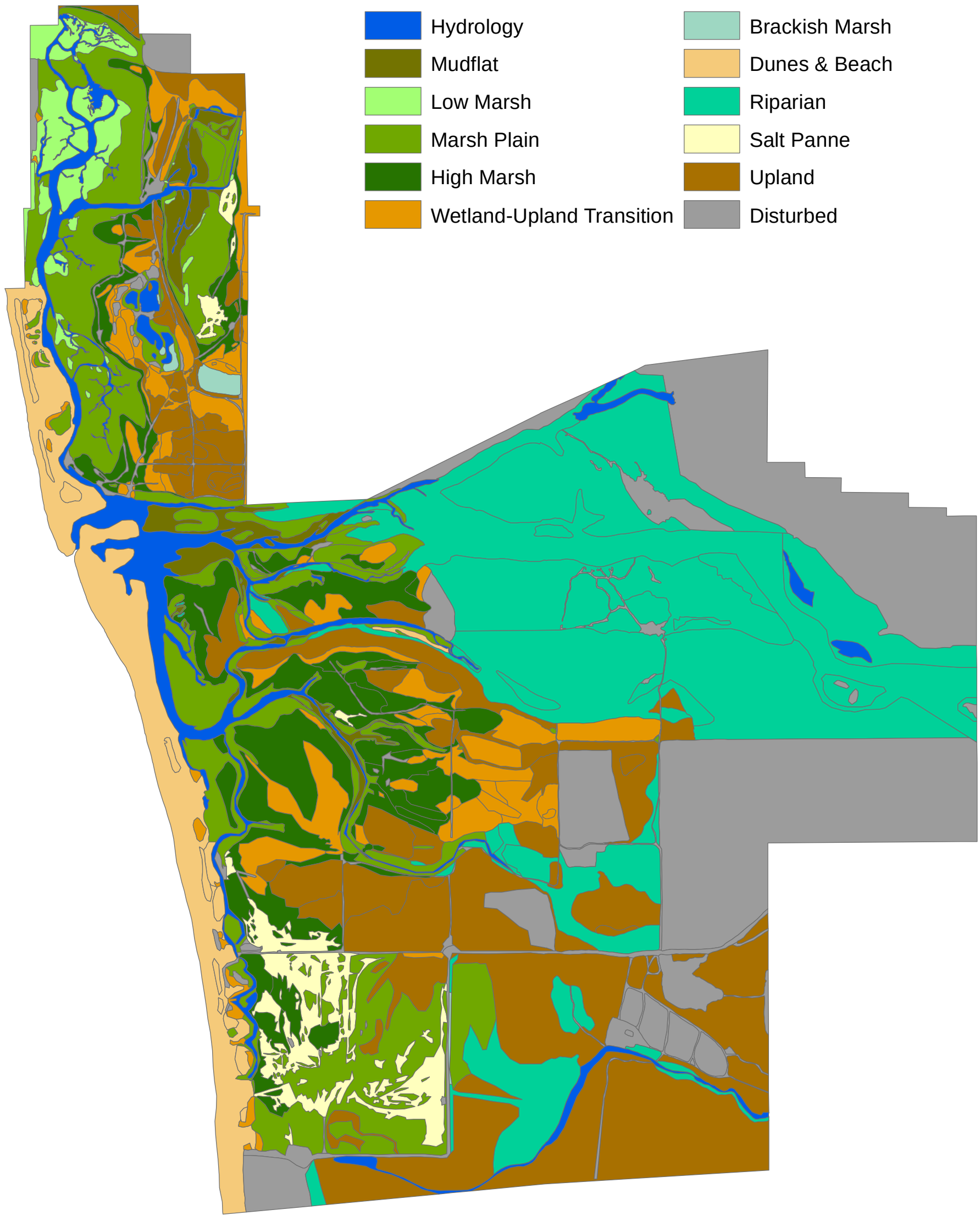


FIGURE 3. RESERVE BOUNDARY AND TIJUANA RIVER VALLEY OWNERSHIP

Tijuana River NERR
Vegetation Base Map (1986)

General Vegetation Categories

- Hydrology
- Mudflat
- Low Marsh
- Marsh Plain
- High Marsh
- Wetland-Upland Transition
- Brackish Marsh
- Dunes & Beach
- Riparian
- Salt Panne
- Upland
- Disturbed



N
W E
S

0 0.25 0.5
Kilometers

Tijuana River
National Estuarine
Research Reserve

FIGURE 4. Vegetation Base Map (1986)

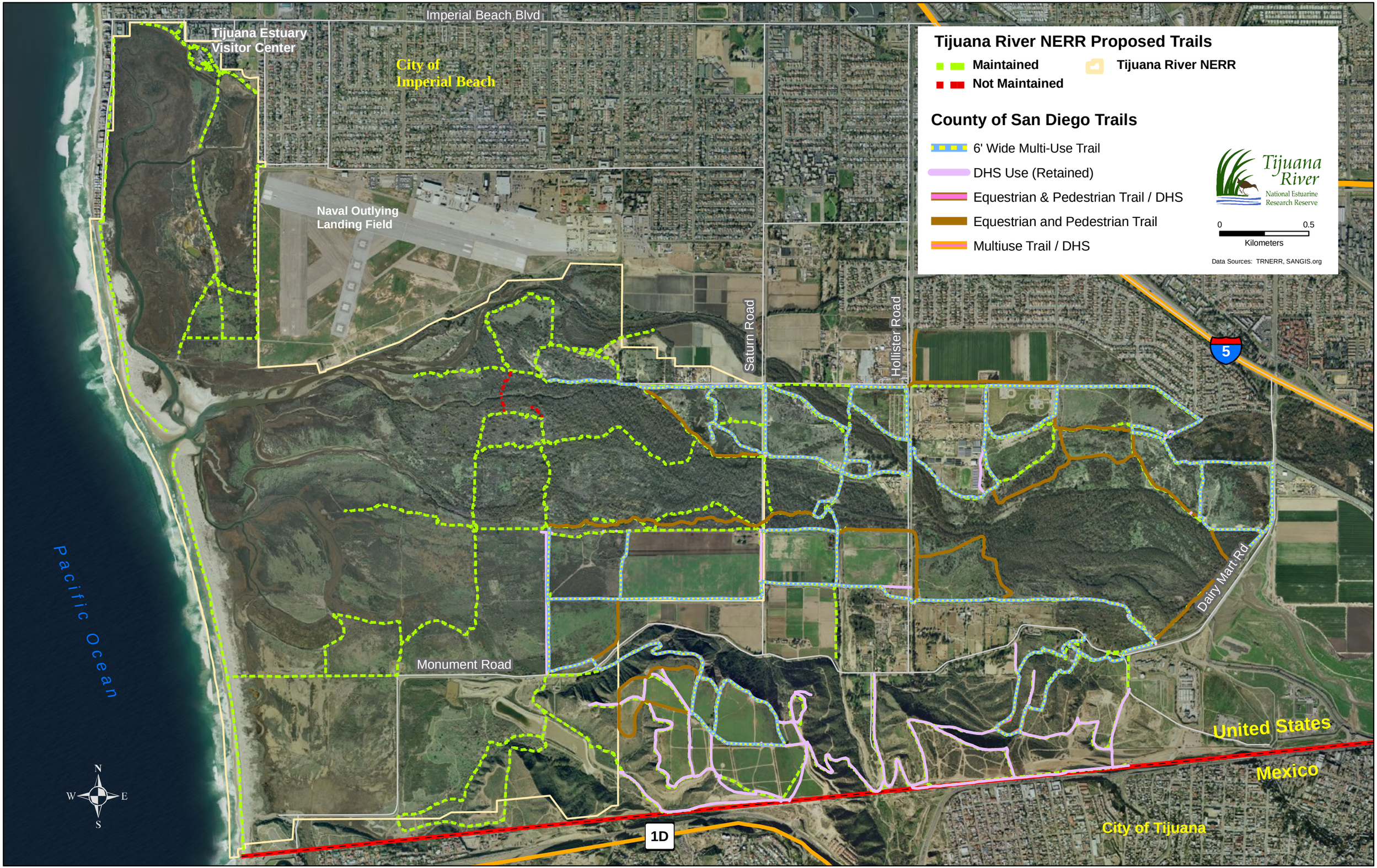
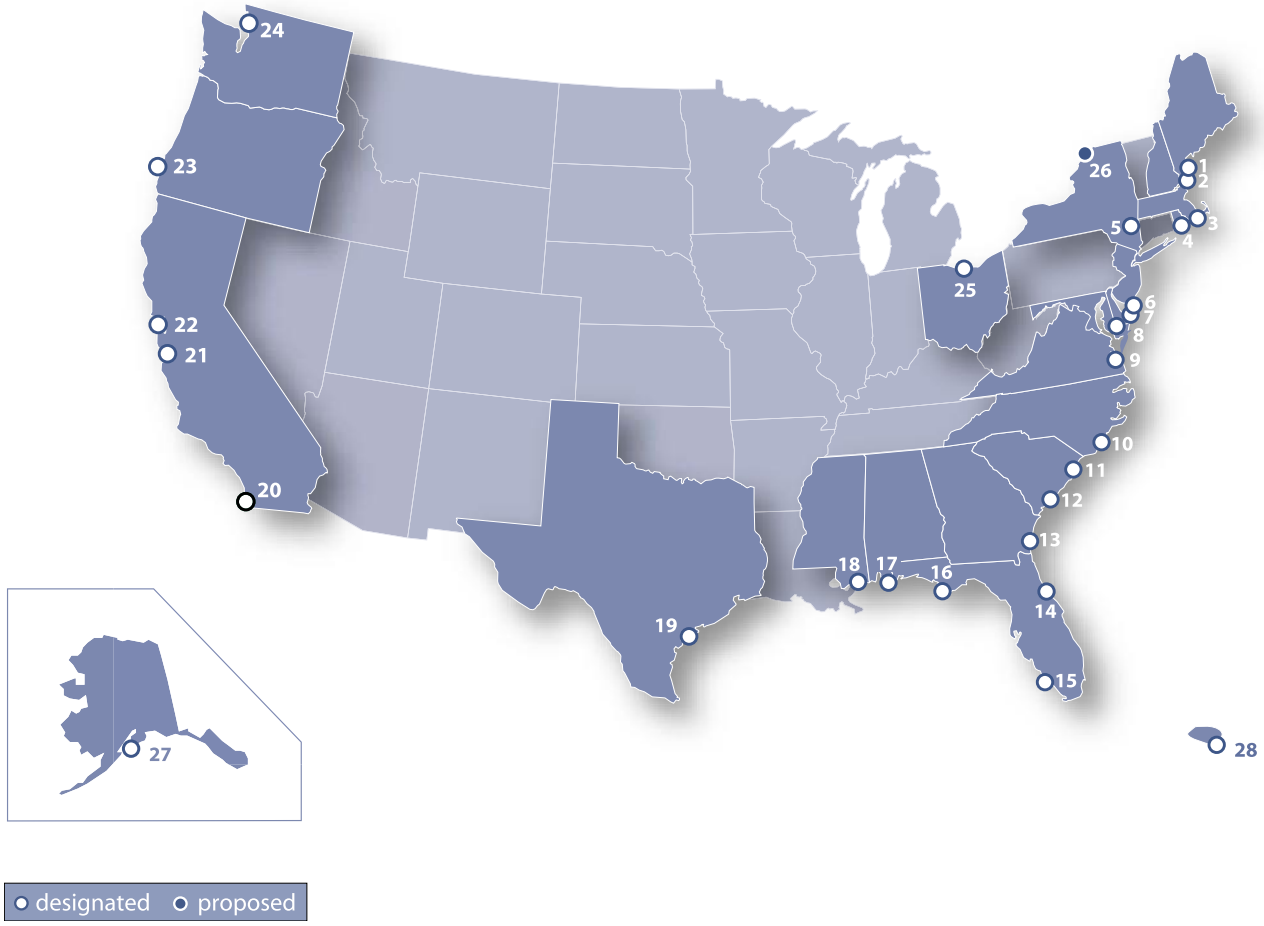


