Resilient Coastlines Project of Greater San Diego
2015 - 2018

Connecting local governments, regional science, and communities.
The Resilient Coastlines Project of Greater San Diego represents a regional and multi-faceted approach to building coastal resilience. The project is designed to connect several local sea-level rise initiatives through a regional strategy, fill existing knowledge gaps that were barriers to resilience planning and implementation, and further engage scientific experts and community members in building coastal resilience for the San Diego region.

The project was launched with support from a 2015 NOAA Regional Coastal Resilience Grant designed to directly support community-based coastal hazard planning.

“San Diego is laying the groundwork to prepare our coast’s people, landscapes and businesses for climate hazards. I am proud to lead a team that exemplifies the power of regional organizations to catalyze and enhance capacity — key ingredients for building resilience in any community.”

— Laura Engeman
Director of the San Diego Regional Climate Collaborative

For more information and supporting materials, go to:
www.resilientcoastlines.org
About the Project Team

Through the Resilient Coastlines Project, the San Diego Regional Climate Collaborative, Climate Science Alliance-South Coast and the Tijuana River National Estuarine Research Reserve partnered to design and implement an innovative and multi-faceted approach to build regional resilience.

From left to right: Dani Boudreau, Laura Engeman, Amber Pairis

Danielle Boudreau
Coastal Management Specialist
trnerr.org

Laura Engeman
Director
sdclimatecollaborative.org

Amber Pairis, Ph.D.
Director
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Rising tides, combined with intense coastal storms, have the potential to damage and harm businesses, residents, and infrastructure along San Diego’s coast. Planning for increased flooding and inundation, coastal erosion, changes in sediment movement, and saltwater intrusion can better prepare our coastal communities and make them more resilient.

This booklet summarizes the results of the project and the positive impacts these efforts are having in the community.

All products and information can be found on the website: resilientcoastlines.org

“This project helped build a stronger relationship between the Scripps Institution of Oceanography and public agencies in our region. It helped me better understand issues facing public agencies, like laws surrounding sea level rise, and how science is integrated into some of those issues.”

– Julie Kalansky
Climate Researcher
Scripps Institution of Oceanography

Connecting Local Initiatives
Fourteen initiatives are currently underway to better prepare our coastal communities and infrastructure for major storm events to make them more resilient.

The Resilient Coastlines Project helped link these activities together to build pathways for communication and collaboration.

Vulnerability Assessments
A survey of how the community will be impacted based on projected coastal flooding and shoreline erosion scenarios.

Living Shorelines Projects
Enhancing coastal landscapes to build resilience and protect communities against future rising tides and coastal storms.

Resilience Plans / Strategies
A set of community strategies that enable a community to build resilience and adapt to accelerated coastal flooding and erosion.
The Resilient Coastlines Project is taking a multi-faceted approach to build resiliency in the coastal communities of the Greater San Diego region.

This approach is designed to build effective, long-lasting actions that increase resilience now and in the future, for ALL communities.
We focus on four key components:

* Leadership
* Science
* Community
* Sharing Our Model
Coastal flooding in Del Mar based on 1.5 meters sea level rise combined with a 100 year storm. Map provided by USGS Coastal Storm Modeling System.
Translating Sea Level Rise and Coastal Storm Science for Planning

The Resilient Coastlines Project of Greater San Diego focuses on connecting local government and community members with scientists. Workshops, tools, and peer exchanges directly support science application in resilience planning. These also foster a deeper understanding of sea-level rise and coastal storms, as well as tangible experiences with coastal vulnerabilities that can be shared to inform present-day and future planning and hazard response.

“It was really helpful to be in the same room with sea level rise modelers face-to-face where we could ask questions.”

– Phil Gibbons
Environmental Specialist
Port of San Diego

TOOLS + TRAINING

- FAQs about USGS Coastal Storm and Sea Level Rise Projections
- Planning for Sea Level Rise Using the Coastal Storm Model (CoSMoS 3.0) Workshop
- Sea Level Rise and San Diego Communities: Science and Planning For Our Future Workshop
- A Hazard Exposure Reporting and Analytics Webinar
- Sea Level Rise Projections Used for Planning in San Diego County Comparison Chart
KDM performing a LiDAR survey of the Solana Beach bluffs
Solana Beach Bluff LiDAR Surveys

The Resilient Coastlines Project of Greater San Diego partnered with Coastal Frontiers and KDM Meridian to conduct a ground-based Light Detection and Ranging (LiDAR) survey of 1.5 miles of coastal bluffs that make up the shoreline in Solana Beach. Bluff features were mapped and photographed to document the bluff condition and armor types. This information can inform local government planning efforts for infrastructure, transportation and natural resource management.

“The LiDAR survey established a critical baseline for monitoring future coastal bluff erosion rates. These data combined with future surveys will help us track changes in our beaches and cliffs and inform our Local Coastal Program shoreline management strategies.”

