



Tijuana River Valley Recovery Team

RECOVERY STRATEGY

LIVING WITH THE WATER



NOVEMBER 2011



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 been accomplished on both sides of the border in recent years. However, storm water flows bring substantial amounts of sediment and trash and other contaminants into the Valley from both United States (U.S.) and Mexican sources. 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 alike.

A number of public agencies and non-profit organizations have worked tirelessly to resolve the Valley's water quality issues. They have held cleanups, created a sediment basin, piloted trash capture devices, executed ecosystem restoration activities, purchased land, and performed many other projects on both sides of the border. 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 come to a consensus on what needs to be done to resolve sediment and trash issues in the Valley. The document has also been reviewed and shaped by the thoughtful comments of representatives of the stakeholders who live, work, and/or regularly visit the Valley. These individuals are what we call the Tijuana River Valley Recovery Team (Recovery Team).

From the perspective of the San Diego Regional Water Quality Control Board (Regional Board), cleaning up the impairments of trash and sediment in the valley is a high priority. Given the fact that the source of much of the trash and sediment is outside of the jurisdiction of the agencies we regulate, the Regional Board has chosen to pursue a collaborative, stakeholder-led approach. As the Water Board's Executive Officer, I firmly believe the strategy outlined in this Recovery Strategy document can successfully reduce sediment and trash pollutants from degrading water quality, exacerbating flooding, affecting habitat and impacting recreational opportunities.

The purpose of this Recovery Strategy document is twofold. First, it is intended to be a concise summary of the first phase of actions required to clean up the Valley so its beneficial uses can be restored and the environmental and human values that the Valley supports can be maintained into perpetuity. Second, it is intended to outline the steps needed to move forward so policy makers and potential funding source representatives will have a clear understanding of both the problems and the solutions that will allow the Recovery Team to achieve its vision and mission. Ultimately, it is the members of the Recovery Team who will implement the strategy through enhanced relationships, partnerships, and funding opportunities. Finally, the Recovery Strategy recognizes that resolution to the sediment and trash problems will require partnerships in the U.S. and in Mexico to provide watershed-based solutions. The Recovery Team recognizes that source control and pollution prevention activities are often our best and most economically feasible long-term solutions to sediment and trash pollutant issues. Accordingly, there is no time like the present to work together and build and enhance cross-border communication and relationships that 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'd like to thank all of the members of the Recovery Team and their agencies for the work that has been accomplished in developing this 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 United States (U.S.) and Mexico. The watershed drains through a highly urbanized environment adjacent to the border into the Tijuana River Valley (Valley) in the southwest corner of the U.S., in southern San Diego County. In the Valley, the Tijuana River flows into the Tijuana Estuary and then into the Pacific Ocean. Sediment and trash pollutants carried in stormwater runoff currently threaten the valuable ecological, recreational and economic resources in the Valley. This Recovery Strategy document provides a roadmap for collaborative, bi-national efforts aimed at long-term recovery and protection of this 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, freshwater, land, and atmosphere. These areas are often highly productive and support a wide variety of rare and unique plants and animals. The Tijuana estuary is one of only two coastal estuaries in southern California with historic extent available for resilience to climate change and is primarily under public ownership. Importantly, it is the only coastal lagoon in southern California that is not bisected by roads and railroads, which contributes to its ecological resiliency.

The Valley is also an important recreational resource, providing over 22 miles of multi-use trails, open space and access to Border Field State Park to hikers, bicyclists, equestrian and other users. In addition to the Valley's natural resources, there are active recreation fields, picnic areas, and a community garden. 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.

There are also numerous federal agencies with significant infrastructure investments in the Valley. The U.S. Navy operates one of its primary helicopter pilot training facilities on the West coast on the northern periphery of the Valley in the Navy Outlying Field Imperial Beach.



Tijuana River Watershed drains 1,700 miles inland 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 Navy operations.

The 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 (IBWC) operates the South Bay International Wastewater Treatment Plant (SBIWTP) which provides secondary treatment for 25 million gallons per day (mgd) average daily flows of sewage that originate in Mexico.

Agricultural activities occur in the Valley on private and leased lands provide an ancillary link to education. Some of the agriculture includes sustainable, organic farming and serves as a local source of fresh produce. In addition, a Community Garden operated by the County provides an opportunity for local residents to grow their own produce.

Finally, there are numerous programs that utilize Valley resources for hands-on environmental education programs. Programs range from college-level educational opportunities to educational/interpretive programs aimed at a wide range of audiences; from grade school children to the community at large. It is widely recognized that effective communication of value of the Valley and its resources and the issues facing it through education leads to broad political support. This, combined with scientific knowledge, is the ultimate foundation

for long-term resource stewardship and funding.

Given the diverse ecological, recreational, and educational uses of Valley resources, the importance of protecting this natural jewel within the highly-populated, highly-developed California coastline is of critical importance today.

Trash and Sediment Threaten Valley Resources

Today, the Valley is increasingly threatened by stormwater flows which contain high concentrations of trash and other urban, agricultural, and industrial pollutants in the Tijuana River and major tributaries. Additionally, the soils in the watershed are highly susceptible to erosion, especially when disturbed. Moderate rains bring significant flows of sediment downstream. As storm water flows to the ocean, the intermixed sediment, trash and other debris is deposited in channels, among vegetation in the Valley floodplain, and in the estuary. Finally, storm flows carry exotic invasive species that displace the sensitive plant communities and reduce habitat for native wildlife. The interaction of these pollutants 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 that obstructs the Valley's hydrology, impact natural resources, threatened residents and infrastructure, and cause ongoing fiscal impacts for landowners and agencies responsible for managing the Valley's resources. The Recovery Team has embarked on a collaborative process to integrate the diverse perspectives of scientific, environmental, regulatory and private stakeholders to solve these problems. This Recovery Strategy document

identifies a path forward for implementing a collaborative, multi-benefit plan across ownership and jurisdictional boundaries 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 is also consistent with existing policies and planning documents developed by local, regional, State and Federal stakeholders.

Key Tijuana River Valley Planning Documents:

- » **Tijuana River Valley Regional Park - Area Specific Management Directives**
County of San Diego 2007
- » **Local Coastal Program Land Use Plan**
City of San Diego 1999
- » **Multiple Species Conservation Program Subarea Plan**
City of San Diego 1997
- » **Tijuana River National Estuarine Research Reserve Comprehensive Management Plan**
California State Parks
National Oceanic and Atmospheric Administration
U.S. Fish and Wildlife Service 2010
- » **BORDER 2020: U.S.-Mexico Environmental Program (Draft)**
Environmental Protection Agency 2011

Past Successes and Future Challenges

Protection and restoration of Valley resources is not new; sediment management, land preservation and habitat restoration efforts have all been concurrently 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 both in the U.S. and in Mexico to improve conditions. Investments to improve wastewater treatment began in the 1980s and 90's. Recent activities have included pollution prevention and source control for sediment and trash, water quality improvements, flood control, improved