FIGURE 5. PROPOSED TRAILS IN TIJUANA RIVER NERR



1. Wells Reserve, Maine
2. Great Bay Reserve, New Hampshire
3. Waquoit Bay Reserve, Massachusetts
4. Narragansett Bay Reserve, Rhode Island
5. Hudson River Reserve, New York
6. Jacques Cousteau Reserve, New Jersey
7. Delaware Reserve
8. Chesapeake Bay Reserve, Maryland
9. Chesapeake Bay Reserve, Virginia
10. North Carolina Reserve
11. North Inlet-Winyah Bay Reserve, South Carolina
12. ACE Basin Reserve, South Carolina
13. Sapelo Island, Georgia
14. Guana Tolomato Matanzas Reserve, Florida
15. Rookery Bay Reserve, Florida
16. Apalachicola Reserve, Florida
17. Weeks Bay Reserve, Alabama
18. Grand Bay Reserve, Mississippi
19. Mission-Aransas, Texas
20. Tijuana River Reserve, California
21. Elkhorn Slough Reserve, California
22. San Francisco Bay, California
23. South Slough Reserve, Oregon
24. Padilla Bay Reserve, Washington
25. Old Woman Creek, Ohio
26. Proposed Reserve—St. Lawrence River
27. Kachemak Bay Reserve, Alaska
28. Jobos Bay Reserve, Puerto Rico

FIGURE 6. NERRS SYSTEM MAP

Compatibility Determinations – Tijuana Slough NWR

Compatibility is a tool refuge managers use to ensure that recreational and other uses do not interfere with wildlife conservation – the primary focus of refuges. For purposes of this document, uses are any recreational, commercial, research, or other use of the refuge by the public or a non-FWS entity. These types of uses are discretionary. Before they are authorized, they must be found compatible. The National Wildlife Refuge System Improvement Act of 1997 stipulates that the needs of wildlife must come first and defines a compatible use as a use that ". . . in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission of the National Wildlife Refuge System or the purposes of the refuge."

Tijuana Slough NWR was established under the authority of the Endangered Species Act of 1973. The Refuge was established specifically to protect habitat for and enhance recovery of the endangered light-footed clapper rail. The official purpose of the Refuge is ". . . to conserve (A) fish and wildlife which are listed as endangered species or threatened species . . . or (B) plants . . ." That is the purpose against which proposed secondary uses are tested during a compatibility determination.

On FWS fee-title land of Tijuana Slough NWR, FWS has full jurisdiction. On NWR lands operated under the 1984 Memorandum of Understanding (MOU) with the U.S. Navy and on state tidelands operated as part of the NWR under the 1980 Lease No. PRC 5938.9 of the California State Lands Commission, FWS exercises jurisdiction only as specified in the MOU and Lease, and does not have complete jurisdiction over all secondary uses.

The following secondary uses of Tijuana Slough NWR have been determined to be compatible with the purpose(s) of the Refuge, as qualified in the individual compatibility determinations (which are on file at the San Diego NWR Complex Office in Carlsbad, CA).

- Environmental Education: found compatible in Compatibility Determination and Environmental Action Memorandum of September 1, 1994.

- Pest Management (including removal of exotic vegetation and mosquito control): found compatible in Compatibility Determination and Environmental Action Memorandum of September 21, 1994.

- Research (including population monitoring and surveys): found compatible in Compatibility Determination and Environmental Action Memorandum of September 1, 1994. (Note: Individual research proposals may be subject to additional compatibility determination.)

- Boating (non-motorized): found compatible in Compatibility Determination and Environmental Action Memorandum of September 1, 1994.

- Wildlife Observation and Photography: Compatibility Determination in preparation.

- Wildlife Interpretation: Compatibility Determination in preparation.

- Trails (including hiking, bicycle, and equestrian trails): Compatibility Determination in preparation.

List of Proposed Projects for the Tijuana Slough NWR Refuge Operating Needs System (RONS)

RONS Project No.	Project Description
97001	Visitor Services: "Trekking the Refuge" Environmental Education Program (1.0 FTE).
97002 (completed)	Visitor Services: Construct Visitor Center additions
97005 (completed)	Visitor Services: Construct amphitheater/ observation deck
97006	Visitor Services: Publish walker's guide and bird list; provide "Songbird Blues" Environmental Education text for children (no new staff requirements)
97008	Visitor Services: acquire, post new (bilingual) interpretive and regulatory signs (no new staff requirements)
98001 (completed)	Law Enforcement: protect rare species/habitats
98002	Wetland Restoration: inventory, enhance and restore vernal pools on the refuge (no new staff requirements).
98003	Predator and Exotic Control: control feral cats, remove invasive exotic vegetation, predator management (0.5 FTE)
98005	Contaminant Investigation and Clean-up: Characterize and clean up old landfills on the refuge (no new staff requirements).
98XXX	Resource Protection: Clean up trash and install protective boom on Oneonta Slough to reduce waterborne trash (0.5 FTE)
98XXX	Visitor Services: Create NWRS interpretive displays for the Visitor Center (no new staff requirements)
98XXX	Visitor Services: Build an accessible wildlife observation and photography blind on the Refuge (no new staff requirements).

STATE OF CALIFORNIA - RESOURCES AGENCY
PETE WILSON, Governor
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Letter of Agreement

United States Fish and Wildlife Service

and

California Department of Parks and Recreation

regarding management of the

Tijuana River National Estuarine Research Reserve

This letter articulates the strategy for cooperation between the United States Fish and Wildlife Service and the California Department of Parks and Recreation for the management of the Tijuana River National Estuarine Research Reserve

It is the intent of both agencies to manage a 'seamless' reserve by maximizing cooperation, communication, and mutual respect In doing so, both agencies agree to abide by the following principles

1 All programs and activities shall be reservewide

2 The Park Superintendent (DPR), as Reserve Manager, serves as the liaison with the National Oceanographic and Atmospheric Administration (NOAA) The Refuge Manager (USFWS) will act as Reserve Manager in the absence of the Park Superintendent

3 The Park Superintendent (DPR) and the Refuge Manager (USFWS) shall constitute the Reserve's Management Team and shall be responsible for developing and maintaining a cohesive work group at the reserve

4. The Park Superintendent (DPR) shall be the primary coordinator of reserve-wide programs and serves as spokesperson for the Reserve. The Refuge Manager (USFWS) assumes these responsibilities and activities for the Park Superintendent (DPR) in his/her absence.

5 Assignment of personnel to the reserve by each respective agency shall be based on needed functional specialties, and shall be complimentary

6 All lands shall be managed as a Research Reserve. However, because National Wildlife Refuge lands and State Park lands are subject to different legal and administrative constraints, both agencies agree to develop procedures and guidelines which allow for full compliance with USFWS and DPR rules and regulations.

Both agencies recognize the challenge of joint management. In the spirit of intergovernmental cooperation, both agencies commit, through the assignment and supervision of reserve personnel and the continuing support of their superiors, to manage and protect the resources at the Tijuana River National Estuarine Research Reserve in the most efficient and effective manner possible.

Dean Rundle
Refuge Manager
San Diego NWR Complex
U.S. Fish and Wildlife Service

Ed Navarro
Superintendent
San Diego Coast District
California State Parks

Don Voros
Refuge Supervisor
California/Nevada
U.S. Fish and Wildlife Service

Dick Troy
Chief, Southern Division
California State Parks

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Species Listed as Endangered or Threatened Currently Known to Occur at Tijuana River National Estuarine Research Reserve

(February 2007)

COMMON NAME	SCIENTIFIC NAME	STATUS
Birds		
Western Snowy Plover	*Charadrius alexandrinus nivosis*	Federal threatened
Belding's Savannah Sparrow	*Passerculus sandwichensis beldingi*	State endangered State threatened
California Brown Pelican	*Pelecanus occidentalis californicus*	Federal endangered State endangered
California Gnatcatcher	*Polioptila californica californica*	Federal threatened State threatened
Light-footed Clapper Rail	*Rallus longirostris levipes*	Federal endangered State endangered
California Least Tern	*Sternula antillarum**	Federal endangered State endangered
Least Bell's Vireo	*Vireo belli pusillis*	Federal endangered State endangered
Invertebrates		
San Diego Fairy Shrimp	*Branchinecta sandiegonensis*	Federal endangered State endangered
Plants		
Salt Marsh Bird's-beak	*Cordylanthus maritimus maritimus*	Federal endangered
Baja California Bird Bush	*Ornithostaphylos oppositifolia*	State endangered

*California least tern underwent a recent nomenclatural change from *Sterna antillarum browni*.

Listing of Educational Program Themes

1. Wetlands and Water

The Reserve seeks to provide visitors with an understanding of the role wetlands and water play in an estuary. This theme includes the following concepts and principles:

- An estuary is where a river meets the sea and is a highly productive habitat. Estuaries are affected in multiple ways by the ocean tides and tidal flushing.

- Estuarine wetlands function to filter out toxics from the water, provide flood control and water storage, and are a nursery, feeding area, and breeding area, for many bird and fish species.

- The type and quality of water defines the habitats that exist in a wetland. Types of water include salty, brackish, or fresh.

- The wetland's water quality is a result of the interrelationship of water quality parameters and their effects on the ecosystem. These parameters include human and natural impacts on water quality.

- California has lost 91% of its wetlands.

- Watersheds or drainage basins are important because they supply a wetland with its water. One fourth of the Reserve's watershed is in the United States and three fourths of the watershed is in Mexico.

2. Habitat and Wildlife

The Reserve programs seek to make visitors aware of the interrelationship among Reserve biological communities. This theme includes the following concepts and principles:

- The Reserve encompasses a number of different habitats including salt marsh, mudflats, uplands, riparian, dunes, salt panne, and coastal sage scrub.

- Animals and plants have developed interesting and unusual physical and behavioral adaptations to these habitats which include but are not limited to salt excretion or storage, types of camouflage, types of food consumed, and various protections against specific predators.

- Most of the plants and animals in these habitats are part of food webs where all producers, consumers, and decomposers are interdependent.

- The Reserve located on the Pacific Flyway serves as an important habitat for approximately 320 migratory bird species. The Reserve serves as a stopover spot for some migratory birds and a wintering spot for others.

- The Reserve is also home to many endangered and threatened species, including the light-footed clapper rail, California least tern, Western snowy plover, California brown pelican, least Bell's vireo, Belding's savannah sparrow, and Salt marsh bird's beak. Human activities can cause habitat loss and pollution which threaten these species.

3. Human Environment Interaction

The Reserve seeks to make visitors aware of the Reserve's cultural history and the impact of human activity on the native habitats. This theme includes the following concepts and principles:

- The Reserve has a history of use by the Kumeyaay, ranchos, and the military.

- A number of the plants from the Reserve have traditional uses.

