



Tijuana River Valley Recovery Team

RECOVERY STRATEGY

Living with the Water



JANUARY 2012



A Message from David Gibson Executive Director; Regional Water Quality Control Board, San Diego Region

The Tijuana River Valley (Valley) has a decades-long history of water quality issues. Significant improvements in the arena of wastewater treatment have in recent years improved water quality on both sides of the border. However, stormwater flows continue to bring substantial amounts of sediment and trash and other contaminants into the Valley from sources in both the United States (U.S.) and Mexico. The sediment and trash pollutants cause water quality impairments, threaten life and property from flooding, degrade valuable riparian and estuarine habitats, and impact recreational opportunities for residents and visitors.

Many public agencies and non-profit organizations have worked tirelessly on both sides of the border to resolve the Valley's water quality issues. They have held cleanups, built a sediment basin, piloted trash capture devices, executed ecosystem restoration activities, purchased land, and performed many other projects. The Tijuana River Valley Recovery Strategy (Recovery Strategy) represents the work of representatives from these and other agencies with operational or land management authority in the Valley to reach consensus on actions to resolve sediment and trash issues. The Recovery Strategy has also been reviewed and shaped by the thoughtful comments from stakeholders who live, work, and/or regularly visit the Valley. These individuals collectively represent the Tijuana River Valley Recovery Team (Recovery Team).

From the perspective of the San Diego Regional Water Quality Control Board (Regional Board), cleaning up sediment and trash in the Valley is a high priority. Since many of the sources of sediment and trash are outside of the jurisdiction of the agencies we regulate, the Regional Board has chosen to pursue a collaborative, stakeholder-led approach to address these problems. As the Regional Board's Executive Officer, I firmly believe the approaches outlined in the Recovery Strategy can successfully reduce the sediment and trash currently degrading beneficial uses, including water quality, exacerbating flooding, affecting habitat and impacting recreation.

The purpose of the Recovery Strategy is twofold. First, it is intended to be a concise summary of the first phase of actions to cleanup the Valley and restore its beneficial uses. Second, it is intended to outline the steps in a way that will allow stakeholders, policy makers, and potential funding sources have a clear understanding of both the problems and the solutions that will allow the Recovery Team to achieve its vision and mission. Ultimately, members of the Recovery Team will implement the strategy through enhanced relationships and partnerships. Finally, the Recovery Strategy acknowledges that resolution to the sediment and trash problems will require partnerships between the U.S. and Mexico to provide watershed-based solutions. The Recovery Team recognizes that source control and pollution prevention activities are often the best and most economically feasible long-term solutions to sediment and trash and other water quality problems. Accordingly, there is no time like the present to work together to build and enhance cross-border communication and relationships. This will lead to our common goals of a healthy Valley, free of pollutants, where plants and animals can thrive and residents, visitors, and landowners can enjoy the unique jewel that is the Tijuana River Valley.

On behalf of the Regional Board, I would like to thank all of the members of the Recovery Team for the work that has been accomplished in developing this Recovery Strategy, and to offer our continuing support.

David Gibson
Co-Chair, Tijuana River Valley Recovery Team

The Condition of the Tijuana River Watershed

The Tijuana River watershed is a large and complex ecological system that straddles the international border between the U.S. and Mexico. The watershed drains through a vibrant, urban environment adjacent to the border into the Valley, in the southwest corner of the U.S. The Tijuana River flows from the watershed into the Tijuana Estuary and then into the Pacific Ocean. Sediment, trash, and other pollutants carried in stormwater runoff currently threaten the Valley's valuable ecological, recreational and economic resources. This document provides a strategy for collaborative, bi-national efforts directed toward long-term recovery and protection of this unique, irreplaceable resource.

Valley is a Unique Resource

Estuaries are a hydrological and biological crossroads, defined as the portion of the coastal zone where there is interaction of ocean water, fresh water, land, and atmosphere. These areas are highly productive and support a wide range of biodiversity that includes rare and unique plants and animals. The Tijuana estuary is one of only two coastal estuaries in southern California large enough, and unimpeded by development, to be resilient to climate change. It is also the only coastal lagoon in southern California that is primarily under public ownership and not bisected by roads and railroads, which contributes to its ecological resiliency and value. There are also important historical and cultural resources in the Valley. Accordingly, the estuary has been designated as a national research reserve (Tijuana River National Estuarine Research Reserve, or TRNERR) and is protected and managed through a federal-state cooperative effort for long-term research, education and interpretation.

The Valley is an important recreational resource, with more than 35 miles of multi-use trails for hiking, biking, equestrian and other uses. The surf offshore of the estuary is considered one of the best surf spots in southern California. Visitors can experience everything from dense riparian forests along the Tijuana River to coastal maritime sage scrub on top of Spooner's Mesa to sandy beach habitat along the Pacific Ocean. In addition to the Valley's natural and cultural resources, there are active recreation fields, picnic areas, and a community garden.

Several agencies have significant infrastructure investments in the Valley. The U.S. Navy operates Navy Outlying Field Imperial Beach, which is one of its primary helicopter pilot training facilities on the West Coast on the northern periphery of the Valley at the Navy Outlying Field Imperial Beach.



Tijuana River Watershed drains 1,700 miles to the Pacific Ocean through the Tijuana River Valley in southern San Diego County



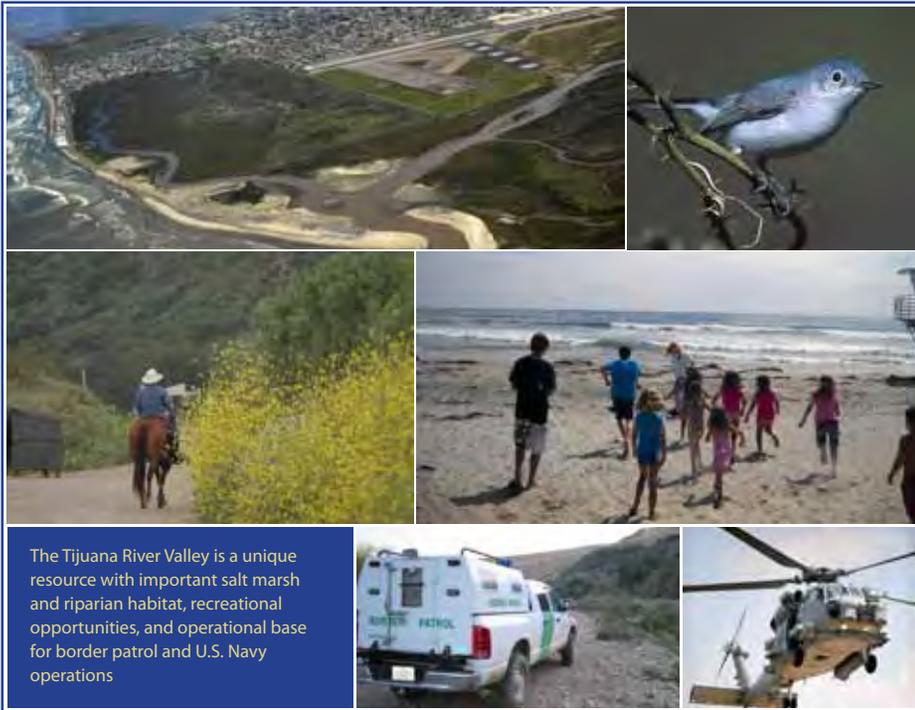
The Tijuana estuary at the end of the Tijuana River, is a valuable ecological, cultural, and recreational resource. Currently, the sediment and trash pollutants threaten its health

Recognized as a **“high priority wetland of regional significance”** by the Southern California Wetlands Recovery Project.

Tijuana estuary is designated as one of only 25

“wetlands of international importance”.

- International Ramsar Convention on Wetlands 2005



The Tijuana River Valley is a unique resource with important salt marsh and riparian habitat, recreational opportunities, and operational base for border patrol and U.S. Navy operations

U.S. Customs and Border Protection conducts operations in the Valley to support its border protection mission. The U.S. International Boundary and Water Commission (U.S. IBWC) operates the South Bay International Wastewater Treatment Plant which provides secondary treatment for average daily flows of 25 million gallons of sewage that originates in Mexico.

Agriculture has had a long historical presence in the Valley. Agricultural activities on private and leased lands include sustainable, organic farms that serve as a local source of fresh produce. In addition, a Community Garden operated by the County of San Diego (County) allows local residents to grow their own produce.

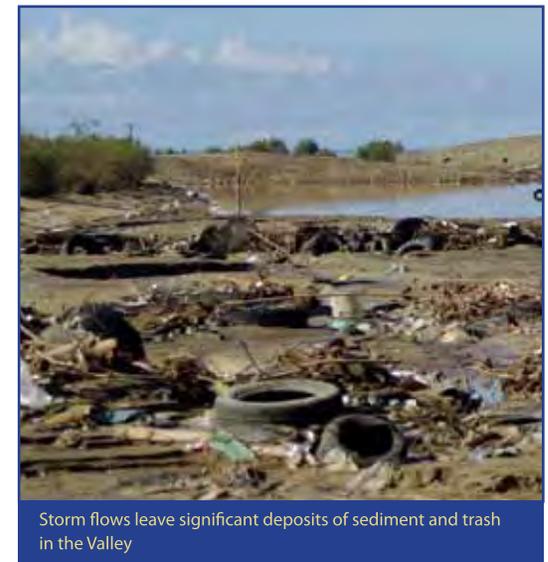
Finally, there are many programs that utilize Valley resources for hands-on environmental education programs. From grade school to college level there are educational opportunities and interpretative programs developed to appeal to a wide audience. It is widely recognized that effectively communicating the value of and the issues facing the Valley will lead to broad public support for its protection. Communication combined with scientific knowledge serve as the ultimate foundation for long-term resource stewardship and funding.

It is of critical importance to protect the Valley's diverse and unique ecological, recreational, cultural, and educational opportunities and preserve this natural jewel that is located within a binational metropolitan area. This will lead to improved habitat, water quality, and ocean protection for citizens of both the U.S. and Mexico.

Trash and Sediment Threaten Valley Resources

Unfortunately, the Valley is increasingly threatened by stormwater flows that contain trash and high concentrations of other urban, agricultural, and industrial pollutants in the Tijuana River and its tributaries. Additionally, the soils in the watershed are highly susceptible to erosion, especially when disturbed. Due to urbanization, even moderate storms can bring significant flows of sediment

downstream. As stormwater flows to the ocean, the intermixed sediment, trash and other debris are deposited in channels, among vegetation in the Valley floodplain, and in the estuary. These conditions create an environment where mosquitoes and other vectors can impact human health and the environment. Also, storm flows transport exotic invasive plant species that threaten native plant communities and negatively affect habitat for native wildlife. The interaction of sediment and trash deposits severely threaten habitat, water quality and other resources in the region.



Storm flows leave significant deposits of sediment and trash in the Valley

Vision for the Valley

The next step in protecting and restoring the Valley is to manage sediment and eliminate unwanted trash. The collaborative approach promoted by the Recovery Team to integrate the diverse perspectives of scientific, environmental,

regulatory and private stakeholders is intended to solve these problems. This Recovery Strategy identifies a path forward for implementing a collaborative, mutually beneficial plan across ownership and jurisdictional boundaries. It is intended to cost-effectively address sediment and trash issues while respecting natural and cultural resources, the roles and responsibilities of agency managers, and the needs of landowners residents, recreational users and visitors. The Recovery Strategy also thoughtfully considers existing policies and planning documents developed by local, regional, state and federal stakeholders.