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

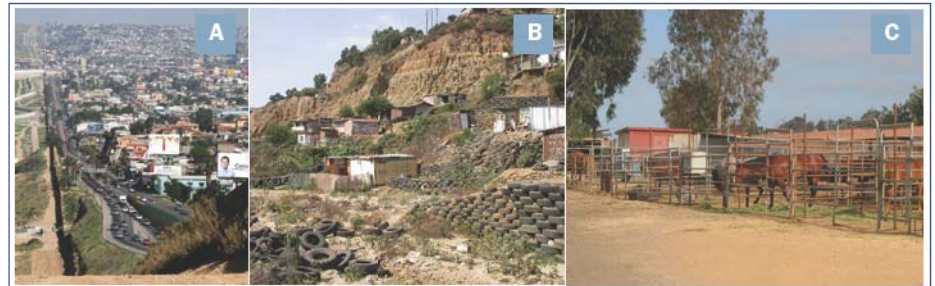
Activity	Project Type	Approximate Expenditure Amount	
		U.S.	Mexico
Wastewater Improvements	Treatment and reclamation plant design and construction	\$600M	\$100M
Sediment Control	Basin design and construction, road paving, community projects	\$18M	?
Trash Control	Cleanups, waste tire removal, studies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

recreational opportunities, and public education and outreach. These projects demonstrate the history and wealth of experience that the various operating agencies and stakeholders have invested in the Valley and watershed.

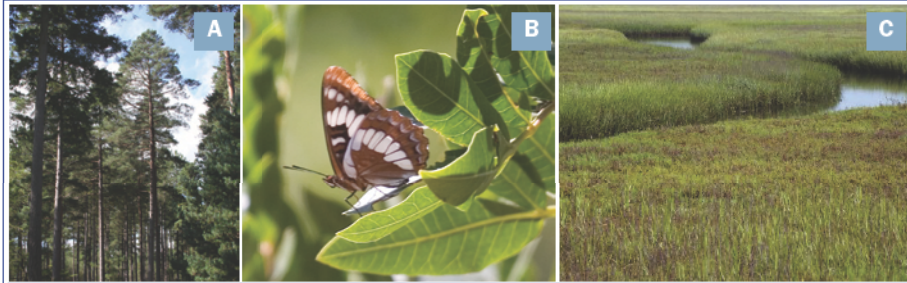
There are many challenges for the Recovery Team moving forward. One of the primary obstacles to overcome is the bi-national nature of the watershed. It is well known that source control and pollution prevention activities can be the most cost-effective solutions for sediment and trash pollutants in stormwater. Yet, with the majority of the watershed situated in Mexico, planning and implementing source control and other projects across the international border can be difficult. Other important challenges include: identifying long-term sources of operations and maintenance funding for structural best management projects, agency coordination in project review and approval processes, and sequencing project implementation schedules to meet short-term trash and sediment 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 the tidal saltwater estuary at the mouth of the Tijuana River to the 6,000 foot pine forest-covered mountains. 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 from as early as 8,000 years ago.



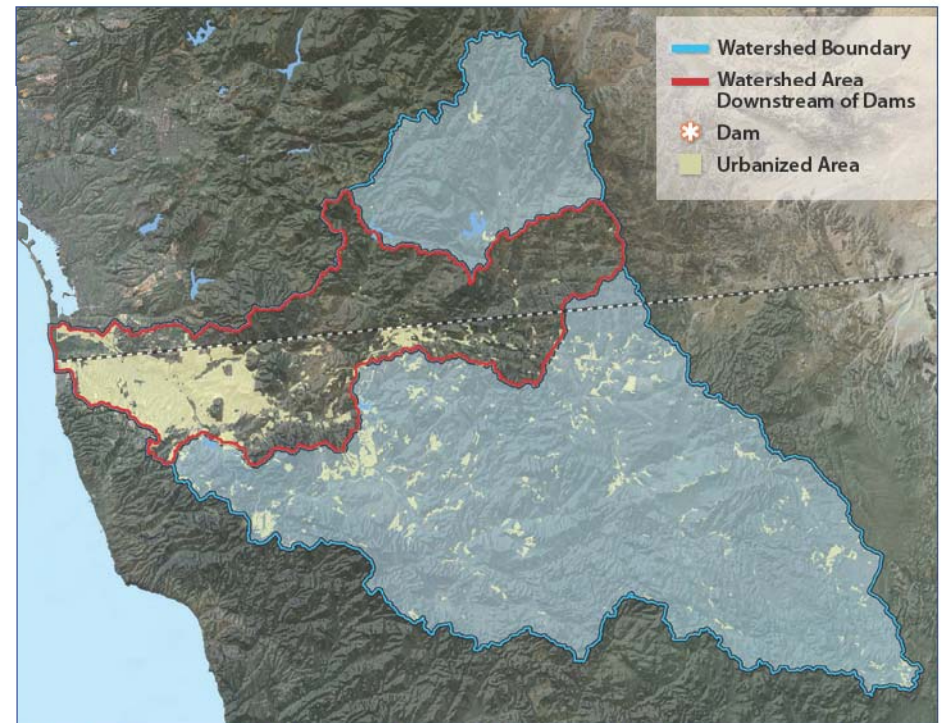
Current land uses in the watershed include: A) urban areas B) semi-urban development C) ranches in the Valley.



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

A diversity of land uses are currently present, 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 and where over a million people currently reside. Several large dams (Barrett and Morena in the United States, and Rodríguez and El Carrizo in Mexico) control a large majority of 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 impediments to sediment and trash flows to the lower watershed. Therefore, the sediment and trash produced in the 462 square mile area downstream of the dams cause most severe impacts to the Valley.

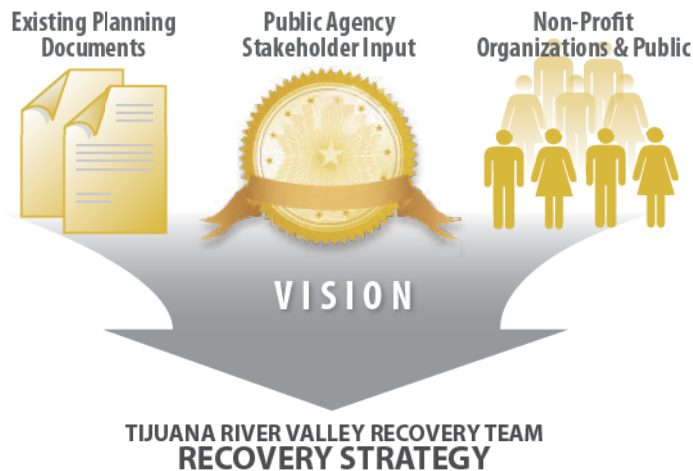
Tijuana River Watershed Statistics	U.S.	Mexico
Population within Watershed	11,000	2.7M
Watershed Area	468 mi ²	1,256 mi ²
Annual Precipitation	5.9 to 25.6 inches per year	



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 organizations from both sides of the border focused on addressing sediment and trash and associated environmental issues. Previous efforts by federal, state, and local agencies, municipalities, residents, environmental organizations, and other stakeholders have resulted in wastewater treatment improvements that have allowed a new focus on sediment and trash pollutants. The collaborative stakeholder-led approach to integrate diverse scientific, environmental, regulatory and private stakeholder perspectives with existing planning documents of this Recovery Strategy is intended to reduce impacts of anthropogenic 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 following management areas present the current situation and a look towards the future of management in the Valley from the sediment and trash, flood control and ecosystem management perspectives. The Recovery Team then utilized its collaborative approach to analyze these various management needs and then develop integrated priority action areas to implement needed projects.



