Reducing land-based sources of pollution: Performance results and highlights for fiscal years 2021–2026

The 2018 Coral Reef Conservation Program strategic plan includes a pillar of work dedicated to reducing the threat of land-based sources of pollution (LBSP) to coastal coral reef ecosystems. During the performance period, this body of work represents strategies to develop, coordinate, and implement watershed management plans, and build and sustain watershed management capacity at the local level. These strategies were developed to catalyze partnerships to address the interdisciplinary management activities necessary to reduce inputs from land, advance the science needed to inform coral-relevant water quality criteria, and support locally-led watershed management activities. In combination over time, these efforts will result in increasing the resilience of coastal reefs to maintain vital ecosystem services they provide to coastal communities.

NOAA's Coral Reef Conservation Program (the Coral Program) invests in supporting capacity, technical assistance, and science products, enabling managers to make informed decisions about watershed management activities to improve coral reefs in their jurisdiction. Since 2020, activities and products contributing to the strategies to reduce land-based sources of pollution have been tracked to document progress toward the strategy's objectives. Information was collected by Coral Program staff members who had direct knowledge of these activities and products. Below, these strategies are presented with corresponding objective performance targets and results, a progress bar, and brief description of progress. Although the ambitious nature of these performance targets resulted in some outcomes falling short of projections, this experience yielded valuable insights that will inform and improve future on-the-ground LBSP actions.

Develop, coordinate, and implement watershed management plans

Objective 1: By 2024, 100 percent of the key watersheds have watershed management plans that address EPA's A-I criteria.

Target almost met; at the close of 2024 six of the seven U.S. coral jurisdictions had completed watershed management plans, representing 86 percent of key watersheds. The Manell Geus plan in Guam was completed in early 2025 and brings the total to 100 percent of key watersheds with completed plans.

Objective 2: By 2024, 50 percent of the key watersheds have water quality targets for sediments or nutrients appropriate for healthy coral reef habitats.

Target not met; the target for 2024 was ambitious and dependent on strong collaborative partnerships. Only the U.S. Virgin Islands developed water quality criteria for clarity and turbidity; however, the Coral Program provided significant investments for technical assistance and scientific support to establish water quality targets in most jurisdictions and invested in strengthening institutional capacity (personnel) in Hawai'i. In addition, the Coral Program invested in strengthening water quality monitoring capacity by supporting personnel in Hawai'i.

Objective 3: By 2024, the efficacy of key erosion and sediment control practices and stormwater management practices to reduce sediments or nutrients is quantified.

Target met; a significant body of work conducted for Culebra, Puerto Rico has been successfully quantified and the results are highlighted in the 'On-the-ground impacts' section below. The Coral Program has also funded similar efforts in fiscal year 2024 to quantify efficacy in the U.S. Virgin Island's East End Marine Park.

Objective 4: By 2029, sediment and nutrient loads meet established water quality targets for receiving coastal waters in >50 percent of the key watersheds.

Ongoing; As noted above for Objective 2, only the U.S. Virgin Islands currently has water quality targets that are relevant to coral. However, the Coral Program supports NOAA-led projects, grants, and U.S. Coral Reef Task Force Watershed Working Group efforts to improve understanding of coral-relevant water quality targets and implement watershed management plans. Additionally, a partnership with the National Fish and Wildlife Foundation funded eight projects across American Samoa, Guam, Hawai'i, and Puerto Rico through the Coral Reef Stewardship Fund.

Progress and next steps

The results of our fiscal year 2021–2026 efforts have led to completed watershed management plans in all of the key watersheds in the U.S. coral jurisdictions, and advanced the science of coral-relevant water quality criteria with jurisdictional partners. Additionally, projects to quantify the efficacy of best management practices to reduce pollutant load, and support recommended actions from the completed watershed management plans have started. Achieving the first milestone (completing watershed management plans) allows the Coral Program to shift resources from planning to providing more technical and scientific support and step up implementation of the new plans. We will continue to work with our partners to carry out the strategies to reduce land-based sources of pollution under the new National Coral Reef Resilience Strategy.

Build and sustain watershed management capacity at the local level

Objective 1: By 2024, 100 percent of the program's key watersheds have coordinators.

Target almost met; there was considerable effort to hire and retain watershed coordinators across all seven jurisdictions and as a result there were no less than five jurisdictions (71%) each year with a watershed coordinator employed. Only Hawai'i and Puerto Rico maintained the same entity in this role between fiscal years 2020 and 2024, and the U.S. Virgin Islands also dedicated resources for a watershed coordinator, but has had difficulty filling the position.

Objective 2: By 2024, 50 percent of the program's key watersheds' priority management activities that improve water quality and enhance coral reef ecosystem resilience are implemented by jurisdictional partners in at least one key watershed per jurisdiction.