Key Tijuana River Valley Planning Documents:

- » **U.S. Border 2020: U.S.-Mexico Environmental Program (Draft)**
Environmental Protection Agency 2011
- » **Tijuana River National Estuarine Research Reserve Comprehensive Management Plan**
California State Parks, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service 2010
- » **Tijuana River Valley Regional Park - Area Specific Management Directives**
County of San Diego 2007
- » **A Binational Vision for the Tijuana Watershed**
Binational Watershed Advisory Council for the Tijuana River Watershed 2005
- » **Local Coastal Program Land Use Plan**
City of San Diego 1999
- » **Multiple Species Conservation Program Subarea Plan**
City of San Diego 1997
- » **Water Quality Control Plan for the San Diego Basin (9)**
California Regional Water Quality Control Board Water San Diego Region 1994

Past Successes and Future Challenges

Efforts to protect and restore Valley resources are not new; sediment management, land preservation and habitat restoration have been conducted in the Tijuana River watershed for many years. Local, state, and federal management agencies, along with non-governmental organizations and other stakeholders have invested significant effort and funding in project planning and implementation

Summary of protection and restoration activities and expenditures in the Tijuana River watershed since the 1980s

Activity	Project Type	Approximate Expenditure Amount	
		U.S.	Mexico
Wastewater Improvements	Treatment and reclamation plant design and construction	\$600M	\$100M
Sediment Control	Basin design and construction, road paving, community projects	\$18M	Unknown
Trash Control	Cleanups, waste tire removal, studies	\$3M	\$0.5M
Flood Control	Channel clearing, berm construction and removal	\$10M	Unknown
Ecosystem Restoration and Protection	Habitat restoration, invasive control, land acquisition	\$33M	Unknown

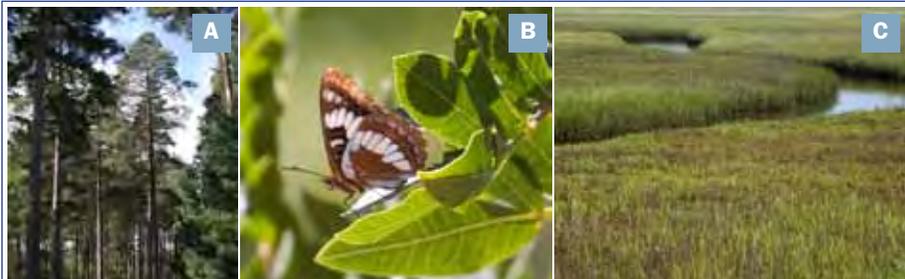
both in the U.S. and in Mexico to improve conditions. Investments to improve wastewater treatment began in the 1980s and '90s. Recent activities have included pollution prevention and source control for sediment and trash, water quality improvements, flood control, improved recreational opportunities, and public education and outreach. These projects demonstrate the dedication and wealth of experience that the various operating agencies and stakeholders have invested in the Valley and watershed.

The future brings many challenges for the Recovery Team. The bi-national nature of the watershed is one major obstacle. It is well known that source control and pollution prevention activities can be the most cost-effective solutions to reduce sediment and trash loading. With the majority of the watershed situated in Mexico, planning and implementing source control and other projects across the international border present an added challenge to an already complex problem. Other challenges include:

- » identifying long-term funding for operation and maintenance of sediment and trash management facilities,
- » coordinating agencies in project review and approval, and
- » scheduling projects to meet short-term sediment and trash control needs with long-term restoration goals while maximizing funding opportunities.

Tijuana River Watershed Description

The Tijuana River Watershed is an approximately 1,700-square mile area that straddles the U.S./Mexico international border. The watershed is a diverse and complex drainage system ranging from 6,000-foot pine forest-covered mountains to the tidal saltwater estuary at the mouth of the Tijuana River. Nearly three-quarters of the watershed is located in Mexico, but the watershed drains to the Pacific Ocean through the 8-square mile valley located adjacent to the border. The Valley is home to tidally flushed wetland, riparian, and upland habitats supporting a broad range of organisms, including threatened and endangered species. In addition, a number of federally listed historical and archaeological sites exist in the Valley, some dating back 8,000 years.



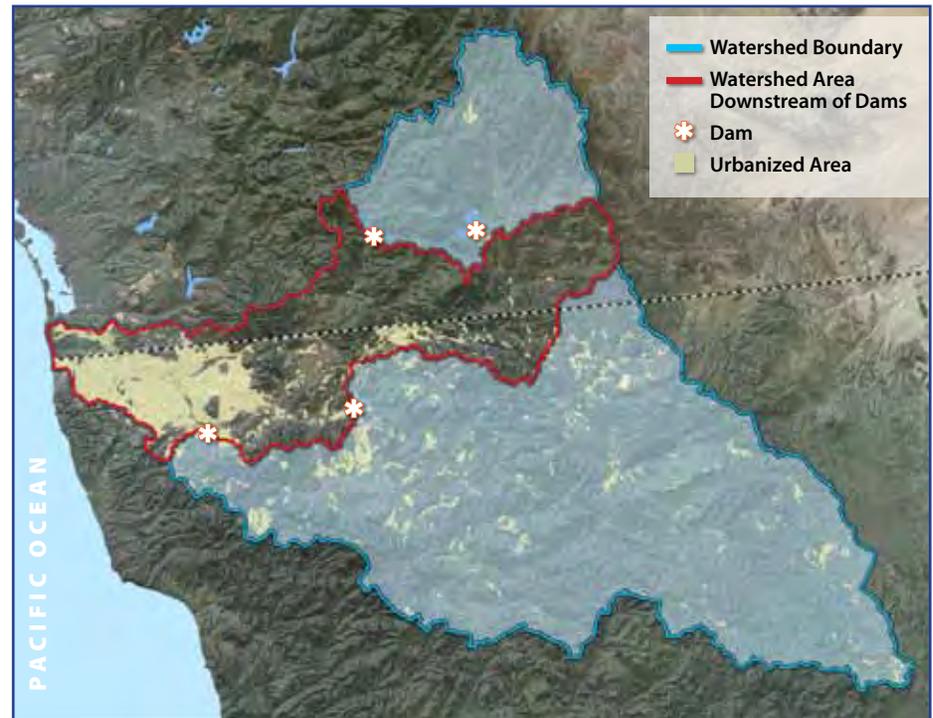
Diverse binational watershed with varied habitats: A) pine forest B) riparian habitat C) salt marsh

A diversity of land uses are present in the watershed, from largely undeveloped open space in the upper watershed to highly-urbanized, residential, commercial, military, and industrial areas in the lower watershed. Rapid urbanization has occurred over the past several decades, most dramatically in the city of Tijuana where more than 2.7 million people currently reside. Several large dams (Barrett and Morena in the U.S., and Rodríguez and El Carrizo in Mexico) control a large majority of the surface water flow in the watershed. While these dams provide reservoirs of potable water to support residents and associated infrastructure on both sides of the border, they also serve as traps for the downstream movement of sediment and trash to the lower watershed. Therefore, the sediment and trash produced in the 462-square mile area downstream of the dams are responsible for impacts to the Valley.



Current land uses in the watershed include: A) urban areas B) semi-urban development C) ranches in the Valley

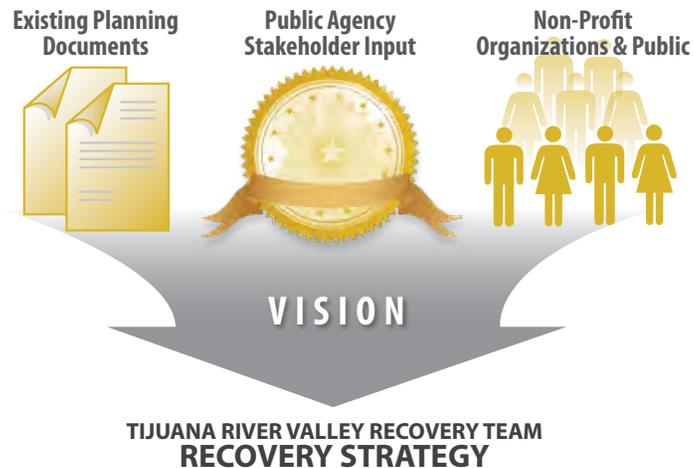
Tijuana River Watershed Statistics	U.S.	Mexico
Population within Watershed	11,000	2.7M
Watershed Area	468 mi ²	1,256 mi ²
Annual Precipitation	5.9 to 25.6 inches per year	



Storm flows from nearly 75% of the watershed are controlled by four major dams. A significant portion of the area downstream of the dams is urbanized, especially in the city of Tijuana

What is the Tijuana River Valley Recovery Team?

The Recovery Team is a collaboration of more than 30 federal, state and local agencies and other interested parties from both sides of the border focused on addressing sediment, trash, and associated environmental issues. The collaborative stakeholder-led approach to integrate the diverse scientific, environmental, regulatory and private stakeholder perspectives with the existing planning documents of this Recovery Strategy is intended to reduce the impacts of anthropogenic (human caused) sediment and trash on the Valley's resources.



The activities described in this document summarize the Recovery Team's efforts to combine the collective knowledge, enthusiasm, and resources of the many agencies and groups that are seeking solutions to sediment and trash issues. The management areas of sediment and trash, flood control, ecosystem management, and recreation and education, described on the following pages, present the current conditions as we consider the future of the Valley. The Recovery Team utilized its collaborative approach to analyze these various management needs and develop and prioritize projects in a manner consistent with the future vision for the Valley.



General Recovery Team Goals

- » Bi-national collaboration
- » Operation and maintenance of sustainable trash and sediment controls
- » Flood control to protect life and property
- » Hydrologically connected, naturally functioning habitats
- » Maintenance of recreation opportunities
- » Informed and engaged community
- » Long-term plan to restore the floodplain and estuary
- » Respect existing uses

Recovery Team Signatory Members



The Mission is to bring together the governmental, 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 future 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.

The Vision is a Tijuana River Valley free of historical trash and sediment, protected from future deposits of trash and sediment, restored to a sustained physical, chemical and biological integrity, and performing its hydrologic functions, while respecting the interests of current and future landowners and users.



Sediment and Trash

Goal: Utilize partnerships among public land owners, public operating agencies, non-governmental organizations, residents and volunteers in the U.S. and Mexico to reduce sources of and cost-effectively manage sediment and trash pollutants.

Current Situation

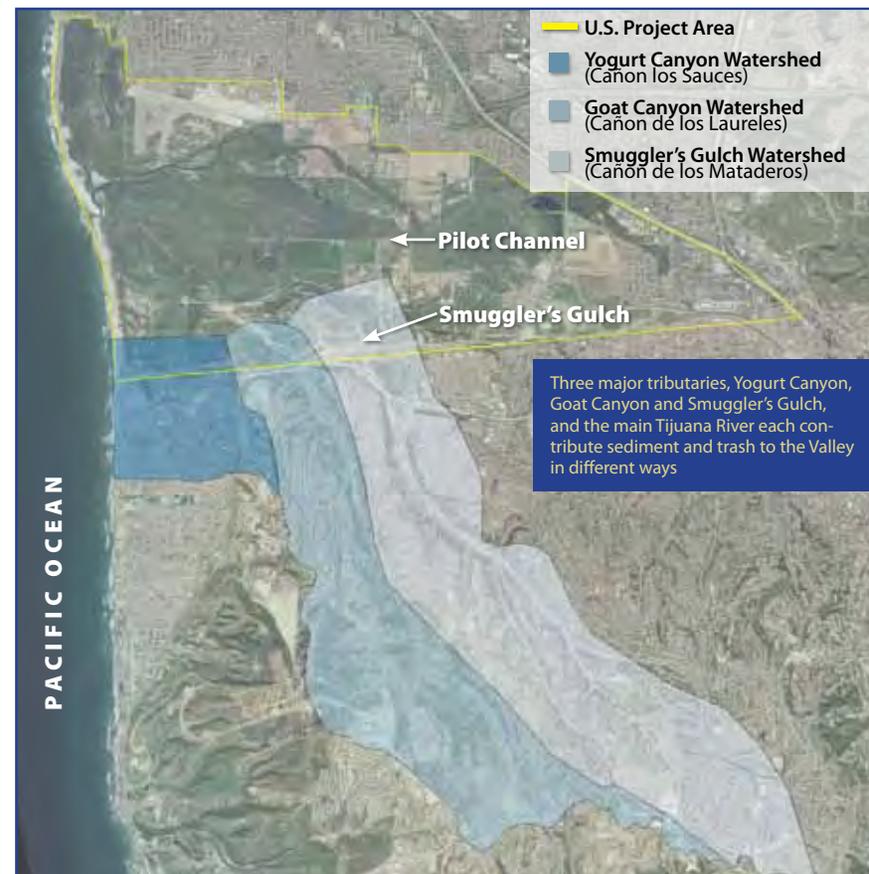
Sediment and trash are degrading the Valley and estuary and threatening public health and safety throughout the Tijuana River watershed. Stormwater flows transport sediment and trash from urban areas downstream into the Valley. The urban population in the city of Tijuana continues to grow rapidly as jobseekers from throughout Latin America seek opportunity near the international border. Infrastructure improvements, such as paved roadways and waste management services, have been unable to keep pace with growth. Often this situation can lead to problems such as accelerated erosion and illicit disposal of trash and other waste materials in canyons and neighborhoods both in incorporated and unincorporated areas of the city. In addition, basic development practices in many areas of the watershed have resulted in disturbance of natural drainage patterns and vegetation removal from slopes, making them unstable and prone to erosion. Storm flows mobilize and then transport the sediment and trash downstream, threatening the health of riparian and estuarine habitats in both the U.S. and Mexico and reducing the flow capacity of the river and tributary channels. While sediment and trash are linked because both are transported by storm flows, these pollutants behave differently in the water column and must be managed differently.

