IDENTIFYING FRAMEWORKS FOR LAND-BASED POLLUTION MANAGEMENT IN THE HAWAIIAN ISLANDS

2021

Identifying Frameworks for Land-Based Pollution Management in the Hawaiian Islands

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Cover image by Bert Weeks

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NOTE

This report outlines the multi-jurisdictional frameworks that govern the management of land-based pollution in Hawai‘i, including federal, state, and county laws, initiatives, agencies, and outreach strategies. The intent of this document is to provide context for decision-makers and to make recommendations to guide the implementation of the Hawai‘i Ocean Resources Management Plan (ORMP) during its 2020-2030 planning horizon.

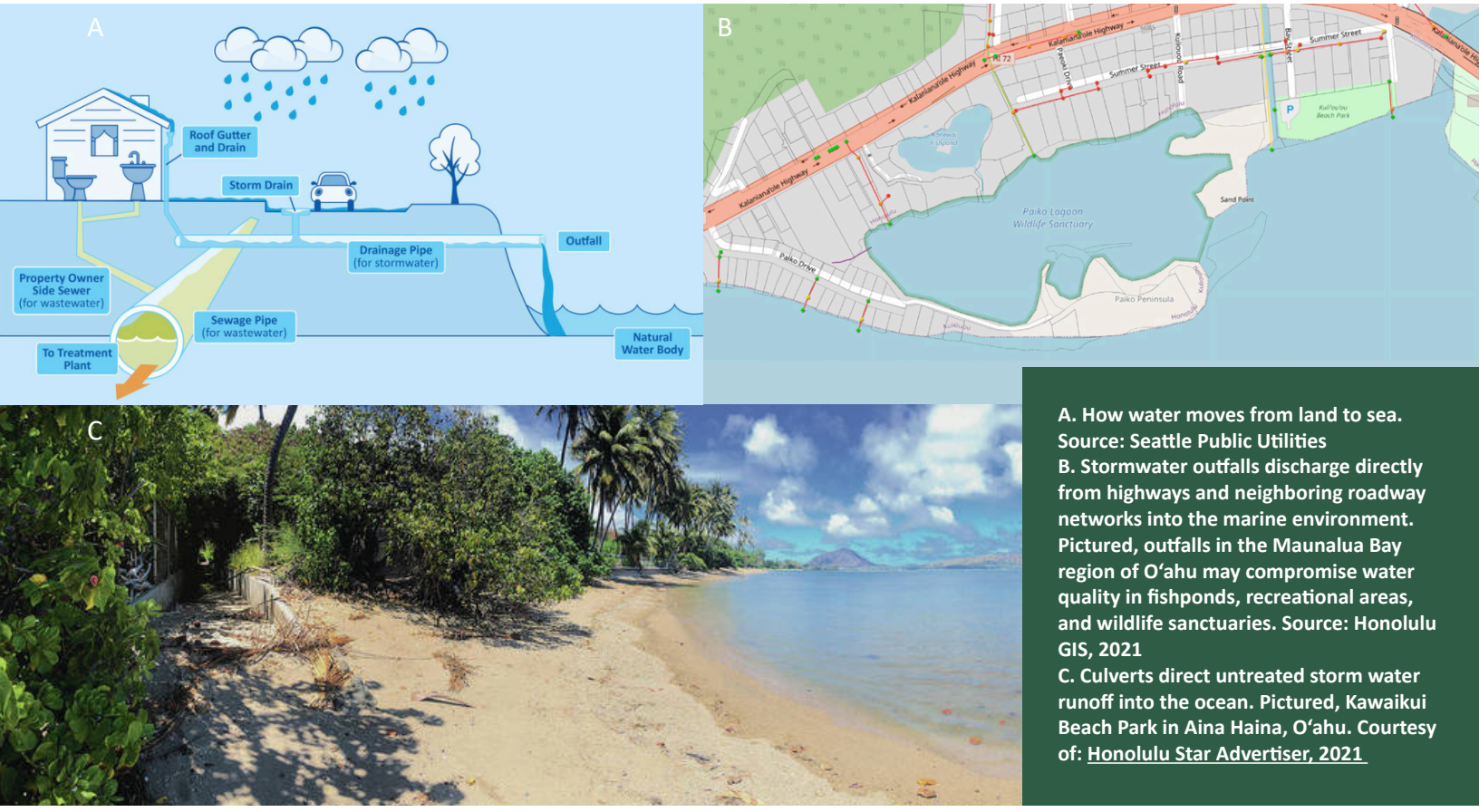
In 2020, the ORMP identified land-based pollution as one of the top three most pressing issues in Hawai‘i’s coastal zone. The plan defines land-based pollution as largely being caused by nonpoint source polluted stormwater runoff. While both point and nonpoint sources of pollution are discussed in this report, nonpoint source pollution is the primary focus of this report and its recommendations. Similarly, this report touches on all land use districts to contextualize the wide-reaching scale of land-based pollution’s origin areas and their multi-jurisdictional, multi-agency management but primarily focuses its analysis and recommendations on the urban zone.

Discussion about the current management system and recommendations for future actions were derived from research and interviews with federal, state, and county stakeholders, as well as non-profit representatives with expertise related to land-based pollution. Recommendations are put forth as options for consideration by the Land-Based Pollution Action Team. This document does not represent the views of the University of Hawai‘i Sea Grant College Program, the Hawai‘i Coastal Zone Management Program, and the National Oceanic and Atmospheric Administration.

INTRODUCTION

Land-based pollution is a term for the many contaminants that originate on land and make their way to the aquatic environment. The term encompasses many possible constituent parts, including terrigenous sediments, pesticides, chemical waste, salts, cleaning agents, oils and heavy metals, garbage and plastics, fertilizers, pharmaceuticals, untreated human sewage, and animal waste. In addition to toxins, pathogens, nutrients, and earthen materials, other factors like thermal pollution, the discharge of heated water, can also be considered pollution. Land-based pollution is generally carried from land to the sea by water, both through natural and modified riparian systems and man-made 'gray' infrastructure.

Land-based pollution can be divided into two main categories: point and nonpoint source pollution. Point source pollution can be traced to a specific point of origin. In the United States point source pollution is subject to robust regulation. Nonpoint, or indirect pollution, is usually a mixture of numerous contaminants from multiple points of origin, collected by moving surface water. Nonpoint source pollutants can move from land to sea through tributaries, streams, wetlands, rivers, and groundwater. In developed areas, land-based pollution often flows overland through neighborhoods, roadways, and parking lots and into storm drains. Hawai'i's storm drain network empties into urban waterway conveyances and includes a system of subsurface pipes, partial to fully channelized waterways, and canals that drain to shoreline outfalls. The extent of existing storm drain networks varies on each island, but throughout Hawai'i nonpoint source runoff is separated from the sewer network. Therefore, it does not undergo treatment to remove contaminants before it is disposed of



A. How water moves from land to sea. Source: Seattle Public Utilities
B. Stormwater outfalls discharge directly from highways and neighboring roadway networks into the marine environment. Pictured, outfalls in the Maunalua Bay region of O'ahu may compromise water quality in fishponds, recreational areas, and wildlife sanctuaries. Source: Honolulu GIS, 2021
C. Culverts direct untreated storm water runoff into the ocean. Pictured, Kawaikui Beach Park in Aina Haina, O'ahu. Courtesy of: Honolulu Star Advertiser, 2021

into the ocean like wastewater does. Whereas treated wastewater is released into the ocean, often at depths greater than 100 feet, stormwater outfalls discharge untreated runoff directly onto beaches and into the nearshore area.

Pollutants can be man-made or naturally occurring, but the majority are released into the environment as a result of human activities. The development and occupation of cities and towns, agriculture, deforestation, accidental oil and chemical spills, the spread of invasive plants and animals, and construction activities all contribute to the issue of land-based pollution. In Hawai'i, land-based pollution is an especially pressing issue due to the islands' short, steep watersheds, dense urban development, and intense rainfall, all of which rapidly carry polluted waters from land to sea.

Pollution impacts on marine health are of particular concern in the Hawaiian archipelago. Land-based sediment stresses coral reef ecosystems by smothering coral and preventing photosynthesis. Rising water temperatures, nutrients, and levels of acidity compound the negative impacts of pollution on marine organisms and their habitats. Worldwide, land-based sources of pollution are thought to account for up to 80% of marine pollution.[1] The terrestrial contaminants that negatively impact the marine environment can cause anoxic 'dead zones', algae blooms, and acidification. In Hawai'i's flora and fauna, nonpoint source pollution has led to disease and tumors, disorientation, accidental ingestion and entanglement, coral bleaching, and species mortality. Recreation and cultural practice in contaminated nearshore waters (gathering, fishing, swimming, surfing) can lead to illness. Shellfish such as oysters exposed to sewage can cause serious sickness in humans that consume them. The economic impacts of land-based pollution are also important to consider. Hawai'i's clean and clear coastal waters are one of the pillars of the state's tourism-dependent economy.

For those residing on islands, clean water and healthy ecosystems are imperative to the perpetuation of cultural practices and community wellbeing. Though largely the root cause of land-based pollution, humans are also deeply affected by pollution's impacts due to societal dependance on habitable, functioning ecosystems which support clean drinking water, food sources, and livelihoods. As such, humans have an intrinsic motivation to limit land-based pollution and remediate its negative impacts.

The formal management of land-based pollution is encompassed by legal, regulatory, and organizational frameworks which cross multiple jurisdictions and do not fall neatly under the responsibilities of a single entity. In Hawai'i, land-based pollution reduction efforts occur at the federal, state, county, watershed, and property levels. From a regulatory perspective, management frameworks largely originate from the national level, though grassroots efforts to reduce land-based pollution maintain a supportive presence in the state as well.

The legal and regulatory instruments currently in place to control land-based pollution and the agencies responsible for their implementation in Hawai'i are summarized in Section I.

Endangered species such as the Hawaiian Monk Seal *(Neomonachus schauinslandi)* and the Green Sea Turtle *(Chelonia mydas)* are directly impacted by Hawai'i's land-based pollution. Source: Hawai'i Marine Animal Response, 2020

SECTION I

The Multi-Jurisdictional Management of Land-Based Pollution

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The Multi-Jurisdictional Management of Land-Based Pollution

The Federal Framework

Federal laws establish overarching mandates that guide the control of land-based pollution in every state. These policies affect planning, management, and implementation at the state and local levels. The policy framework governing land-based pollution management in Hawai'i is largely framed by two important pieces of Federal legislation: the Clean Water Act (CWA) and its amendments and the Coastal Zone Management Act (CZMA) and its amendments.[a]

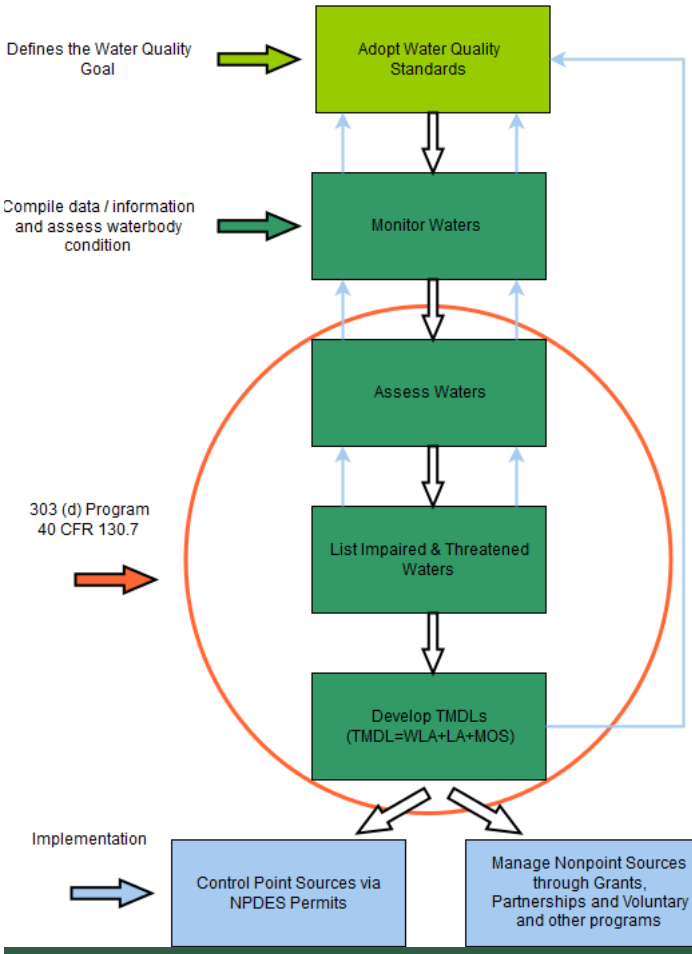
Environmental Protection Agency (EPA)

Mission:
To protect human health and the environment.

Compliance to Regulatory Responsibility:
The EPA co-administers the Federal Water Pollution Control Act, commonly known as the CWA [33 U.S. Code Section 1251 (1972)] with the U.S. Army Corps of Engineers (USACE) and jointly administers the CZMA and its amendments with the National Oceanic and Atmospheric Administration (NOAA).

The CWA created the imperative to review pollutant discharges into the waters of the United States and established standards to protect surface water quality. The CWA is the primary source of regulatory enforcement of point source pollution in the nation, which is defined by the CWA as "any discernible, confined and discrete conveyance… from which pollutants are or may be discharged." Examples of point sources are pipes, man-made ditches and conveyances, and vessels. The CWA does not define nonpoint source pollution, nor does it assert any regulatory authority over its management, instead relying on an incentives-based program.

Management Approach:
The EPA establishes national water quality standards, funds water quality monitoring, creates tools and educational resources, and oversees CWA program administration, implementation, and enforcement. Regulatory oversight of point source pollution is primarily



The Water Quality-Based Approach of the CWA. Source: EPA, 2018

[a]Federal mandates are often viewed as incompatible with Hawai'i's unique conditions. See Section II for additional context on the shortfalls of the current management framework.

What is the '303d' List? **The 303(d) list has become shorthand for a state's impaired waterbodies. The CWA requires states to establish water quality standards, whereby a state designates a use for each waterbody (i.e., recreation, agriculture and industry, navigation, etc.) and accordingly sets water quality criteria to safely meet the intended use. When these standards are not met, a waterbody is deemed to be impaired and put on the 303(d) list. Once listed, the state is required to take actions to improve the water's quality, including addressing nonpoint sources of pollution that may contribute to its impairment.**

What is a Total Maximum Daily Load (TMDLs)? **TMDLs establish the amount of a pollutant that can enter a water body while still meeting its water quality standards. TMDLs include point sources (wasteload allocations (WLAs)), and nonpoint sources (load allocations (LAs)) and include 'wiggle room' for margins of error and natural background levels of a pollutant. Critically, point sources (WLAs) of the TMDL can be enforced through NPDES permits, however, nonpoint sources (LAs) are not enforceable against nonpoint source polluters.**

Source: National Sea Grant Law Center, 2018

accomplished through the CWA's National Pollutant Discharge Elimination System (NPDES) permit program, which is managed at the state level. NPDES permits are only required for point source discharges from industrial facilities, construction sites, and municipal separate storm sewer systems (MS4) meeting certain conditions. The state of Hawai'i actively implements the stormwater NPDES permitting program by issuing permits to entities included under Section 402(p) of the CWA. EPA Region 9 issues NPDES permits for any discharges into federal ocean waters in Hawai'i[b] and all others are issued by the state. MS4s are considered point sources, and their administration under the NPDES program requires compliance with water quality standards, the enforcement of a Storm Water Management Program Plan (SWMPP), and an Annual Monitoring Plan and Report.