Target not met; the 2024 target was ambitious and contingent on the Coral Program's ability to track external partnerships with federal and state agencies, nongovernmental organizations, and academia. Monitoring these entities' support for implementing watershed management plans eventually became too onerous for the Coral Program to maintain, especially as jurisdictional capacity turned over.

Objective 3: By 2024, the ratio of funding (external partner funds to Coral Program funds) is greater than 1:1 for implementing priority watershed management activities that improve water quality and enhance coral reef ecosystem resilience within key watersheds in at least one key watershed per jurisdiction.

Target not met; similar to the previous objective, the target for 2024 was ambitious and relied on consistent local capacity to oversee and coordinate implementation activities so the funds invested across multiple partners could be tracked. Without consistent, local-capacity tracking, these investments were not feasible for the Coral Program.

Progress and next steps

During the fiscal year 2021–2026 implementation period, the Coral Program supported jurisdictional entities to hire and retain watershed coordinator positions through multiple funding mechanisms; however, this effort had variable success across jurisdictions. Staff changes due to promotions and turnover, with some positions vacant for years, resulted in the loss of historical and institutional knowledge necessary for smooth implementation and tracking partner activities and contributions towards multidisciplinary watershed management initiatives. These results highlight the importance of supporting and maintaining capacity at the local level.

Moving forward, there are opportunities to strengthen and sustain jurisdictional management capacity through investing technical and financial resources from the U.S. Coral Reef Task Force federal member agencies' in support of staffing local watershed positions; addressing local monitoring needs; providing nature-based solution trainings; developing relevant and user friendly tools; and facilitating state and territorial interagency collaboration.

On-the-ground impacts

The following projects highlight how scientists and managers are addressing priority needs across the Pacific and Atlantic basins to reduce land-based sources of pollution.

From Ridge to Reef: Turning Coral Science into Local Action in American Samoa

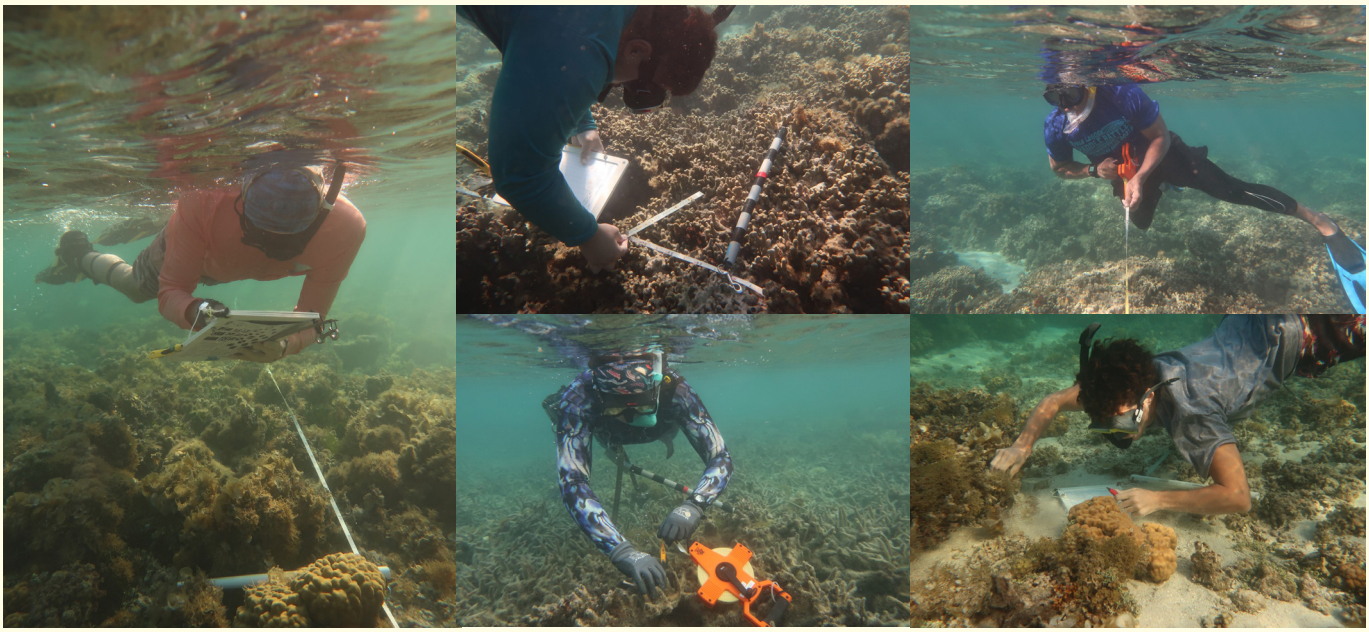
Two coordinated projects funded by the Coral Program were conducted sequentially during the fiscal year 2021–2026 implementation period and successfully linked land-based sources of pollution (LBSP) to coral reef health while building robust local monitoring capacity in American Samoa.