- Many of the plants and animals now found at the Reserve are non-native. The invasion of these plants and animals has disrupted native ecosystems.

- The Reserve's watershed spans the US/Mexico border and pollution entering the watershed does not respect political boundaries.

- The protection and maintenance of the Reserve and its programs occurs through the joint efforts of a number of federal, state, and local agencies.

- The Reserve serves as an important "human refuge" providing open space for the enjoyment of nature through compatible recreational activities.

PREDATOR MANAGEMENT PLAN
Tijuana Slough National Wildlife Refuge
(Tijuana River National Estuarine Research Reserve)

I. Overview

Pursuant to its endangered species management responsibilities and in conjunction with other wildlife and habitat management activities, the U.S. Fish and Wildlife Service (Service) will implement, per available funding, predator management on the Tijuana Slough National Wildlife Refuge (Refuge). Species to benefit from this action include the Federal endangered California least tern (*Sternula antillarum*) and light-footed clapper rail (*Rallus longirostris levipes*) and the threatened western snowy plover (*Charadrius alexandrinus nivosis*).

This predator management plan has been developed as a comprehensive wildlife damage control program that addresses a range of management actions from vegetation control and nesting habitat enhancement to non-lethal and lethal control. The most effective, selective, and humane techniques available to deter or remove individual predators or species that threaten nesting, breeding, or foraging least terns, snowy plovers, or clapper rails will be implemented.

II. Purpose

The Tijuana Slough NWR was established to conserve Federal endangered and threatened species. The Refuge and Reserve share the common goal of supporting the recovery and protection efforts for Federal endangered and threatened species, other species of concern, and their habitats. The objectives of this predator management plan are intended to assist the Service in achieving this goal and meeting the purpose for which the Refuge was established.

The implementation of this predator management plan is intended to increase the productivity of the Refuge's federally-listed endangered and threatened seabird and shorebird species. Numerous incidents of predation on listed species by a variety of native and nonnative mammalian and avian predators are documented annually within the Refuge. The Refuge, along with most other habitat available to California least terns, western snowy plovers and light-footed clapper rails, represent some of the best remaining examples of coastal wetland habitats in southern California. As such, these remaining habitats act as magnets for the community of migratory and endemic wildlife that survive in the current landscape. Urbanization has led to increased numbers of many species of generalist, common predators. The potential impact of increased native and non-native predator densities on endangered species populations is a significant impediment to their recovery.

Reducing the number of California least tern, light-footed clapper rail, and western snowy plover adults, chicks, and eggs lost to predation is an important strategy in achieving the management objective of recovering and maintaining stable populations of these listed species on the Refuge. Other species that could indirectly benefit from predator management include the Federal endangered California brown pelican (*Pelecanus occidentalis californicus*), which roost along the shoreline and sand flats of the Tijuana river mouth area, and the State endangered Belding's savannah sparrow (*Passerculus sandwichensis beldingi*), which nests in the pickleweed-dominated salt marsh habitat of Tijuana Estuary. Several species identified by the Service as Birds of Conservation Concern (*USFWS 2002*), including the black skimmer (*Rynchops niger*), elegant tern (*Sterna elegans*), and western gull-billed tern (*Sterna nilotica vanrossemi*), will also derive some benefits from the implementation of this plan.

The western gull-billed tern, however, is a special case in the context of this plan. Since the nearby San Diego Bay NWR was established in 1999, the gull-billed tern has benefited from various Refuge management activities including predator management and nest site enhancement. Due in part to these Refuge management actions, the breeding population of this species at that refuge has increased from an estimated 11 to 20 breeding pairs in 1999 (*Patton 2001*) to approximately 52 pairs in 2006 (*Patton 2006*). During this same period, the number of least tern and snowy plover chicks lost to gull-billed tern predation has also increased (*Patton 2004*). This interaction between the gull-billed tern and the listed species that nest in the vicinity of San Diego Bay cannot easily be addressed because of the extremely small population size of the western gull-billed tern. Various programs within the Service, including the Division of Migratory Bird Management, Ecological Services, and the National Wildlife Refuge System, are currently working together to identify appropriate actions that when implemented will ensure the recovery and conservation of all three of these trust species (least terns, snowy plovers, and gull-billed terns) throughout their range. The Service also coordinates with state, federal and non-governmental agencies to address the population management issues associated with the presence of nesting gull-billed terns in southern California.

Predator Management Plan Objectives:

- Increase the productivity of California least tern and western snowy plover by reducing the loss of eggs and chicks to predation and reducing the number of adult birds of these species that are lost or driven away by predators;

- Reduce the loss of adult and juvenile light-footed clapper rails and eggs due to predation;

- Reduce the number of individual problem predators in localized areas within the Refuge (*Problem predators* are defined as individual predators that are exhibiting hunting behavior in listed species nesting areas or essential habitat areas or that have been identified as actually preying on a listed species.);

- Eliminate disturbance to roosting California brown pelicans by non-native mammalian predators; and

- Reduce disturbance and predation by mammalian predators within seabird nesting colonies, and other sensitive species breeding sites at Tijuana Estuary.

III. Background and Description of Problem

California's coastal wetlands provide essential habitat for a variety of avian species, including the Federal endangered and threatened species and other species of concern supported on the Refuge. The decline in the population of many of these species has been attributed to habitat loss, the introduction of exotic species populations, water and air pollution, habitat degradation, and human disturbance. The California Coastal Commission (*1987*) estimates that as much as 90 percent of California's original coastal wetlands have been lost to development. Additionally, the majority of California's sandy beaches that historically provided expansive habitat areas for seabirds, such as the California least tern, and shorebirds, like the western snowy plover, are now extensively utilized for human recreation and/or have been modified to support beachfront housing and other coastal development.

Today, coastal migratory birds are faced with two converging problems that seriously reduce reproductive success: limited viable nesting habitat and the concentration of native and non-native predators in proximity to nesting areas. The direct conversion of habitat to urban development and indirect losses of habitat resulting from increased human activity have greatly reduced the availability of suitable nesting areas. With fewer viable sites available, nesting seabirds and shorebirds are concentrated on fewer and more geographically limited nesting areas than previously occurred under more natural landscape conditions. Predation potential under current conditions has increased as predator foraging activities have become more intensely focused on the same remnant areas of coastal habitat that have been set aside for the protection of nesting migratory birds. Additionally, urban development has created conditions that are advantageous to many native, generalist predators resulting in larger populations of some predator species than were present historically. An abundance of non-native predators, such as feral dogs and cats and Virginia opossums, are able to enter the Refuge from adjacent urban areas. Their presence negatively impacts the viability of remaining coastal habitats for supporting endangered species.

Many populations of southern California coastal nesting bird species are declining and others are endangered or threatened with extinction. Without human intervention, it is likely that several of these species will not survive. Reproductive success is strongly influenced by food availability, quality of breeding habitat, and predation pressure. Controlling the numbers of predators in endangered and threatened species habitats is the main variable that humans can directly control in a localized context. Providing additional breeding areas (protected nesting sites) to give the protected species greater opportunity to successfully breed continues to be pursued by land management agencies, however, there are very limited opportunities for such efforts in Southern California's dense urbanizing environment. Therefore, management to reduce the potential for significant losses of threatened and endangered species due to predation on nesting grounds or other crucial habitat areas is an essential wildlife conservation tool.

Various conservation plans have been or are being developed that outline conservation priorities for specific assemblages, guilds, and communities of birds. Among the population conservation issues for waterbirds, as addressed in the North American Waterbird Conservation Plan (*Kushlan et al. 2002*), and the priority conservation actions for shorebirds, as outlined in the Southern Pacific Shorebird Conservation Plan (*Hickey et al. 2003*), is the need for appropriate predator management in waterbird and shorebird nesting areas.

The following are brief summaries of relevant information relating to species populations targeted for protection under this predator management plan.

California Least Tern

The California least tern is a loosely colonial, ground nesting, migratory seabird that returns from tropical latitudes to breed in southern California. Least tern nest sites are largely unvegetated, flat, open areas consisting of light colored, sandy surfaces near water bodies supporting abundant small fish. This tern once nested on beaches throughout southern California, south through Baja California, Mexico, and north to the San Francisco Bay area, however, increasing urbanization and habitat loss has led to the decline of its population with the majority of the remaining nesting colonies confined to San Diego and Orange Counties. With the loss of traditional beach nesting sites, this species has been forced to find alternative, less traditional nesting colony sites including landfills and airports (*Patton 2002*).

The Service published a rule, effective June 2, 1970, listing the California least tern as endangered under the Endangered Species Act of 1973, as amended (ESA). The California least tern is endangered throughout its range as a result of the loss and degradation of nesting

and foraging habitat and disturbance of nesting birds. Recovery actions described in the California Least Tern Recovery Plan (*USFWS 1985a*) include preserving and managing existing nesting colonies and providing new nesting sites in protected areas, maintaining adequate foraging habitat for nesting colonies, and minimizing disturbance and mortality by preventing human disturbance and minimizing predation.

Today, nest sites are largely fixed in their location and size, with two of seven San Diego Bay sites falling within Refuge management responsibility and the complex of sites at Tijuana Estuary falling under Reserve management (which includes Refuge and State Park lands).

The least tern is vulnerable to a long list of predators, some of which are very abundant in urban environments, such as feral or domestic cats and dogs, American crows (*Corvus brachyrhychos*), and American kestrels (*Falco sparverius*). In the 2000 nesting season, 20 species were observed preying on or taking a least tern egg, chick, fledgling, or adult in California. Many of these species are considered possible predators on the Refuge; including feral dog, coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), opossum (*Didelphis virginiana*), peregrine falcon (*Falco peregrinus*), American kestrel, gull-billed tern, and various gull species.

Under this plan, the nest site management actions presented below will be implemented to improve least tern reproductive success.

- Vegetation management to control non-native weeds in the coastal dune habitats of the Reserve;

- Signs and symbolic or temporary fencing are maintained in various areas to reduce human and mammalian disturbance in seabird nesting areas;

- Endangered species monitoring is conducted annually in the nesting colonies to record reproductive success and document factors affecting success including disturbance and predation (monitoring will continue in accordance with available funding);

- Predator monitoring is conducted annually during the nesting season to provide current data regarding the presence of predators within the vicinity of the nesting colony and to document and address incidents of predation within the colony;

- Active nest sites are often protected using tiles, exclosures, and other physical devices to reduce accessibility of eggs and chicks to predators; and

- All mammalian predators observed in nesting areas are removed and individual problem avian predators may be controlled as appropriate to reduce loss of least tern eggs, chicks, and adults.

Western Snowy Plover

On March 5, 1993, the Pacific coast population of the western snowy plover was listed as threatened under the provisions of the ESA. The western snowy plover is threatened throughout its range as a result of the loss and disturbance of habitat and nesting sites. There are only a handful of snowy plover breeding locations currently used in southern California. Regularly used locations include Bolsa Chica (Orange County), Camp Pendleton, Batiquitos

Lagoon, Naval Amphibious Base-Coronado, Silver Strand State Beach, and Tijuana Estuary in San Diego County.

The list of potential predators of snowy plover eggs and chicks is long. During extensive surveys of breeding and wintering snowy plovers conducted in San Diego County between 1994 and the winter of 1999, it was determined that most nest failures in 1994, 1996 and 1997 were the result of predation (*Powell et al. 2002*). Documented egg predators included corvids (ravens and crows), coyotes, Argentine ants and gulls. Although the causes of chick mortality are more difficult to determine, several species were determined to be likely causes of mortality during these surveys including great horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), gull-billed tern, and American kestrel. Due to high densities in surrounding urban areas, corvids, kestrels, and feral dogs and cats represent significant threats to the snowy plover population on this Refuge.