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
- » Long-term plan to restore the floodplain and estuary
- » Respect existing uses

Recovery Team Signatory Members



The Mission 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 rights of current and future landowners and users.

The Vision 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.



Sediment and Trash

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

Current Situation

Sediment and trash pollutants are degrading the Valley and estuary and threatening public health and safety throughout the Tijuana River watershed. Storm flows carry 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 unfortunately not met the demands of this growth. Often this situation can lead to problems like accelerated erosion and illicit dumping 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 in the fact that they are both 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 to address these issues. Community programs have been initiated to improve source control of these materials through generating awareness, changing trash disposal practices and conducting cleanups through volunteer efforts. Further infrastructure

improvements, community programs and cleanups on the Mexican side of the international border will have a positive impact in downstream areas. However, trash and sediment accumulation in the lower Valley on the U.S. side of the border continues to be a chronic problem.

Sediment

The approach to sediment management varies by drainage into the Valley and estuary.



"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."

In Goat Canyon, sediment input has steadily degraded salt marsh habitat. In order to stop further degradation, California State Parks (State Parks) constructed two sediment basins just downstream from the international border, which were designed to provide maximum sediment storage capacity within the space available for construction. In most wet seasons the basins intercept all the sediment. There are extreme seasons, as in 2005, when the basins filled and a single storm buried 18 acres of salt marsh up to 4 feet.



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

In Smugglers Gulch, sediment reduces the capacity of natural channels to carry storm flows, which exacerbates flooding impacts to residential, agricultural and recreational uses in the Valley. When resources are available, the City and County clear the earthen channel draining Smuggler's Gulch to maintain its capacity to carry storm flows and minimize flooding. The County removes approximately 15,000 cubic yards of trash, waste tires, and accumulated sediment each time

it clears the channel from Smugglers Gulch south of Monument Road. Also, in the early 1990's, the City of San Diego created an earthen channel (known as the Pilot Channel) to direct larger storm flows away from the northern portion of the Valley where flooding can cause significant damage to public and private property. Since then the City has had to increase the frequency of clearing the Pilot Channel to nearly every year to reduce flood risk. Each channel clearing event results in the removal of approximately 30,000 to 60,000 cubic yards of sediment, trash and waste tires. Even with this costly ongoing maintenance, flooding continues to affect residents and infrastructure within the Valley and sedimentation is rapidly changing the topography and ecology in the Valley.



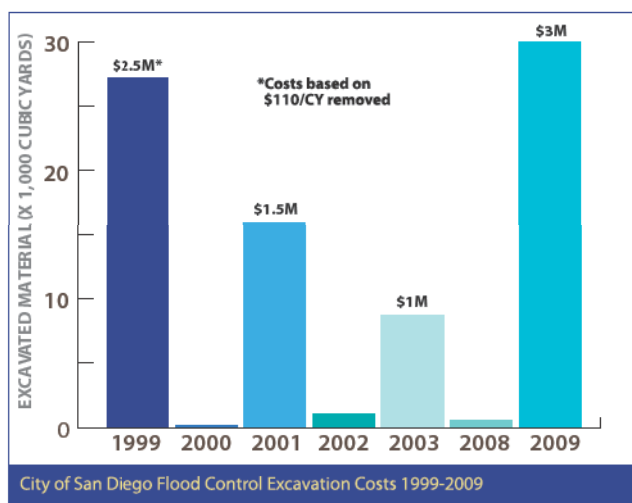
Reduced channel capacity can contribute to flooding events that threaten humans, animals and homes.

The main Tijuana River channel is where the majority of the storm water, sediment and trash enter the U.S. Historically, much of the sediment has been carried downstream. As downstream areas have aggraded and become more vegetated, storm flows back up, depositing sediment and trash. For the first time, IBWC has allocated funds in its 2012 budget for removal of sediment and trash from the upper part of the IBWC flood control project 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 proper disposal of all material. Annual costs vary widely depending upon volumes excavated and availability of local disposal options. For example, disposal of sediment from Goat Canyon basins alone ranges from \$250,000 when a material operator uses the material in local building projects to \$1,200,000 when it is dumped in



a local landfill. These costs exceed local, state, and federal operating budgets and grant programs typically do not fund ongoing operation and maintenance. In an effort to stabilize and reduce costs, City, County, State Parks and IBWC began investigating a suite of alternative local reuse options including using the sediment for beach nourishment and quarry reclamation.



Trash

Trash is only partially controlled 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 disturbed 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.

Clean up of trash is important to minimize impact from transport throughout the Valley. Several nongovernmental organizations (NGOs) conduct cleanups of trash and waste tires in the Valley. However, the timing and frequency of these activities are limited due to environmental restrictions related to threatened and endangered species and access constraints during the wet weather season.

Sediment and Trash Management in Los Laureles Canyon

In Los Laureles Canyon, a California Coastal Conservancy-funded watershed diagnostic was prepared by a team of scientists in the Mexican Institute of Water Technology (IMTA). 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 Pick-up** – Over 700 tons of trash was cleaned up 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- \$50,000
 SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales)- \$112,500

Looking to the Future

A watershed approach to sediment and trash management that simultaneously reduces sources, actively captures at key watershed locations, and beneficially uses ecosystem processes to naturally transport sediment through the Valley and estuary to the ocean is needed. The Recovery Team members intend to partner with appropriate counterparts in Mexico to jointly plan, conduct and operate a suite of source reduction and capture measures optimally located throughout the bi-national watershed. The Goat Canyon experience demonstrates that such a partnership can be mutually beneficial and effective.



Sediment basins constructed in the Goat Canyon can capture up to 60,000 cy of sediment in wet weather flows.

Since source reduction and capture may never be completely sufficient, the river and estuary fluvial geomorphology must be restored in order to increase its sediment transport capacity. To this end, TRNERR, with State Parks, the US Fish and Wildlife Service, the Coastal Conservancy and SWIA, have already conducted a feasibility study to restore the southern portion of the estuary to enhance the tidal prism to handle elevated loads of sediment. Similarly, past hydro-modifications to the river can be corrected to re-establish its natural capacity to carry flows of water and sediment and more effectively connect natural waterways throughout the Valley.

Even after reducing costs by sharing facilities and contractors and creating a suite of local sediment uses, a sustainable financing mechanism for operations and maintenance must be secured in order to responsibly invest in future infrastructure.



Eco-bricks made from plastic water bottles may be a way to beneficially reuse waste and reduce sources of trash.



Storm Water (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 the lower Valley. In a natural state, channels and water paths carved by major storm events in a dynamic system shift location over time depending on channel and vegetation stability, storm event size and frequency, large scale climactic dynamics and other factors. Development related to agriculture, ranching and residential activities in the watershed and Valley over the past 80 years have significantly impacted both the hydrology of the river as well 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 a source of upstream flooding problems.

