One Water Honolulu Plan

Collaborating for a thriving and climate resilient O‘ahu

CITY AND COUNTY OF HONOLULU



The One Water Honolulu Plan and CIP for climate adaptation was jointly developed and accepted by the City office and departments of the One Water Panel listed below and reflects a shared understanding of the information and considerations presented herein. The plan is intended to support coordinated planning, decision-making, investments and implementation across the City and County of Honolulu.

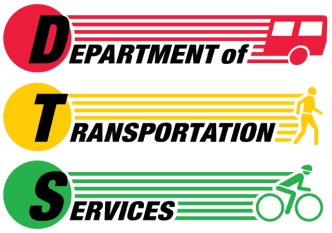
















The One Water Honolulu Plan was prepared for the City and County of Honolulu by:

Brown AND Caldwell

carollo

G70

BODEWELL Group

ONE WORLD ONE WATER



Acronyms

AAP	Area Adaptation Plan
BFS	Department of Budget and Fiscal Services
BWS	Honolulu Board of Water Supply
CAP	City's Climate Action Plan
CCDG	Climate Change Design Guidelines
CCSR	Office of Climate Change, Sustainability and Resiliency
CIP	Capital Improvement Projects or Program
City	City and County of Honolulu
Commission	City Climate Change Commission
CRO	Climate Ready Oʻahu
CWSRF	Clean Water State Revolving Fund
DDC	Department of Design and Construction

Acronyms

DEM	Department of Emergency Management
DFM	Department of Facility Maintenance
DHLM	Department of Housing and Land Management
DLNR	Department of Land and Natural Resources
DOH	Department of Health
DPP	Department of Planning and Permitting
DPR	Department of Parks and Recreation
DPR	Direct Potable Reuse
DTS	Department of Transportation Services
DWSRF	Drinking Water State Revolving Fund
ENV	Department of Environmental Services
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
HDOT	Hawai‘i Department of Transportation
HECO	Hawaiian Electric Company
HVAC	Heating, Ventilation, and Air Conditioning
IDF	Intensity-duration-frequency
IPR	Indirect Potable Reuse
KBDI	Keetch-Byram Drought Index
LG	Leadership Group

Acronyms

LHMP	City's Local Hazard Mitigation Plan
MBR	Membrane Bioreactor
MCBH	Marine Corps Base Hawai'i
mgd	Million Gallons per Day
MHHW	Mean Higher High Water
MOU	Memorandum of Understanding
n.d.	No Date
NASED	New Aloha Stadium Entertainment District
NIDIS	National Integrated Drought Information System
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
OWH	One Water Honolulu
Panel	One Water Panel
Plan	One Water Honolulu Plan
Program	One Water Honolulu Program
PUC	Primary Urban Center
R-1	Recycled Water Meeting R-1 Standards
SFPUC	San Francisco Public Utilities Commission

Acronyms

SIWWTP	Sand Island Wastewater Treatment Plant
SLR	Sea Level Rise
SoVI	Oʻahu Social Vulnerability Index
SPI	Standardized Precipitation Index
SW	Stormwater
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
TOD	Transit-Oriented Development
UH	University of Hawaiʻi
UH-ISR	University of Hawaiʻi Institute for Sustainability and Resilience
UHSG	University of Hawaiʻi Sea Grant College Program
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
WBGT	Wet Bulb Globe Temperature
WIFIA	EPA Water Infrastructure Finance Innovation Act
WRF	Water Research Foundation
WUI	Wildland-Urban Interface
WWPS	Wastewater Pump Station
WWTP	Wastewater Treatment Plant



Glossary

100-Year Storm/Flood: The present-day 100-year flood condition, representing an event with a 1 percent chance of being equaled or exceeded in any given year.

ʻĀina: land, earth

Adaptive Capacity: The ability of people, communities, institutions, infrastructure, or systems to adjust to climate impacts, reduce potential harm, and continue to function and thrive as conditions change.

Adaptive Management: An iterative approach to flexible decision making to handle complex and uncertain environments.

Adaptation Strategy: General adaptation measures that can be applied to a specific location to develop a project. Adaptation strategies can include plans, studies, physical infrastructure, programs, policies, or actions.

Ahupuaʻa: A traditional Hawaiian land division generally extending from the uplands toward the sea and connecting land, water, and natural resources. A Hawaiian sustainability model reflecting stewardship, culture, and the interconnected relationship between mauka and makai environments.

Annual High Wave-Driven Flooding: Coastal flooding caused by wave runup and overwash during large wave conditions that, on average, occur once a year. The extent and depth of this flooding can increase as sea level rises.

Area Classification: A primary grouping assigned to each hotspot based on characteristics found across Oʻahu, such as land use, population density, development patterns, and infrastructure function. Grouping similar hotspots allows relevant adaptation strategies to be considered across comparable locations.

Glossary

Asset Mapping: Data collection and mapping used to locate One Water infrastructure assets across O‘ahu.

Capital Improvement Projects or Program (CIP): Any major improvement to City facilities and infrastructure, including construction of new buildings, major renovations to existing buildings, and repair or maintenance projects to any public infrastructure.

Climate Adaptation: Taking action to prepare for and adjust to both the current and projected impacts of climate change.

Climate Change: Changes in global and regional climate patterns due to human-caused increased levels of atmospheric greenhouse gases, most notably from the burning of fossil fuels.

Climate Exposure: The presence of an asset within the mapped or projected footprint of a climate hazard.

Climate Threat Mapping: Mapping the potential spatial extent, or “footprint,” of a climate hazard using available historical information, projections, and modeling. The resulting footprint identifies locations projected to experience the hazard.

Climate Vulnerability: How strongly a system is likely to be negatively affected by climate change.

Coastal Erosion: The gradual or episodic wearing away and landward retreat of beaches and shorelines caused by processes such as waves, currents, storms, and changing sea levels.

Community-Based Organizations: A public or private nonprofit organization that supports and/or represents a community through engagement, education, and other related efforts to strengthen community well-being.

Complete Streets: Streets planned, designed, and operated to provide safe and convenient travel for people of all ages and abilities, whether walking, bicycling, using transit or mobility devices, or driving.

Consequence Score: A score from 1 to 5 estimating how severely a particular climate hazard could affect an asset type, ranging from minimal or no impact to complete failure and the need for total replacement.

Exposure Mapping: A spatial analysis that overlays climate hazard footprints with water infrastructure asset locations to determine which assets are exposed to each hazard.

Geographic Information System (GIS): Software used to store, manage, analyze, and map information tied to geographic locations, allowing spatial patterns and relationships to be evaluated.

Governance: Governing roles, responsibilities, resource allocation, and both formal and

informal structures through which authority is exercised as related to One Water.

Governance Strategies: Recommendations for overarching actions and processes to support or further define governing roles, responsibilities, resource allocation, and both formal and informal structures through which authority is exercised as related to One Water.

Groundwater Inundation: Flooding that occurs when groundwater rises above the ground surface or reaches buried infrastructure. In coastal areas of Oʻahu, rising sea levels can raise groundwater levels and increase this type of flooding.

Hazard Footprint: The mapped geographic area where a climate hazard is projected or modeled to occur under a specified condition, scenario, or planning horizon.

Hotspot: A priority geographic area with high-risk infrastructure, known community and City concerns, and/or City projects already planned or underway. Hotspots provide focus areas for developing climate adaptation projects.

Kahawai system: Interconnected loʻi and wetlands cycle water and nutrients to support native species like ʻōpae (shrimp) and ʻoʻopu (gobies), creating a living bioremediation system.

Kaiāulu kahawai: Streamside communities support water capture, filtration, and distribution through systems like ʻauwai, sustaining agriculture and ecosystems.

Kākou: Collective action.

Kapu kānāwai: Enforced prohibitions protecting water sources from contamination and misuse.

Kapu mālama: Values-based restriction that guide responsible water use, especially to prevent or respond to scarcity.

Kaulana mahina: The lunar calendar and seasonal water flow guide the cultivation and management of irrigated taro patches, shaping when and how the fields are used.

Known Areas of Concern: Places identified through past and ongoing planning efforts, stakeholder engagement, and City knowledge as having known community concerns or issues. These areas provide context beyond individual infrastructure assets and help inform the identification of hotspots.

Kuleana: Hawaiian concept of responsibility/rights. Kuleana reflects the deep personal commitment to care for ʻāina and community.

Kūpuna: A grandparent, ancestor, relative or close friend of the grandparent's generation.

Level of Resilience: A project-scoring criterion from 1 to 5 that considers the amount and duration of risk reduction, potential losses avoided, and the number of climate hazards

addressed. Higher scores represent longer-lasting solutions that provide greater risk reduction across multiple climate hazards.

Likelihood Score: A score from 0 to 5 estimating how likely or how frequently a climate threat may occur over a specified planning horizon, based on available literature, historical observations, and projected data.

Loʻi kalo: Taro patches

Loko iʻa: Fishponds

Makai: toward the ocean

Managed Retreat: Shifting development inland from the coast either by the physical movement of structures or changing the restrictions and management of coastal areas.

Mauka: toward the mountainside

Non-Potable Water: Water that is not intended or approved for drinking and may be used, depending on its source and treatment, for appropriate non-drinking purposes such as irrigation, industrial processes, or other approved uses.

One Water Honolulu Program: Generally refers to the overall and ongoing collaboration within the City and with key partners as outlined in Ordinance 20-47 and the One Water Panel Memorandum of Understanding.

One Water Infrastructure: Includes specific assets such as wells, wastewater treatment plants, pump stations, ocean outfall pipelines, roadways, and streams. Over 500,000 One Water Infrastructure assets were evaluated as part of the risk assessment.

Ordinance: Regulation set forth by a local governmental authority.

Ordinance 20-47 Chapter 2-10.13 ROH: Adopted in 2020, defined a climate change adaptation One Water policy, and established the City One Water Panel.

Passive Overland Flooding: Flooding of low-lying land where ground elevations are at or below a projected sea level, including areas directly connected to the ocean and low-lying areas that may be indirectly connected through soils and sediments.

Physical Infrastructure: Tangible, built modifications or enhancements to existing or planned infrastructure systems. They involve physical changes to assets and facilities to directly protect them from climate threats or improve their performance under altered conditions.

Plans or Studies: Formal, documented frameworks and strategies that outline how a utility/agency will prepare for, respond to, and recover from climate change impacts. They provide a roadmap for implementing adaptation measures across different time horizons.

Glossary

Pluvial Flooding: Accumulation of water on land due to rainfall, independent of an overflowing water body. Also referred to as urban flooding.

Programs: Ongoing, organized activities or initiatives designed to enhance the resilience of water and wastewater services to climate change. They involve specific procedures, operational adjustments, or community engagement efforts.

Project Champion: The proposed City agency responsible for advancing a recommended project and coordinating its development and implementation. For near-term projects, the lead agency has confirmed project ownership, while mid- and long-term projects may identify a proposed champion without confirmed ownership.

Policies: Rules, guidelines, and overarching principles adopted by governing, regulating, or implementing entities to promote climate resilience. They influence decision-making, resource allocation, and operational practices and can also support governance strategies.

Public-Private Partnership: A long-term partnership between a government and private sector institution(s), usually created for a specific project.

R-1 Reuse: The beneficial use of R-1 recycled water, which has been oxidized, filtered, and disinfected to meet Hawai‘i Department of Health standards and is the State’s highest treatment grade for recycled water. https://health.hawaii.gov/wastewater/files/2021/10/V1_RWFacilities1.pdf

Recycled Water: Recycled water is wastewater that has been treated to a level suitable for industrial processing, irrigation and other non-drinking uses.

Resilience: The capacity to recover quickly from difficulties, bounce back from setbacks, and adapt well in the face of adversity.

Risk Intervention: An action, strategy, or project intended to reduce an identified climate risk, such as by reducing exposure or consequences, improving system performance or redundancy, or increasing adaptive capacity.

Risk Score: A quantitative score representing the relative risk to an infrastructure asset from a specific climate hazard. For an exposed asset, the score is calculated by multiplying the likelihood score (0–5) by the consequence score (1–5), resulting in a Risk Score from 0 to 25.

Scale of Impact: A project-scoring criterion from 1 to 5 based on the geographic scale a project is expected to protect: site/block, community, ahupua‘a, moku, or island-wide. Higher scores prioritize projects with broader geographic reach and, generally, benefits to more people and ecological systems.

Glossary

Sea Level Rise (SLR): The long-term increase in average ocean level. For this project, SLR impacts include the different ways rising seas can affect Oʻahu, including passive flooding, groundwater emergence and inundation, storm-drain backflow, high wave-driven flooding, and coastal erosion.

Shoreline Setback: The distance that a structure or improvement to existing structure must be located landward as measured from the shoreline.

Social Vulnerability: "Social vulnerability" considers certain socioeconomic, housing, transportation, and other variables that can be stressors that can exacerbate environmental shocks such as hurricanes, sea level rise, or extreme heat.

Social Vulnerability Index (SoVI): A place-based index used to identify communities that may be more susceptible to disasters and climate hazards based on socioeconomic, demographic, housing, transportation, and hazard-related factors. For this project, Oʻahu SoVI levels are incorporated into project prioritization so projects serving more vulnerable communities receive greater weight.

Spatial Analysis: The use of location-based data and GIS methods to evaluate geographic patterns and relationships, such as where climate hazards, infrastructure assets, community concerns, and planned projects overlap.

Storm Drain Backup: Flooding that occurs when elevated ocean levels reduce or reverse the normal gravity-driven flow through coastal storm-drain systems, allowing ocean water to move inland through drainage infrastructure and limiting the system's ability to drain runoff.

Storm Surge Intensity: The severity of the abnormal rise in coastal water generated by a hurricane or other intense storm, which can contribute to coastal inundation.

Sustainability: The ability to create harmony between natural and man-made systems to serve the needs of present generations without jeopardizing the needs of future generations or damaging nature beyond recovery.

Total Risk Score: The combined climate risk score for an asset, calculated by summing its individual Risk Scores across all evaluated climate threats.

Trigger: A defined change in condition used in the One Water Honolulu Plan to inform the timing of implementing mid-term and long-term projects and actions. For this Plan, there are three types of triggers: regulatory, financial, and physical.

Wai: Water

Watershed: A catch-basin or drainage basin for rain that funnels water into stream beds that either join other stream beds or go straight out to the ocean.

Wetland: Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Vulnerable Populations: Populations more vulnerable to climate change including, but not limited to low-income communities, geographically isolated communities, women, immigrants, Native Hawaiians, older adults, children, people with disabilities, outdoor workers, and individuals experiencing houselessness.



Executive Summary

The One Water Honolulu Plan is grounded in the idea that adapting to and reducing climate risks requires collaboration—no one City department can do this alone.

Climate resilience, the ability to withstand, recover from, and adapt to climate change impacts like extreme weather events, droughts, and rising temperatures, depends on City departments that have historically planned separately and are now planning together. The One Water Panel was formed to make that collaboration possible.

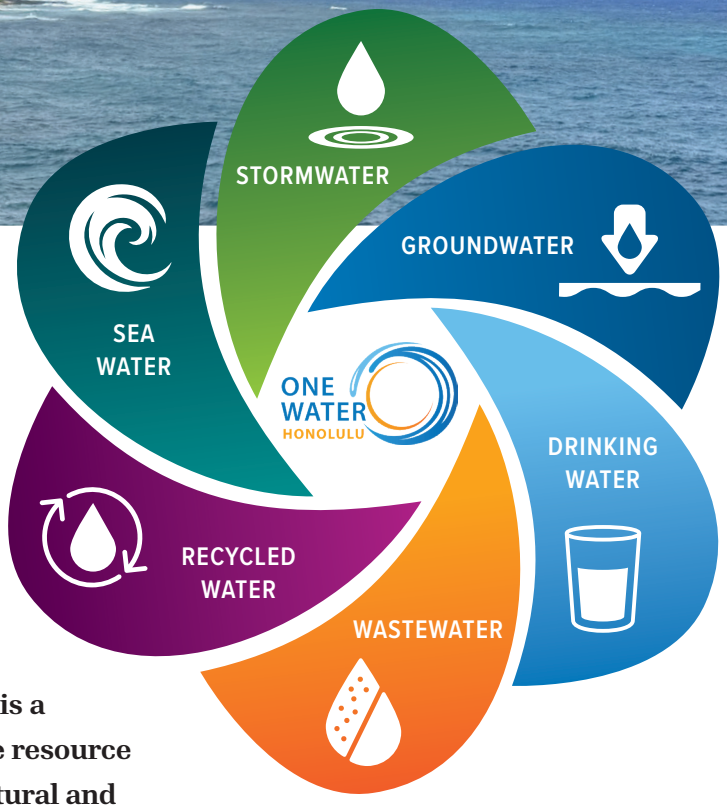
VISION

Collaborating for a thriving and climate resilient O‘ahu

MISSION

One Water Honolulu champions cost-effective and climate resilient infrastructure services and natural systems for the people, culture, and sustainability of O‘ahu through integration and innovation in planning, implementation, and maintenance.





WHY ONE WATER FOR CLIMATE ADAPTATION?

For an island community, water is at the center of planning and building for climate resilience. The City and County of Honolulu (City) is embracing a holistic approach to water and infrastructure management known as One Water to act on solutions for a Climate Ready O'ahu.

The One Water Honolulu Program (OWH Program) is a City climate adaptation initiative that aims to create resource and financial efficiencies in the face of changing natural and urban water cycles. It promotes the coordinated management of stormwater, wastewater, groundwater, seawater, drinking water, surface water, and recycled water as one integrated resource.

Elements of the OWH Program include:

- Ongoing One Water Panel efforts
- The One Water Honolulu Plan (Plan) as a living document
- Climate adaptation through a coordinated CIP
- Current and future stakeholder engagement
- Adaptive management and monitoring

The One Water Panel:

- Office of Climate Change, Sustainability and Resiliency
- Department of Planning and Permitting
- Department of Facility Maintenance
- Department of Environmental Services
- Department of Design and Construction
- Department of Parks and Recreation
- Department of Transportation Services
- Board of Water Supply

WHAT GUIDES THE ONE WATER HONOLULU PROGRAM?

One Water Honolulu builds on the City's climate resilience efforts, including the creation of the Office of Climate Change, Sustainability and Resiliency (CCSR) and the Ordinance 20-47. Ordinance 20-47, adopted in 2020, established a climate change adaptation One Water policy and an eight-agency One Water Panel (Panel) to carry out the policy. The policy helped formalize the need for coordinated action across City departments, partner agencies, the private sector, and community stakeholders. The One Water Panel advances collaboration towards aligning City projects, programs, and policies.

To this end, the Panel collaboratively developed the following objectives for the One Water Honolulu Program:

1. Practice a shared kuleana for a climate resilient O'ahu.
2. Enhance and sustain coordination to recognize interconnections and to co-create and implement projects and strategies.
3. Amplify the voices of O'ahu's people through meaningful stakeholder engagement.
4. Develop a unified roadmap and decision-making process under a One Water approach.
5. Streamline permitting processes to efficiently advance project implementation.
6. Work together to leverage resources and enable climate readiness.
7. Collectively advocate for and pursue funding to support multi-benefit projects.

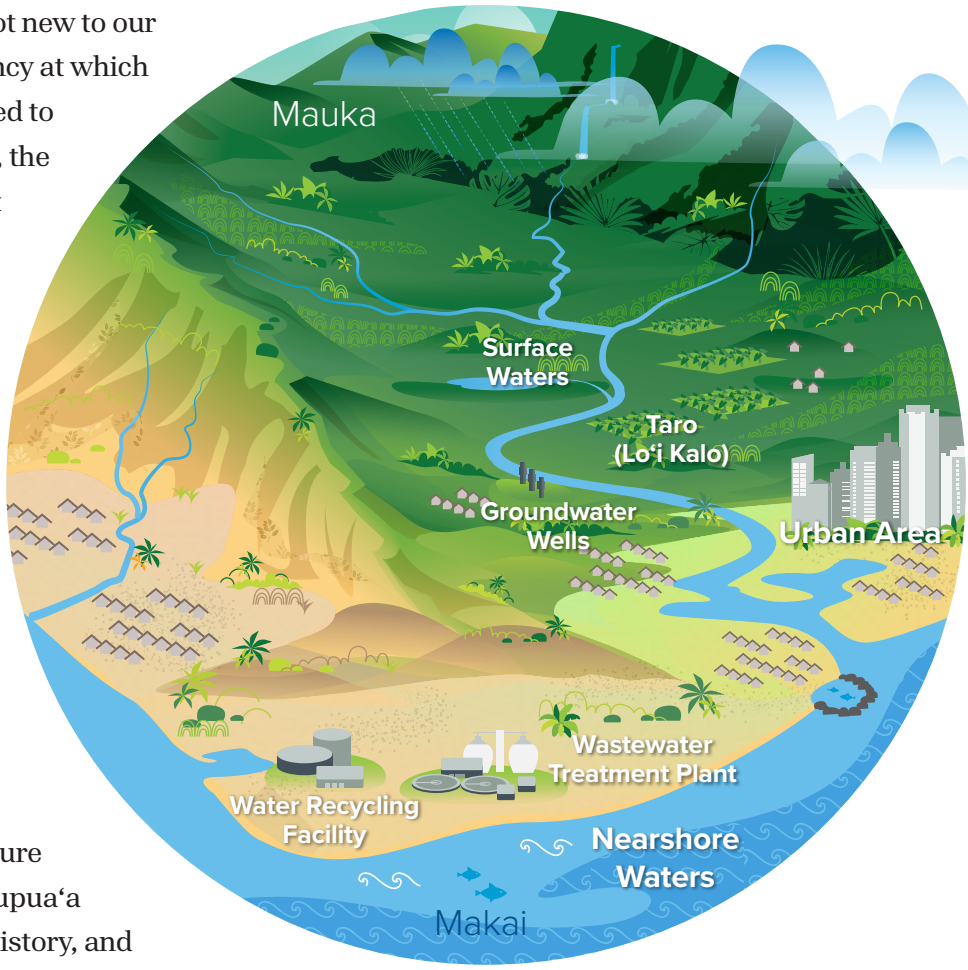
Progress to date includes an interagency coordination agreement, review of existing policies and projects to find opportunities for One Water benefits, funding and cost-sharing discussions, public outreach materials, and project and planning working groups.

Multiple efforts helped position Honolulu as a national leader in integrated water management. The One Water Honolulu Plan is the most recent step in advancing the OWH Program vision and mission.

Connecting Climate with ʻĀina and Wai

The OWH Program recognizes the holistic Hawaiian ahupuaʻa view of the natural world. Ahupuaʻa reflects a longstanding Hawaiian understanding of the relationship between ʻāina, wai, and people, from the uplands to the nearshore. Wai moves through and sustains this connected system, from the upland forest and streams to groundwater, coastal waters, and reefs. Climate change is affecting these relationships across the landscape in ways that do not follow modern jurisdictional or planning boundaries.

Although climate hazards are not new to our island, the intensity and frequency at which we experience them are expected to increase. From mauka to makai, the OWH Program is a shared effort to implement actionable steps to adapt, modernize, and maintain infrastructure, and to safeguard natural systems to enable our communities to withstand increasing climate-related impacts now and into the future.



One Water Honolulu advances projects to address climate impacts on freshwater, wastewater, and stormwater systems, integrating Native Hawaiian best practices into future adaptation. Grounded in the ahupuaʻa concept and Hawaiian values, history, and culture, this approach guides sustainable behaviors and water cycle investments to strengthen services for our communities.

WHY THE ONE WATER HONOLULU PLAN?

As a key component of the overall OWH Program, the Plan provides an adaptive management process and a set of defined projects.

The Plan is guided by the policy goals of the City's Climate Ready O'ahu strategy and takes further direction from the work of the Climate Change Commission. All City departments and agencies have been directed to use the Commission's Guidance in planning, programs, and capital improvement decisions.

The challenges we're facing in our watersheds and coastal ecosystems are inextricably linked to land use practices within City jurisdiction. Cooperation is key to addressing these issues. The City's jurisdiction covers drinking water, wastewater, stormwater, groundwater, surface water, and recycled water systems. Groundwater remains the island's only drinking water source. Wastewater and stormwater systems protect public health, nearshore waters, reefs, aquifers, roads, communities, and public safety.

Healthy watersheds, from mauka to makai, are also critical infrastructure because they regulate flows, protect water quality, reduce runoff, and buffer communities from climate impacts. Conservation of terrestrial and marine ecosystems falls primarily to State and federal agencies, however climate impacts cross boundaries at the places that matter most, shorelines and watersheds, where outcomes depend on land use practices under City jurisdiction. Cooperation among City agencies and across those lines is now fundamental to advancing resilience and building multi-benefit infrastructure.

The One Water Honolulu Plan provides a coordinated roadmap to increase resilience of City infrastructure. The Plan is intended to be a living, dynamic document that helps advance the OWH Program overarching vision, mission, and objectives.



Climate hazards can manifest as too much and too little water. Both extremes are considered within the priority hazards addressed in the Plan.

HAZARD	IMPACTS
Sea level rise	Coastal flooding, rising groundwater beneath inland neighborhoods, loss of shoreline and beach access
Heavy rain	Drainage systems capacity exceeded, stream flooding, runoff carrying sediment and pollutants to nearshore waters
Drought	Less aquifer recharge, greater irrigation demand, stressed streams and watersheds
Wildfire	Loss of watershed vegetation, followed by erosion and degraded water quality downstream
Extreme heat	Higher water demand, added stress on communities and infrastructure with the least shade and tree canopy
Hurricanes including storm surge	Combined wind, rainfall, and coastal flooding; power loss disabling pump stations and treatment plants
Tsunami	Rapid inundation of coastal infrastructure, treatment facilities, and evacuation routes

WHAT'S IN THE PLAN?

The Plan includes the following elements:

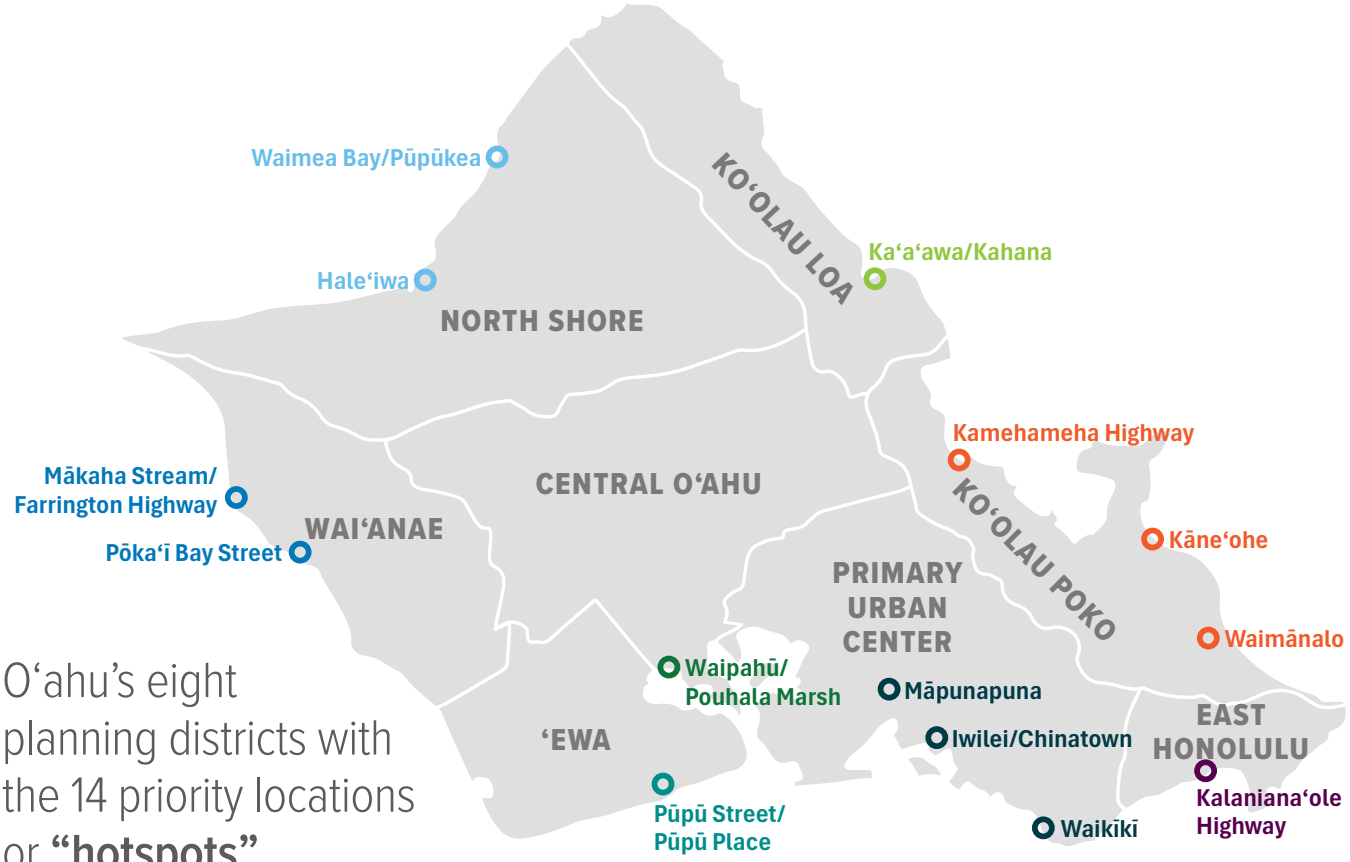
A Collaboration Framework	A set of recommendations and repeatable processes to identify who works together and how collaboration is sustained. • Recommended actions • Stakeholder identification & engagement strategies • Recommended processes
A Climate Change Adaptation Framework	A structured process that can be repeated to find where investment is needed most. • 14 priority locations- where climate risk to City water infrastructure and communities is highest, identified from an islandwide screening. • 49 recommended projects – organized into near-, mid-, and long-term timeframes, each with a proposed lead agency.
A Funding Strategy	Options to fund, sequence, and sustain project implementation
Implementation Guidance	Plan components that provide guidance for advancing the OWH Program and project implementation • Trigger-based Implementation Plan • Governance Strategies, Policies, and Recommended Actions • Private Development Guidelines

The Plan is an early step in connecting the people and the methods to advance the OWH vision. Outcomes from the above listed Plan components help answer: What needs to be done and when? Who needs to work together and how? And how can recommendations get funded and implemented? All essential pieces of a coordinated roadmap towards a climate resilient Oʻahu.

Regional Priorities and Place-Based Planning

Climate change reaches every part of O‘ahu, but it does not impact every region and community the same way. How climate hazards may impact Waikīkī is not necessarily how they impact Wai‘anae, and the solutions to overcome or avoid these impacts may not be the same.

However, there are opportunities to understand similarities across areas within regions that could enable implementing similar adaptation strategies depending on the climate hazard, land use, and area characteristics.



O‘ahu’s eight planning districts with the 14 priority locations or **“hotspots”**

Profiles were developed for each of O‘ahu’s eight districts: North Shore, Ko‘olau Loa, Ko‘olau Poko, East Honolulu, Primary Urban Center (PUC), Central O‘ahu, ‘Ewa, and Wai‘anae. These profiles connect One Water recommendations to the local land use patterns, infrastructure needs, cultural values, water conditions, and climate vulnerabilities for each region.

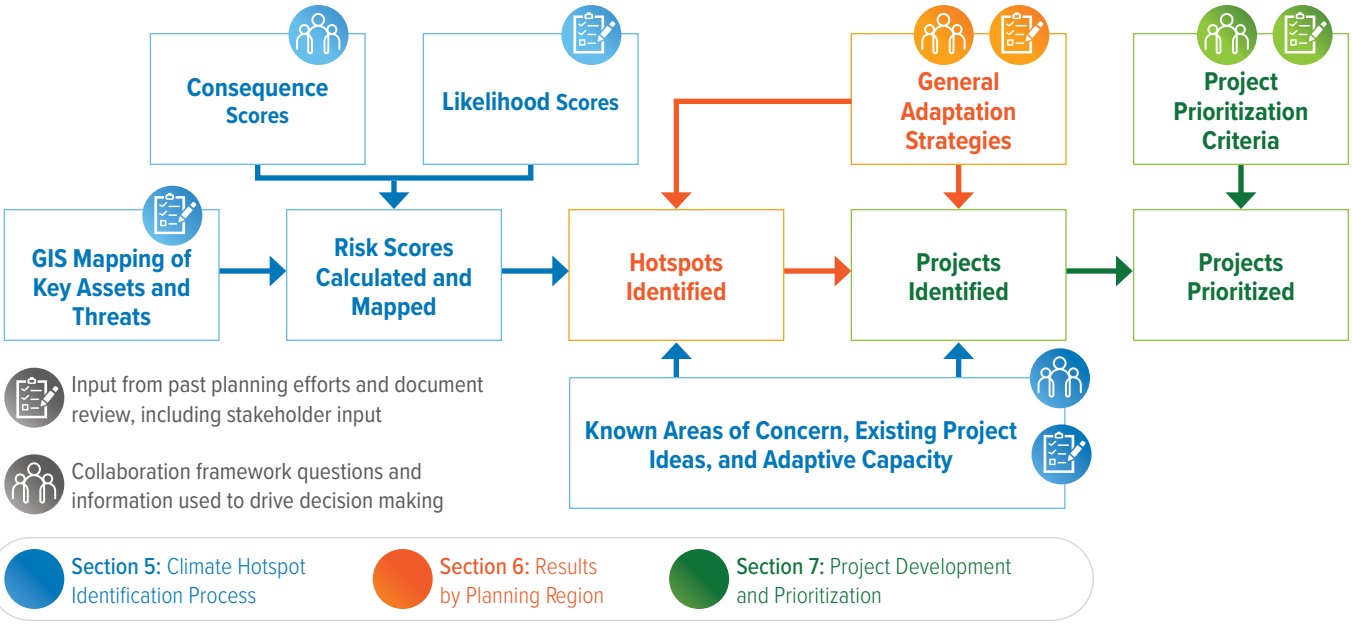
Regional differences matter for implementation, despite common islandwide needs. Densely developed urban areas face aging infrastructure, drainage built for milder rainfall patterns, urban heat, and sea level rise challenges. Rural and coastal areas face shoreline erosion that threatens the only road in or out, irrigation demand competing with limited fresh water, and stream and nearshore water quality shaped by agricultural and urban land uses upstream.



Collaboration and Climate Change Adaptation to Reduce Climate Risks

The Collaboration and Climate Change Adaptation Frameworks were developed to guide the City in how departments work together to identify and address climate risks across the regions.

The figure below summarizes the following process: To decide where to act first, more than 500,000 City assets (pipes, pumps, wells, treatment facilities, and roads) were screened for impacts from O'ahu's top climate hazards through GIS Mapping of Key Assets and Threats. Each asset received Likelihood Scores, reflecting how likely it is to be impacted, and Consequence Scores, reflecting how serious the effects would be if it failed. Together these produced Risk Scores that were calculated and mapped islandwide. Risk Scores were then combined with Known Areas of Concern, such as locations with recurring flooding, longstanding water quality issues, infrastructure gaps, and cultural resources at risk. These were also combined with efforts already underway to address climate risks identified through Existing Project Ideas and Adaptive Capacity. Analysis and collaborative decision making across City staff supported identification of Hotspots, from which projects were identified and prioritized. The project prioritization process involved identifying adaptation strategies and developing and applying prioritization criteria based on collaborative workshops and City discussions. Further details can be found in Sections 5, 6, and 7.



The guidance provided by these frameworks resulted in 92 areas of concern across the island, which were narrowed to 14 priority locations (Hotspots) where risk to infrastructure, community need, and City readiness converge most strongly:

REGION	PRIORITY LOCATION
North Shore	Haleʻiwa; Waimea Bay/Pūpūkea
Koʻolau Loa	Kaʻaʻawa/Kahana; Kamehameha Highway
Koʻolau Poko	Kāneʻohe; Waimānalo
East Honolulu	Kalanianaʻole Highway
Primary Urban Center	Waikīkī; Iwilei/Chinatown; Māpunapuna
Central Oʻahu	Waipahū/Pouhala Marsh
ʻEwa	Pūpū Street/Pūpū Place
Waiʻanae	Pōkaʻī Bay Street; Mākaha Stream/Farrington Highway

These locations provide the starting point where projects, policies, and actions can be developed to foster climate resilience across the City's departments and the communities they serve.

Outcomes: Recommended Projects

Every planning region has at least one project, and nine projects apply islandwide- most of these being near-term plans, studies, or programs.

Many near-term projects relate to ongoing City efforts, using this opportunity to build in collaboration and multiple benefits at the onset of projects and drawing the projects together under a single One Water framework. The full project list, with scores, timeframes, and proposed lead agencies, is in Section 7, and individual project factsheets are in Appendix H.

The Plan translates regional priorities and climate risk results into collaboratively developed goals, adaptation strategies, project concepts, policies, and actions for each priority location. Goals are organized around people (empowered and prepared people), ʻāina (safeguarded and stewarded ʻāina, including the management of wai), and safe and reliable infrastructure to ensure that project development reflects the resilience goals that are championed across City policies and programs.

Projects in this Plan were screened for alignment with Climate Ready Oʻahu strategies and One Water objectives, and scored based on criteria including the level of resilience, scale of impact, social vulnerability index, and community benefits. Details on the criteria and prioritization process can be found in Section 7.

The Plan recommends **49** projects

24 near-term projects to begin within the next **10** years

15 mid-term projects for the following **10** to **25** years

10 long-term projects



The recommended projects advance in part due to available funding and financing. Funding and financing strategies help determine the pace and sequence of implementation by identifying which projects can be advanced through existing programs and funding sources, which require external grants or partnerships and which may depend on future revenue sources, financing tools, or climate triggered capital investment.

The Plan connects recommended projects to existing and potential capital investments and uses regulatory, financial, and physical triggers (trigger-based implementation guidance) to help determine when actions should advance. This approach allows the City to act early where near-term benefits are clear while preparing for more transformative adaptation as conditions change. The OWH Panel and Leadership Group will need to discuss and agree upon suggested triggers that are sufficiently conservative, both currently and as conditions change, to help monitor when actions should be taken for OWH projects.

OUTCOMES: GOVERNANCE STRATEGIES, POLICIES, AND ACTIONS

Projects alone will not deliver resilience. A series of governance strategies, policies, and actions are also recommended in this Plan. These recommendations support project implementation and the progression of the OWH Program. The OWH Program is expected to mature through all of its components (listed on Page ES-2) to advance in planning, organizational culture, stakeholder engagement, informed actions, and monitoring. The full list of recommended governance strategies and actions can be found in Section 8.

The following tables provide an overview of the implementation plan elements summarized by hazard. Each of these elements is presented in more detail in Section 8.

SEA LEVEL RISE

Recommended Policy	Establish an institutional framework for sea level rise adaptation, incorporating forecasting, trigger-based actions, infrastructure hardening, flood control, and strategic retreat managed through innovative financing mechanisms under a unified One Water management model.	
Projects	**Near Term (2026-2035)**	• Road Raising Strategy (Islandwide) • Managed Retreat Legal and Policy Investigation Study (Islandwide) • Expand Tidal Groundwater Well Monitoring Network (Islandwide) • Adapt Waikīkī Phase 2 (PUC) • Iwilei Area Adaptation Plan (PUC) • Māpunapuna Area Adaptation Plan (PUC)
	Mid Term (2035-2050)	• Haleʻiwa Area Adaptation Plan (North Shore) • Beach Park Erosion and Flood Resilience (Koʻolau Loa) • Coastal Management Plan for Erosion and Flooding (Koʻolau Poko) • Māpunapuna Flood Improvements (PUC) • Kapālama Canal Linear Park (PUC) • Resilience Corridors and Road Raising (PUC)
	Long Term (Beyond 2050)	• Resilience Corridor and Pedestrian Accessibility Study (Koʻolau Poko) • Regional Shoreline Adaptation (East Honolulu) • Long-Range Post-Retreat Study (ʻEwa) • Raise Main Arterials Further Inland (ʻEwa) • Dry Flood Proof Waiʻanae High Risk Areas (Waiʻanae)
Suggested Triggers	**SLR Flooding**	• Greater than 4 inches of inundation occurring during king tides (6x per year) [Review trigger as part of OWH Project Road Raising Strategy] • Greater than 6 inches of inundation occurring during annual high-wave flooding [Review trigger as part of OWH Project Road Raising Strategy]
	Shallow and Emergent Groundwater	Groundwater levels indicate the groundwater table is less than 5 ft below grade surface [Review trigger as part of OWH Project Expand Tidal Groundwater Well Monitoring Network]
	Coastal Erosion	Increasing trend in reported damage incidents and cumulative repair costs exceeds agreed-upon threshold (to be determined)
Adaptation Strategy Checklist	Figure 8-4. Checklist for Sea Level Rise Hazard	

DROUGHT

Recommended Policy	Refine drought emergency response and preparedness plans and improve forecasting and monitoring systems. Support with diversified, climate resilient water infrastructure and expanded water conservation, reuse and watershed management programs.	
Projects	**Near Term (2026-2035)**	• Reuse Strategy for Redevelopment Areas (Islandwide) • Expand Non-Potable Water to Large Parks and Water Loss Control (Islandwide) • Waimānalo Effluent R-1 Reuse Feasibility Study (Koʻolau Poko) • New Aloha Stadium Entertainment District (NASED) Regulatory Requirements for Reuse (PUC) • Ala Wai Golf Course Non-Potable Irrigation Study (PUC) • Nuʻuanu Reservoir Hydro Managed Aquifer Recharge (PUC) • Reuse and Potable Water Services for Whitmore Agriculture (Central Oʻahu) • Central Oʻahu Water Recycling Facilities, Mililani (Central Oʻahu) • Potable Reuse Pilot at Honouliuli (ʻEwa)
	Mid Term (2035-2050)	• Stormwater Retention, Recharge, and Reuse in Mauka Lands (North Shore) • Marine Corps Base Hawaiʻi (MCBH) R-1 Recycled Water Upgrade (Koʻolau Poko) • Honouliuli R-1 Distribution System Expansion (Central Oʻahu)
	Long Term (Beyond 2050)	• State Agriculture Water System Connection to Future R-1 (Koʻolau Poko)
Suggested Triggers	Recurring Water Shortage Caution Conditions (Stage 1) Recurring Water Shortage Alert Conditions (Stage 2) Recurring Water Shortage Critical Conditions (Stage 3) 12 months with 12-month Standardized Precipitation Index (SPI) <-0.8 (D1-D2: Moderate to Severe Drought) 12 months with 12-month SPI <-1.6 (D3-D4: Extreme to Exceptional Drought) 24 months with 12-month SPI <0.8 (Persistent D1-D2: Moderate to Severe Drought)	
Adaptation Strategy Checklist	Figure 8-5. Checklist for Drought Hazard	

HEAVY RAIN

Recommended Policy		Develop and implement the Stormwater Master Plan to help improve and maintain the City's drainage infrastructure to protect life, public health, property and repetitive loss areas from flood hazards, and adopt the Stormwater Fee to finance drainage and stormwater green infrastructure projects.
Projects	**Near Term (2026-2035)**	• Stormwater Master Plan (Islandwide) • Green Infrastructure Implementation Plan (Islandwide) • Stormwater Utility Fee (Islandwide) • Onsite Stormwater Management Incentives (Islandwide) • Country Town Resilient Sidewalk & Path Improvements for Unimproved Roadways (Islandwide) • University Avenue Urban Complete Streets and Green Infrastructure (PUC) • Iwilei Area Adaptation Plan (PUC) • Māpunapuna Area Adaptation Plan (PUC) • Adapt Waikīkī Phase 2 (PUC) • Ala Wai Watershed Integrated Stormwater Management (PUC)
	Mid Term (2035-2050)	• Projects from the Integrated Plan (Islandwide) • Haleʻiwa Area Adaptation Plan (North Shore) • Stormwater Retention, Recharge, and Reuse in Mauka Lands (North Shore) • Stormwater Retention along Kamoʻoaliʻi Stream (Koʻolau Poko) • Waimānalo Roads Drainage Study and Improvements (Koʻolau Poko) • Kahawai Stream Restoration Strategy (Koʻolau Poko) • Stream Restoration and Rehabilitation (East Honolulu) • Pilot Floodable Spaces (PUC) • Iwilei Drainage Improvements (PUC) • Resilience Corridors and Road Raising (PUC)
	Long Term (Beyond 2050)	• Increase Green Infrastructure and Green Space (Waiʻanae) • Dry Flood Proof Waiʻanae High Risk Areas (Waiʻanae) • Mākaha Roads Drainage Study and Improvements (Waiʻanae) • Mākaha Stormwater Infrastructure (Waiʻanae)

Suggested Triggers	• Greater than 4 inches of inundation occurring on roadways more than 2x in 5 years. • More than 2 flooding events in 10 years exceeding the expected recurrence interval. • Observed rainfall events over 10 years exceed Atlas 14 precipitation intensities by 5% • Observed rainfall events over 10 years exceed Atlas 14 precipitation intensities by 15%
Adaptation Strategy Checklist	Figure 8-6. Checklist for Heavy Rain Hazard

EXTREME HEAT

Recommended Policy	Require major public facilities, transit areas, schools, parks, and affordable housing projects to analyze heat impacts to human health and infrastructure functionality, and to provide options for heat reduction by incorporating measures such as increasing shading of parking lots and streets, considering cooling solutions for roadway surfaces, and increasing tree planting and ground cover.	
Projects	**Near Term (2026-2035)**	• Green Infrastructure Implementation Plan (Islandwide) • Country Town Resilient Sidewalk & Path Improvements for Unimproved Roadways (Islandwide) • Iwilei Area Adaptation Plan (PUC) • Māpunapuna Area Adaptation Plan (PUC) • University Avenue Urban Complete Streets and Green Infrastructure (PUC)
	Mid Term (2035-2050)	• Hale‘iwa Area Adaptation Plan (North Shore) • Resilience Corridors and Road Raising (PUC)
	Long Term (Beyond 2050)	• Increase Green Infrastructure and Green Space (Wai‘anae)
Suggested Triggers	• More than 5 days/year with a Wet Bulb Globe Temperature (WBGT) above 80°F • One Heat Event or Greater than 3 days/year with WBGT above 85°F	
Adaptation Strategy Checklist	Figure 8-7. Checklist for Extreme Heat Hazard	

WILDFIRE

Recommended Policy	Develop, formalize and regularly update an action plan for proactive wildfire management, community planning, risk mitigation, emergency response, resilient infrastructure hardening, and community partnerships.	
Projects	**Near Term (2026-2035)**	• Develop Cooperative Fireshed Partnerships (Wai‘anae)
	Mid Term (2035-2050)	• Hale‘iwa Area Adaptation Plan (North Shore)
	Long Term (Beyond 2050)	• No current projects identified
Suggested Triggers	• New Very High Risk areas • New High Risk areas • New Medium Risk areas • Number of ignitions increases by 10%	
Adaptation Strategy Checklist	Figure 8-8. Checklist for Wildfire Hazard	

Funding and Financing

Implementation of the One Water Honolulu Plan in the near term will rely primarily on existing City capital planning and funding processes while building the governance, institutional capacity, and funding tools needed to support long-term climate resilience.

Although this Plan does not seek to establish a separate capital program, that remains an option to consider in future efforts and/or Plan revisions. For now, One Water projects will be programmed, prioritized, and funded through participating departments' existing Capital Improvement Programs (CIPs), budgets, and implementation processes in the near-term and perhaps mid-term. Climate resilience priorities must therefore be integrated into departmental planning, CIP development, and Citywide budgeting decisions if One Water goals are to be achieved.

A funding assessment was conducted as part of this Plan (further details in Section 8 and Appendix K) and identified several barriers to implementation:

- Funding and capital planning remain fragmented across departments, climate adaptation investments compete with other infrastructure and operational priorities, and multi-benefit resilience projects often span multiple agencies without fitting neatly into existing funding programs.
- Grant development efforts are decentralized, and the City currently lacks an established funding structure dedicated to coordinating cross-department resilience investments.

One Water projects generate benefits across multiple departments and infrastructure systems, creating challenges related to funding responsibility, cost sharing, ownership, and long-term operations and maintenance.

As a result, adaptation investments often compete with aging infrastructure replacement, regulatory requirements, and other community priorities.



FUNDING ENVIRONMENT: OPPORTUNITIES AND CHALLENGES

Honolulu faces interconnected challenges related to limited funding capacity, workforce constraints, fragmented responsibilities, and the absence of dedicated resilience funding sources for One Water projects. The good news is that many of the near-term projects identified in the Plan are already aligned with existing departmental priorities. The City is already investing in flood management, water supply reliability, watershed protection, infrastructure replacement, and adaptation planning projects that contribute to resilience objectives. The One Water Honolulu Plan builds upon these existing efforts by bringing them together under a coordinated framework that identifies shared benefits, strengthens collaboration, and supports long-term resilience outcomes.

The City may be able to access a diverse portfolio of external funding opportunities that align well with One Water priorities, including grants, low-interest financing, and technical assistance programs from EPA, FEMA, U.S. Bureau of Reclamation, USDA, NOAA, and the State of Hawai‘i. **Despite these opportunities, projected climate adaptation needs are anticipated to exceed currently available funding.**

Existing funding mechanisms, including General Fund appropriations, CIP funding, bond financing, utility revenues, state appropriations, grants, and loan programs, have successfully supported traditional infrastructure investments but were not designed to advance integrated, multi-agency resilience projects.

STRATEGIC FUNDING DIRECTION

While a variety of funding tools are available, stronger coordination, prioritization, grant management, and long-term investment planning are needed to address the scale of future climate resilience needs. The recommended strategy is to continue to advance near-term, priority resilience projects through existing funding mechanisms while building the institutional framework required for long-term implementation.

KEY ACTIONS INCLUDE:

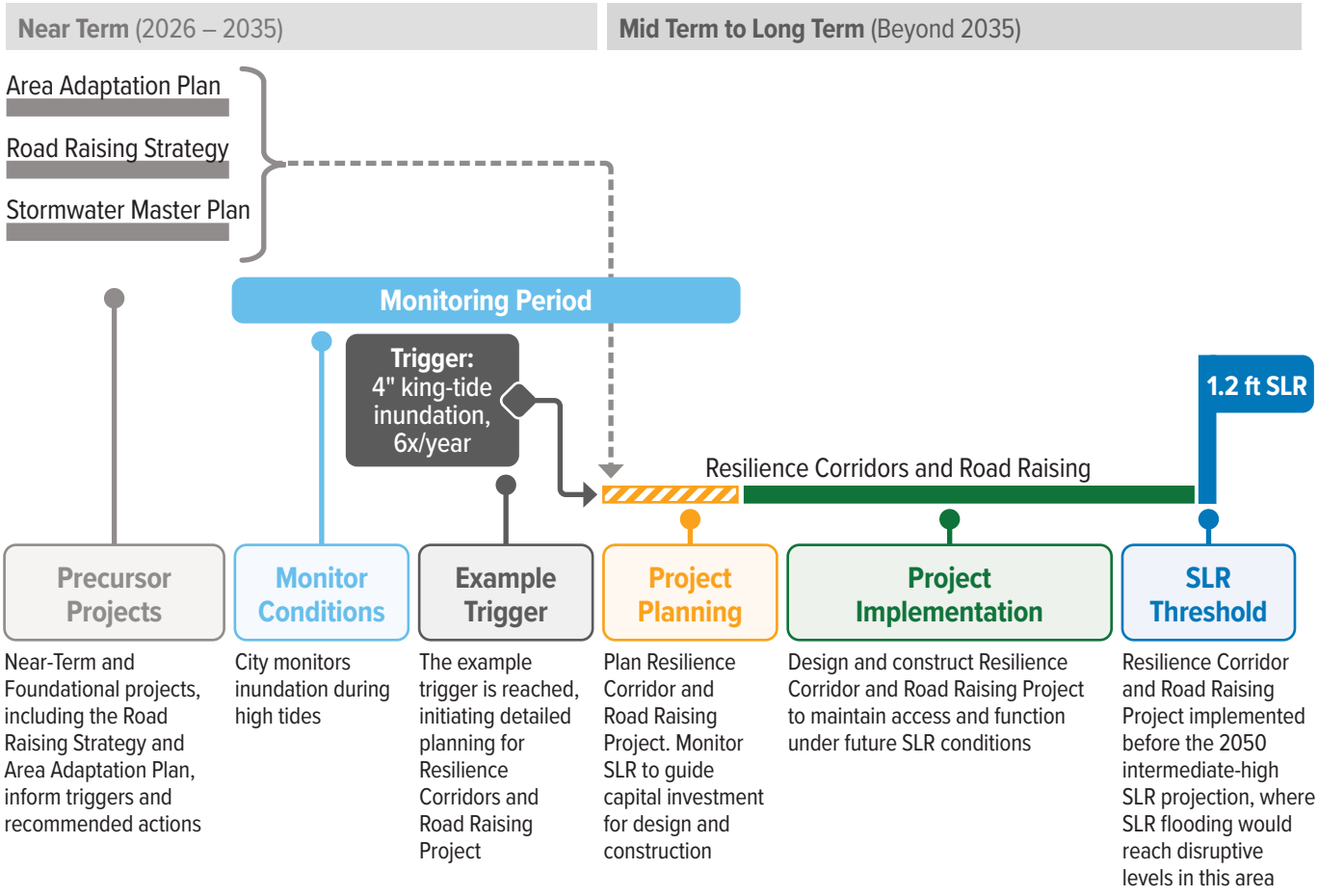
- Establishing a coordinated One Water funding and CIP working group.
- Integrating climate resilience screening and budget tagging into capital planning and budgeting processes.
- Improving project readiness, grant coordination, and prioritization of multi-benefit projects, while evaluating opportunities for project packaging.
- Strengthening cross-department cost-sharing, project ownership, and long-term operations and maintenance planning.
- Evaluating dedicated funding and financing mechanisms, including expanding the use of existing mechanisms, to support future resilience investments.