The Western Snowy Plover Pacific Coast Population draft Recovery Plan (*USFWS 2001*) includes the prevention of excessive predation of snowy plover as one of the recovery tasks requiring implementation to maximize the survival and productivity of this species. The draft plan encourages the employment of an integrated approach to predator management that considers a full range of management techniques and recommends seeking assistance from U.S. Department of Agriculture (Wildlife Services Branch) biologists, State wildlife agency biologists, and others. Specific management techniques addressed by the plan include manual removal of litter and garbage from nesting areas, removal of predator perches and unnatural habitats, use of predator exclosures where appropriate, removal of predators where warranted, and removal of bird and mammal carcasses in nesting areas. These actions, as well as those described for the California least tern, will be implemented on the Refuge under this plan.

Light-footed Clapper Rail

Light-footed clapper rails are year-round residents of coastal salt marshes and lagoons, although they may also occasionally be found upstream in freshwater marsh habitat. Generally, they nest in the lower littoral zone of a salt marsh where dense stands of cordgrass (*Spartina foliosa*) are present (*USFWS 1985b*). As a result of the destruction of coastal wetlands throughout southern California, the total population of light-footed clapper rails became so seriously low that on October 13, 1970, this species was added to the Federal list of endangered species and was designated as endangered within the United States.

The leading threats to clapper rails are salt marsh habitat loss, degradation, and fragmentation. These rails are also threatened by disturbance, diseases, contaminants, and predation. Potential predators of clapper rail eggs, nestlings, and adults include California ground squirrel (*Spermophilus beecheyi*), rats (*Rattus* spp.), long-tailed weasels (*Mustela frenata*), garter snakes (*Thamnophis* sp.), striped skunk (*Mephitis mephitis*), feral dogs and cats, opossum, and a variety of hawks and owls (*USFWS 1985b*). The Recovery Plan for the Light-Footed Clapper Rail (*USFWS 1985b*) includes as a recovery action the need to identify and control predators within marshes where predation is believed to be a significant problem.

Clapper rails within the Refuge suffer from a lack of adequate high-tide refugia which limits the rails' ability to hide when forced out of the salt marsh during high tide events. It is a goal the Refuge to restore and manage a fully functional coastal salt marsh/coastal sage scrub transitional habitat for the protection of the rail during its entire life cycle. However, this is a long-term commitment and will take many years to achieve. The rail will need additional management measures intended to protect and restore its populations including predator management. The FWS is currently working with several partner agencies to develop a

captive breeding protocol development program for the light-footed clapper rail. This program seeks to bolster the genetic and demographic diversity of the species within isolated wetlands in the United States. As salt marshes are restored, it is hoped that various management actions taken now, will give the species the best possible chance to remain viable within coastal salt marshes in southern California well into the future. In 2006, The Tijuana Estuary subpopulation reached a record level with 102 pairs, a 17% increase over the former high set in 2004 and 2005. The Newport Bay subpopulation in Orange County comprised 38.7% of the state total in 2006 and together with the Tijuana Marsh NWR totaled 260 pairs or 63.7% of the breeding population of the Light-footed Clapper Rail in California (*Zembal, 2006*).

The following actions will be implemented to protect the Refuge's clapper rail population:

- Regulatory signage and periodic patrol by the Refuge law enforcement office is provided to minimize human disturbance in clapper rail habitat;
- Nesting platforms may be maintained in the marsh to provide chicks and eggs with enhanced protection from avian predators; and
- Year-round predator management is conducted to identify and control native and non-native mammalian predators that pose a threat to the rails.

California Brown Pelican

The California brown pelican was listed as endangered on June 02, 1970 because of widespread pollutant-related reproductive failures. This bird is extremely sensitive to bioaccumulation of the pesticide DDT (and other organochlorine pesticides), which causes reproductive failure by altering calcium metabolism and thinning eggshells (*USFWS 1983*). Although California breeding populations have rebounded since the elimination of DDT use, the continued presence of DDT and its byproducts in the ecosystem, as well as other factors, still threaten this species. Delisted in1985 in the areas of the U.S. Atlantic coast, Florida, and Alabama, this species is still considered endangered within California, Louisiana, Mississippi, Oregon, Puerto Rico, Texas, Virgin Islands, Washington and Central and South America.

Today, the availability of adequate food supplies is a major concern for the long-term recovery of this species. Commercial over-harvesting of Pacific mackerel, Pacific sardine, and the northern anchovy has resulted in less food availability for these birds, particularly during the breeding season. Pelicans are also threatened by human development along the coast, which increases disturbance to these birds in their breeding and resting habitats. The availability and quality of roosting and loafing areas influence the energy budgets and reproductive potential of these birds (*Jaques and Anderson 1987*). Management of these essential habitats to minimize disturbance is therefore important for both breeding and non-breeding birds. The Tijuana Estuary is an important roosting area for brown pelicans during the non-breeding season. Feral and domestic dogs, coyotes and human disturbance represent the largest threats to these roosting pelicans

Birds of Conservation Concern

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the Service to "identify species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973." To meet this mandate, the Service has prepared Birds of Conservation Concern 2002 (*USFWS 2002*), which is intended to accurately identify the

migratory and non-migratory bird species (beyond those already federally designated as threatened or endangered) that represent our highest conservation priorities and draw attention to species in need of conservation action. The goal of the Service is to preclude the need for additional bird listings under the Endangered Species Act by implementing proactive management and conservation actions. Six shorebirds and three colonial nesting seabirds included on the list of Birds of Conservation Concern 2002 are supported by the habitats within Tijuana Estuary. These species include the whimbrel, long-billed curlew, marbled godwit, black turnstone, red knot, short-billed dowitcher, gull-billed tern, elegant tern, and black skimmer. The elegant tern and black skimmer could indirectly benefit from the implementation of this predator management plan.

Gull-Billed Tern (*Gelochelidon nilotica vanrossemi*)

Management for the suite of avian species that utilize the Refuge is complex and difficult. The species conflicts inherent in managing the changing community of organisms utilizing coastal wetlands in southern California today present challenges that traditional wildlife managers may never have encountered historically. A case in point is the western gull-billed tern in the general San Diego Bay area wetland complex that includes the Tijuana Estuary.

The gull-billed tern is designated as a Bird of Conservation Concern (BCC) at the national, regional (USFWS Pacific Region), and local scale (Southern Coastal California Bird Conservation Region). The Fish and Wildlife Conservation Act (1988 Amendment) requires that the Service "*identify species, subspecies, and populations of all migratory non-game birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973*". BCC 2002 is the 3rd edition of this congressionally-mandated list and represents the most comprehensive effort thus far to identify species in need of active conservation measures. The gull-billed tern was included in the list because of its declining population trends and threats to breeding birds. At the subspecies level, the western gull-billed tern is of increased concern due to its extremely small population size (<600 known nesting pairs range-wide), limited distribution (ten sites range-wide), suspected population declines, and threats during the breeding season. The BCC designation does not impose regulatory conditions; however, birds included on the BCC 2002 list are deemed priorities for conservation actions. In addition, under Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds," Federal agencies are to avoid and/or minimize adverse impacts on birds, and BCC species in particular, while conducting agency actions and are encouraged to restore and enhance habitat for migratory birds. Additionally, one of the Service's primary goals is to conserve avian diversity in North America. Conserving ecosystem diversity is one of the goals of the National Wildlife Refuge System.

The western gull-billed terns that nest at the San Diego Bay NWR benefit from a number of recovery actions implemented to conserve the California least tern and western snowy plover. These recovery actions include habitat protection, habitat enhancement, reduced human disturbance, and predator management. In addition to the benefits of refuge management and management for endangered species recovery, the Service has also been monitoring the gull-billed terns at the salt works and throughout its range to better understand the population size, nesting ecology, and conservation needs of this species. In 2003, the Service joined with biologists in Mexico to conduct comprehensive surveys of gull-billed terns in western Mexico. The results of these surveys were reported in Palacios and Mellink (*2003*).

Based on the information generated by that study, the estimated population of this subspecies in western Mexico in 2003 was 376 breeding pairs, with 80 percent of the population occurring within two relatively large colonies (Cerro Prieto, Baja California and Laguna de Pericos, Nayarit) (*Palacios and Mellink 2003*). Within the United States, this subspecies only nests in two locations: the Salton Sea and the salt works within south San Diego Bay. The combined population of these two colonies in 2003 was estimated at about 190 breeding pairs (*Seto pers. comm.*). Ongoing monitoring of gull-billed tern colonies by the Service and others will improve our understanding of the breeding biology and distribution of the gull-billed tern range-wide. Information provided by these studies will also assist in developing management actions to conserve this species. Further, we will be able to better assess how conservation of the gull-billed tern can be coordinated with ongoing endangered species recovery actions in Southern California.

Gull-billed tern nesting in San Diego Bay was first documented in 1987 (*Terp and Pavelka 1999*). Between 1999 and 2006, the number of breeding pairs at the salt works has slowly increased from between 11 and 20 in 1999 (*Patton 2001*) to approximately 52 in 2006. Unlike the other colonial nesting seabirds at the salt works, the gull-billed tern is an opportunistic feeder, foraging on a variety of terrestrial and aquatic animals. A recent study conducted in San Diego Bay by Molina and Marschalek (*2003*) found small invertebrates (primarily mole crabs, *Emerita analoga*) and small fish to be the primary prey items delivered by adults to chicks. Lizards (*Uta stansburiana* and *Sceloporus occidentalis*), insects, and small black-necked stilt (*Himantopus mexicanus*), killdeer (*Charadius vociferus*), western snowy plover and California least tern chicks were also part of the gull-billed tern's diet. The first report of gull-billed tern predation on a least tern chick occurred in 1988 in Mississippi (*Densmore 1990*). Predation of least tern and western snowy plover chicks by gull-billed terns has been documented in the San Diego Bay area since 1999 (*Patton pers. comm.*).

Over the past few nesting seasons, gull-billed terns nesting at the salt works have become effective predators of young least tern and western snowy plover chicks. The largest losses occurred in 2003, when 54 chicks were known to be lost to gull-billed tern predation. During the 2004 nesting season, 43 chicks were lost to gull-billed terns. It should be noted that these are minimum numerical estimates of listed species chick losses due to the fact that observers are only present at certain times. Biologists monitoring these nesting populations infer that depredation by gull-billed terns on snowy plover and least tern chicks is ongoing when observers are not present.

Since 2001, the Service has met with private biologists, land managers, and Service staff prior to each nesting season to discuss strategies for addressing gull-billed tern predation. Based on input from these meetings, the Service has chosen to refrain from conducting predator control actions on the gull-billed tern. The question of whether or not the Refuge should manage the size of the gull-billed tern colony at the salt works in an effort to reduce the loss of least tern and snowy plover chicks to gull-billed tern predation was raised again during the preparation of this predator management plan. Based on the desire to maintain/enhance the numbers of breeding gull-billed terns in Southern California, it was determined that no control of this species will be considered at this time.