Organizations on both sides of the border recognize that source reduction can provide the most cost-effective means of addressing these issues. Community programs have been initiated to improve source control of these materials through generating awareness, changing trash disposal practices and conducting cleanups with volunteers. Further infrastructure improvements,

community programs and cleanups on the Mexican side of the international border will have a positive impact in downstream areas.

Sediment

The approach to sediment management varies by drainage into the Valley and estuary. Sediment discharged from Goat Canyon directly impacts salt marsh habitat, which has been steadily degraded.



Management of sediment and trash can be accomplished through cross-border partnering, collaboration and exchange of knowledge at all levels in government and among agencies on both sides of the border.

To control degradation, California State Parks (State Parks) constructed two sediment basins just downstream of the international border in 2006. The basins were designed to provide maximum sediment storage capacity within the space available for construction. In most wet seasons, the basins intercept a majority of the sediment. In very wet seasons, as in 2005, the basins filled and 18 acres of salt marsh was smothered by up to 4 feet of sediment in a single storm event.



Periodic storm events can cause up to several feet of sediment to deposit in the Valley

In Smuggler's Gulch, excessive sediment loads reduce the capacity of natural channels to carry storm flows, which exacerbates flooding that adversely impacts residential, agricultural and recreational property in the Valley. When resources are available, the City of San Diego (City) and County clear sediment from Smuggler's Gulch to maintain its capacity to carry storm flows and minimize the effects of flooding. The County removes approximately 15,000 cubic yards of trash, waste tires, and accumulated sediment each time it clears the channel from Smuggler's Gulch south of Monument Road. Also, in the early 1990s, the City

excavated an earthen channel (known as the Pilot Channel) to direct larger storm flows away from the northern portion of the Valley where flooding has resulted in significant damage to public and private property. Since then, the City has frequently cleared the Pilot Channel and Smuggler's Gulch channel north of Monument Road to reduce flood risk. Each channel clearing results in the removal of approximately 30,000 to 60,000 cubic yards of sediment, trash and waste tires. Despite this costly ongoing maintenance to control flooding, it continues to negatively affect residents and infrastructure. Sedimentation is also rapidly changing the topography which has a negative impact on the ecology of the Valley.



Reduced channel capacity can contribute to flooding events that threaten humans, animals and homes

The main Tijuana River channel is where the majority of the stormwater, sediment and trash enters the U.S. Historically, much of the sediment has been carried downstream into the Valley. Over time, the downstream areas have served as a sink for accumulated sediment, resulting in an increase in vegetation. This causes storm flows to flood and deposit additional sediment and trash. For the first time, U.S. IBWC has allocated funds in its 2012 budget to remove sediment and trash from the upper part of the U.S. IBWC Tijuana River Valley Flood Control Project area adjacent to the border.

Over the years, sediment management operations have increased in frequency and cost. Operations entail excavating material from the basins or managed channels, sorting trash and tires from sediment, and disposing of all material properly. Annual costs vary widely depending on volumes excavated and availability of local disposal options. For example, disposal of sediment from the Goat Canyon basins alone ranges from \$250,000 when a material operator uses



the material in local building projects to \$1.2M when it is transported to a local landfill. These costs exceed local, state, and federal operating budgets, and grant programs are reluctant to fund ongoing operation and maintenance activities. In an effort to stabilize and reduce costs, City, County, State Parks and U.S. IBWC began investigating a suite of alternative local reuse options, including using the sediment to replenish beach sand and restore upland areas. In addition, the mayor of Tijuana has provided \$1M of funding for sediment removal from channels in the city of Tijuana.



Trash

Trash is only incidentally addressed through current management practices. Heavier trash, such as tires, are imbedded in the sediment excavated from basins and channels. Floatable trash behaves differently; it is more easily transported even in low flows and can be transported by wind. As part of the Goat Canyon sediment basin project, trash nets were installed to trap surficial trash and debris. These nets are thought to be effective in areas where flow velocities

are relatively low. However, maintaining the nets can be difficult and labor intensive, especially during particularly wet years, since sediment and trash also accumulate upstream of the nets.

Cleanup of trash is important to minimize the impact from transport throughout the Valley. Several non-governmental organizations conduct cleanups of trash

Sediment and Trash Management in Cañon de Los Laureles

In Cañon de Los Laureles, a California Coastal Conservancy-funded watershed diagnostic was prepared by a team of scientists at the Mexican Institute of Water Technology. This work guided implementation of several community-based source control projects and urban policy changes using significant bi-national investment from local, state and federal agencies.

- » **Master Plan** - The first watershed-based urban plan in Mexico was prepared for Los Laureles Canyon. The plan was signed into Baja California public law in 2007.
- » **Re-vegetation** - 96 acres of previously bare slopes were re-vegetated using native drought-tolerant plants.
- » **Permeable Paving** - A permeable paver manufacturing and installation program was developed for public walkways and roads to reduce runoff and erosion.
- » **Reuse of Tires and Plastic Bottles** - A demonstration project for construction using waste tires and eco-bricks made from plastic water bottles was installed in a public park.
- » **Trash Pickup** - Over 700 tons of trash was collected from the Canyon through a temporary employment program for local residents.

Funding Agencies

- The City of Tijuana and the Federal Social Development Agency - \$200,000**
- Southern California Wetlands Recovery Project - \$50,000**
- U.S. EPA Border 2012 - Cañon Lumpio Project - \$50,000**
- SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales) - \$112,500**



and waste tires in the Valley. However, the timing and frequency of these activities are limited due to permit restrictions related to threatened and endangered species' breeding season(s), access constraints during the wet weather season, and health and safety concerns to volunteers.

Looking to the Future

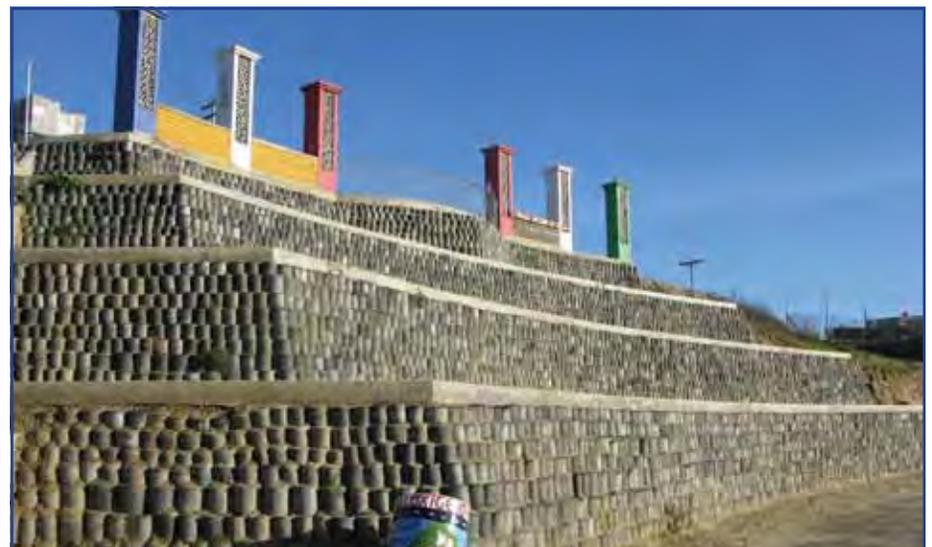
A watershed approach to sediment and trash management that simultaneously reduces pollutant sources, actively captures at key watershed locations, and uses ecosystem processes to naturally transport sediment through the Valley to the ocean is an ultimate goal. The Recovery Team has initiated dialogue with its counterparts in Mexico to jointly plan, conduct and operate a suite of source reduction and capture measures throughout the bi-national watershed. The projects in Cañon de Los Laureles demonstrate that such a partnership can be mutually beneficial and effective.

Since source reduction and capture may never be completely sufficient, the river and estuary fluvial geomorphology need to be used to increase sediment transport capacity. TRNERR, with State Parks, the US Fish and Wildlife Service, the Coastal Conservancy and the Southwest Wetlands Interpretative Association, have conducted a feasibility study to restore the southern portion of the estuary to enhance the tidal prism to accommodate elevated sediment loads. Similarly, past changes to the watershed's hydrology can be reversed to re-establish the natural capacity of the river to carry storm flows and sediment and more naturally connect waterways throughout the Valley.

Despite reducing costs by sharing facilities and contractors and creating options for local sediment reuses, a sustainable financing mechanism for operations and maintenance must be secured in order to responsibly invest in additional infrastructure.



Sediment basins constructed in Goat Canyon capture up to 60,000 cy of sediment from the Cañon de Los Laureles watershed each year



Construction of retaining walls using waste tires may be a way to beneficially reuse waste and reduce sources of trash



Stormwater (Flood) Control

Goal: Foster natural hydrological connectivity between estuarine and riparian habitats while minimizing flooding of public and private infrastructure.

Current Situation

The Tijuana River has historically functioned as a dynamic river system in its natural state. In a dynamic system, channels that convey water during major storm events shift location over time, depending on channel and vegetation stability, storm event size and frequency, large-scale climatic dynamics and other factors. Development related to agriculture, ranching and residential activities in the watershed and Valley over the past 100 years has significantly changed the hydrology of the river and made flood control a major issue in managing this dynamic system. Further, as a result of major flood events in the 1980s and '90s, berms were constructed on several properties to direct floodwaters away from existing infrastructure. In some cases, these changes have reduced channel capacity and may be responsible for an increase in upstream flooding.



Aerial view of 1993 flood event that severely affected Valley residents and infrastructure

Since the 1920s, urban expansion and associated infrastructure development in the watershed increased significantly. Major changes are described below.

- »Four dams, which control upstream flows from approximately 73% of the watershed, were constructed to provide water supply reservoirs to both the U.S. and Mexico.
- »The Tijuana River Valley Flood Control Project was constructed to contain an approximate 500-year storm event in the main river as it enters the U.S. from Mexico.
- »A one-mile-long earthen “pilot” channel was constructed to direct flows away from a northern channel that formed during a flooding event in 1993.
- »Conagua has nearly completed construction of a concrete-lined channel on the Rio Alamar for an upstream distance of approximately 6 miles (10km).

These changes have led to management challenges for the federal and local agencies, including U.S. IBWC, County, and City, responsible for flood control in the Valley. Based on the current channel configuration and condition, an approximately 5-to 10-year flood, representing a flow of between 7,000 and 14,000 cubic feet per second (cfs), can cause localized flooding along Monument Road and Hollister Street, and on private and leased properties in the Valley. During these flooding events, vehicular access in and out of the Valley is limited, residences and other infrastructure are impacted, and border protection operations can be impeded.



Flooding along Hollister Road in the Valley

In order to address localized flooding issues, the City and U.S. IBWC perform channel maintenance and clearing activities to remove accumulated sediment and trash. These costly operation and maintenance activities are needed on

Future goals for flood control activities in the Valley include balancing short-term needs to reduce flood risk, prevent property damage, and protect life with long-term ecosystem restoration, recreation and public use activities

nearly an annual basis to control flooding. In order to conduct the channel clearing operations, public notification, environmental permitting, and biological and cultural monitoring are necessary-at considerable cost. It is estimated that these costs, including disposal fees, are approximately \$100-\$120 per cubic yard of material removed.