Moving from Plan to Action

By aligning City agencies, partner organizations, private development, and community concerns, the Plan provides a roadmap for coordinated projects, policies, actions, funding options, and adaptive decision-making that can strengthen O‘ahu’s long-term climate resilience. The projects, policies, and actions identified herein are a starting point for the City, with guidance provided for funding and implementation that can be replicated for future projects.

Understanding how to sequence projects and interconnected processes forms a key foundation of this roadmap. Below is an example of the implementation process where triggers are applied to adaptation projects to help identify when a project should be planned and implemented to avoid adverse climate change impacts. Moving forward, the Panel will need to discuss and decide on which triggers and thresholds should be used to enable proactive adaptation and a more climate resilient O‘ahu.



A sequence of projects for each regional planning district provides the collective roadmap and supports the collaboration and timing of project implementation. Further guidance is provided through checklists for adaptation strategies for each climate hazard to support a replicable process for future project development and to understand potential triggers that may require a shift in what kinds of actions are taken to adapt to climate risks. This Plan delivers the analysis, the project list, and the frameworks. The One Water Honolulu Program will carry out this Plan.

Advancing the recommended next steps is part of building a stronger One Water Honolulu Program. A stronger program, in turn, enables the City and its stakeholders to better work together towards a climate ready O‘ahu.



THE FOLLOWING ARE RECOMMENDED NEXT STEPS



PRESENT – 3 YEARS

- Review and decide on climate condition thresholds to avoid for (e.g., specific sea level to avoid) and agree on initial triggers to monitor these conditions.
- Establish and continuously carry out monitoring of triggers for specific areas and projects.
- Continue leveraging concurrent stakeholder engagement efforts and consider key themes from the community in the OWH Program and related efforts moving forward.
- Consider implementing and formalizing the recommended program-level and project-specific processes in Appendix A (Collaboration Framework).
- Consider the provided islandwide profile and Regional District Profiles in other near-term climate adaptation efforts and in near-term development of One Water projects.
- Consider the prioritized hotspots in other near-term relevant efforts.
- Consider the risk scores and known areas of concern information in other near-term relevant efforts.
- Implement Governance Strategies supporting actions recommended for the Present – 3 Years timeframe *(refer to Section 8.1 for the list of actions)*.

3 – 5 YEARS

- Implement Governance Strategies supporting actions recommended for the 3 – 5 Years timeframe *(refer to Section 8.1 for the list of actions)*.

5 – 10 YEARS

- Update the islandwide profile and Regional District Profiles as necessary based on changing conditions and in future Plan updates.
- Repeat the provided prioritization process for future prioritization of hotspots as needed.
- Repeat this project development and prioritization process as needed and in future Plan updates.
- Develop the 10-Year update of the OWH Plan.

ONGOING (PRESENT – 25+ YEARS)

- Implement near-term, mid-term, and long-term recommended OWH policies, projects, plans, studies, and programs.
  - Advance project implementation through funding, feasibility analysis, or further scoping.
- Update the islandwide profile and Regional District Profiles as necessary based on changing conditions and in future Plan updates.
- Utilize the One Water Implementation Plan guidance including triggers, project sequencing, checklists, and funding strategy to inform decisions and formalize an institutional framework.
- Throughout the One Water Honolulu Program, pursue timely engagement of stakeholder groups — informed by aligning major decisions and actions.
- Implement Governance Strategies supporting actions recommended as Ongoing *(refer to Section 8.1 for the list of actions)*.

Closing Perspective

The impacts of climate change on O‘ahu’s water infrastructure and our island community were the primary driver for this Plan. Climate impacts involve too much or too little water, and by managing water in all its forms through a One Water lens, we can collectively help strengthen O‘ahu’s resilience for future generations.

An important outcome of this effort was the development of a proposed and repeatable City framework for collaboration and adaptation.

This Plan is a key early step in advancing the OWH Program and bolstering program elements including:

- Ongoing One Water Panel efforts
- One Water Planning
- Climate adaptation through a coordinated CIP
- Current and future stakeholder engagement
- Adaptive management and monitoring

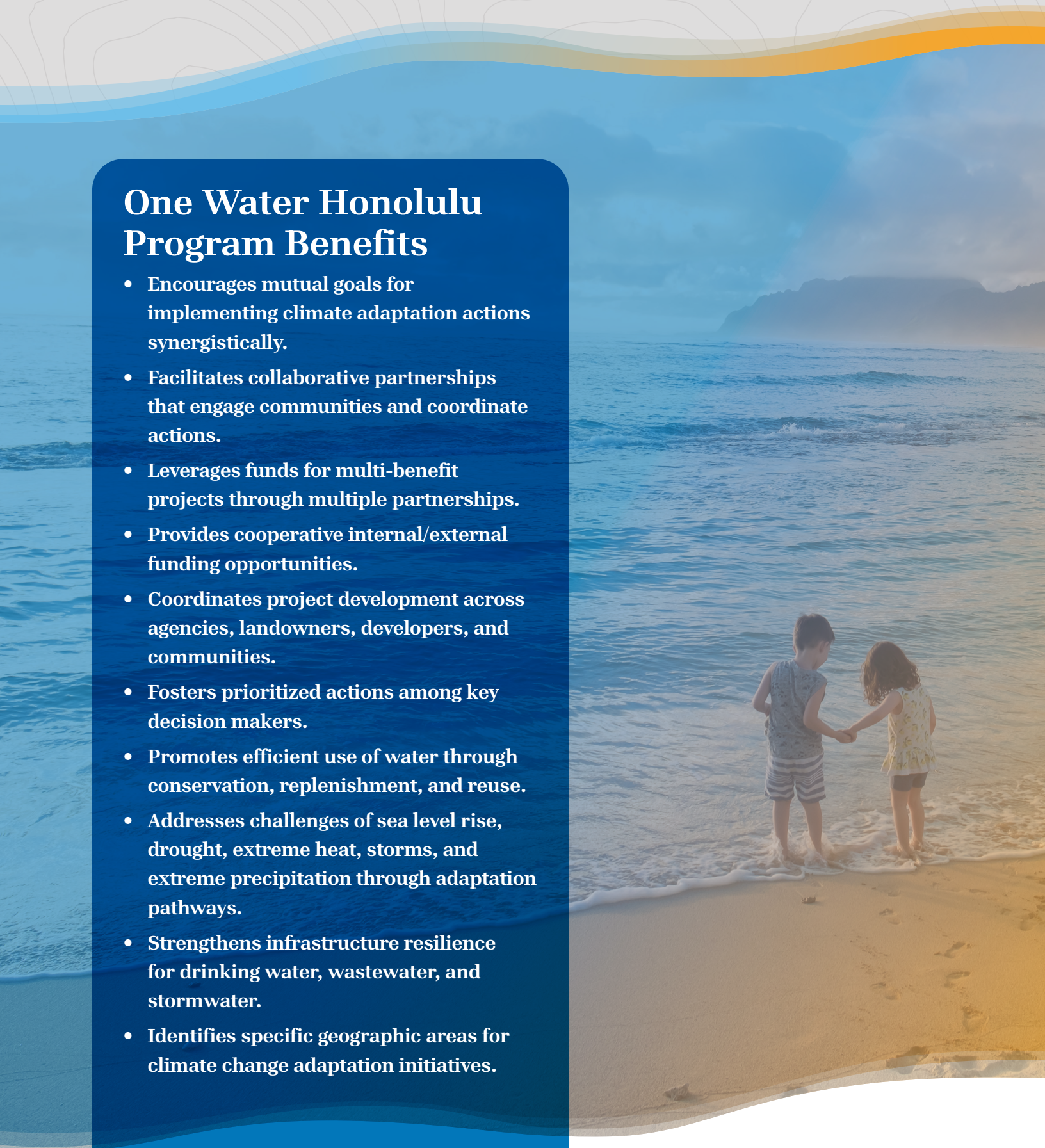
Success will depend on sustained collaboration, continued community engagement, reliable funding, coordinated decision-making, and the ability to adjust as climate conditions, community needs, and implementation opportunities evolve.

By working together to advance the City’s climate resilience strategy, One Water Honolulu supports the broader recognition that a climate ready O‘ahu is one where:

- all people are empowered with the knowledge, tools, and resources to prepare for climate impacts,
- connections between people and native ecosystems are cultivated so the ‘āina (land and natural systems, including water) is safeguarded for generations to come, and
- infrastructure works with natural systems to keep people safe from climate hazards at home, at work, and everywhere in between.

One Water Honolulu Program Benefits

- Encourages mutual goals for implementing climate adaptation actions synergistically.
- Facilitates collaborative partnerships that engage communities and coordinate actions.
- Leverages funds for multi-benefit projects through multiple partnerships.
- Provides cooperative internal/external funding opportunities.
- Coordinates project development across agencies, landowners, developers, and communities.
- Fosters prioritized actions among key decision makers.
- Promotes efficient use of water through conservation, replenishment, and reuse.
- Addresses challenges of sea level rise, drought, extreme heat, storms, and extreme precipitation through adaptation pathways.
- Strengthens infrastructure resilience for drinking water, wastewater, and stormwater.
- Identifies specific geographic areas for climate change adaptation initiatives.



READER'S GUIDE: HOW TO USE THE PLAN AND APPENDICES

The Plan provides concise narrative, key findings, recommended projects, policies, actions, and a roadmap for implementation. The appendices provide supporting documentation of technical methods, regional planning informational details, project development process, proposed sequence for project implementation, and funding options.

The table below shows what readers can find within each major part of the Plan.

PLAN SECTIONS	WHAT CAN YOU USE THIS FOR?	SUPPORTING APPENDICES
SECTIONS 1–2: Purpose, governance, and collaboration	Understand the One Water approach, coordination structure, recommended stakeholder engagement, and program- and project-level collaboration tools and processes.	Appendix A
SECTIONS 3–4: Climate, water systems, data, and regional context	Be able to trace islandwide and regional findings to the data review, data gaps, planning context, and detailed regional summaries.	Appendices B and C
SECTIONS 5–6: Risk screening, hotspot identification, and priority location goals	Find information on the climate risk screening methodology and approach, including incorporation of community themes and known areas of concern to identify hotspots and detailed priority location profiles.	Appendices D, E, and F
SECTION 7: Project development, prioritization, policies, and actions	See how identified hotspots (priority locations) and collaboratively developed goals guide the development of projects.	Appendices G and H
SECTION 8: Implementation, triggers, CIP alignment, and funding	See which policies and governance strategies can advance implementation. Understand how projects, policies, and actions move toward funding, delivery, monitoring, operations, maintenance, and long-term stewardship.	Appendices I and K

LEGEND: Collaboration Framework Climate Change Adaptation Framework Implementation Guidance

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1 | Introduction

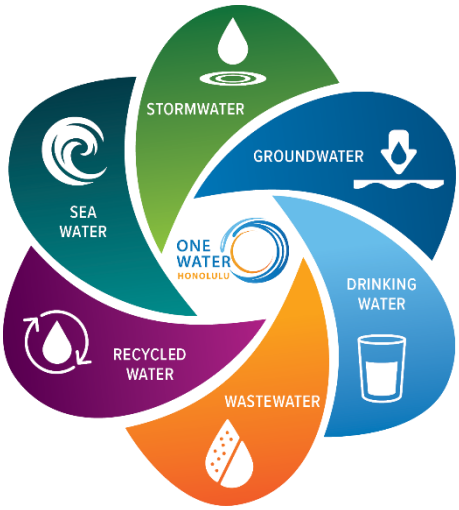
The One Water Honolulu Program and Plan support the One Water approach, focusing on collaboration strategies for integrating all forms of water to support the community and environment.

PURPOSE

This section introduces the One Water approach and how Honolulu has advanced it by building on existing planning efforts and through early establishment of a One Water policy and One Water Honolulu Panel. The One Water Honolulu vision, mission, and objectives are presented along with the values that ground this programmatic effort. The introduction closes with a brief overview of the components of the One Water Honolulu Plan, which is a key piece of the ongoing program.

1.1 WHAT IS ONE WATER?

All water has value. The One Water approach focuses on collaboration strategies for integrating all water – stormwater, groundwater, sea water, wastewater, recycled water, and drinking water – to support community and the environment. One Water Honolulu integrates responsibilities across a broad range of partners to tackle climate change impacts collaboratively.



1.2 ONE WATER HONOLULU PROGRAM BACKGROUND

ORIGINS OF THE ONE WATER HONOLULU PROGRAM

The origins of One Water Honolulu are closely linked with the 2016 City and County of Honolulu's (City's) creation of the Office of Climate Change, Sustainability and Resiliency (CCSR) which seeks to build a resilient island community and support the City in creating a safer and economically self-sufficient Oʻahu.

CCSR leverages local information from scientists to track climate change science and potential impacts to City facilities. Its role includes coordination of actions and policies of departments within the City to increase community preparedness, protect economic activity, protect coastal areas and beaches, and to develop resilient infrastructure to adapt to the effects of climate change. Additionally, CCSR is tasked with integrating sustainable and environmental values into City plans, programs, and policies. CCSR serves in a coordination and facilitation role helping with policy development and alignment of climate adaptation projects and investments and public outreach concerning climate change issues.

In 2020, Ordinance 20-47 was adopted, defining a climate change adaptation One Water policy for the City and establishing an eight-agency One Water Panel (Panel) including CCSR to carry out and implement the policy. The adoption of Ordinance 20-47 led to the start of the One Water Honolulu Program (OWH Program), which started with a structured series of workshops with the Panel to identify water management collaboration opportunities and an initial One Water vision.

A major component of climate adaptation, particularly concerning the protection of critical infrastructure on the island of O‘ahu, involves City agencies with jurisdiction and responsibility for protecting O‘ahu's critical infrastructure through planning and implementation of adaptation measures. These agencies are members of the Panel and include:

- CCSR
- Department of Planning and Permitting (DPP)
- Department of Facility Maintenance (DFM)
- Department of Environmental Services (ENV)
- Department of Design and Construction (DDC)
- Department of Parks and Recreation (DPR)
- Department of Transportation Services (DTS)
- Board of Water Supply (BWS)

The OWH Program, aims to create resource and financial efficiencies in the face of changing natural and urban water cycles. It promotes the coordinated management of stormwater, wastewater, groundwater, sea water, drinking water, surface water, graywater, and recycled water as one integrated resource. Infrastructure such as roadways, buildings, parks, trees, treatment plants, pumping stations, water distribution systems, drainage, and wastewater collection systems are considered within the One Water Honolulu approach.

The approach utilizes the best available science and climate design standards to inform planning and implementation of projects.

Since the inception of the One Water Panel in 2020, interdepartmental collaboration has built the foundational elements to formalize integration of City efforts.

As a result of the initial OWH Program efforts, the City received the 2022 US Water Alliance’s US Water Prize in the Outstanding Public Sector Organization category in recognition of this collaborative framework.

As part of Ordinance 20-47, an Annual Report to the council is required, detailing compliance with the One Water climate resilience policy, and the principles and procedures included therein, during the prior calendar year. The principles and procedures contained in Ordinance 20-47 as related to One Water serve as helpful metrics to regularly gauge the progress of One Water efforts. Progress to date includes foundational elements that support and formalize collaboration within the City such as 1) signing a Memorandum of Understanding (MOU) establishing collaborative objectives and shared approaches to integrating One Water benefits and climate change resilience into appropriate City projects and programs, and 2) identifying Capital Improvement Program (CIP) projects and multi-benefit opportunities that could potentially add One Water benefits, among many other efforts.

ONE WATER HONOLULU PROGRAM AND PLAN PURPOSE

One Water Honolulu recognizes that O‘ahu faces unprecedented climate challenges that require increased collaboration, coordination, and leveraging of resources. Collaboration within the City and with key partners as outlined in Ordinance 20-47 and the One Water Panel MOU will enable better engagement and alignment with stakeholders, including the state, federal government, and the private sector. To this end, the Panel collaboratively developed the vision, mission, and objectives for the One Water Honolulu Program.

VISION

Collaborating for a thriving and climate resilient O‘ahu

MISSION

One Water Honolulu champions cost-effective and climate resilient infrastructure services and natural systems for the people, culture, and sustainability of O‘ahu through integration and innovation in planning, implementation, and maintenance.

The OWH Program consists of:

- The One Water Honolulu Plan (Plan) as a living document
- The One Water Panel and its ongoing efforts
- Collaboration Framework for stakeholder engagement
- A 30-year list of climate resilience projects
- Continuous Monitoring via a OWH Program Annual Report, living OWH Plan, and adaptive management

As a key part of the One Water Honolulu Program, the One Water Honolulu Plan (Plan) provides a coordinated roadmap to increase resilience of City infrastructure in support of Climate Ready O‘ahu (more details on Page 1-8). The Plan provides an adaptive management process and a set of defined projects to advance the One Water Honolulu overarching vision, mission, and objectives.

OBJECTIVES

The One Water Honolulu Program aims to achieve the following objectives. Further information on each objective can be found in Appendix A, Section A.1:

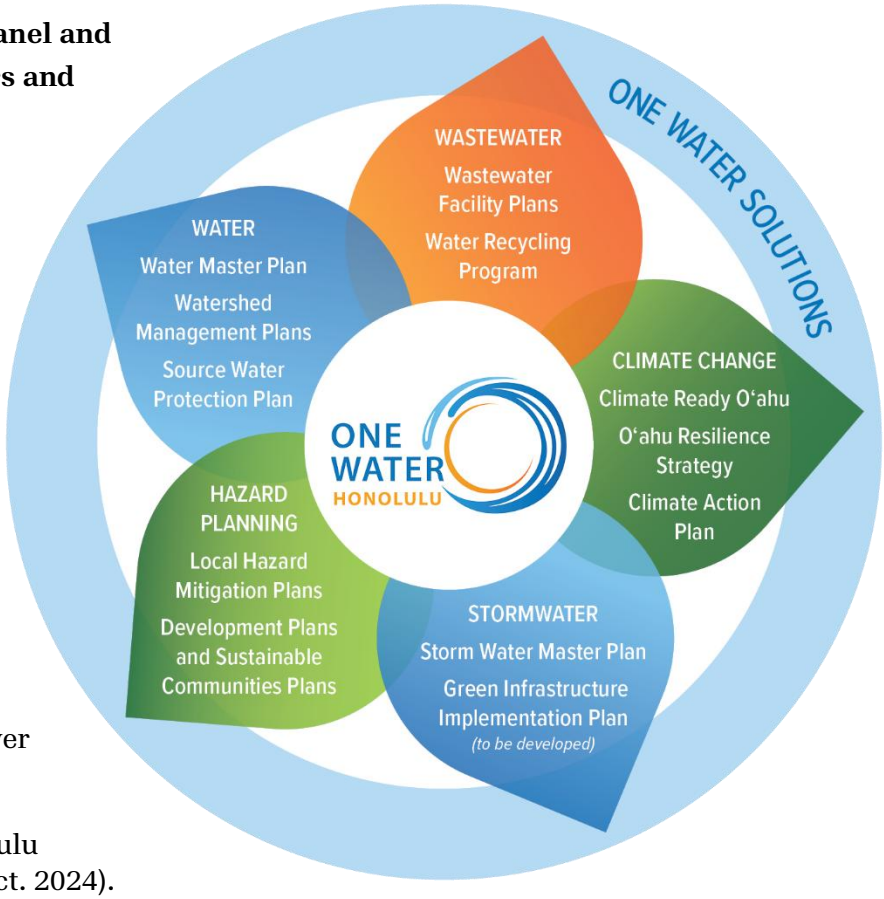
1	**Practice a shared kuleana for a climate resilient Oʻahu.**
2	**Enhance and sustain coordination to recognize interconnections and to co-create and implement projects and strategies.**
3	**Amplify the voices of Oʻahu's people through meaningful stakeholder engagement.**
4	**Develop a unified roadmap and decision-making process under a One Water approach.**
5	**Streamline permitting processes to efficiently advance project implementation.**
6	**Work together to leverage resources and enable climate readiness.**
7	**Collectively advocate for and pursue funding to support multi-benefit projects.**

The One Water Honolulu Plan is an important early step in advancing the program vision and objectives.

BUILDING FROM EXISTING PLANNING EFFORTS

The City, through its One Water Panel and ongoing work with agency partners and community, has cemented its commitment to working together towards a resilient water future.

Relevant past and concurrent efforts for climate resilience across the City include those listed in the figure and list below:



- Joint BWS and ENV incentivization of water efficiency in homes and buildings.
- ENV completion of climate change and vulnerability assessments as part of the Sand Island, Waianae, and Kailua Sewer Basins Facilities Plans.
- Adoption of the BWS East Honolulu Watershed Management Plan (Oct. 2024).
- Update of the City's 2021 Climate Action Plan (CAP) for the new period 2025-2030.
- Ordinance 25-23 which establishes a voter-approved Climate Resiliency Fund.
- Ordinance 22-17 which establishes a Better Buildings Benchmarking Program for energy and water usage reporting for large buildings within Honolulu.

One Water Honolulu supports and builds upon Climate Ready O'ahu while considering efforts across City departments and partner agencies.

- Development of Climate Change Design Guidelines for City facilities to screen for, address, and mitigate climate change impacts.
- DFM preparation of a Storm Water Strategic Plan 2023-2028 to guide and prioritize City stormwater investments and programs.
- Update of the City's Local Hazard Mitigation Plan 2025 (LHMP) documenting the progress on mitigation plans.
- ENV development of Integrated Planning Feasibility Report (2025) and current development of Integrated Plan.
- The Honouliuli Water Recycling Facility was constructed in 2000 and can produce up to 12 million gallons of recycled water per day. It is capable of producing R-1 recycled water for irrigation and reverse osmosis recycled water for industrial uses.
- DPP has created a new class of Special Area Plans called Area Adaptation Plans (AAP) to address the specific challenges of adapting city land use practices, infrastructure, and building guidelines to climate change. Adapt Waikīkī 2050 is the first AAP under development.

Building on these efforts, the One Water Panel has advanced interactions between partner departments, relationship-building, and discovery and integration of shared goals. Individual departments have continued to meaningfully participate and strengthen connections resulting in multiple early accomplishments and success stories.

PLANNING FOR O'AHU'S PEOPLE, 'ĀINA, AND INFRASTRUCTURE

Climate change is already having major impacts today and is an increasing threat to O'ahu's future. A brief description of climate hazards and impacts to O'ahu is provided on Page 1-11.

The One Water Honolulu Plan is guided by the policy goals of the City's Climate Ready O'ahu Strategy and takes further direction from the work of the City Climate Change Commission.

Climate Ready Oʻahu

Because of One Water Honolulu's focus on tackling climate change impacts collaboratively, the Plan is guided by the three-part vision statement of the Cityʻs climate adaptation strategy, Climate Ready Oʻahu:

Empowered and Prepared People	All people are empowered with the knowledge, tools, and resources to prepare for climate impacts
Safeguarded and Stewarded ʻĀina	Connections between people and native ecosystems are cultivated so the ʻāina (land and natural systems, including water) is safeguarded for generations to come
Safe and Reliable Infrastructure	Infrastructure works with natural systems to keep people safe from climate hazards at home, at work, and everywhere in between.

Climate Ready Oʻahu (CRO**)** was completed in 2024. This strategy presents a science-based, community-driven framework for climate adaptation on Oʻahu. It contains a detailed list of strategies, policies, and actions the City can take to prepare, protect, and safeguard Oʻahu's people, ʻāina, and infrastructure from climate hazards. While the 12 strategies and 57 Actions in CRO were crafted for the City and its partners as implementors, it also identifies related actions that individual residents, businesses, and community organizations can take. The Plan supports and advances many of the strategies and actions in CRO.

Throughout the One Water Honolulu Plan, efforts and recommendations that support CRO strategies are highlighted.

One Water Honolulu-related CRO Strategies include:

Empowered and Prepared People

STRATEGY 4:
Center equity in climate change adaptation. *(CRO, Page 61)*

Safeguarded and Stewarded ʻĀina

STRATEGY 5:
Strengthen climate resilience of beach and wetland ecosystems through preservation and restoration. *(CRO, Page 68)*

STRATEGY 6:
Improve watershed health to mitigate wildfire risk and manage flooding. *(CRO, Page 74)*

STRATEGY 7:
Strengthen fresh water security by improving water conservation and reuse. *(CRO, Page 81)*

Safe & Reliable Infrastructure

STRATEGY 9:
Integrate climate resilience into City capital planning, operations, and policies. *(CRO, Page 96)*

STRATEGY 10:
Safeguard buildings, homes, and infrastructure against climate hazards. *(CRO, Page 102)*

STRATEGY 11:
Reduce flood risk and coastal erosion by directing development to safer and higher ground. *(CRO, Page 112)*

STRATEGY 12:
Keep our communities cool as temperatures rise and during heat waves. *(CRO, Page 117)*

Guidance from the City Climate Change Commission

In accordance with the City Charter, the City Climate Change Commission (Commission) is charged with gathering the latest science and information on climate change impacts to Hawai‘i, with a focus on O‘ahu. They also provide advice and recommendations to the mayor, City Council, and executive departments as they look to draft policy and engage in planning for future climate scenarios.

An important guidance document is the Commission’s Climate Change Brief, first adopted in 2018. **The brief provides a foundation for guidance and recommendations from the Commission, and a resource for the community to understand and assess the types and timing of climate change impacts.** The brief is updated every several years, most recently in 2023 It presents updated findings of peer-reviewed scientific literature on past, present, and projected climate change, including trends, events, observed and anticipated impacts. It highlights both global conditions and those specifically known to O‘ahu and Hawai‘i using credible, data-based sources and peer-reviewed model results.

All City departments and agencies have been directed to use the Commission’s Guidance related sea level rise in planning, programs, and capital improvement decisions. The Climate Change Brief along with additional Commission guidance documents can be accessed via the CCSR website.

1.3 OWH VALUES GROUNDED IN LIVING, CULTURAL PRACTICES

As an island community, water is at the center of our way of life. The values of the OWH Program are rooted in the ahupua‘a concept and the recognition that people and natural resources are interconnected from mauka to makai (mountain to sea). These values guided the development of recommended projects, policies, and actions in the One Water Honolulu Plan.

The Plan recognizes that islandwide climate hazards are experienced differently from mauka to makai and across O‘ahu’s regions and that adaptation must be informed by living, cultural practices.

The One Water Honolulu Plan is a key piece in the larger strategy towards climate resilience. Through the One Water Honolulu Program and many other efforts, the City will continue to work toward integrating cultural practices into future adaptation.
Pages 1-11 through 1-13 illustrate how One Water Honolulu strives to build on traditional practices to achieve a climate ready O‘ahu.

TAKING PROACTIVE ACTION REGARDING CLIMATE IMPACTS

Although climate hazards are not new to our island, the intensity and frequency at which we experience them are expected to increase.

From mauka to makai, One Water Honolulu is a shared effort to implement actionable steps to adapt, modernize, and maintain infrastructure, and to safeguard natural systems to enable our communities to withstand increasing climate-related impacts now and into the future. Climate hazards relevant to O‘ahu and One Water are described in the following figure.



WILDFIRES

Drought and higher temperatures increase the likelihood of wildfire that impacts power delivery and harms families, businesses, farmland, and recreational areas



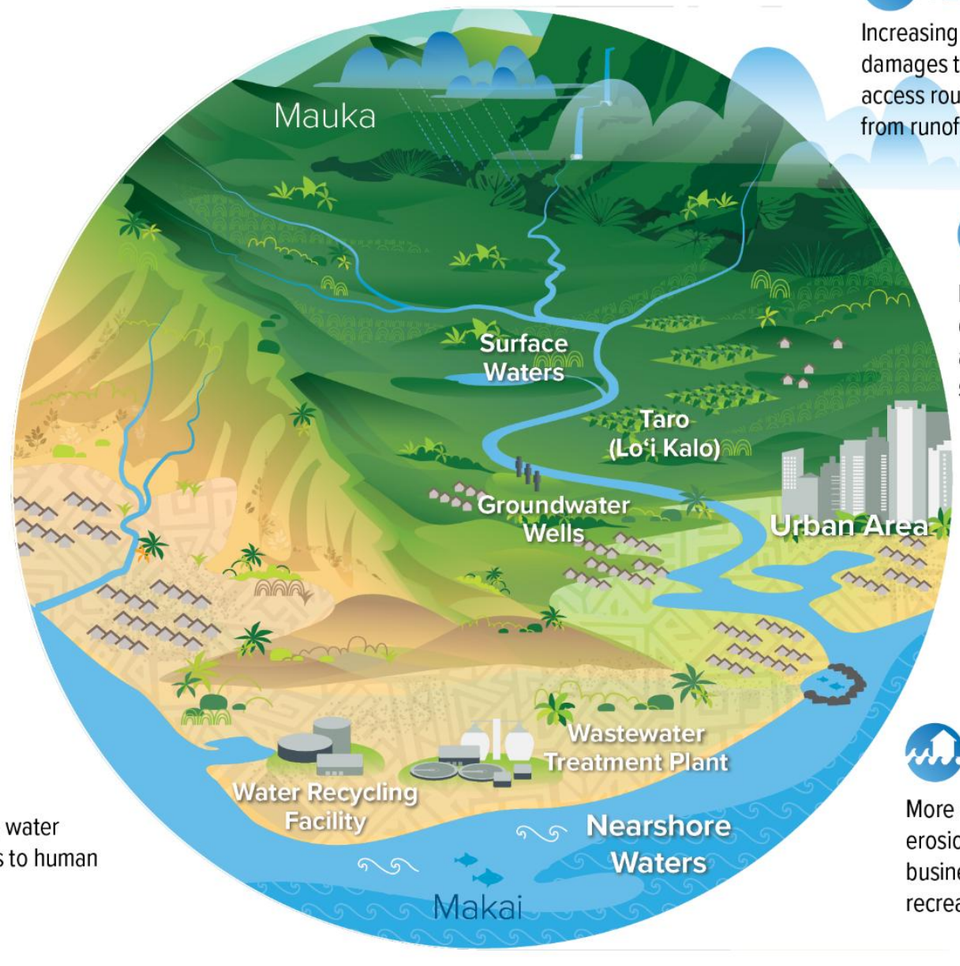
DROUGHT

More frequent and longer dry periods reduce streams and aquifer levels and availability of water for drinking, agriculture, recreation, tourism, and other activities



EXTREME HEAT

Higher temperatures increase water demand and negative impacts to human health and natural resources



HEAVY RAIN

Increasing risks of hazards such as flash floods damages to homes, infrastructure, and critical access routes for communities and impacts from runoff on reef ecosystems



HURRICANE, INCLUDING STORM SURGE

Impacts from severe storms and hurricanes can lead to damaged infrastructure, homes, and impacts to public safety, community services, and businesses



GROUNDWATER INUNDATION [SEA LEVEL RISE (SLR)]

Increasing dangers to people and property and sudden disruption and damage to infrastructure (drainage, transportation, communications, water, power, etc.)



MARINE FLOODING AND COASTAL EROSION [SEA LEVEL RISE]

More extreme coastal flooding and erosion can lead to destruction of homes, businesses, infrastructure, ecosystems, recreation areas, and precious beaches



BUILDING FROM TRADITIONAL HAWAIIAN WATER STEWARDSHIP

The concept of ahupua‘a reflects a traditional Hawaiian system of land and water management that extends from mountain to sea, emphasizing balance, sustainability, and collective responsibility.

Kuleana is the Hawaiian concept of responsibility/rights. Kuleana reflects the deep personal commitment to care for **‘āina** (land) and community. The stewardship of ‘āina involves **kākou** (collective action) to sustainably manage resources and ensure availability for future generations.

AHUPUA‘A

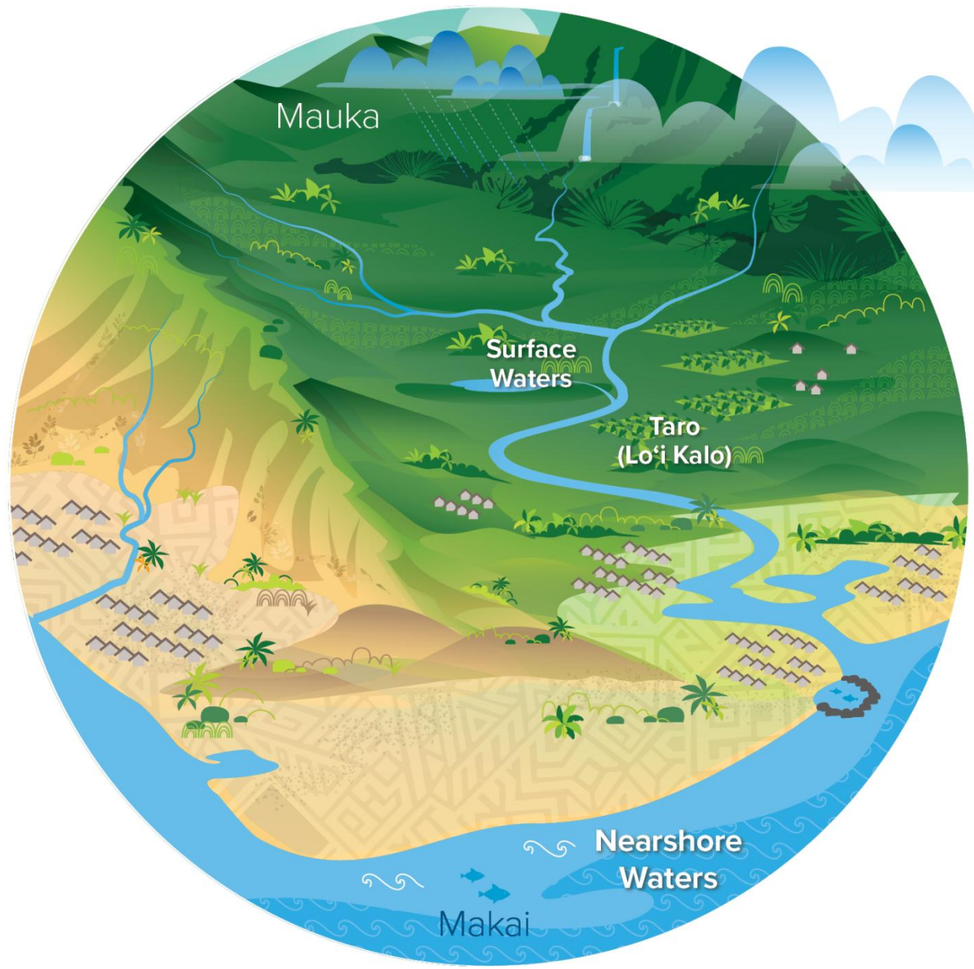
Mountain-to-sea land divisions that follow the natural flow of water combined with actionable stewardship and relationship with the land

KAIĀULU KAHAWAI

Streamside communities support water capture, filtration, and distribution through systems like ‘auwai, sustaining agriculture and ecosystems

KAPU MĀLAMA

Values-based restrictions that guide responsible water use, especially to prevent or respond to scarcity



KAULANA MAHINA / LO‘I KALO

The lunar calendar and seasonal water flow guide the cultivation and management of irrigated taro patches (lo‘i kalo), shaping when and how the fields are used

KAHAWAI SYSTEM

Interconnected lo‘i and wetlands cycle water and nutrients to support native species like ‘ōpae (shrimp) and ‘o‘opu (gobies), creating a living bioremediation system

LOKO I‘A

Coastal fishponds that combine aquaculture with ecosystem care

KAPU KĀNĀWAI

Enforced prohibitions protecting water sources from contamination and misuse

INFORMING MODERN PRACTICES WITH LIVING PRACTICES

One Water Honolulu advances projects to address climate impacts on freshwater, wastewater, and stormwater systems, integrating Indigenous best practices into future adaptation.

Grounded in the ahupuaʻa concept and Hawaiian values, history, and culture, this approach guides sustainable behaviors and water cycle investments to strengthen services for our communities.





WATERSHED MANAGEMENT

Manage watersheds to foster healthy forests, aquifers, streams and nearshore waters, fertile agriculture lands and thriving, resilient communities

LIVING PRACTICE: Ahupuaʻa





DRAINAGE AND FLOOD MANAGEMENT

Manage storm water runoff to reduce flooding, store water for reuse and recharge aquifers with natural filtration to protect water quality

LIVING PRACTICE: Kaiāulu Kahawai



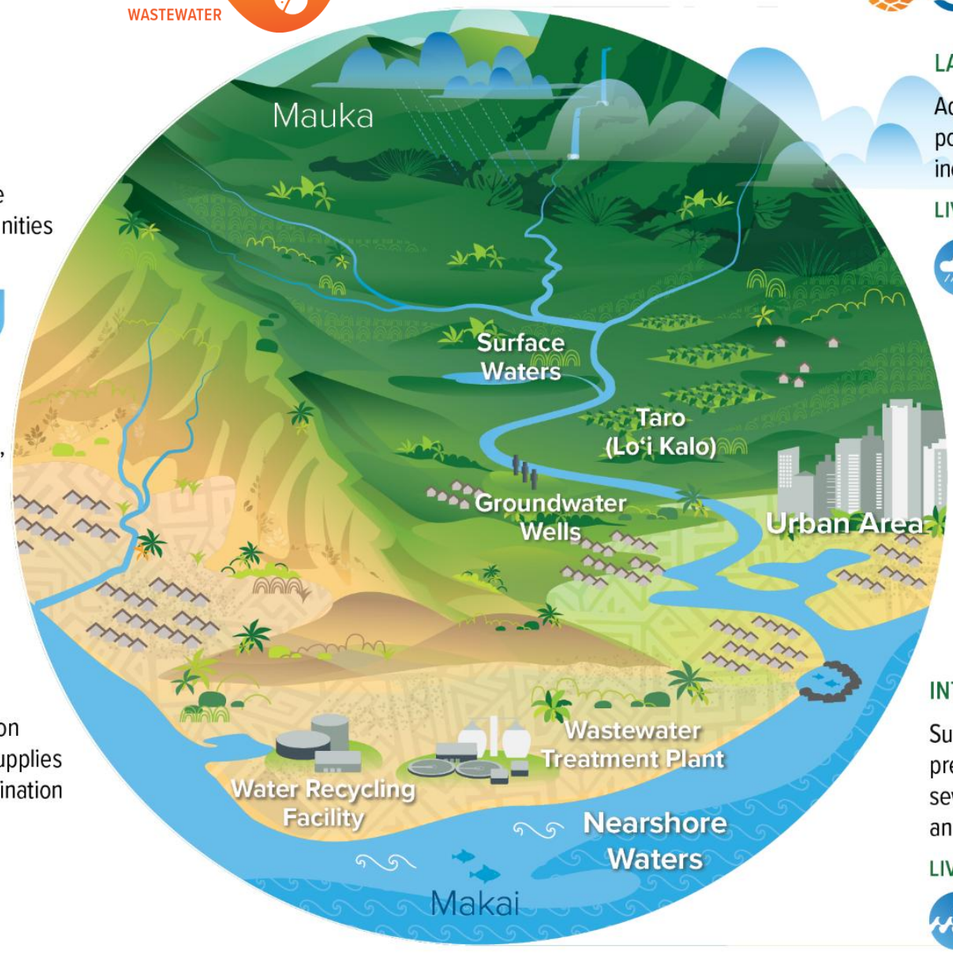


WATER CONSERVATION AND SUPPLY

Promote resource and demand-side conservation practices and advance diverse resilient water supplies from surface and groundwater, reuse and desalination

LIVING PRACTICE: Kapu Mālama





WATER REUSE

Expand reuse and restoration for urban, agriculture and ecosystems through centralized and distributed treatment technology coupled with natural systems and wetlands

LIVING PRACTICE: Kahawai System / Wetlands





LAND USE AND STRATEGIC ADAPTATION

Advance climate-adaptive land use planning, policies, regulations, and resilient infrastructure including elevating streets and buildings

LIVING PRACTICE: Kaulana Mahina / Loʻi Kalo





RIPARIAN AND NEARSHORE MANAGEMENT AND RESTORATION

Safeguard natural systems including streams and springs flowing to loʻi kalo, loko iʻa (fishponds), estuaries, and nearshore waters, as well as support restoration where feasible

LIVING PRACTICE: Kapu Kānāwai





INTEGRATED WASTEWATER MANAGEMENT

Support effective wastewater treatment and prevent source contaminants from entering the sewer system to safeguard water quality, public and ecosystem health

LIVING PRACTICE: Kapu Kānāwai

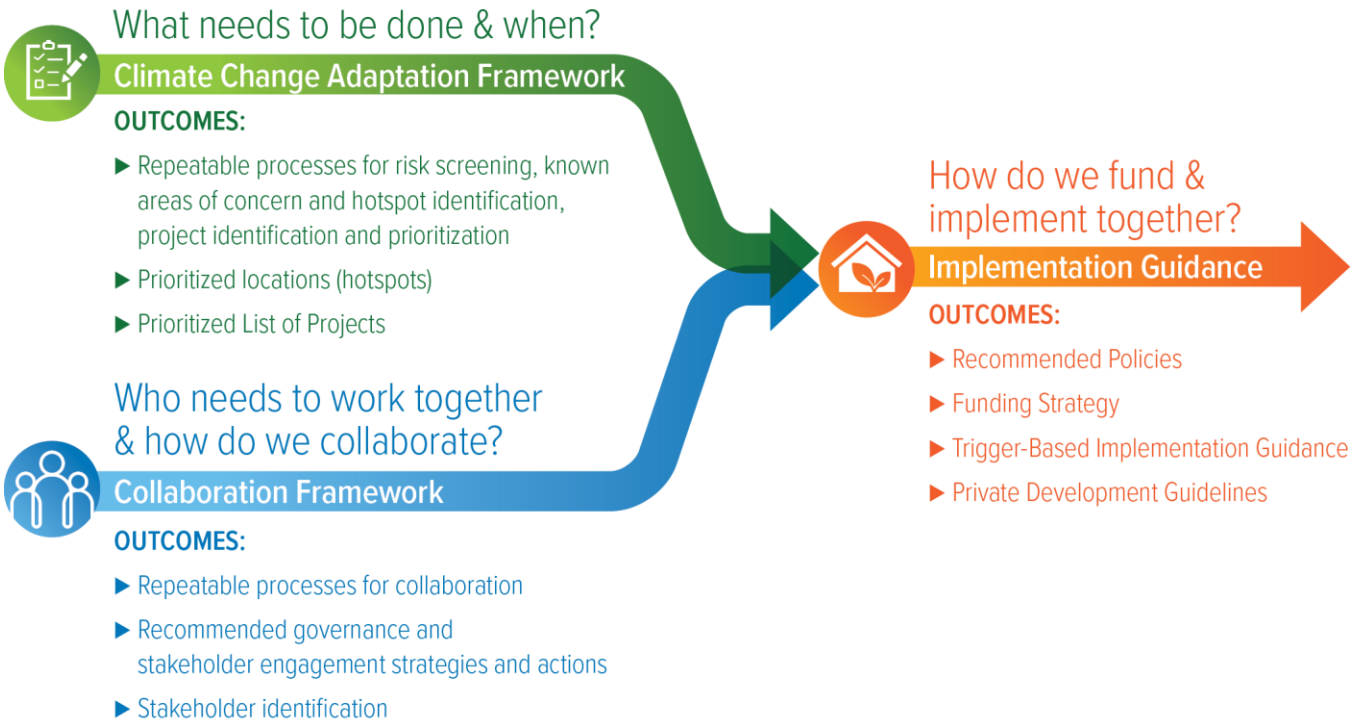


1.4 ONE WATER HONOLULU PLAN: COLLABORATION, ADAPTATION, AND IMPLEMENTATION

The Plan consists of:

A Collaboration Framework	A set of recommendations and repeatable processes to identify who works together and how collaboration is sustained.
A Climate Change Adaptation Framework	A repeatable method for finding where investment is needed most.
A Funding Strategy	How projects are paid for, sequenced, and sustained to support implementation
Implementation Guidance	Plan components that provide guidance for advancing the OWH Program and project implementation.

Outcomes from the above listed Plan components help answer: What needs to be done and when? Who needs to work together and how? And how can recommendations get funded and implemented?



Two foundational components in the One Water Honolulu Plan that work together to support the Plan's recommendations:

CLIMATE CHANGE ADAPTATION FRAMEWORK

Provides the analytical foundation for identifying where City infrastructure and frontline communities are most exposed to climate hazards and where adaptation actions should be prioritized.

COLLABORATION FRAMEWORK

Provides a clear and effective process of who should be working together and how to build resilience into the ongoing and planned projects, programs, and policies related to water management.

Together, the Collaboration Framework and the Climate Change Adaptation Framework establish the foundation for implementation of a One Water Honolulu Program. The Collaboration Framework establishes how the departments, stakeholders, and City administrators work together, and the Climate Change Adaptation Framework identifies where the investments are needed most.

The following implementation components provide guidance to advance the One Water Honolulu Program and the Plan:

Trigger-based Implementation Strategy	Supports sequencing of projects and incremental adaptation over time, reducing risk as climate hazards intensify; allows flexibility for the City to monitor evolving conditions and respond proactively before risks fully materialize. It prioritizes near-term actions in the most vulnerable areas while preserving the ability to transition to more transformative measures if more severe climate impacts emerge later in the century. The trigger-based implementation strategy is summarized in Section 8, and the full guidance can be found in Appendix I.
Funding Strategy	Provides the mechanism for aligning resources, CIP investments, financing tools, and long-term "ownership" responsibilities to advance implementation and ensure long-term operations. Key funding strategy content is included in Section 8, and the full Funding Strategy can be found in Appendix K.
Private Development Guidelines	Aim to support coordination and alignment between private development and the City and provide guidance and recommendations for private developers for climate adaptation. The full standalone document is included as Appendix J.
Governance Strategies, Policies, and Recommended Actions	Help advance Plan implementation by addressing coordination barriers, strengthening governance, aligning resources, and creating a pipeline of future projects. Prioritized governance strategies, policies, and actions can be found in Section 8, and additional policies and actions for future consideration can be found in Appendix G.

Each Plan component is important in organizing and sequencing projects and related efforts, aligning investments, documenting external funding opportunities, and advancing greater collaboration and integration of efforts between City agencies and its stakeholders.

2 | Collaboration Process

The Plan is grounded in the idea that climate adaptation requires collaboration and that no one can do this alone.

PURPOSE

This section describes how the existing OWH governance and planning efforts are being built upon to identify foundational elements to strengthen collaboration and to address institutional barriers. Additionally, recommendations are provided for governance strategies, actions and processes to sustain collaboration through the implementation of the One Water Plan and continuation of the OWH Program efforts.

2.1 INTRODUCTION

The One Water Honolulu Plan is grounded in the shared understanding that climate adaptation requires collaboration and that no one can do this alone. To sustain institutional and stakeholder coordination towards advancing the One Water vision the Plan includes a Collaboration Framework.

The Collaboration Framework consists of recommended governance strategies, actions, and adaptable processes for working together to advance adaptation measures. It provides guidance to sustain collaboration among City departments, with the State, other agencies, communities and the private sector.

The recommended actions are associated with a timeframe, and the recommended processes are intended to be adaptable and repeatable. The City can apply the Collaboration Framework to consider all relevant stakeholders and bring them in at the appropriate time during the progression of a specific project and throughout the One Water Honolulu (OWH) Program. This can help accomplish integrated resilience projects in ways that individual groups or departments would find difficult doing on their own.

2.2 EXISTING GOVERNANCE AND INSTITUTIONS

This section briefly describes the existing governance structure (groups) relevant to the City's One Water Honolulu Program.

CITY AND COUNTY OF HONOLULU ORGANIZATION

The City covers the entire island of Oʻahu, approximately 600 square miles. Honolulu has over 980,000 residents, which is roughly 69% of the State of Hawaiʻi's total population. The Honolulu City Charter established a mayor-council form of government for Honolulu. The legislative branch consists of nine city council members elected by districts. Under the City's charter, the council has legislative and investigative power. The mayor is the chief executive officer, assisted by a managing director (second-ranking executive who is appointed by the mayor with council approval). All elected positions have four-year terms elected on a nonpartisan basis. In addition to City Council, the legislative branch includes the Office of Council Services, Office of the City Auditor, and Office of the City Clerk.

More information about the legislative branch can be found at: Legislative Branch - City and County of Honolulu.

A list of all City departments and corresponding websites can be accessed via: Departments - City and County of Honolulu and Semi-Autonomous agency websites can be accessed via: Semi-autonomous - City and County of Honolulu.

CLIMATE CHANGE COMMISSION

In accordance with the City Charter Section 6-107, the City Climate Change Commission is charged with gathering the latest science and information on climate change impacts to Hawai‘i, with a focus on O‘ahu. They also provide advice and recommendations to the mayor, City Council, and executive departments as they look to draft policy and engage in planning for future climate scenarios.

Commission members are appointed by the mayor and confirmed by the City Council. CCSR administratively supports the Commission.

Since its inception, the Commission has developed multiple Guidance Documents including:

- Climate Change Brief
- Urban Heat – Guidance Document
- Sea Level Rise II – Guidance Document
- Climate Change and Financial Risk – Guidance Document
- Climate Change and Social Equity - Guidance Document
- Reducing Greenhouse Gas Emissions from Building Operation – Guidance Document

The Mayor’s Directive No. 18-2 (City and County of Honolulu Actions to Address Climate Change and Sea Level Rise) requires all City departments and agencies to “use the most current versions of the Commissions Guidance and accompanying Brief, and the Report and associated Hawai‘i Sea Level Rise Viewer as a resource for managing assets…” This includes using the interagency Intermediate High (1.78 m, or 5.8 ft, by 2100) sea level rise scenario as a benchmark for all planning and design of public infrastructure projects.

ONE WATER PANEL

As named in Ordinance 20-47, the Panel consists of the following City agencies: CCSR, BWS, ENV, DFM, DDC, DPP, DPR, and DTS.

As part of continuing One Water Panel collaboration and development of the Plan, the City and County may add additional partners to the Panel as appropriate to enhance coordination and integration of resilience efforts.

ONE WATER HONOLULU LEADERSHIP GROUP

This group was created during the development of the One Water Honolulu Plan and may or may not continue during Plan implementation. The Leadership Group was convened to provide oversight and direction throughout the Plan development in alignment with the One Water Vision and Objectives.

The Leadership Group is formed by a subset of Panel partners as follows:

Board of Water Supply
Program Administrator, Water Resources Division

Department of Environmental Services
Director and Deputy Director

Office of Climate Change, Sustainability and Resiliency
Chief Resilience Officer and Executive Director; Deputy Director; and Coastal and Water Program Manager

Department of Department of Planning and Permitting
Branch Chief, Policy Planning, Planning Division

Department of Facility Maintenance
Program Administrator, Storm Water Quality Division

One Water Panel
Facilitator

ONE WATER HONOLULU TECHNICAL ADVISORY COMMITTEE

The Technical Advisory Committee (TAC) was created to provide input and guidance on the Plan's project development and coordination between City and State efforts. TAC members may change as the program progresses. For One Water Honolulu Plan development, the TAC provided information about relevant efforts (including State and other agencies and organizations), provided early guidance to inform policy development, and reviewed and provided guidance on the One Water project fact sheets. Coordination with the TAC will continue as the City moves to implementation of Plan recommendations.

TAC members include:

Dr. Chip Fletcher, Dean of School of Ocean and Earth Science and Technology, University of Hawai'i at Mānoa

Dr. Victoria Keener, Research Professor for Global Institute of Sustainability & Innovation, Arizona State University; Adjunct Senior Fellow at East-West Center

Wendy Meguro, AIA, LEED Fellow, Associate Professor of Sustainable Building and Community Design, School of Architecture, University of Hawai'i at Mānoa; Member of Sea Grant's Coastal Resilience and Sustainability Team

Joanna Seto, PE, Program Administrator, Environmental Management Division, State of Hawai'i Department of Health

Dr. Bradley Romine, Deputy Director – Pacific Islands Climate Adaptation Science Center, University of Hawai'i Sea Grant College Program; Member of City Climate Change Commission

Ciara Kahahane, Deputy Director, Commission on Water Resource Management, Department of Land and Natural Resources, State of Hawai'i

Mary Alice Evans, Director, Office of Planning and Sustainable Development, State of Hawai'i

Genevieve Sullivan, Climate Resilience Coordinator, Highways Division, Department of Transportation, State of Hawai'i

OTHER AGENCIES AND REGULATORS

As the One Water Honolulu Program progresses and the City works to further integrate relevant efforts, define project concepts, and identify relevant stakeholders, enhanced coordination with other City departments not currently part of the Panel, state and federal agencies, and regulators will be needed. Collaboration with other agencies and regulators is included in the recommended processes in this section.

2.3 FOUNDATION FOR COLLABORATION

In developing the Collaboration Framework, the Plan team first identified several pillars considered to be foundational to advance further collaboration in the One Water Honolulu Program.

The following pillars constitute the Foundation for Collaboration:

- Leveraging **key community themes from previous planning efforts**
- **Identifying stakeholders** for further and future engagement
- Adopting **guidelines for collaborative decision-making (Collaboration Guidelines)** to confirm commitment and promote organizational alignment to resilience through a One Water approach
- Discovering and addressing **barriers and opportunities** to collaboration and/or integration of efforts

A summary of each of the above listed pillars is covered in the following subsections.

KEY COMMUNITY THEMES FROM PREVIOUS PLANNING EFFORTS

The City has engaged community and public stakeholders through past efforts such as the Sustainable Community Plans, Development Plans, Climate Ready O‘ahu, the Resilience Strategy, and Watershed Management Plans.

Stakeholder groups have included Neighborhood Boards, community-based organizations including those in frontline communities, business groups, private developers, and others.