The Act's voluntary management approach for the control of nonpoint source pollution is outlined in the CWA Section 319. This section was added to the CWA in 1987 [33 U.S. Code Section 1329] in recognition that solely managing point sources was not a sufficient approach to comprehensive land-based pollution management. As such, this amendment served as a federal acknowledgement of the scale, impact, and importance of controlling nonpoint source pollution. Funding though the Section 319 grant program is available to states, tribes, and territories that meet certain parameters outlined by the legislation[c]. Per a 2013 EPA guidance, grant funds are divided for use among "Watershed Project Funds," for use implementing nonpoint source pollution reduction activities under the guidance of a state-approved Watershed Based Plan, and "Nonpoint Source Program Funds," which can be used to fund other needs such as program staffing, monitoring, and watershed project implementation.

Relevant Plans and Initiatives:
FY 2018-2022 U.S. EPA Strategic Plan
Urban Waters Federal Partnership Program

Public Outreach, Resources, and Compliance Campaigns:
Best Management Practices (BMPs) Siting Tool
Resources for Students and Educators about Nonpoint Source Pollution
The Nonpoint Source Outreach Toolbox
Materials by State-Hawai'i
National Nonpoint Source Monitoring Program
Resources for Watershed Planning
How's My Waterway
Healthy Watersheds
Watershed Academy
WATERS (Watershed Assessment, Tracking & Environmental Results System)

[b] Currently, there are no EPA-issued permits for any federal discharges in Hawai'i.
[c] Funds are distributed among states with approved Nonpoint Source Assessment Reports and approved Nonpoint Source Management Programs.

Recent Developments:

- CWA Section 401 Certification Rule (85 FR 42210 (2020)) limits state authority over the issuance of water quality certifications by narrowing the certification timeframe and the allowable scope of state review.

- Navigable Waters Protection Rule definition (33 CFR Section 328 (2020)) limits the types of waters subject to CWA jurisdiction. By removing "ephemeral features" (i.e. ephemeral streams, swales, gullies, rills, and pools) from review, EPA and USACE determinations of waters that would otherwise be evaluated for protections contracted by approximately 25%.

- *Cty. of Maui, Hawai'i v. Hawai'i Wildlife Fund*, No. 18-260, 2020 WL 1941966 (U.S. Apr. 23, 2020) found that treated wastewater disposed of through underground injection wells are the "functional equivalent" of a direct, point source discharge under the CWA because the treated wastewater travels to and is ultimately discharged in the ocean (Waters of the United States). This finding means that the federal government must regulate some groundwater pollutants that discharge into navigable waters.

National Oceanic and Atmospheric Administration (NOAA)

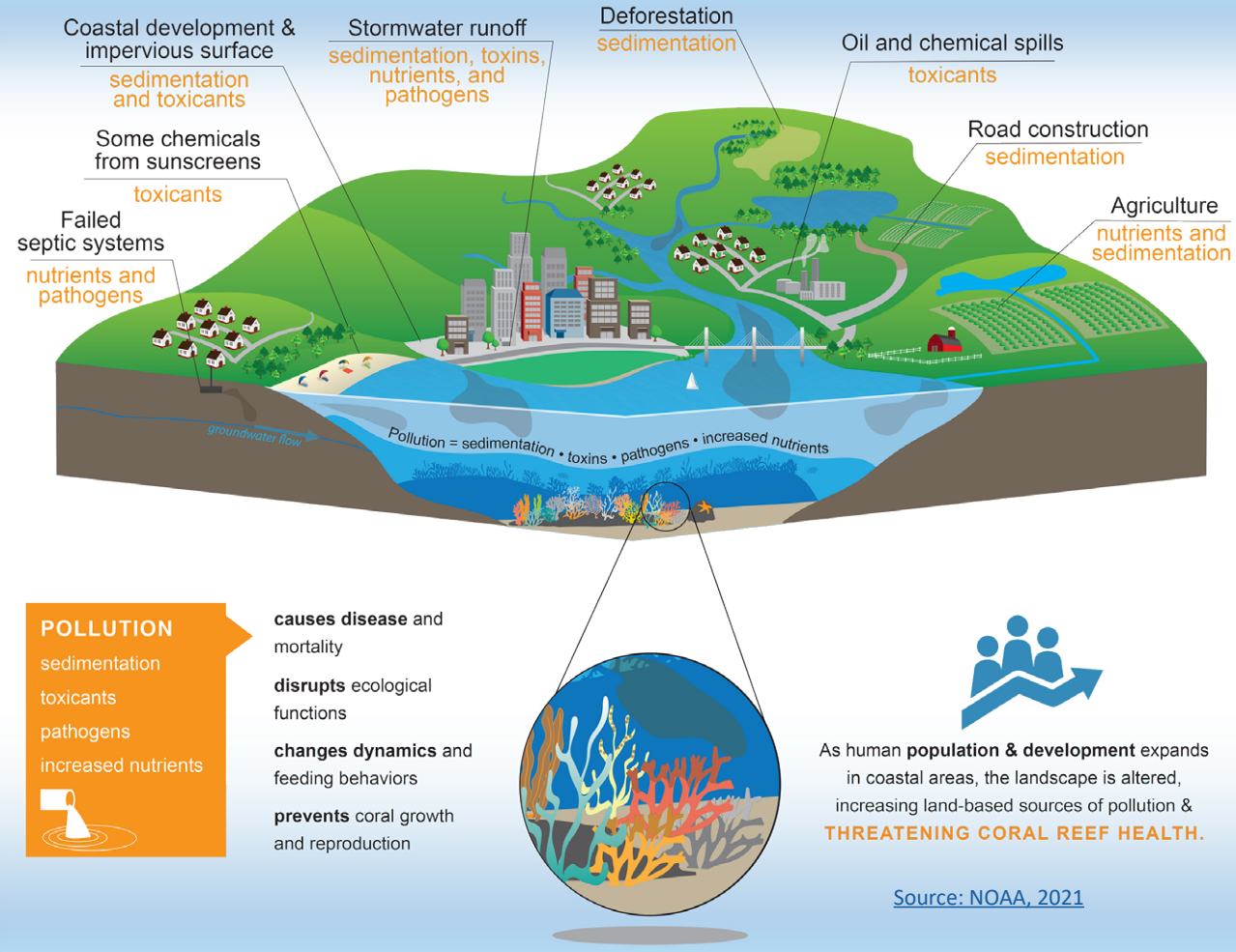
Mission:

To understand and predict changes in climate, weather, oceans, and coasts, to share that knowledge and information with others, and to conserve and manage coastal and marine ecosystems and resources.

Compliance to Regulatory Responsibility:

NOAA's Office for Coastal Management is responsible for administering the Coastal

THREATS TO CORAL REEFS LAND-BASED SOURCES OF POLLUTION



POLLUTION
sedimentation
toxicants
pathogens
increased nutrients

causes disease and mortality

disrupts ecological functions

changes dynamics and feeding behaviors

prevents coral growth and reproduction

As human **population & development** expands in coastal areas, the landscape is altered, increasing land-based sources of pollution & **THREATENING CORAL REEF HEALTH.**

Source: NOAA, 2021

HOW YOU CAN HELP

- Apply fertilizers and pesticides sparingly.
- Pick up after your pets.
- Wash your car on your lawn.
- Dispose of lawn clippings in a compost pile.
- Harvest rooftop rain water through rain barrels or rain gardens.
- DO NOT dump paint, oil, antifreeze, debris, or other household chemicals into street gutters or storm drains.
- Clean up spilled brake fluid, oil, grease, and antifreeze.
- Maintain proper septic system function with inspections and pumpouts every 3-5 years.
- Seek shade between 10 a.m. and 2 p.m., use Ultraviolet Protection Factor (UPF) sunwear, and choose sunscreens with chemicals that don't harm marine life. **For more information, visit** *oceanservice.noaa.gov/sunscreen.*

Zone Management Act (CZMA) and Coastal Zone Act Reauthorization Amendments (CZARA) [(P.L. 101-508), 16 U.S. Code 1455b]). The CZMA and its amendments acknowledge the importance of coastal planning and management for many reasons, including pollution prevention. Its congressional findings state, "land uses in the coastal zone, and the uses of adjacent lands which drain into the coastal zone, may significantly affect the quality of coastal waters and habitats, and efforts to control coastal water pollution from land use activities must be improved."[2]

Management Approach:
The CZMA authorized the National Coastal Zone Management Program (CZM), which includes two program components with management implications for land-based pollution management: federal consistency and nonpoint pollution control.

Federal Consistency
CZMA Section 307, Federal Consistency, is a regulatory mechanism that requires federal activities seeking a federal permit or license and activities conducted with federal funds "that affect coastal uses and resources…must be conducted in a manner consistent with the state's CZM program."[3] This provision elevates the voice of states in ensuring that federal projects align with the enforceable policies of a state's coastal management program.

Nonpoint Pollution Control
The Coastal Nonpoint Pollution Control Program (CNPCP) was established in 1990 through Section 6217 of the CZARA and is administered jointly between NOAA and EPA at the federal level. The CNPCP targets the management of land-based pollution from agriculture, forestry, urban areas, marinas, hydromodification (shoreline and stream channel modification), wetlands, riparian and vegetated treatment systems through a combination of regulatory and voluntary 'management measures' approved by federal entities and enacted at the state and local levels. The Program mandates monitoring and tracking to ensure that management measures are being implemented.

Public Outreach, Resources, and Compliance Campaigns:
Nonpoint Source Pollution Tutorial
Roadmap to Resources
Controlling Nonpoint Source Pollution
What You Can Do
Watersheds, flooding, and pollution
OpenNSPECT Land Cover Analysis

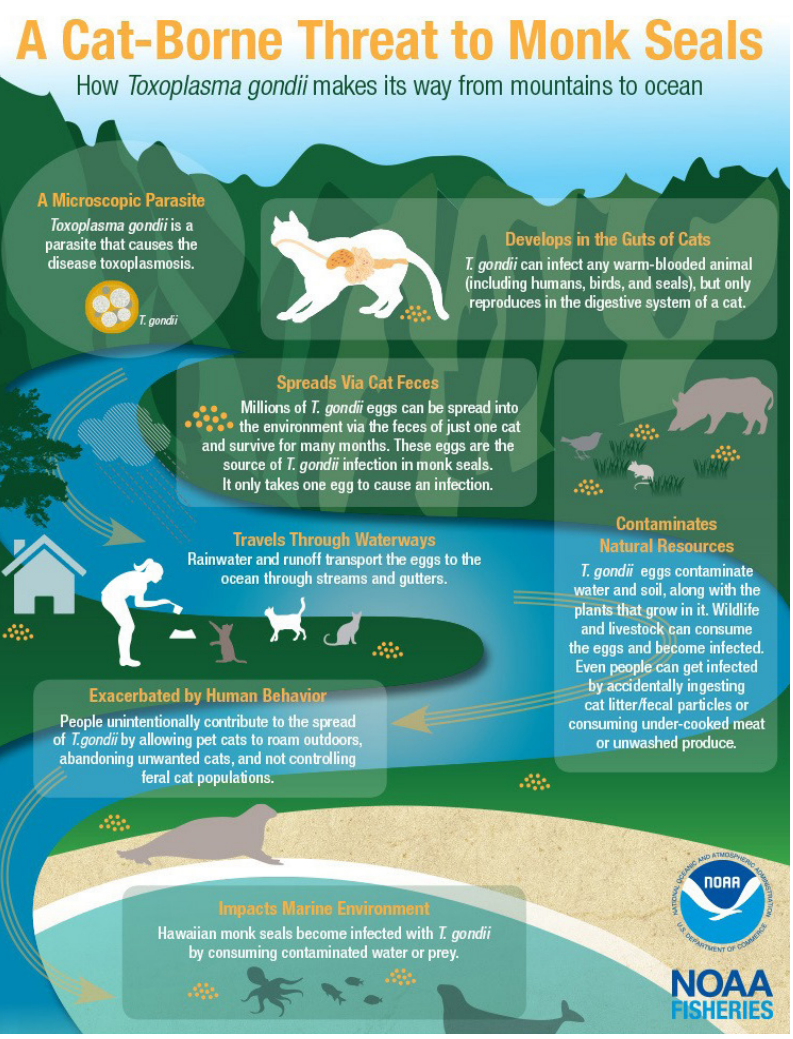
NOAA Programs with Land-Based Pollution Connections

NOAA OCM
- Administration of the National CZM Program, National Estuarine Research Reserve System, Coral Reef Conservation Program, and Digital Coast
- Outreach and education

NOAA Coral Reef Conservation Program (CRCP)
- Development of watershed management plans for priority watersheds in our seven U.S. coral reef areas
- Support of research and best management practices (BMP) implementation

NOAA Habitat Blueprint (West Hawai'i)
- Collaboration with USGS to identify erosion hotspots
- Water quality and coral health surveys to assess impact of nutrients near resorts
- Coral reef resilience surveys and mapping
- Habitat restoration
- Community network creation

NOAA National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO)
- Oversees and manages habitat in the Pacific Islands, including Hawai'i
- Essential Fish Habitat and Endangered Species Act consultations/permitting



Source: NOAA Fisheries, 2019

- Provides fisheries extension, planning, priority watersheds within coral program including afforestation, water quality improvements, etc.

Other federal agencies with a presence in Hawai'i operate under a range of mandates, but all have relationships to land-based pollution management. These agencies leverage statutes, initiatives, and partnerships to mitigate land-based pollution when possible:

U.S. Department of Transportation (DOT)/Federal Highway Administration

Mission:
To ensure America has the safest, most efficient and modern transportation system in the world, which boosts our economic productivity and global competitiveness and enhances the quality of life in communities both rural and urban.

Compliance to Regulatory Responsibility:
Creation of guidance documents, including erosion control guidelines for federally funded construction projects on roads, highways, and bridges, installation of runoff control measures at the time of road, highway, and bridge construction. Reduction in use of pesticides and fertilizers applied along roadway rights-of-way.

Management Approach:
The U.S. DOT Environment Team within the Office of Policy Development, Strategic Planning and Performance works to mitigate the environmental impacts of transportation policies and coordinates implementation of the National Environmental Policy Act across the Department.

Relevant Plans:
U.S. Department of Transportation Strategic Plan for FY 2018-2022

Public Outreach, Resources, and Compliance Campaigns:
Environmental Review Toolkit: Stormwater Management and Water Quality
The Stormwater Practitioners Guide

"The environmental review and permitting process in the United States is fragmented, inefficient, and unpredictable. Existing statutes have important and laudable objectives, but the lack of cohesiveness in their execution make the delivery of infrastructure projects more costly, unpredictable, and time consuming, all while adding little environmental protection"- U.S. DOT Strategic Plan FY 2018-2022

U.S. Department of Agriculture

Mission:
To provide leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management.

Compliance to Regulatory Responsibility:
Administers U.S. Forest Service, Farm Service Agency, Rural Development, and Natural Resources Conservation Service (NRCS). NRCS provides financial and technical assistance to eligible landowners and agricultural producers to help manage natural resources in a sustainable manner. The NRCS oversees elements of the Farm Bill (Public Law 115-334, 2018) including programs that offer varying forms of financial and technical assistance for the implementation of conservation practices on agricultural lands.

Management Approach:
Provides conservation planning services, the creation of technical resources, the provision of conservation practice standards and information, and cropland erosion, nutrient management, and water quality models, tools, and applications. The Conservation Practice Standards developed by the Natural Resources Conservation Service (NRCS) support Hawai'i's compliance with the CNPCP in several management areas, including: agriculture, irrigation, grazing, and erosion and sediment control. Hawai'i's NRCS field offices are assisting with the implementation of the National Water Quality Initiative (NWQI), a partnership between the USDA NRCS, state water quality agencies, and the EPA. The Initiative is intended to identify and address impaired water bodies through voluntary actions and provides resources for on-farm conservation and focused water quality monitoring. The program is notable for its watershed-scale focus and partnership with state water quality agencies. Funding from the CWA Section 319 grant program may support in-stream water quality monitoring in NWQI watersheds.