In the last 30 years, urban expansion and associated infrastructure development



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

in the watershed increased significantly. Major changes include:

- »Four dams, which control upstream flows from approximately 73% of the watershed, were constructed to provide water supply reservoirs to both the United States and Mexico.
- »Tijuana River Valley Flood Control Project was constructed to contain an approximate 500-year storm event in the main river as it enters the United States 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.

These changes have led to a long history of management challenges for the various federal (IBWC) and local agencies such as the City of San Diego (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 to private and leased properties in the Valley. During these flooding events, vehicular access in and to 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 federal government perform channel maintenance and clearing activities to remove accumulated sediment and trash. These costly operation and maintenance activities are needed on a nearly annual basis to control flooding depending on rainfall amount, intensity and other factors. Further, the channel clearing operations require public notification, environmental permitting, biological monitoring,

and other costs. It is estimated that these costs, including disposal fees, add up to approximately \$100-\$120 per cubic yard of material removed.



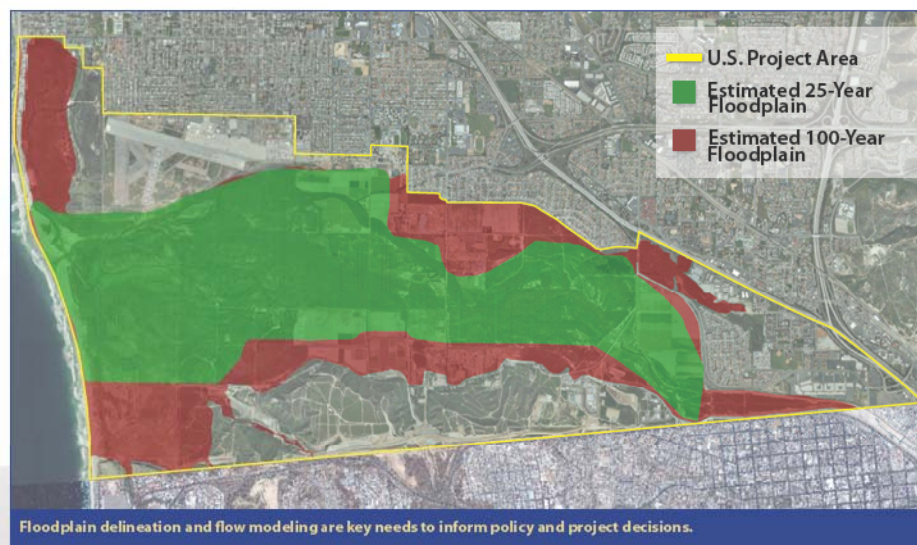
Costly channel clearing operations to remove accumulated sediment and trash and reduce flood risk are needed often in the Valley.

Looking to the Future

Future goals for flood control activities in the Valley include balancing short-term needs to reduce flood risk to 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 previously documented in various planning documents where generally, existing and additional berm and other man-made flow constraints 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 may cause significant flooding in the Valley.

It is understood that focused hydrology and hydraulic studies are a key component of the overall Valley recovery process. Understanding existing conditions, including capacity of channels, will lead to cost-effective and environmentally-sound flood control and stormwater management strategies that 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, vegetation structure and other flow impediments that influence stormwater flows. Identification of current vegetation conditions and other physical characteristics that influence stormwater flows
- »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 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 wetland, riparian, transitional, and upland habitats. Although the physical footprint of the Valley today is similar to that which existed historically, its ecosystems have undergone changes over time.



Unlike most other coastal wetlands in the southern California, the footprint of 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, there has been retirement of many agricultural fields and marked habitat recovery in many parts of the Valley. These changes are reflected in the broad, ecosystem-based goals outlined in foundational resource planning documents prepared for the Valley (see page 4).

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.
- » 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 features coupled with continuing adaptive 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

"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."

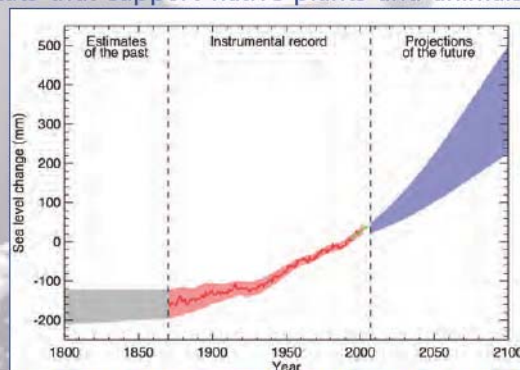
Institutions Performing Research and Monitoring Activities In and Around the Valley

- » 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
- » International Boundary and Water Commission
- » US Fish and Wildlife Service
- » County of San Diego
- » San Diego Coastkeeper

coastal California. Despite the improvements in the overall extent and quality of habitats in the River Valley, however, 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 must be addressed to continue the upward trajectory of Valley ecosystems and make them less vulnerable to future changes.

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.



Sea-level rise and changing patterns of precipitation may have significant impacts in Southern California salt marshes.

The key benefits of restoring the ecosystem include minimizing flood risk, providing environmental buffering and sensitive species support, improving existing and providing additional recreation opportunities, providing education and outreach opportunities, and providing research opportunities leading to adaptive management strategies. Such efforts will also make the system more resilient to sea level rise and changing inputs from the watershed. This will be particularly important as the Valley is the southern California system most likely to be able adapt to changing climates due to the lack of infrastructure, intact habitats, and broad buffer areas.

The strategies that have been offered to achieve these goals draw upon past success in the Valley, and include 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 redundant and unnecessary roads and trails, restoring abandoned sites (e.g., quarries), assessing the continuation of agricultural and other leases, continue to engage private property owners in the restoration process, purchasing properties from willing sellers for public use, obtaining conservation easements on private and public lands, and obtaining development rights.

One of the central efforts for the future is resolving the hydrologic problems that preclude the natural flow of water. Obstructions to flow in the Valley both compromise the healthy functioning of the intact tidal / riparian wetland complex as well as exacerbate flood risk for infrastructure 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 a needed resource.



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 recreational area. It is likely that the Valley was used by native people and hunters for hundreds years. Since the early 20th century, the Valley, particularly Imperial Beach, has served as a summer retreat to Imperial Valley residents and other visitors. Horseracing became a popular pastime in the City of Tijuana in the 1920s and 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 as a 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, and the U.S. Fish & Wildlife Service that same year purchased the northern 500 acres of the estuary, establishing the Tijuana Slough National Wildlife Refuge. Despite opposition from developers, the estuary (both State Park and National Wildlife Refuge land) became part of the U.S. Department of Commerce's National Estuarine Sanctuary Program in 1982, and was designated a National Estuarine Research Reserve.

Currently, recreational opportunities within the Valley are managed by multiple agencies. 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.

The Tijuana River National Estuarine Research Reserve (TRNERR) is managed under a partnership between the United States and the State of California that links the National Oceanic and Atmospheric Administration (NOAA), California State Parks, and the U. S. Fish & Wildlife Service. California 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.