Input and themes from past and concurrent efforts has been well documented and serve as a foundation and guiding source of information for the Plan (see Figure 2-1).



Figure 2-1. Key Community Themes from Previous Planning Efforts

These themes help inform the City's understanding of how to integrate community needs and values into the Plan, including in the development of prioritization criteria for projects and the kinds of potential benefits projects try to achieve.

STAKEHOLDER IDENTIFICATION

To continue fostering collaboration and participation through One Water Honolulu efforts, it is crucial to intentionally and meaningfully engage multi-sector stakeholders. Stakeholder identification efforts in One Water Honolulu expand and build upon the outreach and engagement work that has already taken place through past and concurrent efforts. Through this effort, the City has identified categories and examples of stakeholder groups to engage as One Water Honolulu progresses. Categories are shown in Figure 2-2 and examples are provided in Appendix A. Additionally, the City continues to work to integrate and streamline stakeholder participation across City efforts.

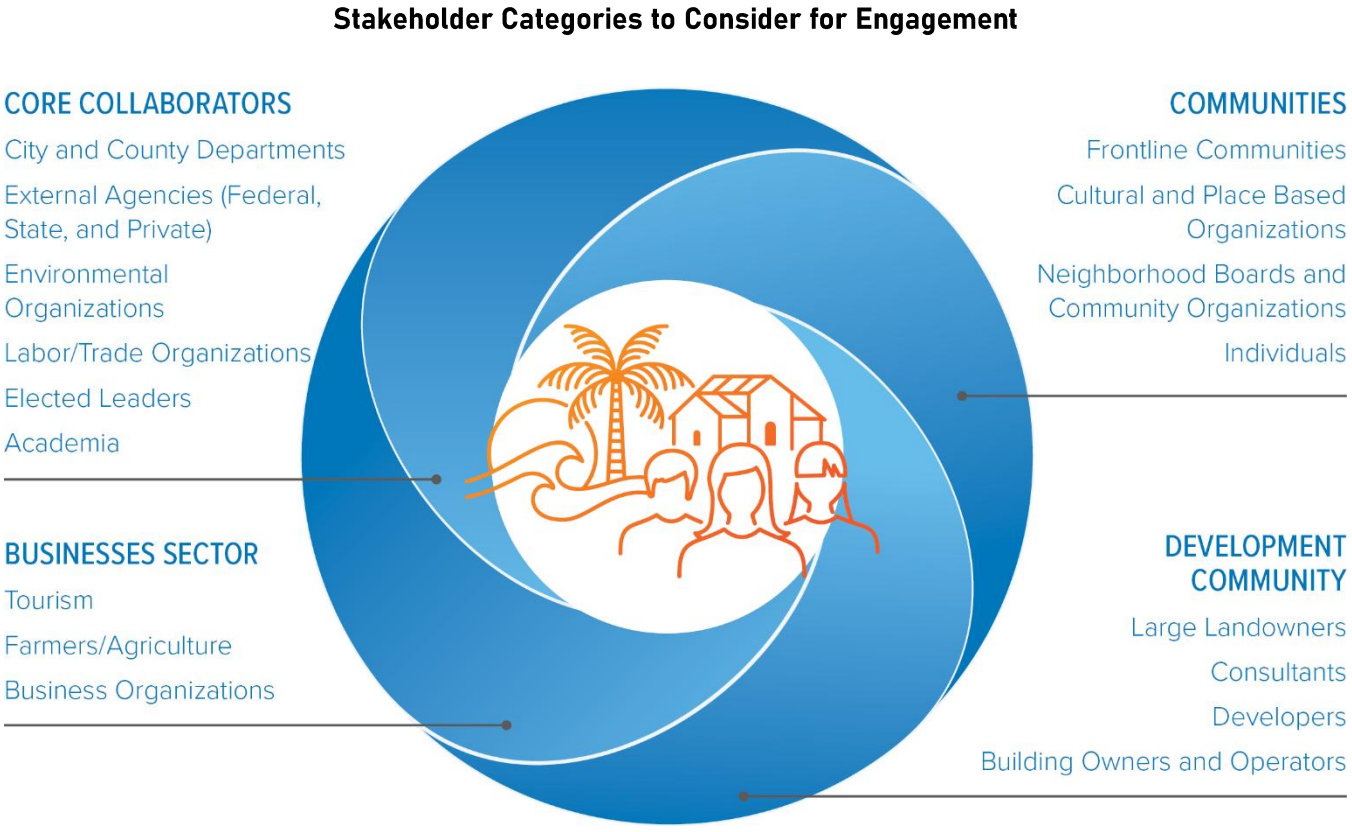


Figure 2-2. Stakeholder categories to consider for engagement

COLLABORATION GUIDELINES

A collaborative decision-making process is best advanced through established guidance that is transparent, understandable, and can be applied broadly to collaborative efforts. Foundational collaboration and integration is already occurring at several levels of One Water Honolulu efforts. This work is helping formalize and solidify a decision-making process that is informed by the many relevant concurrent and past efforts.

To support the advancement of the One Water Honolulu objectives, this section provides guidelines for collaborative decision-making, from establishing a collaboration decision-making process to making and carrying decisions forward.

Figure 2-3 summarizes the recommended guidelines for collaborative decision-making.

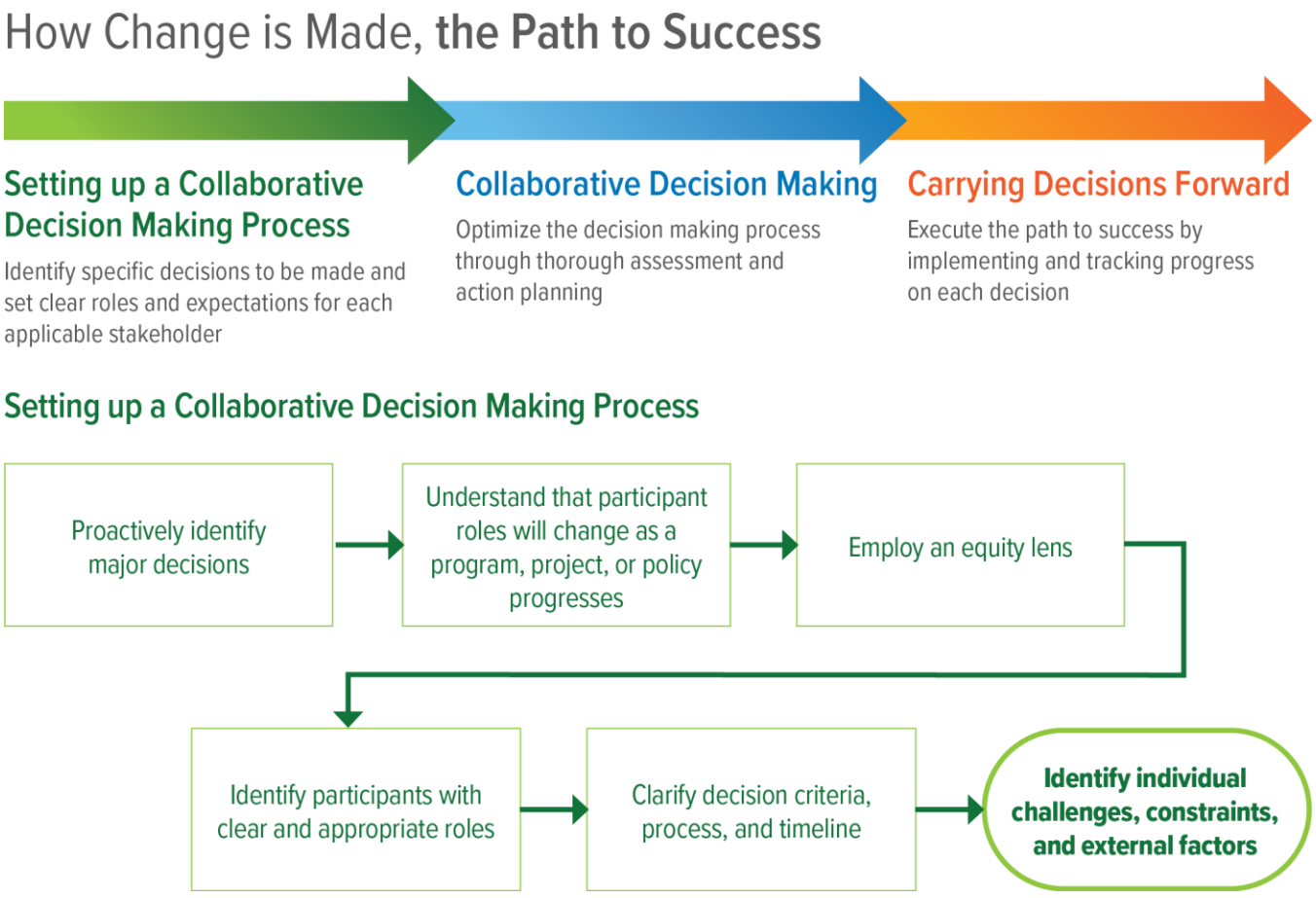
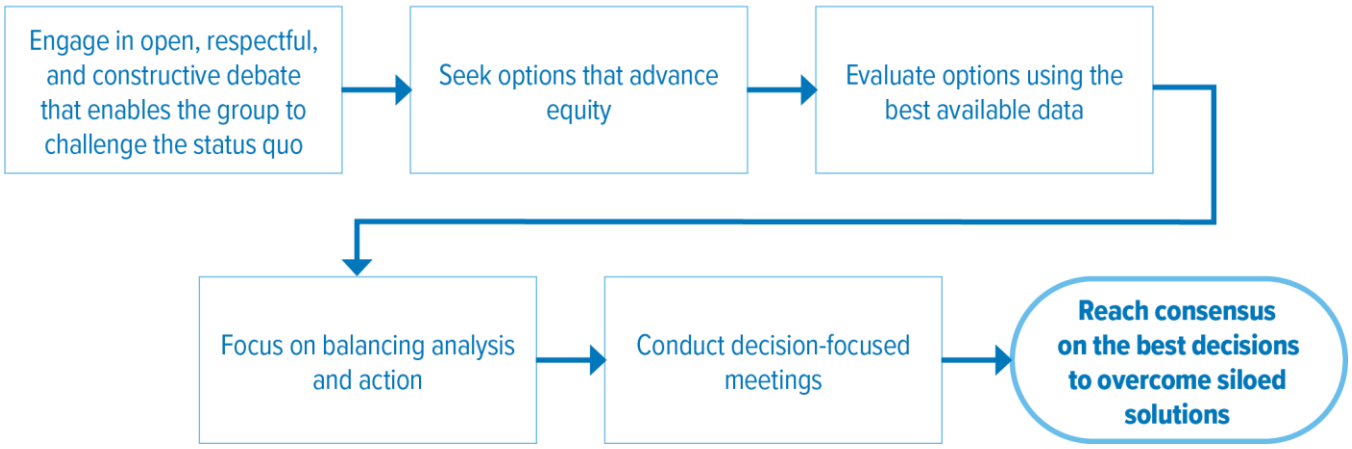


Figure 2-3. Collaboration guidelines (continued on next page)

Collaborative Decision Making



Carrying Decisions Forward



Figure 2-3. Collaboration guidelines

BARRIERS AND OPPORTUNITIES

As the City moves through the development of One Water related projects and policies, there are existing institutional barriers that must be addressed to enable or accelerate progress towards achieving the One Water vision and mission.

The discovery of institutional barriers during plan development led to the exploration of solutions to overcome these barriers. During this process, it was essential to consider the potential modification or adoption of policies, structures, and mechanisms to bolster collaboration and to further facilitate the integration of relevant water-related and resilience efforts.

Identified barriers were categorized as related to CIP Process, Funding and Resources, Development Community, Equity and Engagement, and Policy and Alignment.

Appendix A contains further details including a complete list of barriers and opportunities.

A combination of compiled information from past efforts, input from the Panel, leadership, and partners, and focused discussions throughout the One Water Plan development led to the discovery of relevant institutional barriers or challenges. The full list of barriers and opportunities can be found in Appendix A.

The following are select examples of barriers and opportunities:

Table 2-1. Examples of institutional barriers and opportunities

CATEGORY	BARRIERS	OPPORTUNITIES
CIP Process	• Need for a City-wide database to view Capital Improvement Programs (CIPs) across City departments/agencies	• Development of a City-wide CIP tracking tool that provides line of sight across City agencies. The intent is to have a simple tool that pulls basic information from all CIPs early in the process as a way to provide Panel partners with line of sight to be able to identify opportunities for integration or for multiple benefits early in the project development.
Funding and Resources	• Existing mechanisms to co-fund projects may need to be streamlined and standardized for wider use • City-wide lack of sufficient people resources	• Refinement and standardization of co-funding procedures to align with One Water vision • Development of a One Water funding strategy • Consideration to create a formal One Water coordinator position or group
Development Community	• Multiple department forums exist for coordination and integration of private sector development with City planned projects or improvements. There may be a need to streamline and/or enhance such mechanisms. • Need for formalized, greater coordination of City and partner agency and development community efforts for climate resilience	• Development of outreach materials tailored to specific stakeholder groups • Development of private development guidelines for One Water and resilience • Streamlining of mechanisms and groups for coordination with Private Development

2.4 COLLABORATION FOR PROGRAM AND PROJECT IMPLEMENTATION

To provide core and essential services to residents of Oʻahu, each City department has a distinct mission and function. Standard operating procedures and processes vary by department depending on their main function, responsibilities, size, and organization. Facilitating collaboration across these functions and processes can make collaborative climate adaptation work challenging.

One Water Panel brings together City departments and aims to work collaboratively to address climate change impacts on Oʻahu through integrated planning and implementation of One Water solutions.

Through its MOU, the One Water Panel agreed to set the stage for new operations and processes that will better enable planning efforts around climate change adaptation.

The Collaboration Framework for Program and Project Implementation provides recommended governance strategies, actions, and processes to formalize who is engaged, when, and how participation occurs. Proposed processes build on the traditional stages for project or programs (planning, adoption, implementation, and operation/enforcement) by identifying required or anticipated key decision points and aligning these decisions with internal and external stakeholder engagement.

Through these proposed steps the goal is to incorporate more robust and structured collaboration throughout existing processes.

For the purposes of the Collaboration Framework, relevant processes are organized as follows:

Program-Level Collaboration

Advancement of the One Water Honolulu Program which is inclusive of work championed or advanced by the One Water Panel.

Project-Specific Collaboration

Collaborative implementation of One Water projects.

PROGRAM-LEVEL COLLABORATION

Consistent with the Ordinance requirements, Mayor's Directive, and the One Water Vision, the City will continue One Water Honolulu Program efforts beyond the Plan.

Collaborative efforts so far have helped daylight institutional barriers and opportunities. Many of these barriers and opportunities are related to program governance and point to the need to make some modifications towards a sustained One Water Honolulu Program.

The One Water Honolulu Plan is an important endeavor under the OWH Program to help establish a collaborative decision-making roadmap towards climate resilience.

That roadmap starts with implementation of program-level enhancements including:

- Governance strategies and supporting actions
- Program-level process

The City's One Water Honolulu Program efforts include work done since Panel inception as well as ongoing work within individual partner agencies to support the One Water vision and mission.

The following sections summarize program-level collaboration recommendations. Further details are provided in Appendix A (Section A-2).

Figure 2-3. depicts at a high-level the ideal evolution of the OWH Program starting with its current (2026) state and moving through stages to a future state. In a future state (5+ years) the Program should be supported by more formalized integrated structures and mechanisms. This Plan's recommendations are intended to help enable this evolution.

Figure 2-3. Moving toward a sustained OWH Program

Present to 3 Years

- One Water Honolulu Plan development, adoption, and early implementation
- Existing Panel structure
- Existing single-purpose policies continue in parallel with early steps towards developing cohesive One Water policies
- Existing funding mechanisms:
  - Cost-sharing MOUs
  - Individual agency funding pots
- Single-agency stakeholder coordination forums
- Existing permitting process for private development
- Existing single-agency forums for coordination with State

3 to 5 Years

- Early steps toward implementation of One Water 30-Year Projects List
- Enhanced Panel Structure with One Water coordination roles distributed among several Panel partners
- Use of Implementation Plan and Collaboration Framework including recommended actions and governance strategies
- Developed and adopted priority policies to advance collaboration towards climate resilience
- Expanded use of alternative funding mechanisms for near-term projects
- Integrated stakeholder engagement and public outreach forums
- Earlier coordination and promotion of recommended private development guidelines
- More effective and earlier coordination between State and City to implement adaptation projects and policy
- Consideration of One Water Honolulu Plan updates

5+ Years

- A formal 30-Year One Water CIP
- Implemented Near-Term One Water projects
- Formalized Panel Structure and agency roles
- A formalized One Water Honolulu Program with an appointed/dedicated One Water Coordinator
- Developed and adopted mid-to-longer-term policies to advance collaboration towards climate resilience
- Dedicated annual One Water funding and formalization of other/alternative funding mechanisms
- Mapped funding tracks (including external funding options) for mid- and long-term projects
- Integrated stakeholder engagement and public outreach
- Aligned adaptation strategies and project implementation between city agencies and private development
- Structured, more effective and earlier coordination between State and City to implement adaptation projects and policy
- One Water Honolulu Plan updates



A Resilient One Water Future

- **Enhanced and sustained coordination for climate adaptation**
- **Meaningful stakeholder engagement**
- **Leveraged or shared resources that enable climate readiness**
- **Funded multi-beneficial projects**
- **Streamlined permitting processes**
- **A unified roadmap and decision-making process**

PROGRAM-LEVEL GOVERNANCE STRATEGIES

The One Water Honolulu vision of **collaborating for a thriving and climate resilient O‘ahu** centers around City, partner agencies, and stakeholders working together to advance climate resilient infrastructure, projects and policies. Although collaboration can occur through both informal and formal processes and structures, identification and commitment to advancing overarching One Water governance strategies can help:

- Streamline or fill gaps in existing practices for multi-stakeholder coordination and communication
- Address institutional and structural barriers to collaboration
- Organize overarching actions needed to enable greater integration of efforts and to sustain a One Water Program

In addition to advancing recommended actions, a governance structure that includes formalized One Water Coordination roles is an important part of a sustained program. Recommended coordination roles are described in Appendix A (Section A-2). While these roles can potentially be formalized within the existing Panel structure as an interim step, it is recommended to consider the creation of permanent dedicated position(s) as the program advances.

WHAT ARE GOVERNANCE STRATEGIES?

Recommendations for overarching actions and processes to support or further define governing roles, responsibilities, resource allocation, and both formal and informal structures through which authority is exercised as related to One Water.

The full list of governance strategies can be found in Section 8 and Appendix A (Section A-2). Each of the strategies encompass a series of supporting actions.

The following is an example of a recommended governance strategy:

STRATEGY 4:

Ensure coordinated OWH CIP project implementation among responsible City infrastructure, operational and budgetary agencies

ACTIONS:

4.1	Collaborate on joint development of multi-benefit OW projects.	Ongoing
4.2	Utilize progressive project delivery approaches, like Public-Private Partnerships, Design-Build, Improvement Districts, redevelopment authorities, and others.	Ongoing
4.3	Develop CIP prioritization criteria for efficient use of funds.	Present to 3 years
4.4	Develop a City-wide CIP tracking tool that pulls information from all individual CIPs and is accessible to all Panel partners	Present to 3 years
4.5	Develop and track performance indicators and metrics and report on progress.	Present to 3 years
4.6	Establish climate threat triggers to program projects concurrent with impacts.	Present to 3 years
4.7	Update infrastructure condition and capacity assessments for timely replacement.	Present to 3 years

PROPOSED PROGRAM-LEVEL PROCESS

There is still progress to be made to move towards a more supported OWH Program to better enable collaboration and the implementation of One Water projects. To support the evolution of the OWH program (as depicted in Fig. 2-3), this Plan includes a recommended program-level process. This proposed process includes a series of high-level steps focused on mapping out anticipated decisions, discussions, and incorporating stakeholder interactions throughout the life of the OWH program. The recommended program-level process is provided in Appendix A (Fig. A-3).

PROJECT-LEVEL COLLABORATION AND PROCESS

At the core of One Water Honolulu projects is collaboration between two or more agencies, among other criteria (see Section 7 Project Development and Prioritization). To structure and maintain partner agency collaboration that is sustained after One Water project development (throughout implementation) it is necessary to build greater engagement and interactions within existing project processes.

Further details on Project-Specific collaboration are provided in Appendix A. **A recommended project-specific collaboration process is included in Appendix A (Fig. A-4).** It is provided as guidance to highlight collaboration considerations to incorporate in the decision-making process from project ideation through operations and maintenance.

The project-level collaboration process is intended to provide guidance to project teams by aligning anticipated collaborative decisions and milestones to how and who collaborates towards these decisions and milestones.

NEXT STEPS

- Continue leveraging concurrent stakeholder engagement efforts and consider key themes from the community in the OWH Program and related efforts moving forward.
- Throughout the OWH Program, pursue timely engagement of stakeholder groups.
- Consider and advance program-level governance strategies and supporting actions.
- Consider implementing and formalizing the recommended program-level and project-specific processes in Appendix A.

3 | Islandwide Profile

O‘ahu’s climate hazards are cumulative and interconnected. Understanding how hazards impact our island and water infrastructure is foundational to adaptation.

PURPOSE

This section can be used to understand the range of climate hazards and impacts experienced islandwide and provides an overview of O‘ahu’s complex water infrastructure system. It helps inform planning and coordination of infrastructure investments and water management decisions across the island.

3.1 CLIMATE HAZARDS

Oʻahu faces a set of interconnected climate hazards that are already reshaping environmental conditions across the island. The Plan includes a range of primary climate hazards expected to intensify over time as greenhouse gas emissions continue to enhance atmospheric warming. This warming increases temperatures across the globe and results in both direct and indirect impacts such as increased intensity and longer durations of drought, extreme heat, rising sea levels due to thermal expansion and the melting of land ice, and more extreme storms.

The City Climate Change Commission gathers the latest science and climate change impact-related information on impacts to Oʻahu. More detailed information and guidance on understanding and addressing climate hazards can be found through their publications. The Mayor's Directive 18-2 requires City departments to address climate change and sea level rise hazards in response to reports published by the City Climate Change Commission (Mayor's Directive 18-2, July 16, 2018).

This directive, necessitates an islandwide consideration of climate hazards and potential impacts. These hazards influence planning for land use, infrastructure, emergency response, and natural resource management and are described in the tables below. Contents of these tables draw from Climate Ready Oʻahu and the State of Hawaiʻi Climate Change portal, and demonstrate the interconnectedness of different hazards, in which one hazard can be mutually reinforcing for another hazard (e.g., drought conditions can contribute to drier fuels that can increase the risk of wildfire).[1] These hazards can also be cumulative, in which multiple hazards can occur simultaneously or in short succession, impacting the overall potential for damage or harm (e.g., SLR and heavy rain are not mutually reinforcing but when both occur at the same time this can result in more severe flooding).

[1] Climate Ready Oʻahu references the City Climate Change Commission's publications on climate science and climate change impacts. Readers are also encouraged to visit the Commission's website for additional resources.



DROUGHT



WILDFIRE

Drought Conditions and Wildfire Risk

Periods of reduced rainfall and higher temperatures increase the likelihood of drought. More frequent and potentially more severe droughts are anticipated for future climate conditions. Dry conditions affect soil moisture, vegetation health, and water availability, particularly in leeward and low-elevation areas. Prolonged dry periods, combined with invasive grasses and development patterns, elevate wildfire risk across many parts of the island.



EXTREME HEAT

Rising Temperatures and Extreme Heat

Average air temperatures on Oʻahu are increasing, and the frequency of extremely hot days is projected to rise. Warmer nighttime temperatures reduce opportunities for cooling and recovery, especially in dense urban areas and low-wind regions. Heat is affected by geography, elevation, land cover, and urban development patterns, making it a widespread but uneven hazard across the island. According to the State of Hawaiʻi Climate Change Portal, average temperatures in Hawaiʻi are about 2°F warmer than they were in the mid-20th century. Honolulu has experienced record-breaking hot days in recent years, and 2025 ranked among the warmest years on record statewide.



SEA LEVEL RISE

Sea Level Rise and Coastal Erosion

Sea levels are rising due to global ocean warming and melting land ice. Sea level rise occurs gradually but drives long-term shoreline change, including higher tides, more frequent coastal inundation, raise groundwater levels or create flooding from groundwater, and can accelerate erosion. This hazard also influences and can worsen the damage potential from other hazards including coastal storms and impacts of tsunamis because it increases the baseline water level, can extend the reach of storm flows, and may reduce the overall time to be able to evacuate. Because O‘ahu’s population and infrastructure are concentrated near the shoreline, sea level rise and coastal erosion are defining climate hazards for the island.



HURRICANES

Hurricanes

Climate change increases the potential for stronger tropical storms to affect the island. Hurricanes represent a compound hazard, combining wind, rain, coastal surge, and flooding into single events that can stress multiple systems simultaneously.



HEAVY RAIN

Changing Rainfall Patterns and Storms

Rainfall on O‘ahu is becoming more variable. Climate projections indicate a shift toward fewer but more intense rainfall events, increasing the likelihood of short-duration, high-intensity storms. These changes affect watersheds and drainage systems throughout the island, from steep mountain valleys to low-lying coastal plains. This change in rainfall patterns can result in potential flash flooding around the island, blockage of roads, and greater sediment transport.

3.2 WATER INFRASTRUCTURE OVERVIEW

Oʻahu's water infrastructure is a complex, islandwide system that supports drinking water supply, wastewater treatment, stormwater management, ecosystem health, and public safety.

Water infrastructure on Oʻahu includes groundwater production wells, surface water diversions, treatment facilities, reservoirs, transmission pipelines, drainage systems, and wastewater treatment plants. These systems must function together to deliver safe water, manage wastewater, and reduce flood risk across diverse island conditions. Roads and beaches are included as additional infrastructure in this Plan.

Drinking Water Supply and Delivery	Groundwater is the primary source of drinking water for Oʻahu, supported by wells, tunnels, pumping stations, reservoirs, and extensive distribution pipeline networks. Infrastructure planning focuses on maintaining reliability, protecting source water quality, upgrading aging facilities, and preparing for climate-related stressors such as drought, flooding, and sea level rise.
Wastewater and Water Quality Infrastructure	Wastewater collection and treatment systems protect public health and coastal water quality. These facilities are critical to preventing contamination of nearshore waters, reefs, and aquifers. Long-term planning emphasizes system resilience, capacity management, and opportunities for reuse where appropriate.
Stormwater and Flood Management Infrastructure	Stormwater infrastructure, including channels, culverts, detention areas, pipelines and storm drain networks, helps manage heavy rainfall and reduce flooding risk. Stormwater is managed both through engineered systems and through natural, land-based strategies that reduce runoff and erosion.

The Role of Watersheds from Mauka to Makai

While built infrastructure is essential, healthy watersheds remain a supporting foundation for built and natural water system infrastructure from the mauka to makai. They are the landscape-scale foundation that allow water to move naturally, which in turn reduces pressure on the built environment. Across each ahupuaʻa, forested uplands in conservation areas, stream corridors, agricultural and recharge areas help regulate flows, protect water quality, and reduce stress on downstream infrastructure and nearshore waters. Watershed protection lowers long-term costs by reducing damage and maintenance needs.

Oʻahu is divided into eight regional planning districts, each with its own Watershed Management Plan for water supply planning and infrastructure management. Together, these plans function under a shared islandwide framework rooted in ahupuaʻa-based management, supporting coordinated infrastructure investments and water management decisions across the island.

3.3 CLIMATE IMPACTS ACROSS OʻAHU

Climate hazards translate into wide-ranging impacts that affect daily life, public services, ecosystems, and the economy across Oʻahu. These impacts are already occurring and are expected to intensify and potentially continue to intensify as current greenhouse gas emissions are not expected to decline and will continue to impact current and future conditions.

The following describe some of the aspects of daily life that can be impacted by climate hazards on Oʻahu:

Public Health and Community Wellbeing	Rising temperatures increase heat-related illness, particularly for kūpuna, outdoor workers, and people with limited access to cooling or healthcare. Flooding and major storm events can disrupt emergency services, isolate neighborhoods, and increase stress and displacement. Health impacts often persist beyond the event itself, especially for vulnerable populations.
Homes, Neighborhoods, and Housing	Coastal flooding, erosion, wildfire, and inland flooding can damage homes and neighborhoods throughout the island. Repeated exposure to climate hazards increases repair costs, affects insurance availability, and contributes to long-term housing insecurity. Some communities face recurring disruptions rather than isolated disasters.
Infrastructure and Essential Services	Climate impacts threaten transportation networks, water and wastewater systems, energy infrastructure, and communication systems. Flooding can damage roads and underground utilities, extreme heat can strain electrical systems, and storms can cause prolonged service disruptions. Because these systems are interconnected, failures in one area can cascade across others.
Natural and Cultural Resources	Native forests, streams, wetlands, beaches, and coral reefs are stressed by warming temperatures, altered rainfall, erosion, and flooding. These ecosystems help buffer communities from climate hazards while supporting freshwater supplies, access to cultural practices, and endangered species. Damage to these systems reduces their ability to provide protection and services over time.
Economy	Climate impacts affect tourism, local businesses, agriculture, and public budgets. Recovery from repeated climate events places long-term strain on public resources and can widen inequities if adaptation investments are not targeted thoughtfully. Unmanaged climate impacts have islandwide social and economic consequences.

Climate impacts are cumulative and interconnected. Addressing them requires coordinated action that strengthens infrastructure, supports communities, and restores natural systems to reduce risk over time. Regions can be impacted differently by these hazards. The next section provides a summary of current issues and climate hazards already impacting each region.

NEXT STEPS

- Consider the provided islandwide profile in concurrent climate adaptation efforts and in near-term development of One Water projects.
- Update as necessary based on changing conditions and in future Plan updates.

4 | Regional Planning District Profiles

The Plan recognizes that islandwide climate hazards are experienced differently across O‘ahu’s regions. Connecting One Water recommendations to local land use patterns, infrastructure needs, cultural values, water conditions, and climate vulnerabilities is critical.

PURPOSE

This section highlights how regional differences influence climate risks and water challenges, providing a foundation for prioritizing solutions that reflect local conditions and concerns, and existing planning efforts. Each regional profile helps connect One Water recommendations to community objectives, cultural values, land use patterns, infrastructure needs, water resource conditions, and place-based climate vulnerabilities.

4.1 REGIONAL THREATS AND PRIORITIES

For a holistic approach towards identifying recommendations to address regional threats and priorities, existing local, island-wide, and state level plans were reviewed to develop area overviews or profiles for each of O'ahu's eight planning districts. Detailed summaries of each region are provided in Appendix C. The profiles in this section provide an overview of regional summaries and information gathered through existing plans, workshops, meetings, and discussions with the One Water Panel and Leadership Group from 2024 through August 2026.

This section acknowledges that actions have already been taken by communities, organizations, and City and State agencies to address climate impacts and other concerns, as evidenced by past planning efforts. Each region experiences specific vulnerabilities to climate threats based on location, land uses, infrastructure adequacy and/or condition and more, which necessitate region-specific and location-based solutions. As part of this section, a high level overview of the climate hazards facing each region, with a focus on local conditions that influence these hazards, will be summarized based on previous planning efforts and engagement with One Water Panel and Leadership Group. A map of O'ahu's eight planning regions and the main climate hazards[1] is shown as Figure 4-1.

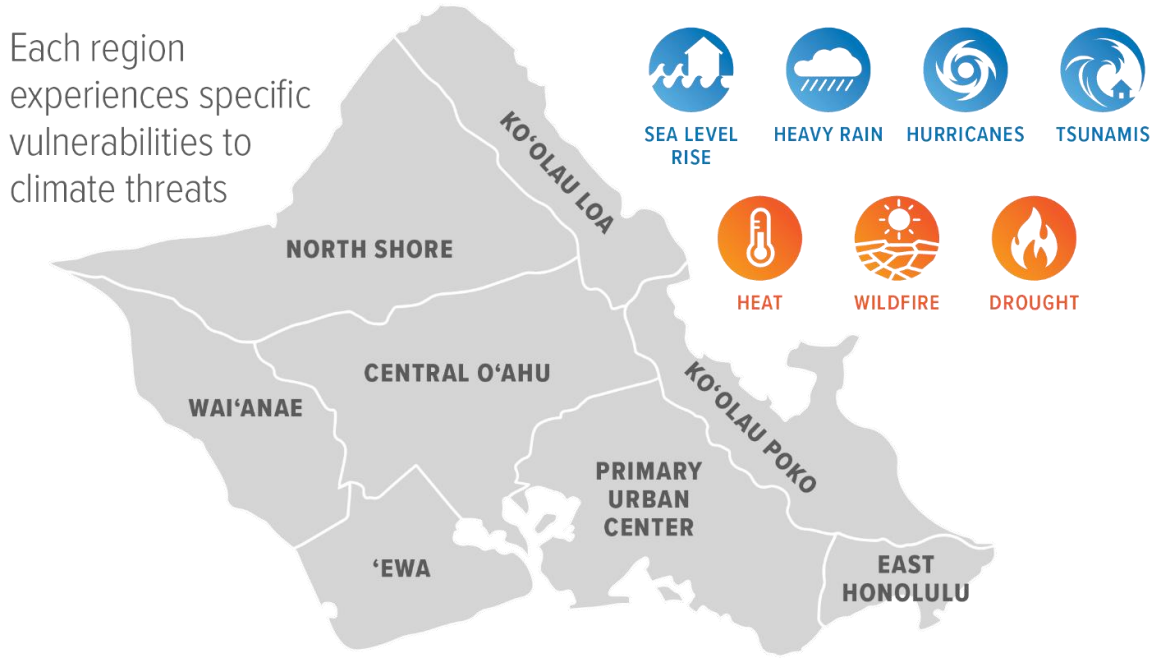


Figure 4-1. O'ahu's eight regional planning districts (source: DPP, 2026).

[1] Although tsunamis are seismic hazards, they have been included given their local relevance.

The purpose of reviewing previous plans is to support consistency of future actions with community objectives and to leverage key takeaways from past and current stakeholder efforts (a pillar of the Foundation for Collaboration).

The planning region profiles and recommendations for each region are from several sources: plans reviewed and cited in Section 9, regional summaries provided in Appendix C, known areas of concern workshops, and meetings and discussions with the One Water Panel and Leadership Group through August 2026. In addition to supporting Section 4, information from the planning district summaries in Appendix C helped identify governance strategies (Section 2), areas of concern (Sections 5 and 6), which led to the development of One Water projects (Section 7), and recommendations for future policies, projects, and implementation (Section 8).

The recommendations presented in this section identify additional opportunities for communities to help shape solutions to the specific conditions and concerns while maintaining values and identity of each region.

Collaboration between the City, community, and other stakeholders is critical to coordinating projects, prioritizing actions, and identifying specific areas that are most at risk in each region. Examining concerns and priorities on a local level can elevate community voices and emphasize the need for shared leadership and action. The processes identified in this Plan may be repeated separately or together whenever necessary to identify opportunities to address regional challenges.

4.2 WHAT IS A PLANNING DISTRICT PROFILE

For each planning district profile, a wide range of information was gathered from reviewing previous plans as specific places of interest or of cultural significance to the area, locations of concern or that may be specifically prone to climate hazards and other impacts, concerns related to water and infrastructure, and recommendations identified for the future from previous planning efforts. Profiles also consist of information from discussions and workshops with key City staff.

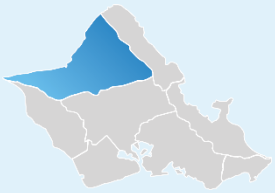
Planning district profiles in the following section include the information listed below:

- Land use highlights
- A general overview of water resources and/or features in the planning area
- A summary of climate impact related threats and other environmental concerns
- City and State efforts in support of addressing priorities or concerns for each area
- Recommendations based on information from previous planning efforts, known areas of concern workshops, and meetings and discussions with the One Water Panel and Leadership Group through August 2026
- A summary of key regional themes related to water

At the beginning of each planning district profile, a snapshot of governing plans, General Plan population share, area classifications, and watersheds are provided. The O‘ahu General Plan establishes City objectives and long-term vision for the island’s development. The General Plan includes population distribution projections for 2040 by region, which are included in each profile. Area classifications represent the diverse characteristics found across O'ahu, such as land use and population density. These classifications are utilized throughout the One Water Honolulu Plan and are especially helpful to group areas so that the City can apply similar resilience strategies in similar locations.

Section 5 provides more detail on how area classifications are leveraged.

NORTH SHORE



Governing Plans: North Shore Watershed Management Plan, North Shore Sustainable Communities Plan

General Plan population share (2040): 2%

Area Classifications: Country Towns and Rural Coastline, Major Linear Network Corridors, Recharge and Runoff Management Opportunities

Watersheds: Kaluakauila (por.), Manini, Kawaihāpai, Pahole, Makaleha, Waialua, Kaukonahua (por.), Kīʻikiʻi, Paukauila, Poamoho (por.), Helemano, ʻŌpaeʻula, Kawaiʻiki, Kawainui, Kawailoa, Anahulu, Loko Ea, Keamanea, Waimea, Kālunawaikaʻala, Pākūlena, Paumalū (por.)

Land Use Highlights

North Shore spans from Kaʻena Point in the west to Waialaʻe Gulch near Kawela Bay in the east, and shorelines along the northern edge. The Koʻolau and Waiʻanae Mountain range slopes and Helemano border the region to the south. The North Shore is predominantly rural, with daytime tourism centered on ocean activities, leading to frequent, year-round traffic congestion. Agriculture on the North Shore depends on irrigation sources from both local and Central Oʻahu systems, supporting cultural practices such as loʻi kalo and loko iʻa.

The community faces climate change impacts, heavy tourism, and encroachment of residential development. Haleʻiwa, Waialua, and Pūpūkea are the region's largest urbanized areas, with Kamehameha Highway serving as the major roadway. The former Waialua Sugar Mill has transitioned from sugar production to an industrial center supporting agriculture-related businesses, manufacturing, warehousing, wholesale operations, and other light industrial uses.

Preservation of open space areas and the natural landscape, including the Koʻolau and Waiʻanae Mountain Ranges, coastal pali (cliffs), gulches, and shoreline areas, and other features such as agricultural fields and park, is a key element of the vision for the North Shore.

NORTH SHORE

Water Overview

The North Shore experiences a range of rainfall conditions, from coastal areas, such as Haleʻiwa and Mokulēʻia, which receive about 31 inches annually, to the upper Koʻolau Mountains, where average annual rainfall exceeds 200 inches. Regional wastewater management is limited, with most properties relying on cesspools or individual wastewater systems. The vulnerability of residential areas and low-lying infrastructure to the impacts of sea level rise is a growing concern.

Perennial streams in North Shore are important habitats for native freshwater species and key sources of water for agriculture. Another major irrigation water source supplying water to the Wahiawā Irrigation System, Wahiawā Reservoir, experiences water quality challenges.

Climate Threats

Sea-level rise poses significant long-term risk to infrastructure near the ocean, and coastal areas are especially vulnerable to impacts such as saltwater intrusion (affecting water resources), ecosystem disruption, and storm intensity. Traditional cultural sites such as taro patches (loʻi kalo) and fishponds (loko iʻa) also face risks from these climate impacts. Greater fluctuations in rain and drought periods as a result of climate change may increase wildfire risk. Higher temperatures combined with increasingly variable rainfall conditions are expected to result in reduced agricultural productivity on the North Shore and can accelerate the spread of invasive pests. Agricultural opportunities are limited by the R-2 water (which can only be used for crops where water does not touch edible portions of plants) from Wahiawā Reservoir (Lake Wilson) that supplies irrigation water to the North Shore via the Wahiawā Irrigation System. The City is evaluating potential recycled water use as an alternative to injection wells at the Paʻalaʻa Kai WWTP and supporting dune restoration efforts at Sunset Beach as part of coastal erosion mitigation.

Stream flooding poses threats to natural resources, and portions of Kamehameha Highway experience closures during period of high surf or flooding. Low lying areas, including Waialua and Haleʻiwa low lying and subject to major flooding. Flood hazards are compounded in other flood prone areas due to modifications to natural drainage patterns and activities

NORTH SHORE

that increase storm runoff from the mauka areas, including stream channelization, increased erosion and sedimentation, and debris buildup/blockage that restrict stream flow. The North Shore is also susceptible to tsunami, tropical storms, high surf, and hurricanes.

Wastewater treatment plants are limited in service area and are mostly small, privately owned systems. Water quality and ecosystem health can be impaired by failing cesspools, sedimentation, and pollution and runoff from non-point sources.

HDOT has engaged in several evaluations and planning efforts to address severe shoreline erosion along Kamehameha Highway near Laniākea Beach and Hawai‘i DOH developed a TMDL applicable to the Kaukōnāhua Stream system to support water quality improvement.

Recommendations from Previous Planning Efforts

The North Shore area recommendations center around flooding and coastal impacts, traditional practices for water use and management, supporting natural systems and habitat, and water quality:

- Support conversion of the cesspools and other on-site disposal systems to ones that provide a higher level of treatment.
- Look at opportunities to reuse WWTP effluent for water reuse.
- Support projects that will upgrade treatment of wastewater to R-1 quality for non-potable irrigation, although due to the few, small wastewater treatment plants in the area - opportunities for R-1 are limited.
- Pipe irrigation ditches to reduce water loss in irrigation ditch systems to provide more efficient water delivery to crops and reduce stream diversions.
- Promote the utilization of nature-based solutions or practice sustainable land use management to mitigate the consequences of soil and coastline erosion towards threatened infrastructure.

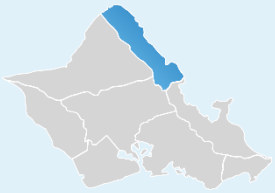
NORTH SHORE

- Encourage Best Management Practices in agriculture, urban development, and land use to minimize impacts on water quality and quantity.
- Uphold Native Hawaiian rights and support traditional water use and management practices by integrating cultural values into modern strategies.
- Support biodiversity, ecosystem-based approaches for water filtration and flood mitigation. Preserving these areas is vital for environmental protection.
- Administer and enforce zoning controls to restrict future development within identified floodways, flood fringe, coastal high hazard, tsunami inundation areas, and general flood plain districts.
- Retain natural gulches as flood plains and open space resources. Restrict development within gulches and prohibit grading or other disturbance of gulch walls.

Key Regional Themes Related to Water

The North Shore's key themes include protecting agricultural and cultural water uses, perennial streams, coastal ecosystems, and rural community character while addressing flooding, coastal erosion, and sea level rise impacts to communities, infrastructure, and natural resources. Water quality concerns from cesspools, sedimentation, runoff, and limited wastewater infrastructure drive recommendations related to wastewater upgrades, water reuse, water quality improvements, nature-based flood and erosion mitigation, and protection of traditional practices.

KOʻOLAU LOA



Governing Plans: Koʻolau Loa Watershed Management Plan, Koʻolau Loa Sustainable Communities Plan

General Plan population share (2040): 1%

Area Classifications: Country Towns and Rural Coastline, Major Linear Network Corridors, Recharge and Runoff Management Opportunities

Watersheds: Waialeʻe (por.) Kawela, ʻŌʻio, Mālekahana, Kahawainui, Wailele, Koloa, Kaipapaʻu, Maʻakua, Waipuhi, Kalaunui, Papaʻakoko, Halehāʻa, Punaluʻu, Kahana, Makaua, Kaʻaʻawa

Land Use Highlights

Koʻolau Loa spans the northern half of Oʻahu's windward coast and is bordered on the north by the Waialeʻe community just beyond Kawela Bay and on the south by the ridgeline just beyond the north end of Kāneʻohe Bay. Residential communities along Kamehameha Highway include Kahuku, Lāʻie, Hauʻula, Punaluʻu, Kahana, and Kaʻaʻawa. Per the Oʻahu General Plan, and expanded upon in the Koʻolau Loa Sustainable Communities Plan, the Koʻolau Loa region is designated as a rural area where growth and development will be managed to maintain the region's country character and natural resources. Areas in Lāʻie and Kahuku are expected to see modest housing growth to support the current population, families, employment opportunities, and the planned expansion of Brigham Young University-Hawaiʻi, while largely maintaining its rural character and agricultural landscape. Country stores and neighborhood commercial areas throughout the region are important community assets that provide essential services close to residents.

Open space areas in Koʻolau Loa focus on protecting undeveloped mauka and shoreline areas, natural gulches and drainageways, coastal habitats, agricultural green belts. Ecologically significant areas include the James Campbell National Wildlife Refuge, and State Seabird Sanctuaries off the coast of Lāʻie and Mālaekahana that help to preserve water resources, support wildlife and ecosystems, and maintain recreational and scenic functions.

KOʻOLAU LOA

Water Overview

Koʻolau Loa receives some of the highest rainfall on Oʻahu due to the surrounding Koʻolau Mountain elevation, where moist air from the ocean cools along the mountains, forms clouds, and then releases rain during most of the year. This rainfall is crucial for aquifer recharge. The region emphasizes protecting coastal waters and shoreline areas while maintaining natural drainage processes that connect upland watersheds to marine ecosystems. Cesspools throughout Koʻolau Loa contribute pollution to streams and estuaries, which could threaten groundwater resources in some areas.

The City has engaged in a stream flood mitigation project, a reuse feasibility study under the Kahuku Wastewater Facilities Plan, and partnership with Hui O Hauʻula (a community-based non-profit) to support a resilience hub. The development of an integrated watershed management plan is underway for Koʻolau Loa to support sustainable management of surface and groundwater.

Climate Threats

Low-lying areas are vulnerable to flooding and face existing and future development challenges, while coastal erosion threatens critical infrastructure, including the primary roadway, Kamehameha Highway. Alteration of rainfall patterns associated with climate change threaten groundwater supply and stream flows, and increasingly frequent severe storms can overwhelm drainage systems. This condition leads to heightened flood risk in low-lying areas such as Punaluʻu, Hauʻula, and Kahuku, valleys, streams, and at Kahuku High and Intermediate School. Flooding from Mālaekahana Stream impacts Kamehameha Highway and downstream areas. Drainage issues in Kahuku's low-lying floodplains cause runoff from mauka areas to flood Kahuku High and Intermediate School, and portions of commercial and residential areas during major storms. Koʻolau Loa is susceptible to flooding, tsunami, tropical storms, hurricanes and high surf conditions

Coastal flooding and storm surge impacts have been intensified by sea level rise, which can make certain areas of highway impassable during high surf or flooding which limits movement in and out of the region. Sea level rise also

KO‘OLAU LOA

increases the risk of impacts to water infrastructure. Coastal areas, including Hau‘ula and Ka‘a‘awa, are susceptible to coastal erosion, which threatens infrastructure, habitats, and recreational opportunities. HDOT is engaged in a revetment project to address shoreline erosion for the Kamehameha Highway in Ka‘a‘awa.

Agricultural and stream diversions are also prone to drought in areas of Ko‘olau Loa, and portions of the region’s watersheds are susceptible to wildfires during low rainfall periods. Higher stream temperatures can adversely impact stream habitats. Environments such as streams, estuaries, and nearshore waters face water quality concerns related to cesspools and urban and agricultural runoff.

Recommendations from Previous Planning Efforts

The recommendations listed below center around water conservation, water supply, restoration, infrastructure resilience improvements, collaboration, and cultural resources:

- Support and incentivize water conservation in areas that receive water from Ko‘olau Loa to increase water availability for local ecological and agricultural needs.
- Continue to support reclaimed water use from Lā‘ie WWTP and sustainable farming practices to preserve water resources.
- Upgrade Kahuku wastewater treatment facilities to allow for water reuse for irrigation purposes (pending a feasibility analysis as part of the Kahuku Wastewater Facilities).
- Transition cesspools to septic tanks with leach fields.
- Restore wetlands and coastal ecosystems to enhance natural resilience. Preserve rare and sensitive coastal resources including coastal strand vegetation, sand dunes, and anchialine pools.

KOʻOLAU LOA

- Harden coastal roadway infrastructure to protect access and underground utilities from coastal erosion, flooding and hurricanes. Implement management strategies to protect unstable sandy beach areas that impact Kamehameha Highway along the Kaʻaʻawa, Punaluʻu, and Hauʻula shorelines.
- Minimize soil erosion runoff of pesticides, fertilizers, and other non-point source contaminants into streams, wetlands, and marine habitats with strategies such as stream setbacks, erosion control devices, integrated pest management plans, and revegetation of disturbed areas.
- Work with partner agencies and the community to address flood protection and erosion concerns in coastal areas.
- Work with Hawaiʻi Reserves Inc. (a property management company) on One Water Planning for the Lāʻie area.
- Continue to collaborate with Kahuku High and Intermediate School to address localized challenges like flooding, facilities hardening and water service.
- Enhance resilience against climate driven hazards such as flooding and sea level rise through the implementation of nature-based solutions and establishing community engagement to incorporate local needs and knowledge.
- Emphasize cultural preservation through educational avenues that teach the importance between cultural heritage and environmental stewardship.
- Support the Hui O Hauʻula Resilience Hub for emergency shelters when Kamehameha Highway is cut off due to storm surge.
- Expand the existing Kahuku public golf course to support the mitigation of drainage issues, if feasible. Encourage the use of non-potable water resources for golf course irrigation.

KO‘OLAU LOA

Key Regional Themes Related to Water	Ko‘olau Loa’s key themes include protecting high-rainfall watersheds and aquifer recharge areas, improving flooding issues, restoration and protection from coastal erosion, and addressing threats to critical access routes. Water quality concerns from cesspools, and agricultural and urban runoff drive recommendations related to wastewater improvements, reclaimed water use, and wetland and coastal ecosystem restoration.

KOʻOLAU POKO



Governing Plans: Koʻolau Poko Watershed Management Plan, Koʻolau Poko Sustainable Communities Plan

General Plan population share (2040): 10%

Area Classifications: Mid-Density Communities, Major Linear Network Corridors, Recharge and Runoff Management Opportunities

Watersheds: Kualoa, Hakipuʻu, Waikāne, Waiāhole, Kaʻalaea, Haiamoa, Waiheʻe, Kahaluʻu, ʻĀhuimanu Heʻeia, Keaʻahala, Kāneʻohe, Kāwā, Puʻu Hawaiʻiloa, Kawainui, Kaʻelepulu, Waimānalo, Kahawai, Makapuʻu

Land Use Highlights

The Koʻolau Poko region ranges from Ka Lae O Ka ʻŌʻio (Ka ʻōʻio Point) at the northern edge of Kāneʻohe Bay to Makapuʻu Point to the south and framed by the peaks of the Koʻolau Range and the sea. Kāneʻohe Bay is a defining feature of Koʻolau Poko that serves as a major scenic, recreational, and cultural resource. Kāneʻohe Bay and its stream tributaries include stream estuaries where fresh and saltwater mix, an offshore barrier reef, and ocean waters, which support an important ecosystem. Rapid growth in the region was largely enabled by construction of the highways that made the area more accessible to Urban Honolulu. Environmental concerns led to a shift in public policy by the mid-1970s, and population growth and urban development slowed down. Koʻolau Poko is a mix of rural agricultural communities (Wakāne, Waiāhole, Waiheʻe, Kahaluʻu, and Waimānalo) and more developed residential/commercial communities (ʻĀhuimanu, Kāneʻohe, and Kailua). Koʻolau Poko also includes the Marine Corps Base Hawaiʻi in Kāneʻohe.

The region hosts several significant wetlands, which are home to native waterbirds. Major wetlands, proposed nature parks and preserves, and botanical gardens are key to conserving Koʻolau Poko's natural and cultural landscapes for wildlife, recreation, and sustainable resources.

KOʻOLAU POKO

Water Overview

The wet climate and abundant perennial streams of Koʻolau Poko have historically made it a major region for wetland taro cultivation and aquaculture. Permanent instream flows are maintained and restored fishponds and ancient irrigation systems continue to be used. According to the Koʻolau Poko Watershed Management Plan, the rainfall of this area varies from about 197 inches annually in the Waiāhole and Waikāne uplands to about 31 inches per year at the coastal area of Makapuʻu.

Climate Threats

Areas of Koʻolau Poko face pollution from urban runoff and agricultural activities which affect water quality, while changing precipitation patterns and increased temperatures threaten water resources availability and agricultural productivity, particularly for kalo. Climate change impacts (saltwater intrusion and rainfall changes) can threaten cultural sites, such as fishponds, and water quality and quantity can impact traditional Hawaiian practices, such as taro cultivation, aquaculture, and fishing. Coastal waters, including Waimānalo Bay, Kailua Bay, Lanikai Beach, and Kāneʻohe Bay, are important recreational areas and their marine ecosystems require protection from pollution and intense storms. Rising sea levels can impact beaches and development along the shoreline. Effective stormwater management practices and infrastructure maintenance are necessary to address increased flooding. Urban encroachment can present challenges for natural and agricultural lands.

City engagement includes efforts related to stormwater management, potential water reuse alternatives, restoration to support coastal mitigation, infrastructure repairs, a resilience review, and a vulnerability assessment to identify at-risk roads to future climate events.

HDOT has completed roadway, drainage, pedestrian, and bicycle improvements along Kalanianaʻole Highway in Waimānalo, including installation of a new drainage system from Mōʻole Street to Tinker Road and safety features, such as raised pedestrian crosswalks in some areas.

KOʻOLAU POKO

Urban areas like Kāneʻohe, Kailua, and Lanikai, are at risk from wildfires due to their proximity to wildland areas and presence of invasive species. Koʻolau Mountains and Forest Reserves also experience wildfire risk, which are critical areas for groundwater recharge.