Relevant Plans and Initiatives:
NRCS Conservation Programs
NWQI
USDA's High Priority Performance Goal for Water
Water and Waste Loan and Grant Program

Recent Developments:
The NWQI has been extended through Fiscal Year (FY) 2023 and has been updated to include a focus on watershed assessment and planning as well as a long-term commitment to assisting water quality efforts. As of FY2021, Hawai'i's NWQI targeted watersheds include Hilo Bay, West Maui, and Pelekane Bay (South Kohala).

U.S. Army Corps of Engineers

Mission:
To provide vital public engineering services in peace and war to strengthen our Nation's security, energize the economy, and reduce risks from disasters.

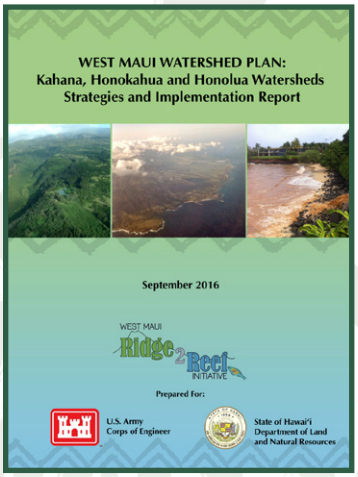
Compliance to Regulatory Responsibility:
Creation of watershed plans, guidance, and studies. Environmental permitting and administration. Stakeholder outreach, compliance, and enforcement.

Management Approach:
Implementation of CNPCP management measures for hydromodifications and wetlands. Administration of the CWA Section 404 permit program. Collaboration with local entities to improve watershed outcomes, most recently in West Maui (see Section II: Successes and Shortfalls of the Current Management System).

Relevant Plans/Initiatives:
West Maui Draft Watershed Management Plan, 2021
Feasibility Study with Integrated Environmental Impact Statement: Ala Wai Canal Project Flood Risk Management Study, O'ahu, Hawai'i, 2020 (Includes provisions for capture of debris and sediment)
West Maui Watershed Plan: Kahana, Honokahua and Honolua Watersheds Strategies and Implementation Report, 2016
Modeling Sediment Yield in Hawai'i, 2008

Public Outreach, Resources, and Compliance Campaigns:
Public scoping meetings for major projects, collaboration and partnerships with nonprofit associations, outreach regarding permitting processes and requirements to public and agencies, regulatory team conducts compliance inspections and public outreach.
Social Media: Facebook

Recent Developments:
Navigable Waters Protection Rule definition (33 CFR Section 328 (2020)) limited the types of waters subject to CWA jurisdiction. By removing "ephemeral features" (i.e. ephemeral streams, swales, gullies, rills, and pools) from review, EPA and USACE determinations of waters that would otherwise be evaluated for protections contracted by approximately 25%.



The USACE can assist with the creation of watershed-based plans, which are required in order to apply for CWA Section 319 grant funding for nonpoint source pollution control activities. Source: West Maui Ridge to Reef Initiative, 2016

United States Geologic Service (USGS)

Mission:
To monitor, analyze, and predict current and evolving dynamics of complex human and natural Earth-system interactions and to deliver actionable information at scales and timeframes relevant to decision makers.

Compliance to Regulatory Responsibility:
The USGS Pacific Islands Water Science Center is a resource for reliable, objective scientific information to address water-related issues in the state of Hawai'i and the U.S. Affiliated Pacific Islands. The Pacific Islands Water Science Center collects data and identifies the sources of suspended sediment, nutrients, pesticides, and wastewater indicators in Hawai'i's streams for partners at the federal, state, and county levels.

Management Approach:
Surface water quality monitoring with focus on consistency and standards in data collection. Data collection, maps, and research through funded contracted collaborations (funding not federally appropriated).

Relevant Plans/Research:
From Ridge to Reef—Linking Erosion and Changing Watersheds to Impacts on the Coral Reef Ecosystems of Hawai'i and the Pacific Ocean, 2011
Coral Reef Project: Moloka'i, 2021
Identifying the Risk of Runoff and Erosion in Hawai'i's National Parks
Nearshore water quality and coral health indicators along the west coast of the Island of Hawai'i, 2010–2014

Public Outreach, Resources, and Compliance Campaigns:
Social Media

[USGS] Research has found that while the hotspots make up only 2.5% of the watershed area, they contribute to the excess 40% sediment export from non-natural sources. With ungulates removed from the landscape, USGS data estimates that hotspot erosion will be reduced from 1.4 cm/year to 0.1 cm/year. - Alternative Watershed-Based Plan For The Kawela Watershed, Moloka'i, Hawai'i, 2019

U.S. Department of the Interior, United States Fish and Wildlife Service (USFWS)

Mission:
Working with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

Compliance to Regulatory Responsibility:
Stewardship of lands and natural resources for fish and wildlife conservation.

Management Approach:
Provision of geospatial data and services, grants for ecosystem restoration and enhancement, response to incidents of contamination (oil spills, Superfund sites, military sites), prosecution of polluters and use of settlement funds for remediation. Permitting and approvals, including management of the Endangered Species Act (16 U.S.C. Chapter 35 Section 1531 et seq.) and administration of the Clean Vessel Act (33 U.S.C. Section 1322).

Relevant Plans:
Habitat Conservation Plans, Comprehensive Conservation Plans (Refuge System)
Hawai'i Fish Habitat Partnership Strategic Plan, 2010

Public Outreach, Resources, and Compliance Campaigns:
Social Media: Facebook

Reinforcing the Federal Framework

While they may not have been created to grapple with pollution, a suite of federal legislation has been leveraged to strengthen land-based pollution management frameworks. Laws with land-based pollution connections include, but are not limited to:

Safe Drinking Water Act and its amendments, (42 U.S.C. Section 300f et seq.)
A regulatory program established to protect the nation's drinking water supply, including surface and groundwater. Administered by the EPA and implemented by state agencies.

National Environmental Policy Act, (42 U.S.C. Section 4321 et seq.)
Requires federal agencies to evaluate their proposed projects for environmental impacts.

Fish & Wildlife Coordination Act, (16 U.S.C. 661-667e)
Provides environmental protections when federal actions impact a natural stream or body of water. Gives the
USFWS the authority to evaluate impacts to fish and wildlife.

Migratory Bird Treaty Act, (16 U.S.C. 703–712, MBTA)
Protects migratory birds and their habitats between the United States and Canada.

Endangered Species Act, (16 U.S.C. Chapter 35 Section 1531 et seq.)
Protects and promotes recovery of endangered species and their ecosystems.

Administered by NOAA Fisheries Service for marine mammal species and anadromous species; USFWS for freshwater fish species, birds, mammals, reptiles, amphibians, invertebrates, and plants.

America's Water Infrastructure Act, (33 U.S.C. 2326 note; Public Law 115–270)
Provides for water infrastructure improvements, including but not limited to flood control, navigable waterways, water resources development, and ecosystem restoration.

Water Resources Development Act (Public Law 99-662, as amended (33 U.S.C. 2267a)
Section 729 enables development of watershed plans that are multi-purpose and multi-objective in scope and developed in cooperation with federal, state and local government entities

Rivers and Harbors Act, (33 U.S.C. 403)
Requires a permit for obstructions to navigable waters, creates water quality control standards and regulations.

Watershed and Flood Prevention Act, (P.L. 83-566)
Assists federal, state, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources.

The State Framework

At the state level, water quality is protected at the highest level. Article XI of the Hawai'i State Constitution, the utmost legal authority of the state of Hawai'i, establishes the state's responsibility to Hawai'i's water resources.

Article XI, Section 9, states that, "Each person has the right to a clean and healthful environment, as defined by the laws related to environmental quality, including control of pollution and conservation, protection, and enhancement of natural resources."[4]

State statutes and rules provide government agencies with the authorities they need to carry out their roles related to land-based pollution management, which often include both federal and state mandates.

Department of Health (DOH)

Mission:
To protect and improve the health and environment for all people in Hawai'i.

Compliance to Regulatory Responsibility:
State legislation tasks the DOH with several water quality related responsibilities:

HRS Chapters 342D and 342E and Hawai'i Administrative Rules (HAR)[d] Title 11 Chapters 54, 55, and 56 are the state's primary statutes governing pollution control and are core to the Hawai'i DOH's responsibilities and controls.[e]

HRS Chapter 342D, 'Water Pollution', was enacted to "prevent, control, and abate water pollution in the State" and gives the DOH administrative and enforcement authority over Chapter 342D and its administrative rules.

HRS Chapter 342E, 'Nonpoint Source Management and Control', created the Polluted Runoff Control (PRC) Program within DOH and requires the state to "reduce, control, and mitigate" nonpoint source pollution in Hawai'i.

[d] The Hawai'i Administrative Rules are used to enforce statutes and have been established by administrative agencies of the government under the authority of the state legislature.
[e] HAR Title 11, Chapters 54, 55, and 56 and HRS 342D do not differentiate between point and nonpoint sources of pollution but establish important channels for pollution prevention.

Hawai'i's 'Water Quality Standards' (WQS), established in HAR Title 11 Chapter 54, created the legal foundation for surface water pollution control in the state.

HAR Title 11 Chapter 55, 'Water Pollution Control', established the conservation of State waters and their protection, maintenance, and improvement as public policy.

HAR Title 11 Chapter 56, 'Nonpoint Source Pollution Control', established regulatory management for nonpoint source pollution management at the state level.

HAR Title 11 Chapter 62, "Wastewater Systems," guides the DOH Wastewater Branch's efforts.

Title 11 Chapter 200.1, 'Environmental Impact Statement (EIS) Rules' establishes the requirements for implementing HRS Chapter 343, the EIS law.

Signage informs beachgoers about potential health concerns associated with nearshore water quality after a rain event. Source: DOH CWB, 2021

<u>Management Approach:</u>
Land-based pollution management activities primarily take place within the following DOH units:

Clean Water Branch (CWB)
The CWB is composed of four sections. Monitoring, Engineering, and Enforcement primarily monitor and manage point source discharges. The Polluted Runoff Control Program addresses nonpoint sources of pollution.

Monitoring
- Determines compliance with rules via source testing, water sampling, and special studies
- Conducts monitoring activities to support permit development, revisions to water quality standards, generation of the water quality inventory prepared under CWA Section 305(b) and the list of impaired water bodies prepared under CWA Section 303(d), and Total Maximum Daily Load (TMDL) development

Engineering
- Administers the NPDES[f] permit program, including permitting and administrative needs (DOH CWB adopted the NPDES General Permits as Appendices to the HAR, Title 11 Chapter 55)
- Issues CWA Section 401 Water Quality Certifications for federal permits for construction in nearshore and inland waters

Enforcement
- Analyzes water quality and operational data to determine degree of non-compliance with NPDES permits. Relies heavily on self-reporting of Discharge Monitoring Reports (DMRs) and compliance evaluation inspections.
- Determines compliance with permit conditions via site inspection, source testing and special studies
- Takes corrective measures through administrative or court actions
- Coordinates with the Wastewater Branch in enforcement cases regarding wastewater treatment plants

[f] Stormwater discharges of industrial facilities, construction sites, and municipal separate storm sewer systems (MS4) that meet CWA parameters must obtain NPDES coverage for their stormwater discharges and must have measures in place to prevent pollution from being discharged with stormwater into nearby waterways. Agricultural runoff, construction below the NPDES size threshold, and small MS4s outside of urban areas are considered nonpoint sources by the EPA.

Polluted Runoff Control Program

- Administers Hawai'i's CWA Section 319 Grant Program, which directs monies received from the EPA to eligible entities through a competitive proposal process and through partnerships
- Collaborates with other nonpoint source-related entities, including federal, state, and county partners
- Provides CWA Section 319 grant funds for nonpoint source pollution management and mitigation, including BMPs and education relating to nonpoint source control
- Promotes community-based watershed management through education and voluntary compliance with environmental management standards
- Co-administers the CNPCP with OPSD-CZM, recipient of funding for program implementation

Wastewater Branch

The Wastewater Branch administers statewide engineering functions relating to water pollution control, municipal and private wastewater treatment works program, individual wastewater systems program and the water pollution control revolving fund program. Engineers review wastewater plans for upgrades or new developments including the evaluation of cesspools as nonpoint pollution sources with potential impacts on nearshore, drinking water, or streams. Staff respond to complaints and issue field citations or formal notices of violation when needed. The Wastewater Branch administers the Clean Water State Revolving Program, which provides low interest loans for the construction of point source and nonpoint source water pollution control projects and the Recycled Water Program, which treats wastewater for its reuse in nonpotable applications like gardening and water features. The Branch was involved in the creation of the Cesspool Conversion Working Group, authorized by Act 132 Session Laws of Hawai'i (SLH).

Safe Drinking Water Branch

The Safe Drinking Water Branch manages the Source Water Assessment and Protection Program, Underground Injection Control Program, and the Groundwater Protection Program. Additionally, the Branch prepares the Water Quality Plan, a component of the Hawai'i Water Plan, and administers the Drinking Water State Revolving Fund (DWSRF), created under the federal Safe Drinking Water Act to fund infrastructure improvements. Per the Hawai'i Nonpoint Source Management Plan (2021-2025), "DWSRF local assistance set-aside funds can be used to address [nonpoint source] activities through established wellhead protection or source water protection plans. The state may also develop a loan program with the 15% set-aside funds to provide funds for land acquisition and conservation easements in targeted areas." Such conservation actions have benefits for protecting drinking water sources and mitigating sedimentation that originates in forested areas and moves through the watershed.

Hazard Evaluation and Emergency Response (HEER) Office

HEER prevents, plans for, responds to, and enforces environmental laws relating to releases or threats of releases of hazardous substances, pollutants, or contaminants. Including emergency response and long-term non-emergency clean up.

Relevant Plans:

The CWA requires states to develop management plans to direct implementation. State-level water quality management plans institutionalize the state's framework to accomplish the CWA's aims.

Water Quality Plan (2019), a component of the Hawai'i Water Plan required by the State Water Code.

Hawai'i Nonpoint Source Management Plan (2021-2025), Hawai'i's strategy to address nonpoint source pollution statewide.

State of Hawai'i Water Quality Monitoring and Assessment Report (2020), pursuant to Section 303(d) and Section 305(b) of the CWA

Watershed-based plans: Voluntarily created plans developed to address impaired waterbodies and other natural resource problems at the watershed scale. Only watersheds that have watershed-based plans approved by the Clean Water Branch are eligible for Section 319 project funds

Public Outreach, Resources, and Compliance Campaigns:
Polluted Runoff Control Program sponsors outreach, volunteer events, and watershed coordinators (funded by CWA Section 319 and other state agencies)
Annual Mauka to Makai Environmental Expo:
Sponsored by City and County of Honolulu's Department of Facility Maintenance, DOH CWB, and Waikīkī Aquarium
Subscription-based Water Quality Alert System
'What You Can Do to Prevent Polluted Runoff'
Resources Library

Recent Developments:
The adoption of HAR Title 11 Chapter 56 'Nonpoint Source Pollution Control', in June of 2021 created a new regulatory framework for the "prevention, abatement, and control of new and existing nonpoint sources of pollution."[5] It is currently proposed to create within DOH a Surface Water Protection Branch which would regulate nonpoint source pollution through HAR Title 11 Chapter 56 and would administer the CWA Section 319 Grant Program, which is currently administered through the Polluted Runoff Control Program, a section of the Clean Water Branch. See Section II for further details.

Department of Land and Natural Resources

Mission:
Enhance, protect, conserve and manage Hawai'i's unique and limited natural, cultural, and historic resources held in public trust for current and future generations of the people of Hawai'i nei, and its visitors, in partnership with others from the public and private sectors.