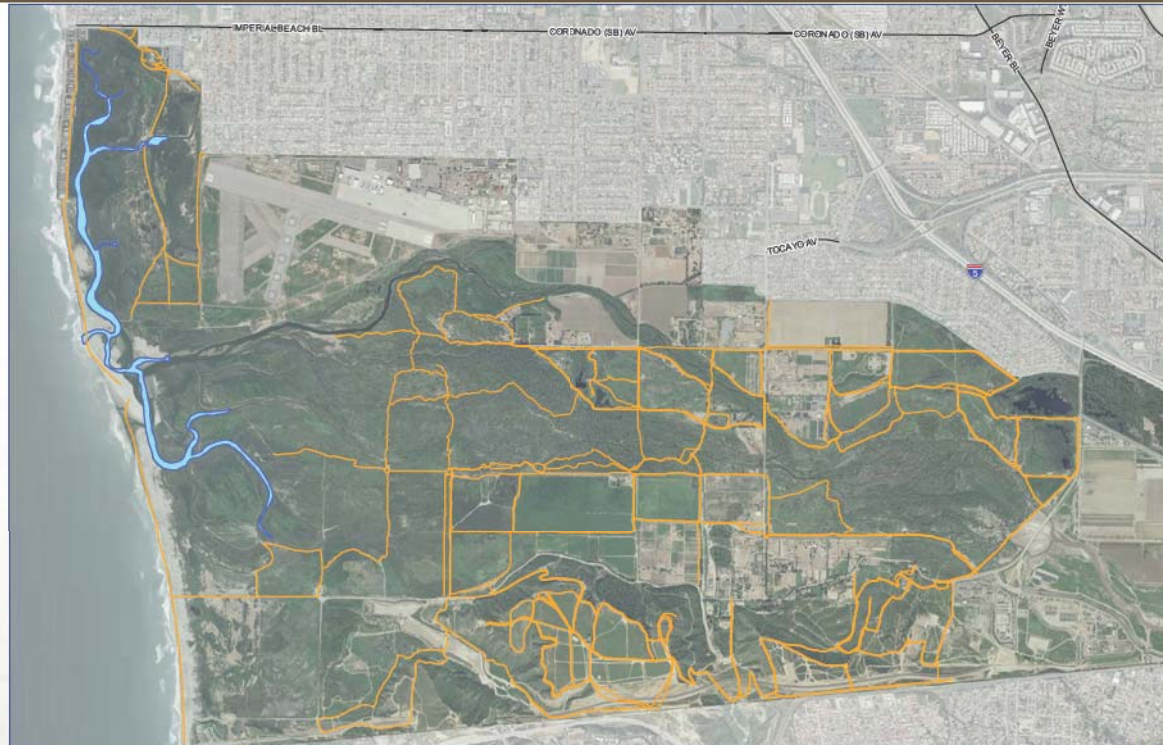
The Tijuana River Valley Regional Park (Regional Park) occupies more than 1,700 acres and is the largest recreational area in the Valley. It was established in 1996 by the County of San Diego (County). Through grants and other funding mechanisms, the County has spent over \$20 million in the acquisition of properties for open space. The Regional Park's 21 miles of trails connects to extensive system of trails that provide visitors access to the Valley from Dairy Mart Road to the beach. This trail network is the only place along the southern California coastline where horseback riding is allowed on the beach. (Pic trail map) In addition, a County sports facility is located north of the main river channel east of Hollister Street.

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

The Valley provides many opportunities for public education involving 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 historical and archaeological values, 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. Non-profit advocacy groups also provide educational tours and volunteer opportunities.

Looking to the Future

The agencies and non-profits that provide recreation will continue their efforts and plan to expand programs. The development of a Border Education Plaza on Monument Mesa, expansion of volunteer planting and restoration programs, improved 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. 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 in final planning 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.



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

Roadmap to Recovery

A central component of the Recovery Strategy was the development of a Proposed Recovery Concept (Recovery Concept). 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, Navy operations, border security, and other needs. Consistent with the region's planning documents, the Recovery Concept imagines river flow improvements balanced with ecosystem restoration, removal of impediments to natural flow, flood management, and compatible agriculture, and recreation uses leading to water quality improvements.

This Strategy, and the overall Recovery Team, recognize 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 long-recognized the importance of preserving the region's cultural heritage and valuing existing residential, agricultural, and other land uses in areas of the Valley subject to frequent flooding. However, agencies responsible for cost-efficient flood plain 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

ECOSYSTEM AREAS

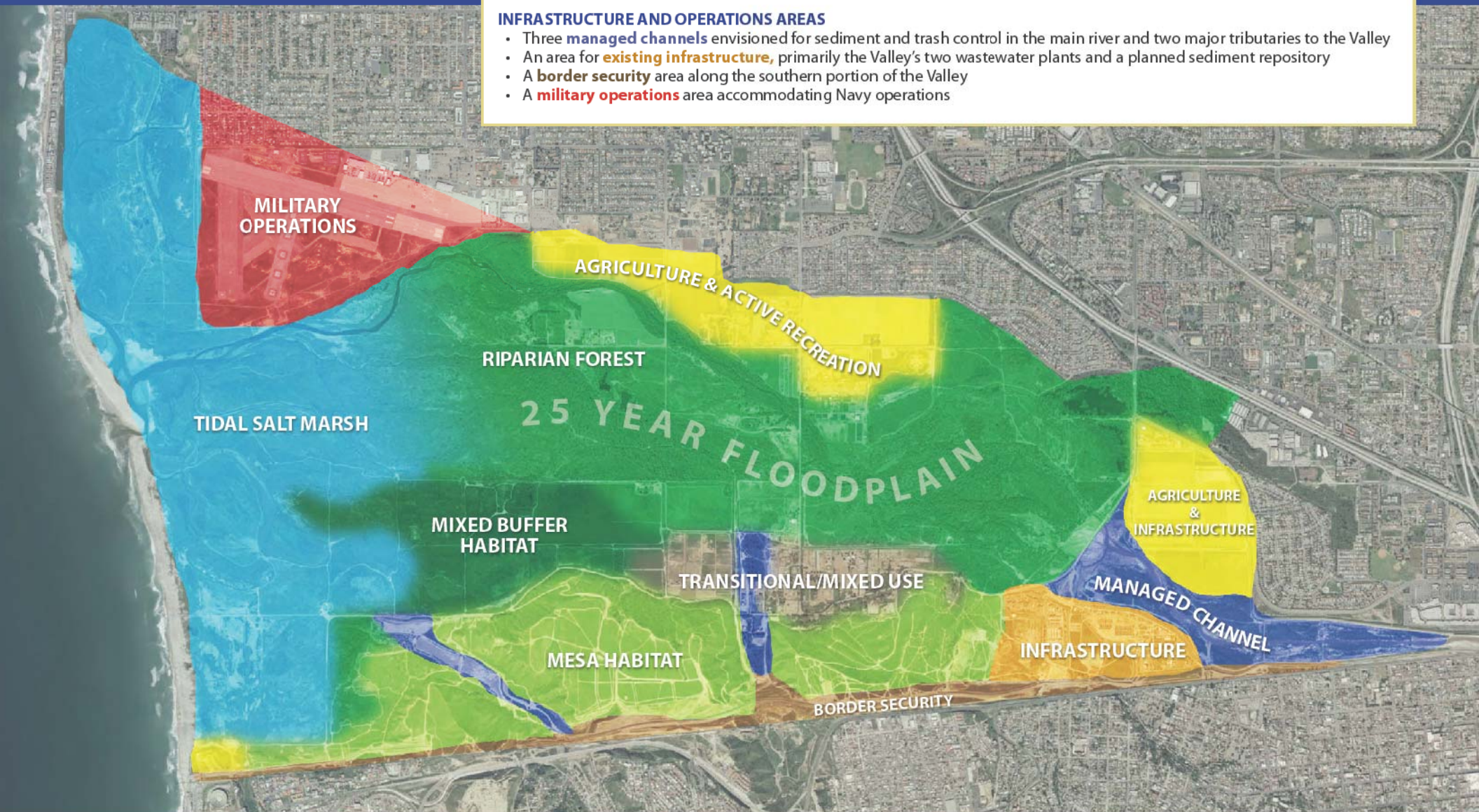
- A large tidal **salt marsh area** in the western portion of the Valley
- A broad central **riparian forest** within the 25-year floodplain (Note: several privately owned parcels reside within this area)
- **Mesa habitat** bordering the southern edge of the Valley with chaparral, sage scrub and grasslands
- A **mixed buffer habitat** area between the upland/mesa habitat 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 increased 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
- An area for **existing infrastructure**, primarily the Valley's two wastewater plants and a planned sediment repository
- A **border security** area along the southern portion of the Valley
- A **military operations** area accommodating Navy operations