IV. Existing Predator Management Efforts in the San Diego Bay Region

San Diego National Wildlife Refuge Complex. The San Diego National Wildlife Refuge Complex (Complex) currently conducts a variety of management activities on the Tijuana Slough NWR and San Diego Bay NWR for the purpose of protecting colonies and/or pairs of California least tern, western snowy plover, light-footed clapper rail, and other Federal trust species of migratory birds. Management activities currently conducted to minimize attractants to predatory populations include: trash management, installation and maintenance of perimeter fencing in some locations, removal or trimming of large shrubs and trees in proximity to nesting areas to reduce the availability of resting and perching areas, and the use of various forms of exclosures over the nests of some species such as the western snowy plover. Another activity, public education and outreach, is an important component of the predator management program conducted at the Tijuana Slough NWR. This involves ongoing education programs relating to endangered species, the annual distribution of educational materials to the local community just prior to the nesting season. These materials address the problems associated with intended or unintended feeding of feral populations of domestic animals, clearly identify wildlife protected areas, and explain the importance of responsible control of household pets to the Refuge's wildlife species. Special emphasis, usually in the form of door-to-door distribution of materials, is placed on getting these materials to those residents who live immediately adjacent to the Refuge.

Predator management activities are closely coordinated with regular biological monitoring of nesting colonies in part to provide evidence of the identity of problem predators and the magnitude of the predation impacts to listed species populations. When indirect means do not provide adequate protection based upon data gathered through biological monitoring, direct predator management actions, including non-lethal and if necessary lethal control, are implemented.

Unified Port of San Diego. The Unified Port of San Diego (Port) manages two sites surrounding the Bay, including tern nesting areas within Lindbergh Field (San Diego International Airport) and the Chula Vista Wildlife Reserve. The D Street Fill portion of the Sweetwater Marsh Unit of the San Diego Bay NWR is co-managed by the Port and the Service, which each owns a portion of this fill area. Management is similar to that conducted on the San Diego Bay NWR and includes site preparation, annual monitoring, and predator control. USDA APHIS-WS currently conducts active predator management on these areas under contract with the Port.

United States Navy. The United States Navy manages three of the six current least tern and snowy plover nesting areas surrounding San Diego Bay. These three locations are located within the Naval Air Station North Island and Naval Amphibious Base Coronado. Management is similar to that conducted on the San Diego Bay NWR and includes site preparation, annual monitoring, and predator control. However, some nesting areas occur within heavily used training areas and the Navy's training needs may influence the timeliness of these programs. The Navy has historically contracted with USDA APHIS-WS for predator management implementation at these sites.

Interagency Coordination. Coordination among agencies is ongoing and statewide pre and post-breeding season least tern and western snowy plover meetings are held annually to discuss plans and results of the various management programs for that season. These meetings provide the opportunity to discuss what actions are most effective in achieving the recovery goals for the various endangered and threatened species covered by these programs. Additionally, interagency meetings are periodically scheduled to address species-specific issues related to predation and recovery. Interagency meetings to address issues related to gull-billed terns have been conducted

since 2001. These meetings have led to support for continuing population assessments for the species, as well as support by some for the candidacy as threatened or endangered for the western North American population of the gull-billed tern.

V. Management Plan

The predator management plan for the Tijuana Slough NWR will be implemented to reduce damage by predators to Federal threatened or endangered species populations. The threat may be to adults, chicks, or eggs. A range of management actions, including non-lethal and lethal control, will be implemented. As such, the plan represents a comprehensive wildlife damage control program that will integrate and apply practical methods of prevention and control to reduce damage by wildlife while minimizing the harmful effects of the control measures on humans, other species, and the environment. The activities conducted on the Refuge will vary depending upon the specific wildlife damage problem that is occurring. A particular predator problem may be addressed through the implementation of activities related to resource management, physical exclusion, wildlife management, or any combination of these.

For most predatory species, removal will be accomplished primarily by hazing or live trapping and secondarily by lethal control. In all cases, the most humane methods available will be used. Efforts will be made to avoid and minimize losses of non-target native wildlife and all uninjured non-target species inadvertently captured will be immediately released near the site of capture or at a suitable location at the discretion of the Refuge Manager.

Direct control methods will include live-capture and translocation of individual predators; the intentional hazing (scaring off) of predatory species from nesting areas; and in some cases the lethal removal of problem predators. Lethal removal, which may involve shooting or the use of body grips or gas cartridges, may be used to remove predators that are identified as known and immediate threats to endangered or threatened species within the Refuge. Only licensed and authorized agencies or individuals will implement predator management actions.

Without continued management of mammalian and avian predators, the Refuge's population of light-footed clapper rails could be significantly reduced and the population size and nesting success of snowy plovers and least terns could decline dramatically. As a result, the Service believes that the following approach to predator management within the various areas of the Refuge will achieve the goals, objectives, and legal mandates of the Service.

A public outreach program will be conducted annually to inform nearby residents of the adverse effects that cats and dogs can have on the species. Unauthorized access by the public into sensitive marsh areas will be controlled through signs, fencing, and patrol by law enforcement personnel. Nesting platforms or shelters may be installed and maintained where appropriate to protect eggs and young chicks. Mammalian predators are predators of concern for all protected species at Tijuana Slough. These include domestic and feral cats, raccoons, and the non-native red fox, among others. Predator monitoring will be implemented throughout the year to look for signs of specific predators, tracks, or other indicators of the presence of mammalian predators in the marsh that could pose a threat to protected species. Avian predators will be treated on a case-by-case basis. Non-lethal methods will be tried first whenever feasible before implementing lethal removal.

VI. Direct Control of Predators - Species Specific Protocols

The direct control of predators on the Refuge has historically been implemented by U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service, Wildlife Services (APHIS – WS) through an interagency agreement with the Service. It is likely that this arrangement will continue in the future, provided funds are available. Contracts will be issued annually and will include detailed descriptions of approved control methods, disposition procedures for captured predators, and species-specific protocols. Predator management will be implemented year-round, although the majority of the contracted activities will occur during the breeding season. During the non-breeding season for endangered species, APHIS – WS will concentrate on the control of feral dogs and cats and mammalian predators such as skunks and opossums, which pose a threat to the light-footed clapper rail.

Various types of equipment and techniques will be used to implement predator management on the Refuge and all such implementation will occur in accordance with federal and state regulations. The preferred control methods include live trapping and hazing. Knowledge of the particular predator's habits, particularly the habits of avian predators, will determine which trapping technique is employed.

Live trapping may include the use of box type mammal traps, Bal-chatri traps [a type of baited monofilament line leg-hold/cage trap], scent baited padded leg-hold traps and perch pole traps. Manual capture methods may also be employed using hand held capture poles or other manual techniques. Traps are inspected in accordance with State Fish and Game Code and Service policy. Specifically, traps set out overnight for mammalian predators are checked within two hours of sunrise and traps left out during daylight hours are monitored regularly and checked a minimum of four times per day. Traps set for avian predators may be left out overnight if nocturnal predation is considered a threat to protected species. The use and monitoring of pole traps will be conducted in accordance with Service policy.

Hazing may be used to deter particular predators at the discretion of the Refuge Manager, and can include the use of firearms, pyrotechnics, and/or audio or visual stimuli.

When deemed necessary, lethal removal by shooting, body grip traps, and gas cartridges may be used to take predators that are identified as known and immediate threats to endangered or threatened species. Lethal removal of avian predators is most often employed when an individual problem predator has focused its foraging activities on the nesting colony. In this case, an entire colony's productivity or even survival can be jeopardized in a short time frame. One such example occurred in 1997. A pair of burrowing owls was observed preying on adult and chick California least terns at the Tijuana Estuary. Refuge staff determined that live trapping was the preferred method of control because of a concern for the sensitivity of the local burrowing owl population. Over about a 12-day period (the time it took to locate and live-capture the owls), this pair of owls had taken between 70 and 80 breeding adult least terns and an unknown number of chicks. This one event resulted in the lost of approximately 18% of all breeding individuals in the colony during that nesting season (*Patton 1998*). Under this plan, selective removal of individual problem predators may be permitted for all avian predators with the exception of gull-billed terns.

Routine predator monitoring will be conducted in the nesting colonies. Problem predators may be identified through direct observation of predators in the act of hunting or preying on listed species. The presence of predators in the colony can also be established through the identification of tracks of birds, reptiles, or mammals in the nesting colony, dissection of raptor pellets (disgorged undigested material from previous meals), observations of preyed-upon individuals, eggs, or other

material. In many cases these observations can be used to identify, at least to species, the predator impacting the site.

Some problem predators will defeat all attempts at hazing or live trapping and will be removed by lethal methods. Prior approval from the Refuge Manager is required for all actions involving the lethal removal of a predator. This approval for lethal removal may be in the form of blanket discretionary removal of certain species found within the confines of the breeding colony site (such as for corvids, feral dogs, or feral cats where live trapping has been ineffective and nesting has begun) or on a case-by-case basis (such as for identified individual raptors).

Although not approved for use on this Refuge at this time, the avicide DRC 1339, a pesticide used to control corvid populations, may be approved for use in the future if deemed necessary, to control corvids. DRC 1339 is injected into chicken eggs, which are then secured onto strategically placed elevated bait stations in the vicinity of endangered species nesting areas. Ingestion of the pesticide is lethal to the crow or raven. Specific baiting and pre-baiting activities are conducted to eliminate the possibility of attracting non-target species. Currently DRC 1339 is used occasionally on State lands and DOD facilities adjacent to the Tijuana Slough NWR.

Species Specific Protocols

Procedures for intervention with predators will be dependent upon several factors, including, but not limited to: 1) the degree of threat the individual predator poses to protected populations; 2) the native or non-native status of the predator; 3) the conservation status of specific predator species populations; and 4) the general condition of a particular protected species nesting colony including; species, nest colony phenology, relative disturbance levels from other sources, numbers of vulnerable individuals on site, and other factors.

The following species may be trapped or otherwise removed if observations, tracks, or other indicators of the presence of the species are found within the vicinity of protected species' nesting areas during the nesting season, or if it is determined that the species poses a threat to light-footed clapper rails or roosting California brown pelicans: domestic and feral dogs and cats, coyote, red fox, gray fox, California ground squirrel, Virginia opossum, striped skunk, raccoon, Norway rat, black rat, common crow, common raven, or injured gulls.

The following native avian species will be live trapped from the immediate vicinity of nesting terns and plovers, when they are determined to pose a threat to these species by USDA APHIS-WS in consultation with the Refuge Manager: American kestrel, loggerhead shrike, barn owl, great horned owl, burrowing owl, red-tailed hawk, sharp-shinned hawk, Cooper's hawk, and various gull species.

The following species require prior consultation with the Refuge Manager before lethal or non-lethal control actions can be taken: peregrine falcon, northern harrier, and short-eared owl.

Disposition of Captured Animals

All raptors and other avian predators that are live captured will be removed and held in a licensed/permitted rehabilitation/holding center until they can be released back into the wild. Release will be at a suitable location after the endangered species nesting season is completed. Holding facilities and the location of all release sites must be approved by the Refuge Manager.

All non-native mammalian predators, other than dogs and cats, will be euthanized using approved humane methods. Target and non-target predators that are injured during trapping will be treated on a case-by-case basis. These animals may be euthanized or taken to an approved rehabilitation/veterinary care facility depending on species and extent of injuries.

All non-target wildlife (animals determined not to be a threat to protected species) that is captured unharmed will be immediately released near the capture site or at another suitable location. All domestic or feral dogs and cats, when feasible, will be taken to an approved shelter facility operated by a cooperating local unit of government, humane society or a veterinary care facility.