Compliance to Regulatory Responsibility:
- HRS Chapter 180, Soil and Water Conservation Districts
- HRS Chapters 342D and 342E
- HAR Title 11 Chapters 54, 55, and 56
- HAR Title 13 Chapter 104-5, 'Litter and sanitation'
- HRS Chapter 183, 'Forest Reserves, Water Development, Zoning'
- HRS Chapter 195, 'Natural Area Reserves System'
- HRS Chapter 174C, 'State Water Code'
- HRS Chapter 183C 'Conservation District'
- HRS Chapter 171, 'Public Lands, Management and Disposition of'

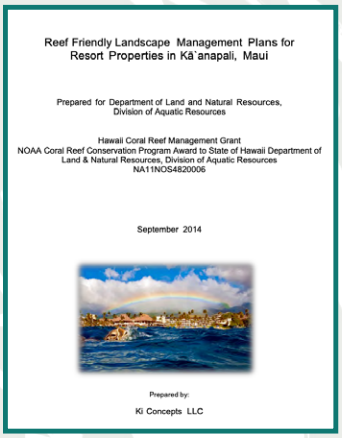
Management Approach:
Land-based pollution management activities primarily take place within the following DLNR divisions:

Division of Forestry and Wildlife (DOFAW)

Manages state-owned forests, natural areas, public hunting areas, and plant and wildlife sanctuaries. Includes the Watershed Partnerships Program, which provides technical and financial support for the implementation of watershed management plans. Responsible for leading Hawai'i's pledge to protect 30% of the State's most important watershed forests by 2030.

Division of Aquatic Resources (DAR)

Protects native and resident aquatic species and their habitat. Coordinates with partner agencies and supports non-profit organizations in their efforts to curb terrestrial inputs of pollution. Funds ecosystem restoration. Leads the Holomua Marine 30x30 Initiative, which seeks to effectively manage Hawai'i's nearshore waters with 30% established as marine management areas by 2030.


Reef Friendly Landscape Management Plans for Resort Properties in Kā'anapali, Maui

Prepared for Department of Land and Natural Resources, Division of Aquatic Resources

Hawaii Coral Reef Management Grant
NOAA Coral Reef Conservation Program Award to State of Hawaii Department of Land & Natural Resources, Division of Aquatic Resources
NA11NOS4820006

September 2014

Prepared by:
Ki Concepts LLC

Reef-friendly landscape management at resort properties aims to reduce water quality impairment Source: DLNR-DAR, 2014

Commission on Water Resource Management (CWRM)

Administers the State Water Code through effectuation of the Hawai'i Water Plan and its subcomponent, the Water Quality Plan (2019-2024) produced by DOH. Both plans include surface and groundwater considerations.

Office of Conservation and Coastal Lands (OCCL)

Responsible for regulation of lands within the State Land Use Conservation District through permitting, compliance, and enforcement.

Land Division

Leases state lands for agricultural uses. Per lease conditions, agricultural operators collaborate with local soil and water conservation districts and the USDA NRCS to create a Conservation Plan.

Hawai'i Association of Conservation Districts and the Soil and Water Conservation District (SWCD) Program

Hawai'i's 16 SWCD Programs offer place-based, no-cost technical assistance on agricultural lands. They assist with the development of Conservation Plans, which help agricultural producers to decrease soil erosion, tailor water use and efficiency, learn legal requirements of management and property leasing, and qualify for county Grading, Grubbing & Stockpiling permit exemptions.

Relevant Plans:
Hawai'i Coral Reef Strategy 2030, 2020
Water Quality Plan, 2019
Holomua: Marine 30x30 Plan, 2020
Hawai'i Forest Action Plan, 2016
The Rain Follows the Forest, 2011

Public Outreach, Resources, and Compliance Campaigns:
Kaulunani Urban & Community Forestry Program[g]
Hunter Education Program[h]
DOFAW Education
DAR Education
Watersheds
Fencing Matters. Watershed Protection by 2030
Conservation Awareness Program (CAP)
SWCD Resources

[g] Increased tree canopy cover supports reductions in surface runoff
[h] Promotes safe removal of feral ungulates, which can increase sedimentation in runoff

Department of Transportation

Mission:
To provide a safe, efficient, accessible, and sustainable inter-modal transportation system that ensures the mobility of people and goods, and enhances and/or preserves economic prosperity and the quality of life.

Compliance to Regulatory Responsibility:
- CWA
- HAR Title 11, Chapter 54 and Chapter 55

Management Approach:
The Hawai'i Department of Transportation (HDOT) has three stormwater management programs that work to comply with stormwater management legislation applicable to point sources:
Airports Division
Harbors Division
Highways Division-O'ahu and Maui Divisions

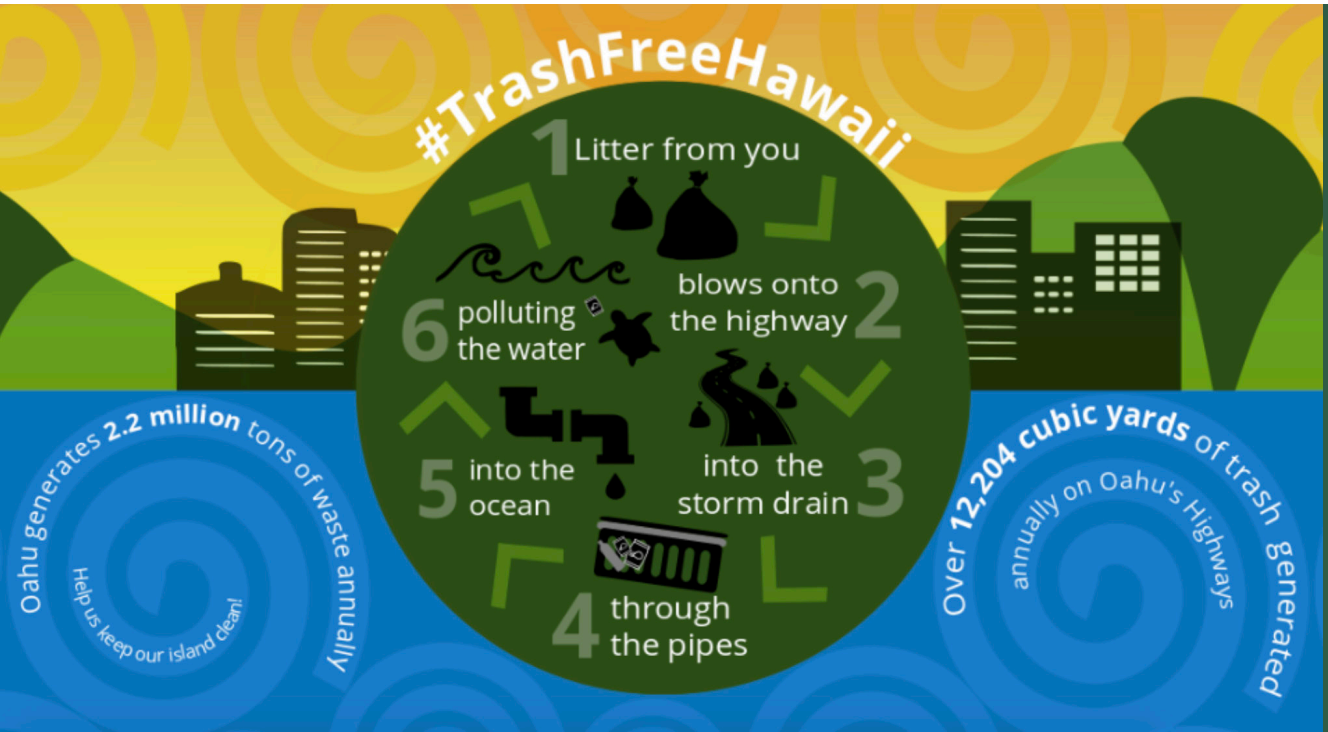
The use of federal funding, such as the Statewide Transportation Improvement Program (STIP), requires that projects be developed in compliance with pollution prevention measures.

Relevant Plans:
NPDES permittees are required to prepare a SWMPP:
Airports Division: HNL SWMPP
Harbors Division: Storm Water Management Plan, Honolulu Harbor, 2009
Highways Division: O'ahu SWMPP, Maui District SWMPP

Highways Division, O'ahu District Trash Reduction Plan, 2016

Public Outreach, Resources, and Compliance Campaigns:
Airports Division: Public service announcements, compliance manuals and programs
Harbors Division: Training Videos, Compliance Guides, BMP Flyers

Highways Division:
O'ahu District: Hawai'i Storm Patrol, Adopt-A-Highway Program, Public Outreach and Events, Educational Materials, Quarterly eNewsletter, Trash Free Hawai'i Campaign, Social Media: Instagram
Maui District: Education Outreach Workshops & Presentations, Adopt-A-Highway Program, Best Management Practices and Brochures, Email Subscriptions, Education and Outreach, Social Media: Instagram



HDOT uses online resources like ArcGIS StoryMaps to educate the public on the importance of keeping roadways free of litter. Source: HDOT, N.D.

Hawai'i Department of Agriculture (HDOA)

Mission:
To further expand the role of Hawai'i's agricultural industry to benefit the well-being of our island society by diversifying the economy, protecting resources important for agricultural production, and gaining greater self-sufficiency in food and renewable energy production.

Compliance to Regulatory Responsibility:
- National Environmental Policy Act (NEPA)
- HRS Chapter 343 'Environmental Impact Statements'

Management Approach:
HDOA implements CNPCP management measures for agriculture and has a cooperative agreement with USGS to conduct pesticide monitoring and assess chemical water contaminants. The Agricultural Resource Management Division prepares and leases state agricultural lands, provides operations and maintenance, constructs utility scale irrigation systems (>20 miles long) and capital improvements. The Department oversees the requirement for conservation plans for state lands leased for agriculture.

Relevant Plans:
Agricultural Water Use and Development Plan, 2019

Public Outreach, Resources, and Compliance Campaigns:
Property managers employed by the HDOA serve as the main point of contact to lessees for communicating the mandatory preparation of a Conservation Plan based on USDA NRCS Conservation Practice Standards. The Department conducts community engagement upon acquiring new parcels to be converted for agricultural leases. Educational resources are offered for a range of interests, including farmers, schools, and government officials.

Department of Hawaiian Home Lands (DHHL)

Mission:
To manage the Hawaiian Home Lands trust effectively and to develop and deliver lands to Native Hawaiians. We will partner with others towards developing self-sufficient and healthy communities.

Compliance to Regulatory Responsibility:
- Hawaiian Homes Commission Act, 1920 as amended
- CWA
- HRS Chapter 343 'Environmental Impact Statements'
- HAR Title 10 Chapter 4, 'Management of Hawaiian Homelands'

Management Approach:
DHHL is responsible for the management of over 200,000 acres statewide and provides homestead leases to Native Hawaiian beneficiaries for residential, agricultural, and pastoral purposes. The authorities and powers of the Hawaiian Homes Commission, which is responsible for the administration of these lands, are distinct from other agencies. DHHL adheres to federal and state laws, including those interpreted as 'procedural' or 'incidental' requirements, such as state environmental review processes. However, the Department cannot be directed to employ homestead lands for a certain use or purpose. As such, state land use laws are not applicable on homestead lands. Requirements such as permitting, county zoning regulations, and subdivision ordinances have been found to be unenforceable on Hawaiian Home Lands. Despite this, lessees on homestead lands typically follow county permitting procedures. Building, grading, and flood development permits are typically obtained by lessees, however due to these permits' inherent connections to zoning requirements they are not unequivocally required.

Relevant Plans:
DHHL has a General Plan and also conducts planning processes at the island scale.

General Island Plan (2002)
O'ahu Island Plan (2014)
Hawai'i Island Plan (2002)
Kaua'i Island Plan (2004)
Maui Island Plan (2004)
Moloka'i Island Plan (2005)

At the site scale, Environmental Assessments (EA) and Environmental Impact Statements (EIS) are used to evaluate proposed land use changes and improvements.

[DLNR] DAR recommends that the applicant take steps to plant native vegetation that actively retain surface storm-water runoff and sediment during precipitation events. Planting an effective vegetated buffer, downslope and between agricultural plots site will help capture soil and pollutants and absorb excess surface runoff from precipitation before they reach the shoreline.

- Final Environmental Assessment for the Proposed DHHL Waikupanaha Agricultural Lots Project in Waimānalo Ahupua'a, Ko'olaupoko District, O'ahu Island, Hawai'i, 2020

Public Outreach, Resources, and Compliance Campaigns:
Homestead associations are the main point of contact for homesteaders regarding property management. The Department issues Native Hawaiian Rehabilitation Fund (NHRF) grant funds to nonprofit organizations proposing projects benefiting Native Hawaiians, which may include environmental restoration projects with stormwater mitigation benefits.

Prior to the COVID-19 pandemic, DHHL held annual homestead leader conferences to increase the capacity of community-based management in homestead areas.

OFFICE OF PLANNING & SUSTAINABLE DEVELOPMENT
STATE OF HAWAI'I

Coastal Zone Management Program

Mission:
To provide for the effective management, beneficial use, protection, and development of the coastal zone.

Compliance to Regulatory Responsibility:
HRS Chapter 205A

Management Approach:
CZARA Section 6217, which established the CNPCP, is implemented at the state level though a joint partnership between the Hawai'i Department of Business Economic Development and Tourism (DBEDT) Office of Planning and Sustainable Development (OPSD) Coastal Zone Management (CZM) Program and DOH CWB programs. The federal legislation requires state-level enforceable policies and mechanisms as well as monitoring and tracking of management measure implementation. In 1998 Hawai'i was granted Conditional Approval of the CNPCP and the state continues to pursue full approval of its program.

HRS Chapter 205A, 'Coastal Zone Management', focuses on development impacts in the coastal zone (the entire state of Hawai'i falls within Hawai'i's coastal zone boundary). The statute asserts that "all state and county agencies shall enforce the CZM objectives and policies defined in HRS Chapter 205A-2" (OPSD-CZM, 2021). This component of HRS Chapter 205A establishes a collaborative network of state and county agencies led by the CZM Program.[6]

With financial support and technical assistance from the CZM Program, county authorities work to implement regulatory functions outlined by the state's Coastal Zone Management statute. 'Special Management Areas' (SMA) outlined in HRS Section 205A-21, are one such "special [control] on developments within an area along the shoreline… necessary to avoid permanent losses of valuable resources." The SMA permitting system influences land-based pollution management in its oversight of coastal development through project siting, including the location of onsite waste disposal systems. HRS Section 205A-43 establishes a minimum shoreline setback which counties can choose to exceed. Shoreline setbacks have benefits for coastal hazards risk reduction as well as land-based pollution management.

Federal Consistency also plays a role in land-based pollution control by enabling state review of federal actions or federally funded projects to ensure consistency with state enforceable policies.

Relevant Plans:
Hawai'i's Coastal Nonpoint Pollution Control Program and Management Plan
CNPCP Updated Management Measures and Supplemental (2010)
The Hawai'i Ocean Resources Management Plan (ORMP) (2020)

Public Outreach, Resources, and Compliance Campaigns:
Hawai'i Watershed Guidance assists with the development of watershed-based plans. Only watersheds that have watershed-based plans approved by the Clean Water Branch are eligible for Section 319 project funds.
The ORMP Public Listening Sessions found that addressing non-point source pollution was the most cited theme statewide.
Social media: Facebook
CZM Program Bimonthly Newsletter
ORMP StoryMap

University of Hawai'i

Mission:
The common purpose of the University of Hawai'i system of institutions is to serve the public by creating, preserving, and transmitting knowledge in a multi-cultural environment.