Recommendations from Previous Planning Efforts

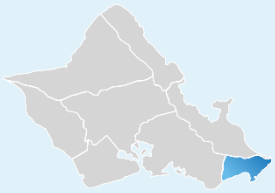
Proposed recommendations include surface and groundwater protections, wildfire mitigation, investment in resilient infrastructure, and community engagement, while supporting cultural values:

- Protect and restore natural / cultural resources that support water quality, manage flooding, and provide cultural and food systems support.
- Protect drinking and agricultural irrigation water sources and support water conservation measures to reduce water loss and keep more water in streams and aquifers for stream restoration and storage for drought.
- Expand R-1 reuse in Waimānalo and Kāneʻohe Marine Corps Base Hawaiʻi to reduce source production and restore stream flows.
- Continue to expand restoration for loʻi kalo (taro patches) and loko iʻa (fishponds).
- Implement measures to prevent wildfires and mitigate their impacts, including promoting fire-safe practices in land management and community planning.
- Invest in resilient infrastructure to withstand extreme weather conditions and natural disasters.
- Work with the state to develop coastal management plans to address erosion and flooding, including beach nourishment and relocation of vulnerable infrastructure.
- Maintain the Sustainable Communities Plan Community Growth Boundary to contain urban development to protect agricultural and conservation lands in the upper watershed through protective regulatory measures and public acquisition.

KOʻOLAU POKO

	• Promote sustainable development practices that reduce environmental impacts including green infrastructure like rain gardens and bioswales to manage runoff and improve water quality. • Replace outdated individual cesspools with newer, less polluting alternatives in areas outside of planned municipal wastewater service areas, or with municipal coverage where possible • Develop comprehensive resilience plans, conduct public education campaigns related to emergency response strategies and drills, and engage the community in natural disaster preparedness activities.
Key Regional Themes Related to Water	Koʻolau Poko's key themes include protecting abundant stream systems, wetlands, aquifers, and coastal waters while sustaining traditional practices such as loʻi kalo, loko iʻa, and aquaculture, and fishing. Water quality concerns from urban and agricultural runoff, changing precipitation patterns, coastal flooding, and wildfire risk drive recommendations related to watershed protection, green infrastructure, water conservation and reuse, and resilient infrastructure.

EAST HONOLULU



Governing Plans: Koʻolau Loa Watershed Management Plan, Koʻolau Loa Sustainable Communities Plan

General Plan population share (2040): 1%

Area Classifications: Country Towns and Rural Coastline, Major Linear Network Corridors, Recharge and Runoff Management Opportunities

Watersheds: Waiʻalae Nui, Wailupe, Niu (also referred to as Pia), Kuliʻouʻou, Hahaʻione, Kamilo Nui, Kamilo Iki, Portlock, Hanauma, Koko Crater (also referred to Napaia)

Land Use Highlights

East Honolulu extends from Makapuʻu Point in the east to Waiʻalae Nui stream and gulch in the west. The region is encompassed by the peaks of the Koʻolau Range to the north, and by the shoreline, including Maunalua Bay, to the south. East Honolulu consists primarily of residential communities, including Waiʻalae Iki, Wailupe, ʻĀina Haina, Niu Valley, Kuliʻouʻou, Hawaiʻi Kai, Portlock, and Kalama Valley, with some supporting businesses. The East Honolulu Sustainable Communities Plan notes that the population is projected to stabilize through 2040, and therefore, significant demand for additional commercial development, major infrastructure investments because of growth, and public facility capacity is not anticipated. However, East Honolulu must take proactive measures to improve resiliency to hurricanes, coastal and inland erosion, inundation, and flooding, and address aging infrastructure. The Community Growth Boundary for East Honolulu directs most new development to infill sites within or adjacent to existing urbanized areas to promote the efficient use of infrastructure, protect nearby properties, and support walking, biking, and transit use.

East Honolulu is home to many wildlife preserves and natural areas, including Kānewai Spring and Fishpond, Paikō Lagoon Wildlife Sanctuary, Kaʻiwi Scenic Shoreline, Maunalua Bay, and other mountainous, coastal, and wetland habitats.

EAST HONOLULU

Water Overview

The area experiences a generally dry climate year-round, but development has exacerbated flooding impacts along local streams. Erosion and sea level rise affect portions of East Honolulu's roadway network and these climate threats are expected to limit lateral shoreline access. Maunalua Bay, which spans the most developed portion of the coastline, is a popular recreational hub featuring a boat harbor, fishing areas, and canoe paddling launch sites. Other significant nearshore areas include Hanauma Bay, a popular visitor attraction known for snorkeling, and the Kaʻiwi Coast, a preserved shoreline area with recreation access and scenic views. Springs are a main source of water for habitats, and many of East Honolulu's streams have been concreted and channelized to help convey stormwater. This fast stormwater conveyance leads to water quality issues since the water does not have time to settle and carries sediments and other particulates downstream and into Maunalua Bay.

There are ongoing City efforts to address flooding along Wailupe Stream, and green infrastructure and water conservation are emphasized to address sediment transport and nonpoint source pollution impacts to Maunalua Bay. Improvements to Sand Island WWTP include increased climate resilience and full secondary treatment. BWS is also evaluating an alternative source of water for the Hawaiʻi Kai Executive Golf Course irrigation as a conservation strategy.

The DLNR completed a dredging and beach restoration project at the entrance channel of the Maunalua Bay in 2026.

Climate Threats

East Honolulu faces severe flooding in valleys and current control measures are insufficient to meet flood conditions. Surface and groundwater in the area face pressures from floods, urbanization, and other contamination sources, which can also threaten habitats and rare species. Wailupe Stream experiences significant drainage issues and the current flood control system cannot handle debris flows and flood discharges greater than a 20-year recurrence interval. Sedimentation, urban runoff and wastewater/cesspools contribute to environmental impacts in Maunalua Bay. Areas including Niu

EAST HONOLULU

Valley, Kuliʻouʻou Valley, and Hahaʻione Valley have historically experienced severe flooding, especially during intense rainstorms, and concrete-lined channels further contribute to drainage issues. Flooded infrastructure, such as bridges, can prevent access during storms and other climate threats.

Additionally, like many areas across the state, emergency shelters are not hurricane-rated or climate change resilient, and East Honolulu features steep hillsides with boulders and sediments, which can pose health and safety risks. Recycled water from the privately owned East Honolulu WWTP has high salinity levels, which can limit its use without expensive demineralization. A drying trend from climate change, in addition to increased heat and other factors, will contribute to reduced aquifer yields and affect future water supply. Wildfire risk is also a concern in this region. Coastal and low-lying areas adjacent to the shoreline will be subject to higher groundwater, inundation, and other related impacts as sea levels rise.

Recommendations from Previous Planning Efforts

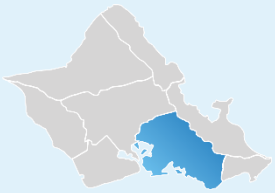
These recommendations focus on addressing water supply concerns, improvements to Sand Island WWTP and emergency shelters, watershed restoration, and flood-related risk and impacts:

- Continued participation in the Army Corps of Engineers Wailupe Stream Flood Risk Management Study.
- Construct improvements to the Sand Island WWTP, serving Kāhala to Niu Valley, to meet secondary treatment requirements.
- Support water quality improvements, such as green infrastructure, and restoration efforts in the upper watershed of Niu and Wailupe Valleys to decrease soil erosion entering Maunalua Bay.
- Implement, where feasible, water recycling as a conservation measure.
- Harden emergency shelters to effectively serve communities facing an increase in windstorms and hurricanes frequency and intensity.
- Analyze the potential impact of sea level rise for new public and private projects in shoreline and low-lying areas.

EAST HONOLULU

	• Implement low-impact development standards to capture stormwater, sediment, and toxic pollutant runoff on-site and reduce pollutant loads into downstream water bodies.
Key Regional Themes Related to Water	East Honolulu's key themes include improving flood resilience, addressing sediment and stormwater impacts to Maunalua Bay, and protecting springs, wetlands, and nearshore ecosystems. Constraints on recycled water use, aging infrastructure, water quality, wildfire risk, and vulnerable emergency facilities drive recommendations related to flood mitigation, green infrastructure, water conservation, and upper watershed restoration.

PRIMARY URBAN CENTER



Governing Plans: Primary Urban Center Watershed Management Plan (DRAFT), Primary Urban Center Development Plan, ʻAiea- Pearl City, Airport, Kalihi, Downtown, Civic Center (HCDA), and Ala Moana Transit Oriented Development Neighborhood Plans

General Plan population share (2040): 43%

Area Classifications: Major Hubs & Economic Centers, Opportunities within Redevelopment and Growth, Major Linear Network Corridors, Recharge and Runoff Management Opportunities

Watersheds: Waiʻalae Nui (por.), Mānoa-Palolo, Makiki, Diamond Head, Ala Wai, Nuʻuanu, Kapālama, Kalihi, Moanalua, Keʻehi, Manuwai, Halāwa, Salt Lake, ʻAiea, Kalauao, Waimalu, Waiawa (por.)

Land Use Highlights

The PUC extends from Waiʻalae - Kāhala to Pearl City, along a portion of the southern Oʻahu coastline and bounded by the Koʻolau Range. The PUC is Oʻahu's most densely developed region, accounting for around 44% of the island's population and serving as a major center of employment as well. Current development trends in the PUC focus on infill and redevelopment, particularly in areas like Kakaʻako. Additionally, TOD associated with the rail system is promoting higher-density mixed-use communities and increased transit usage around the Skyline rail stations.

The most recent PUC Development Plan (2025) calls for guiding new development away from climate hazards and sensitive natural environments, including high flood risk areas. The Urban Growth Boundary policy supports development within currently designated residential areas to protect forest areas and avoid further development on steep slopes.

Healthy upper watershed areas that support groundwater recharge and enhance stream health and forest restoration and conservation lands within the PUC are recognized as vital to supporting sustainable watersheds.

PRIMARY URBAN CENTER

Water Overview

Much of the coastline in the PUC was historically modified through land reclamation and/or hardened to support development, particularly Waikīkī, which was constructed on drained wetlands, and Māpunapuna, which was built on filled fishponds. Interest in projects that integrate natural area restoration with urban design in the region has emerged as a preferred approach to addressing local flooding concerns and environmental quality. The region's extensive development also includes aging water-related infrastructure, with many pipelines requiring repair or replacement to meet current and future demands. The majority of the region's water supply comes from the Honolulu aquifer for eastern PUC areas and the Pearl Harbor aquifer for western areas.

City efforts in the PUC include adaptation planning efforts, various water infrastructure related studies, projects, and assessments, potential water resource development, stormwater management, and key infrastructure improvements.

Various projects, led by both City and State agencies, are working to reduce flood risk in this highly developed part of Oʻahu.

Climate Threats

The PUC faces significant climate-driven hazards, including sea level rise, coastal erosion, flooding, and stormwater runoff, particularly in low-lying areas such as those surrounding Pearl Harbor and the Ala Wai Canal. The PUC Development Plan also cites increasing preparedness for disasters, including hurricanes, as a priority. Flooding and heavy rain events threaten infrastructure, businesses, homes along streams, and sea-level rise creates higher risk for flooding and coastal inundation. Many of the areas that are at high risk of flooding and coastal inundation include dense, urban areas, with critical infrastructure. Aging infrastructure, water, wastewater and drainage requires maintenance, replacement and capacity expansion to reduce water loss, stormwater management issues, and flooding. Polluted runoff, including contaminants such as sediments, nutrients, pesticides, trash, and other pollutants, contribute to water quality degradation. The Honolulu and Pearl Harbor Aquifers are important drinking water resources in the area which

PRIMARY URBAN CENTER

require long-term protection from polluting land uses. Rising temperatures due to climate change and urban landscapes create concern around heat stress. Neighborhoods adjacent to vegetated natural areas may face increased fire risk, and fires can generally spread quickly in dense, urban areas.

Recommendations from Previous Planning Efforts

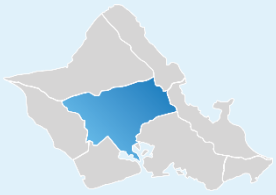
The PUC recommendations include infrastructure upgrades and maintenance, groundwater recharge, community preparedness, water resources protection, flood mitigation, and emphasizing public education:

- Implement stream management practices to mitigate flooding, including community initiatives like "Adopt a Stream" for maintenance and monitoring, and expand drainage capacity.
- Maintain and replace water-related infrastructure to ensure quality, support growth (especially infill), and meet environmental standards.
- Inspect and upgrade infrastructure regularly to address drainage capacity, population growth and future needs.
- Incorporate green infrastructure design features (e.g., permeable surfaces, bioswales, rain gardens) to manage stormwater, recharge groundwater, and protect ocean water quality.
- Provide public education on fire safety, evacuation plans, hazard awareness, and water conservation.
- Protect and manage upper watersheds and forests to enhance groundwater recharge and stream health.
- Conduct flood channel improvements, and other stormwater management improvements such as detention basins.
- Develop a road raising strategy and coordinate with development to address chronic flooding and sea level rise challenges.

PRIMARY URBAN CENTER

	• Prioritize restoration of traditional Hawaiian practices, such as loʻi kalo and loko iʻa, to enhance community health and well-being, while improving stormwater management, groundwater recharge, climate resilience, and food security.
Key Regional Themes Related to Water	The Primary Urban Center's key themes include maintaining and upgrading aging water, wastewater, and drainage infrastructure in Oʻahu's most densely developed region, and emphasizing protection of the Honolulu and Pearl Harbor aquifers. Sea level rise, flooding, stormwater pollution, urban heat, and development pressure drive recommendations related to green infrastructure, flood mitigation, infrastructure replacement, upper watershed protection, water conservation, and restoration of traditional Hawaiian water and land practices.

CENTRAL O‘AHU



Governing Plans: Draft Central O‘ahu Watershed Management Plan, Central O‘ahu Sustainable Communities Plan, Waipahū Transit-Oriented Development (TOD) Neighborhood Plan

General Plan population share (2040): 18%

Area Classifications: Mid-Density Communities, Recharge & Runoff Management Opportunities

Watersheds: Waiawa (por.), Waipi‘o, Kapakahi, Waikele (por.), Ki‘iki‘i (por.), Honouliuli (por.)

Land Use Highlights

The Central O‘ahu planning region includes the wide and fertile plateau between the Wai‘anae and Ko‘olau mountain ranges and extends narrowly down to a southerly point at the Waipi‘o Peninsula in Pearl Harbor. From the turn of the last century, much of this area was previously in large-scale agricultural production of sugarcane and pineapple. Today the older and formerly rural low to mid-density suburban towns of Wahiawā, Mililani, and Waipahū have been joined by more recent developments in Royal Kunia, Village Park, Waipi‘o, and Waikele. Agricultural use remains an important component of the Central O‘ahu economy.

The area hosts the Schofield Barracks, the island’s largest army base, and other former and active military installations. Central O‘ahu is considered an agricultural and “urban fringe” region with pockets of established suburban development that are expected to remain mostly stable. Apart from these uses, a substantial portion of the region is mountainous and remains in county preservation and state conservation designations. Central O‘ahu has many notable sites including historic plantation villages, the Kūkaniloko Birthstones State Monument and its surrounding lands managed by the Office of Hawaiian Affairs, the historic OR&L Railway, and the Wahiawā Botanical Garden.

Key mauka conservation efforts in the region include the Wai‘anae and Ko‘olau Mountains Watershed Partnerships, the Helemano Wilderness Area, and the O‘ahu Forest National Wildlife Refuge, a federally protected mountain forest that supports rare native flora and fauna.

CENTRAL O‘AHU

Water Overview

The Central O‘ahu region is on the hotter and drier leeward side of the island. Water resource planning for the Central O‘ahu region must strike a balance between preserving and managing watersheds and maintaining sustainable ground and surface water use, as well as developing alternative sources such as through recycled water. Groundwater from Central O‘ahu is used to supply potable demands in ‘Ewa and Wai‘anae, and to lesser extent the Primary Urban Center (PUC).

High quality recycled water produced at the Wahiawā Wastewater Treatment Plant (WWTP) that is currently discharged into the Wahiawā Reservoir could eventually be distributed to future recycled water users via pump upgrades at the WWTP. The Waiāhole Ditch Irrigation System brings water from windward O‘ahu to remaining agricultural lands in Central O‘ahu including Kunia. Use of recycled water from the Wahiawā WWTP and reclaimed storm water for urban and agricultural irrigation is supported by the Central O‘ahu Sustainable Communities Plan.

Near the coast, the City’s Waipahū Town TOD planning calls for additional studies for the existing berm at the Hawai‘i Plantation Village to assess its ability to control flooding in the Waipahū Station area, as well as identifying other specific actions to address floodplain requirements. Low lying areas of Pearl Harbor and parts of Waipahū are subject to coastal erosion. The Pearl Harbor estuary, and Wahiawā and Pearl Harbor aquifer recharge areas, are important water resources for the region. After significant flooding in 2026, the state acquired the Wahiawā Dam and irrigation system (c.1906) from the Dole Food Company to protect the agricultural irrigation supply that flows to the North Shore region and to help alleviate future flooding in that region from the Wahiawā Reservoir by broadening the spillway.

The City is taking part in efforts related to stormwater management and reuse, wastewater treatment plant upgrades, solid waste management options, and watershed planning. Pouhala Marsh (a former lo‘i and loko i‘a) owned by the State and the City is the largest remaining tidal wetland in Pearl Harbor and is

CENTRAL O‘AHU

undergoing ongoing habitat and restoration efforts. Related improvements include Kapakahi Stream restoration.

A key state-led effort includes the development of total daily maximum loads (TMDL) for water bodies. The Hawai‘i Department of Health (DOH) develops TMDLs to determine the maximum amount of a pollutant that a body of water can receive and still meet water quality standards. TMDLs are established for Kaukonahua and Waikele stream systems in support of water quality improvement.

Climate Threats

Climate-related threats identified for Central O‘ahu include flooding, both along streams and in portions of roadway, and coastal and shoreline erosion in certain communities that can damage businesses, homes, and infrastructure. Natural and constructed vegetated drainage systems and drainageways create flood concerns in low lying areas, such as Waipahū around Waikele Stream. Areas of Waiawa also face flood risks due to inadequate drainage. Farrington Highway is an arterial road prone to flooding that requires infrastructure resilience improvements. There is a statewide shortage of emergency shelters, and of those that exist, many are not able to withstand hurricane strength winds and storms. The agricultural plains in the center of the region are dependent on aging irrigation infrastructure and are at moderate risk for experiencing drought conditions. Central O‘ahu has experienced several large wildfires and increased drought can impact wildfire risk.

Water quality degradation resulting from nutrients contamination, chemicals, and sedimentation in waterbodies is also a concern. Contaminants can also impact potable water sources, such as the Pearl Harbor aquifer. In addition to nonpoint source pollutants from urban and agricultural land use, areas surrounding the closed Waipahū Ash Landfill and former incinerator site also pose potential environmental contamination risks. Fueling operations related to military uses, including underground storage tanks and pipelines, and the Pearl Harbor Naval Complex site may pose higher contamination risk as sea levels rise and persistent flooding occurs.

CENTRAL O‘AHU

Recommendations from Previous Planning Efforts

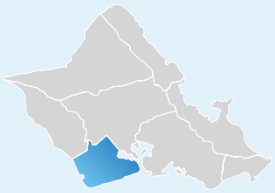
Some of the key recommendations related to water supply and quality, conservation and restoration, stormwater management and flooding, and community benefits include:

- Assessing flooding issues, upgrade drainage infrastructure, promote localized rainfall absorption, and restore wetlands for increased resilience and water quality improvement.
- Securing sufficient potable and non-potable water supplies for new developments.
- Promoting conservation measures (low flow plumbing and efficient irrigation systems) to support water supply for both residential and agricultural uses.
- Increasing access to water-related recreational opportunities along the Pearl Harbor shoreline.
- Supporting a sustainable diversified agricultural economy in Kunia and Whitmore with sufficient non-potable irrigation supply, water and wastewater infrastructure for food processing hubs, fire protection and workforce housing.
- Protecting source water from potentially contaminating activities.

Key Regional Themes Related to Water

Central O‘ahu’s key themes include the balance of water conservation with agricultural and community needs, exploration of alternative water supplies, and improvement of flood control infrastructure. Coastal and shoreline erosion pose threats to communities, and water quality concerns from nonpoint sources and the closed Waipahū Ash Landfill and former incinerator site are also present. Key themes drive recommendations related to water supply and quality, conservation and restoration, stormwater management and flooding abatement, and community benefits including ecosystem restoration and greater connections to the shoreline.

ʻEWA



Governing Plans: ʻEwa Watershed Management Plan (DRAFT), ʻEwa Development Plan, East Kapolei TOD Neighborhood Plan

General Plan population share (2040): 16%

Area Classifications: Mid-Density Communities, Opportunities within Redevelopment and Growth

Watersheds: Honouliuli (por.), Kaloʻi, Makaīwa

Land Use Highlights

The ʻEwa planning region has boundaries extending from Kunia Road to Kahe Point and extending mauka from the coast to towards Kaloʻi Gulch. It includes the communities of Iroquois Point, ʻEwa, ʻEwa Beach, Kalaeloa, Kapolei, and Makakilo. Although a much smaller share of the island's population, the ʻEwa planning region is outpacing the Primary Urban Center (PUC) for new growth, per the City's FY2023 Annual Report on the Status of Land Use on Oʻahu. Identified in the General Plan as a secondary urban center, the ʻEwa region through the City's directed growth policies is absorbing new growth along with the entire TOD Special District (some in ʻEwa but mostly in the PUC) in order to steer excessive growth away from rural and natural resource areas to "keep the country, country." Apart from the remaining historic plantation era villages, the residential communities in the ʻEwa planning region are comprised almost entirely of master planned developments built from the mid-century to present day, which are intended to be complete live and work communities. A construction boom that has continued in successive phases until today began in the late 80's upon the decline of the farming economy.

The ʻEwa region and to a lesser extent Central Oʻahu are likewise absorbing much of the demand for utility scale solar fields and industrial uses, including heavy industrial uses that have largely been pushed out of the PUC in favor of higher value land uses. The region also hosts a number of legacy industrial sites including the island's only municipal solid waste landfill, the H-Power facility, and the Kahe Power Plant. The Skyline rail system began operating the first segment from east Kapolei to Aloha Stadium in 2023 and is gradually coming online heading east, making ʻEwa the first region to benefit from the new transit alternative. Historic and decommissioned military installations

ʻEWA

transitioning to new uses and remnant agricultural areas complete the land use profile in the region. Notable sites in the ʻEwa region include the Kalaeloa Heritage Park, the historic ʻEwa Plantation Villages, the Leeward Bikeway connecting the West Loch Bike Path and the Pearl Harbor Historic Trail and including interpretive signage, and the Hawaiian Railway Society (OR&L Railway). The ʻEwa region is also home to the UH West Oʻahu campus.

The ʻEwa region reaches the southern slopes of the Waiʻanae range where conservation areas and efforts include the Honouliuli Forest Reserve that provides critical habitat and recharge to the Pearl Harbor aquifer, and the work of the Waiʻanae Mountains Watershed Partnership.

On the ʻEwa Beach shoreline extending 150 feet seaward, the Hawaiʻi Department of Land and Natural Resources (DLNR) manages the ʻEwa Limu Management Area to protect the seaweed resources that are historically prevalent in ʻEwa.

Water Overview

ʻEwa is on the hot and dry far-leeward side of the island that has relatively low levels of rainfall. Most of the region receives less than 35 inches per year and has higher average temperatures, especially in the urbanized areas. Ongoing climate change impacts has trended in the direction of higher temperatures and reduced rainfall, while simultaneously increasing rainstorm intensity. These impacts may be expected to accelerate under climate change. The region draws groundwater from several limited sources and has only one perennial surface stream (Honouliuli) and a number of dry gulches. Water conservation, aquifer recharge, and resource diversification are high priorities for this region, especially as the population continues to increase.

The BWS operates the Honouliuli Water Recycling Facility in ʻEwa that is the largest water recycling facility in the state, designed to produce 12 million gallons of recycled water per day. R-1[2] water is produced for the region's irrigation needs, and reverse osmosis (RO) water is used for industrial

[2] R-1 is the highest grade of recycled water. Wastewater must be treated through oxidization, filtration, and disinfection (Hawaiʻi State Department of Health, 2016).

ʻEWA

processes. Several of the region's golf courses have been designed to contain floodwater. In 2024, the City took ownership of roughly 400 acres of the former Barbers Point Naval Air Station in Kalaeloa with a vision to begin planning and developing a new regional park. Much of Kalaeloa has transitioned from the Navy's water system to the private Hawai‘i Water Service system. The BWS is developing a state-of-the-art seawater desalination plant in the Kalaeloa James Campbell Industrial Park to support future potable water needs in the growing region. Other City efforts include sustainability initiatives to wastewater systems, implementation of stormwater best management practices, and evaluation of adaptation options for coastal areas that are especially vulnerable to sea-level rise and storm surge.

Climate Threats

Rising sea levels and extreme weather further highlight the need for climate adaptation, prompting the community to incorporate resilience measures such as green infrastructure, sustainable stormwater practices, and wildfire mitigation into planning efforts.

Urbanization has led to flooding and nonpoint source water pollution issues, which can impact habitat and cultural practices, while erosion and sea level rise threaten coastal areas. Several areas in ʻEwa are particularly susceptible to flooding, including the ʻEwa Plain, a low-lying region with ongoing stormwater system improvements. Sea level rise may increase the risk of saltwater infiltration into sewer collection systems, posing challenges for water treatment and reuse. Other areas including Renton, Tenney, and Varona Villages, have inadequate drainage systems and require targeted infrastructure upgrades. Areas like Kaloʻi Gulch, Kapolei, and West Loch watersheds need improvements to address flooding and pollution control. The ʻEwa Beach coastline faces challenges from erosion and sea-level rise. There is a statewide shortage of emergency shelters, and many are not hurricane resistant.

The region imports more than half of its water needs from Central Oʻahu, which makes ʻEwa reliant on other parts of the island for its water supply. However, rapid growth and water demand already places pressure on existing water infrastructure. Warmer air and water temperatures, along with changing precipitation patterns, increase pollution of streams and nearshore waters.

ʻEWA

	Increased temperatures also contribute to increases in potable and non-potable water supplies and compound coastal environment impacts. Certain areas are at heightened risk for wildfires due to dry conditions and unmanaged vegetation, especially along the wildland-urban interface. Many areas are more flood-prone due to geography, insufficient drainage, and impervious surfaces. Extreme weather conditions resulting from climate change exacerbate these issues.
Recommendations from Previous Planning Efforts	Recommendations focusing on flood management, wildfire risk, water quality and resources, conservation, and cultural practices, include the following: • Conduct hydrologic modeling for flow and drainage management where frequent flooding occurs. • Look for additional opportunities for use of recycled water. • Continue to develop new groundwater and alternative water supplies. • Continue to promote water conservation measures and public engagement. • Assess wildfire risks and implement wildfire prevention measures especially along the wildland-urban interface. • Protect and restore cultural and natural resources in ʻEwa including those that help to enhance and protect water quality and water resources. • Ensure that setbacks along shorelines are sufficient based on erosion projections. • Improve stormwater retention and detention for sediment control. • Evaluate the Kalo'i Gulch planning and permitting process for lessons learned that can be applied to other large-scale drainage plans.
Key Regional Themes Related to Water	ʻEwa's key themes include managing relatively rapid growth and increasing water demand in a hot, dry region with limited local water resources. Flooding, coastal erosion, wildfire risk, and water quality concerns from urbanization and industrial land uses further emphasize the need for conservation, alternative water supplies, stormwater management, aquifer recharge, and protection of cultural and natural resources.

WAIʻANAE



Governing Plans: Waiʻanae Watershed Management Plan, Waiʻanae Sustainable Communities Plan

General Plan population share (2040): 5%

Area Classifications: Country Towns and Rural Coastline, Major Linear Network Corridors, Recharge and Runoff Management Opportunities

Watersheds: Nānākuli, Ulehawa, Māiliʻili, Kaupuni, Kamaileʻunu, Mākaha, Keaʻau, Mākua, Kalaukauila

Land Use Highlights

The Waiʻanae region is characterized by white sand beaches, a narrow coastal plain, large valleys extending 3 to 5 miles inland, and framed by the steep, deeply eroded slopes of the Waiʻanae Mountains. Waiʻanae is a rural area with residential and commercial centers in Māʻili, Nānākuli, Waiʻanae and Mākaha, with the highest concentrations of the Native Hawaiian population on Oʻahu. The region's history with commercial agricultural and expansions have contributed to the protection of lands from development, but conversely, as in other areas, has greatly altered the natural landscape. The Waiʻanae Coast is noted for its ancient temples, and natural areas such as rocks, cliffs, and reefs carrying deep historic and religious significances. The region contains large concentrations of historical and cultural sites and emphasizes Native Hawaiian values and traditional practices.

Much of the region's urban and suburban development is along the Farrington Highway corridor. Valley areas consist of primarily agricultural and military land, while steeper ridges and mountainous areas are typically undeveloped grassland and forested areas. Agriculture primarily consists of small-scale family farms, and continued protection and availability of agricultural lands for farms and rural homesteads is essential to preserving Waiʻanae's lifestyle. There are thousands of acres of military lands within Mākua Military Reservation and Lualualei Naval Magazine. Retail commercial and industrial areas in Waiʻanae are focused on serving the needs of residents, as opposed to serving as "destination retail" centers or "regional industrial" centers.

WAIʻANAE

General community support for more defined local commercial and service centers is described in the Waiʻanae Sustainable Communities Plan.

Safeguarding the region's beaches, coral reefs, and estuaries is a priority, both from development and pollutants. Undeveloped land and open space areas include locations such as Kepuhi Point, beach parks, ranch lands, and extensive areas of State-owned forest lands. Waiʻanae places importance on preserving, protecting, and restoring its shorelands, valleys, and mountains.

Water Overview

Water is central to the identity and survival of Waiʻanae, reflected in its name (wai for freshwater and ʻanae for mullet) and its role in sustaining agriculture, aquaculture, and daily life. Low annual rainfall results in very dry conditions most of the year and high susceptibility to wildfire. When rains do occur, low-lying areas are subject to flash flooding. The Waiʻanae and Mākaha Aquifer System Areas are vital for ecosystem health and important potable water sources. Waiʻanae has limited groundwater resources, which has guided types of development in the region.

In Waiʻanae, the City has completed wastewater treatment plant improvements and upgrades and plan to pursue the designation of the Waiʻanae Aquifer Sector Area as a Ground Water Management Area to help protect the resource.

Climate Threats

Flash flooding events occur along streams and can disrupt roadways, and saltwater inundation threatens potable and brackish water sources. Additionally, sedimentation and pollution from non-point sources, impervious surfaces, and cesspools can threaten the health of waterbodies. Some areas of the Waiʻanae Coast are vulnerable to natural hazards including tsunami, tropical storms, high surf and hurricanes.

State of Hawaiʻi Department of Transportation (HDOT), Highways Division, replaced Mākaha Bridge No. 3 & No. 3A, located along Farrington Highway, with prefabricated steel bridges to improve structural integrity, hydraulic openings, and stream channel improvements.

WAIʻANAE

Increased water demand resulting from additional residential development places pressure on water infrastructure and water supply. Groundwater depletion and drought impacts on surface water create additional concerns. Over half of the water used in Waiʻanae is imported from the Pearl Harbor sector. Coastal areas and lower sections of valleys are generally hot and dry. Due to Waiʻanae's dry environment, wildfire poses a significant climate hazard. Large areas of Waiʻanae are subject to Public Safety Power Shutoffs by the Hawaiian Electric Company (HECO) during periods of high wildfire risk.

Recommendations from Previous Planning Efforts

The following recommendations address flooding and pollution concerns, conservation, prioritization of ecological and cultural practices related to water, and wildfire impacts:

- Conduct infrastructure improvements to address flash flooding and reduce pollution and runoff.
- Support additional sewer infrastructure such as sewer transmission mains
- Continue to develop additional drinking water sources.
- Support the provision of water for ecological and cultural practices such as loʻi kalo.
- Emphasize conservation of water and preservation of ecosystem assets through installation or improvement of the built environment.
- Support wildfire prevention efforts to protect lives and properties as well as reduce possible sediment pollutant loading.
- Partner with the community on ecological stewardship and restoration projects.
- Pursue local and district-scale drainage improvements.

WAIʻANAE

Key Regional Themes Related to Water

Waiʻanae's key themes include protecting limited groundwater resources, supporting local and imported water supply reliability, and sustaining cultural and ecological practices in a dry leeward region with high wildfire risk. Flooding, drought, saltwater inundation, and water quality concerns from cesspools, sedimentation, and runoff drive recommendations related to drinking water resource development, wastewater improvements, flood infrastructure, conservation, wildfire prevention, and protection of water resources for cultural practices.

4.3 SUMMARY

This section summarizes previous planning efforts, including past outreach, for key takeaways that help inform the path forward.

THEMES ACROSS REGIONAL PLANNING EFFORTS

Across the planning districts, recommendations center around flood and stormwater management, water quality protection and wastewater system improvements, increasing water supply availability through reuse, conservation, and source development, restoration activities and low-impact development, climate hazard preparedness, and community and culture-focused governance.

Table 4-1 summarizes and compares key climate hazards, including other concerns, across the regions based on reviewed plans. The climate hazards identified in Table 4-1 affect regions across Oʻahu; however, where region-specific concerns were documented in the reviewed plans, they are noted in the table. All regions are impacted by various sea level rise challenges and issues related to heavy rain and flash flooding. Specific impacts from sea level rise include coastal flooding and erosion, and infrastructure inundation. Flooding issues often accompany insufficient drainage systems, the need for debris management, and urbanization impacting natural drainage patterns. Hurricanes are a threat across Oʻahu, and many emergency shelters are not rated for severe storms, which are last resort options for those who may not have a safer space. Drought frequency and severity are anticipated to increase, especially on the leeward side of Oʻahu. Drought concerns cited in reviewed plans include both long-term availability (i.e., changing rainfall patterns) and water demand-related infrastructure concerns, such as being able to meet growth needs. Several regions face elevated wildfire concerns, especially in the drier parts of Oʻahu and in areas with wildland-urban interfaces. Urban heat effects, rising temperatures, and the need for increased emergency preparedness are challenges throughout the island. High temperatures can affect agricultural productivity and contribute to increased water demand.

Although planning districts share climate hazards, regional conditions and considerations affect how recommendations may be implemented.

Table 4-1. Summary of climate threats by region based on reviewed plans

	NORTH SHORE	KOʻOLAU LOA	KOʻOLAU POKO	EAST HONOLULU	PRIMARY URBAN CENTER	CENTRAL OʻAHU	ʻEWA	WAIʻANAE
SEA LEVEL RISE	Coastal zones and infrastructure are vulnerable to sea level rise and storm intensity, and other risks like ecosystem disruption is also a concern.	Sea level rise intensifies coastal flooding affecting roadways and leads to increased erosion risks for coastal infrastructure and habitats.	Rising sea levels threaten beaches, shoreline development, fishponds, and coastal ecosystems	Coastal communities and infrastructure are increasingly vulnerable to erosion and flooding.	Coastal erosion, high tide flooding, and groundwater inundation pose risks to critical infrastructure and communities.	Low-lying areas near Pearl Harbor and Waipahū are subject to erosion that threaten coastal areas and communities.	Coastal areas, including the ʻEwa Beach shoreline, face challenges related to sea level rise.	Saltwater inundation threatens potable and brackish water sources.
HEAVY RAIN	Flood-prone areas include streams and low-lying areas which experience significant flooding, exacerbated by altered drainage patterns and increased storm runoff from the mauka areas.	Intense rainfall and inadequate drainage lead to heightened flood risk in low-lying areas, in valleys, along streams, in roadways, and in school areas.	Effective stormwater management practices and infrastructure maintenance are necessary to address increased flooding.	Severe flooding occurs in valleys, and current flood control and debris management are not sufficient to meet flood conditions.	Heavy rainfall causes flooding along streams, infrastructure, and in dense urban areas where drainage systems are constrained.	Flooding along streams and roadways can damage businesses, homes, and infrastructure, and overwhelm drainage systems during heavy rainfall.	Various residential and low-lying areas are susceptible to flooding, with inadequate drainage systems.	Flash flooding events occur along streams and can disrupt roadways.
HURRICANES	Susceptible to hurricanes, other coastal and storm-related hazards.	Koʻolau Loa is susceptible to flooding, tsunami, tropical storms, hurricanes and high surf conditions.	Hurricanes represent a threat across Oʻahu. The development of more emergency shelters is encouraged.	Emergency shelters are not rated to withstand the effects of intense windstorms and Hurricanes.	Increased community preparedness is needed for disaster events, including hurricanes.	Hurricanes represent a threat across Oʻahu. A shortage of hurricane-resistant shelters leaves areas vulnerable during major storms.	Hurricanes represent a threat across Oʻahu. A shortage of hurricane-resistant shelters leaves areas vulnerable during major storms.	Areas of the Waiʻanae Coast are susceptible to hurricanes and other coastal and storm-related hazards.
DROUGHT	Agricultural water supply is constrained by limited irrigation water quality (R-2 water can only be used for crops where water does not touch edible portions of plants).	Changing rainfall patterns associated with climate change threaten water supply and stream flows. Agricultural and potable water supply are prone to drought in some areas of the region.	Agricultural water sources and cultural practices are threatened by changing precipitation patterns.	A drying trend from climate change will affect aquifer recharge and water supply in the future.	Water quality impacts pose a risk to drinking water resources.	Agricultural plains in the center of the region are at moderate risk of drought.	The region imports more than half of its water needs from Central Oʻahu, which makes ʻEwa reliant on other parts of the island for its water supply.	Groundwater depletion, drought impacts on surface water, limited groundwater resources, and dependence on imported water are concerns.
WILDFIRE	Wildfire is a threat across Oʻahu, and wildfire risk may increase due to increased variability in rain and drought.	Portions of watersheds in Koʻolau Loa are susceptible to wildfires during low rainfall periods.	Wildfire risks threaten forest reserves, areas of the Koʻolau Mountains, and communities in proximity to wildland areas.	Wildfire is a concern (generally dry climate and many residential communities in the region).	Neighborhoods bordering vegetated natural areas may have increased fire risk and fires can spread quickly in dense, urban areas.	The region has experienced multiple large wildfires, and drought conditions can exacerbate wildfire risk.	Periods of drought and wildland-urban interface areas can increase fire risk, especially in areas with unmanaged vegetation.	The region's dry environment increases wildfire risk, and multiple communities are subject to fire hazards and power shutoff.
EXTREME HEAT	Higher temperatures and more variable rainfall patterns are expected to reduce agricultural productivity and accelerate the spread of invasive pests.	Extreme heat is a threat across Oʻahu. Higher stream temperatures can adversely impact stream habitats.	Increased temperatures can affect agricultural productivity, particularly for kalo.	Increasing heat and other factors contribute to reduced aquifer yields.	Rising temperatures and urbanized landscapes increase heat-related concerns.	Extreme heat is a threat across Oʻahu.	Higher temperatures, among other factors, contribute to increased water demand, impacts on coastal areas, and water pollution.	Extreme heat is a threat across Oʻahu, and the coastal plain zone of Waiʻanae is already naturally hot and dry.

The information provided in Table 4-1 is from the plans reviewed and cited in Section 9 and from One Water Honolulu Panel, Leadership Group, and focused working group discussions and meetings through August 2026. An analysis of specific areas and regions that are projected to be impacted the most by identified climate risks is detailed in Section 5.

In addition to climate threats, other common issues across regions focus on water quality, water infrastructure improvements, protection of cultural sites and practices, and water resources. Many regions experience water quality concerns related to cesspools and impacts from urbanization, which can contaminate water supply and cause habitat degradation. Environmental challenges and concerns noted in reviewed planning documents for each region are broadly summarized as follows:

- The **North Shore** experiences pollution and runoff from non-point sources, cesspools, and excessive sedimentation pose water quality and ecosystem health threats. Wastewater treatment plants in the region are limited in service area and are mostly small, privately owned systems.
- Water quality protection from cesspools, and urban and agricultural runoff is a concern in **Koʻolau Loa**.
- Urban and agricultural runoff degrade water quality in **Koʻolau Poko**, while climate change threatens cultural sites and practices, and urban development encroachment on natural and agricultural lands can add land use challenges.
- **East Honolulu** experiences water reuse constraints and water quality concerns related to cesspools, and urbanization also threatens habitats and species.
- Drinking water resources in the **PUC** require long-term protection. Aging water infrastructure faces pressures from environmental and growth demands and nonpoint source pollutants can contribute to water quality degradation.
- **Central Oʻahu** experiences water quality challenges from past land uses, and urban, industrial, and agricultural runoff, affecting waterbodies and water resources.
- Pressures exist on water infrastructure and resources to meet local demands and growth in **ʻEwa**, and water quality protection is needed for habitat and cultural practices in the region.
- Waterbodies in **Waiʻanae** are impacted by sedimentation and pollution from nonpoint sources, impervious surfaces, and cesspools. Existing and future development places pressure on water infrastructure and water supply in the region.

The lack of adherence to growth boundaries and absence of climate-resilient infrastructure can also make regions more vulnerable to impacts from tsunamis and other natural disasters. Community preparedness, zoning controls to restrict future development in vulnerable areas, and retrofitting structures to meet tsunami-resistant standards were among the recommendations in reviewed plans, indicating that these are also threats. Infrastructure and systems in place also require resources to monitor, operate and maintain them.

Climate change impacts also include more extreme Kona Lows and king tides. Extreme storm events impact many areas across Oʻahu, as demonstrated by two consecutive Kona Low storm systems in March 2026, leading to a request to the President of the United States for a Major Disaster Declaration to support recovery efforts. These events underscore the importance of coordination and partnerships across levels of government and the community.

BUILDING FROM PLANNING EFFORTS TOWARD CLIMATE CHANGE ADAPTATION

Certain areas are more vulnerable to climate hazards than other areas based on multiple factors, including environmental conditions, resources, and adaptive capacity. Adaptive capacity refers to the ability of a community to adapt to climate impacts, which is often shaped by historical patterns of inequity and colonization, socioeconomic status differences, and/or systemic environmental injustices. Regional planning efforts are crucial to understanding climate threats since local communities are often the first to notice emerging issues when conditions change and can be uniquely equipped to identify effective potential solutions that most reflect local needs.

Building on the information presented in this section, the next section presents a climate risk screening for water infrastructure and integrates known issues and areas of concern identified through prior planning efforts, known areas of concern workshops, and ongoing discussions with the One Water Panel and Leadership Group through August 2026.

Elevating main areas of concern and vulnerability, together with key regional themes and approaches as expressed by communities in existing planning efforts, can help inform areas and threats to prioritize.

NEXT STEPS

- Consider the provided Regional District Profiles in concurrent climate adaptation efforts and in near-term One Water project development
- Update as necessary based on changing conditions and in future Plan updates

5 | Climate Hotspot Identification Process

The Climate Hotspot Identification Process identifies areas with present and future climate risks where the City can build greater resilience.

PURPOSE

Determine where on O‘ahu the City’s water, wastewater, and stormwater infrastructure is most at risk from climate hazards. A hotspot is an area with infrastructure at high risk from climate hazards or that has been noted as an area of concern by the City. This section explains how all One Water assets on the island were screened, scored, and grouped into hotspots. The result is a list of 14 priority hotspots.

5.1 CLIMATE CHANGE ADAPTATION FRAMEWORK

Climate Hotspot Identification is the first half of the Climate Change Adaptation Framework. The Climate Change Adaptation Framework identifies areas on the island that are projected to be most impacted by or at risk from various climate hazards and selects applicable adaptation strategies to prioritize projects across the island.

The Climate Change Adaptation Framework follows a structured, two-part workflow. It begins with a broad, island-wide spatial analysis before focusing on specific areas and regions. As shown in **Figure 5-1**, Section 5 covers the analysis and inputs required to identify priority hotspots, shown in blue boxes. The middle row of the figure shows the key steps in the process, with inputs shown above and below. Icons indicate where stakeholder input is incorporated.

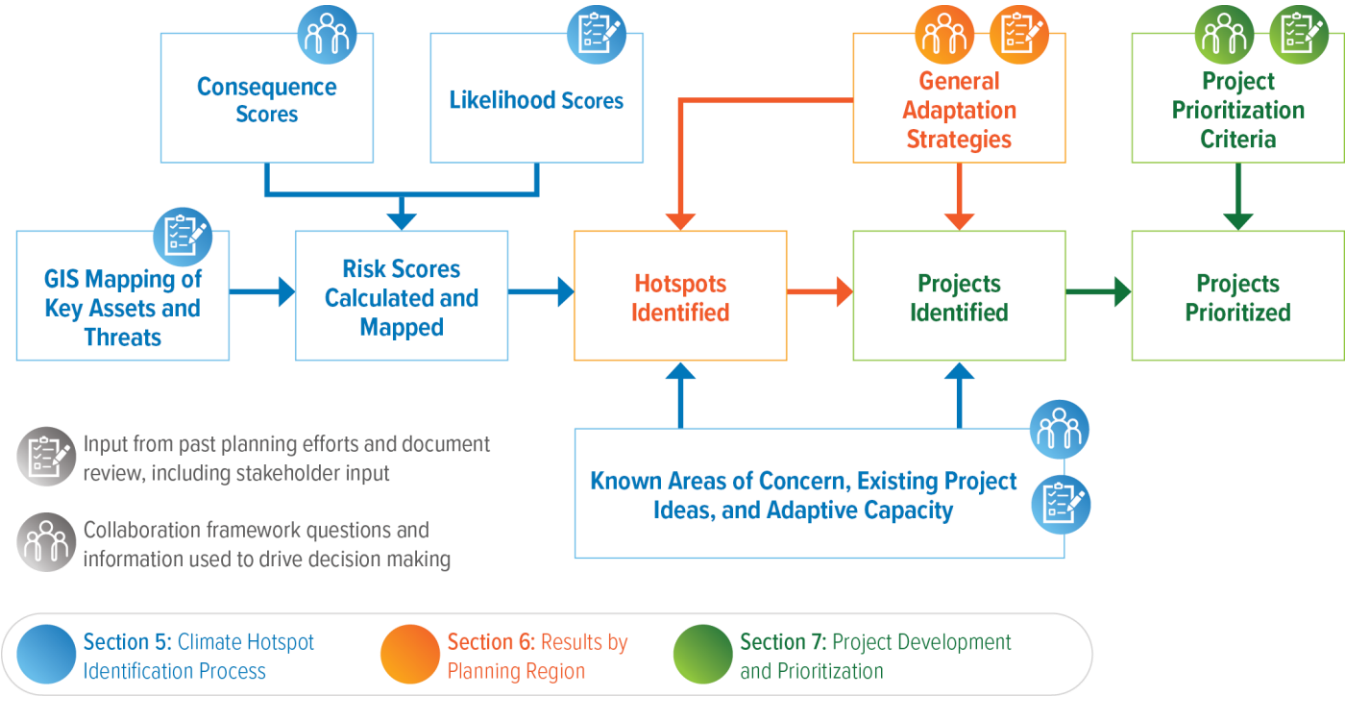


Figure 5-1. Climate Change Adaptation Framework process

PART 1: Involves a high-level, automated screening of over 500,000 water, wastewater, and stormwater infrastructure assets across O'ahu. This screening process enables an efficient evaluation of various water assets around the island to identify areas with high concentrations of risk from climate hazards. This includes:

PART 1 GOAL:
To generate a Risk Score for every asset, identifying the top 0.5% of the island's most vulnerable water infrastructure.

- **GIS Mapping of Key Assets and Threats:** Using GIS technology to identify the exposure of assets to climate hazards.
- **Consequence Scores:** Estimating the impact of each hazard on each asset type, determined through collaborative discussion with the One Water Panel and Leadership Group.
- **Likelihood Scores:** Estimating how often a climate threat may occur using available literature, historical, and projected data for each threat.
- **Risk Scores Calculated and Mapped:** Combining consequence and likelihood considerations across climate hazards to generate a single quantitative score reflecting the relative risk to each asset.

PART 2: Transitions to a customized in-depth assessment to support development of actionable projects. This includes the following components of the Climate Hotspot Identification Process:

PART 2 GOAL:
To develop a prioritized list of hotspots that are ready for project identification.

- **Known Areas of Concern, Existing Project Ideas, and Adaptive Capacity**: Reviewing past and existing planning efforts, previous stakeholder engagement, and direct input from the One Water Panel and Leadership Group to identify local issues and community priorities.
- **Hotspot Identification**: Grouping at-risk assets and known concerns into 92 geographic hotspots or concentrated areas where climate adaptation and/or risk intervention is most urgent.

Identified hotspots and adaptation strategies are discussed in Section 6, and project identification and prioritization are discussed in Section 7.

5.2 CLIMATE EXPOSURE MAPPING

Exposure is the overlap between assets of interest and hazard impacts. Exposure mapping overlays hazard footprints on water infrastructure asset locations. Hazard footprints represent the potential spatial extent of impact for each hazard. This spatial extent, or 'footprint,' determines what locations are projected to experience the hazard. Asset mapping involves data collection to locate One Water assets across O'ahu. The One Water infrastructure assets included in the risk assessment are water, wastewater, and stormwater infrastructure, as well as major streets.

The first step in understanding risk is to identify the exposure of assets to climate hazards.

HAZARD MAPPING

Each climate hazard has a different spatial extent and location of impact, though there is overlap among the many climate hazards. For example, areas subject to sea level rise often also experience exposure to coastal erosion, flooding, and tsunami impacts. Similarly, areas exposed to extreme heat may overlap with areas that are subject to drought and/or wildfire impacts.

The mapping considerations for each hazard are described below:

 SEA LEVEL RISE	Based on the best available science, sea level rise (SLR) and coastal erosion are mapped including the main SLR increments of analysis for this Plan at 1, 3, and 8 feet of SLR. Projected SLR impacts are mapped for passive flooding (Anderson et al., 2018), annual high wave-driven flooding (Mihami et al., 2022), storm drain backup, groundwater inundation (Habel et al., 2024), and coastal erosion (Vitousek et al., 2017). *SLR-related hazard information was provided in cooperation with the University of Hawai'i at Mānoa.*
 HURRICANES	Hurricanes are mapped for Categories 1-4, each affecting a different spatial extent due to differences in storm surge intensity (NOAA, 2018).
 TSUNAMI	Tsunami evacuation zones are defined by areas within the evacuation zone and the extreme evacuation zone (PDC, 2015). Although tsunamis are seismic hazards, they have been included given their local relevance.

 HEAVY RAIN	The 100-year storm is defined by the present-day 100-year floodplain (Hawai‘i Statewide GIS Program, 2025), though the frequency of the present-day 100-year storm is expected to increase under future climate conditions.
 WILDFIRE	Three wildfire likelihood areas are mapped: low, medium, and high likelihood, based on the Department of Land and Natural Resources (DLNR) *Communities at Risk (CAR) from Wild-land Fires* project (Hawai‘i Statewide GIS Program, 2024).
 DROUGHT	Three drought areas are mapped: high, medium, and low susceptibility from the DLNR *Revised Hawai‘i Drought Plan* (DLNR, 2017).
 EXTREME HEAT	Extreme heat is mapped based on the single-day measurements taken in 2019, with consequence thresholds identified at 85°F and 90°F (CCH GIS, 2022).

5.2.1 Asset Mapping

One Water infrastructure includes many specific assets such as wells, wastewater treatment plants, pump stations, ocean outfall pipelines, roadways, and streams. The majority of these assets are water, stormwater, and wastewater pipelines.

Other assets such as community assets, socio-cultural assets, and ecological assets are mapped to understand the associated climate impacts, though these assets are not included in risk calculations. Community assets include electrical infrastructure, hospitals/clinics, police stations, schools, fire stations, and bridges. Socio-cultural assets include Hawaiian Homelands, land zoning, and communities evaluated under the Social Vulnerability Index. Ecological assets include aquifers, critical habitat ecosystem, coral reefs, and wetlands. Consideration of these assets provides a broader understanding of hazard impacts, as well as the benefits of potential adaptation projects beyond their resilience benefits to One Water infrastructure.

5.3 RISK SCORES

To assess which One Water infrastructure assets are most vulnerable to climate threats, a risk scoring process was developed to assign risk scores to individual assets across O‘ahu.
The Risk Score is calculated based on three core questions that involve the likelihood, exposure, and consequence of a climate hazard impacting One Water assets:

How likely is the threat to happen?

Measures the **likelihood** or probability that a climate hazard (or “threat”) will occur over a specific planning horizon.

Is the asset located within the hazard footprint?

If an asset is located within a climate hazard footprint, it is considered **exposed**; if the asset is located outside of the footprint, it is not considered exposed to that threat. Sources for hazard footprint areas and asset locations are in Appendix E.

How much will the asset be impacted by the threat?

Reflects the **consequence** of the potential impact to a threat to a particular infrastructure asset. This ranges from the need to conduct minor repairs to a complete loss of an asset, service or system.

UNDERSTANDING RISK SCORES

LIKELIHOOD SCORES

Defined on a scale from 0 to 5, with a score of 0 assigned to assets not physically exposed to a threat. Scores 1-5 represent a range from extremely unlikely to extremely likely.

The likelihood score is a property of the hazard itself, depending on the hazard severity, and can vary across O‘ahu based on the spatial extent of the threat across the island. Scores were developed based on literature review.

CONSEQUENCE SCORES

Defined on a scale from 1 to 5 representing a range from minimal or no impact to complete failure and total replacement needed.

Consequence scores were developed for each combination of a hazard with an asset type through collaborative input from subject matter experts and City staff. This input was used to evaluate whether an impact would be minimal, moderate, or significant.

TOTAL RISK SCORE

For each infrastructure asset at risk, the risk score is calculated by multiplying the likelihood (0-5) by the consequence (1-5), resulting in a score between 0 and 25.