Key Outcomes: The first project established critical benthic biological and water quality baselines in the Aua watershed, identifying terrestrial sediment as the principal stressor driving reef community decline. The second project expanded on this foundation by training local agency staff in benthic demographics and water sampling, generating rich collaborative datasets in the nearby Nu'uuli lagoon.

Management Utility: Results directly updated the Aua watershed management plan and integrated targeted LBSP-mitigation language into four territory-wide marine conservation plans. Collaborative engagement with public works and the territorial land-use permitting board successfully translated this reef science into local coastal development policy.

Transferability: The initiatives pioneered a highly transferable three-stage training model—advancing from virtual lectures to classroom practicals and collaborative in-water surveys. Standardized digital learning packages, written Standard Operating Procedures, and field guides provide a turnkey template to secure monitoring continuity against staff turnover in any coastal geography.

Ultimately, these initiatives demonstrate how localized ecological research can be transformed into effective policies supporting long-term territorial resilience.



Participants were provided hands-on experience conducting benthic monitoring protocols underwater. This knowledge can be used in future surveys. Credit: NOAA Fisheries.

Paving the Way for Coral Reefs: Culebra's Ridge-to-Reef Restoration Blueprint

For over 10 years, the Coral Program has invested in activities to address land-based sources of pollution (LBSP) on Culebra Island, Puerto Rico, by mitigating unpaved road erosion to protect nearshore coral reefs and seagrass habitats.

Key Outcomes: The initiative stabilized over 32 miles of unpaved roads by implementing almost 300 Best Management Practices (BMPs), which prevented nearly 3,900 metric tons of sediment from reaching the coast annually. Core accomplishments include establishing 13 fixed, nearshore monitoring stations, developing robust watershed and nearshore water quality baselines, retrofitting a local wet lab, building municipal workforce capacity, and demonstrating green infrastructure resilience during strong hurricanes.

Management Utility: Utilizing a comprehensive ridge-to-reef monitoring framework, ongoing monitoring and modeling revealed that sediment retention efficiency ranged from 25 to 90 percent across managed sites. These insights drive adaptive management actions, such as paving highly erosive slopes with inclines greater than 20 percent, while future monitoring will identify key variables to further enhance efficiency. Multi-agency collaboration and open data portals maximized funding efficiency while ensuring sustained, long-term project oversight.

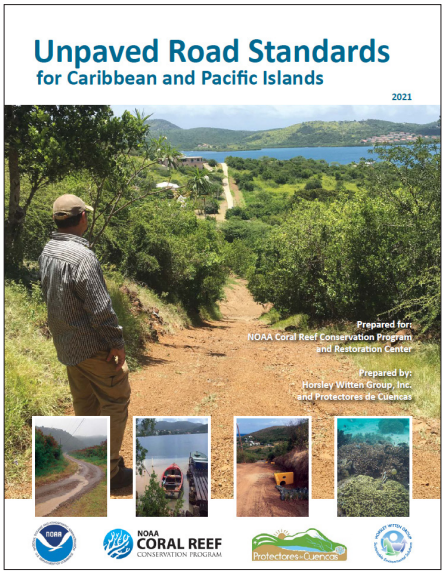
Transferability: A major project output is the unpaved road standards and guidance manual, crafted for broader application across Caribbean and Pacific coral jurisdictions. The scalable monitoring protocols, standardized BMPs, and community engagement strategies offer a highly transferable blueprint for coastal island management worldwide.

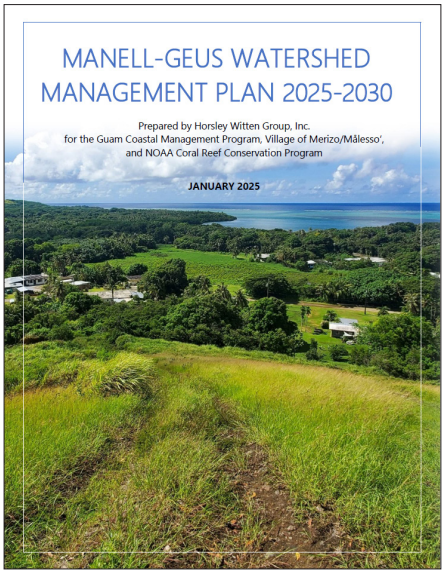
The culmination of this body of work is a model for integrated ridge-to-reef management and monitoring to reduce LBSP and serve as a tool for adaptive management over time.

Boats moor near the coast in southern Culebra Island, Puerto Rico. Credit: Adobe Stock.

Products

The featured publications below highlight Coral Program projects to reduce land-based sources of pollution and increase local management capacity during the implementation period. Our work supports watershed management activities and provides managers with the science, tools, and technical assistance needed to inform their decisions.





Looking ahead, the Coral Program will build off the progress made during this time as we align our program capacity and capabilities to carry out the National Coral Reef Resilience Strategy with our partners.

For more information about NOAA's Coral Reef Conservation Program, visit coralreef.noaa.gov and coralref.noaa.gov/digital-corals, or contact us at coralreef@noaa.gov.