Compliance to Regulatory Responsibility:
Funded research and projects related to and supportive of:
- CWA
- CZMA
- Act 125, SLH 2017
- Act 132, SLH 2018

Management Approach:

University of Hawai'i Sea Grant College Program (Hawai'i Sea Grant)

Hawai'i Sea Grant supports an innovative program of research, education, and extension services, directed to the improved understanding and stewardship of coastal and marine resources of the state, region, and nation. The Program partners with federal, state, and county partners to promote the use of science and place-based best practices for land-based pollution mitigation and management.

University of Hawai'i Water Resources Research Center (WRRC)

The WRRC provides water-related research, education, and outreach related to Hawai'i and the Pacific Islands. Recent research

related to water quality in Hawai'i has been commissioned by the DOH WWB to assist with Act 125, SLH 2017, a mandate to convert cesspools to more advanced forms of waste treatment by 2050, and Act 132, SLH 2018, which established a cesspool conversion working group.

PacIOOS
PACIFIC ISLANDS OCEAN OBSERVING SYSTEM

PacIOOS has improved local capacity in the Hawaiian Islands by loaning water quality monitoring technologies to groups with interests in watershed health. Their nearshore sensors provide data on temperature, salinity, turbidity, chlorophyll, and depth, with which communities can make better-informed land-management decisions.

Public Outreach, Resources, and Compliance Campaigns:
Hawai'i Sea Grant's program publications include educational books and periodicals, videos, podcasts, a blog, and a biannual publication, *Ka Pili Kai* magazine. The web-based resource 'The Streamside Guide: Recommendations for Hawai'i' includes best practices for property owners to reduce their contributions to land-based pollution. Social Media: Facebook, Twitter, Instagram, YouTube

The Water Resources Research Center publishes scientific literature, an annual newsletter, hosts conferences and seminars, posts trainings and resources, and holds Wastewater Operator Trainings.

PacIOOS has a monthly newsletter and hosts educational resources. Social Media: Facebook, Twitter

County Frameworks

Counties of Maui[i], Kaua'i, Hawai'i, and the City and County of Honolulu

Counties are the governmental bodies below the state level. Unlike the continental United States, there are no formal governmental bodies below the county level in Hawai'i (i.e. townships, cities, villages). Several county departments have a direct influence on and important role in land-based pollution management, including Planning Departments, Public Works/ Facility Maintenance Departments, and Environmental Management Services.

Planning Departments

Compliance to Regulatory Responsibility:
Issue use permits, plan and subdivision approval, variances, SMA permitting, zoning, General/Island Plans and Community Development/Sustainable Communities Plan updates, shoreline setbacks, code and rule amendments

Management Approach:
Land-based pollution can be managed through its incorporation into planning processes. At the county (Island and General Plans) and regional (Community Development and Sustainable Communities Plans) scales, land-based pollution mitigation begins with directing growth away from floodplains, known sources of contamination, steep slopes, and erosion-prone areas. Planners can use tools such as zoning ordinances to

[i]Maui County is comprised of the islands of Maui, Lāna'i, Kaho'olawe, Molokini, and Moloka'i. A small part of Moloka'i has its own administrative governance, Kalawao County. This report focuses on the populated areas of the County, Maui, Lāna'i, and Moloka'i.

assign appropriate forms of development to certain areas. Other rules can be developed to limit the use of impervious surfaces in the built environment, incorporate best practices into construction, and provide provisions for the installation and long-term maintenance of low-impact development, systems that mimic nature's ability to retain, filter, and infiltrate stormwater. Planning departments typically defer to their counterparts in Public Works or Facilities Maintenance departments for water-related concerns such as flooding, wastewater, and stormwater/drainage considerations. However, planners have influence to mitigate land-based pollution outcomes through participation in the site planning process, particularly for development located within the SMA. County planners can raise concerns and provide recommendations about siting at the project-scale, particularly in relation to the location of wastewater treatment, runoff control options, and appropriate setbacks from riparian areas and wetlands.

Relevant Plans and Resources:
City and County of Honolulu: General Plan, Development Plans and Sustainable Communities Plans,
Storm Water BMP Guide for New and Redevelopment for the City and County of Honolulu (2017)
County of Kaua'i: General Plan, Long-Range Planning Division
County of Hawai'i: General Plan and Community Planning
County of Maui: Long-Range Planning Division

Public Outreach, Resources, and Compliance Campaigns:
County of Kaua'i: Facebook, Instagram
County of Hawai'i: Events Calendar
City and County of Honolulu: Twitter

Recent Developments:
Prompted by the City and County of Honolulu City Council, Ordinance 19-3 (effective May 2019) amended the Land Use Ordinance with the addition of Section 21.3-70-1c(G), which limits the impervious surface area for residential zoned lots to a maximum of 75%. Ordinance 20-7 (effective August 2020) amended the Revised Ordinances of Honolulu Chapter 16 by adopting the Hawai'i State Building Code (2012 International Building Code) and Residential Code (2012 International Residential Code) and adding subsections R107.5, 'Stormwater Management', and R107.5.1, "Maximum Impervious Surface.' These sections state that the amount of impervious surface found on a given property "shall not exceed 75 percent of the total zoning lot area for construction of a one-family or two-family detached dwelling or duplex" and applies to both new construction and renovations of existing structures.

Public Works/Facility Maintenance Departments & Engineering Divisions

Compliance to Regulatory Responsibility:
- CWA
- HAR Title 11 Chapter 54, 'Water Quality Standards'
- HAR Title 11 Chapter 55, 'Water Pollution Control'
- HRS Chapter 180, 'Hawai'i Soil and Water Conservation District Law'

County-specific rules and ordinances related to water quality:

Hawai'i County: Storm Drainage Standards, Chapter 10 Erosion and Sedimentation Control, Chapter 27, Floodplain Management

Maui County: Storm Drainage Standards, Code of Ordinances Chapter 12.12 – Drainageways, Chapter 20.08 - Soil Erosion And Sedimentation Control

Kaua'i County Code: Storm Drainage Standards, Article 7. Grading, Grubbing and Stockpiling, Sec. 22-7.5 Minimum Best Management Practices (BMPs)

City and County of Honolulu: Storm Drainage Standards, Erosion Sediment Control Plan & Post Construction Best Management Practices, Revised Ordinances of Honolulu Chapter 14

Management Approach:
County Public Works and Facility Maintenance Departments across the state work to maintain the drainage systems that act as conduits for the water that moves from land to sea, and primarily interface with point source pollution management and related permitting requirements. These departments provide engineering and surveying services and administer ordinances related to grading, grubbing, and floodplains. Public Works and Facility Maintenance Departments provide input through engineering review and comments on permitting applications, including subdivision, zoning and use, and building permits. They are also responsible for county road projects, including road and bridge inspection, engineering, design, and construction. In the City and County of Honolulu and the County of Maui, departments must work to comply with CWA NPDES provisions. The state of Hawai'i delegates responsibility for stream maintenance and the repair of erosional areas to counties, however Facility Maintenance and Public Works Departments are generally far underresourced, and struggle to effectively maintain clear stream channels and address erosional areas in addition to their other functional work areas.

The City and County of Honolulu's Department of Facility Maintenance Storm Water Quality Division is the lead agency (principal permittee) of the CWA for the county. The Division provides guidance and coordinates with other agencies and the public to protect water quality and is currently undergoing a long-term planning process to develop an updated SWMP. The Plan is intended to inform stormwater management and investments for the next 50 years, including adherence to the requirements of the CWA. The City and County of Honolulu Department of Facility Maintenance also recently considered the feasibility of forming a storm water utility for O'ahu, which would raise funds for stormwater management through a fee-based system. If implemented, it would benefit both point and nonpoint source pollution management.

Relevant Plans and Resources:
Maui SWMPP
City and County of Honolulu SWMPP
Interim Construction Best Management Practices (Bmp's) for Sediment and Erosion Control for the County of Kaua'i, 2004

Public Outreach, Resources, and Compliance Campaigns:
City and County of Honolulu: Learning Center, Green Infrastructure for Homeowners, Contain the Rain, Adopt-A-Stream
Maui: Mālama Kahawai Brochure
County of Hawai'i: Dry Wells Island Wide

Department of Environmental Services (City and County of Honolulu), Environmental Management (Counties of Maui and Hawai'i), Divisions of Solid Waste and Wastewater Management (County of Kaua'i)

Compliance to Regulatory Responsibility:
- CWA
- HAR Title 11 Chapter 54, 'Water Quality Standards'
- HAR Title 11 Chapter 55, 'Water Pollution Control'
- HAR Title 11 Chapter 62, 'Wastewater Systems'

City and County of Honolulu:
The Revised Ordinances of Honolulu, Chapter 9, Collection and Disposal of Refuse
Chapter 14, Public Works Infrastructure Requirements Including Fees and Services

County of Maui:
Code of Ordinances, Article 2, Wastewater

County of Kaua'i:
Kaua'i County Code, Chapter 14, Plumbing Code

County of Hawai'i:
Hawai'i County Code, Chapter 21, Sewers

Management Approach:
The City and County of Honolulu's Department of Environmental Services deals exclusively with point source pollution in its management of wastewater but also mitigates the spread of nonpoint source waste through its trash collection services. Its Division of Environmental Quality conducts monitoring and testing to ensure that water quality standards are upheld in the disposal of wastewater.

Likewise, the County of Maui's Environmental Management Program, County of Hawai'i's Department of Environmental Management, and the County of Kaua'i Public Works Divisions of Solid Waste and Wastewater Management manage both sewer operations and maintenance as well as solid waste disposal, landfills, and recycling.

Public Outreach, Resources, and Compliance Campaigns:
Learning Center, Podcast, Division of Environmental Quality Public Education, Cesspool Service Information, Best Management Practices: Property Maintenance

Relevant Plans:
City and County of Honolulu, SWMPP, 2021

Recent Developments:
County agencies responsible for the disposal of treated wastewater are impacted by the decision of *Cty. of Maui, Hawai'i v. Hawai'i Wildlife Fund* (see EPA: Recent Developments).

SECTION II

Successes and Shortfalls of the Current Management System

SECTION II *Successes and Shortfalls of the Current Management System*

Shortfalls

Cascading Effects of Federal Actions

Federal mandates to manage water quality guide the management of land-based pollution at the state and county levels. In creating and amending the CWA, the U.S. Congress elected to encourage voluntary rather than regulatory controls for nonpoint sources of pollution. As a result, state and county governments have largely lacked mechanisms to create comprehensive, proactive, and enforceable management frameworks of their own. Instead, states and counties have allocated staffing and funding to work areas mandated by the federal government in order to keep up with reporting and planning obligations. While nonpoint sources of pollution are acknowledged as an important factor in meeting federal water quality standards, the voluntary emphasis on nonpoint source management has resulted in a substantial lack of investment in the data collection, research, technology and innovation, project implementation, and long-term maintenance needed to effectively curb water quality impacts.

When changes occur at the federal level, they effectively reshape the policy framework that Hawai'i works within. For example, recent alterations to the Navigable Waters Protection Rule definition[j] has had an impact on many of Hawai'i's waterways. Ephemeral gulches and streams no longer meet the jurisdictional requirements for federal review. This has removed a layer of regulatory protection from streams that do not flow consistently, making them vulnerable to hydromodifications. While the state could meet this new management gap with targeted legislation, terrestrial impacts with land-based pollution implications may occur in the interim.

The broad influence of federal agencies can be interpreted as either a success or shortfall. If the federal government were to pass sweeping legislation or make available substantial funding targeting nonpoint source pollution, such a change would have positive impacts at the state and county levels. However, based on the current legal framework and its implementation within Hawai'i, the national emphasis on voluntary measures for nonpoint source pollution can largely be interpreted as a management shortfall.

Separation of Flood and Water Quality Management

Water quantity and quality are two sides of the same coin—managing the volume of water produced during a storm is a very effective way to reduce the amount of land-based pollution carried from land to sea. However, in our current regulatory environment, flood hazards are primarily managed to reduce risks to life and property. Because water quality is legally considered as a separate issue from flood management, opportunities to leverage synergies between the two have largely been lost.

A great example of this management failure can be seen in the wide-reaching hydromodifications that have taken place across the state. When clear of debris and operating as designed, concrete-lined stormwater channels have generally been an effective flood management strategy.[k] However, this flood management approach has immeasurably increased water quality issues statewide by increasing the velocity, quantity, temperature, and pollutant loads in stormwater. Abetted by flood control

[j]The CWA Section 401 Certification Rule and Navigable Waters Protection Rule are currently under review at the federal level.
[k]Currently, stream channel maintenance is under-resourced, impacting both flood and water quality management.

Urban streets and driveways become floodwater conveyances in Niu Valley, O'ahu as the capacity of the area's channelized waterways are exceeded. Source: Ellen Zhang, 2021

structures, development has encroached upon and impaired the natural functions of Hawai'i's floodplains.

Minimizing further floodplain loss and enhancing riparian management would positively impact land-based pollution outcomes by enriching the natural capacity of floodplains to provide ecosystem services like filtration, retention, infiltration, and habitat. In the most densely developed neighborhoods, the use of distributed rainwater catchment systems may be an effective stopgap to alleviate the water quality impacts seen concurrently with flooding events. By holding water in catchment systems, stormwater peak flows and velocities are reduced, resulting in less erosion and floodwater contamination.

Parcel-Scale Management of a Watershed-Scale Issue

Water travels from the top of a watershed to the ocean, gathering and carrying pollutants along the way. Nationally, planning and implementation at the watershed scale is gaining traction, as evidenced by the use of 'watershed' terminology by some of the largest federal players, including the EPA, NOAA, and USDA. However, the majority of permits and regulatory actions are processed and considered at the property scale. When a single parcel is developed, the standard practice is to consider impacts to immediately adjacent areas. This provides only a partial view of a project's contributions to wider landscape change and land-based pollution issues. In order to facilitate the shift from a narrow to wide lens, it's important to be able to contextualize a single project within a region or watershed and holistically assess its impacts.

Disparity Between the Impact of Land-Based Pollution and the Level of Funding and Support it Receives

Land-based pollution is widely understood to be highly degrative to human and environmental health in Hawai'i, but funding support dedicated to the management of nonpoint sources of pollution is paltry in comparison to the innumerable sources and increasing gravity of pollution impacts in the state.

Currently, nonpoint source pollution management within Hawai'i is almost exclusively funded by the EPA; however, there are limitations on where and how

federal funds can be spent. For instance, EPA funds can only be expended in watersheds with approved watershed-based plans. An overall lack of funds has translated to the development of watershed plans irregularly (every 3-4 years), and a lack of capacity to update outdated plans. Funding limitations have also resulted in the consistent expenditure of funds within the same watershed areas in order to achieve and sustain improvements.

Additional state funding support is needed to supplement capacity shortfalls within the DOH. The Department's CWB Monitoring Section only collects water samples at the most highly visited beach locations[7] and does not conduct any regular freshwater monitoring. Sampling is not conducted during 'brown water events,' however water quality advisories are issued to inform the public of the potential for negative health outcomes.[8] The Monitoring Section has 1-2 staff per island sampling nearshore water quality. The Polluted Runoff Control Program has only 4 staff statewide, making the processing of contracts in a timely fashion difficult. The Program also no longer has a public participation coordinator, an important role in a largely public-focused, voluntary management framework. The Polluted Runoff Control Program has no enforcement capacity; however, the Program does conduct monitoring and tracks and reports outcomes from its Section 319 Grant-funded projects to the EPA annually. The creation of the proposed DOH Surface Water Protection Branch, which would regulate nonpoint source pollution via HAR Title 11 Chapter 56 and administer the CWA Section 319 Grant Program, would further prioritize nonpoint source funding and management activities at the state level. The Wastewater Branch has only 1-2 wastewater engineers on each island with oversight for nearly 110,000 onsite systems, 60,000 of which are located on Hawai'i Island alone. The engineers are responsible for the review and approval of new systems, review of building permits, and responding to complaints. In addition to these current responsibilities, the recent mandate to convert the state's nearly 90,000 cesspools to more advanced forms of treatment will require substantially more capacity with the Wastewater Branch.