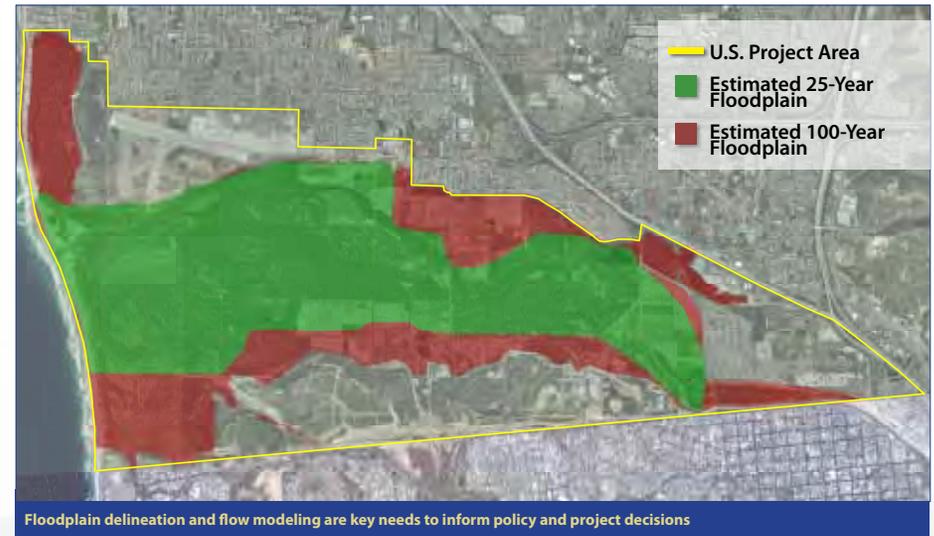
Looking to the Future

Future goals regarding flood control activities in the Valley include balancing short-term needs to reduce flood risk, prevent property damage, and protect life with long-term ecosystem restoration, recreation and public use activities. The need for this balanced approach in the Valley has been discussed in various planning documents where, in general, man-made flow constraints such as berms are prohibited without comprehensive agency review and cost-benefit analysis. The Recovery Team also recognizes that controlling flooding in the Valley is dependent upon partnership and coordination with Mexican and U.S. agencies responsible for dam operations. Given the relative amount of dam-controlled watershed area and water storage capacity of existing dams, ill-timed and/or large releases of water could cause significant flooding in the Valley.



Costly channel clearing operations to remove accumulated sediment and trash and reduce flood risk are needed often in the Valley

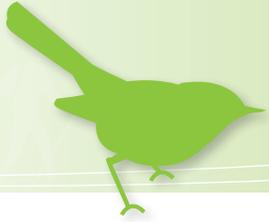
It is understood that conducting focused hydrological and hydraulic studies is key to the Valley recovery process. Understanding existing conditions, including the capacities of channels, will lead to cost-effective and environmentally-sound flood control and stormwater management strategies that are in balance with long-term ecosystem restoration goals.



Focused hydrology and hydraulic studies will allow:

- » floodplain delineation to inform policy and project implementation decisions,
- » detailed mapping of existing berms, dense vegetation, and other flow impediments that influence stormwater flows, and identification of current vegetation conditions and other physical characteristics that influence stormwater flows, and
- » improved understanding of processes that naturally transport sediment from the watershed to the ocean through the riparian and estuarine habitats in the Valley.

Additionally, sediment and trash source control and pollutant capture activities in the watershed are likely to reduce the need for costly ongoing operations and maintenance activities designed to reduce flooding risk in the Valley. The coordination and prioritization of these activities through the Recovery Team are key to providing sustainable, long-term solutions to effective stormwater management.

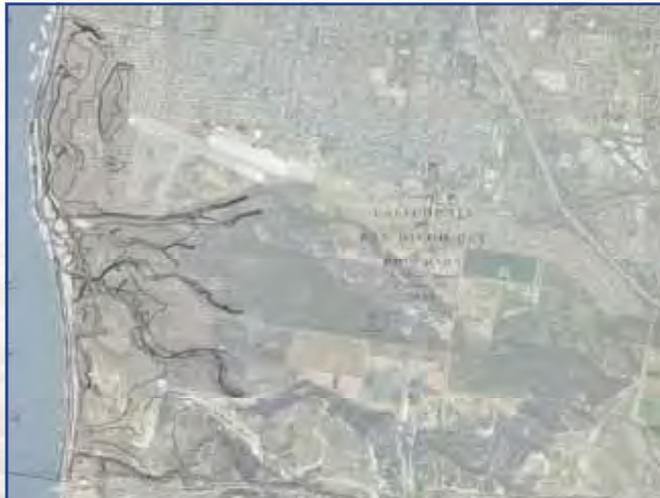


Ecosystems

Goal: Creation of a sustainable, interconnected complex of natural habitats that supports native species, provides valuable ecosystem services, and offers opportunities for education and research.

Current Situation

The Tijuana River watershed historically has consisted of well-developed estuarine, riparian, transitional, and upland habitats. Although the physical footprint of the Valley today is similar to what existed historically, its ecosystems have changed over time.



Unlike most other coastal wetlands in southern California, the footprint of the Valley today is similar to what existed in the 1850s

The Valley was largely agricultural from the 1920s through the 1960s, especially in the eastern, non-tidal areas. Since then, many agricultural fields have been retired and marked habitat recovery has occurred in many parts of the Valley. These changes are reflected in the broad, ecosystem-based goals outlined in resource planning documents prepared for the Valley. Activities performed

in support of these planning documents have resulted in many habitat improvements in recent years, including:

- » active habitat and species protection,
- » invasive species management,
- » public acquisition of property,
- » shifting agricultural practices and transition to sustainable, organic farming,
- » ecosystem restoration, particularly in the tidal salt marsh,
- » compensatory mitigation, particularly in the riparian zone,
- » other “passive” restoration, such as roads and trails being retired and restored, and
- » water quality improvements related to advances in wastewater treatment and infrastructure.



Invasive species control and habitat restoration programs have helped restore hundreds of acres of habitat in the Valley over the past 20 years

The Valley’s intrinsic habitat, coupled with continuing ecosystem recovery efforts over recent decades make it one of the largest, least developed, and best-studied coastal wetland ecosystems in southern California. Also, the recent establishment of the Tijuana River Mouth State Marine Conservation Area, offshore of the estuary, presents an opportunity to foster a truly unique integration of habitats and ecosystem-based programs in coastal California.

The Recovery Strategy is aligned with the broad ecological vision espoused in prior planning documents - that of a largely natural, interconnected complex of habitats that support native plants and animals, as well as passive recreation opportunities for people.

Institutions Performing Research and Monitoring Activities in and around the Valley

- » Tijuana River National Estuarine Research Reserve
- » San Diego State University
- » University of California San Diego
- » University of California Santa Barbara
- » University of San Diego
- » Scripps Institution of Oceanography
- » Over 15 public and private educational institutions, federal partnerships, and other organizations

Despite the improvements in the overall extent and quality of habitats in the Valley, significant issues remain. These stem in large part from the influx of sediment and trash, altered hydrology, continued pollution during wet weather, and invasive species. These issues must be addressed to continue the ongoing improvement in the health of the Valley ecosystem and make the habitats less vulnerable to future adverse changes, particularly sea level rise associated with climate change.

Looking to the Future

From an ecosystem perspective, the broad ecological visions for the Valley espoused in existing planning documents—that of a largely natural, interconnected complex of habitats that support native plants and animals, as well as passive recreation opportunities for people—are fundamental goals. This vision was designed to maximize natural processes and respect existing stakeholders and landowners, while allowing for the need to adapt to changing environmental conditions, such as those due to climate change.

The key benefits of restoring the ecosystem include minimizing flood risk, improving water quality in the estuary and ocean, providing environmental buffering, supporting sensitive species, improving recreational value, supporting education and outreach, and providing research opportunities leading to adaptive management strategies. Such efforts will also make the

system more resilient to sea level rise and changing watershed inputs. This is particularly important in the Valley, as it is the wetland system in southern California most likely to be able to adapt to changing climate due to its limited development, relatively intact habitats, and broad buffer areas.

The strategies that have been offered to achieve these goals rely on past successes in the Valley. The strategy includes: conserving and protecting the healthy aspects of the ecosystem, restoring the degraded portions of the ecosystem; adapting land use practices to align with broad ecosystem-based goals on publicly owned land; restoring habitat damaged by redundant and unnecessary roads and trails, restoring abandoned sites (e.g., quarries); assessing the continuation of agricultural and other leases; continuing to engage private property owners in the restoration process; purchasing properties from willing sellers for public use; and obtaining conservation easements and development rights on private and public lands.

One of the focus areas for the future is resolving the hydrologic problems that preclude the natural flow of water. Obstructions to flow in the Valley compromise both the healthy functioning of the intact tidal / riparian wetland complex, as well as exacerbate flood risk to properties and businesses in the Valley. A key principle for ecological restoration in the Valley is the recognition that improving hydrologic connectivity and increasing tidal exchange will not only benefit habitats, but also enhance the natural ability of the ecosystem to convey flood waters and effectively transport sediment through the system to the ocean, where it is needed to replenish sand on beaches.



Recreation Systems and Education

Goal: Coordinate recreation and education activities in the Valley with trash and sediment management in order to provide social, economic and environmental benefits for residents, visitors and land managers.

Current Situation

The Valley has a long history of use as a resource and recreational area. The Valley and the estuary is a premier recreational resource for hikers, bird watchers, naturalists, equestrians, school children and other members of the public. These users recognize and value the Valley's unique setting and serve as stewards to improve and enhance the recreational experience in the Valley. There is evidence that the Valley was used by native people and hunters for hundreds of years. Since the early 20th century, the region around the Valley, particularly Imperial Beach, has served as a summer retreat for Imperial Valley residents and other visitors. Horse racing became popular in the city of Tijuana in the 1920s; the Valley served as a location for stables for horse breeders and owners. In 1964, California voters approved funding to acquire the property that later became Border Field State Park.

During the same period, developers lobbied the federal government and local landowners to build a marina in the estuary. In 1971, President Nixon announced that Border Field would be developed for recreational use as part of his "Legacy of Parks" program, and 372 acres became part of Border Field State Park, preserving the southern flank of the estuary and mesa area adjacent to the international border. Meanwhile, local biologists Joy Zedler and Paul Jorgensen, along with Dr. Mike McCoy, a wildlife veterinarian, organized local environmentalists and Imperial Beach residents to build support for the estuary's preservation. While Imperial Beach residents voted in favor of the marina project in 1980, the U.S. Fish & Wildlife Service purchased the northern 500 acres of the estuary, establishing the Tijuana Slough National Wildlife Refuge. Despite opposition from developers, the estuary (both State Parks and National Wildlife

Refuge land) became part of the U.S. Department of Commerce's National Estuarine Sanctuary Program in 1982, and was designated a National Estuarine Research Reserve.

Currently, recreational opportunities within the Valley are managed by multiple agencies. TRNERR is managed under a partnership between the U.S. and the State of California that links the National Oceanic and Atmospheric Administration, State Parks, and the U. S. Fish & Wildlife Service. State Parks operates the Visitor Center and maintains Border Field State Park. The U.S. Fish and Wildlife Service manages the Tijuana Slough National Wildlife Refuge. Several regional agencies and local municipalities share ownership and management responsibilities at the Reserve.

The Tijuana River Valley Regional Park (Regional Park) occupies more than 1,700 acres and is the largest recreational area in the Valley. It was established in 1996 by the County. Through grants and other funding mechanisms, the County has spent over \$20 million in the acquisition of properties for open space. The Regional Park's 35 miles of trails connect to an extensive system of trails that provide visitors access to the Valley from Dairy Mart Road to the beach. This



Students can learn valuable lessons about the environment through educational programs conducted in the Valley

... a wealth of recreation and education opportunities exist for hikers, bird watchers, naturalists, equestrians, school children and other members of the public.

trail network is the only place along the southern California coastline where horseback riding is allowed on the beach. In addition, a County sports facility is located north of the main river channel east of Hollister Street.

The Valley provides many opportunities for public education about the importance of wetlands ecosystems and the many facets of the Valley's current uses and history. The combination of salt marsh and riparian wetlands, complemented by upland habitat, mixed human uses, and cultural resources, provide interpretive opportunities for these resources. The Tijuana Estuary Visitor Center incorporates educational and volunteer opportunities for students from local schools and the general public. These activities include everything from classes and bird walks to planting native vegetation and removing non-native plants. The Tijuana River National Estuarine Research Reserve has been providing educational and interpretive opportunities to pre-kindergarten to college age students. The Tijuana Estuary Explorers and Junior Rangers programs are examples of ecology-based curriculum designed to inform future stewards of the watershed. Non-government organizations also provide educational tours and volunteer opportunities in the Valley.