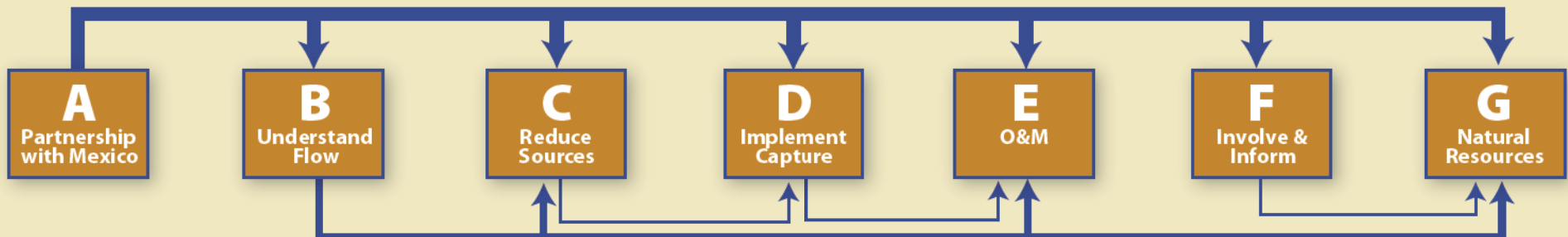
Priority Action Areas

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. Priority Action Areas consider the various perspectives of controlling sediment and trash, reducing flood risk, improving ecosystem function and health, and optimizing recreation and education opportunities in the Valley. The Priority Action Areas are:

- 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 in Watershed
- E. Fund and Perform Ongoing Operations and Maintenance (O&M)
- F. Involve and Inform Community in Mexico and U.S.
- G. Protect and Enhance Natural Resources

Priority Action Area Linkage

The Priority Action Areas inform current and future work. Coordinating with key partners in Mexico is required to solve the trash and sediment issues affecting the Valley. Understanding how water, sediment, and trash flow in stormwater is used to implement cost-effective bi-national source reduction programs and capture devices. Stormwater and pollutant flow information is used to plan and budget for operation and maintenance activities. Informing and involving local, regional and bi-national communities fosters protection and enhancement of natural resources. A conceptual diagram of the interconnection between the Priority Action Areas is presented below.



Interconnection of Priority Action Areas - Project Outcomes Inform Future Work

Project Execution Lifecycle Description

Projects within each Priority Action Area are executed through individual processes for each Recovery Team stakeholder. The range and extent of implementation processes are often dependent on the project scope, timing, and internal organization needs. Generally, capital project implementation efforts can be categorized into five main components:

- » Data Collection and Feasibility Assessment
- » Permitting and Design
- » Implementation
- » Operate and Maintain

Non-capital projects may not require each of the project lifecycle components.

Data Collection and Feasibility Assessment

Projects begin with a problem that needs to be solved. Prior and during project initiation, Recovery Team organizations will coordinate activities among stakeholders and with overall recovery efforts to assess available data and perform appropriate feasibility assessments to evaluate alternatives.

- »Background data collection and coordination by the Recovery Team
- »Feasibility Assessment — background data leading to a defined project scope, cost estimate. May be combined with the Permitting and Design
- »Requires consideration for capital and long-term operation and maintenance funding if applicable

Design and Permit

Federal, state, and environmental approvals, as well as consensus from project stakeholders and the public are required at the design and permit stage. Contract plans and specifications, cost estimate, and contracting processes are also required.

Permit components:

- » Environmental permitting documents
- » Draft Environmental Document (or exclusion)
- » Public review and comment of the Draft Environmental Document
- » Final Environmental Document certification and approval

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

- » Base maps, plan sheets (30, 60 and 100% designs)
- » Plans, specifications, and estimate package
- » Construction contract(s) and other agreements

Implementation

For capital projects, the implementation component includes construction:

- » Constructed physical improvement — follows the applicable federal, state, and local guidelines
- » As-Built Plans — Includes plan changes during construction
- » Environmental compliance certificates

Operate and Maintain

Many capital projects need ongoing operation and maintenance activities:

- » Dedicated, reliable sources of funding
- » Maintenance agreement(s)
- » Planning to assess the long-term effectiveness of the project

Summary

The following section presents a preliminary schedule for actions within the seven Priority Action Area components identified by the Recovery Team. These actions are required to successfully and cost-efficiently implement the diverse array of multi-benefit projects identified in this Recovery Strategy that will have benefits across multiple management areas.

PROPOSED 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 with TRVRT member organizations.

B. Understand How Water, Sediment and Trash Flow

- 1. Watershed Hydrology & 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 in Watershed

- 8. Design and Implementation of Sediment Basin in Smugglers Gulch
- 9. Sediment Capture Implementation- Mexico
- 10. Design and Implementation of Floatable Trash Capture Device(s) in Goat Canyon, Smugglers Gulch, Main River
- 11. Storm Drain System Trash Capture Device(s) Implementation 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 Nourishment Project *In Progress*
- 15. Nelson and Sloan Property 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 Hydrology of the River
- 23. Restore Tidal Prism in the Estuary
- 24. Implement the Tijuana River Valley Invasive Plant Control Program *In Progress*
- 25. Establish Native Plant Cover and Weed Control on BIS *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 with TRVRT member organizations.					

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 get sediment and trash under control to reduce flooding and prevent further degradation of the Valley and estuary. Accordingly, effective treatment of sediment and trash in stormwater requires a combination of pollutant source reduction, capture, cleanup activities, policy enhancements, and restoration of hydrologic processes in Mexico and the U.S. portions of the watershed.