VI. Monitoring and Reporting

Implementation of this predator management plan will be monitored and a report will be issued annually describing the actions taken to control predation and the numbers and types of predators controlled. In addition, the report will include documented incidents of predation on listed species, recommendations on how predation might be further reduced, and an evaluation of how the current year's predator management actions relate to the objectives established for this plan.

VII. Cooperators

This plan will be implemented in cooperation with the following agencies and organizations, as appropriate:

- Fish and Wildlife Service, Carlsbad Ecological Services Field Office
- Fish and Wildlife Service, Division of Migratory Birds and Habitat Programs, Region 1
- California Department of Fish and Game
- California Department of Parks
- U.S. Department of Agriculture, Animal Plant Health Inspection Service -Wildlife Services
- San Diego County Department of Animal Control
- Project Wildlife

VIII. Other Recovery Actions to be Implemented on the Refuge

Predator management is just one of several strategies that will be implemented to achieve the management goal of recovering and maintaining stable populations of the Federal threatened and endangered species and species of concern that occur within the Refuge. Other strategies include expanded habitat and wildlife management activities, habitat enhancement, and habitat restoration strategies are described below.

Various management strategies are proposed to minimize human disturbance of sensitive habitat areas, including fencing, signage, and public education and outreach. Habitat enhancement is proposed to improve tidal circulation within existing marsh habitat, improve the quality of the nesting substrate for ground nesting birds, and expand the availability of cordgrass-dominated salt marsh habitat to support the clapper rail.

The CMP also includes a variety of habitat restoration proposals that would provide additional nesting, foraging, and resting habitat for endangered and threatened species and other species of conservation concern. Large areas of coastal salt marsh restoration are proposed within the Tijuana Estuary that would benefit the clapper rail, least tern, and various Birds of Conservation Concern.

IX. Alternatives Considered

In addition to the predator management plan presented above, various alternative methods for addressing predation of listed species on the Refuge were considered. These included:

- Non-lethal Control Only
- Indirect Control Only (implement management activities that reduce predation without non-lethal or lethal removal of predators)
- No Predator Management

Proposed Plan

The proposed predator management plan combines direct actions to control predation along with indirect actions related to reduced disturbance and improved habitat quality. The Service believes this proposal represents the most effective and most humane alternative.

Non-lethal Control Only

A predator plan that relies on the control of all predators using only non-lethal methods could have devastating effects on the Refuge's least tern and snowy plover populations. This is particularly true if an avian predator learns to prey on the eggs or young of a listed species. In some cases, considerable time can pass before a problem predator is trapped; as was the case in 1997 involving a pair of burrowing owls at the Tijuana Slough NWR (refer to Section IV.). Because lethal removal was not implemented in this case, the offending burrowing owls took a large number of chicks and more importantly, breeding adults. These events had a lasting effect on productivity at the site since losses of breeding adults can have population effects for many seasons. Least terns can be quite long-lived birds and may make many nesting attempts in their lives.

Indirect Control Only

Indirect control of predation would involve implementing management activities that reduce predation without lethal or non-lethal removal of predators. Instead, measures such as the use of visual and auditory repellents and physical barriers would be employed. Visual and auditory repellants are limited by several factors, including: 1) unintentional hazing of protected species while attempting to haze predatory species; 2) reduced effectiveness over time as some predatory species become accustomed to particular stimuli and begin to ignore them; 3) difficulties in effectively deploying such repellents in the field; and 4) limited effectiveness of repellents on particular species. Physical barriers are a part of an integrated predator management program and will be used for some purposes such as keeping most off-leash dogs out of the nesting colonies. However, physical barriers in the absence of the ability to remove a predator are ineffective in controlling avian predation, as well as some forms of mammalian predation. The use of exclosures over nesting plovers has been effective in protecting eggs, but once the chicks leave the exclosure, they are once again vulnerable to predation. Although predation reduced to some extent through indirect control, this reduction in loss is not considered adequate to achieve the goals and objectives of the Refuge for listed species.

No Predator Management

Under this alternative, no actions would be taken on the Refuge for the specific purpose of controlling predators. Mammalian and avian predators would not be harassed or specifically deterred from traveling or flying through the Refuge or entering the nesting colonies. Based on previously documented losses of listed species to predation, it is likely that the Refuge's population of least terns, snowy plovers, and light-footed clapper rails would no longer be able to achieve sustainability goals for fledging success. In addition, a dramatic reduction in nest productivity could cause least terns and snowy plovers to abandon the existing nesting areas

on the Refuge. A management strategy that excludes any form of predator management would place the viability of the Refuge's listed species at risk and would be inconsistent with the purposes for which this Refuge was established.

X. Justification

The implementation of this predator management plan will result in temporary localized reductions in populations of some mammalian and native avian predators around the Refuge. In recent years, the California ground squirrel, Norway rat, and black rat were the mammalian species most affected by predator management, while ravens and western gulls were the avian species most often removed from nesting areas. The lethal removal of some raptors and large native mammalian predators will occur annually on the Refuge, however the numbers of individuals lost will be low (one to three annually). Lethal removal will generally only be implemented after other non-lethal methods for removal and relocation have proved to be unsuccessful. For the most part, avian predators, with the exception of corvids and some gulls, will be trapped and released into suitable habitat elsewhere, and only those avian predators that are foraging within nesting areas will be removed.

The Federal endangered and threatened avian species supported by this Refuge were once more widely distributed throughout southern California and the sizes of the various populations throughout the region were much larger. The loss of coastal habitat, displacement of nesting areas due to increasing human use of beaches and surrounding wetlands, increases in non-native predators in proximity to natural areas, and the concentration of native predators into smaller, more isolated natural areas have all contributed to significant declines in the populations of California least tern, western snowy plover, and light-footed clapper rail. The recovery plans prepared for the Refuge's Federal endangered and threatened species (*USFWS 1985a, 1985b, 1998, 2001, 2002*), as well as the conservation plans prepared to address declines in the populations of shorebirds and waterbirds (*Page et al. 2003 and Kushlan et al. 2002*), all include predator control in the list of recovery and conservation actions that must be considered if reversal of these population declines is to be achieved. However, predator control alone cannot achieve the recovery goals established for these species, which is why this predator management plan is just one component of a larger overall management plan for the Refuge. The CMP for this Reserve includes habitat enhancement and restoration proposals, as well as additional actions directed at reducing disturbance to sensitive species. Through this combination of efforts, the Refuge's populations of endangered and threatened species are expected, at a minimum to sustain their current sizes, and ideally to increase as these various actions are implemented.

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MOU FOR INTER-AGENCY TRAIL COORDINATION

MEMORANDUM OF UNDERSTANDING BETWEEN: UNITED STATES BORDER PATROL, THE UNITED STATES FISH AND WILDLIFE SERVICE, CALIFORNIA STATE DEPARTMENT OF PARKS AND RECREATION, SAN DIEGO COUNTY PARKS AND RECREATION DEPARTMENT, CITY OF SAN DIEGO, STATE PARK MOUNTED ASSISTANCE UNIT (MAU), THE TIJUANA RIVER VALLEY EQUESTRIAN ASSOCIATION (TRVEA) AND CITIZENS AGAINST RECREATIONAL EVICTION (CARE), UNITED STATES NAVY

RECITALS

A The signatory public agencies and citizen organizations to this memorandum of understanding desire to establish a framework for the coordinated planning, alignment, design and development of trails within the Tijuana River Valley

B The signatory public agencies and citizen organizations to this memorandum of understanding have found that the development of regional and local trails helps to achieve a higher quality of life for the residents of San Diego County by providing recreational opportunities, promoting alternative non-motorized transportation corridors, preserving and providing open space areas, creating links between parks and other recreational areas, and providing other benefits

C The signatory public agencies and citizen organizations desire to establish a committee to be known as the Tijuana River National Estuarine Research Reserve Management Authority (also known as TRNERRMA) Trails Subcommittee (hereafter the "Committee") to provide a clearinghouse for information relating to trails and for coordination of trail planning, design and development by the various signatory public agencies This memorandum of understanding establishes a framework for the creation and responsibilities of the Committee

D This memorandum of understanding does not establish a contract between any of the signatory public agencies or citizen organizations nor shall this memorandum be construed to be an agreement for the joint exercise of powers or creating a joint powers agency under the provisions of Government Code Section 6500 et seq Each signatory public agency shall retain full regulatory authority with respect to the subject matter of this memorandum of understanding and full discretionary authority with respect to the provision of trails within their respective jurisdictions

Therefore, in furtherance of the goals set forth in the Recitals the signatory public agencies set forth their mutual understanding as follows:

THE COMMITTEE

1. The chief administrative officer (e.g. City Manager, Chief Executive Officer, Executive Director, etc.) of each signatory public agency or citizen group will appoint a member (and an alternate) of the agency staff to serve as a member of the Committee. The Committee shall be established as soon as three members are appointed.

2. The purpose of the Committee will be to do all of the following:

a. Coordinate recreational trail links and associated facilities between and within the Tijuana River Valley. Develop recommendations for trail features (i.e. bicycling, hiking, equestrian uses, staging areas, paving, fencing, furniture, landscaping, signage, interpretive centers, handicap accessibility and other features). Develop plans for regional trail routes which connect regional recreational areas, open space areas, historic areas, educational institutions, culturally significant areas and transportation staging areas and other significant areas in the Tijuana River Valley.

b. Research and pursue various mechanisms to plan, acquire, develop, maintain and patrol trails and associated open space corridors.

c. Pursue financial and other support from the public agencies (including agencies of the state and federal government), community service groups, educational institutions, businesses and individuals to supplement funding by the respective signatory public agencies.

d. Generate volunteer support.

e. Encourage and assist in the development of integrated processing procedures for the preservation of open space corridors and trails through the planning processes of each of the signatory public agencies.

f. Draft proposed ordinances, plans and other implementation documents for consideration by the signatory public agencies. Attached herein and labeled "Appendix A" is a Trail Use Policy. This Policy represents the concensus of the Committee at the time of MOU signing and will serve as the foundation document for future trail management decisions.

g. Pursue applications for grant funding to support construction, operation, and maintenance (including cowbird trapping) of regional trails.

h. Pursue the formation of a formal joint powers authority or joint exercise of powers agreement and make

a recommendation to the signatory public agencies regarding the desirability of such an authority agreement.

The Committee has no legislative or administrative authority and shall act solely in an advisory capacity to the chief administrative officer of each signatory public agency or to the appropriate planning, parks and recreation or other similar department of each signatory public agency as may be determined appropriate by each agency.

3. The Committee shall commence meeting as soon as three members have been appointed. The Committee shall conduct meetings not less frequently than once every three months at such times and places as the committee may designate. The Committee may establish by-laws which are not inconsistent with this memorandum of understanding. Meetings of the committee shall be open to the public in accordance with all applicable State and local laws. A simple majority of the members shall constitute a quorum for the transaction of any business of the Committee. Formal actions of the Committee shall require an affirmative vote by a majority of the quorum.