Brown water runoff at Sunset Beach on O'ahu's North Shore. Courtesy of: Honolulu Star Advertiser, 2020

In addition to the DOH, many state agencies conduct management activities connected to land-based pollution control including DLNR DOFAW, HACD SWCD's, and HDOA. However, a lack of integrated data collection and monitoring capacity have left the state with an incomplete picture of how funding in conservation and agricultural areas leads to the prevention and reduction of pollution in lower reaches of watersheds. The spread of invasive flora and fauna in undeveloped areas contribute substantially to nonpoint source pollution from ridge to reef. In addition to sedimentation, unmitigated animal waste and carcasses are a considerable source of nutrient pollution. Wild pigs are understood to produce up to ten pounds of manure per day.[9] These drivers of deforestation and pollution in undeveloped areas are not regulated or enforceable like other forms of pollution. Erosion, fire, and species control measures have proven to be successful and cost-efficient, yet remain underfunded relative to their positive water quality impacts.

Additionally, reduced funding of the USDA NRCS has had a trickle-down effect on HDOA. A loss of capacity and investment at the federal level have slowed down conservation plan development, which currently delays the implementation of best practices for agriculture on the ground. State-funded staff positions dedicated to development of conservation plans for HDOA leased lands would alleviate the issue. The HDOA has also struggled to provide translation and educational services for farmers with English as a second language based on their current bandwidth.

If a more robust management scheme or regulatory framework were to be implemented, considerable increases in funding support would be needed to fill gaps in almost every aspect of management, including a lack of baseline data, community education and outreach, understanding nonpoint source origin areas and their constituent contributions (i.e. tons of sediment originating from agricultural vs. conservation areas), investments in mitigation (low impact development, community education), long-term maintenance, administration and funding distribution mechanisms, and staffing capacity.

Ungulate damage to forested areas, like this pig wallow in Kamakou Preserve, Moloka'i, precipitate sediment and nutrient transport to lower reaches of the watershed. Source: Hawai'i Association of Watershed Partneships, 2021

The Need for a Green Workforce

In the urban zone, the widespread adoption of low impact development and green infrastructure cannot occur without a shift in the training paradigm for landscape architects, engineers, floodplain managers, permit reviewers, and contractors. The mandate to convert the state's cesspools by 2050 will require dedicated engineers, construction professionals, inspectors, and water quality monitoring staff. Similarly, investments in bioremediation, urban forestry, wetland and stream restoration, rainwater retention and catchment systems, and other innovative technologies are needed to transform the management of water quality in Hawai'i's communities.

Mismatch Between Policies and Best Practices

Until recently, there were no limits to the amount of impervious surface that could be constructed on a single residential lot in the City and County of Honolulu's residential zone, leading to the construction of 'monster homes' and large parking lots to accommodate occupants. Recent regulations such as Ordinance 19-3 (effective May 2019) and Ordinance 20-7 (effective August 2020) target impervious surfaces by limiting them to 75% of a residential lot. However, these new standards still do not reflect the best available knowledge about the impacts of impervious surfaces in watersheds—75% impervious surface coverage results in upwards of 55% of stormwater runoff (compared to only 10% in an undeveloped area with natural ground cover)[10] and impairments to stream habitats begin at only 10% impervious surface coverage.[11]

From a watershed perspective, 75% impervious surface coverage falls far short of a best practice in residential areas and still contributes to considerable flood risk and water quality impairment. Nevertheless, setting a maximum impervious surface area is a net positive step for the City and County of Honolulu and should be considered in other urban areas of the state, including zoning categories outside of residential uses. Residential lots sometimes pave large portions of their properties due to a reliance on vehicles for ground transportation, a lack of secure on-street parking areas, and the perceived cost and effort of maintaining a vegetated yard. Some cities, such as San Francisco, have responded to this through a Green Landscape Ordinance, which requires 50% of surfaces in the front yard to be pervious.[12] Other cities have implemented similar Green Area Ratios for stormwater quality and quantity benefits.

Recent City and County of Honolulu ordinances take aim at the new and redevelopment of residential lots with nearly 100% impervious lot coverage and above average parking needs. Source: Google Maps, 2021

For properties along waterways, the scientific literature indicates that it is a best practice to set aside a vegetated buffer along riparian corridors. Findings suggest that even narrow buffers between 1-15 meters (3-45 feet) may have positive water quality benefits, though wider buffers (>50 m, 164 feet) are most effective at reducing nitrogen loads, among other benefits.[13] Studies of how water quality responds to riparian buffers in Hawai'i's unique conditions are needed. The state currently has no regulatory protections for riparian buffer areas in any land use district. Riparian buffers are currently under study in Hawai'i County (See Section II: County Leadership) and have been suggested in Maui County planning efforts (See Section II: Place-Based Collaborations).

The wholescale removal of trees and pervious lawns bring a host of negative externalities at the property, neighborhood, and watershed scales. When present, vegetation slows the flow of water and provides filtration benefits that protect coastal water quality. In addition to decreasing the severity of erosion, increasing evapotranspiration, and reducing stormwater runoff, canopy-level trees and shrubs help water to infiltrate into the ground and replenish the subsurface aquifer. At present, Hawai'i's counties have adopted ordinances to protect only 'exceptional trees' which are defined by HRS Section 58-3 as "a tree, stand, or grove of trees that have historic or cultural value, or because of its age, rarity, location, size, esthetic quality, or endemic status is worthy of preservation." The vast majority of trees across the state have no legal safeguards. The establishment of a municipal tree ordinance would provide protections for urban trees located on private properties and the ecosystem services they provide at the municipal scale. Tree ordinances are flexible policy tools that seek to preserve trees during land use transitions and redevelopment. When preservation is not possible, tree ordinances provide for the mitigation of tree loss through options like off-site planting and in-lieu fees, which can be directed at targeted reforestation efforts, for instance, along riparian corridors. Between 2010 and 2013 alone the Honolulu Urban Tree Canopy Assessment (2017) found that urban Honolulu lost 5% of its canopy, at least 76,600 trees.[14] The majority of losses were in non-public zoning districts. With an existing tree canopy of less than 20%, Honolulu ranks below the U.S. average of approximately 30% tree canopy cover in urban and metropolitan areas.[15] While proposed incentives under Honolulu's Stormwater Utility (see 'Successes: County Leadership') would incentivize the protection of canopy tree cover, the continued reliance on voluntary best practices to preserve what remains of statewide urban tree canopy cover may not be enough to derive measurable mitigative benefits in the management of land-based pollution.

Successes

Nonpoint Source Control Projects
Hawai'i has implemented projects to restore waterbodies impaired by nonpoint source pollution, some of which have been documented by the EPA as 'Success Stories.' Two projects, *Watershed Restoration Projects Improve He'eia Stream*, implemented on O'ahu, and *Restoring Native Vegetation Reduces Sediment Entering Coastal Waters*, which was implemented in two watersheds on Kaho'olawe, are featured by the EPA.[16] The implementation of successful nonpoint source control efforts is contingent on coordination with a variety of federal, state, and local agencies who leverage resources to mitigate NPS pollution, particularly in priority watershed areas.

Incremental Change at the State-Level
A combination of new state-level measures with positive implications for land-based pollution management are in the planning stages or have begun implementation:

Act 286, SLH 2012, codified as HRS Chapter 226, Section 109, established the Hawai'i Climate Change Adaptation Priority Guidelines. Among other positive goals, the guidelines encourage

the preservation of natural infrastructure systems, including streams, floodplains, and wetlands as a means to 'avoid, minimize, and mitigate' climate change impacts.

Act 83, 2014, codified as HRS Chapter 225P, established the Hawai'i Climate Change Mitigation and Adaptation Commission and called for the development of a sea-level rise vulnerability and adaptation report.

Act 42, 2015, enabled counties to establish stormwater utilities, funding mechanisms that charge user fees for stormwater management.

Act 125, 2017, mandated cesspools be upgraded, converted to a septic system or aerobic treatment unit, or connected to a sewer system by 2050.

Act 132, 2018, established a Cesspool Conversion Working Group to develop a long-range plan for cesspool conversions statewide, directed the UH WRRC and DOH to conduct a comprehensive statewide study of sewage contamination in nearshore marine areas.

Act 16, 2020, strengthened provisions of HRS Chapter 205A with co-benefits for land-based pollution mitigation, including new triggers for development reviews, minimum shoreline setbacks, coastal dune protection, and the addition of the sea-level rise exposure area (SLR-XA).

The Sustainable Hawai'i Initiative (2017). Though not designed to control land-based pollution, the Initiative's goals to protect 30% of priority watersheds by 2030 and effectively manage 30% of nearshore ocean waters by 2030 have positive implications for reducing nonpoint sources of pollution. Additionally, the goals to implement an interagency biosecurity plan (reducing impacts of non-native and invasive species), double local food production (regenerating and stewarding currently fallow lands for agriculture), and achieve 100% renewable electricity (reducing oil, heavy metals, and other contaminants associated with fossil fuels) all have benefits for water quality.

Hawai'i's federally mandated CNPCP is administered jointly by the Hawai'i CZM Program and state DOH PRC Program. The CNPCP-established management measures are the best available, economically achievable practices or combinations of practices that can be used to address nonpoint source pollution. The management measures are designed to control runoff from six main sources: forestry, agriculture, urban areas, marinas, hydromodification, and wetland and vegetated shorelines, or riparian areas. These measures are backed by enforceable state policies and actions that will ensure implementation of the program.

The Hawai'i CZM Program and PRC Program have made progress in obtaining EPA/NOAA approval of four management measures: 1) New Development, 2) New Onsite Disposal Systems, 3) Planning, Siting, and Developing Roads and Highways, and 4) Bridges. There are three remaining management measures that still require approval. These actions are key to retaining EPA/NOAA funding for each of these programs in their work to reduce polluted runoff.

Cesspool in Punalu'u, O'ahu exposed by chronic coastal erosion. Source: DNLR, Office of Conservation and Coastal Lands photo archive

Expansion of Regulatory Authority over Nonpoint Source Pollution

One of Hawai'i's greatest challenges in managing water quality is the voluntary approach to controlling nonpoint source pollution. However, HAR Title 11 Chapter 56, 'Nonpoint Source Pollution Control', which was adopted in June of 2021, created regulatory mechanisms to control nonpoint source pollution. It requires certain entities to develop and implement "a Water Pollution Prevention Plan that identifies the specific management measures to be used for effectively controlling…sources of [nonpoint source] pollution."[17] HAR Title 11 Chapter 56 standardizes best practices employed statewide and will improve the implementation and monitoring of CNPCP management measures. Additionally, this statute provides compliance and enforcement mechanisms to uphold its regulatory standards, a first for the state.

County Leadership

Shoreline Setbacks-Maui and Kaua'i County

As discussed in Section I: OPSD-CZM, HRS Chapter 205A-43 establishes a minimum shoreline setback which counties can choose to exceed. Though shoreline setbacks are typically established for coastal hazards risk reduction, they also have benefits for land-based pollution management. Generally, the further inland development is placed from the shoreline, the more opportunities polluted water has to be captured, filtered, purified, infiltrated, or reused before it enters coastal waters. Shoreline setbacks also give county officials the tools to restrict the placement of waste management systems and other potential sources of pollution in high-hazard zones. With partial funding from the Hawai'i CZM Program, both Maui and Kaua'i County have recently updated their shoreline setbacks to be some of the most progressive in the nation.

Riparian Buffers- Hawai'i County

The Hawai'i County Planning Department is conducting a study to better understand locally-specific riparian hazards in East Hawai'i.

State agencies are challenged to sample coastal waters at the spatial and temporal resolution needed to make decisions about improving watershed management. The acquisition of environmental data by committed non-profit organizations and trained community members represents a major opportunity to support agency monitoring programs and to complement field campaigns in the study of watershed dynamics. When data collection protocols match state agency protocols and these are supported by sufficient documentation, there is an opportunity to create regulatory-quality data that can inform management. -Faliniski, et. Al., 2019

The study, which is partially funded by the Hawai'i CZM Program, will examine connections between riparian conditions, flooding, bluff loss, and shoreline change. It seeks to establish science-based shoreline and riparian setbacks to minimize impacts to and from development, and will mitigate erosional land-based pollution and their impacts on nearshore resources.

'One Water' Approach, Forthcoming Stormwater Master Plan, and Stormwater Utility- City and County of Honolulu

The One Water framework is an approach to integrated water management that includes all forms of water—stormwater, graywater, wastewater, and drinking water—as resources to be managed holistically. This strategy is being pursued by the City and County of Honolulu to break down siloes between planning efforts and encourage interagency collaboration.

The City and County of Honolulu Stormwater Master Plan, which is under development, will have a 50-year planning horizon and serve as a strategic plan integrating local drainage and green stormwater infrastructure planning, workforce development planning, asset renewal and replacement planning, regional flooding and watershed management planning, and

partnership opportunities. The plan will be tied to the County's 'One Water' approach and will also include functional planning and the prioritization of project implementation.

The City and County of Honolulu's proposed Stormwater Utility would establish a special fund for stormwater management. Stormwater utility fees would be assessed based on a home or landowner's contribution to stormwater runoff, which would be estimated based on their property's impervious surface coverage. The largest investments projected for the utility include stream maintenance and drainage system maintenance and sweeping. The Utility is anticipated to be introduced to City Council in early 2022.

Hui to Fill the Pukas!
(Get together, gather to fill the holes, voids)
Hawai'i has an active and engaged citizenry and vast spectrum of non-profit and community organizations, many of which contribute to the management of land-based sources of pollution. In recent years, citizen science groups have helped to address capacity shortfalls at the state and county levels by collaborating to fill government management gaps. Government agencies, non-profits, and community groups have formed team efforts like the Hawai'i Wai Ola citizen science program. The collective is active on both Maui and Hawai'i Island and contributes high-quality water quality data to assist with decision-making and tracking progress.

Non-profit organizations have initiated numerous land-based pollution mitigation projects and public information campaigns in their regions of focus. A few examples include:

Wastewater Alternatives and Innovations (WAI) is working to assist Hawai'i's communities with the conversion of outdated wastewater treatment systems. WAI's 'Potty Portal' provides cesspool information for homeowners.

Pūlama Lāna'i has partnered with the National Fish and Wildlife Foundation (NFWF) for the Kuahiwi a Kai: Lāna'i Watershed Conservation Program, which seeks to employ watershed-scale management to achieve sediment runoff reductions, restoration of native vegetation, protection and enhancement of endangered and endemic species, habitat improvement, predator management, and enhanced community conservation ethics and engagement.

Malama Maunalua's Cherish Protect Restore (CPR) Campaign focuses on the ahupua'a of Maunalua Bay on O'ahu. The program promotes monthly actions for community members can take to reduce urban stormwater runoff and partners with local businesses to provide participation incentives for residents through discounts and other opportunities. Malama Maunalua also encourages stewardship through their volunteer programs, which focus on the removal of alien invasive algae from the bay, the spread of which is largely facilitated by nutrient-enriched nearshore conditions in the area.

West Maui Kumuwai promotes ocean health through community collaboration and the sharing of best management practices. The group is a collaborative composed of community members, individuals from nonprofits, and state and federal agencies. Their 'Ocean Friendly Pledges' allow individuals, landscapers, and large properties

The 'ōlelo no'eau (Hawaiian proverb) 'Inā e lepo ke kumu wai, e hō'ea ana ka lepo ikai' means 'If the source of the water is dirty, muddy water will travel to the sea,'

- Ulalia Woodside, Director of The Nature Conservancy

to commit to best management practices in a tangible way and provide opportunities to promote their work.