A number of mechanisms currently exist for coordinating and funding work in Mexico. Existing mechanisms include the U.S. EPA Border 2020 program, IBWC Citizens Forum, San Diego Association of Governments (SANDAG) 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 analysis and project identification and implementation through cooperative data sharing. In addition, education and coordination activities among Recovery Team member agencies to understand the structure, function and jurisdictional responsibility of Mexican agencies tasked with sediment and trash controls will be needed. This will improve communication and allow the Recovery Team to recognize and integrate with work being currently being conducted in Mexico to control sediment and trash.

	2012	2014	2016	2018	2020
B. Understand How Water, Sediment and Trash Flow					
1. Watershed Hydrology & 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 developing 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. In addition, only recently has this work 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 and trash and reducing flood risk. Focused hydrology and hydraulic studies will jointly inform and allow collaborative bi-national solutions to be developed to: (1) restoration of the river and estuary to optimize flows for flood control and for 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 Hydrology and Hydraulic Modeling

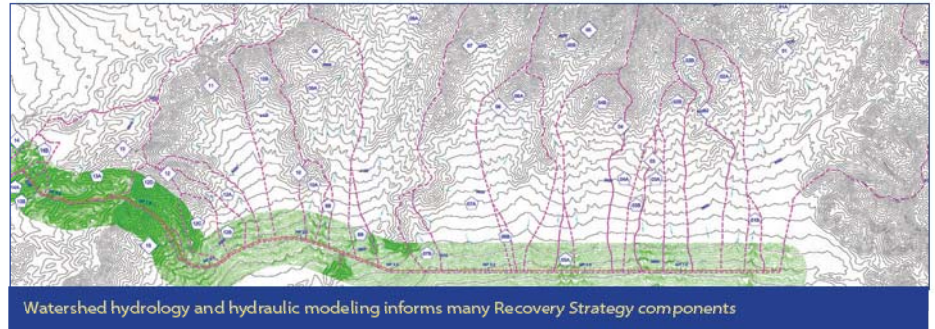
Perform hydrology and hydraulics modeling based on current conditions. Project will re-evaluate the extent of the 25- and 100-year flood plains using LIDAR and other available data. Expected results: identification of current flow characteristics that may be used for sediment and trash management, delineation 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. Expected results: data to calibrate sediment transport model(s). Project will inform source reduction and management practice implementation planning and cost-benefit analysis for projects such as: erosion, sediment, and trash control education and outreach, slope/road stabilization, and potential sites for local or regional sediment basin and/or trash capture implementation.

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. Analysis 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 select capture devices.



	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	■	▨	▨	▨	▨

Sediment and trash pollutants have long been a major concern throughout the watershed. 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. In order to stop impacts from sediment and trash, education and outreach, pollution prevention and source control projects are required. 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 are present 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 and B (Partner with Mexico to Implement Optimum, Watershed-based Solutions);

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 good erosion control and sediment management practices. Expected results: source reduction of sediment.

C2. Trash

It is widely recognized that trash sources originate on both sides of the border. Traditional source control activities include education and outreach efforts focused on proper disposal, various activities to reduce litter and illegal dumping and policy improvements to encourage recycling and other beneficial activities. Recently in the U.S., product ban efforts have emerged as potentially viable pollution prevention strategy.

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

6. Regular Trash Removal- U.S.

Fund and implement partnership program for Recovery Team stakeholders and volunteer groups/NGOs to perform manual trash and tire removal activities in the Valley. Project to include disposal costs. Expected results: removal of quantifiable amount 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, and regular trash removal programs. Expected results: removal of quantifiable amount of accumulated trash.



Trash removal programs in Mexico can cost-effectively reduce trash sources.

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

Capture of sediment and trash pollutants is a key component for long-term recovery of the Valley. The work of the Recovery Team recognizes that source control and pollution prevention on both sides of the border is the first step in reducing the amount of sediment and trash in stormwater that will need to be treated to protect 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 throughout the watershed. At a local implementation scale, land use, drainage area and stormwater conveyance system configuration are all factors that will affect the effectiveness of capture devices and/or strategies. In addition, the effectiveness of capture devices is often dependent on performance of regular operation and maintenance activities. It is recognized that sediment and trash

capture implementation projects in both the U.S. and Mexico will be guided by results derived from 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 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 Smugglers Gulch

Informed by results of projects conducted under Priority Action Area B (Understand How Water, Sediment and Trash Flow), 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. Expected results: siting, permitting and 100% engineering design for sediment removal device.

9. Sediment Capture Implementation- Mexico

Informed by results of projects conducted under Priority Action Areas A and B (Partner with Mexico to Implement Optimum, Watershed-based Solutions; Understand How Water, Sediment and Trash Flow), implement actions such as: road repaving/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) in Goat Canyon, Smugglers Gulch, Main River

Informed by results of projects conducted under Priority Action Area B (Understand How Water, Sediment and Trash Flow), engineering design and permitting for trash capture device(s) for low-medium flows. Expected results: siting, permitting and 100% engineering design for trash removal device and associated trash load reduction.



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

Design and construction of storm drain system (in urban areas storm drain systems are often called municipal separate storm sewer system [MS4]) trash capture device(s) in key locations. Expected results: trash and bacteria load reductions.

12. Trash Capture Implementation- Mexico

Informed by results of projects conducted under Priority Action Areas A and B (Partner with Mexico to Implement Optimum, Watershed-based Solutions; Understand How Water, Sediment and Trash Flow), implement actions such as: MS4 trash capture devices, improved street sweeping, trash capture nets and

	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 Nourishment Project <i>In Progress</i>					
15. Nelson and Sloan Property Reclamation <i>In Progress</i> (Feasibility phase)					
16. Reuse Construction Grade Material - Contract Terms and Conditions Recommendations					
17. Long Term Operations and Maintenance Financing					

screens in channels and/or drainage conveyances. Expected results: trash and bacteria load reductions.

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. Current operations in the U.S. include clearing of accumulated sediment and trash in the main river channel near the international border, within the Smuggler's Gulch and Pilot Channel, and annual cleaning of the Goat Canyon sediment basins. 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 a Recovery Team conducting annual O&M activities have joined forces to stabilize and reduce the annual costs by creating local uses for sediment and by commencing joint sediment processing. To expedite these methods taking affect, collaborative environmental permitting review and joint operation agreements will be imperative. These projects include:

13. Local Integrated Sediment and Trash Processing Site

Joint sediment and trash management location for the sediment captured in the Goat Canyon sediment basins, resulting from excavation activities and for potential sediment and trash capture devices elsewhere in the Valley. Expected

results: Centralized cost-efficient processing for excavated material.

14. Nearshore Sediment Reuse/Beach Nourishment Project In Progress

Continuation of fill placement for beach nourishment along the beach adjacent to Border Field State Park and Tijuana River National Estuarine Research Reserve. 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) Expected results: Cost-efficient and environmentally beneficial placement of captured sediment for beach replenishment.

15. Nelson and Sloan Property 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: beneficially reuse captured sediment to reclaim sand and gravel mine in conformance with 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



Channel and basin excavation activities can generate large amounts of sediment

results: Increase beneficial reuse of material and improve sediment disposal tracking.

E2. Secure Long Term Financing for O&M Activities

Development of a sustainable financing mechanism must be secured to ensure that O&M can be accomplished annually and to responsibly invest in future

infrastructure. One traditional mechanism is establishing an endowment for management; however, identifying sources for capitalizing the fund will require investigation with financial advisors.