PLANNING ACTIVITIES

4. Trail planning activities by the various signatory public agencies should be coordinated with the goal of establishing a regional public trail network within the Tijuana River Valley. Particular emphasis should be placed on establishing connections between trail systems within the boundaries of the various signatory agencies and on avoiding conflicts in trail types, uses and designs where such conflict would inconvenience or endanger the public. Trail use and the creation of any new or alternative trail routes shall avoid impacts to designated critical habitat for the least Bell's Vireo, proposed critical habitat for the Southwestern willow fly catcher and habitats utilized by the California least tern, Western snowy plover and any other listed species to the greatest extent practicable. Where feasible and consistent with public safety, easements for major utility and transportation facilities (other than streets) should be made available for joint use as trails. Each signatory agency should consider the trail planning activities of the other signatory agencies in developing trail routes within their respective jurisdictions.

5. Each signatory public agency agrees to refer applicable proposals for major land developments to the Committee for comment regarding trail program implementation as a part of the development review process.

6. The signatory public agencies agree to coordinate regional trails planning with land use regulations while maintaining local land use control.

FUNDING

7. The signatory public agencies will each bear their own costs of implementing this memorandum of understanding. Expenses for copying, document preparation, mailing or other similar common costs should be shared equally among the signatory agencies, or rotated between the agencies on a regular basis.

8. The Committee should pursue grant or other funding to support its activities.

MISCELLANEOUS

9. This memorandum shall become effective upon the execution by any three of the public agencies which are listed in the title hereof. Any public agency listed in the title hereof may become a signatory public agency at any time or may withdraw as a signatory public agency at any time.

10. Each signatory agency shall be solely responsible for its own acts or omissions taken with respect to activities within its jurisdiction with respect to the subject matter of this memorandum. No signatory agency shall be liable with respect to any comments or requests whether implemented or not, pertaining to trail activities of any other public agency. Where trails of one public agency adjoin or abut the trails or property of another public agency, liability to third persons with respect to personal injury or property damage shall be determined according to ordinary principles of law without regard to this memorandum.

In witness whereof the signatory parties have executed this memorandum of understanding as of the dates set forth below:

AGENCY	BY	DATE
U.S. BORDER PATROL	William Dunbar	3/28/96
U.S. FISH & WILDLIFE	Gail C. Kobetich	3.25.96
STATES PARKS/REC.	Edward Ram	4.4.96
COUNTY PARKS/REC.	Alex A. Martin	3-26-98
CITY OF SAN DIEGO	Jon E. Vinkar	5-1-96
STATE PARKS MAU	Andrew Rivas	3/28/96
TRVEA	Andrew Rivas	3/28/96
CARE	Marolyn Powers	3/28/96
U. S. NAVY	K. [illegible] CAPT, CEC USN, SCE	9/17/97

Trail Use Policy for the Tijuana River Valley

Preamble

The Tijuana River National Estuarine Research Reserve Management Authority (TRNERRMA) has always recognized the unique and fragile ecology of the entire Tijuana River Valley (TJRV). TRNERRMA's highest priority goal as stated in its own Management Plan is "the protection of the estuarine environment and resources of the Tijuana River National Estuarine Sanctuary, consistent with the policies of land-owning and land use regulating agencies." TRNERRMA additionally recognizes that it must also provide recreational access appropriate to the nature of the land and consistent with stated ecological values. Due to the increasingly popular use of the recreational trails in the Tijuana River National Estuarine Sanctuary and the uplands of the TJRV, it has become necessary for TRNERRMA to adopt a specific policy regarding trail use. This action will insure continued compatibility for both of the above stated goals. TRNERRMA has therefore created a Trails Subcommittee hereafter known as the Committee, to create the policies and procedures necessary for an effective recreational trail system within it's jurisdiction. The Committee shall be composed of selected resource managers from within TRNERRMA, associated non-member agencies having jurisdiction over some aspect of the TJRV, and representatives of any recognized equestrian or hiking organization utilizing the trails within the Valley.

TRNERRMA is concerned both with the safety of all TJRV visitors and the enjoyment of their open space experience. The purpose for which people legitimately use open space areas varies depending on individual or group needs. Visitors may come to observe nature in a protected environment, experience tranquility, exercise in a non-urban setting, or any combination of these. The means by which visitors use trails also varies -- be it on horseback or a bicycle, hiking, running, or in a wheelchair. Motorized vehicles, except electric wheelchairs and those associated with public safety will be prohibited.

The combination of trail conditions, level of use, and the mix of uses may lead to conflicts. Conflicts result in negative environmental impacts, unpleasant user experiences, or unsafe situations. Conflicts are related to several factors, including:

The relative speeds of different users.
Existing trail conditions, such as poor line-of-sight, narrowness, steep slopes and wide-open stretches of trail that might encourage excessive speed.
A lack of knowledge of, or disregard for, trail use etiquette and regulations by all types of users.
A high concentration of use in certain areas.
Existence of threatened or endangered species near trails.

This set of policies is intended as a guide in establishing trail use designations throughout the areas of TRNERRMA which will promote safe and enjoyable experiences for all who use TRNERRMA lands. These policies are not intended to restrict who may use the TRNERRMA trails, but they may restrict how or under what conditions the trails are to be used.

POLICIES

1.0 The Committee will endeavor to provide a variety of satisfying trail use opportunities on open space preserves throughout the District. More specifically, the Committee will endeavor to:

1.1 Provide multiple use on individual trails where such use is consistent with the balance of these policies.

1.2 Protect the opportunity for tranquil nature study and observation, especially in those areas identified as providing a unique wilderness experience.

2.0 The Committee will designate appropriate use(s) for each trail. Uses will be allowed that are consistent with Committee's objectives for sound resource management and safe and compatible use. More specifically, the Committee will:

2.1 Allow trail use appropriate to the nature of the land and consistent with the protection of the natural, scenic, and aesthetic values of open space.

2.2 Within budgetary and staffing constraints, make reasonable efforts to provide safe conditions for trail users.

2.3 Evaluate trail user needs, concerns, quality of experience, impacts, and the compatibility of various uses. Those uses creating the least conflict among trail users and the least environmental impact will be given greatest preference in trail use planning.

2.4 Ensure that all TRNERRMA trails will be accessible to hiking. When consistent with this policy, if a non-hiking use adversely impacts user safety, the use may be restricted or redirected. The intention is not to restrict access by any individual, but rather to limit incompatible uses and means of travel.

2.4 Maintain bilingual signs at all trailheads and as necessary along trail routes.

2.5 Ensure that trailheads are inaccessible to unauthorized motorized vehicles of any type. Authorized vehicle is defined as one operated by local, State or Federal law enforcement personnel already in hot pursuit or responding to a known medical emergency.

3.0 The Committee will adopt qualitative and quantitative trail use guidelines to aid TRNERRMA in determining appropriate trail use designations in the implementation of these policies.

4.0 Specific trail use designations will be established and reviewed periodically through the Committee, and will be subject to public notification. Trail use designations may change if use patterns develop that are in conflict with these policies.

4.1 In extreme cases where there is not sufficient time to notify TRNERRMA the Committee may make an interim decision to limit use while providing an evaluation process and timeline for final determination of the designated use.

5.0 The Committee will endeavor to provide trail access for a variety of physical capabilities and user needs (including persons with physical limitations) in a manner consistent with resource protection goals, budgetary constraints, and state and federal regulations.

6.0 The Committee will carry out management programs necessary for the implementation of these trail use policies. The designation of appropriate trail use as a method of minimizing trail use conflicts and environmental impacts will require a significant increase in trail use measures such as education, physical improvements to trails and enforcement of trail use regulations. More specifically the Committee will:

6.1 Support trail use actions with a strong educational program. The Committee recognizes that education in proper trail etiquette and low impact use is a key measure towards the reduction of negative trail use impacts. The educational program shall be designed to apply to individual riders, equestrian clubs and rental stables.

6.2 Monitor trail use conditions on a regular basis. The purpose of a monitoring program will be to evaluate current conditions and to determine whether or not trail management programs, including maintenance, reconstruction, education and use regulations, are effective in addressing user conflicts and environmental impacts, and to recommend changes if necessary.

6.3 Include implementation costs in determining the feasibility of trail use designations and regulations.

7.0 The Committee will work with other agencies, interest groups and private landowners in an effort to promote an interconnecting trail system throughout the region. The Committee recognizes that connections should be compatible with other jurisdiction designations and land owner objectives as well as these policies and trail use guidelines.

8.0 The Committee recognizes that existing trail use characteristics such as the types of use, conflicts, and impacts may change over time so that certain policies may no longer be appropriate or a new policy may be required. Hence, these policies will be subject to review and revision as deemed necessary by the Committee and approved by TRNERRMA.

9.0 The Committee recognizes the need to coordinate closely with the United States Fish and Wildlife Service, Division of Ecological Services, Carlsbad, CA, in all matters pertaining to trails and any actual or potential impact to wooded riparian wetland habitat, caused by use, construction, or maintenance of any trail within the Committee's jurisdiction.

9.1 Any removal of riparian vegetation for trail maintenance or safety reasons must be first approved by the Service and will be offset by revegetation as specified by the Service.

9.2 The potential increase in brown-headed cowbirds associated with horse trail use will be offset by the implementation of an annual cowbird trapping program as specified by the Service.

9.3 All trail traffic on the beach areas north and south of the Tijuana River mouth will be restricted (by signage or other appropriate measures) to the hard packed sand areas created by the ocean's wave action, between March 1 and September 15 of each year. This seasonal closure will insure the maximum safety of the California least tern and western snowy plover, nesting on sandy beach habitat during the above mentioned dates.

9.4 The Committee recognizes that the Service may temporarily or permanently recommend closure of any section of trail that clearly poses a serious threat to any threatened or endangered species of plant or animal or its habitat, located within the jurisdiction of the Committee.

9.5 The Committee recognizes the importance of restoring the tidal prism, water circulation and estuarine habitats including coastal salt marsh, dune and maritime succulent shrub within the Tijuana River Estuarine Research Reserve. It is understood that long term restoration may in some instances eliminate a segment of a trail system. When this occurs, the Committee, in close coordination with the Service and California State Department of Parks and Recreation, will in a timely manner, seek and formally designate mutually approved alternative trail routes.

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Memorandum of Agreement
Between the
National Oceanic and Atmospheric Administration
And the
California Department of Parks and Recreation
Detailing the State-Federal Roles in the
Management of the Tijuana River National Estuarine Research Reserve

This Memorandum of Agreement states the provisions for the cooperative management of the Tijuana River National Estuarine Research Reserve (NERR) in the state of California, between the California Department of Parks and Recreation and the National Oceanic and Atmospheric Administration's (NOAA) Office of Ocean and Coastal Resource Management.

WHEREAS, this Memorandum of Agreement supercedes the previous "Memorandum of Understanding Between NOAA and California Department of Parks and Recreation regarding the Tijuana River NERR" made on June 8, 2001.