The *West Maui Ridge to Reef (R2R) Initiative* includes multiple agencies and organizations who work to address the adverse impacts of land-based pollution on coral reefs in West Maui. R2R has many ongoing projects with direct connections to land-based pollution management.

The *Coral Reef Alliance (CORAL)*'s Clean Water for Reefs Initiative has been implemented on Maui and Hawai'i Island. The Initiative has galvanized stakeholders to replace cesspools with a wastewater treatment facility in Puakō, Hawai'i Island and has focused on green infrastructure and best practices in West Maui. CORAL promotes reef-friendly landscape design through an array of guidance documents as well as the Hawai'i Hotel Guide for Reef Stewardship.

The *Nature Conservancy (TNC) Hawai'i* has been actively involved in land-based pollution mitigation through watershed planning efforts, including the Kawela, Moloka'i Alternative Watershed-Based Plan. TNC promotes reef stewardship and preservation throughout the Hawaiian Islands.

The *Hawai'i Association of Watershed Partnerships* includes ten island-based watershed partnerships as well as 74 public and private partners on five islands, encompassing 2.2 million acres of forested watershed lands. The watershed partnerships dedicate resources to on-the-ground projects including fencing and ungulate removal, invasive species control, and native out-plantings, all of which reduce sedimentation and downstream land-based pollution impacts. The partnerships also commit resources to outreach and education in Hawai'i's communities.

"The Honolulu District, [USACE] is partnered with [DLNR DAR] to jointly pursue watershed planning efforts for the West Maui watershed, Island of Maui, Hawai'i... USACE collaborated on the development of the West Maui Watershed Management Plan with the West Maui Ridge to Reef (R2R) Initiative to develop the watershed study objective used as the Shared Vision for this study. The West Maui R2R working group and [Funding and Agency Support Team] consist of members from the following agencies and organizations: Mauna Kahālāwai Watershed Partnership, Maui Cultural Lands, Ka'anapali Operators Association, [CORAL], County of Maui (COM) Department of Public Works, [UH] Sea Grant College Program, Maui Land & Pineapple Co. Inc., 'Aha Moku Council, DLNR, [DOH], U.S. Department of Commerce (DOC) [NMFS], [USEPA], [NFWF], [DOA NRCS], [DOI USFWS], [USGS] and USACE. Regular and ongoing meetings by each of these bodies ensures collaboration of efforts to leverage technical capabilities and funding opportunities necessary to progress the West Maui R2R Initiative's mission and shared vision for this study. Additionally, the USGS has partnered with USACE to provide technical assistance to furthering analysis of the management measures proposed by this study. The USGS has completed numerous water budget, groundwater, and stream discharge studies within the existing study area and brings regionally-specific scientific expertise to the USACE study."-Draft West Maui Watershed Management Plan, 2021

Waiwai Ola Waterkeepers Hawaiian Islands includes Kona Coast, Hilo Bay, and O'ahu Waterkeepers. Their alliance includes dedicated partners working to restore water quality, introduce innovative pilot projects, and provide community education

on stormwater issues. Recent efforts have explored the restoration of native oysters to remove pollutants from wastewater and stormwater upon entering the ocean.

Place-Based Collaborations

When funding is available and collaborative partnerships form, watershed-scale studies and analysis have proven invaluable to the mitigation and management of land-based pollution in Hawai'i. Federal, state, county, non-profit, private sector, and other community partners have exemplified the potential for multi-jurisdictional partnerships in their work to control nonpoint source pollution in West Maui. The USACE, in collaboration with DLNR DAR, recently drafted a watershed study to inform management actions in the region over a 50-year timeline. The study builds upon watershed management plans from 2012 and 2016. The plan spans five watersheds and identifies and recommends actions "to address land-based pollutants that upon transport to the marine environment adversely affect nearshore coral reef ecosystems, thereby compromising the health of the West Maui watershed."[18] Correspondingly, the recent Draft West Maui Community Plan Update includes several policies targeting runoff reduction, including the requirement of low impact development, planting of native vegetation, reducing development in and around gulches. The Draft Plan proposes code amendments for gulch, wetland, and stream buffers, pervious surface requirements, and the development of guidelines and incentives for landowners to retain stormwater runoff at the site scale[19].

Clouds hover over the West Maui Forest Reserve and mountains. Source: Lembi, Shutterstock

SECTION III

Suggestions of Research Needs to Improve Land-Based Pollution Understanding and Management

SECTION III

Suggestions of Research Needs to Improve Land-Based Pollution Understanding and Management

Improve Understanding of Source and Volume of Nonpoint Source Pollutants

Hawai'i's environmental managers lack fundamental information for decision making, specifically the constituent parts that compose land-based pollution and the varying contributions of each land use area to pollution at the watershed scale. This fundamental knowledge is lacking due to the sheer number of watersheds statewide, fragmented research efforts (often based on short grant funding cycles), lack of consistent monitoring methodologies and acceptance of the resulting data by accredited labs, and an overall lack of investment in data collection from ridge to reef.

It is important to understand the components that comprise land-based pollution, but this can only be done through thorough and often expensive monitoring and data collection. When monitoring systems are put in place, they are frequently stolen or vandalized. Currently, most monitoring occurs along Hawai'i's shorelines and beaches. By the time runoff reaches the coast, it's difficult to determine the full spectrum of pollutants in contaminated waters and ascertain their sources. In order to collect information on origin zones and pollutant amounts, monitoring needs to occur through the entire watershed, in upper, middle, and lower reaches, both up and downstream of major confluences and land use changes. At the state and watershed scales, this information could be implemented in management decisions. For instance, in some regions the untreated waste from feral ungulates in conservation areas may outpace contamination from cesspools, whereas in others cesspool conversion may be the most urgent priority. This information would allow the prioritization and direction of resources to the pollution 'hotspot' and would also allow managers to gauge the success of investments by comparing data before and after the intervention occurs. In other areas, the value and success of investments in low impact development could be assessed by understanding the amount of sediment flowing to, and through, urban areas along the coastline.

Until this data becomes available, there are several resources and tools that may be helpful as a stopgap. The Ocean Tipping Points Hawai'i Case Study tool allows users to explore mapped 'environmental and anthropogenic drivers of coral reef ecosystem states', with sedimentation, effluent, development, and habitat modification layers being particularly important considerations for land-based pollution management.[20] However, Ocean Tipping Points is likely most useful for marine habitat managers as the tool only displays these drivers in the nearshore area. The NFWF Coastal Resilience Evaluation and Siting Tool (CREST) includes more robust terrestrial information.[21] CREST provides generalized insight about threats like impermeable soils and soil erodibility on land, and also allows the display of marine, terrestrial, and fish and wildlife indexes to gauge habitat value. This tool has been used to consider the siting of restoration and resilience projects but was not designed for use in planning and permitting.

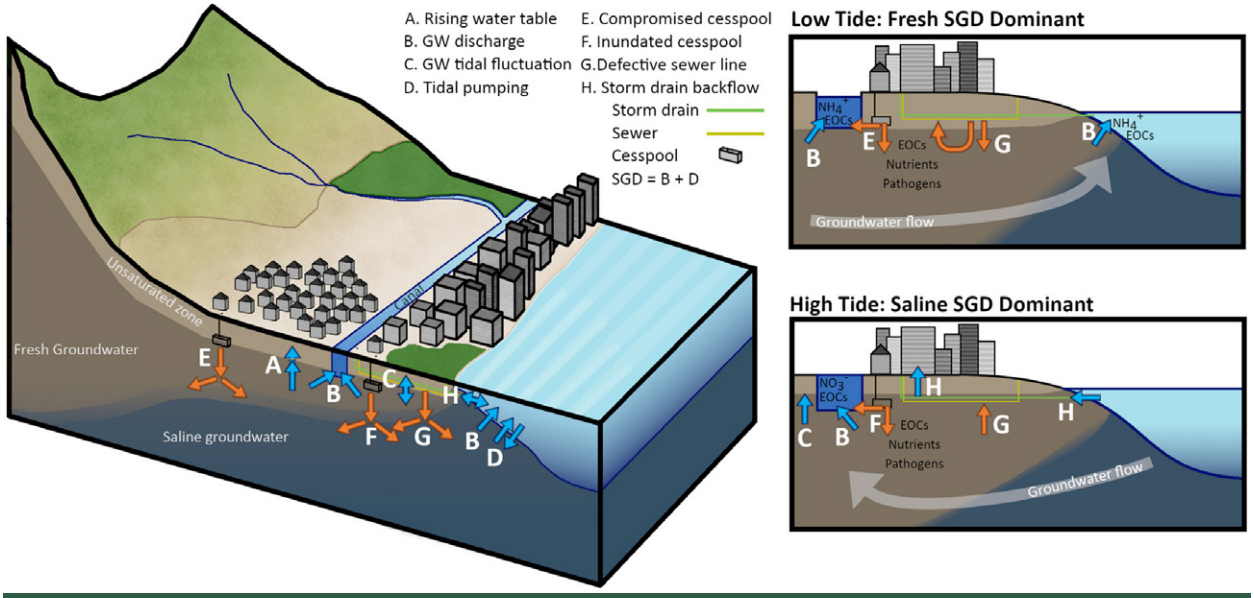
Further Assess the Intersection of Global Climate Change and Land-Based Pollution Management

The formation of the Hawai'i Climate Change Mitigation and Adaptation Commission (as called for by Act 83 (2014) codified as HRS Chapter 225P), and the commissioning of the *Hawai'i Sea Level Rise Vulnerability and Adaptation Report,*[22] *Guidance for Using the Sea Level Rise Exposure Area in Local Planning*

and Permitting Decisions,[23] and *State of Hawai'i Sea Level Rise Viewer*[24] have enabled new connections to be made between the issues of land-based pollution, sea-level rise, and groundwater inundation. As discussed in Section II: Incremental Progressive Change at the State-Level, the SLR-XA has great potential in a diversity of subject areas for use as a risk assessment overlay. The exposure area is already being used in county and community planning frameworks to inform growth areas, managed retreat considerations, and adaptation needs. The SLR-XA has also been an important tool for public outreach and education.

The SLR-XA has been used by the DOH HEER Office, which recently published a memorandum on climate change and chemical contamination. Their analysis found that of about 1,000 hazardous sites monitored by HEER, 'many' are located in low-lying areas and along shorelines. The Office reports that standard practice has been capping and abandoning sites, however, rising sea levels, increasingly intense storms, and erosive threats may uncover and expose sources of contamination to the environment. Such threats could impact drinking water, marine resources, and human health. Of particular concern are large swaths of contaminated lands that could become nonpoint source pollutants, such as "extensive areas of the shoreline in downtown Honolulu…underlain with fill material known to be contaminated with lead from former incinerator ash" which is likely to leach into the nearshore environment as sea levels rise and percolate through the subsurface contamination.[25]

Rising groundwater levels can inundate cesspools, causing untreated sewage to leach to the surface or contaminate the island's aquifers and nearshore environments. Climate-induced flooding research by Habel et al. (2020) found that stormwater infrastructure in low-lying coastal areas is particularly susceptible to failure.[26] Roadways, gravity-flow drainage inlets, and cesspools are anticipated to be compromised in function at minor and moderate thresholds as soon as the 2030's to 2060's with impacts mounting as water levels rise. The nonpoint source impacts of such failures are likely to be severe as urban contaminants find new, more efficient pathways between land and sea.



Subsurface connections between groundwater, surface water, storm drains, and wastewater infrastructure are evolving as sea levels rise. Source: McKenzie, T., Habel, S. L. & Dulai, H., 2021

These findings can be applied to decisions about the adaptation of drainage infrastructure and the evolution of wastewater treatment in the state. Though cesspools are currently required to be replaced by 2050, impacts of the changing climate are already being experienced in Hawai'i and are likely to intensify leading up to the mandate's mid-century deadline. In fact, early studies have indicated that contamination fluctuates tidally, suggesting that sources of wastewater are already converging with ocean waters.[27] As Hawai'i's mandate to convert cesspools is implemented over the next three decades, the availability of multi-factor inundation models is particularly critical to informing the appropriate siting of septic tanks as potential replacements for cesspools. Septic tanks require drain fields well above the groundwater table to effectively treat sewage. As conversions occur, it is important for analyses to determine where they can be functional in the long-term, and where their use would swap one ineffective system for another. In further assessing this risk, Hawai'i may wish to connect with the State of Florida as they assess how to phase out septic tanks due to their vulnerability to sea-level rise.

Sea-level rise isn't the only factor that needs to be considered in relation to land-based pollution. Global climate change is anticipated to bring more intense storms to the islands, which are likely to amplify surface water flows, intensify flood risks, and increase erosion both in terrestrial and shoreline areas. Without significant repairs, infrastructure updates, and investments in low impact development to retain increased rainwater, sewer overflows and brown water events are likely to become more common.

Increasing heat, particularly in urban areas or 'heat islands', will also have an aggravating effect on land-based pollution by increasing the stress placed on riparian and marine ecosystems and reducing the water quality benefits they currently provide. Polluted runoff will likely cause greater thermal impacts to stream waters, facilitating the spread of invasive species and furthering the decline of native species. Increasing heat may lead to excess algal growth in the nearshore and accelerate ocean acidification. These factors should be more comprehensively assessed, particularly in relation to their connections to land-based pollution and the urban interventions available to mitigate their impacts.

Ground-truth Cesspool Data

Geographic Information System (GIS) data layers are used to indicate the presence of cesspools throughout the state. However, theses layers have not been verified in the real world through field verification. 'Ground-truthing' would assess and document the presence of a cesspool, its location on a property, its condition, and whether or not it is active. Of particular concern are active cesspools adjacent to drinking water sources, riparian areas, popular recreation areas, coral reefs, and other marine conservation areas. Ground-truthed data could be used to prioritize the conversion of these sites.

Accurate data is also integral to tracking the conversion of cesspools from now until 2050 and the state's ability to follow up with compliance and enforcement actions. This information would also be helpful in informing watershed-scale nonpoint source pollution models, as discussed above in 'Improve Understanding of Source and Volume of Nonpoint Source Pollutants.' At present, the DOH Wastewater Branch does not have the staffing resources or capacity to conduct cesspool ground-truthing.

Consider New Planning Frameworks

Because land-based pollution is an issue that originates from a multitude of sources it is particularly difficult to manage. As such, overlapping jurisdictions and management responsibilities theoretically serve to strengthen pollution reduction efforts. However, in practice, under-resourced

agencies and predominately voluntary control measures have stretched the state's ability to innovate, collaborate, and implement effective controls for land-based pollution.

A different approach for reprioritizing funding allocations lies in the EPA-endorsed process of Integrated Planning, which was added to the CWA in 2019.[28] Integrated plans allow municipalities to align needed capital investments for both storm and wastewater programs, which are typically managed separately. Though oriented towards point source pollution management, the creation of integrated plans within Hawai'i would have substantial benefits for all forms of land-based pollution, particularly because they are customizable to place and allow for the reduction and treatment of contaminants, rather than just permitting and treating discharges. Integrated plans also allow counties and utilities districts to make alternative investments like distributed systems of green infrastructure, and delay costly improvements to wastewater treatment systems if other needs are more pressing.

The development of the Seattle, Washington Integrated Plan allowed city stakeholders to evaluate, rank, and compare possible stormwater projects and prioritize the most effective options, deferring previously planned maintenance that was deemed to be less impactful and cost-effective.