The total risk score for each asset is the sum of risk scores across each threat. A risk score is calculated for each individual asset in the inventory, with minor assets such as lateral pipelines filtered out.

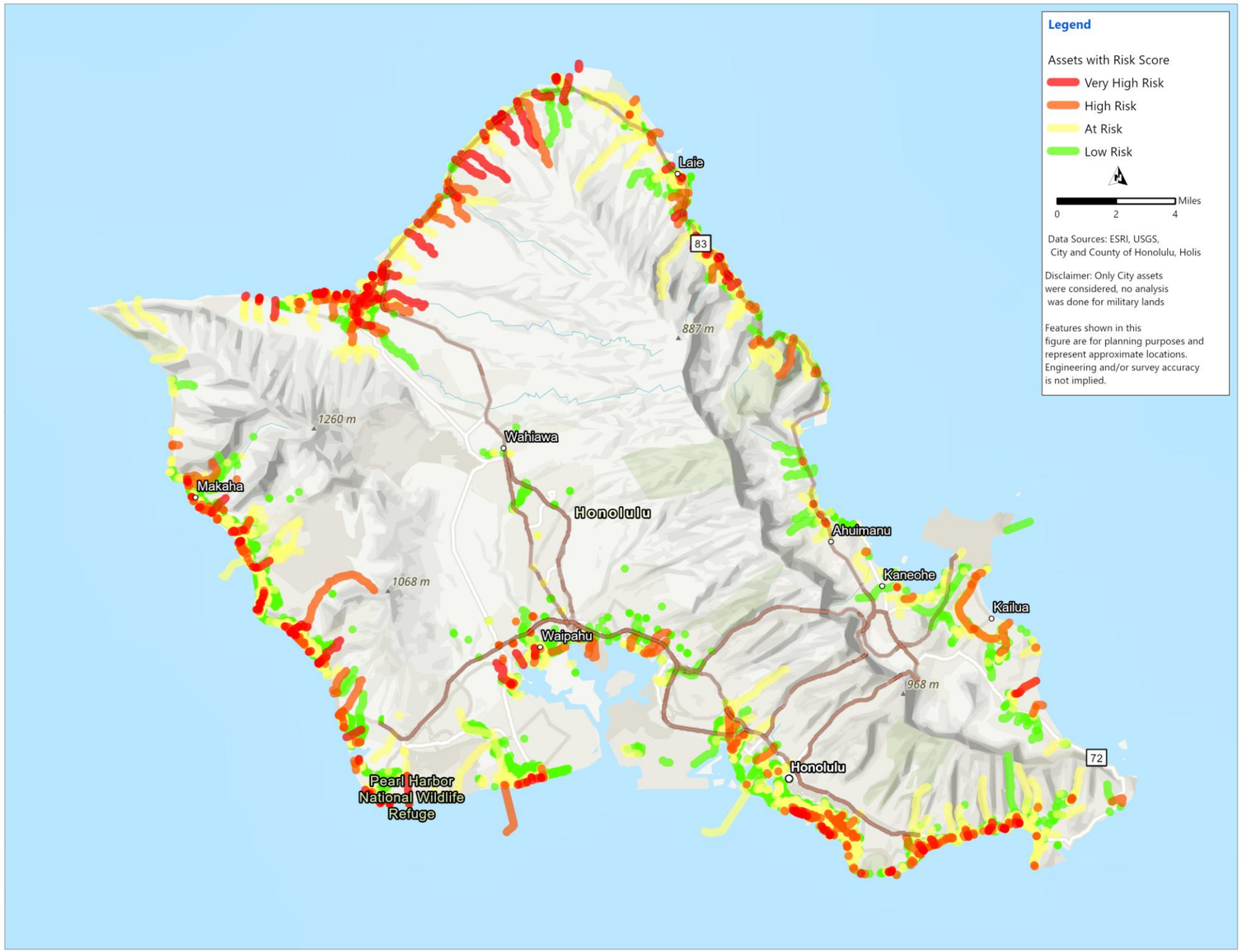


Figure 5-2. Risk score mapping of island-wide assets (excludes "Very Low" risk score assets)

5.4 KNOWN AREAS OF CONCERN

Known areas of concern build from past and existing planning efforts including previous stakeholder engagement to provide important context to understand and elevate known issues in communities across the island. This information includes but extends beyond infrastructure assets and supports the identification of hotspots.

Incorporating known areas of concern into the climate hotspot identification process captures local context and priorities from community and City knowledge.

Information used to identify known areas of concern included input from a review of past plans and studies, meetings and workshops with key City staff and documentation of relevant information for all eight planning regions as described in the Regional Planning District Profiles in Section 4. The information provided contextual data to understand regional and ahupuaʻa scales organized into the following categories:

Threats/ opportunities	Includes information on the kinds of climate hazards most often experienced and what opportunities there might be to provide community benefits in addressing these hazards.
Prior recommendations	Past plans provide recommendations for different regions that reflect community and general infrastructure needs.
Current City efforts to-date	Information provided by City staff on current plans, studies, and infrastructure projects that are planned or underway.
Key community values	Highlighted documented values statements around community needs and relationships within the watersheds.
Places of interest	Community assets such as schools, hospitals, and public safety agencies. This also includes cultural places of interest such as wetlands, heiau, areas for loʻi kalo, and fishponds identified for local communities.
Specific locations	Identified locations, especially streams and roads, where past hazards have occurred such as localized flooding.
ʻĀina and infrastructure concerns	Information on existing issues for local streams, groundwater, waterbodies, and nearshore waters as well as known issues for water, wastewater, and stormwater infrastructure and roads.

5.5 HOTSPOT IDENTIFICATION AND PRIORITIZATION

A hotspot is an area with infrastructure at high risk from climate hazards and or is an area that has been noted as an area of concern by the City or in past planning efforts. These hotspots provide focus areas for climate adaptation project development. Identified hotspots are narrowed down to priority hotspots where the City proposes to act first.

HOTSPOT IDENTIFICATION

The hotspot identification process brings together the island-wide automated risk screening and known areas of concern contextual information to support the development of a focused One Water Honolulu Project List.

The identification methodology relied on two parallel workflows:

Following initial identification, hotspots were prioritized using several criteria to further focus areas for project development.

Technical Risk Mapping	Infrastructure assets were categorized into five risk levels based on their vulnerability to climate threats, ranging from very low to very high risk. The spatial analysis focused heavily on the top 0.5% of assets classified as "Very High Risk." GIS mapping tools were used to identify geographic clusters of these assets alongside nearby vulnerable communities and community facilities to delineate preliminary hotspot boundaries. See Appendices D and E for details on the Climate Change Adaptation Framework and the resulting climate exposure maps.
Review of Known Areas of Concern	Information from previous planning efforts and local knowledge were used in tandem with automated data from the infrastructure risk mapping. Regional summaries, workshops, and meetings with One Water Honolulu Leadership Group and Panel members identified existing projects and recognized areas of concern and opportunities across regional and local levels. This information provided context used in creating hotspot profiles. See Appendix C for regional summaries that were incorporated into this review and Appendix D on where the Known Areas of Concern were incorporated in the Climate Change Adaptation Framework.

A profile for each hotspot documents the mapped Risk Scores for water infrastructure, climate threats and specific assets, other known issues, ongoing or planned projects, and potential gaps in the area (see Appendix F for all hotspot profiles). These 92 hotspot profiles served as the foundation for the subsequent prioritization phase.

HOTSPOT PRIORITIZATION

The goal of hotspot prioritization was to reduce the identified hotspots to a focused list of locations that move forward into the project development stage as part of the current One Water Plan process. This list provided a starting point to direct resources to areas with urgent needs and high potential for community benefit.

The prioritization process ran two parallel steps, assigning prioritization criteria and area classifications to each hotspot. Prioritization criteria focused on ranking hotspots based on the severity of risks and community needs. Area classifications focused on categorizing areas so similar resilience strategies can be used in similar locations. The goal of prioritization criteria was to determine which areas to focus on first and the goal of area classification was to provide representation of a diverse variety of land uses and regional characteristics across Oʻahu.

After scoring and classifying each of the 92 original hotspots, the highest-ranking hotspots from every regional planning district were selected for further focus. A final “balance check” was then performed to represent each area classification and every type of climate risk across the island.

Through this integrated approach, 92 hotspots were identified across Oʻahu. Of these hotspots, 14 were prioritized for project development.

Hotspot prioritization is a two-part approach:

Prioritization Criteria

Each hotspot was evaluated against six criteria:

1. Known Flooding Issues
2. Known Water Quality Issues
3. Vulnerability to 1 foot of Sea Level Rise
4. Vulnerability to 4 feet of Sea Level Rise
5. Area Identified Through Leadership Group Experience
6. ʻĀina Impact (Rural/Agricultural Land)

Developed collaboratively with the One Water Honolulu Panel, these six equally weighted criteria were used to evaluate each hotspot. Each criterion is scored on a binary scale (1 if it applies, 0 if it does not), resulting in a total score from 0 to 6. Hotspots with the highest scores were prioritized for project development.

Area Classification

Each area was assigned a primary classification:

1. Major Hubs & Economic Centers
2. Opportunities within Redevelopment & Growth
3. Mid-Density Communities
4. Country Towns & Rural Coastline
5. Major Linear Network Corridors
6. Recharge & Runoff Management Opportunities

Classifications represent the diverse characteristics found across Oʻahu, such as land use and population density. Grouping hotspots this way allows the City to replicate relevant adaptation strategies across similar locations, helping to provide coverage for all types of communities.

The analysis resulted in the 14 Priority Hotspots listed in Table 5-1 and shown in Figure 5-3. The Priority Hotspots represent all regional districts, all six area classifications, and cover areas that are exposed to all climate hazards considered in this Plan. While some hotspots could reasonably be assigned to multiple area classifications, the primary classification was assigned with Panel input to reflect the location's replicability across the island.

Table 5-1. Priority hotspots with districts, classifications, and relevant threats

PRIORITY HOTSPOT	REGIONAL DISTRICT	AREA CLASSIFICATION	MOST SEVERE / EARLIEST-ONSET CLIMATE THREAT(S)[1]
Haleʻiwa	North Shore	Country Towns and Rural Coastline	Sea level rise, heavy rain, wildfire, tsunami
Waimea Bay/ Pūpūkea	North Shore	Recharge and Runoff Management Opportunities	Sea level rise, wildfire, tsunami
Kaʻaʻawa/Kahana	Koʻolau Loa	Major Linear Network Corridors	Sea level rise, heavy rain, hurricane
Kamehameha Hwy	Koʻolau Loa/Koʻolau Poko	Major Linear Network Corridors	Sea level rise, hurricane
Kāneʻohe	Koʻolau Poko	Country Towns and Rural Coastline	Heavy rain, hurricane, tsunami
Waimānalo	Koʻolau Poko	Country Towns and Rural Coastline	Hurricane, tsunami
Kalanianaʻole Hwy	East Honolulu	Major Linear Network Corridor	Sea level rise, wildfire, hurricane, tsunami
Waikīkī	Primary Urban Center	Major Hubs & Economic Centers	Hurricane, tsunami
Iwilei/Chinatown	Primary Urban Center	Opportunities within Redevelopment and Growth	Hurricane
Māpunapuna	Primary Urban Center	Opportunities within Redevelopment and Growth	Sea level rise, heavy rain, hurricane, tsunami
Pūpū St/Pūpū Pl	Ewa	Mid-Density Communities	Wildfire, drought, hurricane, tsunami
Waipahū/Pouhala Marsh	Central Oʻahu	Recharge and Runoff Management Opportunities	Wildfire, drought, hurricane
Pōkaʻī Bay Street	Waiʻanae	Country Towns and Rural Coastline	Sea level rise, wildfire, drought, hurricane, tsunami
Mākaha Stream/ Farrington Hwy	Waiʻanae	Major Linear Network Corridor	Sea level rise, wildfire, drought, hurricane, tsunami

Notes:

1) This column shows where the impact arrives soonest or hits hardest.
   - All priority hotspots are affected by SLR, with those noted having impacts at 1 foot. SLR impacts include any mechanism of SLR exposure including groundwater emergence.
   - All priority hotspots are affected by partial inundation from heavy rain (100-year flood) and hurricane, with those noted having complete inundation.
   - All priority hotspots have low risk to wildfire and drought unless noted.
   - All priority hotspots are in the extreme tsunami evacuation zone, with those noted being in the evacuation zone.
   - All priority hotspots have extreme heat over 90 degrees Fahrenheit.

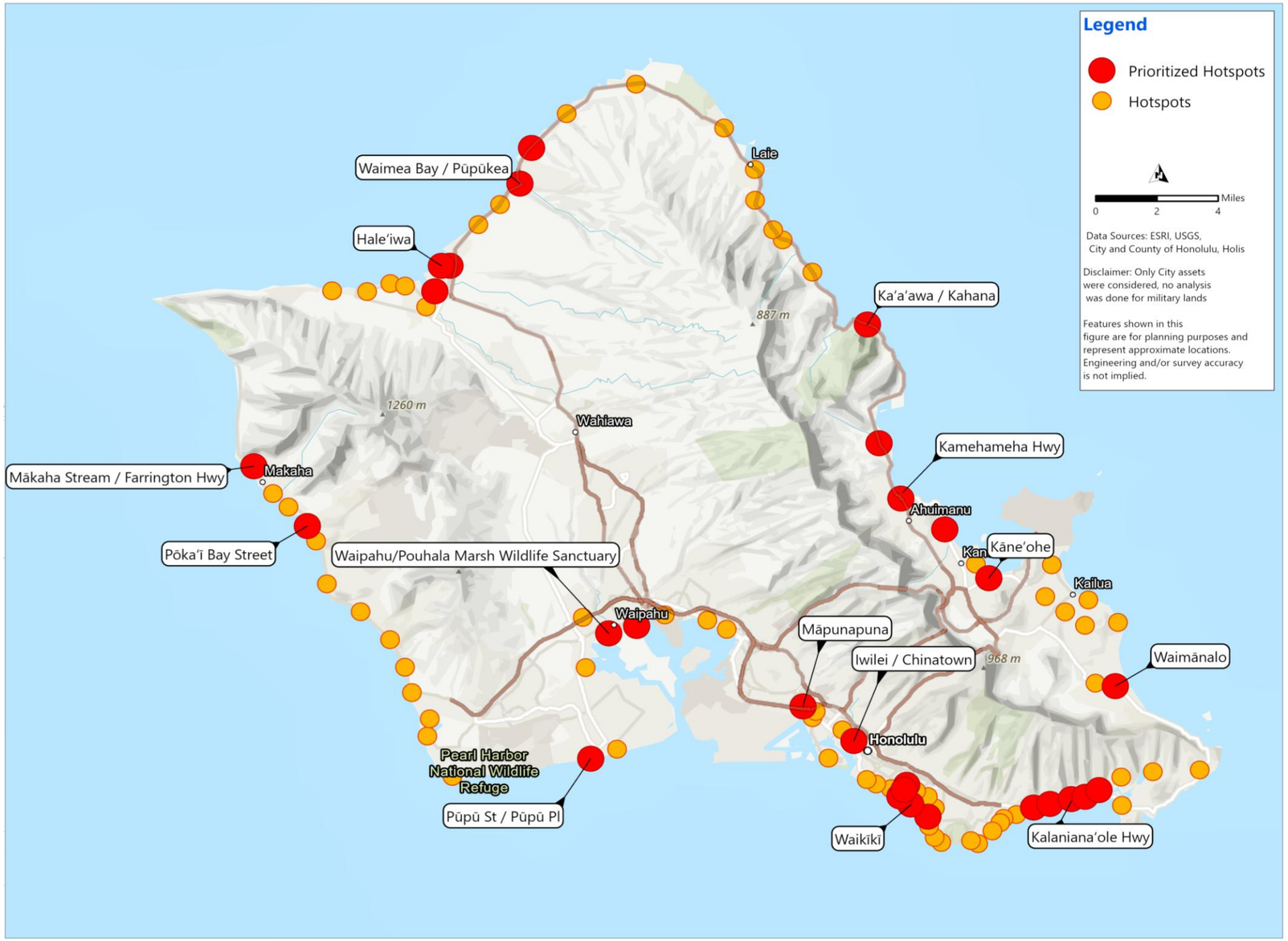


Figure 5-3. Map of O ʻahu with hotspots (orange) and priority hotspots (red)

5.6 HOTSPOT SUMMARY

The result of the Climate Hotspot Identification Process is the list of 14 Priority Hotspots. These hotspots are based on the climate hazard exposure and risk assessment, considering all climate hazards that impact Oʻahu, exposure based on One Water asset locations, consequence scoring based on asset types, and likelihood scoring based on hazard frequency. Detailed descriptions of each of the priority hotspots are provided in Section 6, organized by planning region. Based on the hotspot profiles, projects are identified and prioritized within each Priority Hotspot, which will be described in Section 7.

NEXT STEPS

- Repeat the process for future identification of hotspots.
- Consider the risk scores and known areas of concern information in other near-term relevant efforts.

6 | Results by Planning Region

Bringing together knowledge and information from climate risk hotspots and potential adaptation strategies results in the foundations for OWH project development.

PURPOSE

This section brings together findings from Section 4 (Regional Planning District Profiles) and Section 5 (Climate Hotspot Identification Process) to describe each of the 14 Priority Hotspots in turn, grouped by planning region. Each hotspot description covers what is at risk in that location, which climate hazards pose the greatest threat, and what the established hotspot-specific goals are for that location. The section closes with the adaptation strategies that could deliver those goals. The results presented in this section inform project development and selection in Section 7 (Project Development and Prioritization).

6.1 FROM RISKS TO STRATEGIES

OWH project development follows a six-step process shown in Figure 6-1. Steps 1 to 3 are discussed in this section. Steps 4 to 6 are discussed in Section 7.

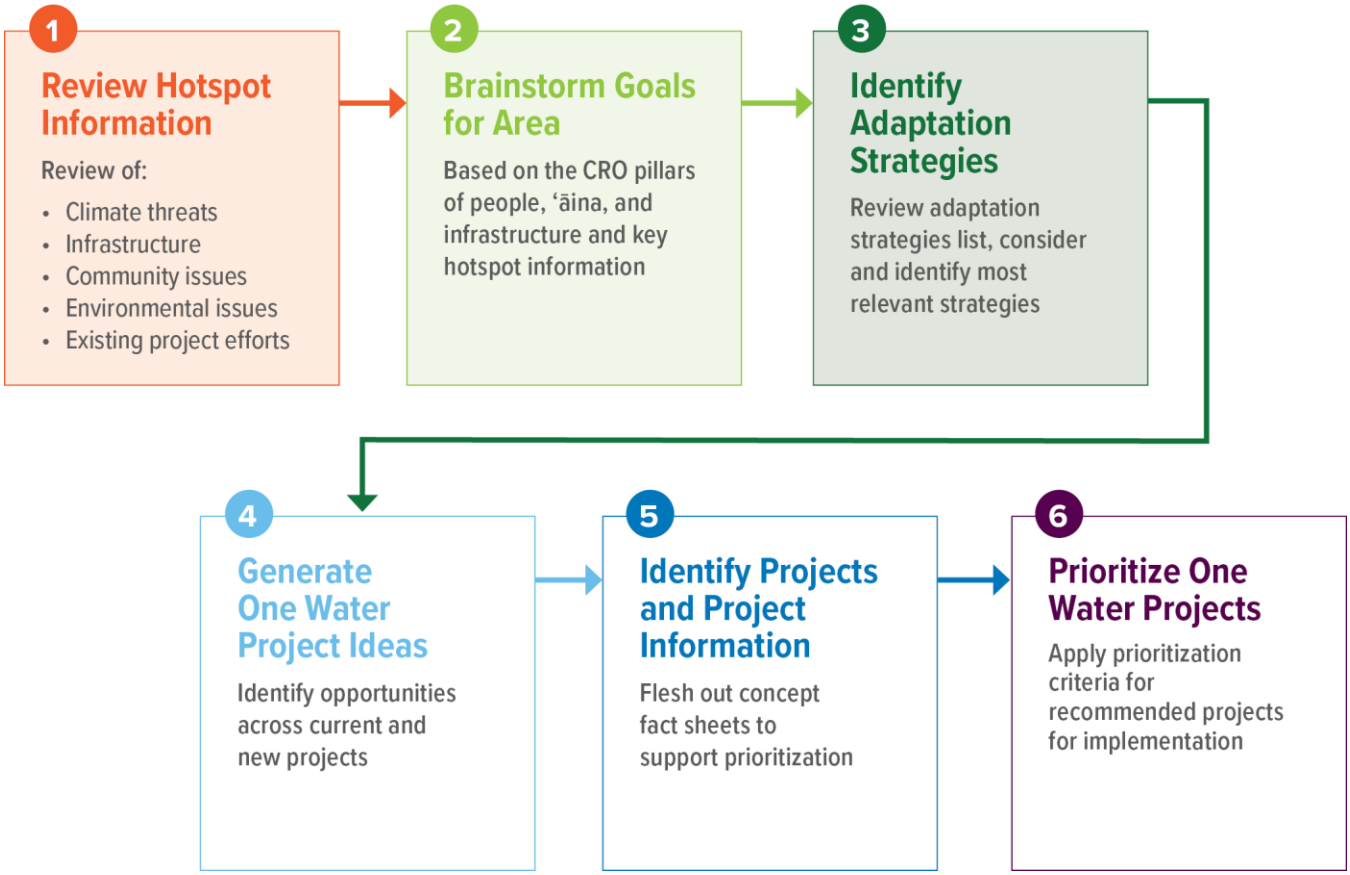


Figure 6-1. Six-step project development process for each priority hotspot area.

Step 1: Review Hotspot Information

Hotspot information is consolidated and reviewed, including relevant climate threats and One Water infrastructure. Threats are categorized as high, medium, or low risk based on hazard data analysis and the projected SLR impacts for each hotspot summarized in this section. This review builds on the hotspot profiles presented in Section 5.5.

Step 2: Brainstorm Goals for Area

Goals are developed for each hotspot area to address priority threats and opportunities and organized around the CRO pillars of people, ʻāina, and infrastructure. These goals were developed based on information in the Regional Planning District Summaries as well as workshops held with OWH Panel members. The questions used to generate goals were:

People	What are the goals for this area to support the people (residents, businesses, visitors, etc.) of the local community?
ʻĀina	What are the goals for this area related to protecting our native ecosystems and stewarding the island's natural resources for future generations?
Infrastructure	What are the goals to upgrade and adapt our infrastructure to withstand current and future climate impacts?

Step 3: Identify Adaptation Strategies

Adaptation strategies most relevant for the identified climate threats and hotspot goals were selected from a large menu of nearly 100 options. Adaptation strategies include the different project types: plans and studies, programs, and physical infrastructure. The strategies span 22 categories including flood barriers and containment, risk assessment and planning, wildfire preparedness and management, elevation of infrastructure, emergency response, and more. Each strategy is assessed for which climate hazards it addresses and for which One Water infrastructure type is relevant. Some examples of strategies for two categories (flood barriers and containment and emergency response) are listed in Table 6-1. The full table of adaptation strategies including relevant climate hazards and infrastructure assets is available in Appendix D.1.

Table 6.1. Adaptation strategies for two categories: Flood barriers and containment, and emergency response

CATEGORY/TYPE	ADAPTATION STRATEGY EXAMPLES
Flood barriers and containment	
Physical Infrastructure	Incorporate or upsize perimeter floodwalls or levees, including operable flood gates
Physical Infrastructure	Incorporate groundwater seepage barrier
Physical Infrastructure	Incorporate breakwaters
Physical Infrastructure	Raise marine structures
Emergency response	
Physical Infrastructure	Harden base yards to provide pre-hurricane staging of debris-clearing equipment and personnel
Physical Infrastructure	Pre-purchase and maintain emergency equipment
Plans & Studies	Assess departmental emergency response capabilities
Programs	Incorporate non-structural emergency response measures (e.g. warning systems, evacuation routes/signs)

ADAPTATION STRATEGY SOURCES

The adaptation strategies were developed by compiling recommendations from multiple sources combined with additional subject matter expertise. The adaptation strategies came from the Climate Change Design Guidelines (CCH, 2024a), Koʻolau Poko Readiness Review (Brown and Caldwell, 2025), Climate Ready Oʻahu (CCH, 2024b), Sand Island Facilities Plan (CCH, 2025), Multi-Hazard Pre-Disaster Mitigation Plan (CCH, 2021), the Adapt Waikīkī 2050 Presentation on AW2050 Area Adaptation Plan presented to the City Climate Change Commission (March 7, 2025), and the HDOT Climate Adaptation Action Plan (HDOT, 2021).

6.2 PRIORITIZED HOTSPOTS & POTENTIAL ADAPTATION STRATEGIES

The results of Steps 1-3 shown in Figure 6-1 are organized by Regional Planning District and focus on Priority Hotspots. This information informs the One Water Honolulu Project List detailed in Section 7.

NORTH SHORE

From the hotspots assessed in the North Shore region, two priority hotspots, Haleʻiwa and Waimea Bay/Pūpūkea, were identified. These hotspots are described in Table 6-2 and contain a mix of transportation, utility, community, public safety, and natural resource assets exposed to sea level rise, flooding, tsunami, wildfire, and related coastal hazards. Groundwater inundation data was not available during the time of the analysis for this region.

Table 6-2. North Shore Priority Hotspots

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Haleʻiwa	**People:** Haleʻiwa Elementary School, Waialua Fire Station #14, Haleʻiwa Boat Harbor **ʻĀina:** Kaiaka Bay Beach Park, Paukauila stream, ʻŌpaeʻula Stream, Helemano Stream, Haleʻiwa Aliʻi Beach Park, Haleʻiwa Beach Park, Loko Ea Fishpond, Ukoa Pond, Loko Ea Stream **Infrastructure**: stormwater lines, and water lines; a water treatment plant, critical wells, Haleʻiwa Rd, Joseph P. Leong Highway, Kamehameha Highway and associated bridges, cesspools	WILDFIRE EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 1 ft* HEAVY RAIN TSUNAMIS	HURRICANES	DROUGHT	• Distribution System Resilience • Drinking Water Treatment Resilience • Dry Floodproof the Building/Asset/Utility • Educational Resources on How Native Hawaiian Cultural Practices Positively Contribute to Climate Adaptation • Elevate Access Road and Associated Utilities • Elevate Critical Assets/Equipment • Increase Passive Survivability of Assets/Systems During Power Outages • Raise Marine Structures (e.g., elevated wharf, pier) • Restore Beach, Dune Systems, and Coastal Floodplain • Stormwater System Resilience	• Improve community resilience to wildfire • Mitigate damage to infrastructure, community assets, and property impacted by sea level rise, coastal erosion, and flooding • Improve groundwater, waterway, and coastal water quality impacted by contamination from cesspools, agriculture, and industry • Maintain safe and reliable community access and water service by increasing the resilience of infrastructure corridors to flooding and coastal erosion • Improve nearshore water quality and ecosystem health of Pūpūkea and Waimea Bay marine ecosystems • Protect Waimea Bay as an intact ahupuaʻa

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Waimea Bay/Pūpūkea	**People:** Puʻu o Mahuka Heiau State Historic Site, Sunset Beach Elementary School, Sunset Fire Station #11, Pūpūkea Marine Life Conservation District **ʻĀina:** Waimea River, ʻElehāhā Stream, Kalahopele gulch, Waimea Falls, Waimea Bay Beach Park, Waimea Bay, Pūpūkea Beach Park, Sunset Beach Park, Ke Iki Beach, ʻEhukai Beach, Sharks Cove **Infrastructure**: stormwater lines, water lines, water mains, streams; Kamehameha Highway and an associated river bridge, cesspools	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 1 ft* HURRICANES	WILDFIRE HURRICANES HEAVY RAIN	DROUGHT	• Distribution System Resilience • Dry Floodproof the Building/Asset/Utility • Elevate Access Road and Associated Utilities • Improve materials and construction practices of roadways • Improved Wildfire Detection and Response • Incorporate Non-Structural Hazard Mitigation Measures (e.g., watershed/district scale communication network, public education) • Increase Passive Survivability of Assets/Systems During Power Outages • Modify Site Drainage, Storage, and Infiltration • Stream Restoration	• Improve community resilience to wildfire • Mitigate damage to infrastructure, community assets, and property impacted by sea level rise, coastal erosion, and flooding • Improve groundwater, waterway, and coastal water quality impacted by contamination from cesspools, agriculture, and industry • Maintain safe and reliable community access and water service by increasing the resilience of infrastructure corridors to flooding and coastal erosion • Improve nearshore water quality and ecosystem health of Pūpūkea and Waimea Bay marine ecosystems • Protect Waimea Bay as an intact ahupuaʻa

KOʻOLAU LOA

From the hotspots assessed in the Koʻolau Loa region, one priority hotspot consisting of the area of the stretch of Kamehameha Highway from Kahana to Kaʻaʻawa was identified (described in Table 6-3). This hotspot contains transportation, water utility, community, public safety, and ecological assets exposed to sea level rise, flooding, extreme heat, hurricanes, wildfire, and tsunami hazards.

Table 6-3. Koʻolau Loa Priority Hotspot

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Kamehameha Hwy/Kaʻaʻawa & Kahana	**People:** Kaʻaʻawa Elementary School, Kaʻaʻawa Fire Station 21 **ʻĀina:** Kaʻaʻawa Stream, Makaua Stream, Kahana Stream, Keaniani Stream, Kalaeʻoio Beach Park, Swanzy Beach Park, Makaua Beach Park, Kaʻaʻawa Beach Park, Ahupuaʻa O Kahana State Park **Infrastructure**: Kamehameha Highway along with four associated bridges, stormwater lines, water lines and wells, onsite waste disposal systems (e.g., cesspools)	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR above ground impacts starting at 2 ft but starting at 1 ft for impacts from groundwater inundation.* HURRICANES HEAVY RAIN TSUNAMIS	None	WILDFIRE DROUGHT	• Elevate Critical Assets/Equipment • Incorporate Corrosion Resistant Materials and Coatings • Incorporate Heat Resilient Materials • Incorporate Native Vegetation • Maintenance plan for Rivers and Streams • Restore Beach, Dune Systems, and Coastal Floodplain • Riparian and Wetland Buffers	• Protect facilities (incl. roads and utilities) and maintain emergency evacuation routes during flood events • Maintain water service from critical wells under conditions of future sea-level rise and emergent groundwater • Address flooding through low-impact development and nature-based solutions • Improve community access to recreational and transportation resources especially the beach

KOʻOLAU POKO

From the hotspots assessed in the Koʻolau Poko region, three priority hotspots, Kamehameha Highway, Waimānalo Beach, and Kāneʻohe were identified and are described in Table 6-4. These hotspots contain a mix of transportation, utility, community, public safety, and ecological assets exposed to flooding, sea level rise, hurricanes, extreme heat, wildfire, and tsunami hazards.

Table 6-4. Koʻolau Poko Priority Hotspots

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Kamehameha Hwy	**People:** Waiāhole Elementary School, Kahaluʻu Elementary School, King Intermediate School, Kahaluʻu Fire Station 37 **ʻĀina:** Kahaluʻu Regional Park, Laenani Neighborhood Park, Kahaluʻu Pond, Waikāne Stream, Hakipuʻu Stream, Heʻeia State Park, Heʻeia Fish Ponds **Infrastructure**: seven wastewater pump stations and associated sewer lines, Kamehameha Highway along with associated bridges, stormwater lines, stream bridges, water lines and wells	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 1 ft for both above and below ground impacts* HURRICANES HEAVY RAIN TSUNAMIS	None	WILDFIRE DROUGHT	• Dry Floodproof the Building/Asset/Utility • Elevate Access Road and Associated Utilities • Elevate Critical Assets/Equipment • Improve materials and construction practices of roadways • Incorporate Non-Structural Emergency Response Measures (e.g., watershed/district scale communication network, public education) • Increase Passive Survivability of Assets/Systems During Power Outages • Riparian and Wetland Buffers • Stabilize Roadbeds and Protect Roadbed Integrity • Upsize Pumping Capacity • Upsize Stormwater Drainage Capacity or Sanitary Sewer Capacity	• Maintain roadway access for emergency services during flooding conditions • Continued management and restoration of He'eia Wetlands to improve flood management • Protect streams from pollution and excessive diversions to maintain ecological balance and support traditional practices

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Kāneʻohe	**People:** Kāneʻohe Fire Station 17, Kāneʻohe District Police Station, Parker Elementary School, Pūʻōhala Elementary School, Ke Kulaʻo Samuel M. Kamakau, Bayview Golf Park **ʻĀina:** Kāneʻohe Bay, Nāonealaʻa a Kāneʻohe, Waikalua Fish Pond **Infrastructure**: five wastewater pump stations and associated sewer lines, a sewer influent facility, stormwater lines, water lines, Kulauli St, Waikalua Rd, Holowai St/Pl, Kāneʻohe Bay Dr; stream bridges.	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 2 ft for above ground impacts, and at 1 ft for groundwater inundation* HURRICANES HEAVY RAIN TSUNAMIS	None	WILDFIRE DROUGHT	• Distribution System Resilience • Dry Floodproof the Building/Asset/Utility • Elevate Critical Assets/Equipment • Improve materials and construction practices of roadways • Incorporate Alternative/Back-Up Power Sources • Incorporate Non-Structural Hazard Mitigation Measures (e.g., watershed/district scale communication network, public education) • Increase Passive Survivability of Assets/Systems During Power Outages • Modify Site Drainage, Storage, and Infiltration • Upsize Stormwater Drainage Capacity or Sanitary Sewer Capacity	• Protect water quality and natural resources in streams, ponds, and coastal areas • Prevent flooding in neighborhoods, roadways, and public areas of concern • Protect Kāneʻohe Bay for future generations through coastal management

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Waimānalo	**People:** Bellows Air Force Base, Waimānalo Fire Station 27, Waimānalo Health Clinic, Waimānalo Elementary and Intermediate School, Blanche Pope Elementary School, Olomana Golf Links **ʻĀina:** Waimānalo Stream, Kahawai Stream, Hūnānaniho Beach Park, Waimānalo Beach Park, Waimānalo District Park, Kaiona Beach Park **Infrastructure**: a wastewater treatment plant and associated pump station, a wastewater pump station and associated sewer lines, stormwater lines, water lines, a reservoir, a critical well; Kalanianaʻole Highway along with associated bridges	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts above ground starting at 1 ft (erosion) and 5 ft (flooding), with groundwater inundation starting at 1 ft* HURRICANES TSUNAMIS	HEAVY RAIN	WILDFIRE DROUGHT	• Dry Floodproof the Building/Asset/Utility • Elevate Access Road and Associated Utilities • Elevate Critical Assets/Equipment • Improve Materials and Construction Practices of Roadways • Incorporate Alternative/Back-Up Power Sources • Incorporate Native Vegetation • Incorporate Non-Structural Hazard Mitigation Measures (e.g., watershed/district scale communication network, public education) • Increase Passive Survivability of Assets/Systems During Power Outages • Modify Site Drainage, Storage, and Infiltration	• Respect and support Native Hawaiian cultural and traditional practices reliant on healthy land and water resources • Improve water supply resilience for local community use • Improve water quality and flood mitigation • Address coastal erosion for recreational areas, residences, and emergency access routes

EAST HONOLULU

From the hotspots assessed for the East Honolulu region, one prioritized hotspot spanning several areas along Kalanianaʻole Highway was identified. The hotspot, described in Table 6-5, includes the areas along Kalanianaʻole Highway near Wailupe Beach Park, Wailupe Stream, Hawaiʻi Loa Ridge, Paikō Drive, and Kuliʻouʻou. These hotspots contain transportation, utility, community, and ecological assets exposed to sea level rise, flooding, extreme heat, hurricanes, wildfire, and tsunami hazards. Groundwater inundation data was not available during the time of the analysis for this region.

Table 6-5. East Honolulu Priority Hotspot

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
East Honolulu	**People:** Wailupe Fire Station 23, Holy Nativity School, ʻĀina Haina Shopping Center, ʻĀina Haina Elementary School, Honolulu Waldorf School, Niu Valley Middle School, surrounding residential area **ʻĀina:** Wailupe Beach Park, Wailupe Stream, Kawaikuʻi Beach Park, Maunalua Bay Beach, Niu Valley Neighborhood Park, Niu Valley Stream, Paikō Lagoon Wildlife Sanctuary, Paikō Beach, Kuliʻouʻou Gulch, Kuliʻouʻou Beach Park, Kānewai Spring **Infrastructure**: Kalanianaʻole Highway along with associated bridges, two wastewater pump stations, a ditch, sewer lines, stormwater lines, and water lines	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 1 ft* HURRICANES HEAVY RAIN TSUNAMIS	WILDFIRE	DROUGHT	• Drainage System Plan • Dry Floodproof the Building/Asset/Utility (e.g., seal windows, doors, vents, drainage systems, manholes) • Educational Resources on How Native Hawaiian Cultural Practices Positively Contribute to Climate Adaptation • Incorporate Alternative/Back-Up Power Sources (e.g., back-up generators, off-grid solar panels, microgrids) • Incorporate Corrosion Resistant Materials and Coatings • Incorporate Flood/Submersible Pumps for Surface Water or Groundwater • Incorporate Salt and Flood Resilient Vegetation • Raise Building Ground Floor Elevation • Upsize Pumping Capacity	• Maintain safe and reliable community access by increasing the resilience of Kalanianaʻole Highway to flooding and coastal erosion • Reduce pressure on groundwater resources to support local water supply reliability • Mitigate flooding and debris transport in and along Wailupe, Niu Valley, and Kuliʻouʻou streams • Improve water quality and ecosystem health in Maunalua Bay impacted by sediment transport and stormwater runoff

PRIMARY URBAN CENTER

From the hotspots assessed in the PUC region, three priority hotspots were identified: Waikīkī, Iwilei, and Mapunapuna, included in Table 6-6 below. These hotspots contain transportation, utility, community, public safety, healthcare, and ecological assets exposed to flooding, sea level rise, hurricanes, extreme heat, wildfire, tsunami, and drought hazards.

Table 6-6. Primary Urban Center Priority Hotspots

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Waikīkī	**People:** Jefferson Elementary School, Hawai'i Center for Deaf and Blind School, Honolulu Zoo, Waikīkī Shell, Waikīkī Elementary, Jefferson Orthopedic Unit, Straub Waikīkī Hospital Clinic, Fort DeRussy, Fort DeRussy Beach, Ala Wai Boat Harbor, Ala Wai Golf Course, Hawai'i Convention Center **'Āina:** Queens Beach, Kapi'olani Regional Park, Kahanamoku Beach, Duke Kahanamoku man-made Lagoon, Ala Wai Canal (and impacts to beaches), Ala Wai Regional Park, Makki Stream **Infrastructure**: a wastewater pump station and associated sewer lines, several bridges, stormwater lines, water lines, several major streets; Kalākaua Ave, Kapahulu Ave, Monsarrat Ave, 'Ōhua Ave, Paoakalani Ave, Kapi'olani Blvd	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts above ground starting at 1 ft (erosion) and 2 ft (flooding), with groundwater inundation starting at 3 ft* HURRICANES HEAVY RAIN TSUNAMIS	None	WILDFIRE DROUGHT	• Dry Floodproof the Building/Asset/Utility • Elevate Access Road and Associated Utilities • Elevate Critical Assets/Equipment • Implement Low Impact Design (LID)/Green Infrastructure Stormwater Management Strategies • Improve materials and construction practices of roadways • Incorporate Non-Structural Hazard Mitigation Measures (e.g., watershed/district scale communication network, public education) • Increase Passive Survivability of Assets/Systems During Power Outages • Raise Marine Structures (e.g., elevated wharf, pier) • Riparian and Wetland Buffers • Riparian and Wetland Buffers • Upsize Pumping Capacity	• Reduce economic disruption for residents, workers, and businesses from groundwater and overland flooding • Enhance public safety and maintain access to essential services from groundwater and overland flooding • Protect coastal and nearshore ecosystems by improving water quality of stormwater runoff • Improve drainage and reduce flooding

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Iwilei/Chinatown	**People:** Honolulu Harbor, Aloha Tower, Waterfront fire station 45, Chinatown Substation Police Station **ʻĀina:** ʻAʻala Park, Nuʻuanu Stream **Infrastructure**: a wastewater pump station and associated sewer lines, stormwater lines, and water lines; Ala Moana Blvd and Nimitz Highway and associated bridges	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 4 ft for groundwater impacts and 5 ft for above ground flooding.* HURRICANES TSUNAMIS	HEAVY RAIN	WILDFIRE DROUGHT	• Dry Floodproof the Building/Asset/Utility • Elevate Access Road and Associated Utilities • Elevate Critical Assets/Equipment • Improve materials and construction practices of roadways • Incorporate Non-Structural Hazard Mitigation Measures (e.g., watershed/district scale communication network, public education) • Increase Passive Survivability of Assets/Systems During Power Outages • Upsize Pumping Capacity • Upsize Stormwater Drainage Capacity or Sanitary Sewer Capacity	• Improve drainage and reduce flooding • Increase water supply and improve water quality • Improve walkability and multi-modal transport options
Mapunapuna	**People:** Moanalua Middle and Elementary Schools **ʻĀina:** Moanalua Stream, Keʻehi Lagoon Beach Park, Moanalua Gardens **Infrastructure**: two wastewater pump stations and associated sewer lines, low pressure sewer system lines, stormwater lines, DOT baseyards, and water lines; Moanalua Road, North Nimitz Highway and associated bridges	EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 1 ft for groundwater inundation and at 2 ft for above ground flooding.* HURRICANES HEAVY RAIN TSUNAMIS	None	WILDFIRE DROUGHT	• Dry Floodproof the Building/Asset/Utility • Elevate Critical Assets/Equipment • Improve materials and construction practices of roadways • Incorporate Non-Structural Hazard Mitigation Measures (e.g., watershed/district scale communication network, public education) • Increase or Preserve Site Tree Canopy Coverage, Natural Planted Areas, or Wetlands • Increase Passive Survivability of Assets/Systems During Power Outages • Riparian and Wetland Buffers • Upsize Pumping Capacity	• Maintain safe and reliable community access by increasing the resilience of drainage systems and roads to flooding • Mitigate impacts of urban heat • Improve stream and nearshore water quality and ecosystem health

CENTRAL O‘AHU

From the hotspots assessed for the Central O‘ahu region, one prioritized hotspot, Waipahū/Pouhala Marsh, was identified and described below in Table 6-7. This hotspot contains transportation, utility, educational, and community assets exposed to sea level rise, flooding, extreme heat, hurricanes, wildfire, and tsunami hazards. Groundwater inundation data was not available during the time of the analysis for this region.

Table 6-7. Central O‘ahu Priority Hotspot

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Waipahū/Pouhala Marsh	**People:** New Hope Christian School, Waipahū Intermediate School, Honowai Elementary School, Kaiser Punawai Clinic, Waipahū Fire Station 12, Waipi‘o Soccer Complex **‘Āina:** Pouhala Marsh Wildlife Sanctuary, Waikele Stream, Hō‘ae‘ae Stream, and Waipahū Cultural Gardens **Infrastructure**: Farrington Highway, several bridges, HART transit station two wastewater pump stations and associated sewer lines, stormwater lines, wells, and water lines	WILDFIRE EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 3 ft* HURRICANES TSUNAMIS	DROUGHT HEAVY RAIN	None	• Distribution System Resilience • Dry Floodproof the Building/Asset/Utility (e.g., seal windows, doors, vents, drainage systems, manholes) • Elevate Access Road and Associated Utilities • Elevate Critical Assets/Equipment • Improved Wildfire Detection and Response • Incorporate Alternative/Back-Up Power Sources (e.g., back-up generators, off-grid solar panels, microgrids) • Incorporate Backflow Prevention Devices • Incorporate Native Vegetation • Upsize Pumping Capacity	• Improve community and watershed resilience to wildfire • Reduce pressure on the Pearl Harbor Aquifer to support regional water supply reliability • Mitigate flooding, sediment transport, and pollution in the Waikele, Hō‘ae‘ae, and Kapakahi drainage basins • Improve Pouhala Marsh water quality, ecosystem health, and adaptation to sea level rise • Improve community access to natural and recreational resources

ʻEWA

From the hotspots assessed for the ʻEwa region, one priority hotspot, the Pūpū St/Pūpū Place hotspot, was identified and is described in Table 6-8. This hotspot contains transportation, utility, and coastal recreational assets exposed to sea level rise, flooding, extreme heat, hurricanes, wildfire, and tsunami hazards. Groundwater inundation data was not available during the time of the analysis for this region.

Table 6-8. ʻEwa Priority Hotspot

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Pūpū St/Pūpū Pl	**People:** primarily residential area **ʻĀina:** Oneʻula Beach Park **Infrastructure**: Farrington Highway, several local streets, a transit operations center, stormwater lines, and water lines	WILDFIRE EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 7 ft* HURRICANES TSUNAMIS	DROUGHT HEAVY RAIN	None	• Dry Floodproof the Building/Asset/Utility (e.g., seal windows, doors, vents, drainage systems, manholes) • Incorporate Corrosion Resistant Materials and Coatings • Incorporate Native Vegetation • Pilot Study on the Use of an Adaptive Design Process (for Highways) • Reef Facilitation • Restore Beach, Dune Systems, and Coastal Floodplain • Upsize Pumping Capacity	• Maintain critical water infrastructure to provide reliable service to residents and adequate drainage of streets. • Enhance awareness of flooding risks to residents • Proactively plan to protect communities and the environment • Improve water quality to protect ocean and nearshore reef

WAIʻANAE

From the hotspots assessed for the Waiʻanae region, two priority hotspots were identified: Pōkaʻī Bay Street and Mākaha Stream/Farrington Hwy, described in Table 6-9 below. These hotspots contain transportation, utility, educational, public safety, community, and coastal recreational assets exposed to flooding, sea level rise, hurricanes, extreme heat, wildfire, tsunami, and drought hazards. Groundwater inundation data was not available during the time of the analysis for this region.

Table 6-9. Waiʻanae Priority Hotspots

PRIORITIZED HOTSPOT	ASSETS WITHIN HOTSPOT	RELEVANT HIGH RISK THREATS	RELEVANT MEDIUM RISK THREATS	RELEVANT LOW RISK THREATS	RELEVANT ADAPTATION STRATEGIES TO BE CONSIDERED	GOALS
Pōkaʻī Bay Street	**People:** Adventist Malama Elementary School, Kuʻiliolоa Heiau, Waiʻanae police substation **ʻĀina:** Pōkaʻī Bay Beach Park **Infrastructure**: sewer lines, stormwater lines, and water lines; Farrington Highway, Pōkaʻī Bay St	WILDFIRE EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 1 ft for erosion and at 4 ft for above ground flooding.* HURRICANES TSUNAMIS	DROUGHT HEAVY RAIN	None	• Distribution System Resilience • Dry Floodproof the Building/Asset/Utility • Elevate Access Road and Associated Utilities • Improved Wildfire Detection and Response • Increase Passive Survivability of Assets/Systems During Power Outages • Stormwater Capture and Use • Utilize Alternative Water Sources: Non-potable Reuse, Indirect Potable Reuse, On Site Reuse, Desalination	• Improve infrastructure to effectively manage wastewater and stormwater flows • Respect and support Native Hawaiian culture and traditional practices reliant on healthy land and water resources • Protect local water sources and the natural habitat to provide water for our future generations • Improve community resilience to wildfire
Mākaha Stream / Farrington Hwy	**People:** Mākaha Elementary School **ʻĀina:** Mākaha Stream North & South, Keaʻau Stream, Mākaha Beach Park **Infrastructure**: sewer lines, stormwater lines, and water lines; Farrington Highway, stream bridges, cesspools	WILDFIRE EXTREME HEAT SEA LEVEL RISE ***SLR potential threshold:*** *SLR impacts starting at 1 ft for erosion and passive flooding at 7 ft.* HURRICANES TSUNAMIS	DROUGHT HEAVY RAIN	None	• Distribution System Resilience • Elevate Access Road and Associated Utilities • Improve materials and construction practices of roadways • Improved Wildfire Detection and Response • Increase Passive Survivability of Assets/Systems During Power Outages • Stormwater Capture and Use • Utilize Alternative Water Sources: Non-potable Reuse, Indirect Potable Reuse, On Site Reuse, Desalination	• Reduce flood impacts to Farrington Highway and Mākaha Beach during heavy rains/coastal inundation • Address sedimentation and soil deposit challenges within Mākaha Stream to decrease flooding risks • Maintain access for emergency services along Mākaha roads • Improve community resilience to wildfire

6.3 MOVING FROM GOALS TO PROJECTS

This section lists which assets are at risk in each of the 14 Prioritized Hotspots, which hazards could impact these hotspots, the goals set for each area, and the adaptation strategies that could be applied to meet those goals. These adaptation strategies are options, not commitments.

A strategy becomes a project only when an agency can champion and fund the work, when the work fits alongside efforts already underway, and when the investment benefits the community. Steps 4 through 6 of the project development process apply those tests. Section 7 describes how approximately 150 project ideas were developed from the strategies identified in this chapter, scored and prioritized, and a subset of which were recommended for the near-, mid-, or long-term planning horizon.

NEXT STEPS

- Revisit these results when new data becomes available.
- Consider the full list of at-risk assets within each hotspot when identifying future projects as well as relevant adaptation strategies.

7 | Project Development and Prioritization

Developing and prioritizing projects helps the City address the most urgent climate risks and provide multi-benefits to the community.

PURPOSE

Translate regional priorities and climate risk results into collaboratively developed project concepts for each priority hotspot. The Plan recommends 49 One Water projects: 24 proposed to begin within the next 10 years, 16 projects in 10 to 25 years, and 9 beyond that timeframe. This section explains what those projects are and how they were selected from roughly 150 project ideas.

7.1 PROJECT DEVELOPMENT

Potential One Water projects are identified within each priority hotspot and prioritized based on criteria developed with the One Water Panel.

Section 7 builds on Step 3 in Section 6 and focuses on Steps 4 through 6 of the six-step process shown in Figure 7-1. While Step 3 identified adaptation strategies relevant to each hotspot, Step 4 develops One Water project concepts by identifying opportunities to integrate them into current or upcoming initiatives, expanding existing projects, or initiating entirely new efforts. Step 5 further develops project descriptions and provides documentation as a starting point for future implementation. Step 6 develops final One Water projects using prioritization criteria to recommend projects for implementation.

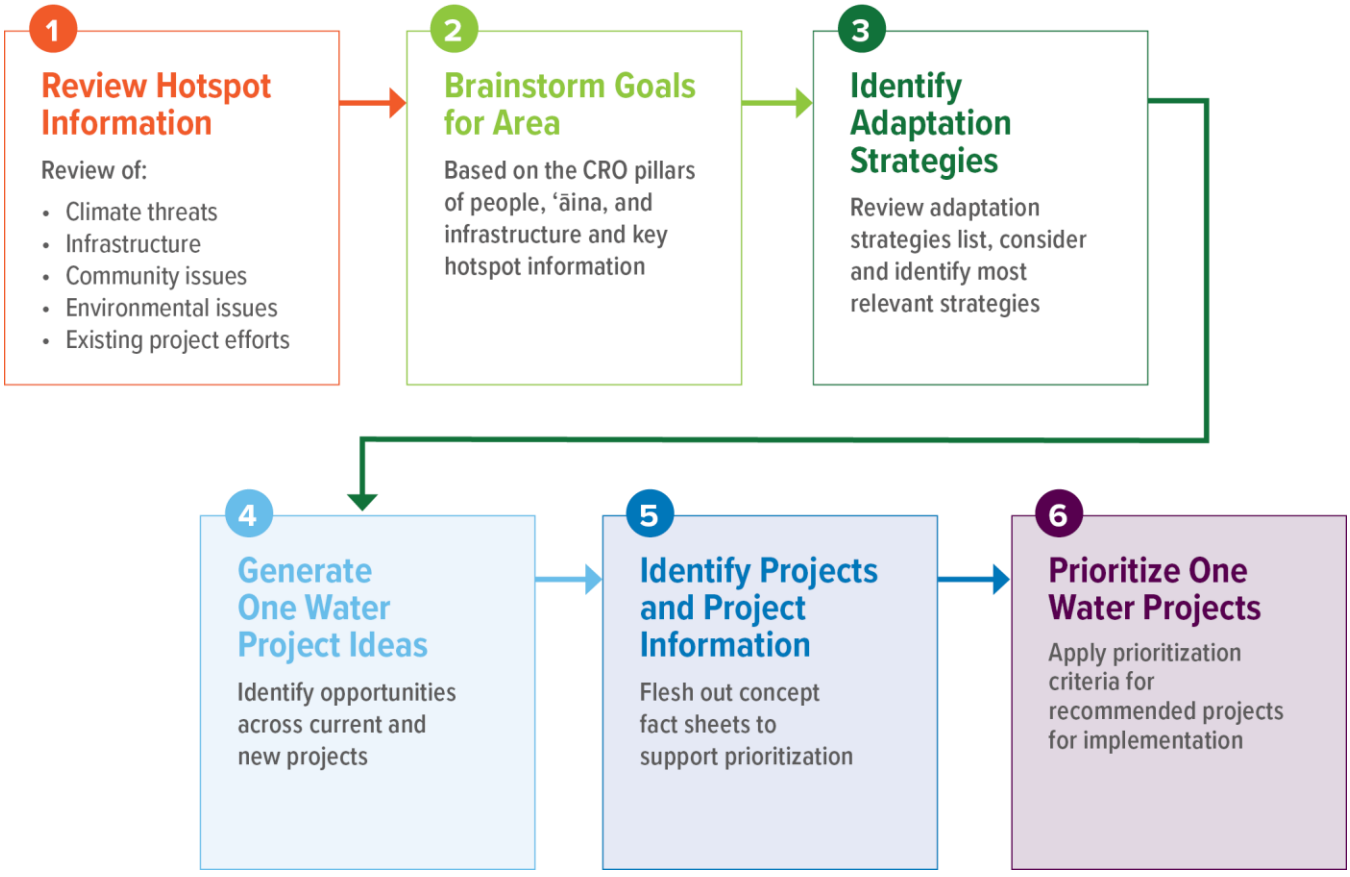


Figure 7-1. Six-step project development process for each priority hotspot area

Selected adaptation strategies were further developed into One Water project ideas, which fit the definition of a One Water project that:

- Support CRO strategies
- Address one or more OWH objectives and aligns with the OWH mission and vision
- Address climate risk(s)
- Focus on City One Water infrastructure
- Require collaboration between two or more agencies and are led by a City agency.