WHEREAS, the state of California has determined that the waters and related coastal habitats of Tijuana River National Estuarine Research Reserve provide unique opportunities for study of natural and human processes occurring within the estuarine ecosystems of the state to contribute to the science of estuarine ecosystem processes, enhance environmental education opportunities, and provide scientific information for effective coastal zone management in the state of California; and

WHEREAS, the state of California has determined that the resources of the Tijuana River National Estuarine Research Reserve and the values they represent to the citizens of California and the United States will benefit from the management of these resources as part of the National Estuarine Research Reserve System; and

WHEREAS, the National Oceanic and Atmospheric Administration has concurred with that finding and pursuant to its authority under section 315 of the Coastal Zone Management Act of 1972, as amended (CZMA, 16 U.S.C. 1461) and in accordance with implementing regulations at 15 CFR 921.30 has designated the Tijuana River National Estuarine Research Reserve; and

WHEREAS, the California Department of Parks and Recreation as the agency designated by the Governor of California is responsible for managing the Tijuana River National Estuarine Research Reserve and acknowledges the value of state-federal cooperation for the long-term management of the reserve in a manner consistent with the purpose of their designation; and

WHEREAS, the management plan describes the goals, objectives, strategies/actions, administrative structure, and institutional arrangements for the reserve, including this MOA and others;

NOW THEREFORE, in consideration of the mutual agreements herein, NOAA and California Department of Parks and Recreation agree to the following:

ARTICLE I: STATE-FEDERAL ROLES IN RESERVE MANAGEMENT

A. California Department of Parks and Recreation Role in Reserve Management

The California Department of Parks and Recreation shall:

1. be responsible for compliance with all federal laws and regulations, and ensure that the Tijuana River National Estuarine Research Reserve management plan is consistent with the provisions of the CZMA and implementing regulations;

2. ensure protection of the natural and cultural resources of the reserve, and ensure enforcement of the provisions of state law, including rules and regulations of the state coastal management program;

3. ensure adequate, long-term protection and management of lands included within the reserve boundary;

4. annually apply for, budget, and allocate funds received for reserve operations, research and monitoring, education and stewardship; and as necessary, land acquisition and reserve facility construction;

5. conduct and coordinate research and monitoring programs that encourage scientists from a variety of institutions to work together to understand the ecology of the reserve ecosystem to improve coastal management;

6. conduct and maintain programs that disseminate research results via materials, activities, workshops, and conferences to resource users, state and local agencies, school systems, general public, and other interested parties;

7. provide staff, and endeavor to secure state funding for the manager, education coordinator and research coordinator;

8. secure facilities and equipment required to implement the provisions within the reserve management plan;

9. ensure adequate funding for facilities operation and maintenance;

10. maintain effective liaison with local, regional, state, and federal policy makers, regulators and the general public;

11. serve as principal contact for issues involving proposed boundary changes and/or amendments to the reserve management plan;

12. respond to NOAA's requests for information, particularly cooperative agreement and grant progress reports and evaluation findings, including necessary actions and recommendations, made pursuant to Section 312 of the CZMA; and

13. expend funds in accordance with federal and state laws, the reserve management plan, and annual funding guidance from NOAA.

B. Federal Role in Reserve Management

NOAA's Office of Ocean and Coastal Resource Management shall:

1. administer the provisions of the Sections 315 and 312 of the CZMA to ensure that the reserve operates in accordance with goals of the reserve system and the Tijuana River National Estuarine Research Reserve reserve management plan;

2. review and process applications for financial assistance from the California Department of Parks and Recreation consistent with 15 CFR 921, for management and operation, and as appropriate, land acquisition and facility construction;

3. advise California Department of Parks and Recreation of existing and emerging national and regional issues that have bearing on the reserve and reserve system;

4. maintain an information exchange network among reserves, including available research and monitoring data and educational materials developed within the reserve system;

5. to the extent possible, facilitate NOAA resources and capabilities in support of reserve goals and programs.

C. General Provisions

1. Nothing in this agreement or subsequent financial assistance awards shall obligate either party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.

2. Upon termination of this agreement or any subsequent financial assistance awards to California Department of Parks and Recreation any equipment purchased for studies to further this agreement will be disposed of in accordance with 15 CFR 24.32.

3. A free exchange of research and assessment data between the parties is encouraged and is necessary to ensure success of cooperative studies.

D. Other Provisions

1. Nothing in this agreement diminishes the independent authority or coordination responsibility of either party in administering its respective statutory obligations. Nothing in this agreement is intended to conflict with current written directives or

policies of either party. If the terms of this agreement are inconsistent with existing written directives or policies of either party entering this agreement, then those portions of the agreement which are determined to be inconsistent with such written directives and policies shall be invalid; but the remaining terms not affected by the inconsistency shall remain in full force and effect. At the first opportunity for revision of this agreement, all necessary changes shall be made by either an amendment to this agreement or by entering in a new superseding agreement, whichever is deemed expedient to the interested parties. Should disagreement arise on the interpretation of the provisions and/or amendments of this agreement that cannot be resolved by negotiations at the operating level of each party, the area(s) of disagreement shall be stated in writing by each party and promptly presented to a mutually approved mediator for non-binding mediation. If the parties cannot agree on the choice of a mediator or if the mediation does not resolve the dispute to the mutual approval of the parties, the parties are free to pursue any other legal remedies that are available.

ARTICLE II: REAL PROPERTY ACQUIRED FOR PURPOSE OF THE RESERVE

As well as acknowledging the rest of the requirements set forth at 15 CFR 921, California Department of Parks and Recreation specifically acknowledges and will fully comply with conditions set forth at 15 CFR 921.21 (e), which specify the legal documentation requirements concerning the use and disposition of real property acquired for reserve purposes with federal funds under Section 315 of the CZMA.

ARTICLE III: PROGRAM EVALUATION

The Office of Ocean and Coastal Resource Management Division of NOAA will schedule periodic evaluations of California Department of Parks and Recreation performance in meeting the terms of this agreement, financial assistance awards, and the reserve management plan. Where findings of deficiency occur, NOAA may initiate action in accordance with the designation withdrawal or interim sanctions procedures established by the CZMA and applicable regulations at 15 CFR 921.40-41.

ARTICLE IV: EFFECTIVE DATE, REVIEW, AMENDMENT AND TERMINATION

A. This agreement is effective on the date of the last signature on this agreement and shall be in effect until terminated by either party.

B. This agreement will be reviewed periodically by both parties and may only be amended by the mutual written consent of both parties.

C. This agreement may be terminated by mutual consent of both parties, or by NOAA if NOAA withdraws designation of the reserve within the reserve system, pursuant to applicable provisions of the CZMA and its implementing regulations as described under 15 CFR 921.40-41, or if NOAA finds that California Department of Parks and Recreation fails to comply with this MOA. The agreement may be terminated by California Department of Parks and Recreation with or without cause. Should this agreement be terminated,

reimbursement of unexpended funds from financial assistance awards shall be determined on a pro rata basis according to the amount of work done by the parties at the time of termination. Additionally, reimbursement for land purchased and facilities constructed with NOAA funds shall be consistent with terms and special award conditions of financial assistance awards.

D. If any clause, sentence or other portion of this MOA shall become illegal, null or void for any reason, the remaining portions of this MOA shall remain in full force and effect.

E. No waiver of right by either party of any provision of this MOA shall be binding unless expressly confirmed in writing by the party giving the waiver.

IN WITNESS THEREOF, the parties have caused this agreement to be executed.

Donna Wieting
Acting Director
Office of Ocean and Coastal
Resource Management
National Ocean Service
National Oceanic and
Atmospheric Administration
U.S. Department of Commerce

9-10-2010
Date

Clayton Phillips
Acting District Superintendent
San Diego Coast District
California Department of Parks
and Recreation

9/19/10
Date

County of San Diego

DEPARTMENT OF PARKS AND RECREATION

BRIAN ALBRIGHT
DIRECTOR

Administrative Office: (858) 694-3030
Fax: (858) 495-5841
Reservations: (858) 565-3600

www.sdparks.org

September 13, 2010

Clay Phillips, Manager
Tijuana River National Estuarine Research Reserve
301 Caspian Way,
Imperial Beach, CA 91932

Dear Mr. Phillips,

As a fellow member of the Tijuana River National Estuarine Research Reserve (TRNERR) Management Authority, our agency is aware that a final draft of the TRNERR Comprehensive Management Plan has been available for public review over the past few weeks. We have reviewed the draft document and support the vision and general objectives of the plan.

Any more detailed questions and comments will be provided to TRNERR under separate cover and/or through the September 2, 2010 meeting of the Management Authority.

Sincerely,

BRIAN ALBRIGHT, Director
Department of Parks and Recreation

cc: Frank Special, Chief of Park Operations
Larry Duke, District Park Manager
Sylvia Bugiel, Reservations Desk Manager

State of California • The Resources Agency
Arnold Schwarzenegger, *Governor*
DEPARTMENT OF PARKS AND RECREATION • P.O. Box 942896 • Sacramento, CA 94296-0001
Ruth G. Coleman, *Director*
San Diego Coast District
4477 Pacific Highway
San Diego, CA 92110
619-688-3269 – Fax: 619-688-3229

September 16, 2010

Clay Phillips, Manager
Tijuana River National Estuarine Research Reserve
301 Caspian Way,
Imperial Beach, CA 91932

Dear Mr. Phillips,

As a member of the Tijuana River National Estuarine Research Reserve (TRNERR) Management Authority, California State Parks is aware that a final draft of the TRNERR Comprehensive Management Plan has been available for public review over the past few weeks. We have reviewed the draft document and fully support the vision and objectives of the plan. We think it is an excellent document.

Sincerely,

Clayton Phillips, Acting District Superintendent
San Diego Coast District
California State Parks

9/10/10

Robert E. Miller
1167 5th Street
Imperial Beach, CA 91932
Phone (619) 575-6819
Fax (619) 575-4930
Cell (619 933-6819
email: robertinge@aol.com

TRNERR Comprehensive Management Plan

Clay Phillips
Tijuana River National Estuarine Research Reserve
301 Caspian Way
Imperial Beach, CA 91932

Dear Mr. Phillips,

Our association, Southwest Wetlands Interpretive Association (SWIA), has reviewed the TRNERR Comprehensive Management Plan. The vision and general objectives of the plan are well stated and you have the support of the SWIA Board of Directors.

Robert E. Miller
Vice-President
SWIA Board of Directors

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
SAN DIEGO BORDER LIAISON OFFICE
610 West Ash Street
Suite 905
San Diego, CA 92101

September 2, 2010

Clay Phillips, Manager
Tijuana River National Estuarine Research Reserve
301 Caspian Way,
Imperial Beach, CA 91932

Dear Mr. Phillips:

As a fellow member of the Tijuana River National Estuarine Research Reserve (TRNERR) Management Authority, the U.S. Environmental Protection Agency is aware that a final draft of the TRNERR Comprehensive Management Plan has been available for public review over the past few weeks. We have reviewed the draft document and support the vision and general objectives of the plan.

Any more detailed questions and comments will be provided to TRNERR under separate cover and/or through the September 2, 2010 meeting of the Management Authority.

If you have any questions, please contact me at 619-235-4763 or by email at liden.douglas@epa.gov.

Sincerely yours,

Doug Liden

Doug Liden
Environmental Engineer
U.S. Environmental Protection Agency
Region 9, San Diego Border Office

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Diego National Wildlife Refuge Complex
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

September 10, 2010

Mr. Clay Phillips, Manager
Tijuana River National Estuarine Research Reserve
301 Caspian Way
Imperial Beach, CA 91932

Re: Support for TRNERR Management Plan

Dear Mr. Phillips,

The U.S. Fish and Wildlife Service, Tijuana Slough National Wildlife Refuge and Borderfield State Park co-manage the western reaches of the Tijuana River Valley and estuary, creating a seamless refuge. Our partnership is invaluable benefiting the public and resources at-hand.

As a fellow member of the Tijuana River National Estuarine Research Reserve (TRNERR) Management Authority, our agency is aware that a final draft of the TRNERR Comprehensive Management Plan has been available for public review over the past few weeks. We have reviewed the draft document and support the vision and general objectives of the plan.

Andy Yuen
Andrew Yuen
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