Looking to the Future

The agencies and non-government organizations that provide recreation will continue their efforts and plan to expand programs. Expansion of volunteer



The Valley provides a unique opportunity where equestrians can ride from picturesque riparian habitat to the beach



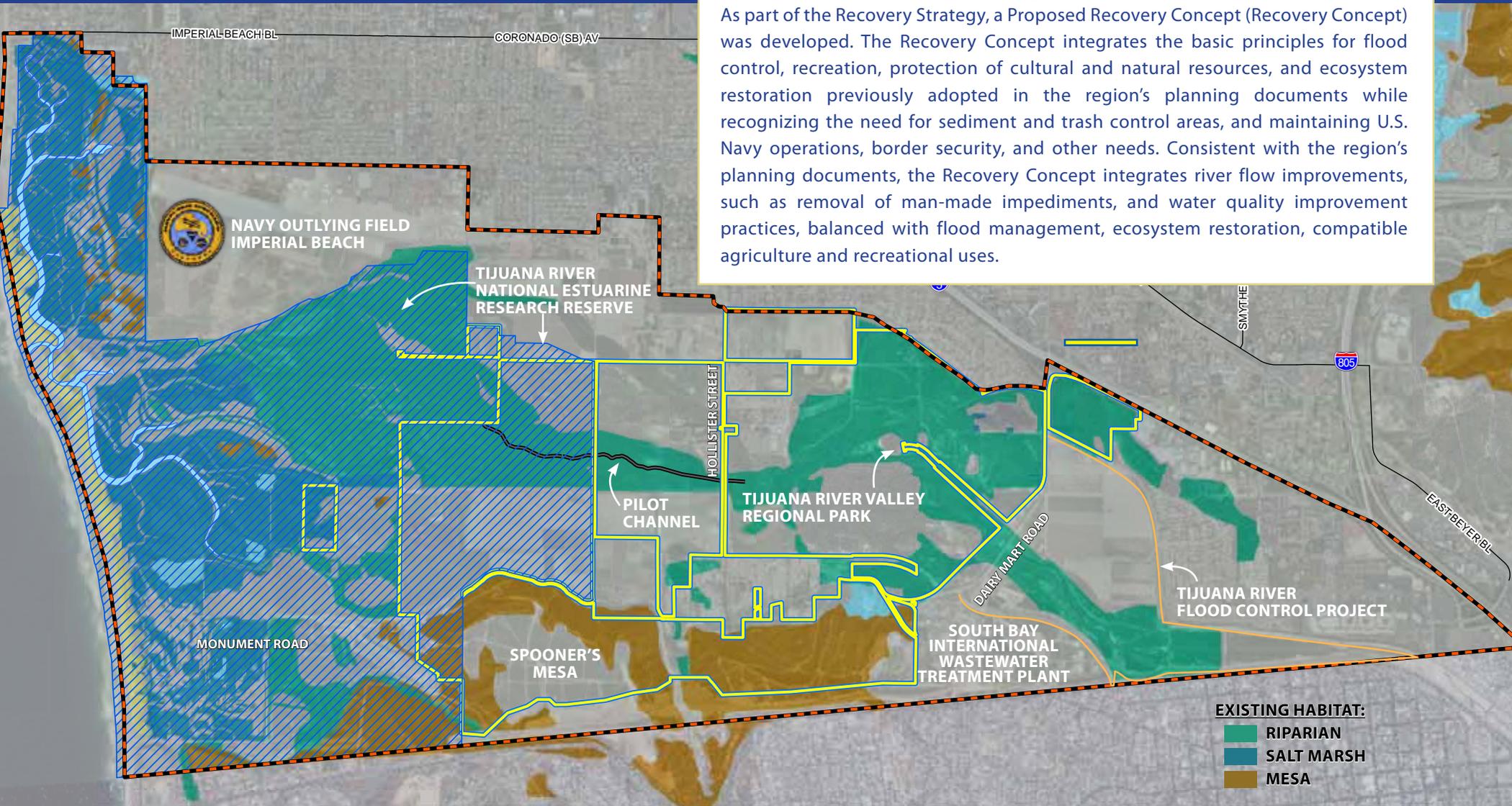
The extensive system of trails in the Valley, is one of the few places in southern California where recreational users can walk from riparian habitat to the beach

planting and restoration programs, improvement of equestrian facilities and construction of the planned recreational facility and playing fields on the north edge of the Valley are all part of enhancing recreational and educational opportunities. Community-based social marketing would be an excellent tool to help reach the community in order to meet the behavior change goals of this Strategy and develop the best techniques to influence community members on both sides of the border.

The trail system, which is beneficial to multiple users, is continually reevaluated in order to provide a high quality experience and access to the Valley while protecting habitat value. Picnic tables, benches, and small-scale horticultural and gardening areas will be developed where appropriate. The alignment of the southernmost segments of the California Coastal Trail is the final planning stages and is expected to culminate at Monument Mesa. This will eventually provide trail users coastal trail access from the international border to the Oregon coast.

Mapping the Recovery Strategy

As part of the Recovery Strategy, a Proposed Recovery Concept (Recovery Concept) was developed. The Recovery Concept integrates the basic principles for flood control, recreation, protection of cultural and natural resources, and ecosystem restoration previously adopted in the region's planning documents while recognizing the need for sediment and trash control areas, and maintaining U.S. Navy operations, border security, and other needs. Consistent with the region's planning documents, the Recovery Concept integrates river flow improvements, such as removal of man-made impediments, and water quality improvement practices, balanced with flood management, ecosystem restoration, compatible agriculture and recreational uses.



This Strategy, and the overall Recovery Team, recognize that there are several specific areas or parcels where existing or planned uses conflict with the long-term Recovery Concept. As an example, existing planning documents, public agency stakeholders, and others have recognized the importance of preserving the region's cultural heritage and respecting existing residential, agricultural, and other land uses in areas of the Valley subjected to frequent flooding. However, agencies responsible for cost-efficient floodplain management have also recognized the need to balance flood protection for properties and infrastructure within the 25-year floodplain in the short-term with long-term strategies to reduce flooding risk and enhance natural ecosystems and processes. Accordingly, the Recovery Team has developed this Strategy to document the iterative, integrated, multi-stakeholder planning and implementation approach to coordinate and maximize the cost efficiency of recovery efforts in the Valley.

Proposed Recovery Concept

Key Components of the Proposed Recovery Concept include:

ECOSYSTEM AREAS

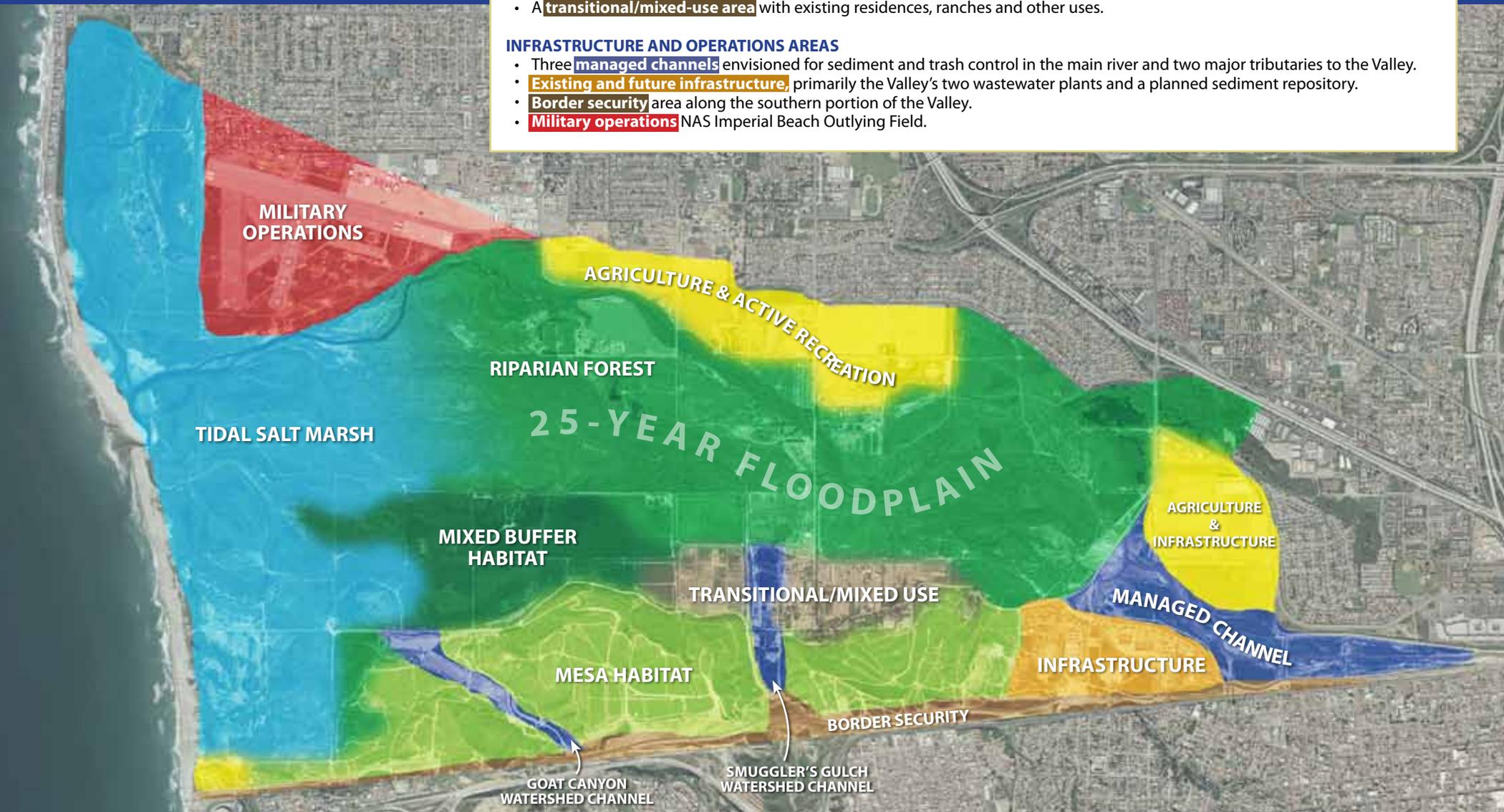
- A large tidal **salt marsh area** in the western portion of the Valley.
- A broad, central **riparian forest** within the 25-year floodplain (Note: several privately owned parcels are located within this area).
- A **mesa habitat** bordering the southern edge of the Valley with chaparral, sage scrub and grasslands.
- A **mixed-buffer habitat** between the upland/mesa habitat and the lowland riparian/salt marsh areas. This area could provide ecosystem resiliency to potential sea-level rise by providing raised topographic areas where salt marsh habitat can migrate in periods of inland sea water inundation.

HUMAN USE AREAS

- Two **agriculture and active recreation** areas to accommodate existing residential and recreation uses.
- A **transitional/mixed-use area** with existing residences, ranches and other uses.

INFRASTRUCTURE AND OPERATIONS AREAS

- Three **managed channels** envisioned for sediment and trash control in the main river and two major tributaries to the Valley.
- **Existing and future infrastructure**, primarily the Valley's two wastewater plants and a planned sediment repository.
- **Border security** area along the southern portion of the Valley.
- **Military operations** NAS Imperial Beach Outlying Field.



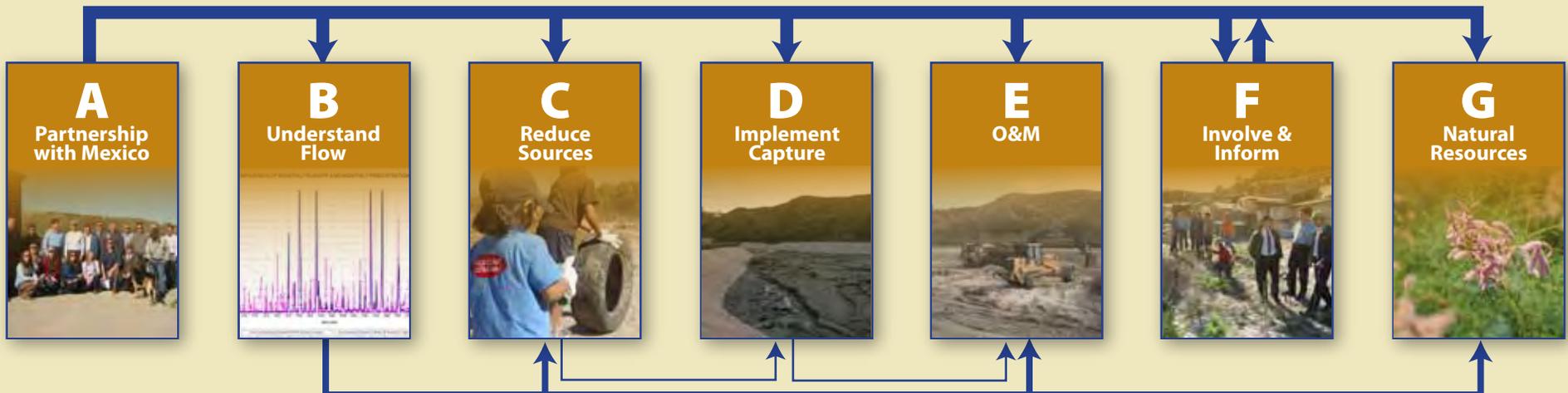
Priority Action Areas

By combining the goals required for successful sediment and trash management, flood control, ecosystem restoration, and recreation and education needs with the broad, integrated management themes captured in the Proposed Recovery Concept, the Recovery Team identified seven Priority Action Areas for work in the initial phase of Recovery. The Priority Action Areas are described below.