These requirements were developed collaboratively based on goals of the One Water Honolulu Plan and Panel input.

Example CRO Strategies:

- **Strengthen fresh water security by improving water conservation and reuse**
- **Integrate climate resilience into City capital planning, operations, and policies**
- **Make buildings, homes, and infrastructure more climate resilient**

RESULTS

The project identification process resulted in a list of approximately 150 project ideas with initial project information. The process largely occurred during a week-long workshop with the Panel in January 2026. The project information includes alignment with One Water requirements, project timeline (in the next 5-10, 10-25, or 25+ years), potential resilience benefits, climate threats addressed, One Water assets involved, and community benefits. Each project was also assigned preliminary proposed lead and supporting agencies.

Project types are categorized as either plans/studies, programs, or physical infrastructure:

- **Plans and studies** are formal, documented frameworks and strategies that outline how a utility/agency will prepare for, respond to, and recover from climate change impacts, or systematic analyses of a specific condition or opportunity to develop understanding, evaluate alternatives, and inform decisions, planning, or action.
- **Programs** are ongoing, organized activities or initiatives designed to enhance the resilience of water and wastewater services to climate change.
- **Physical infrastructure** captures tangible, built modifications or enhancements to existing or planned infrastructure systems.

7.2 PRIORITIZATION CRITERIA

The goal of project prioritization was to select the top projects from the approximately 150 initial project ideas for further development and prioritized implementation.

Project prioritization criteria were confirmed by the Panel and applied by the project team. Project prioritization follows a three-step process, laid out in Figure 7-2 below.

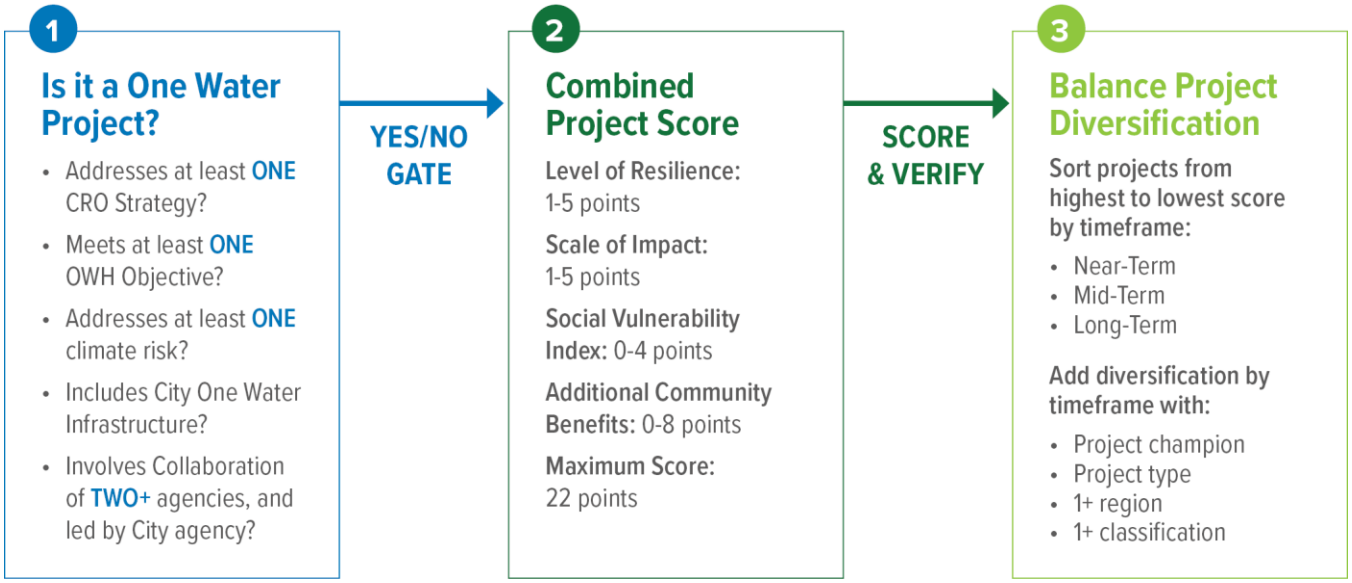


Figure 7-2. Flow chart of the three-step process of project prioritization, with considerations for each step of the process

STEP 1
IS IT A ONE WATER PROJECT?

The first step is to check that the project fits the One Water project requirements, as defined in Section 7.1. If the project meets all five of the One Water criteria, it passes through the 'Yes/No gate' to step 2. Projects that do not meet all of these criteria are documented in Appendix D, separately from the One Water Honolulu Projects List, as they may be appropriate for implementation outside of the One Water purview.

2 STEP 2
COMBINED PROJECT SCORE

The second step of the prioritization process is to score projects using the prioritization criteria developed for this Plan. Each project earns points based on four components. Level of Resilience (1-5 points) rewards lasting solutions that reduce risk from more than one climate hazard. Scale of Impact (1-5 points) rewards projects protecting a larger area and more people. Social Vulnerability Index (0-4 points) rewards projects serving vulnerable communities. Community Benefits (0-8 points) rewards projects that also deliver cultural, ecological, and quality-of-life value. The maximum score that a project can receive is 22 points. Final scores fell between 5 and 16 points for the One Water projects. Project scores have a relatively equal contribution from the four categories, so no weighting is added.

Level of Resilience captures the climate adaptation potential of each project. Level of Resilience is scored from 1-5, with increasing resilience potential as the numeric score increases. Level of Resilience captures multiple dimensions: the averted losses, how many climate risks are reduced, and the permanence of the solution. Projects that score a 1 are temporary solutions that have minimal risk reduction from a single climate hazard. As the score increases to 5, projects have long-term significant risk reduction from multiple climate hazards. Table 7-1 provides definitions, with an example project for each. For projects that fall between multiple categories, the amount of risk reduction is used to determine the resilience level score.

Table 7-1. Definitions for levels of resilience along with example projects for each

SCORE	RESILIENCE	DEFINITION	EXAMPLE
1	Low	Temporary solution that reduces a minimal amount of risk from a single climate hazard	Water Conserving Showers
2	Low/Med	Temporary solution that reduces a moderate amount of risk from a single or multiple climate hazards	Beach Nourishment
3	Med	Semi-permanent solution that reduces a moderate amount of risk from a single or multiple climate hazards	Dip Tanks for Wildfire Suppression
4	Med/High	Long-term solution that reduces a significant amount of risk from a single climate hazard	Living Levee
5	High	Long-term solution that reduces a significant amount of risk from multiple climate hazards	Linear Park along Kapālama Canal

The second component in prioritization scores is the Scale of Impact. The Scale of Impact is used to capture the spatial extent that a project will protect from the climate hazards. Shown in Table 7-2, the five scales of impact are defined as site/block, community, ahupuaʻa, moku, and islandwide, worth 1-5 points, respectively. This criterion gives priority to projects that have a wider scale of impact and implicitly prioritizes projects that will impact the most people, with the widest ecological benefits.

Table 7-2. Definitions for scale of impact along with example projects for each

SCORE	SCALE OF IMPACT DEFINITION	EXAMPLE
1	Site or Block	Green Streets
2	Community	Neighborhood Flood Reduction
3	Ahupuaʻa (Watershed)	Mauka Watershed Improvements
4	Moku (Region)	Coastal Road Raising Program
5	Islandwide	Managed Retreat Legal and Policy Study

The Oʻahu Social Vulnerability Index (SoVI) score is the third contribution to project prioritization score. The Oʻahu SoVI captures many dimensions of social vulnerability including exposure to hazards, socioeconomic status, household composition, minority status/language, and housing/transportation. The Oʻahu SoVI assesses a community's susceptibility to disasters in relation to their capacity to mitigate or adapt to these environmental shocks based on socioeconomic variables. Oʻahu SoVI values have been assigned to each Census tract on Oʻahu, from Very Low, Low, and Medium to High and Very High. These qualitative SoVI levels are assigned scores from 0-4, respectively.

The final component of prioritization scores are the Community Benefits. Each project is assessed for its contribution to eight community benefits, described in Table 7-3. If the project will provide that benefit as a central component or driver of the project, then the project scores a 1. If the criterion does not apply or is not a component of the project, it receives a 0. While additional benefits may be incorporated into each project, the score focuses on components that are central to the project and are nearly certain to be realized, to avoid boosting scores for benefits that may not end up being included in the project. These additional potential benefits are noted within project factsheets for consideration during further project development (see Appendix H for project factsheets).

Table 7-3. Definitions of each of the eight community benefits with example projects for each

COMMUNITY BENEFIT	DEFINITION	EXAMPLE
Protects Cultural Sites	Project protects or restores loʻi kalo, loko iʻa, heiau, burial sites, streams, and/or Hawaiian Homelands from climate impacts. Cultural sites are identified using the Oʻahu ʻĀina Inventory.	Stormwater capture/use upstream of cultural site location (reduces flood risk at site)
Incorporates Living and Traditional Hawaiian Practices	Project uses the ahupuaʻa based planning approach, ʻauwai for water capture/distribution, water conservation, natural systems for water reuse (agricultural or ecological), nearshore ecological management, and/or land uses that support seasonal water flow-driven irrigation. Practices may include loko iʻa, loʻi kalo, kapu, and restoring native vegetation, among others.	Loʻi Restoration
Reduces Community Flooding	Project will reduce flooding, especially from frequent, small events (i.e., nuisance flooding), for residential and broader community spaces. The project must go beyond protecting components of water infrastructure and have benefits to housing, businesses, and/or roadways.	Green Streets
Increases Public Awareness	Project has a significant driver/component of public awareness and education, beyond typical outreach necessary for infrastructure projects.	R-1 Reuse along a Shared-Use Path with Educational Signage
Improves Water Quality	Project will improve water quality of streams, sea water, groundwater, or drinking water.	Stream Restoration & Rehabilitation
Provides Ecosystem Restoration	Project incorporates green infrastructure and native plants, restores land or water ecosystems including reefs and wetlands, increases groundwater recharge, and/or removes pollutants from the environment.	Wetland Rehabilitation
Improves Public Access to Community Spaces	Project will create additional or enhanced access to parks, beaches, or other community spaces, or support continued access by minimizing climate impacts to single points of connection (i.e., towns with one access road)	New/Improved Beach Access
Enhances Recreational Spaces	Project creates additional recreational opportunities through shared-use paths, expanded parks, beaches or open space, or added amenities to recreational spaces.	Resilient Corridor (Adding Shared-Use Path to Existing Roadway)

For physical infrastructure and programs, community benefit scores are based on the direct impacts they will have. For plans/studies, the community benefits are applied to areas where they will have a focus, or where impacts would be realized in future application of the plan. For example, a study focused on hydrogeological and environmental impact would inform future stormwater infrastructure projects, receives points for increasing community flood protection and improving water quality, as these are central to stormwater management.

STEP 3
BALANCE PROJECT DIVERSIFICATION

The third step in project prioritization is to balance the diversity of projects that move forward to factsheet development. First, projects were separated by their implementation timeframe: near-term (within the next 10 years), mid-term (10-25 years), and long-term (25+ years), shown in Figure 7-3. Once projects were separated by their anticipated timeframe, they were sorted from highest to lowest project prioritization score. The final One Water Project List was developed by considering project prioritization score as well as the presence of a project champion and finding a balance of projects by type, region, and area classification, as described below. One-on-one meetings with agencies were conducted to confirm project champions for near-term projects.

Overall, the project prioritization criteria promote projects that reduce significant climate risk, impact a large spatial area, protect socially vulnerable communities, and provide multiple benefits to the community.

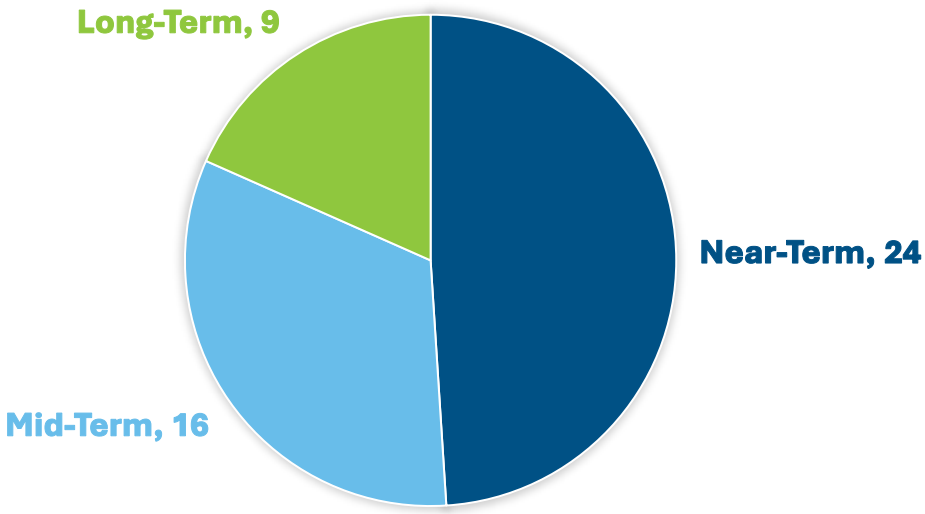


Figure 7-3. Pie chart showing the 49 projects by timeframe, with the number in each timeframe shown

Project Champion

A project champion is a City agency that has agreed to lead a project and see it through completion. The total list was checked to determine and encourage the diversity of project champions. For near-term projects, the lead agencies confirmed their ownership of the project and their role as a project champion. The agencies also contributed their priorities and upcoming projects that fit the One Water criteria. These identified priority projects were added to the near-term project list as they were new project opportunities that were already championed by a lead agency. Projects without a strong lead agency commitment were either categorized as mid- or long-term projects or removed from the recommended project list. One-on-one meetings were conducted with agencies to confirm their role as project champions. Mid- and long-term projects have a proposed champion, which is considered for diversity among City agencies but does not require confirmation of project ownership to remain on the list.

Figure 7-4 shows the number of near-term projects led by each City agency, with those in a leading role shown in blue and those with a supporting role shown in green. The number of lead agencies exceeds the number of projects since multiple agencies can lead (and support) each project. BWS, ENV, and DFM are listed as project champions on the most projects, and most of the other agencies contribute to between four and seven near-term projects.

Project Type

The project types are Plan/Study, Program, and Infrastructure. To provide a balanced and comprehensive selection of projects, the project list intentionally incorporates a diverse mix of physical infrastructure, programs, and foundational plans and studies. This balance between project types necessarily differs among timeframes, as plans/studies and programs are generally more near-term projects, while physical infrastructure tend to land in the mid- and long-term due to longer implementation timelines, so a balance is achieved over the total list of recommended projects, shown in Figure 7-5.

Region	To spread projects geographically across Oʻahu, the recommended project list was checked to confirm there is at least one project per planning region represented. Figure 7-6 shows the number of projects in each planning region and islandwide. There are a large number of projects in the Primary Urban Center, which reflects ongoing work and development. In addition, there are twelve islandwide projects, which are primarily near-term plans/studies or programs. Otherwise, projects are distributed across the planning regions, with many projects in Koʻolau Poko and Waiʻanae.
Area Classification	To check that different land uses and development types are represented, and to promote replicability in future projects, the third prioritization step also included confirming that at least one project falls within each area classification: Major Hubs & Economic Centers, Redevelopment & Growth, Mid-Density Communities, Country Towns & Rural Coastline, Major Linear Network Corridors, and Recharge & Runoff Management Opportunities (as defined in Section 5.5). The balance of area classifications in the recommended project list is shown in Figure 7-7. While all regions and area classifications have at least one project, that does not mean that every priority hotspot has a project. In the project list, no project is located in Kamehameha Hwy in Koʻolau Poko/Koʻolau Loa.

The final recommended One Water Honolulu Project List accounts for the project prioritization scores and the balancing considerations described above, with particular focus on near-term project champions to support successful implementation of near-term projects. The overall list is skewed towards near-term projects, since many are supported by lead agencies and have sufficient information and momentum. Recommended projects are shown by lead and supporting agency in Figure 7-4, by project type in Figure 7-5, by region in Figure 7-6, and by area classification in Figure 7-7.

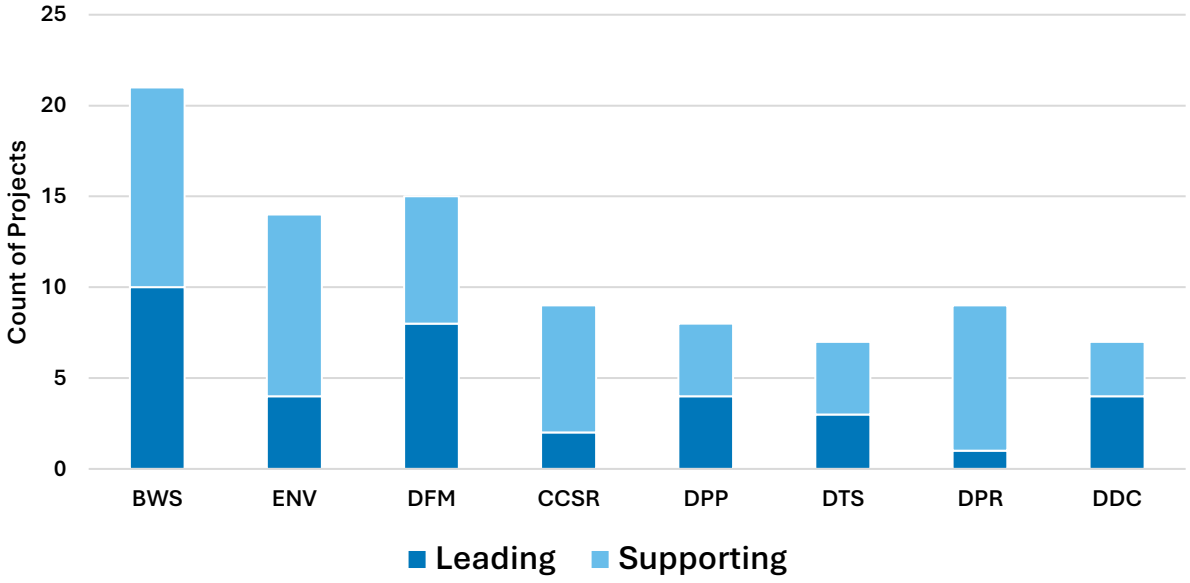


Figure 7-4. Count of the 24 near-term projects that are led or supported by each City agency

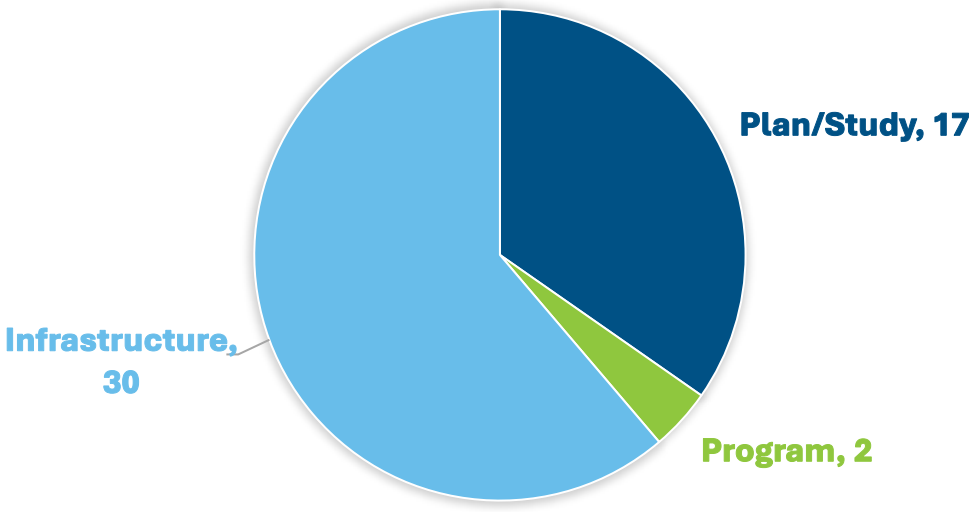


Figure 7-5. Pie chart showing the portion of project types among the 49 recommended projects

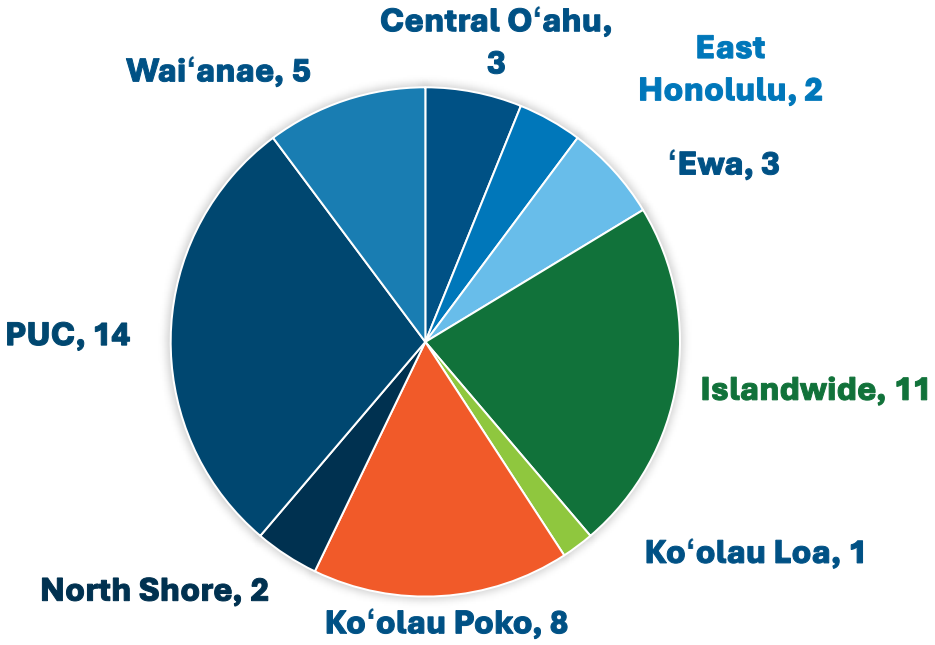


Figure 7-6. Pie chart of the 49 projects by their region, with the number of projects per region as shown

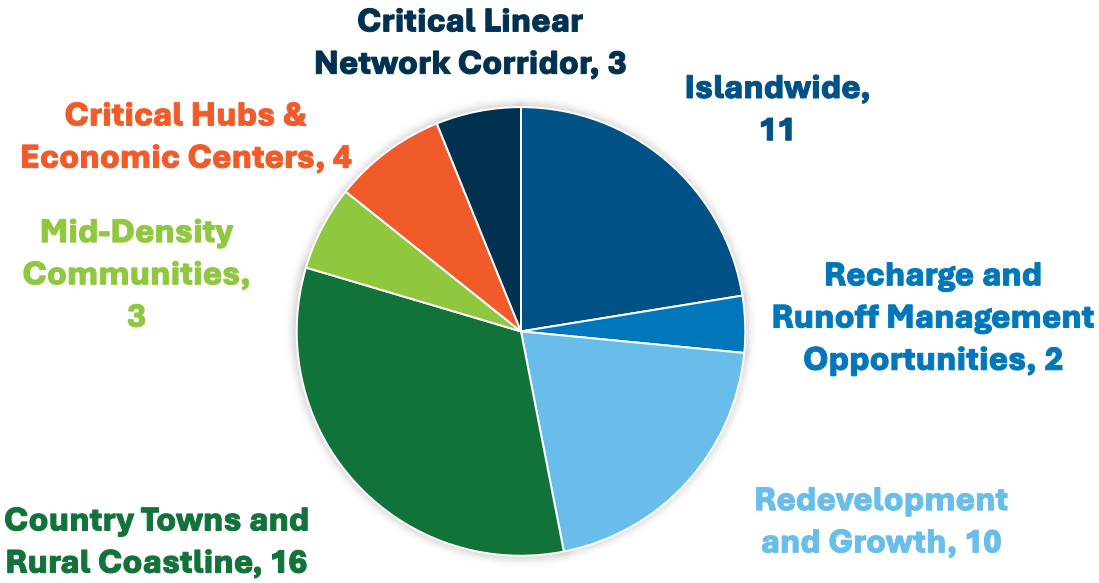


Figure 7-7. Pie chart showing the distribution of the 49 projects by area classification

7.3 PROJECT OPPORTUNITIES AND BENEFITS

The following tables show the One Water Honolulu Project List, separated by timeframe.

There are 24 projects identified as near-term, defined as within the next 10 years (Table 7-4); 16 projects identified as mid-term, defined as within in the next 10-25 years (Table 7-5), and 9 identified long-term projects, defined as more than 25 years out (Table 7-6). The project benefits are captured through the total prioritization scores, as described in Appendix D, and by which hazard impacts they address. Hazards with a full circle indicate a primary hazard the project addresses, and open circles indicate additional hazards that could benefit from the project. Some near-term projects with relatively low project scores are included in the recommended list due to having strong project champions and being upcoming or ongoing efforts and were thus prioritized during the balancing step of the prioritization process.

Table 7-4. Prioritized **near-term** One Water Honolulu projects, organized by region and total score. Each project shows the total prioritization score and climate hazards addressed, primary as a filled circle and secondary as open circles

			CLIMATE HAZARD							
PROJECT NAME	LEAD AGENCY	PRIORITIZATION SCORE	100 YEAR FLOOD	HURRICANE	TSUNAMI	SEA LEVEL RISE	COASTAL EROSION	WILDFIRE	EXTREME HEAT	DROUGHT
Islandwide										
Managed Retreat Legal and Policy Investigation Study	DPP	14	○	○	○	●	●			
Stormwater Utility Fee	DFM	13	●	○						○
Road Raising Strategy	DTS/DDC	12	○			●	○			
Green Infrastructure Implementation Plan	DFM/BWS	12	●						○	○
Expand Tidal Groundwater Well Monitoring Network	BWS	12				●				
Stormwater Master Plan	DFM	12	●	○		○				
Onsite Stormwater Management Incentives	DFM/DDC	11	●							○
Beach Shower NPDES Compliance Improvements	DFM	10	●			●	○			○
Reuse Strategy for Redevelopment Areas	BWS	10							○	●
Expand Non-Potable Water to Large Parks and Water Loss Control	DPR/DDC/BWS	10							○	●
Country Town Resilient Sidewalk & Path Improvements for Unimproved Roadways	DTS	7	●						○	
Koʻolau Poko										
Waimānalo Effluent R-1 Reuse Feasibility Study	ENV/BWS	10							○	●
PUC										
Iwilei Area Adaptation Plan	DPP/CCSR/DFM	16	●	●	●	●	○	○	●	○
Māpunapuna Area Adaptation Plan	DPP/CCSR/DFM	14	●	●	●	●	●	○	●	○
Adapt Waikīkī Phase 2	DPP	14	●	●	●	●	●	○	●	○
Ala Wai Watershed Integrated Stormwater Management	DFM	11	●			○				
NASED Regulatory Requirements for Reuse	BWS/ENV	8							○	●
University Avenue Urban Complete Streets and Green Infrastructure	DTS/DDC/DFM	7	●						○	
Ala Wai Golf Course Non-Potable Irrigation Study	DES/DDC/BWS	5	○						○	●
Nuʻuanu Reservoir Hydro Managed Aquifer Recharge	BWS	5	○							●
Central Oʻahu										
Reuse and Potable Water Services for Whitmore Agriculture	ENV/BWS	7						○	○	●
Central Oʻahu Water Recycling Facilities, Mililani	ENV/BWS	6							○	●
ʻEwa										
Potable Reuse Pilot at Honouliuli	ENV/BWS/DOH	6							○	●
Waiʻanae										
Develop Cooperative Fireshed Partnerships	BWS	13						●		○

Table 7-5. Prioritized **mid-term** One Water Honolulu projects, organized by region and total score. Each project shows the total prioritization score and climate hazards addressed, primary as a filled circle and secondary as open circles

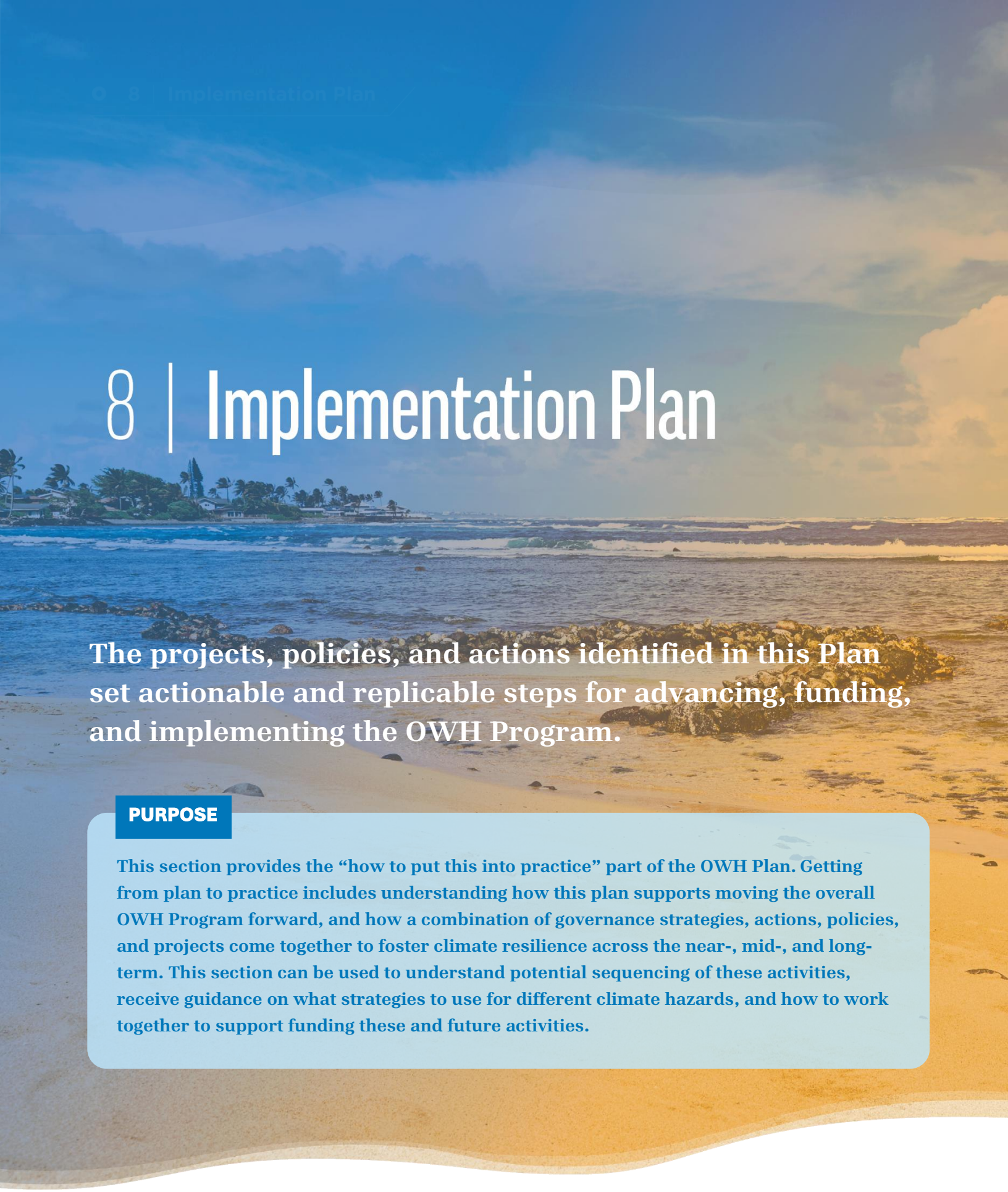
			CLIMATE HAZARD							
PROJECT NAME	LEAD AGENCY	PRIORITIZATION SCORE	100 YEAR FLOOD	HURRICANE	TSUNAMI	SEA LEVEL RISE	COASTAL EROSION	WILDFIRE	EXTREME HEAT	DROUGHT
Islandwide										
Projects from the Integrated Plan	ENV/DFM	TBD	●							
North Shore										
Haleʻiwa Area Adaptation Plan	DPP/CCSR	16	●	●	●	●	●	●	●	○
Stormwater Retention, Recharge, and Reuse in Mauka Lands	DFM	15	●	○						○
Koʻolau Loa										
Beach Park Erosion and Flood Resilience	DPR/CCSR	14	○	○		●	●		○	
Koʻolau Poko										
Coastal Management Plan for Erosion and Flooding	DPP	15	○	○	○	●	●			
Waimānalo Roads Drainage Study and Improvements	DFM	13	●	○	○					
Kahawai Stream Restoration Strategy	DFM	12	●	●		○				○
Stormwater Retention along Kamoʻaliʻi Stream	DES	10	●	○						○
MCBH R-1 Recycled Water Upgrade	BWS	9							○	●
East Honolulu										
Stream Restoration & Rehabilitation	DFM	10	●	○			○			
PUC										
Kapalama Canal Linear Park	DPP TOD	16	○			●			○	
Pilot Floodable Spaces	DFM	14	●							○
Iwilei Drainage Improvements	DFM	14	●	○		○			○	
Resilience Corridors and Road Raising	DTS/CCSR	14	●			○			○	
Māpunapuna Flood Improvements	DFM	10	○			●				
Central Oʻahu / ʻEwa										
Honouliuli R-1 Distribution System Expansion	BWS	10							○	●

Table 7-6. Prioritized **long-term** One Water Honolulu projects, organized by region and total score. Each project shows the total prioritization score and climate hazards addressed, primary as a filled circle and secondary as open circles

			CLIMATE HAZARD							
PROJECT NAME	LEAD AGENCY	PRIORITIZATION SCORE	100 YEAR FLOOD	HURRICANE	TSUNAMI	SEA LEVEL RISE	COASTAL EROSION	WILDFIRE	EXTREME HEAT	DROUGHT
Koʻolau Poko										
State Agriculture Water System Connection to Future R-1	BWS	9							○	●
Resilience Corridor and Pedestrian Accessibility Study	DTS	7	○	○		●			○	
East Honolulu										
Regional Shoreline Adaptation	DDC, BWS, ENV, DPR	10	○	○		●	●			
ʻEwa										
Raise Main Arterials Further Inland	DTS	11	○	○	○	●	○			
Long-range Post-retreat Study	CCSR	8				●	○			○
Waiʻanae										
Mākaha Stormwater Infrastructure	DFM	13	●	○					○	
Mākaha Roads Drainage Study and Improvements	DFM	13	●	○					○	
Increase Green Infrastructure and Green Space	DFM	10	●					●	○	
Dry Flood Proof Waiʻanae High Risk Areas	DDC	10	●	○	○	○				

NEXT STEPS

- Integrate prioritized projects with policy recommendations and ongoing efforts.
- Advance project implementation through funding, feasibility analysis, or further scoping.
- Repeat this project development and prioritization process in future Plan updates.



8 | Implementation Plan

The projects, policies, and actions identified in this Plan set actionable and replicable steps for advancing, funding, and implementing the OWH Program.

PURPOSE

This section provides the "how to put this into practice" part of the OWH Plan. Getting from plan to practice includes understanding how this plan supports moving the overall OWH Program forward, and how a combination of governance strategies, actions, policies, and projects come together to foster climate resilience across the near-, mid-, and long-term. This section can be used to understand potential sequencing of these activities, receive guidance on what strategies to use for different climate hazards, and how to work together to support funding these and future activities.

8.1 MOVING THE OWH PROGRAM FORWARD

One Water Honolulu recognizes that O‘ahu faces unprecedented climate challenges that require increased collaboration, coordination, and leveraging of resources. Climate change risks and impacts require adaptation across communities, the City, the state, and federal entities. Collaboration within the City and with key partners as outlined in both the Ordinance 20-47 and the Panel MOU will enable better engagement and alignment with stakeholders, including the state, federal government, and the private sector. To this end, the Panel collaboratively developed the vision, mission, and objectives for the One Water Honolulu Program.

VISION

Collaborating for a thriving and climate resilient O‘ahu

MISSION

One Water Honolulu champions cost-effective and climate resilient infrastructure services and natural systems for the people, culture, and sustainability of O‘ahu through integration and innovation in planning, implementation, and maintenance.

OBJECTIVES

The One Water Honolulu program supports and builds upon Climate Ready O‘ahu by advancing collaboration toward the following objectives:

1	**Practice a shared kuleana for a climate resilient O‘ahu.**
2	**Enhance and sustain coordination to recognize interconnections and to co-create and implement projects and strategies.**
3	**Amplify the voices of O‘ahu’s people through meaningful stakeholder engagement.**
4	**Develop a unified roadmap and decision-making process under a One Water approach.**
5	**Streamline permitting processes to efficiently advance project implementation.**
6	**Work together to leverage resources and enable climate readiness.**
7	**Collectively advocate for and pursue funding to support multi-benefit projects.**

The City's One Water Honolulu efforts include work done since the One Water Panel inception as well as ongoing work within individual partner agencies to support the One Water vision and mission. In addition to the development of the One Water Honolulu Plan, the City will continue One Water Honolulu program efforts to advance collaboration in support of Climate Ready Oʻahu. As program efforts advance, the City continues to assess and monitor progress through various mechanisms including an Annual Report. The 2025 One Water Honolulu Annual Report included a self-assessment based on the national One Water Cities Self-Assessment developed by the Water Research Foundation (WRF) as part of WRF Project #4969. WRF Project #4969 provides a methodology to monitor and evaluate progress toward One Water implementation.

The results of the One Water Honolulu self-assessment for 2025 are shown by red boxes in Figure 8-1. The City has advanced the OWH Program in all 5 categories from the One Water Cities Self-Assessment guidance with varying levels of improvement in each category.

The following OWH Program components align with each of the five categories in Figure 8-1:

- The One Water Honolulu Plan (Plan) as a living document – One Water Planning
- The One Water Panel and its ongoing efforts - Organizational Culture
- Collaboration Framework - Stakeholder Engagement
- A 30-year list of climate resilience projects – Informed Actions
- OWH Program Annual Report, living OWH Plan, and adaptive management – One Water Monitoring



Figure 8-1. WRF One Water Self-Assessment Categories and OWH Program 2025 Results

The One Water Honolulu Plan is one component of the broader One Water Honolulu Program, which advances the vision, mission, and objectives through ongoing collaboration among the Panel, partners, and stakeholders. Over time, the OWH Program is expected to progress within each category through the stages shown in Figure 8-1.

To support the progression of the OWH program, which in turn bolsters resilience efforts, a series of governance strategies, actions, and process modifications are recommended. The following section describes recommended governance strategies and actions.

WHAT ARE GOVERNANCE STRATEGIES?

Recommendations for overarching actions and processes to support or further define governing roles, responsibilities, resource allocation, and both formal and informal structures through which authority is exercised as related to One Water.

PROGRAM-LEVEL COLLABORATION AND GOVERNANCE STRATEGIES

The list of recommended governance strategies and associated supporting actions are organized by the following implementation timeframes:

Present to 3 years 3 - 5 years 5 - 10 years

Recommended governance strategies can support advancing the program within the self-assessment categories listed in Figure 8-1, and as such, these categories are also identified for each strategy as indicated below.

STRATEGY 1:

Implement the One Water Honolulu Plan and advance collaboration and climate change adaptation frameworks.

Supports One Water Program Category: One Water Planning

ACTIONS:

1.1	Expand the One Water Panel MOU to advance Plan implementation.	Present to 3 years
1.2	Develop monitoring metrics for the use of DDC's Climate Change Design Guidelines to ensure continuous application.	Present to 3 years
1.3	Formalize One Water Collaboration Framework and Climate Change Adaptation Framework.	Present to 3 years
1.4	Utilize adaptation pathways for long term planning for critical infrastructure assets.	3 - 5 years
1.5	Update the One Water Honolulu Plan every ten years.	5-10 years

STRATEGY 2:

Enable and support City financing and funding systems and the pursuit of external funding that allow One Water partners to collaborate in developing and implementing integrated solutions.

Supports One Water Program Category: Funding focused (Supports all other categories)

ACTIONS:

2.1	Develop and maintain a OWH Funding and Financing Implementation Roadmap that aligns funding opportunities with project sequencing and implementation priorities.	Ongoing
2.2	Evaluate and pursue Federal and State grants and low interest loans to advance implementation of OWH projects.	Ongoing
2.3	Optimize and standardize procedures for interdepartmental cost-sharing and joint funding of multi-benefit One Water projects.	Present to 3 years
2.4	Develop a dedicated funding mechanism to support stormwater infrastructure projects.	Present to 3 years
2.5	Create a dedicated City-wide One Water and Resilience Fund.	3 - 5 years
2.6	Standardize the way that climate information including risks, costs, and benefits are considered within the budget process.	3 - 5 years

STRATEGY 3:

Champion an inclusive One Water City Organizational Culture from leadership to operations to foster collaborative climate resilient perspectives and problem solving.

Supports One Water Program Category: Organizational Culture

ACTIONS:

3.1	OWH Panel of Directors to identify and commit One Water champions to sustain a diverse and inclusive One Water leadership team.	Present to 3 years
3.2	Develop a One Water Leadership Program to inspire the next generation of collaborative climate resilient leaders within the City.	Present to 3 years
3.3	Encourage, acknowledge, and reward inter-agency collaboration and commit to implementation.	Present to 3 years
3.4	Establish new One Water Coordinator position with roles and responsibilities and recruit or designate an existing position with support from a contract facilitator.	Present to 3 years
3.5	Establish formal mechanisms for facilitated, recurring internal inter-disciplinary collaborations.	3 - 5 years
3.6	Collectively build staff capacity to plan and implement One Water solutions.	3 - 5 years

STRATEGY 4:

Ensure coordinated OWH CIP project implementation among responsible City infrastructure, operational and budgetary agencies

Supports One Water Program Category: Informed Actions

ACTIONS:

4.1	Collaborate on joint development of multi-benefit OW projects.		Ongoing
4.2	Utilize progressive project delivery approaches, like Public-Private Partnerships, Design-Build, Improvement Districts, redevelopment authorities, and others.		Ongoing
4.3	Develop CIP criteria to prioritize and support collaborative One Water projects.		Present to 3 years
4.4	Develop a City-wide CIP tracking tool that pulls information from all individual CIPs and is accessible to all Panel partners.		Present to 3 years
4.5	Establish climate threat triggers to program projects concurrent with impacts.		Present to 3 years
4.6	Share infrastructure condition and capacity data to support adaptation planning and timely replacement.		Present to 3 years

STRATEGY 5:

Develop indicators, tracking and performance metrics to annually evaluate and report on progress of the One Water Honolulu Program implementation.

Supports One Water Program Category: One Water Monitoring

ACTIONS:

5.1	Conduct an annual One Water leadership team self-assessment on OWH Program strengths, weaknesses, opportunities and threats.	Ongoing
5.2	Develop and track performance indicators and metrics and report on progress.	Present to 3 years
5.3	Develop benchmarking indicators to assess levels of resilience to the 6 climate threats: SLR, flooding, drought, wildfire, heat, and hurricanes.	3 - 5 years
5.4	Monitor the alignment of City resources (staff, budgets, investments), with implementation actions and how the City adapts to future challenges.	3 - 5 years

STRATEGY 6:

Advance processes for stakeholder collaboration and engagement.

Supports One Water Program Category: Stakeholder engagement

ACTIONS:

6.1	Consider and apply already developed equity criteria in projects and programs.	Present to 3 years
6.2	Promote Private Development Guidelines to streamline permitting and coordinate resilience features into new development.	Present to 3 years
6.3	Foster collaboration with Native Hawaiian communities to incorporate cultural values, practices, and water rights into modern water management.	Present to 3 years
6.4	Engage communities in climate adaptation efforts to reflect local priorities and knowledge and in outreach to create awareness of climate hazards.	Present to 3 years
6.5	Strengthen collaboration efforts with State and Federal agencies, developers and large landowners.	Present to 3 years
6.6	Promote water resource education in schools and the community to encourage informed collaboration and future stewardship.	Present to 3 years
6.7	Explore opportunities to collaborate with academic institutions on local environmental challenges and potential innovative solutions.	Present to 3 years
6.8	Integrate existing stakeholder engagement forums.	3 - 5 years

In addition to advancing recommended actions, a governance structure that includes formalized coordination roles is an important part of a sustained program. Recommended coordination roles are described below. While these roles can potentially be formalized within the existing Panel structure and fulfilled by one or more people/groups as an interim step, it is recommended that the Panel collectively advocate for the funding and establishment of one or more permanent dedicated position(s) as the program advances.

Program level and policy coordination

Panel Facilitator

- Convening and organizing Panel meetings
- Planning discussions and working groups in alignment with program and Plan implementation needs
- Supporting coordination of Panel-wide activities
- Documenting program-level decisions and supporting information

OWH Program Champion(s)

- Program planning in alignment with City-wide strategies and priorities
- Coordinating program-level policy decisions and leading development of formal policy language
- Providing oversight and advocacy for program advancement

Project coordination and implementation

One Water Projects Coordinator

- Advancing and facilitating integration of (agreed-upon) One Water projects into respective partner CIPs
- Aligning one water projects within individual department budgeting cycles
- Coordinating, tracking, and providing regular updates to the Panel on project implementation
- Coordinating high-level integration or consideration of One Water vision and efforts into in-progress projects

OWH Program Monitoring and Reporting Officer

- Tracking program-level progress based on agreed-upon performance metrics
- Monitoring agreed-upon regulatory, financial, and climate hazard triggers in coordination with the One Water Projects Coordinator
- Leading program-level reporting through development of agreed upon progress reports and coordination of report reviews, submittals and approvals

RECOMMENDED POLICIES TO ADVANCE IMPLEMENTATION

The recommended policies included in this section are intended to help drive or advance One Water projects by formalizing coordinated action.

Recommended policies are listed in Table 8-1 and organized by relevant hazard.

WHAT ARE POLICIES?

Rules, guidelines, and overarching principles adopted by governing, regulating, or implementing entities to promote climate resilience. They influence decision-making, resource allocation, and operational practices and can also support governance strategies.

Table 8-1. Recommended Policies by Hazard

RECOMMENDED POLICY	RECOMMENDED NEXT STEPS FOR THE PANEL	RELEVANT HAZARD
Establish an institutional framework for sea level rise adaptation, incorporating forecasting, trigger-based actions, infrastructure hardening, flood control, and strategic retreat managed through innovative financing mechanisms under a unified One Water management model.	Consider the One Water Honolulu Implementation Plan guidance including triggers, project sequencing and checklists to inform decisions towards an institutional framework; implement near-term recommended OWH project studies related to managed retreat and road raising. Consider how Area Adaptation Plans fit into the overall potential framework.	 SEA LEVEL RISE
Develop and implement the Stormwater Master Plan to help improve and maintain the City's drainage infrastructure to protect life, public health, property and repetitive loss areas from flood hazards, and adopt the Stormwater Fee to finance drainage and stormwater green infrastructure projects.	Coordinate with DFM to support the development and implementation of the Stormwater Master Plan and a future Stormwater Fee including aligning stakeholder engagement efforts with OWH program efforts. Although the Stormwater Master Plan and a future Stormwater Fee help advance adaptation related to heavy rain, in combination with such steps, the City should consider advancing policy discussions and other large-scale solutions to address flood hazards based on the best available data.	 HEAVY RAIN [1]

RECOMMENDED POLICY	RECOMMENDED NEXT STEPS FOR THE PANEL	RELEVANT HAZARD
Periodically review, update, and implement emergency response and preparedness plans, resilient building standards, and post-disaster recovery plans to address climate-related increases in hurricane frequency and intensity, tsunami hazards, and other risks identified in the Honolulu Local Hazard Mitigation Plan. https://www.honolulu.gov/dem/lhmp/	Work with the Department of Emergency Management (DEM) and State agencies to coordinate updates to emergency preparedness plans; publish the Private Development Guidelines; work with DEM and State agencies to coordinate integrated post-disaster recovery plans including consideration of managed retreat from repetitive loss areas.	 HURRICANES  TSUNAMIS
Develop, formalize and regularly update an action plan for proactive wildfire management, community planning, risk mitigation, emergency response, resilient infrastructure hardening, and community partnerships.	Work with relevant agencies and stakeholders including the Department of Emergency Management to scope, coordinate and develop the action plan. Important considerations: • OWH Plan Climate Adaptation process (Sec. 5) and results (Sec. 6) contain information about mapped One Water assets facing wildfire risk. This information can be a helpful reference in identifying other types of assets and facilities located in the vicinity. • Identification and early engagement of relevant stakeholders including community-based organizations who can help develop and implement an action plan is an important next step.	 WILDFIRE
Require major public facilities, transit areas, schools, parks, and affordable housing projects to analyze heat impacts to human health and infrastructure functionality, and to provide options for heat reduction by incorporating measures such as increasing shading of parking lots and streets, considering cooling solutions for roadway surfaces, and increasing tree planting and ground cover.	Work with CCSR and relevant agencies and stakeholders to draft the requirement. Important considerations: • Coordinate with CRO strategy 12.3 (Establish shade quotas along multimodal transit corridors, in public recreation spaces, and in other public facilities). • Consider any City-led studies that could be developed ahead of requirement. • Coordinate with private developers to align efforts and leverage heat reduction opportunities.	 EXTREME HEAT

RECOMMENDED POLICY	RECOMMENDED NEXT STEPS FOR THE PANEL	RELEVANT HAZARD
Refine drought emergency response and preparedness plans and improve forecasting and monitoring systems. Support with diversified, climate resilient water infrastructure and expanded water conservation, reuse and watershed management programs.	Work with BWS, ENV, DFM and relevant stakeholders to identify gaps or opportunities to improve drought emergency response and preparedness; expand public outreach with refined messaging around climate hazards and drought; continue coordination to expand reuse and watershed management programs including the exploration of a Stormwater Utility Fee.	 DROUGHT

[1] *This policy may help address impacts from other non-permanent flood-related hazards such as high wave flooding.*

8.2 OVERVIEW OF IMPLEMENTATION BY HAZARD

The tables in this section provide an overview of the implementation plan elements summarized by hazard. Each of these elements is presented in more detail in later sections.

- Section 8.3 describes the suggested triggers developed for the implementation plan.
- Section 8.4 presents adaptation strategy Checklists by Hazard for City CIP projects
- Section 8.5 presents detailed, trigger-based implementation plans by region for OWH projects.