– Greg Wade
City Manager, City of Solana Beach

**TOOLS**

* Baseline data on coastal bluffs in Solana Beach
* GIS data included in OpenTopography to inform regional beach nourishment and cliff erosion management
Discussion during a Living Shorelines Workshop
Learning About Living Shorelines

Living Shorelines offer opportunities to protect our coasts with natural ecosystems that are resilient and adaptive, but need to be tried and tested in the urbanized and wave intense Southern California shoreline environment.

The Resilient Coastlines Project of Greater San Diego partnered with the Tijuana River National Estuarine Research Reserve to bring together the region’s key players in coastal resilience to engage in thoughtful discussion and brainstorming for how to enhance the natural coastal landscape of our region, while building community resilience.

“The Resilient Coastlines Project provided a great venue to engage with people working on living shorelines across sectors and help everyone understand the breadth of what we mean when we say ‘living shorelines’”

— Rebecca Schwartz
Project Manager, San Diego Audubon

**TOOLS + TRAINING**

* Living Shoreline Examples Applicable to Southern California Summary
* Living Shorelines and Resilience Workshops in San Diego, Los Angeles, Orange County and Santa Barbara
* Technical Advisory Committee for the Cardiff State Beach Living Shoreline Project
* Article: “Living Shorelines From a Southern California Perspective”
* Literature Review and Resource List Applicable to Southern California
* State of California 4th Climate Assessment “Coastal Infrastructure Technical Advisory Committee”
Legal, Policy, and Planning Tools

Coastal communities are facing tough decisions about how and when to act to mitigate future sea-level rise and coastal storms. These can involve a myriad of near-term and long-term actions, establishing indicators that will trigger future actions, and extensive community dialogue around the future of their community’s people, landscape and infrastructure. To help these communities with weighing their options, the Resilient Coastlines Project of Greater San Diego partnered with the Environmental Law Institute to develop an easy-to-understand legal guide summarizing the legal risks associated with different adaptation strategies, including taking no action. Revell Coastal also provided information on scenario planning, as well as template language for incorporating actions into local coastal plans.

“My experience with the legal risk analysis helped me directly respond to questions from a planning commissioner on legal aspects of our sea level rise plan.”

– Carl Stiehl
City Planner, City of Carlsbad

TOOLS + TRAINING

* A Legal Risk Analysis of Sea Level Rise Adaptation Strategies
* Sample Local Coastal Program Text
* Table of Adaptation Strategies and Planning Considerations
* Understanding the California Coastal Commission’s Updated Sea Level Rise Policy Guidance Workshop
High tide in Carlsbad. Photo by Carl Stiehl, City of Carlsbad
Economic Analyses

Weighing the varying costs, benefits, and economic impacts of coastal resilience strategies can help inform local decision-making and justify early and cost-effective investments. The Resilient Coastlines Project of Greater San Diego partnered with Nexus Planning to road-test a National Oceanic and Atmospheric Administration (NOAA) cost-benefit evaluation tool for sea level scenarios at the local level. The Center for a Blue Economy helped evaluate wage, employment and economic growth impacts from potential future coastal flooding for use by local government partners.

Strategies identified in this project can build resilience into San Diego’s economy now and in the future.

“The Cost Benefit Analysis was really helpful in communicating the idea that the choice of no action is the most costly option for our city moving forward. This is something we really need to communicate to the public.”

— Amanda Lee
Senior Planner, City of Del Mar

Tools + Training

* "A Regional Economic Impact Assessment of Future Coastal Flooding"
Resilient economy now and in the future.
Building coastal resilience requires a great deal of multi-level collaboration and leadership. For the San Diego region, economic vitality, local community members, and sensitive coastal resources are all part of the fabric that makes our community thrive. The Resilient Coastlines Project of Greater San Diego uses a variety of innovative strategies to develop coastal resilience leadership, with a focus on empowering local stakeholders to be resilience “champions” in their communities or organizations. The Project is supported at its core by a Regional Sea Level Rise Working Group that integrates and coordinates coastal resilience activities across the county. This group serves as a central hub to leverage expertise and resources, develop consistent planning frameworks, and enhance the overall effectiveness of regional resilience strategies.

**LEADERSHIP**

"This working group has been immensely helpful. It gave regional consistency and legitimacy to our work as individuals, especially since we’re all working off the best science available."

— Kimberly Roland, Senior Planner, City of San Diego

"The working group helped strengthen my relationship with other agencies addressing the same coastal resilience issues."

— Phil Gibbons, Environmental Specialist, Port of San Diego

**TOOLS**

* Elected Leader Presentations
* Community Educational Forums
* Direct Technical Assistance
* Engagement with Local Scientists
* Regional Working Group Trainings
* Workshops / Webinars
Sea Level Rise (SLR) Working Group members discussing the Carlsbad SLR Vulnerability Assessment with constituents.
Innovative Community Engagement

Through the Resilient Coastlines Project of Greater San Diego the Climate Science Alliance-South Coast leads multiple community and youth events focused on increasing climate literacy and building support for coastal resilience solutions in our communities.