- A. Partner with Mexico to Implement Optimum, Watershed-based Solutions
- B. Understand How Water, Sediment and Trash Flow
- C. Reduce Sources of Sediment and Trash
- D. Implement Sediment and Trash Capture Devices in the Watershed
- E. Fund and Perform Ongoing Operations and Maintenance (O&M)
- F. Involve and Inform the Community in Mexico and U.S.
- G. Protect and Enhance Natural Resources

Priority Action Area Linkage

The results of projects described in each of the Priority Action Areas affect what future work will be needed to restore the Valley. There is a level of interdependence between each of the Priority Action Areas, and each may be conducted concurrently to meet the vision for the Valley. First and foremost, identifying and developing a team approach between the U.S. and Mexico to address the sediment and trash issues will be of the highest priority. The interconnectivity of the Priority Action Areas is described below.



Interconnection of Priority Action Areas - Project Outcomes Inform Future Work

Project Execution Lifecycle Description

Projects within each Priority Action Area will be executed by individual Recovery Team stakeholders. The range and extent of implementation will depend on the project scope, timing, and internal organizational needs. Generally, capital improvement project implementation consists of four main components:

- » data collection and feasibility assessment,
- » permitting and design,
- » implementation, and
- » operation and maintenance.

Non-capital projects may not require each of the project lifecycle components. A brief description of the main project life cycle components is presented below.

Data Collection and Feasibility Assessment

Projects begin with a problem that needs to be solved. Prior and during project initiation, Recovery Team members will coordinate with each other to assess available data and perform appropriate feasibility assessments to evaluate alternatives. Activities may include:

- » background data collection and coordination,
- » feasibility assessment — background data leading to a defined project scope, cost estimate, may be combined with permitting and design, and
- » consideration of capital and long-term operation and maintenance funding mechanisms, if applicable.

Permitting and Design

Federal, state, and environmental approvals, as well as consensus from project stakeholders and the public are required at the permitting and design stage. Contract plans and specifications, cost estimates, and contracting processes are also required. Permit components include:

- » environmental permitting documents,
- » draft environmental document and public review and comment, and
- » final environmental document certification and approval.

Engineering studies support design, environmental evaluation, and address stakeholder input and include:

- » base maps, plan sheets (e.g., 30, 60 and 100% designs),
- » plans, specifications, and estimate package, and
- » construction contract(s) and other agreements.

Implementation

For capital projects, the implementation component includes:

- » constructed physical improvement — follows the applicable federal, state, and local guidelines,
- » as-built plans — includes plan changes during construction, and
- » environmental compliance certificates.

Operate and Maintain

Many capital projects envisioned in the Valley will need ongoing operation and maintenance that will require:

- » dedicated, reliable sources of funding,
- » maintenance agreement(s), and
- » planning to assess the long-term effectiveness of the project.

Summary

The following section presents a preliminary schedule for possible projects associated with each of the seven Priority Action Areas identified by the Recovery Team. These actions are required to successfully and cost-efficiently implement the diverse array of projects identified in this Recovery Strategy that will have benefits across the multiple management areas previously described.

ESTIMATED PROJECT SCHEDULE

2012

2014

2016

2018

2020

A. Partner with Mexico to Implement Optimum, Watershed-based Solutions

Specific projects to be determined through bi-national partnerships and the Recovery Team

B. Understand How Water, Sediment and Trash Flow

- 1. Watershed Hydrological and Hydraulic Modeling
- 2. Sediment and Trash Load Calibration Study
- 3. Bi-national Sediment and Trash Control Plan

C. Reduce Sources of Sediment and Trash

- 4. Sediment Source Control Implementation Program
- 5. Trash Source Control Implementation Program
- 6. Regular Trash Removal - U.S.
- 7. Trash Removal Programs - Mexico

D. Implement Sediment and Trash Capture Devices in Watershed

- 8. Design and Implementation of Sediment Basin in Smuggler's Gulch
- 9. Sediment Capture Implementation - Mexico
- 10. Design and Implementation of Floatable Trash Capture Device(s)
- 11. Storm Drain System Trash Capture Device(s) Assessment - U.S.
- 12. Trash Capture Implementation - Mexico

E. Fund and Perform Ongoing Operations and Maintenance Work

- 13. Local Integrated Sediment and Trash Processing Site
- 14. Nearshore Sediment Reuse/Beach Replenishment Project ^{In Progress}
- 15. Nelson and Sloan Quarry Reclamation ^{In Progress} (Feasibility phase)
- 16. Reuse Construction Grade Material - Contract Terms and Conditions Recommendations
- 17. Long-term Operations and Maintenance Financing

F. Involve and Inform Community in Mexico and U.S.

- 18. Recovery Team Administration, Website Management and Media Support
- 19. Cross-border Notification Network

G. Protect and Enhance Natural Resources

- 20. Climate Change Analysis and Planning
- 21. Integrated Floodplain Management Alternatives Analysis
- 22. Restore River Hydrology
- 23. Restore Estuary
- 24. Implement the Tijuana River Valley Invasive Plant Control Program ^{In Progress}
- 25. Establish Native Plant Cover and Weed Control on Border Infrastructure System ^{In Progress}
- 26. Acquire Private Property from Willing Sellers ^{In Progress}
- 27. Agricultural Land Management Strategy

	2012	2014	2016	2018	2020
A. Partner with Mexico to Implement Optimum, Watershed-based Solutions					
Specific projects to be determined through bi-national partnerships and the Recovery Team.	➔				

The international border serves as both a challenge and an opportunity in developing and implementing integrated programs to address sediment and trash issues. In practice, a watershed approach to source control and pollution prevention is often the most cost-effective management measure strategy to control stormwater-borne pollutants. The Recovery Team recognizes that although “end-of-pipe” solutions and cleanup can be done in the U.S. portion of the watershed, it may not be sufficient to reduce sediment and trash inputs to reduce flooding and prevent further degradation of the Valley and estuary. Accordingly, effective treatment of sediment and trash requires a combination of pollutant source reduction, capture, cleanup activities, policy enhancements, and restoration of hydrologic processes in both the U.S. and Mexico portions of the watershed.

U.S. IBWC, San Diego Association of Governments Borders Committee, and others. The Recovery Team will work to fully engage the appropriate agencies and organizations in Mexico in identifying and implementing an optimum suite of source reduction and capture measures in the watershed, as outlined below, and utilize existing collaborative bi-national funding mechanisms. In practice, this entails jointly advising and reviewing data, and identifying and implementing projects through cooperative data sharing. In addition, education and coordination activities will be needed among Recovery Team member agencies to understand the structure, function and jurisdictional responsibility of Mexican agencies tasked with sediment and trash controls. This will improve communication and allow the Recovery Team to recognize and integrate with work currently being conducted in Mexico to control sediment and trash.

A number of mechanisms currently exist for coordinating and funding work in Mexico. Existing mechanisms include the U.S. EPA Border 2020 program,

	2012	2014	2016	2018	2020
B. Understand How Water, Sediment and Trash Flow					
1. Watershed Hydrological and Hydraulic Modeling					
2. Sediment and Trash Load Calibration Study					
3. Bi-national Sediment and Trash Control Plan					

It is critical to understand how water and sediment flow in order to develop an effective, integrated program for cost-efficient sediment and trash management and long-term recovery for the Valley. Sediment and trash accumulation and associated flood risk to public infrastructure and private property present costly environmental and management issues for Valley stakeholders. Many hydrology and hydraulic studies have been conducted in the Valley to understand how water flows for a variety of specific purposes, but some of this work is outdated or not relevant. In addition, only recently have studies focused on analysis of peak flows in the main Tijuana River, runoff volume and duration during extreme storm events, and assessed production and distribution of sediment

in the main river and tributary canyon drainages specifically for the purpose of reducing sediment, trash and flood risk. Focused hydrological and hydraulic studies will jointly inform and allow collaborative bi-national solutions to be developed for: (1) restoration of the river and estuary to optimize flows for flood control and natural sediment transport to the ocean, (2) cost-benefit analysis of optimum management actions to control sediment and trash at the source(s) in the watershed and in the Valley, and (3) development of design, siting and sizing criteria for sediment and trash capture infrastructure in both the U.S. and Mexico portions of the watershed.

1. Watershed Hydrological and Hydraulic Modeling

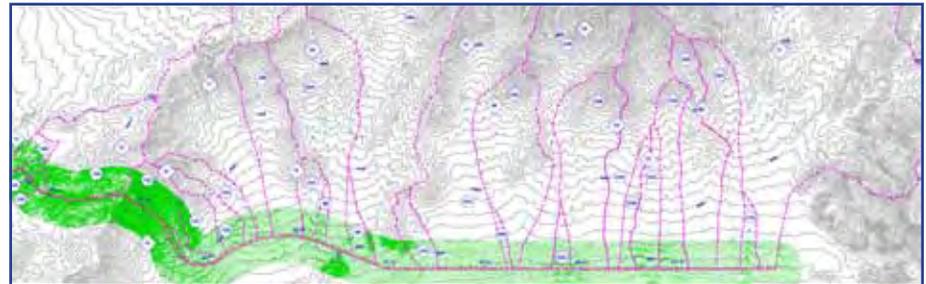
Project will perform hydrology and hydraulics modeling based on current conditions. Project will re-evaluate the extent of the 25- and 100-year floodplains using LIDAR and other available data. Expected results: identification of current flow characteristics that may be used for sediment and trash management, delineation of 25- and 100-year floodplain boundaries, and data to inform other policy and project implementation decisions.

2. Sediment and Trash Load Calibration Study

Desktop and field measurement study of sediment and trash loads in the Tijuana River watershed at key locations. Project will inform source reduction and management practice implementation planning and cost-benefit analysis for activities such as erosion, sediment, and trash control education and outreach, slope/road stabilization, and siting for sediment basins and/or trash capture. Expected results: data to calibrate sediment transport model(s).

3. Bi-national Sediment and Trash Control Plan

Watershed-based study to determine the feasibility, expected benefits, and operations and maintenance requirements for various types of sediment and trash management activities and/or capture devices. Project will include cost-benefit analysis for site-specific and watershed-based alternatives. Expected results: coordinated source control, conceptual design, siting options and preliminary (30%) engineering design for selected capture devices.



Watershed hydrology and hydraulic modeling informs many Recovery Strategy components

	2012	2014	2016	2018	2020
C. Reduce Sources of Sediment and Trash					
4. Sediment Source Control Implementation Program		█	█		
5. Trash Source Control Implementation Program		█	█		
6. Regular Trash Removal - U.S.					→
7. Trash Removal Programs - Mexico		█			

Sources of sediment and trash derived from both sides of the border contribute to ecosystem degradation, water quality concerns, and other problems that threaten the watershed. Education and outreach, and pollution prevention and source control projects are required to stop impacts from sediment and trash. The success of these types of programs depends on planning and implementation that will require time and significant political and economic investment on both sides of the border. Accordingly, results from partnership projects conducted under Priority Action Area A (Partner with Mexico to Implement Optimum, Watershed-based Solutions) will be used to identify specific watershed-based source reduction activities.

C1. Sediment

Sources of anthropogenic sediment exist on both sides of the border. In the U.S., significant effort has been directed toward development and implementation of land development, construction practice, and post-construction erosion control and sediment management policies over the past several decades. While this work has resulted in significant reductions in sediment loads from human activities, more work can be done.