17. Long Term operations and Maintenance Financing

Develop government, philanthropic, and/or other innovative sponsorship and

	2012	2014	2016	2018	2020
F. Involve and Inform Community in Mexico and U.S.					
18. Recovery Team Administration, Website Management and Media Support	[Solid blue bar with arrow pointing right]				
19. Cross-border Notification Network	[Green bar]	[Hatched bar]	[Hatched bar]	[Hatched bar]	[Hatched bar]

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 project implementation activities.

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.

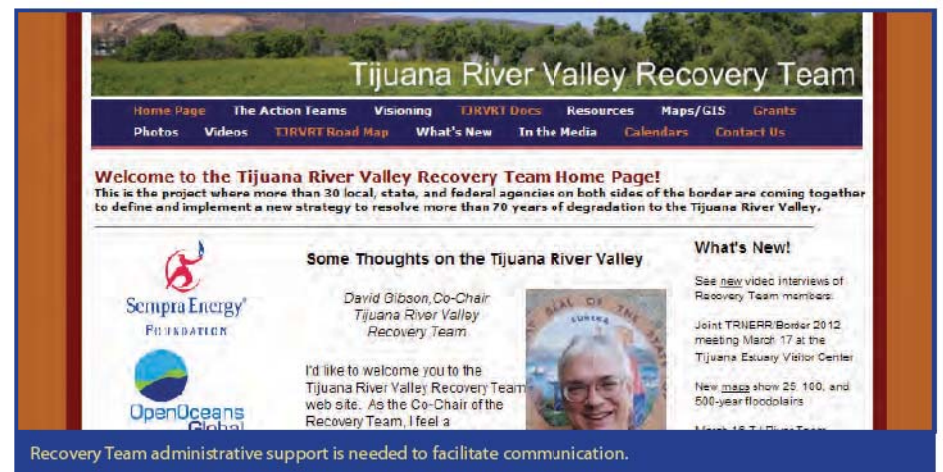
18. Recovery Team Administration, Website Management and Media Support

Develop ongoing administrative support for the Recovery Team with provisions for development and maintenance of the Recovery Team website, popular

media support and technical information exchange between U.S. and Mexico resource agencies. Expected results: ongoing Recovery Team administrative support to improve project implementation/coordination opportunities.

19. Cross-border Notification Network

Develop an effective streamlined cross-border notification network and process to advise key agencies/staff on the status of water quality and other issues affecting human and ecosystem health. Expected results: improved



	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 Hydrology of the River					
23. Restore Tidal Prism in the Estuary					
24. Implement the Tijuana River Valley Invasive Plant Control Program ^{In Progress}					
25. Establish Native Plant Cover and Weed Control on BIS ^{In Progress}					
26. Acquire Private Property from Willing Sellers ^{In Progress}					
27. Agricultural Land Management Strategy					

international communication. Potential to reduce various environmental and human health impacts from pollutants in the Tijuana River watershed.

The Valley and estuary is one of the largest and least developed coastal wetland ecosystems in southern California. The extensive riparian, estuarine and coastal scrub habitat features found in the Valley are both ecologically important and home to many rare and threatened species. Despite significant disturbance from anthropogenic 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. Long-term continuance of this trend will require reductions in sediment and trash pollutant inputs, enhancements to hydrologic function, improvements to water quality, protection of sensitive habitat and species, control of invasive species, and adaptation to effects of climate change including sea-level rise. Actions to meet these needs will also reduce flood risk for residents and infrastructure and improve recreational opportunities.

20. Climate Change Analysis and Planning

Preparation and planning documentation to assess potential impacts of sea level rise and changing watershed inputs in order to develop long term planning needs. Expected results: improved understanding of shifting habitats;

identification of impacts to infrastructure and property; development of climate change adaptation plans.

In its current condition, the river and estuary is aggraded from sediment deposits. In addition to conversion of habitats to less productive types, these topographic changes have exacerbated flooding and reduced the capacity of the river and estuary to carry sediment to the ocean. In addition, large storm events that overwhelm sediment reduction and capture measures and further aggrade the river floodplain and estuary are inevitable. Informed by results of projects conducted under Priority Action Area B (Understand How Water, Sediment and Trash Flow) projects 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 are needed.

21. Integrated Floodplain Management Alternatives Analysis

Develop 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, Brown fill and other flow-impeding attributes.

22. Restore River Hydrology

Develop plans to restore Valley to naturally connected system of wetland, 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.

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

Implement the ongoing Program is guided by mapping of target species distributions, a control plan, programmatic environmental permits, and ongoing research and monitoring about 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.

25. Establish Native Plant Cover and Weed Control on BIS ^{In Progress}

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

Coordinated efforts by federal, state, and local governments to purchase private property in the Valley from willing sellers. This program has resulted in purchase of XX acres of land from willing sellers in the Valley since the 1980s and is complemented by ongoing efforts in Mexico to secure conservation easements in open space areas. Expected benefits: Reducing risks to public health and safety from flooding and erosion.

27. Agriculture Land Management Strategy

Develop coordinated land management techniques for agricultural land as it becomes available through acquisition from willing sellers or retirement of existing leases. Expected results: reduce erosion and release of potential pollutants in soils.



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 (TMDLs) be developed to reduce the sources of impairment in 303(d) listed waterbodies. However the bi-national nature of the Tijuana River watershed, number of agency and private stakeholders and other factors led the Regional Board to consider the collaborative stakeholder-led Recovery Strategy approach.

Given this collaborative approach, the Regional Board recognizes that a number of governmental agencies have been established to enforce regulations pertaining to maintaining and restoring water quality, protecting habitat and sensitive species, and management of cultural and other resources. Within the Recovery Team, these agencies include: the U.S. Environmental Protection Agency (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 San Diego Regional Water Quality Control Board (Regional Board) and others. Each of these agencies has specific, and often independent processes to review and approve projects 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 larger watershed. Integral to this process is communication and early involvement between project stakeholders and regulatory agencies. The collaborative nature of the Recovery Team will assist in the development of a comprehensive permitting approach for projects in the Valley that promotes its restoration in a manner consistent with existing laws and regulations and in concert with the overall vision of the Recovery Team.



Collaborative Recovery Team visioning workshop to identify priority action areas.

Ongoing Collaboration

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 is a simple formalization of the relationship between the land managers and operating agencies to serves as a basis for collaboration in implementing priority projects. The Letter of Commitment recognizes that collaboration can be limited 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 as members in good standing.

The Regional Board will serve as sponsor signatory to the Recovery Team and. It 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 trash and sediment 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 in order 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 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

Implementation of the Recovery Strategy is intended to initiate the first phase of actions required to clean up the Valley so its beneficial uses can be restored and the environmental and human values that the Valley supports can be maintained into 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 enhanced relationships, partnerships, and funding mechanisms to align in the U.S. and in Mexico to provide watershed-based solutions. Accordingly, the Recovery Team stakeholders recognize 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.

Acknowledgements

We would like to acknowledge the following people for...

RECOVERY TEAM TO PROVIDE INPUT