SEA LEVEL RISE

Recommended Policy	Establish an institutional framework for sea level rise adaptation, incorporating forecasting, trigger-based actions, infrastructure hardening, flood control, and strategic retreat managed through innovative financing mechanisms under a unified One Water management model.	
Projects	**Near Term (2026-2035)**	• Road Raising Strategy (Islandwide) • Managed Retreat Legal and Policy Investigation Study (Islandwide) • Expand Tidal Groundwater Well Monitoring Network (Islandwide) • Adapt Waikīkī Phase 2 (PUC) • Iwilei Area Adaptation Plan (PUC) • Māpunapuna Area Adaptation Plan (PUC)
	Mid Term (2035-2050)	• Haleʻiwa Area Adaptation Plan (North Shore) • Beach Park Erosion and Flood Resilience (Koʻolau Loa) • Coastal Management Plan for Erosion and Flooding (Koʻolau Poko) • Māpunapuna Flood Improvements (PUC) • Kapālama Canal Linear Park (PUC) • Resilience Corridors and Road Raising (PUC)
	Long Term (Beyond 2050)	• Resilience Corridor and Pedestrian Accessibility Study (Koʻolau Poko) • Regional Shoreline Adaptation (East Honolulu) • Long-Range Post-Retreat Study (ʻEwa) • Raise Main Arterials Further Inland (ʻEwa) • Dry Flood Proof Waiʻanae High Risk Areas (Waiʻanae)
Suggested Triggers	**Sea Level Rise (SLR) Flooding**	Greater than 4 inches of inundation occurring during king tides (6x per year) [Review trigger as part of OWH Project Road Raising Strategy]
		Greater than 6 inches of inundation occurring during annual high-wave flooding [Review trigger as part of OWH Project Road Raising Strategy]
	Shallow and Emergent Groundwater	Groundwater levels indicate the groundwater table is less than 5 ft below grade surface [Review trigger as part of OWH Project Expand Tidal Groundwater Well Monitoring Network]
	Coastal Erosion	Increasing trend in reported damage incidents and cumulative repair costs exceeds agreed-upon threshold (to be determined)
Adaptation Strategy Checklist	Figure 8-4. Checklist for Sea Level Rise Hazard	

DROUGHT

Recommended Policy	Refine drought emergency response and preparedness plans and improve forecasting and monitoring systems. Support with diversified, climate resilient water infrastructure and expanded water conservation, reuse and watershed management programs.	
Projects	**Near Term (2026-2035)**	• Reuse Strategy for Redevelopment Areas (Islandwide) • Expand Non-Potable Water to Large Parks and Water Loss Control (Islandwide) • Waimānalo Effluent R-1 Reuse Feasibility Study (Koʻolau Poko) • New Aloha Stadium Entertainment District (NASED) Regulatory Requirements for Reuse (PUC) • Ala Wai Golf Course Non-Potable Irrigation Study (PUC) • Nuʻuanu Reservoir Hydro Managed Aquifer Recharge (PUC) • Reuse and Potable Water Services for Whitmore Agriculture (Central Oʻahu) • Central Oʻahu Water Recycling Facilities, Mililani (Central Oʻahu) • Potable Reuse Pilot at Honouliuli (ʻEwa)
	Mid Term (2035-2050)	• Stormwater Retention, Recharge, and Reuse in Mauka Lands (North Shore) • Marine Corps Base Hawaiʻi (MCBH) R-1 Recycled Water Upgrade (Koʻolau Poko) • Honouliuli R-1 Distribution System Expansion (Central Oʻahu)
	Long Term (Beyond 2050)	• State Agriculture Water System Connection to Future R-1 (Koʻolau Poko)
Suggested Triggers	Recurring Water Shortage Caution Conditions (Stage 1)	
	Recurring Water Shortage Alert Conditions (Stage 2)	
	Recurring Water Shortage Critical Conditions (Stage 3)	
	12 months with 12-month Standardized Precipitation Index (SPI) <-0.8 (D1-D2: Moderate to Severe Drought)	
	12 months with 12-month SPI <-1.6 (D3-D4: Extreme to Exceptional Drought)	
	24 months with 12-month SPI <0.8 (Persistent D1-D2: Moderate to Severe Drought)	
Adaptation Strategy Checklist	Figure 8-5. Checklist for Drought Hazard	

HEAVY RAIN

Recommended Policy	Develop and implement the Stormwater Master Plan to help improve and maintain the City's drainage infrastructure to protect life, public health, property and repetitive loss areas from flood hazards, and adopt the Stormwater Fee to finance drainage and stormwater green infrastructure projects.	
Projects	**Near Term (2026-2035)**	• Stormwater Master Plan (Islandwide) • Green Infrastructure Implementation Plan (Islandwide) • Stormwater Utility Fee (Islandwide) • Onsite Stormwater Management Incentives (Islandwide) • Country Town Resilient Sidewalk & Path Improvements for Unimproved Roadways (Islandwide) • University Avenue Urban Complete Streets and Green Infrastructure (PUC) • Iwilei Area Adaptation Plan (PUC) • Māpunapuna Area Adaptation Plan (PUC) • Adapt Waikīkī Phase 2 (PUC) • Ala Wai Watershed Integrated Stormwater Management (PUC)
	Mid Term (2035-2050)	• Projects from the Integrated Plan (Islandwide) • Haleʻiwa Area Adaptation Plan (North Shore) • Stormwater Retention, Recharge, and Reuse in Mauka Lands (North Shore) • Stormwater Retention along Kamoʻoaliʻi Stream (Koʻolau Poko) • Waimānalo Roads Drainage Study and Improvements (Koʻolau Poko) • Kahawai Stream Restoration Strategy (Koʻolau Poko) • Stream Restoration and Rehabilitation (East Honolulu) • Pilot Floodable Spaces (PUC) • Iwilei Drainage Improvements (PUC) • Resilience Corridors and Road Raising (PUC)
	Long Term (Beyond 2050)	• Increase Green Infrastructure and Green Space (Waiʻanae) • Dry Flood Proof Waiʻanae High Risk Areas (Waiʻanae) • Mākaha Roads Drainage Study and Improvements (Waiʻanae) • Mākaha Stormwater Infrastructure (Waiʻanae)
Suggested Triggers	Greater than 4 inches of inundation occurring on roadways more than 2x in 5 years.	
	More than 2 flooding events in 10 years exceeding the expected recurrence interval.	
	Observed rainfall events over 10 years exceed Atlas 14 precipitation intensities by 5%	
	Observed rainfall events over 10 years exceed Atlas 14 precipitation intensities by 15%	
Adaptation Strategy Checklist	Figure 8-6. Checklist for Heavy Rain Hazard	

EXTREME HEAT

Recommended Policy	Require major public facilities, transit areas, schools, parks, and affordable housing projects to analyze heat impacts to human health and infrastructure functionality, and to provide options for heat reduction by incorporating measures such as increasing shading of parking lots and streets, considering cooling solutions for roadway surfaces, and increasing tree planting and ground cover.	
Projects	**Near Term (2026-2035)**	• Green Infrastructure Implementation Plan (Islandwide) • Country Town Resilient Sidewalk & Path Improvements for Unimproved Roadways (Islandwide) • Iwilei Area Adaptation Plan (PUC) • Māpunapuna Area Adaptation Plan (PUC) • University Avenue Urban Complete Streets and Green Infrastructure (PUC)
	Mid Term (2035-2050)	• Haleʻiwa Area Adaptation Plan (North Shore) • Resilience Corridors and Road Raising (PUC)
	Long Term (Beyond 2050)	• Increase Green Infrastructure and Green Space (Waiʻanae)
Suggested Triggers	More than 5 days/year with a Wet Bulb Globe Temperature (WBGT) above 80°F	
	One Heat Event or Greater than 3 days/year with WBGT above 85°F	
Adaptation Strategy Checklist	Figure 8-7. Checklist for Extreme Heat Hazard	

WILDFIRE

Recommended Policy	Develop, formalize, and regularly update an action plan for proactive wildfire management, community planning, risk mitigation, emergency response, resilient infrastructure hardening, and community partnerships.	
Projects	**Near Term (2026-2035)**	• Develop Cooperative Fireshed Partnerships (Waiʻanae)
	Mid Term (2035-2050)	• Haleʻiwa Area Adaptation Plan (North Shore)
	Long Term (Beyond 2050)	• No current projects identified
Suggested Triggers	New Very High Risk areas	
	New High Risk areas	
	New Medium Risk areas	
	Number of ignitions increases by 10%	
Adaptation Strategy Checklist	Figure 8-8. Checklist for Wildfire Hazard	

8.3 PROJECT SEQUENCING AND TRIGGERS

The Plan will be implemented through a trigger-based framework that supports sequencing of projects and incremental adaptation over time, reducing risk as climate hazards intensify.

This flexible approach allows the City to monitor evolving conditions and respond proactively before risks fully materialize. It prioritizes near-term actions in the most vulnerable areas while preserving the ability to transition to more transformative measures if more severe climate impacts emerge later in the century.

TRIGGERS FOR ADAPTATION

A trigger is a defined change in condition used in the Plan to inform the timing of implementing mid-term and long-term projects and actions.

As the Plan is implemented, the City departments will continue to work together through the One Water Panel to collect and monitor information. This will help build an understanding of how conditions may change over time and support refining project triggers. In the current plan, there are three types of triggers: regulatory, financial, and climate hazard.

Regulatory Triggers	Regulatory triggers apply to projects that may be prioritized in the future if new regulations arise. For example, some mid-term or long-term projects that improve water quality but are not required under current regulatory mandates (e.g., Total Maximum Daily Loads) have regulatory triggers. These projects may be advanced in the absence of regulatory requirements if funding is available or if other co-benefits justify earlier implementation.

Financial Triggers

The City's ability to implement projects may be constrained by available funding. Financial triggers indicate changes in funding conditions that could accelerate implementation of mid- and long-term projects. These projects are often needed under current conditions but have been deferred because of higher costs or lower priority relative to other needs. Financial triggers could also be met when economic or cost-benefit analyses conclude that investing in a higher up-front cost project is more cost-effective than completing many lower-cost projects over a long period of time (e.g., how many times would the City pay to fix a failing seawall before it became more cost-effective to rebuild, move or remove the seawall altogether). Additional information on funding opportunities is provided in Section 8.6.

Climate Hazard Triggers

For each climate hazard, example thresholds, triggers, and monitoring metrics have been suggested for OWH Panel consideration to support tracking changing conditions and impacts.

- **Thresholds** represent the point at which changes in climate conditions, such as increased rainfall or heat stress, increase hazard exposure to a level that requires expanded or new adaptation measures to mitigate adverse impacts.
- **Triggers** are set in advance of thresholds to allow for proactive decision-making and timely investment in infrastructure adaptation strategies.
- **Monitoring Metrics** track infrastructure performance and inform when a trigger has been reached.

CLIMATE HAZARD TRIGGERS

This section provides examples of potential triggers for SLR, drought, wildfire, extreme heat, heavy rain to consider for OWH projects and actions. It is understood that the One Water Panel will need to determine whether these suggested triggers are sufficiently conservative, both currently and as conditions change, and in order to reach agreement on which triggers to use and how they will be applied in the OWH project planning and implementation process.

Climate hazard triggers and thresholds are applied in the One Water Honolulu Project Implementation Plan and the Checklists by Hazard to connect changing conditions with recommended adaptation measures and One Water projects. Figure 8-2 illustrates the relationship between thresholds, triggers, and monitoring metrics. Triggers are paired with monitoring metrics to help inform decision-making.

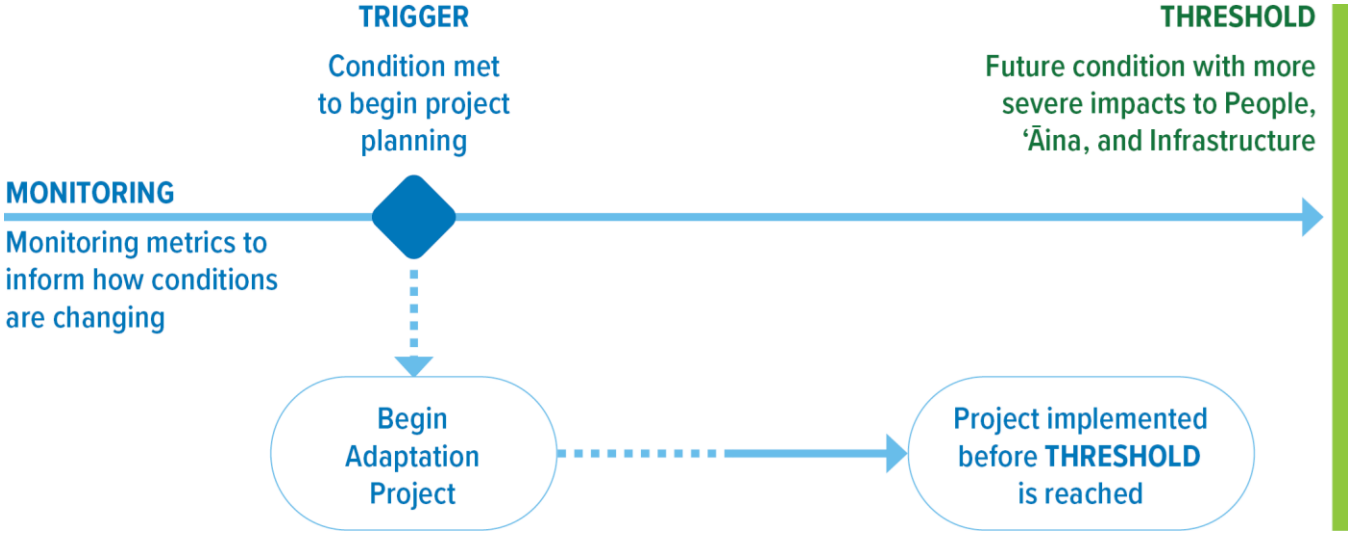


Figure 8-2. Relationship between monitoring, triggers, and thresholds.

Figure 8-3 presents an example of how monitoring metrics, triggers, and thresholds work together.

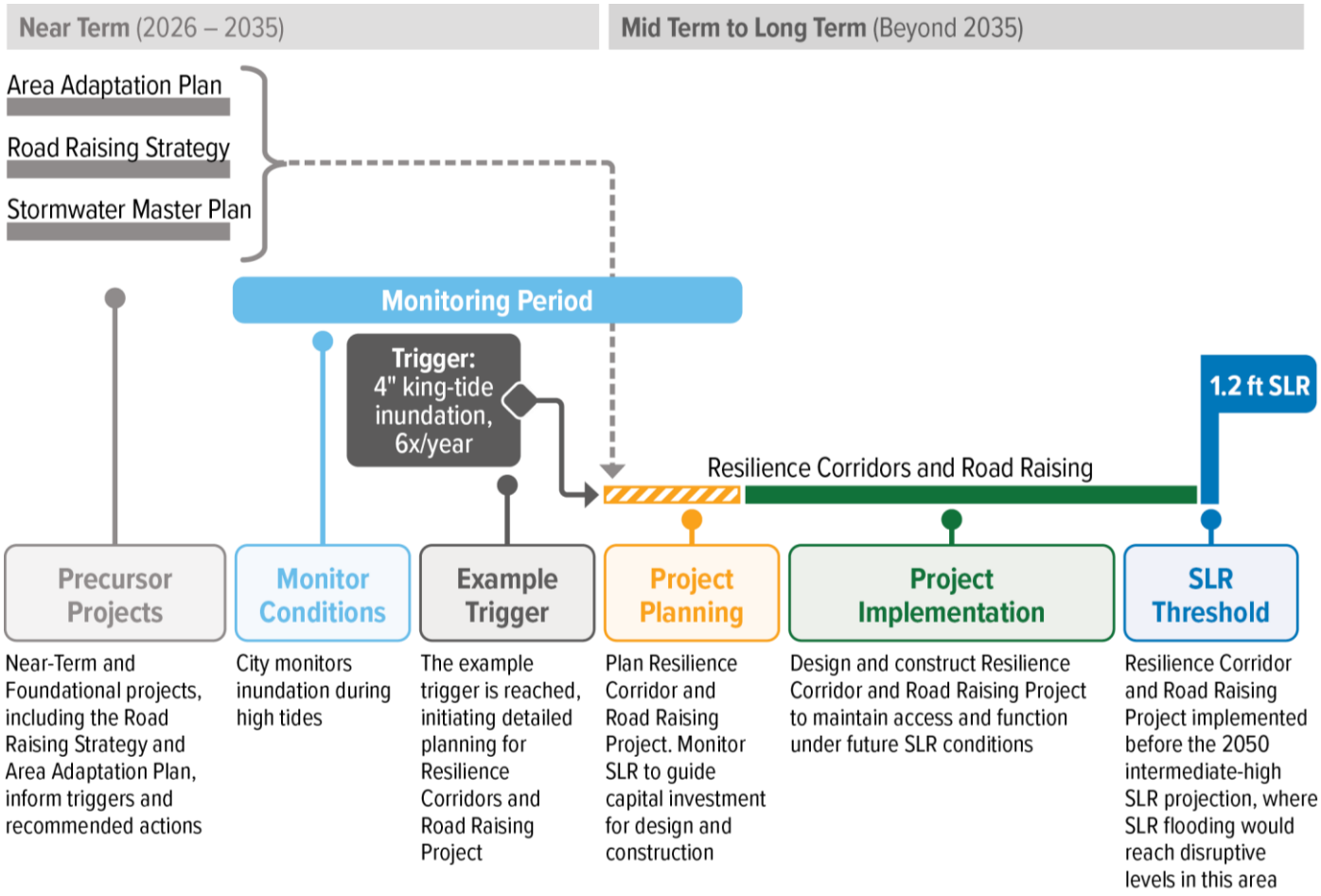


Figure 8-3. Example of applying triggers to Resilience Corridors and Road Raising Project

In this example shown in Figure 8-3, an area is anticipated to be vulnerable to passive flooding during king tides under future SLR conditions. It is also assumed that funding will be pursued and secured to establish any additional monitoring networks and to fund or finance eventual road raising efforts. The content below is not an exhaustive list of actions but highlights the progression of actions needed to advance project implementation for this example.

After the **Area Adaptation Plan, Stormwater Master Plan,** and **Road Raising Strategy** projects are completed in the near term, conditions are monitored for SLR flooding on high tide days, and inundation depths remain below the example 4-inch trigger condition.

In the future, monitoring data indicate 4 inches of inundation during king tide events, activating the example passive flooding **trigger**. Although roadway impacts are expected to occur at approximately 6 inches of inundation, the trigger provides advance notice to account for the time needed for planning and implementation.

After the trigger is reached, the project is prioritized in the City's CIP process so planning for the Resilience Corridors and Road Raising Project can begin. Planning includes engagement with key stakeholders and builds on previous work completed in the Area Adaptation Plan.

Following the planning phase, the Resilience Corridors and Road Raising project will advance through design and construction. The project will be implemented before reaching the **threshold**, to put adaptation measures in place before SLR flooding reaches disruptive levels.

SEA LEVEL RISE TRIGGERS

Table 8-2 summarizes the potential thresholds, triggers, and monitoring metrics for SLR for consideration by the Panel and Leadership Group. The monitoring metrics support tracking SLR impacts over time and provide information on when triggers and thresholds have been reached.

Table 8-2. Sea Level Rise Thresholds, Triggers, and Monitoring Metrics

THRESHOLDS	MONITORING METRICS
• **Intermediate Scenario:** 1 ft by 2050; 3.8 ft by 2100[1,2] • **Intermediate-High Scenario:** 1.2 ft by 2050; 5.8 ft by 2100[1,2]	• Change in relative SLR for Honolulu and Moku o Loʻe Island Tide Gauges
TRIGGERS	**MONITORING METRICS**
• **SLR Flooding:** Greater than 4 inches of inundation occurring during king tides (6x per year) [Review trigger as part of OWH Project Road Raising Strategy] • **SLR Flooding:** Greater than 6 inches of inundation occurring during annual high-wave flooding [Review trigger as part of OWH Project Road Raising Strategy]	• Frequency of flooding in low-lying areas (#Days/Year) • Depth of inundation of flooding (inches) • Frequency of road closures due to flooding
• **Shallow and Emergent Groundwater:** Groundwater levels indicate the groundwater table is less than 5 ft below grade surface [Review trigger as part of OWH Project Expand Tidal Groundwater Well Monitoring Network]	• Groundwater Rise in Monitoring Wells [OWH Project Expand Tidal Groundwater Well Monitoring Network]
• **Coastal Erosion:** Increasing trend in reported damage incidents and cumulative repair costs exceeds agreed-upon threshold (to be determined)	• Frequency of damage to City infrastructure and public rights of way, e.g., roads • Costs over time for maintenance and repairs

1. Per Mayor's Directive No. 18-2 and the 2022 City and County of Honolulu Climate Change Commission SLR Guidance Document, the Intermediate sea level rise scenario should be the minimum scenario for all planning and design projects. Public infrastructure projects with low tolerance for risk should use the intermediate-high scenario.
2. Per the 2022 City and County of Honolulu Climate Change Commission SLR Guidance Document, projects should apply the sea level rise value to the mean higher high water level (MHHW) and add 1 to 2 ft to account for compound events such as king tides or drainage impacts under future high tides. See Appendix D for methodology used for identifying hotspots in the Plan.

The SLR thresholds were established in alignment with the 2022 City Climate Change Commission SLR Guidance Document. The 2050 thresholds are intended to identify and prioritize areas that may be vulnerable under near-term sea level rise conditions, while the 2100 thresholds support long-term adaptation planning by identifying areas that may require adaptation to future SLR conditions.

Suggested triggers were selected to identify areas where SLR-driven impacts are becoming more severe. The trigger for passive flooding occurring on dry days (greater than 4 inches of inundation on roads occurring during king tides) serves as an early warning that more frequent SLR flooding may begin impacting roadways and other infrastructure. At 6 inches of inundation on roadways, low-clearance vehicles may be impacted and/or stalled. The trigger was set at 4 inches of inundation to provide lead time for planning, designing, and implementing projects to protect, elevate, or relocate vulnerable infrastructure and roadways.

Similarly, the suggested annual high wave flooding trigger was set at 6 inches of inundation on roads to identify conditions that may require implementation of adaptation strategies ahead of an undesirable threshold. At 6 inches of inundation, this flood level is enough to stall most vehicles and can impact steering and maneuverability of even large or all-wheel drive vehicles. Together, these triggers provide an early indication of areas where chronic SLR flooding may emerge and where adaptation measures should be prioritized.

The suggested trigger for shallow and emergent groundwater is a groundwater level less than 5 feet below the ground surface, likely impacting subsurface utilities. Similar to the other SLR flooding triggers, the groundwater trigger was established ahead of more significant impacts, such as groundwater inundation, to provide sufficient lead time for planning and implementing projects to protect or adapt vulnerable infrastructure.

For coastal erosion, the suggested trigger is tied to the frequency of road closures, damage and repairs for roadways and other coastal infrastructure. The trigger was selected to identify areas experiencing erosion where the cost and frequency of repairs may justify adaptation strategies such as broader coastal management strategies, shoreline adaptation measures, or managed retreat planning.

DROUGHT TRIGGERS

Although drought is a recurring condition in Hawai‘i, more frequent or prolonged drought events can reduce aquifer recharge and water supply availability. O‘ahu's highly permeable basalt aquifers support rapid infiltration and recharge during wet conditions but are sensitive to drought because recharge is largely dependent on rainfall. Table 8-3 summarizes the potential thresholds, triggers, and monitoring metrics developed for drought for consideration by the Panel and Leadership Group. Drought thresholds were developed using the DLNR Revised Hawai‘i Drought Plan and the BWS Water Shortage Plan.

Table 8-3. Sea Level Rise Thresholds, Triggers, and Monitoring Metrics

THRESHOLDS	MONITORING METRICS
• Recurring Water Shortage Caution Conditions (Stage 1) • Recurring Water Shortage Alert Conditions (Stage 2) • Recurring Water Shortage Critical Conditions (Stage 3)	• Head level in water supply aquifers • Frequency and Duration of Water Shortage Conditions
TRIGGERS	**MONITORING METRICS**
• 12 months with 12-month SPI <-0.8 (D1-D2: Moderate to Severe Drought) • 12 months with 12-month SPI <-1.6 (D3-D4: Extreme to Exceptional Drought) • 24 months with 12-month SPI <0.8 (Persistent D1-D2: Moderate to Severe Drought)	• Standardized Precipitation Index (SPI) 12-Month averages • Frequency and Duration of Drought Conditions

Thresholds and monitoring metrics include measures of hydrologic drought, including aquifer levels and water shortage conditions to inform decision-making. The thresholds from the BWS Water Shortage Plan of Recurring Water Shortage Caution (Stage 1), Alert (Stage 2), and Critical (Stage 3) conditions represent increasing water supply stress.

The Standardized Precipitation Index (SPI) was used for potential drought triggers. SPI measures meteorological drought by characterizing the precipitation deficit over time. Positive SPI values indicate wetter-than-normal conditions while negative SPI values indicate drier-than-normal conditions. The National Integrated Drought Information System (NIDIS) describes the SPI values and potential impacts associated with the following drought conditions:

- **D0 – Abnormally Dry:** Short-term dryness may slow planting and reduce crop or pasture growth. Some lingering water deficits may remain as conditions recover from drought (SPI = -0.5 to -0.7).
- **D1 – Moderate Drought:** Some damage to crops and pastures may occur. Streams, reservoirs and wells may experience declining levels, with developing water shortages and requests for voluntary water conservation (SPI = -0.8 to -1.2).
- **D2 – Severe Drought:** Crop and pasture losses become likely. Water shortages are common and water-use restrictions may be imposed (SPI = -1.3 to -1.5).
- **D3 – Extreme Drought:** Major crop and pasture losses may occur. Widespread water shortages and water-use restrictions are expected (SPI = -1.6 to -1.9).
- **D4 – Exceptional Drought:** Exceptional and widespread crop and pasture losses may occur. Severe shortages in reservoirs, streams, and wells may create water emergencies (SPI = -2.0 or less).

Because recurring or persistent meteorological drought can reduce aquifer recharge and contribute to hydrologic drought, the 12-month SPI was selected to represent longer-term drought conditions. The SPI can serve as a leading indicator for triggers to support proactive planning and investments in programmatic water conservation and capital improvement projects for water supply and aquifer recharge. Moderate to severe drought conditions (D1-D2) sustained for 12 months are intended to initiate water supply project planning and programmatic water conservation actions, while extreme to exceptional drought conditions (D3-D4) sustained for 12 months, or D1-D2 conditions sustained for 24 months, are intended to trigger capital investments in water supply and aquifer recharge.

WILDFIRE TRIGGERS

Wildfire risk is connected to other hazards, including drought, extreme heat, and high winds. Potential triggers for these other hazards may serve as a proxy for monitoring potential change in wildfire risk. Table 8-4 presents the suggested thresholds, triggers, and monitoring metrics for wildfire for consideration by the Panel and Leadership Group.

Table 8-4. Wildfire Thresholds, Triggers, and Monitoring Metrics

THRESHOLDS	MONITORING METRICS
• **Medium Risk:** Between 40th to 70th percentile • **High Risk:** 70th to 90th percentile • **Very High Risk:** Above 90th percentile	• USDA Forest Service Wildfire Risk to Communities rankings
TRIGGERS	**MONITORING METRICS**
• New Very High, High, or Medium Risk areas	• Keetch-Byram Drought Index (KBDI) • Change to Wildland-Urban Interface (WUI) areas • Hawai‘i Climate Data Portal Ignition Probability Maps
• Number of ignitions increases by 10%	• Wildfire locations, size, and frequency to identify hotspots

Wildfire risk data available from the USDA Forest Service Wildfire Risk to Communities was used to create thresholds. The Wildfire Risk to Communities is a national geospatial dataset providing Wildfire risk classifications by percentile that represent the relative risk of wildfire damage based on likelihood, intensity, exposure, and susceptibility.

It is recommended that the City proactively monitor changes in wildfire risk classifications and ignition frequency across the island. To support this effort, monitoring of the Keetch-Byram Drought Index (KBDI) and the extent of areas classified as wildland-urban interface can provide early indications of changing wildfire likelihood. Areas identified as shifting to medium risk and high risk should be prioritized for wildfire resilience actions. As triggers are reached, new areas may require wildfire engagement and adaptation such as firebreaks to reduce risk.

EXTREME HEAT TRIGGERS

Table 8-5 presents the suggested triggers and thresholds used to evaluate extreme heat conditions for consideration by the Panel and Leadership Group. Wet Bulb Globe Temperature (WBGT) is suggested as an appropriate measure for triggers and thresholds because it reflects the combined effects of temperature, humidity, solar radiation, and wind on human heat stress. Unlike air temperature or heat index, WBGT directly captures the environmental conditions that affect the body's ability to cool itself. For these reasons, WBGT is widely used by the National Weather Service (NWS) and Occupational Safety and Health Administration (OSHA) to characterize heat-related risks and inform safety thresholds, making it an appropriate indicator for guiding investments in shade, greening, and other strategies intended to reduce heat impacts on people.[1]

The Wet Bulb Globe Temperature (WBGT) is a measure of heat stress on the human body.

WBGT accounts for the combined effects of air temperature, humidity, solar radiation, and wind.

NIOSH describes the potential impacts associated with the following WBGT ranges:

- **80–85°F:** Working or exercising in direct sunlight may cause heat stress after approximately 45 minutes.
- **85–90°F:** Working or exercising in direct sunlight may cause heat stress after approximately 20 to 30 minutes.
- **>90°F:** Working or exercising in direct sunlight may cause heat stress after approximately 15 minutes.

[1] Although WBGT is a standard metric for heat stress for human health, other metrics may still be relevant for anticipating impacts to infrastructure including those related to physical weakening of specific assets. These metrics can include softening, buckling, and melting. Spikes in energy consumption, such as spikes in AC use, is another potential measurement that could be considered.

These WBGT ranges define heat stress impacts that can be paired with frequency of occurrence to establish adaptation thresholds and triggers that identify when heat exposure becomes both more frequent and more severe. The thresholds of WBGT exceeding 80°F on more than 10 days per year and WBGT exceeding 85°F on more than 5 days per year represent progressively worsening extreme heat conditions that increase risks to human health. As these thresholds are exceeded more frequently, adaptation measures may be warranted to reduce human health risks associated with extreme heat. Potential responses include broad urban cooling strategies, such as expanding tree canopy and shade infrastructure, as well as targeted active cooling interventions, including cooling centers in vulnerable areas. It is recommended to monitor both the total number of days exceeding the WBGT thresholds and the number of multi-day heat events (e.g., three or more consecutive days with WBGT above 80°F) to capture prolonged exposure conditions that may result in greater cumulative health impacts than isolated extreme heat days.

Table 8-5. Extreme Heat Thresholds, Triggers, and Monitoring Metrics

THRESHOLDS	TRIGGERS	MONITORING METRICS
• More than 2 heat events or 10 days/year with WBGT over 80°F	• More than 5 days/year with WBGT above 80°F	• Number of days per year WBGT > 80°F • Number of heat events lasting longer than 3 days with WBGT > 80°F
• More than 1 heat event or more than 5 days/year with WBGT over 85°F	• One Heat Event or Greater than 3 days/year with WBGT above 85°F	• Number of days per year WBGT > 85°F • Number of heat events lasting longer than 3 days with WBGT > 85°F

HEAVY RAIN TRIGGERS

FEMA floodplain mapping captures coastal and riverine flood hazards; however, it does not fully represent pluvial flood risk associated with intense rainfall that overwhelms local drainage systems. Other data, such as repetitive loss areas and observed data from recent Kona Lows and hurricanes can also be considered when developing potential heavy rain and storm-related triggers. Areas effected by these events can provide information of areas that can be inundated in the future beyond the current Federal Emergency Management Agency (FEMA) floodplain. The 100-year floodplain, as defined by FEMA, represents the area expected to be inundated by the 1-percent annual chance flood under current conditions. Future increases in rainfall intensity may result in more frequent exceedance of existing design storms and expansion of flood-prone areas. The Plan addresses existing drainage deficiencies while establishing a framework to monitor changing rainfall conditions and maintain system performance over time.

Table 8-6 presents the suggested thresholds, triggers, and monitoring metrics for pluvial and riverine flooding for consideration by the Panel and Leadership Group. NOAA Atlas 14 (Atlas 14) was identified as the baseline for evaluating changes in precipitation conditions. Atlas 14 provides precipitation intensity and depth estimates for a range of storm durations and recurrence intervals across O‘ahu and is widely used for planning, design, and evaluation of stormwater infrastructure. Thresholds are based on the DDC Climate Change Design Guidelines, which project rainfall intensities could increase by approximately 10% by mid-century and 25% by the end of the century under Representative Concentration Pathway (RCP) 8.5 conditions.

The proposed framework incorporates both climate-based and performance-based triggers. Climate-based triggers are tied to projected increases in rainfall intensity relative to the Atlas 14 baseline and indicate when existing design assumptions may no longer reflect future conditions. Exceedance of these triggers may warrant updates to stormwater planning assumptions, drainage design criteria, and infrastructure performance standards.

In contrast, performance-based triggers are tied to observed flooding impacts and are intended to identify areas where existing drainage capacity may be insufficient. For example, roadway inundation exceeding 4 inches more than twice per year may serve as a trigger to identify recurring flood hotspots and prioritize stormwater and drainage investments. Because low-clearance vehicles may be impaired or stalled at approximately 6 inches of inundation, the trigger is set at 4 inches to provide lead time to plan and implement projects that protect, elevate, or relocate vulnerable infrastructure and roadways.

Monitoring metrics should include trends in rainfall recurrence, changes in precipitation intensity relative to the Atlas 14 baseline, and the frequency and depth of flooding. Together, these metrics help identify recurrent flooding, evaluate drainage system performance, and inform updates to design standards and investments in stormwater management strategies.

Table 8-6. Pluvial and Riverine Thresholds, Triggers, and Monitoring Metrics

THRESHOLDS	MONITORING METRICS
• Increase in precipitation intensities by 10% relative to Atlas 14 Baseline by 2050. • Increase in precipitation intensities by 25% relative to Atlas 14 Baseline by 2100.	• Trends in precipitation intensity–duration–frequency (IDF) curves from climate projections.
TRIGGERS	**MONITORING METRICS**
• Greater than 4” of inundation occurring on roadways more than 2x in 5 years.	• Depth of inundation on roadways during flood events • Frequency of nuisance flooding and drainage complaints
• More than 2 flooding events in 10 years exceeding the expected recurrence interval.	• Areas with recurring private property flood losses • Number of events exceeding the drainage system design storms
• Observed rainfall events over 10 years exceed Atlas 14 precipitation intensities by 5% • Observed rainfall events over 10 years exceed Atlas 14 precipitation intensities by 15%	• Trends in precipitation intensity–duration–frequency (IDF) curves from climate projections

8.4 CHECKLISTS BY HAZARD

The Hazard Checklists help identify adaptation strategies that can improve the resilience of City CIP projects to climate-related hazards. Each checklist highlights potential actions and shows how adaptation priorities may shift as climate conditions, hazard exposure, and risk change over time. The checklists are intended to be living resources that will be refined over time as information on the effectiveness of adaptation strategies become available.

Checklists were developed for the following hazards:



The checklists include no-regrets strategies that provide benefits under a wide range of future conditions, along with actions that progress from incremental improvements to more substantial investments as climate risks increase. If a strategy is not listed for a particular level of exposure, it does not necessarily mean the strategy is ineffective. Instead, it reflects the relative suitability of different adaptation options under varying levels of climate exposure and risk. **As conditions evolve, priorities may shift from broadly applicable resilience measures to more targeted, location-specific, or capital-intensive actions.**

READER'S GUIDE FOR CHECKLISTS BY HAZARD

The checklists below in Figures 8-4 through 8-8 use a combination of colors, threshold markers, trigger points, and bar patterns to illustrate how adaptation measures relate to changing climate conditions. The following guidance explains how to interpret these visual elements and provides examples of the different strategy patterns used throughout the checklists.

- **Vertical dashed bars** are threshold markers. These indicate shifts in climate exposure or hazard risk conditions where adaptation priorities may change. These thresholds may signal when additional planning, evaluation, or investment becomes appropriate.
- **Horizontal colored bars** show where and when specific strategies are recommended. The colors correspond to the exposure or risk conditions under which a strategy may be more applicable.
- **General strategy bars** are gray and indicate actions that are broadly applicable for supporting resilience.
- **Red bars** represent strategies that are appropriate for areas currently impacted or projected to have the highest exposure to impacts from the hazard, where more targeted measures may be needed in the near-term.

- **Gold bars** represent adaptation strategies that may be appropriate for areas exposed under intermediate future conditions, where applicable.
- **Blue bars** indicate adaptation strategies that may be appropriate for areas exposed in the future under more severe climate conditions. Since there is greater uncertainty in these conditions occurring, more intensive adaptation strategies are recommended only after an exposure threshold or trigger is reached.
- **Diamonds** represent trigger points that connect phased adaptation actions to changing exposure conditions. These triggers help identify when planning, investment, or implementation may warrant consideration before or as a threshold is reached.

The examples below illustrate the recurring bar patterns used in the checklist to show how adaptation measures relate to changing conditions.

No-Regrets Strategy: Typically, lower-cost actions that are often more incremental measures. These actions provide benefits under current conditions while also supporting long-term resilience, even in areas that have not yet experienced significant climate hazard impacts.



No-Regrets Strategy (Future Exposure Areas): Strategies are often lower cost and improve resilience. However, they are recommended in areas with lower exposure to the climate hazard.



Threshold-Based or Phased Strategy: These strategies are more capital-intensive and implemented as confidence in future exposure increases or as triggers are reached.



Exposure-Dependent Strategy (Future Exposure Areas): Strategies that may improve resilience at lower or moderate exposure levels but may become less appropriate at high exposure conditions. These strategies may be most appropriate in the near term but may need additional measures as moderate or high exposure conditions develop.

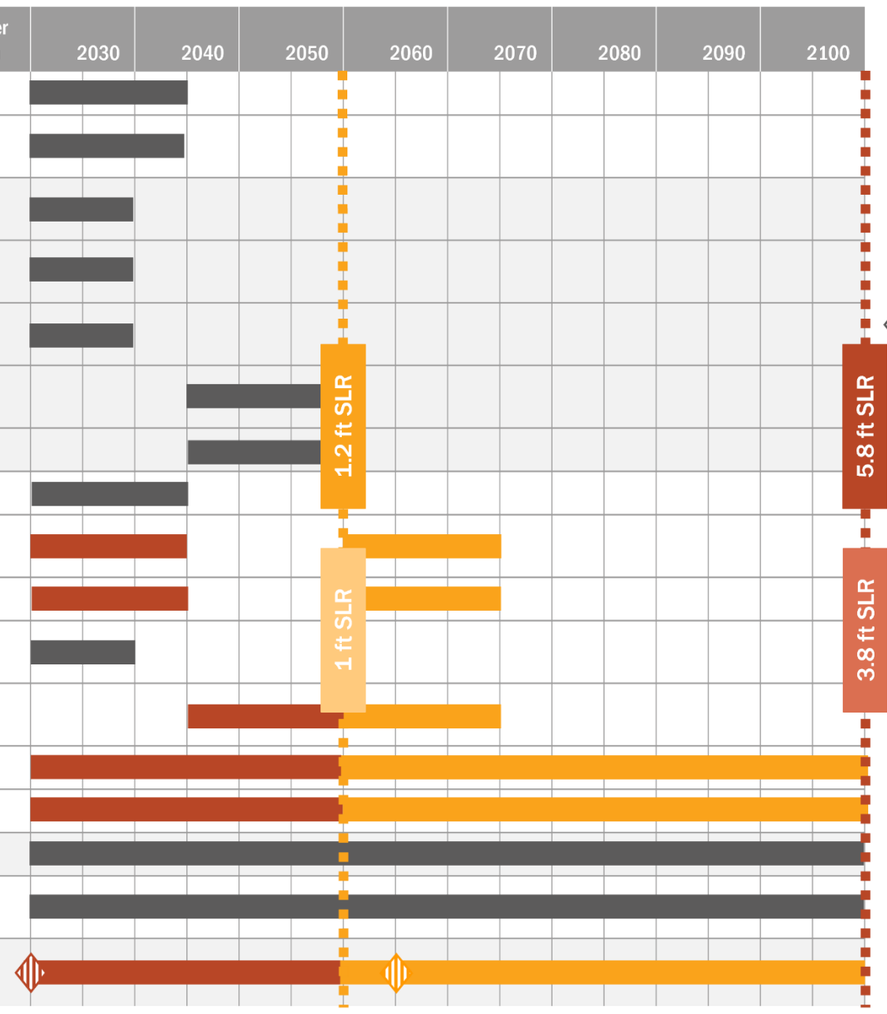


Plans (Phase-Focused): Planning efforts that are advanced in phases as hazard exposure increases.



HAZARD: SEA LEVEL RISE

Adaptation Actions:		High Tide & Wave Flooding	Groundwater Inundation
Research and Monitoring	Update SLR-XA Models with islandwide **Tidal Groundwater Well Monitoring Network**		●
	Install real-time tide and flood level sensors to measure road inundation depths and occurrences	●	
Policy and Regulation	City Climate Change Commission SLR Guidance Updates to Mayor's SLR directive 18-02	●	●
	Amend City special management area rules to incorporate SLR-XA Resiliency Districts/Zoning and Shoreline Setback Rules with SLR	●	●
	Adopted Ordinance 26-10 Flood Hazard Areas Requirements for Flood Hazard Zone Designations	●	
	Establish adjusted Design Flood Elevations for streets and structures that integrates event-based and chronic flooding with SLR	●	
	Adopt **Road Raising Strategy**	●	●
Planning and Engineering Feasibility Studies	Develop **Road Raising Strategy**	●	●
	Develop Area Adaptation Plans (AAPs), e.g. **Adapt Waikīkī, Iwilei AAP, Māpunupuna AAP, Haleʻiwa AAP**	●	●
	Conduct Vulnerability and Risk Assessments of SLR-XA impacted infrastructure	●	●
	Develop **Stormwater Master Plan** for 100-year storm with SLR to inform project development for elevating areas	●	
	Develop detailed drainage master plans in areas to inform road raising and elevating infrastructure	●	
	Develop interim flood mitigation measures, e.g. backwater flow prevention	●	
	Initiate district area EIS and long lead permitting/approvals	●	●
Financing	Adopt OWH Financing Strategy for CIP appropriations	●	●
Public Outreach	Conduct project-specific stakeholder and community outreach through the SLR adaptation process	●	●
Design and Construction	Design and construct the highest priority adaptation projects	●	●



ADAPTATION STRATEGY LEGEND

Priority Strategy for Exposure at 2050

Priority Strategy for Exposure at 2100

General Strategy

TRIGGER LEGEND

Greater than 4" inundation occurs 6 times per year during king tides. **OR**

Greater than 6" inundation occurs during annual high-wave flooding. **OR**

Groundwater level indicates the groundwater table is less than 5 ft below grade surface. **OR**

Increasing trend in reported damage incidents and cumulative repair costs exceed agreed-upon threshold (to be determined)

THRESHOLD LEGEND

Both intermediate and intermediate-high SLR scenarios are represented on the threshold vertical bars.

Lighter shades are the intermediate SLR scenario.

1 ft SLR | 3.8 ft SLR

Darker shares are the intermediate-high SLR scenario.

1.2 ft SLR | 5.8 ft SLR

*Actions in bold represent OWH Projects that are further elaborated in Sections 8.2-8.5 and in Appendix H.

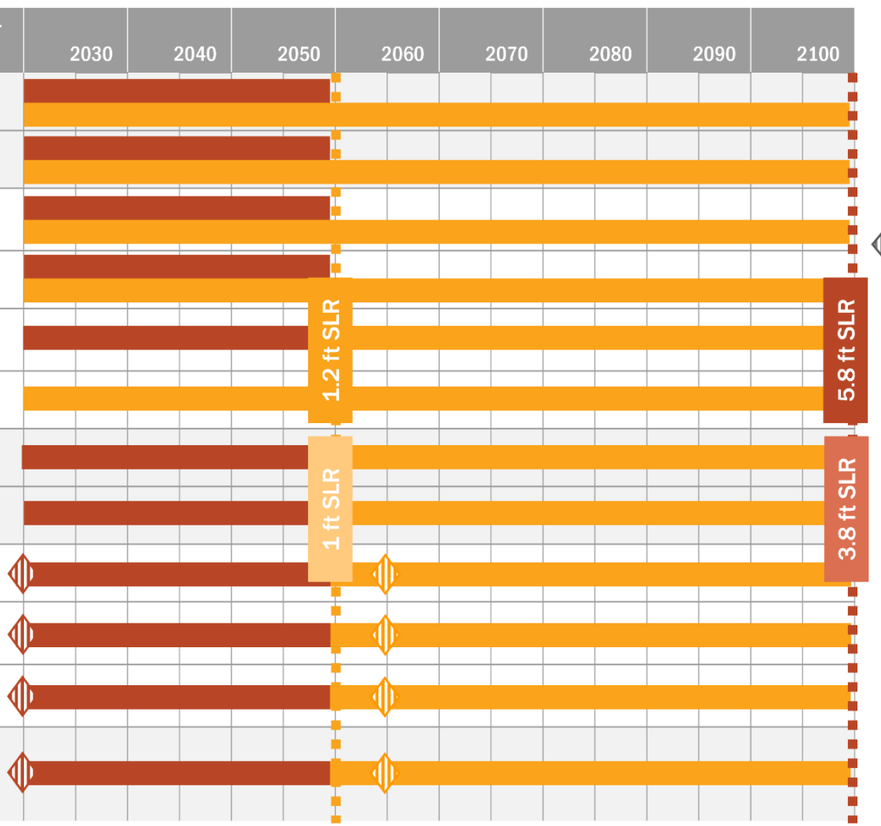
* Per Mayor's directive No. 18-2 and the 2022 City and County of Honolulu Climate Change Commission SLR Guidance Document, the intermediate sea level rise scenario should be the minimum scenario for all planning and design projects. Public infrastructure projects with low tolerance for risk should use the intermediate-high scenario.

* Per the 2022 City and County of Honolulu Climate Change Commission SLR Guidance Document, projects should add 1 to 2 ft to account for compound events such as king tides or drainage impacts under future high tides.

Figure 8-4. Checklist for Sea Level Rise Hazard

HAZARD: SEA LEVEL RISE

Adaptation Strategies:		High Tide & Wave Flooding	Groundwater Inundation
Ecosystem Protection / Restoration	Incorporate native/salt and flood resilient vegetation.	●	●
	Restore beach, dune systems, and coastal floodplains or build a living levee.	●	
Facility Hardening/ Protection	Incorporate geotechnical stabilization/ reinforcement practices for asset foundations.		●
	Incorporate corrosion resistant materials/coatings.	●	●
	Incorporate submersible pumps/flood pumps for managing for surface water or groundwater under high tides	●	●
	Wet floodproofing: incorporate damage-resistant materials and openings.	●	●
Flood Protection/ Containment	Incorporate backwater flow prevention devices (e.g., tide gates).	●	●
	Incorporate or raise perimeter levees, flood gates, or floodwalls.	●	
Elevation of Infrastructure	Coastal Bridge retrofits and replacements.	●	●
	Elevate critical assets/equipment and elevate access roads and associated utilities; elevate site grade.	●	●
	Raise building ground floor elevation and/or elevate occupied spaces above flood elevations.	●	●
Managed Retreat and Relocation	Relocate or abandon facility.	●	●



ADAPTATION STRATEGY LEGEND

Priority Strategy for Exposure at 2050

Priority Strategy for Exposure at 2100

TRIGGER LEGEND

Greater than 4" inundation occurs 6 times per year during king tides. **OR**

Greater than 6" inundation occurs during annual high-wave flooding. **OR**

Groundwater level indicates the groundwater table is less than 5 ft below grade surface. **OR**

Increasing trend in reported damage incidents and cumulative repair costs exceed agreed-upon threshold (to be determined)

THRESHOLD LEGEND

Both intermediate and intermediate-high SLR scenarios are represented on the threshold vertical bars.

Lighter shades are the intermediate SLR scenario.

1 ft SLR | 3.8 ft SLR

Darker shares are the intermediate-high SLR scenario.

1.2 ft SLR | 5.8 ft SLR

* Per Mayor's directive No. 18-2 and the 2022 City and County of Honolulu Climate Change Commission SLR Guidance Document, the intermediate sea level rise scenario should be the minimum scenario for all planning and design projects. Public infrastructure projects with low tolerance for risk should use the intermediate-high scenario.

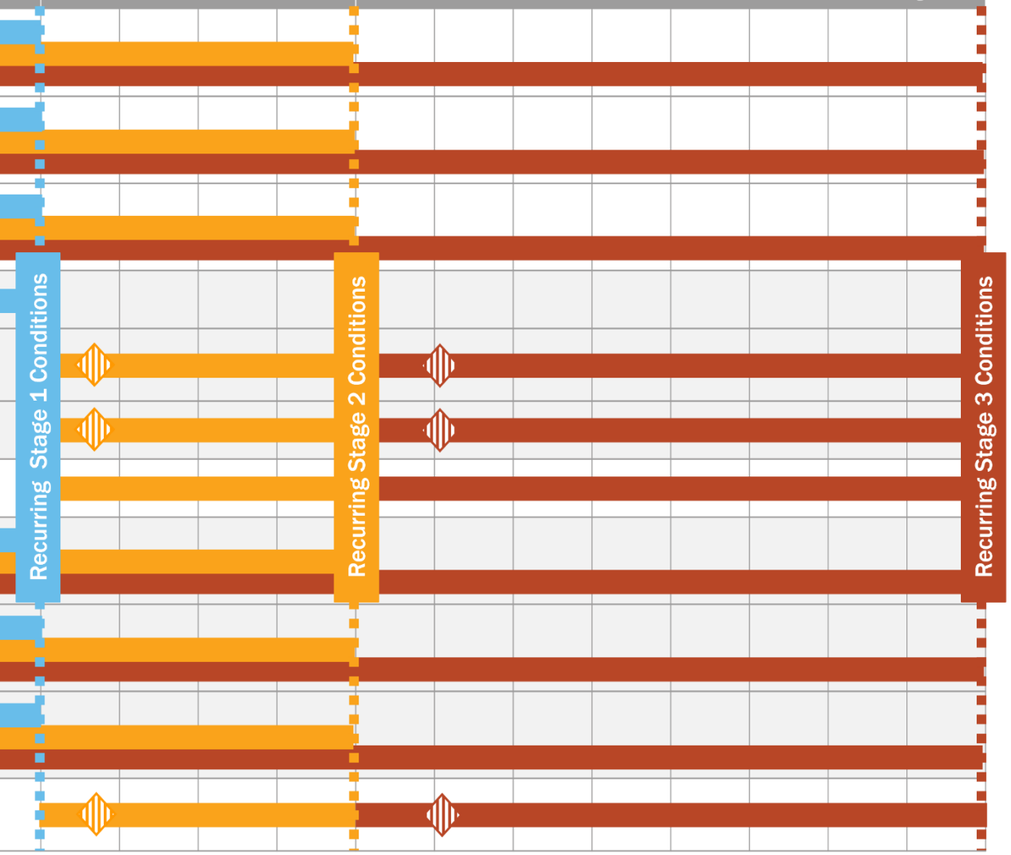
• Per the 2022 City and County of Honolulu Climate Change Commission SLR Guidance Document, projects should add 1 to 2 ft to account for compound events such as king tides or drainage impacts under future high tides.

*Unlike the priority actions presented on the other SLR checklist, these items are additional opportunities for consideration by CCH and private developers rather than a prescribed list of actions to implement.

Figure 8-4. Checklist for Sea Level Rise Hazard

HAZARD: DROUGHT

Adaptation Strategies:		Near-Term	Mid-Term	Long-Term
Programs	Water conservation.			
	Water loss control and leak detection improvements, e.g. **Expand Non-Potable Water to Large Parks and Water Loss Control**			
	Hydrologic drought monitoring.			
Alternative Water Supplies	Stormwater capture and use.			
	Utilize reuse: recycled water, potable reuse, on-site reuse, e.g. **Honouliuli R-1 Distribution System Expansion**			
	Desalination (brackish groundwater, seawater).			
Community Protection	Urban heat index reduction for water demand management.			
Ecosystem Protection / Restoration	Incorporate native, salt and drought resilient vegetation.			
	Incorporate native vegetation.			
	Enhance aquifer recharge in Mauka areas through conservation and managed aquifer recharge.			
Facility Hardening and Protection	Improve drinking water treatment resilience to water quality changes.			



ADAPTATION STRATEGY LEGEND

Priority for Areas with Recurring Water Shortage Caution Conditions (Stage 1)

Priority for Areas with Recurring Water Shortage Alert Conditions (Stage 2)

Priority for Areas with Recurring Water Shortage Critical Conditions (Stage 3)

TRIGGER LEGEND

12 months with 12-month SPI <-0.8

12 months with 12-month SPI <-1.6 **OR** 24 months with 12-month SPI <-0.8

THRESHOLD LEGEND

[Threshold] Threshold Marker

NOTE: Thresholds for Drought Risk are not projected to occur on certain dates. Strategies with higher costs are prioritized as drought conditions become more severe.

*Items in bold represent OWH Projects that are further elaborated in Sections 8.2-8.5 and in Appendix H.

Figure 8-5. Checklist for Drought Hazard

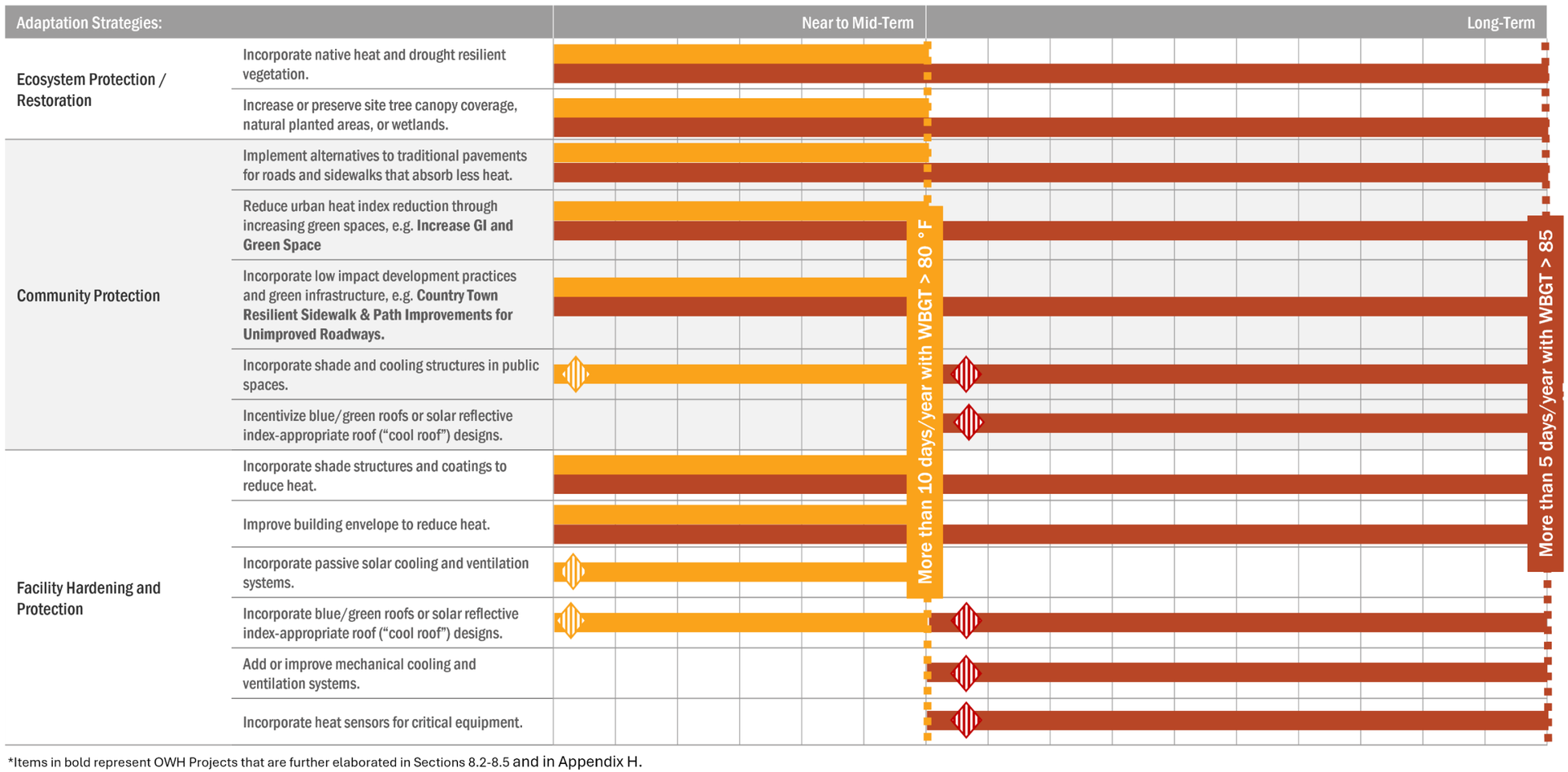
HAZARD: HEAVY RAIN



*Items in bold represent OWH Projects that are further elaborated in Sections 8.2-8.5 and in Appendix H.