4. Sediment Source Control Implementation Program

Informed by results of projects conducted under Priority Action Area A (Partner with Mexico to Implement Optimum, Watershed-based Solutions) and

B (Understand How Water, Sediment and Trash Flow), implement actions such as: road and slope stabilization, erosion/sediment control guidance and incentives for development projects, legislation to enhance municipal codes and enforcement activities, and outreach for effective erosion control and sediment management practices. Expected results: source reduction of sediment.

C2. Trash

Traditional source control activities include education and outreach efforts focused on proper disposal, various activities to reduce litter and illegal disposal and policy improvements to encourage recycling and other beneficial activities. Recently, in the U.S., efforts to ban products have emerged as a potentially viable pollution prevention strategy.

5. Trash Source Control Implementation Program

Informed by the results of projects conducted under Priority Action Area A (Partner with Mexico to Implement Optimum, Watershed-based Solutions) and B (Understand How Water, Sediment and Trash Flow), implement actions such as: improved trash collection services, illegal disposal abatement, legislation to provide incentives for recycling and disposal, and community-based social marketing outreach. Expected results: source reduction of trash.

6. Regular Trash Removal- U.S.

Fund and continue to implement partnership program for Recovery Team stakeholders and volunteer groups/non-governmental organizations to perform manual trash and tire removal activities in the Valley. Project to include disposal costs. Expected results: removal of quantifiable amounts of accumulated trash.

7. Trash Removal Programs- Mexico

Informed by results of projects conducted under Priority Action Area A (Partner with Mexico to Implement Optimum, Watershed-based Solutions), implement actions such as: trash collection enhancements, plastic and tire recycling program improvements, illegal dumping abatement/enforcement, community-based social marketing outreach, and regular trash removal programs. Expected results: removal of quantifiable amounts of accumulated trash.



Trash removal programs such as manual trash removal can cost-effectively reduce trash sources

	2012	2014	2016	2018	2020
D. Implement Sediment and Trash Capture Devices in Watershed					
8. Design and Implementation of Sediment Basin in Smuggler's Gulch					
9. Sediment Capture Implementation - Mexico					
10. Design and Implementation of Floatable Trash Capture Device(s)					
11. Storm Drain System Trash Capture Device(s) Assessment - U.S.					
12. Trash Capture Implementation - Mexico					

In addition to source control, capture of sediment and trash pollutants is a necessary component for the long-term recovery of the Valley. The Recovery Team recognizes that source control and pollution prevention on both sides of the border are the first steps in reducing the amount of sediment and trash that will need to be treated to protect the designated beneficial uses of receiving waters. However, successful implementation of sediment and trash reduction

activities will improve the cost-effectiveness, but not eliminate the need for implementing capture devices at strategic locations in the watershed. Factors such as land use, drainage area, and configuration of stormwater conveyance systems will determine the effectiveness of capture devices and/or strategies. In addition, the effectiveness of capture devices is dependent on performance of regular operation and maintenance activities. Sediment and trash capture

implementation projects in both the U.S. and Mexico will depend on the outcome of Priority Project Areas A (Partner with Mexico to Implement Optimum, Watershed-based Solutions) and B (Understand How Water, Sediment and Trash Flow). The success of these types of programs is dependent on understanding that planning and implementation will require time and significant resource investment from partners in both the U.S. and Mexico.

D1. Sediment

Sediment capture alternatives include on-site detention basins, regional basins designed to treat at the sub-watershed level, and large end-of-drainage area basins in the Valley.

8. Design and Implementation of Sediment Basin in Smuggler's Gulch

Informed by results of work conducted under Priority Action Area B (Understand How Water, Sediment and Trash Flow), this project will develop engineering design and permitting for sediment capture device(s) for low-medium flows provided this approach is deemed feasible and cost-effective. This project will ultimately include construction. Expected results: siting, permitting, 100% engineering design, and construction for sediment removal device(s).

9. Sediment Capture Implementation- Mexico

Informed by results of work conducted under Priority Action Areas A (Partner with Mexico to Implement Optimum, Watershed-based Solutions) and B (Understand How Water, Sediment and Trash Flow), implement actions such as road paving/stabilization, non-vegetated slope stabilization, local/regional sediment basin implementation. Expected results: sediment load reduction.

D2. Trash

Trash capture alternatives include: mechanized removal of trash and litter from urban areas, improvements to urban drainage conveyance systems to reduce trash transport, and trash capture nets or screens located within drainage conveyances.

10. Design and Implementation of Floatable Trash Capture Device(s)

Informed by results of work conducted under Priority Action Area B (Understand How Water, Sediment and Trash Flow), provide engineering design and permitting for trash capture device(s) for low-medium flows, provided this approach is deemed feasible and cost-effective. This project will ultimately include construction. Expected results: siting, permitting, 100% engineering design, and construction for trash removal device(s) and associated trash load reduction.



11. Storm Drain System Trash Capture Device(s) Assessment - U.S.

Storm drain system capture devices can include hydrodynamic separators (flow-through structures with a settling or separation unit to remove trash, sediment, and other pollutants), catch basin inserts, inlet filters and other devices. Project aims to assess feasibility, design and potentially construct storm drain system capture devices in key locations. Expected results: sediment and trash pollutant load reductions.

12. Trash Capture Implementation - Mexico

Informed by results of projects conducted under Priority Action Areas A (Partner with Mexico to Implement Optimum, Watershed-based Solutions) and B (Understand How Water, Sediment and Trash Flow), implement actions such as: storm drain system trash capture devices, improved street sweeping, trash capture nets and screens in channels and/or drainages. Expected results: trash load reductions.

	2012	2014	2016	2018	2020
E. Fund and Perform Ongoing Operations and Maintenance Work					
13. Local Integrated Sediment and Trash Processing Site	█	█	█	█	█
14. Nearshore Sediment Reuse/Beach Replenishment Project <i>In Progress</i>	█	█	█	█	█
15. Nelson and Sloan Quarry Reclamation <i>In Progress</i> (Feasibility phase)	█	█	█	█	█
16. Reuse Construction Grade Material - Contract Terms and Conditions Recommendations	█	█	█	█	█
17. Long-term Operations and Maintenance Financing	█	█	█	█	█

The major challenge of capturing sediment and trash material in basins and managed natural channels is budgeting and funding the annual O&M activities that include: excavation, sorting, and disposal. While source reduction measures throughout the watershed will reduce the volume and frequency of this work, operation and maintenance of existing and new sediment and trash capture infrastructure must be considered as a long-term, ongoing need. Initial work to fund operations and maintenance activities can generally be divided into two major components, as described below.

E1. Reduce Annual O&M Costs with Joint Operations and Local Reuse of Sediment

The members of the Recovery Team that conduct annual O&M activities have joined forces to reduce annual costs by creating local uses for sediment and by implementing joint sediment processing. To expedite these methods taking effect, collaborative environmental permitting review and joint operation agreements will be imperative. These projects are summarized below.

13. Local Integrated Sediment and Trash Processing Site

Joint sediment and trash management location for the sediment captured in the Goat Canyon sediment basins and resulting from other excavation activities elsewhere in the Valley. Expected results: centralized cost-efficient processing of excavated material.

14. Nearshore Sediment Reuse/Beach Replenishment Project *In Progress*

Continue placing sediment on the beach adjacent to Border Field State Park and TRNERR. This project originated as a pilot under the Tijuana Estuary Sediment

Fate and Transport Study and is currently authorized under Department of Army Permit (SPL-2008-00812-RRS). Sediment may also be placed in the nearshore environment through an agreement with the City of Imperial Beach in accordance with the Sand Compatible Opportunistic Use Project (SCOUP) Plan. Expected results: cost-efficient reuse and environmentally beneficial placement of captured sediment for beach replenishment.

15. Nelson and Sloan Quarry Reclamation *In Progress*

Implement the Reclamation Plan for the Nelson and Sloan property (also known as the Border Highlands Borrow Pit) using sediment excavated from Valley sources. Expected results: beneficial reuse of captured sediment to reclaim sand and gravel mine in conformance with the original conditional use permit and reclamation plan, cost-efficiently place sediment excavated from Valley sources, and improve habitat through revegetation of severely eroded slopes.

16. Reuse Construction Grade Material-Contract Terms and Conditions Recommendations

Development of standardized terms and conditions for contracts with material operators to responsibly distribute construction grade material obtained from sediment operation and maintenance activities in the Valley. Expected results: increase beneficial reuse of material and improve sediment placement tracking.



Current channel and basin excavation activities can generate large amounts of sediment

E2. Secure Long-term Financing for O&M Activities

Development of a sustainable financing mechanism must occur to ensure that O&M can be accomplished annually, and to responsibly invest in future infrastructure. Traditional O&M mechanisms include establishing an endowment or cooperative agreements for management; however, identifying sources for capitalizing the fund will require consultation with financial and legal advisors.

17. Long-term Operations and Maintenance Financing

Develop government, philanthropic, and/or other innovative sponsorship and revenue-generating activities to secure long-term O&M funding for sediment and trash control activities. Expected results: dedicated funding for various sediment and trash control projects.

	2012	2014	2016	2018	2020
F. Involve and Inform Community in Mexico and U.S.					
18. Recovery Team Administration, Website Management and Media Support	[Progress bar from 2012 to 2020]				
19. Cross-border Notification Network	[Progress bar from 2012 to 2014]	[Progress bar from 2014 to 2020]			

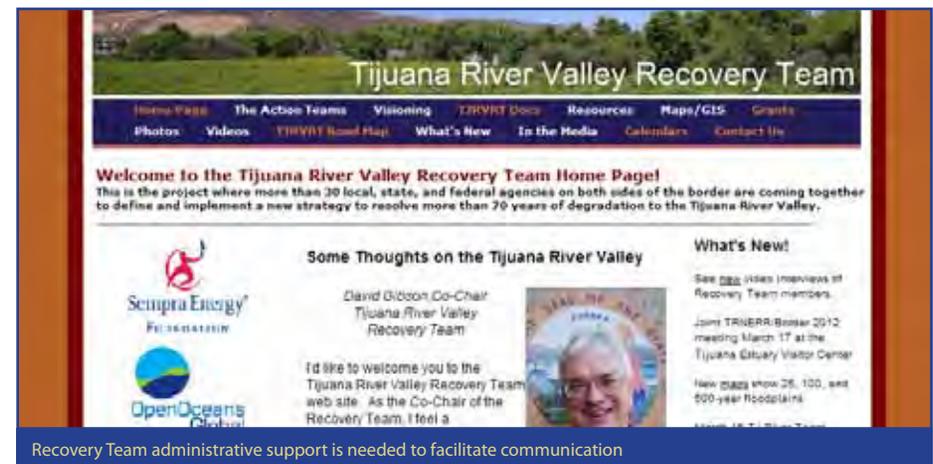
Effective and fully functional bi-national partnerships are integral to successfully reducing sediment and trash-related problems and improving the quality of the environment along the international border. Given the key role that source control and pollution prevention activities have in reducing costs to protect and cleanup the Valley, a collaborative and comprehensive education and outreach program is needed. Stakeholders may then leverage existing education and outreach activities bi-nationally and work together to develop new and more effective programs to increase awareness, change behavior and improve conditions contributing to sediment and trash issues on both sides of the border.

19. Cross-border Notification Network

Develop an effective, streamlined cross-border project coordination and notification network and a process to advise key agencies/staff on the status of water quality and other issues affecting human and ecosystem health. Expected results: improved international communication; potential to reduce various environmental and human health impacts from pollutants in the Tijuana River watershed.

18. Recovery Team Administration, Website Management and Media Support

Develop ongoing administrative support for the Recovery Team with provisions for development and maintenance of its website, popular media support and technical information exchange between U.S. and Mexico resource agencies. Expected results: continuous Recovery Team administrative support to improve project implementation/coordination opportunities.