Runoff in the neighborhood of Lanikai, Kailua makes its way to the ocean. Source: The Nature Conservancy, Andrew Hood

SECTION IV

Recommendations for Future ORMP Focus Area 2 Action Team Implementation Actions

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This section includes recommendations intended to build upon the bolded objectives below, which were included under the ORMP Focus Area 2 as 'Proposed Components for Goal Success'. These recommendations are intended to provide a spectrum of implementation options for proposed ORMP actions, each of which will vary in time, expense, and effort. Pursuit of one, several, or all of the following recommendations would make a contribution towards improving land-based pollution management in the state. This section has been collaboratively derived from conversations with federal, state, and county stakeholders who participated in the creation of this report.

The following priorities are elaborated on in the recommended actions for each objective:

- Encourage county planning departments to take ownership of their unique role in controlling land-based pollution and empower more rigorous review during permitting processes
- Engage the public as partners in mitigation, compliance, and enforcement
- Support efficiencies by partnering with state and county agencies with shared goals
- Increase the implementation and visibility of green infrastructure in developed areas

Focus Area 2 Objective: Increase the shared understanding of green stormwater infrastructure among homeowners, government officials, practitioners, and private industry, through continuing outreach efforts.

Recommended Action: Increase access to land-based pollution and natural infrastructure information.

Work to add known erosional hotspots, soil survey data, riparian habitat areas, impervious surfaces, and urban tree cover layers to existing state and county 'map viewer' resources such as, but not limited to, the DLNR Flood Hazard Assessment Tool (FHAT), Sea Level Rise Viewer, Maps of O'ahu, and government mapping tools used for internal plan review processes. Notify relevant agencies when new or updated GIS layers become available related to land-based pollution, low impact development, or green infrastructure.

Justification- Users of map viewer resources may be impeded by a lack of available information and consistency across public-facing platforms. State and county officials have expressed concerns that they do not have access to or awareness of the latest data layers for GIS platforms used in decision-making.

Suggested Partners- NOAA OCM, Hawai'i Statewide GIS Program, DLNR Engineering Division, County Planning Departments, PacIOOS

Recommended Action: Increase the publics' role in enforcement by providing new, user-friendly ways to report land-based pollution observations.

Work with neighbor island information technology departments to encourage development of reporting mechanisms like the City and County of Honolulu's 311 App, a simple and effective reporting tool that includes reporting options such for stormwater pollution, stream/canal cleaning, and debris/litter dumping.

Justification- State and county agencies have shared that most of their compliance and enforcement actions begin as reports from members of the community. Apps like 311 provide a 'one-stop shop' that encourage community reporting on a variety of potential infractions and pollution hot spots. Community tips are directed through the app to the appropriate government agency for response and follow-up. This model has more readily allowed members of the public to participate in land-based pollution management by reducing communication barriers between the community and public agencies and maximizing government staff capacity. Expanding the availability of reporting apps statewide would capitalize on these efficiencies.

Suggested Partners- City and County of Honolulu Department of Information Technology, Maui Information Technology Services Division, County of Hawai'i Department of Information Technology, Kaua'i Information Technology Division

Focus Area 2 Objective: Sponsor symposia and trainings on green stormwater infrastructure installation and maintenance for professionals, homeowners, and advocates.

Recommended Action: Create succinct guidance specific to SMA permit review for land-based pollution considerations.

Host co-development workshops between each county's planning and public works departments to update best management practices for use in permitting and to be attached as permit conditions.

Justification- Planning departments typically defer to public works departments for matters related to floodplains and drainage. Land-based pollution considerations should be collaboratively managed.

Suggested Partners- County Planning Departments, County Public Works Departments

Recommended Action: Train permit reviewers, particularly 'plan checkers' who initially review a permit and delegate further review to other staff and/or appropriate extra-governmental agencies, to straightforwardly assess permit applications for land-based pollution risk factors.

Consult with subject-matter experts to define and compile recommended land-based pollution 'risk factor' layers (i.e. hydrological feature classes, soils, slope). Collaborate with statewide county planning offices to introduce review of these layers in permit review workflows. Where applicable, use software programs to alert 'plan checkers' to refer permit applications to Civil Engineering staff for additional review if a proposed project's tax map key area is adjacent to or intersecting with risk-factor layers.

Justification- Current practice does not mandate riparian or contour layers be viewed with GIS during initial permit review at the county level. Without the holistic consideration of a proposed development's environmental context, permitting may be approved in areas that increase land-based pollution risk, such as steep, erodible slopes or near intermittently flowing waterways.

Suggested Partners - Hawai'i Statewide GIS Program, County Planning Departments, Hawai'i Sea Grant, UH WRRC

Focus Area 2 Objective: Identify adaptations needed to implement green stormwater infrastructure successfully in Hawai'i's unique conditions (topography, climate, soils, development patterns).

Recommended Action: Work with County Partners to further incorporate land-based pollution considerations into local planning efforts.

Standardize the inclusion of water quality considerations in mid-to-long-term community-scale planning efforts. Analyze potential growth zones through a watershed context by considering nearby groundwater recharge priority areas, native forests, erosional hotspots, freshwater riparian zones, and valuable marine habitat.

Further scrutinize construction approvals, particularly the subdivision approvals process, through the lens of land-based pollution mitigation. Conduct thorough site analysis to conclude whether environmental conditions can support the proposed building density or require further study. Consider an area's carrying capacity, including soils types, topography, sea level rise risk, distance from sewer line connections, and the depth to the groundwater table prior to permitting approvals. Special conditions such as advanced treatment systems for wastewater or green infrastructure investments should be applied as needed.

Justification- Making changes to developed areas can be expensive, complex, and fraught with legal challenges. The optimal opportunity to prevent new sources of land-based pollution is to conduct thorough site analysis and require land-based pollution mitigation measures prior to the approval of development. Because the state already faces wide-spread issues in land-based pollution management, it is crucial that new development does not further compound land-based pollution issues and require costly adaptation down the road.

Suggested Partners- County Planning Departments Long-Range Divisions, UH WRRC, USGS, DOH WWB

Focus Area 2 Objective: Compare and contrast the efficacy, cost, and lifespan of green stormwater infrastructure, and traditional water management techniques (through such process as phytoremediation and filtration) compared to the ['gray'] infrastructure (engineered assets) currently utilized in Hawai'i in order to dispel misconceptions about green options.

Recommended Action: Demonstrate the effectiveness of the urban tree canopy in mitigating stormwater runoff and reducing urban heat vs. conventionally applied 'gray' methods.

Actively engage with new stakeholders to pursue the Hawai'i Forest Action Plan (2016) Water Quality and Green Infrastructure goal to, "Work together with a broader network of partners to give trees a predominant role in green infrastructure" within priority urban forest landscape areas.[29]

Advance research into the place-based understanding of urban tree canopy protection and afforestation in relation to beneficial outcomes for coastal water quality.

Support the adoption of urban tree ordinances and other regulatory strategies, as suggested in the City and County of Honolulu Urban Tree Plan (2019), statewide.[30]

Justification- Lacking statewide partnerships and protective legislation, Hawai'i faces challenges in maintaining and enhancing its urban canopy, the protection of which has innumerable benefits for land-based pollution management and urban heat island mitigation.

Suggested Partners- DLNR DOFAW Urban and Community Forestry Program, Kaulunani, City and County of Honolulu Office of Climate Change, Sustainability, and Resilience, Hawai'i Sea Grant

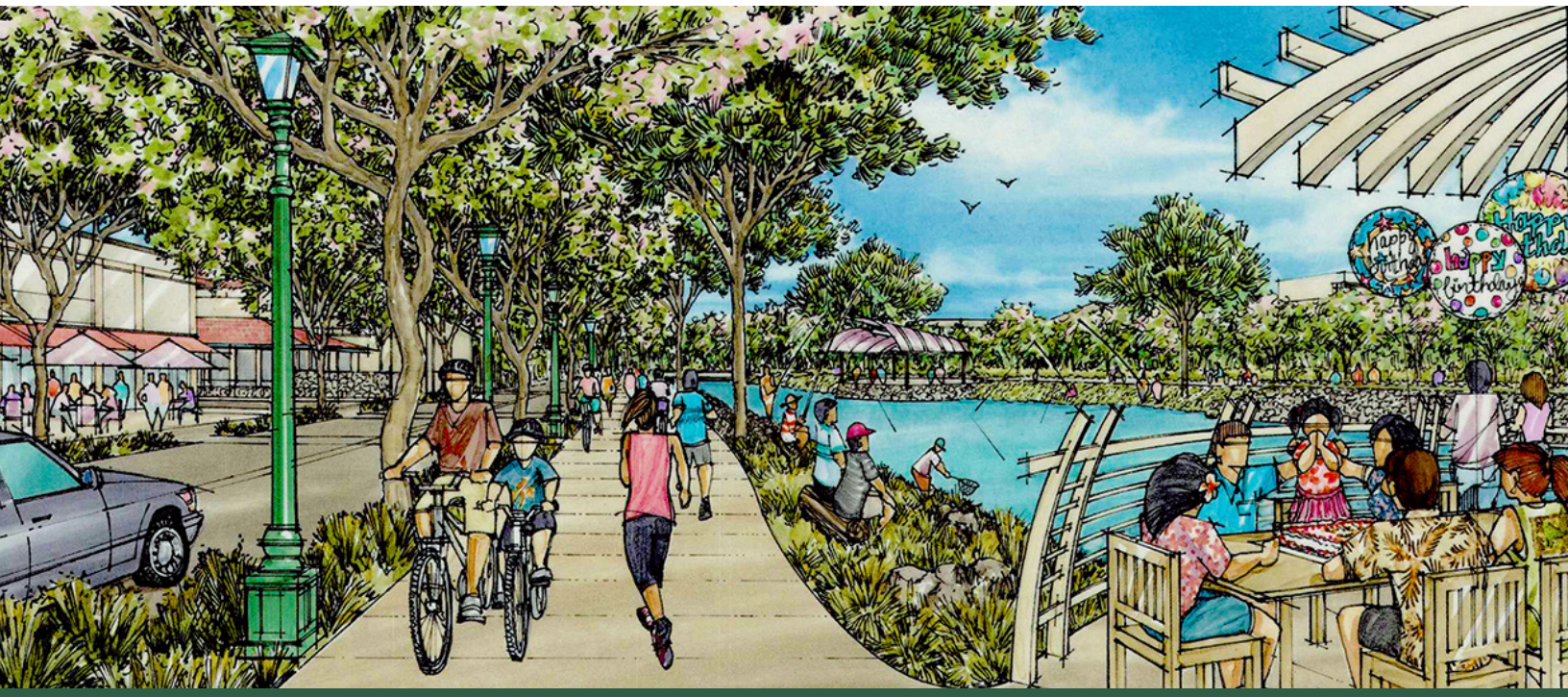
Recommended Action: Work with state and county partners to standardize and expand implementation of multi-benefit greenway and complete streets projects.

Champion the active implementation of transit-oriented development, greenways, and riparian corridor activation, which seek to holistically integrate green infrastructure into planned improvements.

Coordinate with HDOT through Bike Plan Hawai'i-Refresh 2021 and their county implementation counterparts to encourage the use of stormwater bioswales as protective barriers for bike lanes and pedestrians.

Justification- Seek to expand the real-world application of green infrastructure and its co-benefits for land-based pollution management. Increased visibility and diverse applications of green infrastructure across Hawai'i's developed areas will reinforce its value and appeal. Encouraging alternative forms of transportation through the creation of safe and attractive transitways will simultaneously mitigate sources of land-based pollution.

Suggested Partners- HDOT, OPSD Land Use Division, Hawaii Interagency Council for Transit-Oriented Development (TOD Council), County Planning Departments



Urban green infrastructure designed for protective and aesthetic co-benefits. Source: TOD Honolulu, 2021

Focus Area 2 Objective: Evaluate the use of green stormwater infrastructure along Hawai'i's shoreline and throughout the coastal zone, with the dual-benefit of controlling erosion and other shoreline processes while mitigating the impacts of land-based pollution and inland flooding.

Recommended Action: Support the use of innovative biomimicry technologies with resilience, habitat, and water quality benefits. Reduce barriers to implementation that may impede the application of novel ideas and pilot projects.

As shoreline projects seek to retain sand and reduce shoreline erosion, encourage place-based testing of products like Dune Infiltration Systems, living seawalls and groins, oyster gardens, and reef balls, which simultaneously encourage coastal habitat restoration, mitigate coastal hazards, and treat contaminated discharges into the ocean.

Justification- Nearshore innovations present an opportunity to work with partners who have responsibilities for marine health but limited ability to directly mitigate terrestrial sources of land-based pollution.

Suggested Partners- NOAA NMFS, DLNR DAR, DLNR OCCL, Hawai'i Sea Grant

Recommended Action: Work with county partners to integrate green infrastructure into permit conditions and comments for shoreline projects as necessary upgrades, retrofits, and redevelopment occurs in response to sea-level rise (See: '*Identify adaptations needed to implement green stormwater infrastructure successfully in Hawai'i's unique conditions (topography, climate, soils, development patterns)'.*

Focus Area 2 Objective: Expand use of NOAA's Coastal Change Analysis Program (C-CAP) sea-level rise and land cover data in conducting stormwater assessments and modeling.

Recommended Action: Create a digital addendum to the Hawai'i Watershed Guidance (2010) highlighting newly available modeling tools to enhance planning efforts. Coordinate with federal partners at NOAA to offer trainings or technical assistance for the use of C-CAP in watershed planning efforts.

Focus update efforts on Chapter 3, 'Planning and Implementing Management Measures to Restore and Protect Water Quality', and specifically the 'Watershed Assessment and Modeling Tools' Section (P. 38-39).

Justification- Many Watershed-Based Plans are decades old, complicating DOH PRC Program review for CWA Section 319 grant proposals and limiting the number of qualified applicants for this stream of federal funding. Communities across the islands face challenges in preparing and updating watershed plans, with most unlikely to have funds to commission watershed-specific research and data collection, or have access to staff or volunteers with data interpretation and modeling experience. User-friendly modeling tools and data sets like NOAA C-CAP may assist communities in updating and creating holistic planning documents in order to access funding for plan implementation.

Suggested Partners: NOAA OCM, DOH PRC Program

CONCLUSION

While the protection of terrestrial and ocean water quality are unquestionably important global priorities, it is particularly crucial for island states and nations to control pollution, conserve water use, protect coastal ecosystems, and proactively foster and enhance the environmental conditions that facilitate water resource sustainability. Despite the existence of water quality-specific legal frameworks and statewide goals, Hawai'i remains 'on the back foot' in its efforts to control and manage land-based pollution. This foundering can largely be interpreted as a product of injudicious historical land use development, environmental alterations, and an incomplete understanding of terrestrial-marine connections combined with compounding present-day factors, including aging infrastructure, reduced staffing capacity at all levels of government, competing priorities, and global climate change. Despite these challenges, the protection and enhancement of water quality is not a goal that can be abandoned. The state of Hawai'i must take more progressive action to safeguard water resources by further reducing land-based pollution statewide.

Hawai'i's CZM Program is in the unique position to galvanize action in this area and has taken important steps to do so by acknowledging land-based pollution as one of three focus areas in the 2020 Ocean Resources Management Plan and commissioning the recommendations within this report. Yet, just as land-based pollution does not originate from any one area, it is not the duty of any single entity to manage. It is critical that the Hawai'i CZM Program continually work to elevate this issue and consistently coordinate its network around the elements listed in HRS Section 205A-2 specific to the protection and enhancement of terrestrial and coastal water quality. Network stakeholders should collaborate to create, update, and implement innovative strategies that reflect the best available scientific knowledge and leverage the partnerships inherent to the CZM network model of interdepartmental and multi-jurisdictional management.

Lanipo drainage in Lanikai, O'ahu. Sorce: The Nature Conservancy, Andrew Hood

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Photo by Bert Weeks