Climate Kids Youth Engagement

Climate Kids is an initiative of the Climate Science Alliance that provides youth education on climate change through science activities, storytelling and art. In partnership with the Resilient Coastlines Project, Climate Kids brings together scientists, educators, local artists and storytellers to engage students of all socioeconomic levels to learn more about their coastal landscapes and climate impacts and inspire them to become coastal stewards.

“Now I know that climate change is very important and people shouldn’t ignore it.”

– 3rd grader
“The lab coats made me feel like a real scientist!”

– 4th grader
Art and Community

The Climate Science Alliance initiated an Affiliated Artists program to match artists with scientists and display their art in the community. A special traveling art exhibit titled “Art of Change” was created and shared around the county. Climate inspired work created by local youth and artists helped engage the public on coastal resilience themes.

- Affiliated Artist Audrey Carver developed mural paintings depicting the four climate change scenarios for the Tijuana River Valley based on GIS maps and quantitative data.

Art Shows

**October - December, 2016**
Art created by Climate Kids shown at the Balboa Park Sustainability Studio.

**March 6th - April 27th, 2017**
“Art of Change” open to the public at the Pacific Beach Taylor Branch Library.

**June 17th - 30th, 2017**
CSA Affiliated Artist Audrey Carver featured in “MUSE: San Diego Museum Murals” at La Bodega Gallery in Barrio Logan.

**July - September, 2017**
“Art of Change” open to the public at the San Diego Central Library.

**September - October, 2017**
“Art of Change” open to the public at the Del Mar Library and City Hall.

**November 2017 - January 2018**
Art displayed at California Department of Fish and Wildlife State Building

**February 2018 - March 2018**
“Art of Change” at Imperial Beach Library
Community Outreach

Balboa Park Earth Fair 2017

Along with twenty community events reaching thousands of people, the Balboa Park Earth Fair was our biggest event to date, reaching an estimated 60,000 people. This new and exciting area was brought to the community by the Climate Science Alliance–South Coast and the San Diego Regional Climate Collaborative as part of the Resilient Coastlines Project of Greater San Diego. Organizations, performers, and artists came together to offer a fun, interactive space for people of all ages to learn about climate change and ocean science.

“Color Your Future” Coloring Book

Color Your Future is a coloring book of illustrations featuring our unique coastal regions to draw attention to how they are susceptible to climate change. These books are designed to foster dialogue by adults and children about how to work across generations and communities to maintain the vibrance of our natural and community resources. These coloring books were distributed in the community during events and youth outreach programs.

Original artwork is provided by Arpita Choudhury, a Climate Science Alliance Affiliated Artist.
Sharing Our Model

The Resilient Coastlines Project of Greater San Diego provided a unique opportunity to showcase the regional frameworks and collaborations that significantly enhance community and coastal resilience activities. We continue to share this model and best practices with others across the state, nation, and internationally.

“We were incredibly pleased to host a webinar featuring this project so that our partners throughout the state could learn from the great work being done in San Diego and build upon it in their own jurisdictions up and down the coast.”

— Kelly Leo
Coastal Project Director, California Coastal Resilience Network
The Nature Conservancy

EVENTS + CONFERENCES

* California’s Alliance of Regional Collaboratives for Climate Adaptation Workshops
* California Coastal Resilience Network Webinars + Educational video
* California Department of Fish and Wildlife Climate Mini-forums
* California Natural Areas Conference
* Coastal Law Conferences
* International Emerging Environmental Leaders Field Trip
* National Adaptation Forum
* Restore America’s Estuaries National Conference
* Security and Climate Change: The Pacific Coast Conference
The Resilient Coastlines Project of Greater San Diego was made possible with funding from:

NOAA Office for Coastal Management

California State Coastal Conservancy

Matching commitments from the cities of Carlsbad and Del Mar
These funds allowed the following organizations to provide technical and planning support services to the region’s coastal cities and public agencies to directly support their climate resilience efforts.

* indicates organizations in Sea Level Rise Working Group

**Technical Assistance Partners**

Center for Blue Economy  
Climate Science Alliance—South Coast*  
Coastal Frontiers  
Environmental Law Institute  
Environmental Science Associates  
Moffat & Nichol  
Nexus Planning  
Revell Coastal  
State Coastal Conservancy  
Scripps Institution of Oceanography*  
US Geological Survey  
USC Sea Grant

**Local Agency Partners**

California Department of Fish and Wildlife*  
City of Carlsbad*  
City of Coronado*  
City of Chula Vista*  
City of Del Mar*  
City of Encinitas*  
City of Imperial Beach*  
City of Oceanside*  
City of San Diego*  
City of Solana Beach*  
San Diego Association of Governments*  
San Diego County*  
San Diego International Airport Authority*  
San Diego Port Authority*  
Tijuana River National Estuarine Research Reserve*  
US Navy*

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For more information and supporting materials, go to: www.resilientcoastlines.org

Supporting community-based coastal hazard planning.

Design and illustrations by Diane Terry