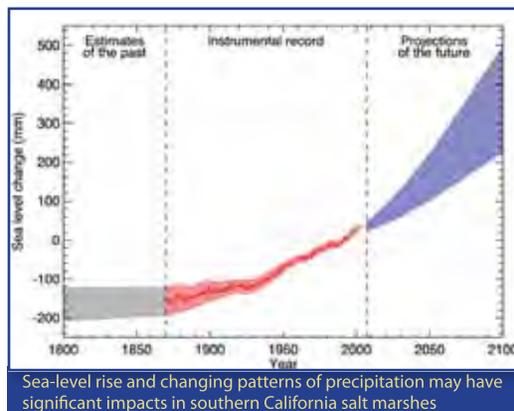


	2012	2014	2016	2018	2020
G. Protect and Enhance Natural Resources					
20. Climate Change Analysis and Planning					
21. Integrated Floodplain Management Alternatives Analysis					
22. Restore River Hydrology					
23. Restore Estuary					
24. Implement the Tijuana River Valley Invasive Plant Control Program ^{In Progress}					
25. Establish Native Plant Cover and Weed Control on Border Infrastructure System ^{In Progress}					
26. Acquire Private Property from Willing Sellers ^{In Progress}					
27. Agricultural Land Management Strategy					

The Valley and estuary is one of the largest and least developed coastal wetland ecosystems in southern California. Despite significant disturbance from human activities in the Valley and adjacent metropolitan areas, protection and restoration efforts have resulted in an improvement in habitat and ecological function over the past several decades. Informed by results of projects conducted under Priority Action Area B (Understand How Water, Sediment and Trash Flow), projects are needed to restore the river flows and estuary tidal prism to reduce flooding, re-establish natural sediment transport to the ocean, and regain the productivity and resilience of the ecosystem.

20. Climate Change Analysis and Planning

Analysis to assess the potential impacts of sea level rise and changing watershed inputs to develop long-term planning needs. Expected results: prediction of habitat migration; identification of potential impacts to infrastructure and property; development of climate change adaptation plans.



21. Integrated Floodplain Management Alternatives Analysis

Develop a feasibility-stage alternatives analysis to determine the technical viability of integrated flood control, vegetation maintenance, and invasive species management alternatives in the Valley. Expected results: development of cost-efficient alternatives to reduce flood risk for residents and infrastructure in the Valley, improve ecosystem function and transport of sediment from river to ocean, reduce the presence of invasive plant species and plan for river and estuary resiliency to climate change. This project may also lead to management alternatives for flow impediments such as berms, the Brown Fill and other flow-impeding obstacles.

22. Restore River Hydrology

Develop plans to restore the Valley to a naturally connected system of estuarine, riparian, transitional and upland habitats allowed to function as a braided river system with the associated capacity to naturally transport stormwater flows and sediment to the ocean. It is recognized that this goal will be balanced with flood protection of infrastructure, respect for existing land uses, and recreational opportunities. Expected results: sustainable hydrological connectivity between land and ocean with ecosystem capacity to beneficially manage sediment transport.

23. Restore Estuary

A Feasibility and Preliminary Design Study was completed in 2008. The next phase will include design and environmental compliance with products such as engineering cost estimates, designs and specifications, environmental compliance documents, and permit applications. Expected results: ecosystem restoration to improve tidal prism and overall ecosystem value.

24. Implement the Tijuana River Valley Invasive Plant Control Program ^{In Progress}

Implementation of the ongoing Program is guided by mapping of target species distributions, a control plan, programmatic environmental permits, and ongoing research and monitoring of treatment methods. Since its inception in 2002, the Program has treated invasive plants within 1,752 acres. A Technical



Advisory Group meets annually to prioritize work. Current high priorities include eradicating tamarisk from the main river channel through the estuary, establishing protocols to minimize spread of *Arundo donax* by ground disturbing maintenance activities, and providing a means to check whether completed control/revegetation areas exist in the footprint of planned work in the Valley. Expected results: prevent the spread of invasive species and reduce the impacts caused by invasive species to the Valley's sensitive ecological habitats.

25. Establish Native Plant Cover and Weed Control on Border Infrastructure System ^{In Progress}

In October 2011, U.S. Customs and Border Protection began a perennial enhancement revegetation effort in Smuggler's Gulch using native shrub species and a drip irrigation system. The primary goals of the revegetation are to prevent erosion and reduce the invasive species on the staging areas, access routes, and cut-and-fill slopes temporarily disturbed during the construction of the Border Infrastructure System (BIS). Plant and irrigation system installation is expected to be completed by March 2012, with monitoring and management expected to last through 2015. Expected results: reduction of sediment loads and improved water quality.

26. Acquire Private Property from Willing Sellers ^{In Progress}

A coordinated effort by federal, state, and local governments to purchase private property in the Valley from willing sellers has resulted in the purchase of over 1,700 acres since the 1980s. This effort is complemented by ongoing efforts in Mexico to secure conservation easements in open space areas. Expected results: reduced risks to public health and safety from flooding and erosion and improved natural habitat connectivity.

27. Agriculture Land Management Strategy

Develop a management strategy for agricultural land as it becomes available through acquisition from willing sellers or retirement of existing leases. Expected results: reduce soil erosion and loading of pesticides and fertilizers that could negatively affect sediment and water quality.

Recovery Team Actions in the Regulatory Environment

A primary driver for the formation of the Recovery Team was the listing of the Tijuana River as impaired for sediment, trash and several other water quality pollutants under Section 303(d) of the Clean Water Act. Federal law requires that Total Maximum Daily Loads be developed to reduce the sources of impairment in 303(d)-listed waterbodies. However the bi-national nature of the Tijuana River watershed, the number of agency and private stakeholders and other factors led the Regional Board to consider the collaborative stakeholder-led Recovery Strategy approach.

In response to the need for an increased understanding of the Tijuana River Valley and watershed within the context of resource management agency responsibilities/missions and across the U.S.-Mexico Border, a stakeholder workshop series was conducted. The three workshop series:

- » informed the development of the Recovery Strategy,
- » served as a collaborative process vehicle to inform stakeholders and integrate recovery strategies in the Valley,
- » linked policy and science with agency stakeholder responsibility roles, and
- » allowed sharing of multiple perspectives of recovery goals across stakeholder groups.



Participants in the stakeholder workshops contribute to the development of strategies for Valley recovery



Collaborative Recovery Team visioning workshop to identify priority action areas

Over 50 stakeholders attended each workshop and post-workshop surveys were delivered by TRNERR's Coastal Training Program. The surveys reported a 95% increase in awareness of collaboration opportunities.

The Regional Board is one of a number of governmental agencies established to enforce regulations pertaining to maintaining and restoring water quality, protecting habitat and sensitive species, and managing cultural and other resources. Within the Recovery Team, these agencies include: U.S. IBWC, the EPA, U.S. Army Corp of Engineers, U.S. Fish and Wildlife Service, the California Department of Fish and Game, the California State Water Resources Control Board, the Regional Board, and others. Each of these agencies has specific, and often independent processes to review and approve projects conducted under their jurisdictional authority.

The Recovery Team provides a forum for coordinating regulatory processes and project review that can meet the needs of individual stakeholders while benefitting the overall recovery of the Valley and the watershed. Communication and early collaboration among project stakeholders and regulatory agencies is key to this process. The collaborative nature of the Recovery Team promotes the development of a comprehensive permitting approach for projects that will restore the Valley in a manner consistent with existing laws and regulations and in concert with the overall vision of the Recovery Team.

Next Steps for the Recovery Team

The Recovery Team recognizes the importance of continuing to work collaboratively to implement actions to achieve its vision. The member agencies of the Recovery Team have developed a Letter of Commitment, a simple formalization of the relationship between the land managers and operating agencies that serves as a basis for collaboration in implementing priority projects. The Letter of Commitment recognizes that collaboration can be limited to individual agency responsibilities, jurisdictions, and legal mandates and is subject to the availability of funding.

Moving forward, the land managers and operating agencies will be signatories to the Letter of Commitment and will serve as the Steering Committee for the Recovery Team. Other Recovery Team stakeholders that are not signatories to the Letter of Commitment will be Members of Good Standing. These include: the environmental community, scientific community, and Valley stakeholders, such as private land owners and users. Additionally, the Recovery Team recognizes the importance of collaboration with agencies and organizations in Mexico and has agreed to jointly communicate common messages regarding its activities. Mexican agencies, environmental groups, and scientific organizations are also welcomed to the Recovery Team.

The Regional Board will serve as sponsor signatory to the Recovery Team and believes the Recovery Team is an innovative model that could demonstrate how water quality improvements can be made without the contentious and costly regulatory and legal remedies typically employed. The Regional Board also agrees to hold in abeyance its legal and regulatory options relevant to addressing sediment and trash issues while the Recovery Team pursues implementation of the priority projects identified in this document. This in no way limits the Regional Board's regulatory and legal options, but, instead, shows a reciprocal respect for progress, provided that the signatories below are making a good faith effort to work collaboratively to implement the priority projects. Progress toward implementing the priority projects to achieve the vision for the Valley will be assessed after a two-year period. At that time, the Letter of Commitment will be renewed and/or revised by employing an iterative planning cycle. The planning cycle will include a four-part adaptive management strategy:

- » **Assessment** - Includes the collection and assessment of data and other information to determine priority project implementation needs.
- » **Planning** - Identifies and prioritizes measures to effectively and cost-efficiently reduce sediment and trash sources while balancing flood risk, ecosystem management, and recreational opportunity needs.
- » **Implementation** - Employs priority projects in an integrated and collaborative approach that may include bi-national cooperation, interagency coordination, and/or cost-sharing components.
- » **Effectiveness Assessment** - Evaluates project implementation activities to refine future planning and implementation efforts.



It is anticipated that the adaptive management strategy will be applied both to specific project implementation assessments as well as assessment of overall progress toward long-term recovery goals. Approximately six months prior to the end of this initial phase of recovery, the Recovery Team will begin a planning process to evaluate findings and to develop an action plan for additional implementation activities and priority projects.

Recovery Strategy Summary

The Recovery Strategy is intended to initiate the first phase of actions required to cleanup the Valley so its beneficial uses can be restored and the environmental and human values that the Valley supports can be maintained in perpetuity. Through this document, the Recovery Team has taken a significant step to document the existing conditions related to sediment and trash issues in the Valley, and outline solutions that will allow beneficial uses of the Valley and its resources to be achieved. Resolution to the sediment and trash problems will require alignment of enhanced relationships, partnerships, and funding mechanisms in the U.S. and in Mexico to provide watershed-based solutions. Accordingly, the Recovery Team stakeholders recognize the benefit of using a collaborative approach to build and enhance cross-border communication and relationships that will lead to our common goals of a healthy Valley and watershed.

The TRVRT would like to especially thank:



California State Water Resources Control Board



Sempra Energy Foundation

for providing funding to support the development of the Strategy.

For more information please contact:

Charles Cheng, Ph.D., P.G.
California Regional Water Quality Control Board, San Diego Region
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340
Phone 858-627-3930
Fax 858-571-6972
Email: ccheng@waterboards.ca.gov

Or visit the Regional Board website at:
<http://www.waterboards.ca.gov/sandiego/>

Tijuana River Valley Recovery Team

The Recovery Team consists of the following member agencies and organizations:

- » Audubon Society
- » California Coastal Commission
- » California Coastal Conservancy
- » California Department of Conservation, Office of Mining and Reclamation
- » California Department of Fish and Game
- » California Department of Resources Recovery and Recycling (CalRecycle)
- » California Environmental Protection Agency
- » California State Parks
- » California State Water Resources Control Board
- » City of Imperial Beach
- » City of San Diego
- » County of San Diego
- » International Boundary and Water Commission
- » National Marine Fisheries Service
- » National Oceanic and Atmospheric Administration
- » OpenOceans Global
- » San Diego Coastkeeper
- » San Diego County Water Authority
- » San Diego Regional Water Quality Control Board
- » San Diego State University
- » Scripps Institution of Oceanography
- » Southern California Coastal Water Research Project
- » Southwest Wetlands Interpretive Association
- » State Coastal Conservancy
- » Surfrider
- » Tijuana River National Estuarine Research Reserve
- » Tijuana River Valley Equestrian Association (TRVEA)
- » U.S. Army Corps of Engineers
- » U.S. Bureau of Reclamation
- » U.S. Customs and Border Patrol
- » U.S. Department of Agriculture
- » U.S. Environmental Protection Agency
- » U.S. Fish and Wildlife Service
- » U.S. Navy

Photo Credits

Images contained in the Recovery Strategy have been provided by:

California Coastal Conservancy
California State Parks
Carl Nettleton (OpenOceans Global)
City of San Diego
County of San Diego
Tijuana River National Estuarine Research Reserve
U.S. Fish and Wildlife Service
URS Corporation
WILD Coast