Figure 8-6. Checklist for Heavy Rain Hazard

HAZARD: EXTREME HEAT



ADAPTATION STRATEGY LEGEND

Priority for areas with recurring exposure to WBGT over 80°F

Priority for areas with recurring exposure to WBGT over 85°F

TRIGGER LEGEND

Greater than 5 days per year with WBGT above 80°F.

Greater than 3 days per year with a WBGT above 85°F.

THRESHOLD LEGEND

[Threshold] Threshold Marker

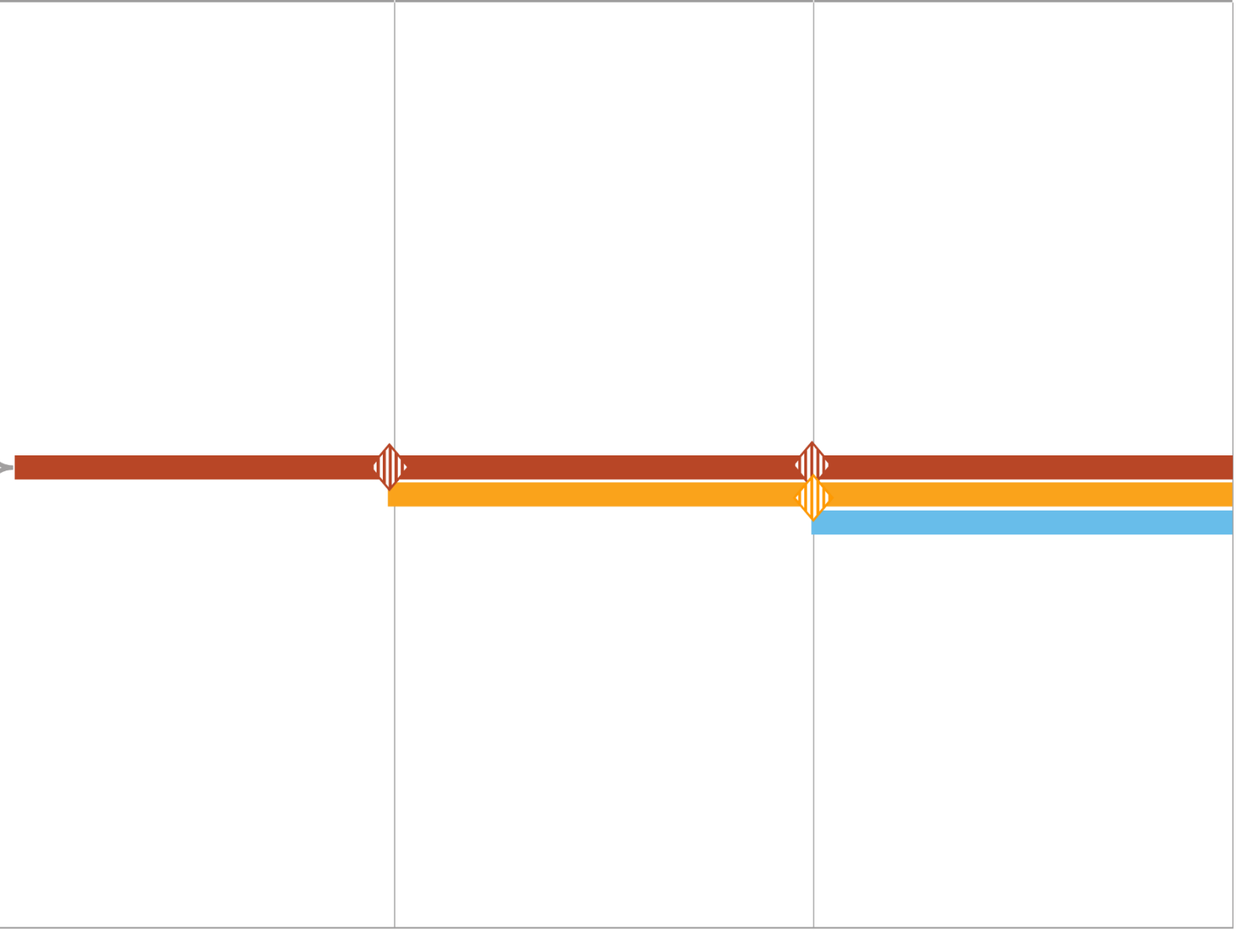
NOTE: Thresholds for Extreme Heat Risk are not projected to occur on certain dates. No-regrets strategies are recommended in the near term, and strategies with higher costs are prioritized as extreme heat becomes more frequent and severe.

*Items in bold represent OWH Projects that are further elaborated in Sections 8.2-8.5 and in Appendix H.

Figure 8-7. Checklist for Extreme Heat Hazard

HAZARD: WILDFIRE

Adaptation Strategies:		Near-Term	Mid-Term	Long-Term
Risk Assessment and Planning	Integrate wildfire hazard policies into general and community plan updates.			
	Perform wildfire analysis and inventory, e.g. **Develop Cooperative Fireshed Partnerships**.			
	Create wildfire setback policies and fire lanes			
Monitoring	Support improved wildfire detection and response through investment in user-friendly, modern technologies for data collection and analysis (e.g. drones, real time monitors, and tablets for field inspection & maintenance).			
Ecosystem Protection / Restoration	Grassland, forest, and vegetation management for wildfire prevention.			
	Develop incentives program for less flammable and native vegetation.			
Community Protection	Develop firebreaks in urban-wildland interface areas and perform routine maintenance.			
	Install water tanks at fringes of threatened communities for fire suppression.			
	Add dip tanks to surface water reservoirs for wildfire suppression.			
	Improve water distribution system's fire flow capacity.			
Water Infrastructure Resilience	Incorporate wildfire resilience into critical facilities such as drinking water treatment, wastewater treatment and conveyance facilities.			
	Incorporate fire and ignition resistant materials and coatings.			
	Install residential check valves and more fire hydrants.			
	Increase portable generators capacity for pump stations during extended power outages.			



ADAPTATION STRATEGY LEGEND

Priority Strategy for Very High-Risk Areas

Priority Strategy for High-Risk Areas

Priority Strategy for Medium Risk Areas

TRIGGER LEGEND

New High-Risk Areas

New Very-High Risk Areas

NOTE: Very High Wildfire Risk Areas are present under current conditions, and wildfire risk is projected to increase over time, creating new High or Very High areas. Actions in the near-term should prioritize adaptation strategies in the areas with the highest risk. As new very high-risk or high-risk areas are identified under future conditions, these adaptation strategies for wildfire should be prioritized in these areas.

*Items in bold represent OWH Projects that are further elaborated in Sections 8.2-8.5 and in Appendix H.

Figure 8-8. Checklist for Wildfire Hazard

8.5 OWH PROJECT IMPLEMENTATION PLAN

The sequencing of OWH projects is visualized for islandwide projects and each Regional Planning District. The visuals show lead agencies, project linkages and precursors, and potential triggers that may influence implementation.

REPRESENTING COLLABORATION IN THE IMPLEMENTATION PLAN

Implementing the Plan will require the activation of the Collaboration Framework to advance holistic, multi-benefit solutions that strengthen resilience across O‘ahu. The Implementation Plan synthesizes the work described in previous sections and defines how City departments will work together to deliver these outcomes. City departments will need to collaborate to develop triggers and mechanisms for project funding to best support achievement of the Plan.

IMPLEMENTATION PLAN FRAMEWORK

This subsection includes the sequencing of proposed OWH projects and islandwide actions for each Regional Planning District. This sequencing is identified through visualizations that include the proposed projects, potential lead agencies and supporting agencies, connections to other proposed projects, and implementation triggers. The triggers represent critical points in changing conditions that may require a shift in pursued projects and actions in order to reduce climate risks and avoid adverse consequences. A description appears before each sequencing graphic that summarizes key takeaways from the overall sequence of projects and actions shown in each visual.

The plan framework is designed to show the relationships between projects, policies, and actions, including:

Project Sequencing	Provides a priority for implementing projects, with triggers for mid- and long-term projects tied to changing conditions; near-term projects typically proceed without triggers.
Project Connections	Illustrates shared objectives between islandwide and regional efforts and identifies precursor projects and project dependencies.
Coordination and Resource Planning	Visualizes parallel initiatives, creating opportunities for alignment and more effective resource planning across departments

READER'S GUIDE FOR IMPLEMENTATION PLANS SYMBOLS AND DESCRIPTIONS



- Proposed OWH projects are symbolized with horizontal bars, labeled with the project name. The length of the bar represents the time required to implement the project
  - Hatched bars represent **Planning or Studies** and Solid Bars represent **Programs and Infrastructure** projects.
- Proposed agency participation is represented by color: **Lead Agencies** are represented by the bar.



- Triggers[1] are shown with diamonds and labeled with the associated condition(s) or hazard(s) that may warrant implementing a project ahead of the sequence identified in the regional implementation plans.



- Thresholds[2] for Sea Level Rise are shown with vertical bars. These thresholds show the timing of future SLR conditions under the NOAA Intermediate and Intermediate-High scenarios in alignment with the City's 2022 Climate Change Commission guidance documents.



- Black arrows represent Dependent Projects, i.e., projects that are connected to, or rely on implementation of other projects in the region. For example, outcomes from an Area Adaptation Plan may inform future projects to mitigate Sea Level Rise impacts.



- Gray, dashed arrows represent Islandwide Project Connections, visualizing regional projects that are informed by plans, frameworks, or strategies developed in near-term islandwide projects

1. *Triggers are only included in Regional Implementation Plan figures for Mid-Term and Long-Term Projects*
2. *Thresholds are only included for Sea Level Rise since the other Hazard Thresholds do not have an expected timeline.*

FOUNDATIONAL & ISLANDWIDE IMPLEMENTATION

The Islandwide Implementation Plan includes projects focused on establishing the policies, plans, pilot programs, and technical analyses needed to enable long-term climate adaptation across Oʻahu. These near-term islandwide actions are foundational, informing and supporting the implementation of other One Water projects across Oʻahu.

PROJECTS	TIME HORIZON	HAZARDS
Road Raising Strategy Creates a framework and design guidance for approaching raising and adapting roads in areas exposed under future SLR and compound flooding conditions.	Near-Term	
Managed Retreat Legal and Policy Investigation Study Supports policies and approaches for managed retreat in areas susceptible to coastal erosion and permanent inundation from SLR.	Near-Term	
Expand Tidal Groundwater Well Monitoring Network Expands the existing well monitoring network to calibrate the SLR model and identify trends in emergent groundwater.	Near-Term	
Country Town Resilient Sidewalk & Path Improvements for Unimproved Roadways Multi-site program to improve pedestrian access and roadways, while piloting permeable paving and green stormwater management strategies.	Near-Term	
Stormwater Utility Fee Implements a stormwater utility fee based on parcel impermeable area to fund projects to improve stormwater management.	Near-Term	
Onsite Stormwater Management Incentives Creates an incentive program for private property owners to implement onsite stormwater management strategies.	Near-Term	

PROJECTS	TIME HORIZON	HAZARDS
Stormwater Master Plan Islandwide long-range plan encompassing stormwater infrastructure mapping and modeling, capital improvement prioritization, O&M needs, and funding pathways.	Near-Term	
Green Infrastructure Implementation Plan Identifies and prioritizes green infrastructure projects across Oʻahu to improve water quality, recharge groundwater, and reduce urban heat.	Near-Term	
Reuse Strategy for Redevelopment Areas Evaluates water reuse strategies including decentralized treatment, on-site reuse, and centralized reuse to support future growth and long-term water supply resilience.	Near-Term	
Beach Shower NPDES Compliance Improvements Upgrades beach showers across Oʻahu to improve water quality through subsurface infiltration, sewer connections, or on-site reuse.	Near-Term	
Expand Non-Potable Water to Large Parks and Water Loss Control Reduces potable water use at large parks through converting parks to non-potable water and improving irrigation efficiency.	Near-Term	
Projects from the Integrated Plan Implements coordinated DFM and ENV investments identified in the Integrated Plan to improve water quality.	Mid-Term	

LEGEND:



FOUNDATIONAL AND ISLANDWIDE IMPLEMENTATION PLAN

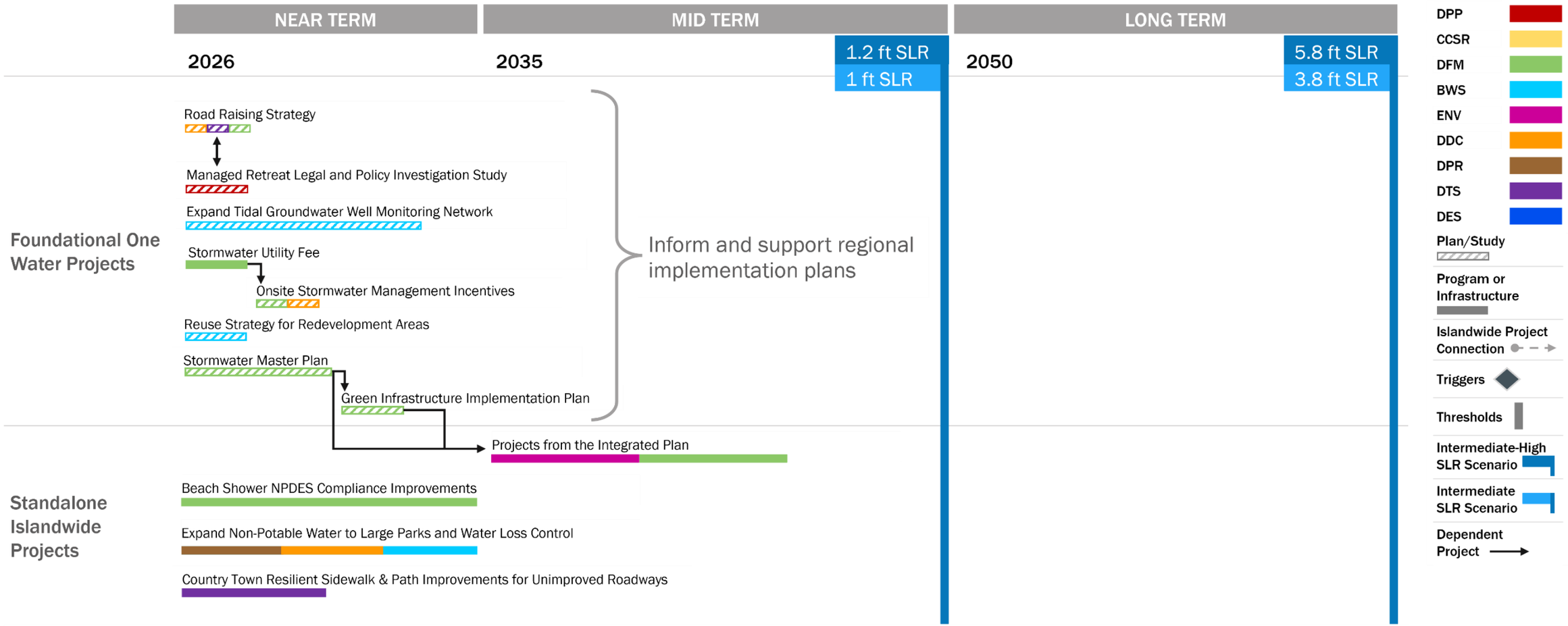


Figure 8-9. Foundational and Islandwide Implementation Plan

IMPLEMENTATION BY REGION

Proposed OWH projects are organized into regional implementation plans that provide a coordinated roadmap for improving resilience by region. The plans connect the near-term islandwide projects with regional project initiatives. Triggers associated with mid- and long-term projects help identify when implementation may be accelerated as regulations change, funding becomes available, and climate risks evolve.

NORTH SHORE

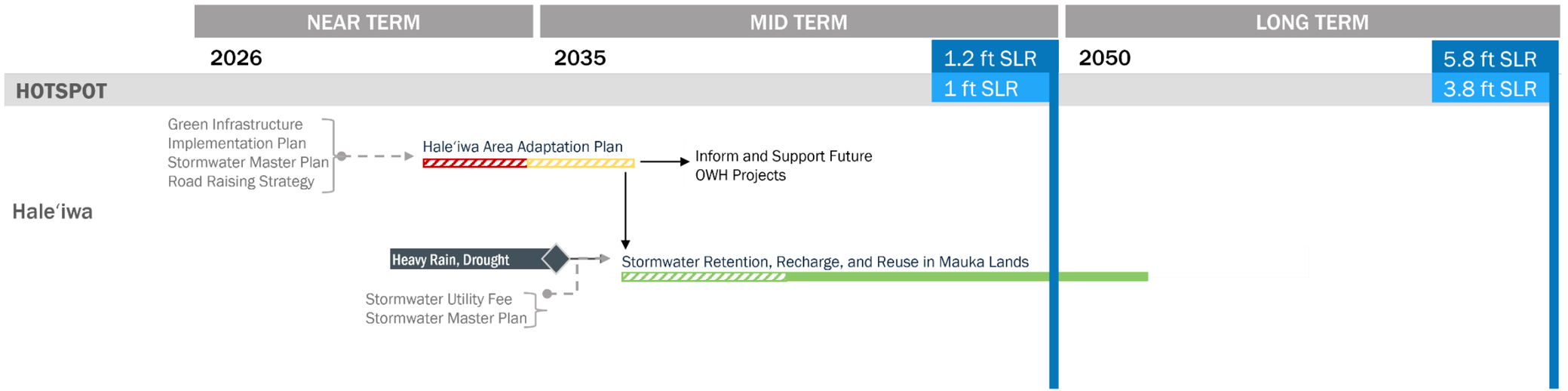
Figure 8-10 presents the regional implementation plan for North Shore. Projects in the North Shore support planning for future climate change and improve watershed health to build resilience to flooding and drought through integrated stormwater management.

PROJECTS	TIME HORIZON	HAZARDS
Haleʻiwa Area Adaptation Plan Area Adaptation Plan for Haleʻiwa that evaluates climate risks and identifies adaptation pathways for resilience, long-term land use change, and managed retreat.	Mid-Term	
Stormwater Retention, Recharge, and Reuse in Mauka Lands Identifies opportunities for nature-based and multi-benefit infrastructure solutions on mauka and former agricultural lands in the North Shore region to capture stormwater, reduce flooding, enhance groundwater recharge, and improve watershed health.	Mid-Term	

LEGEND:



NORTH SHORE



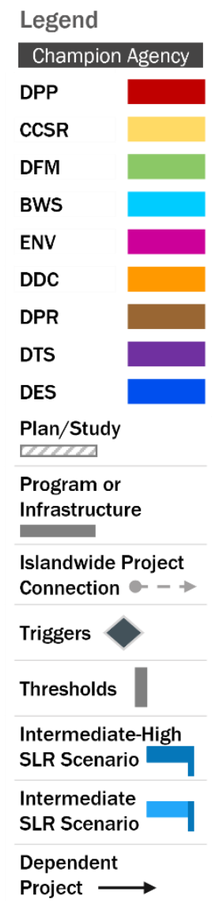


Figure 8-10. North Shore Implementation Plan

KOʻOLAU LOA

Figure 8-11 presents the regional implementation plan for Koʻolau Loa. Koʻolau Loa has one project that aims to mitigate coastal erosion and extreme heat in beach parks.

PROJECTS	TIME HORIZON	HAZARDS
Beach Park Erosion and Flood Resilience Improves the resilience of shoreline parks in Koʻolau Loa through implementing coastal erosion and extreme heat mitigation measures.	Mid-Term	

LEGEND:



KOʻOLAU POKO

Figure 8-11 presents the regional implementation plan for Koʻolau Poko. The Koʻolau Poko regional implementation plan focuses on projects to increase recycled water supply, improve water quality, mitigate flooding, and address coastal erosion.

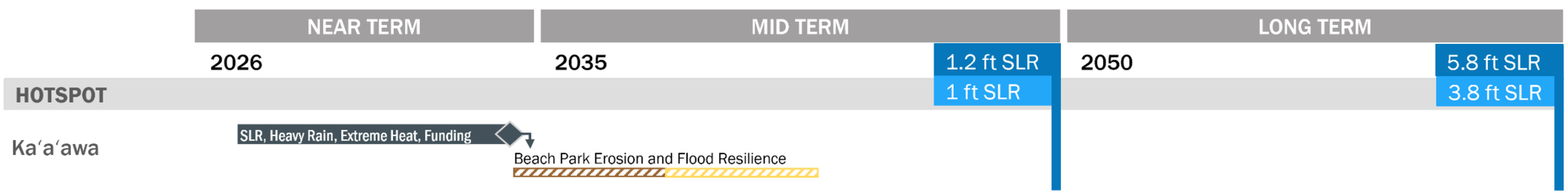
PROJECTS	TIME HORIZON	HAZARDS
Waimānalo Effluent R-1 Reuse Feasibility Study Evaluates and implements R-1 recycled water infrastructure at the Waimānalo WWTP to reduce reliance on injection wells, expand non-potable water supplies for irrigation, and improve long-term water security.	Near-Term	
Kahawai Stream Restoration Strategy Advances nature-based flood mitigation and stream restoration strategies in the Kahawai Watershed to reduce flooding, manage emergent groundwater, and improve community resilience.	Mid-Term	
Waimānalo Roads Drainage Study and Improvements Stormwater drainage improvements in Waimānalo to reduce flooding and reduce risk from extreme weather events.	Mid-Term	
Coastal Management Plan for Erosion and Flooding Develops a Coastal Management Plan for Kāneʻohe to reduce erosion and flooding risks while protecting coastal resources and maintaining public shoreline access.	Mid-Term	

PROJECTS	TIME HORIZON	HAZARDS
Stormwater Retention along Kamoʻaliʻi Stream Increases stormwater retention capacity along Kamoʻaliʻi Stream to reduce flooding, improve water quality, and strengthen watershed resilience in Kāneʻohe.	Mid-Term	
MCBH R-1 Recycled Water Upgrade Develops a recycled water system at the Marine Corps Base to reduce potable water demands.	Mid-Term	
State Agriculture Water System Connection to Future R-1 Connects the Waimānalo WWTP recycled water system to the Waimānalo Irrigation System to expand water reuse and reduce demand on potable sources and stream diversions.	Long-Term	
Resilience Corridor and Pedestrian Accessibility Study Advances concepts for SLR adaptation in Koʻolau Poko, including critical utility infrastructure improvements while improving pedestrian access and mobility.	Long-Term	

LEGEND:



KOʻOLAU LOA



KOʻOLAU POKO

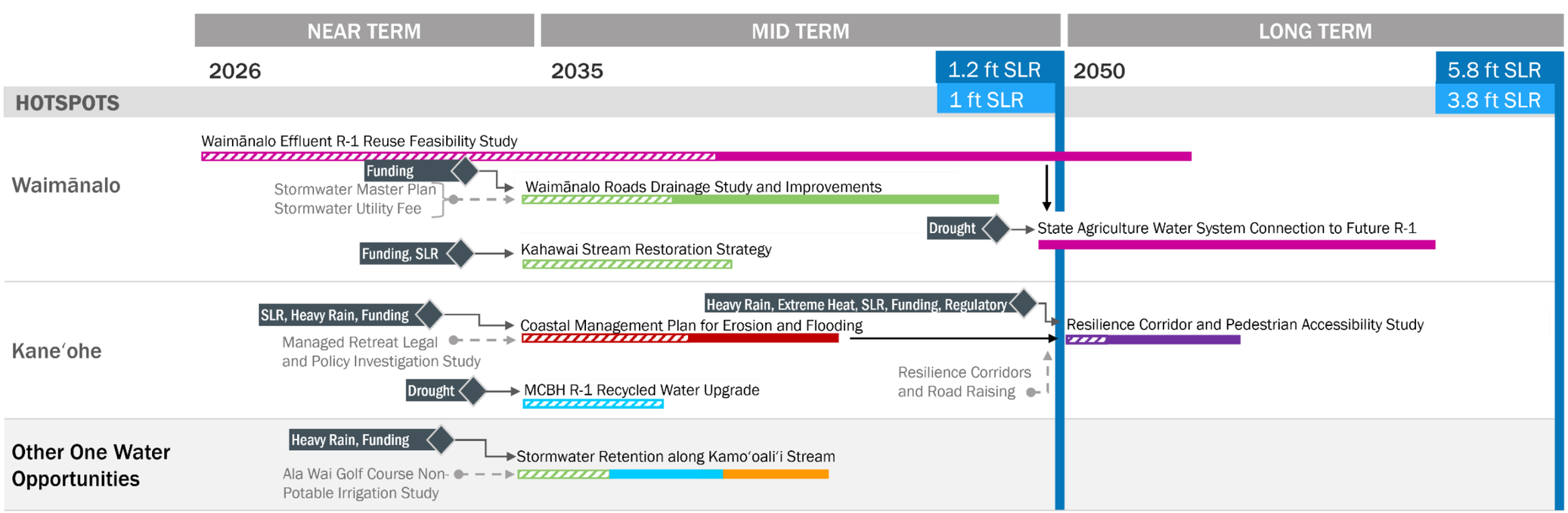


Figure 8-11. Koʻolau Loa and Koʻolau Poko Implementation Plans

EAST HONOLULU

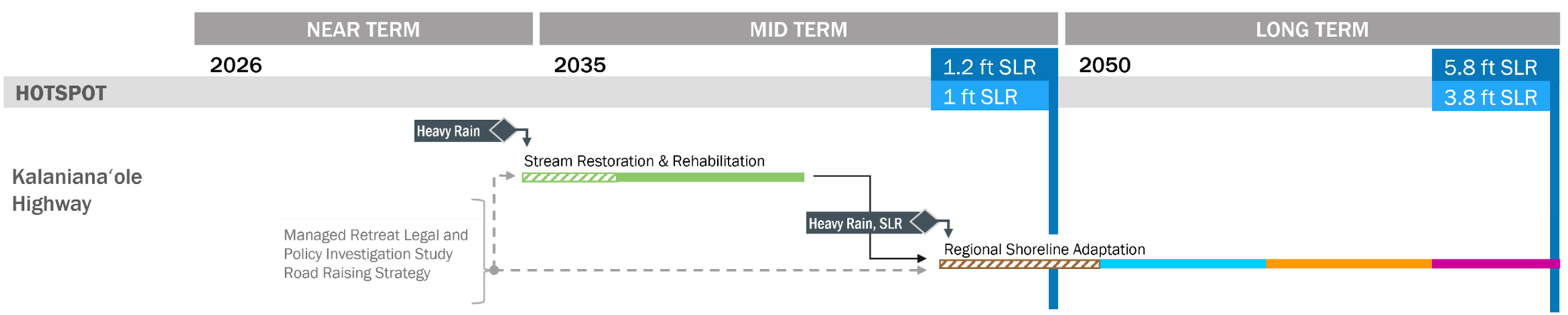
Figure 8-12 presents the regional implementation plan for East Honolulu. Projects in East Honolulu support watershed restoration and coastal resilience to mitigate the impacts of SLR, flooding, and coastal erosion.

PROJECTS	TIME HORIZON	HAZARDS
Stream Restoration & Rehabilitation Evaluates opportunities to reduce flood risk, manage sediment transport, and improve watershed function within the Wailupe, Niu, and Kuliʻouʻou watersheds through stream restoration and rehabilitation efforts.	Mid-Term	
Regional Shoreline Adaptation Advances coastal resilience through shoreline protection strategies along Kalanianaʻole Highway to protect infrastructure, public assets, and regional access.	Long-Term	

LEGEND:



EAST HONOLULU



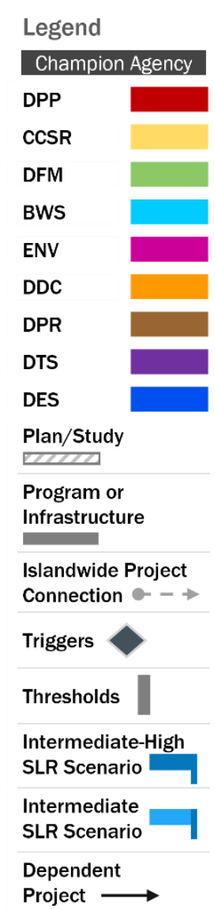


Figure 8-12. East Honolulu Implementation Plan

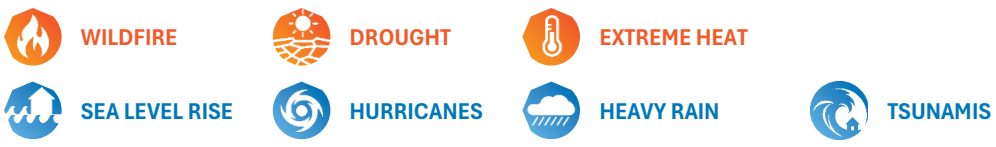
PRIMARY URBAN CENTER

Figure 8-13 presents the regional implementation plan for the PUC. Projects within the PUC focus on improving resilience to sea level rise and flooding, enhancing water quality, strengthening water supply reliability, and reducing extreme heat impacts.

PROJECTS	TIME HORIZON	HAZARDS
Adapt Waikīkī Phase 2 Advances climate adaptation planning and pilot projects in Waikīkī to address sea level rise, flooding, infrastructure vulnerability, and long-term resilience.	Near-Term	
Ala Wai Golf Course Non-Potable Irrigation Study Evaluates non-potable water supply alternatives for irrigation and assesses opportunities to improve water quality and flood resilience, aligned with Ala Wai Watershed Integrated Stormwater Management Program.	Near-Term	
Iwilei Area Adaptation Plan Develops a climate resilience plan for the Iwilei area to address sea level rise, flooding, and infrastructure needs associated with future redevelopment.	Near-Term	
Māpunapuna Area Adaptation Plan Area Adaptation Plan for Māpunapuna to evaluate climate risks and identifies adaptation pathways for resilience, long-term land use change, and managed retreat.	Near-Term	
NASED Regulatory Requirements for Reuse Applies the Private Development Guidelines to the New Aloha Stadium Entertainment District (NASED), including recommended regulatory permitting requirements for water use efficiency, reuse, and stormwater management.	Near-Term	
University Avenue Urban Complete Streets and Green Infrastructure Upgrades the University Avenue corridor to improve safety, drainage, and reduce impervious area through permeable paving.	Near-Term	

PROJECTS	TIME HORIZON	HAZARDS
Nuʻuanu Reservoir Hydro Managed Aquifer Recharge Diverts stormwater from Nuʻuanu Reservoir for groundwater recharge and renewable energy generation to enhance water supply reliability and watershed resilience.	Near-Term	
Ala Wai Watershed Integrated Stormwater Management Guides community-based watershed restoration, stormwater management, and climate resilience efforts across the Ala Wai Watershed.	Near-Term	
Pilot Floodable Spaces Develops pilot subsurface stormwater capture projects and a framework for private landowner partnerships.	Mid-Term	
Kapālama Canal Linear Park Develops a linear park along Kapālama Canal and implements green street improvements to enhance flood resilience, water quality, public access, and multimodal connectivity.	Mid-Term	
Resilience Corridors and Road Raising Develops a planning tool to identify priority corridors, then implements resilience improvements.	Mid-Term	
Iwilei Drainage Improvements Advances regional flood resilience in Iwilei through roadway and drainage improvements and SLR adaptation projects.	Mid-Term	
Māpunapuna Flood Improvements Improves flood resilience in Māpunapuna through roadway and drainage upgrades, stormwater detention, floodwall, and pump stations.	Mid-Term	

LEGEND:



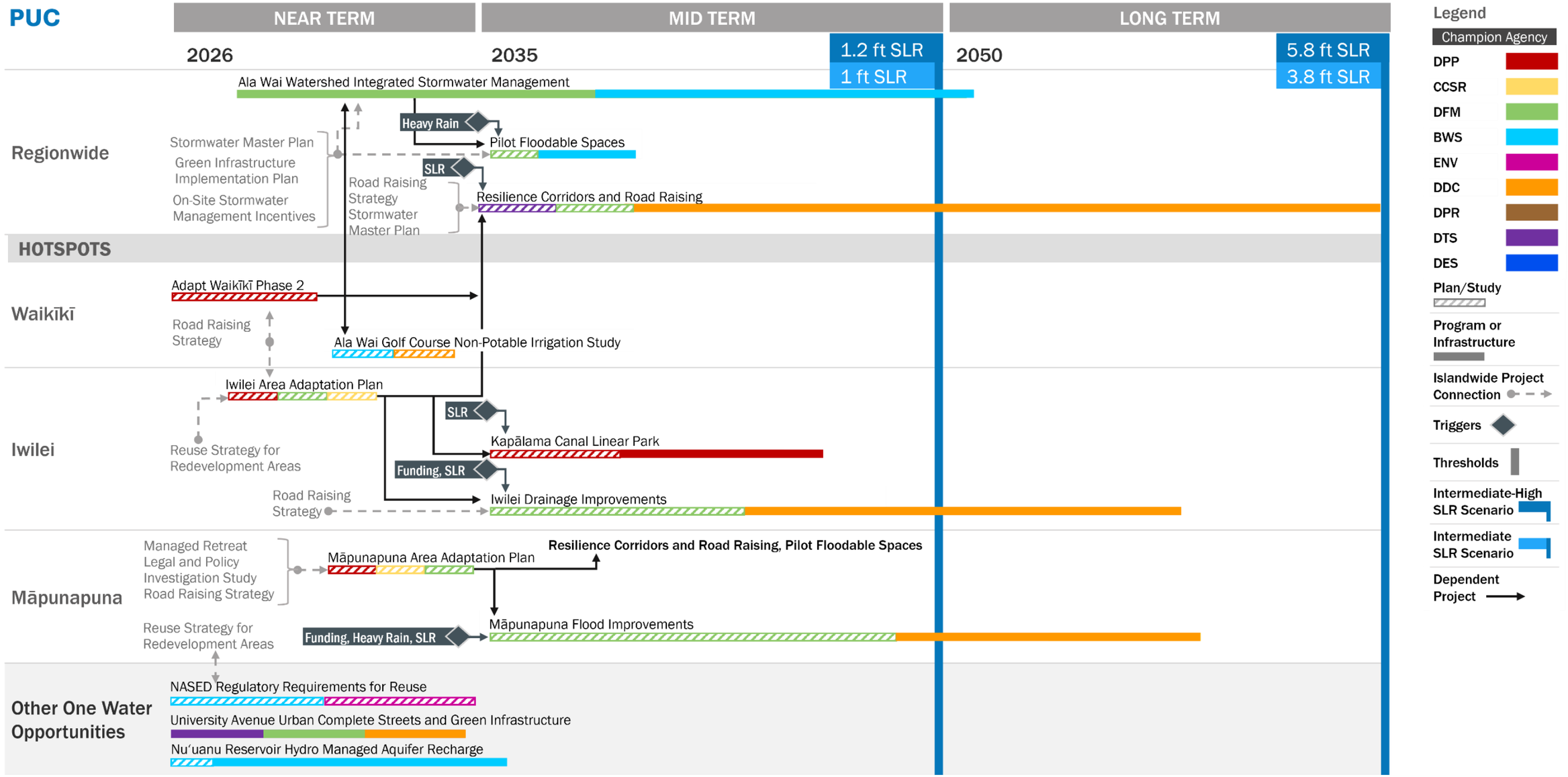


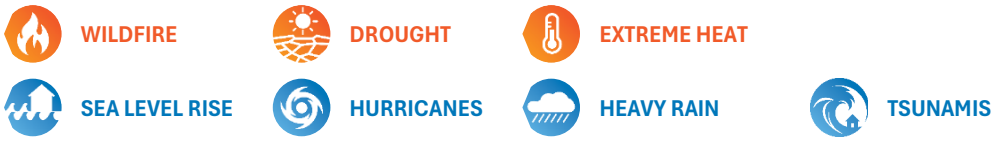
Figure 8-13. PUC Implementation Plan

CENTRAL O‘AHU

Figure 8-14 presents the regional implementation plan for Central O‘ahu. The projects proposed in Central O‘ahu support regional water supply reliability and reduce the pressure on the Pearl Harbor Aquifer.

PROJECTS	TIME HORIZON	HAZARDS
Reuse and Potable Water Services for Whitmore Agriculture Extends potable water and R-1 infrastructure to support Whitmore agricultural developments and improve fire protection for resilience under future drought and wildfire conditions.	Near-Term	
Central O‘ahu Water Recycling Facilities, Mililani Evaluates the feasibility of upgrading the Mililani Pre-Treatment Facility to produce R-1 water for irrigation in nearby parks.	Near-Term	
Honouliuli R-1 Distribution System Expansion Expands R-1 recycled water infrastructure in ‘Ewa and Central O‘ahu to increase water reuse and improve water supply resilience.	Mid-Term	

LEGEND:



CENTRAL O'AHU

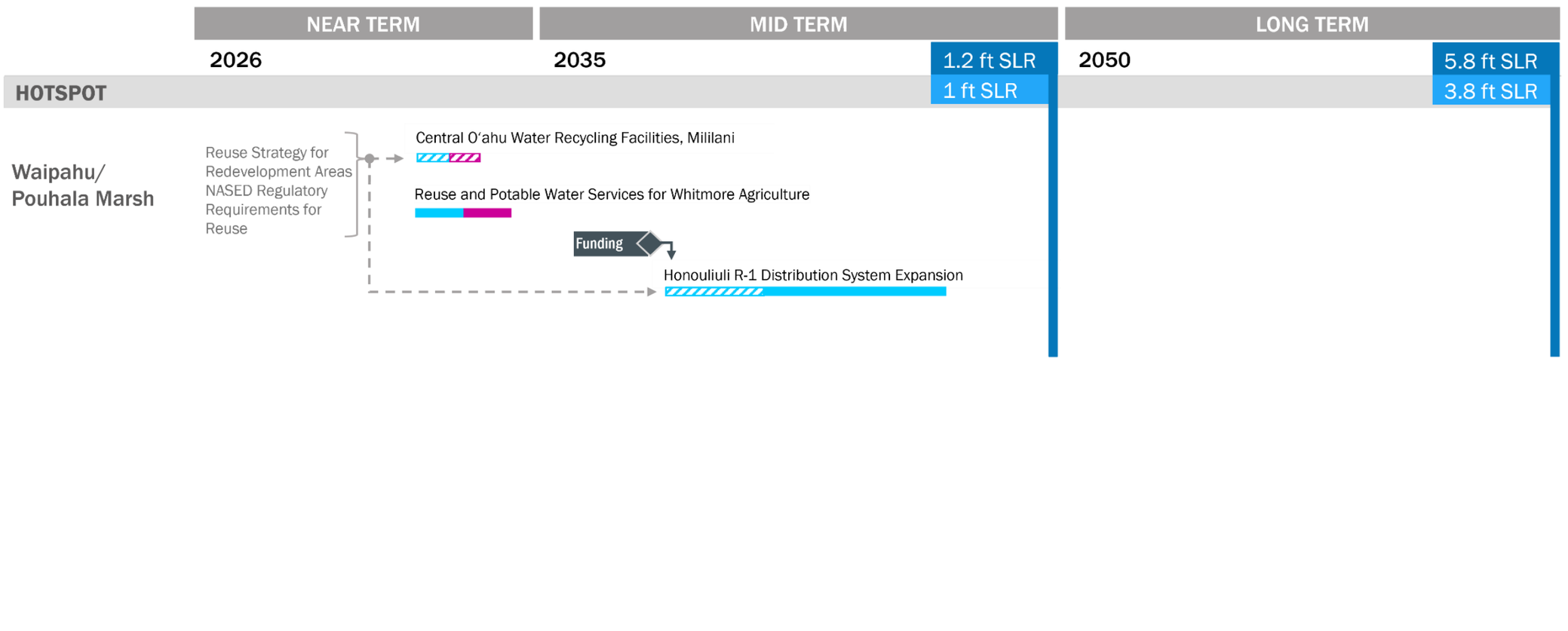


Figure 8-14. Central O'ahu Implementation Plan

‘EWA

Figure 8-15 presents the regional implementation plan for ‘Ewa. Projects in the ‘Ewa region support developing reuse water supplies and addressing future impacts of sea level rise.

PROJECTS	TIME HORIZON	HAZARDS
Potable Reuse Pilot at Honouliuli Pilots potable reuse treatment technologies at the Honouliuli WRF to inform regulatory development and support integrating potable reuse into long-term water supply.	Near-Term	
Honouliuli R-1 Distribution System Expansion Expands R-1 recycled water infrastructure in ‘Ewa and Central O‘ahu to increase water reuse and improve water supply resilience.	Mid-Term	
Long-Range Post-Retreat Study Evaluates managed retreat options in ‘Ewa to address long-term sea level rise impacts and guide future use of vulnerable coastal lands.	Long-Term	
Raise Main Arterials Further Inland Develops roadway resilience strategies in ‘Ewa to address flooding, coastal erosion, and sea level rise impacts on critical transportation infrastructure.	Long-Term	

LEGEND:



ʻEWA

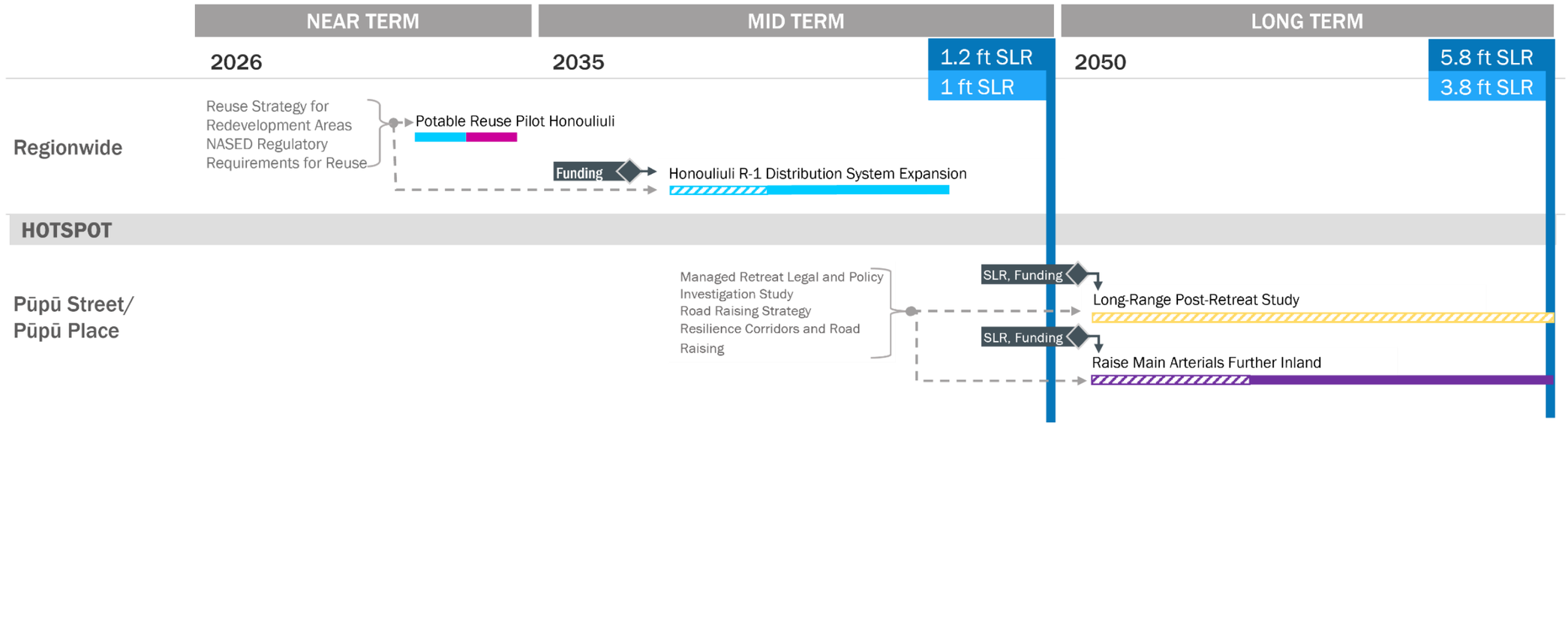


Figure 8-15. ʻEwa Implementation Plan

WAIʻANAE

Figure 8-16 presents the regional implementation plan for Waiʻanae. Projects in Waiʻanae focus on improving wildfire resilience, reducing flood risk, and adapting to sea level rise.

PROJECTS	TIME HORIZON	HAZARDS
Develop Cooperative Fireshed Partnerships Identifies high-risk areas and prioritizes wildfire mitigation projects in Waiʻanae.	Near-Term	
Mākaha Roads Drainage Study and Improvements & Mākaha Stormwater Infrastructure Implements drainage infrastructure improvements to manage stormwater and reduce flood risk; informed by the Islandwide Stormwater Master Plan	Long-Term	
Increase Green Infrastructure and Green Space Expands green space and green infrastructure to reduce extreme heat, manage stormwater, and improve water quality; informed by the Green Infrastructure Implementation Plan.	Long-Term	
Dry Flood Proof Waiʻanae High Risk Areas Elevates and protects critical infrastructure in vulnerable areas to improve resilience to flooding and future sea level rise.	Long-Term	

LEGEND:

WILDFIRE DROUGHT EXTREME HEAT

SEA LEVEL RISE HURRICANES HEAVY RAIN TSUNAMIS

WAIʻANAE

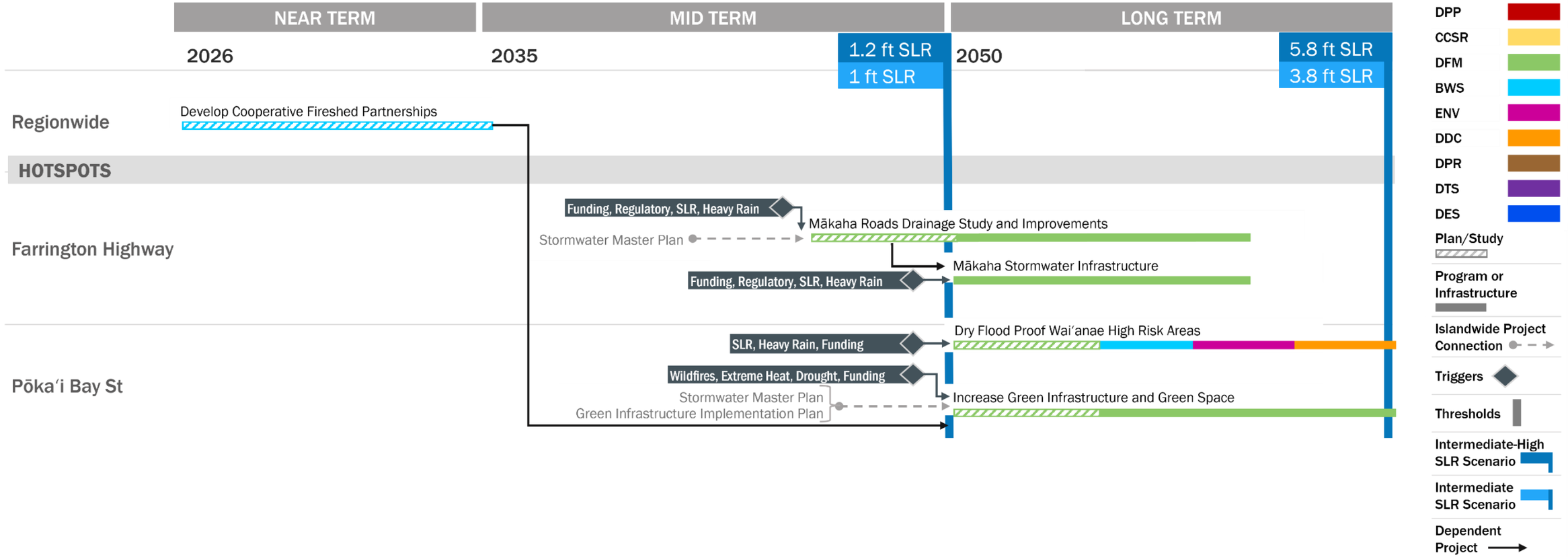


Figure 8-16. Waiʻanae Implementation Plan

8.6 FUNDING STRATEGY

FUNDING STRATEGY OVERVIEW

Successful implementation of the OWH Program depends on more than identifying projects. Long-term success will require sustained funding, coordinated governance, institutional commitment, and integration of One Water principles into ongoing planning and investment decisions. The projects identified throughout this Plan address multiple climate and water resource challenges while providing benefits that span water supply, wastewater, stormwater, watershed restoration, flood resilience, climate adaptation, ecosystem health, and community well-being. Because these benefits extend across multiple agencies and service areas, implementation cannot rely solely on traditional departmental funding approaches or independent capital improvement programs.

The OWH Program therefore requires a coordinated funding and financing framework that supports planning, implementation, operations, maintenance, monitoring, and future adaptation. The purpose of the funding strategy is not to identify a single funding source for the program, but rather to establish a framework that enables the City to consistently advance projects, leverage available resources, and adapt to changing funding conditions over time.

Implementation will require a diversified portfolio of funding sources that combines City appropriations, utility revenues, grants, low-interest financing, bonds, resilience funding programs, and future dedicated funding mechanisms. Successful implementation will also require the City to pursue a dual-track approach that advances projects using existing funding tools, while simultaneously building the long-term institutional and financial capacity needed to support resilience investments over multiple decades.

Funding and financing strategies should seek to balance infrastructure investment needs with ratepayer affordability considerations by maximizing external funding opportunities, pursuing cost-sharing arrangements, leveraging low-interest financing programs, and sequencing investments over time. In addition to traditional capital improvement and external funding sources, the City continues to evaluate innovative financing mechanisms and emerging climate finance opportunities in the ongoing Climate Financial Risk Assessment. A core objective of the OWH funding strategy is to increase resilience while minimizing unnecessary financial burdens on the community.

Funding programs, legislative priorities, grant eligibility requirements, and financing opportunities will continue to evolve. Consequently, the most important determinant of implementation success is not any individual funding program but the City's ability to maintain project readiness, coordinate investments, demonstrate benefits, and align projects with available funding opportunities as they emerge.

Additional information regarding specific funding opportunities, financing tools, project funding pathways, and funding program evaluations is provided in Appendix K.

FUNDING PRINCIPLES

The OWH funding strategy is built upon five guiding principles that support long-term implementation.

- **Diversify Funding Sources:** No single funding source can support the scale of investment needed to implement the OWH vision. A diversified funding portfolio improves flexibility, reduces reliance on any individual revenue source, and provides greater resilience as funding programs change over time.
- **Prioritize Multi-Benefit Investments:** Many One Water projects provide multiple benefits simultaneously. Projects that address resilience, water quality, flood reduction, ecosystem restoration, water supply reliability, and community needs should be prioritized because they create opportunities to leverage resources across multiple funding programs and agencies.
- **Maintain Project Readiness:** Implementation-ready projects improve the City's ability to compete for external funding and advance projects efficiently when opportunities arise.
- **Integrate Funding and Governance:** Funding decisions should be coordinated with governance structures, planning processes, project prioritization frameworks, and capital investment decisions.
- **Support Affordability and Fiscal Sustainability:** Funding approaches should balance long-term infrastructure investment needs with affordability considerations and financial sustainability objectives.

FUNDING RESILIENCY AND ADAPTABILITY

The funding landscape for resilience, infrastructure, and environmental investments will continue to change throughout implementation of the OWH Program. Federal appropriations, state funding priorities, grant programs, financing opportunities, and legislative initiatives may expand, contract, or evolve over time. Implementation should focus less on specific funding programs and more on building durable organizational capabilities that allow the City to succeed regardless of changes in the external funding environment. Key implementation priorities include:

- Maintaining implementation-ready projects.
- Integrating One Water priorities into CIP and budgeting processes.
- Strengthening cross-departmental coordination.
- Establishing consistent project evaluation criteria.
- Building local match capacity.
- Developing long-term funding mechanisms.
- Expanding partnerships and collaborative investments.

This approach creates funding resilience by reducing dependence on individual programs while improving the City's ability to adapt to future opportunities.

PROJECT READINESS

Project readiness will be one of the most important factors influencing implementation success. Many resilience and infrastructure funding opportunities prioritize projects that have completed planning, engineering, environmental review, stakeholder engagement, benefit evaluations, and implementation planning. Maintaining project readiness enables the City to compete effectively for external funding and move projects forward when opportunities become available.

The City should maintain a portfolio of implementation-ready projects supported by the following readiness elements:

READINESS ELEMENT	PURPOSE
Asset Management System Planning Complete	Demonstrates project need
Preliminary Design	Improves project scope and cost certainty
30% or 60% Design	Defines a readiness to proceed
Environmental Review	Supports eligibility especially for implementation projects
Benefit Cost Analysis	Required by many grant programs to demonstrate cost effectiveness
Community Engagement	Demonstrates stakeholder support and engagement
Local Match Commitment	Increases competitiveness and ability to secure funding
O&M Responsibility Defined	Demonstrates long-term sustainability

In addition, small local investments in planning, feasibility analysis, environmental review, and preliminary design can unlock significantly larger external funding opportunities. Strategic and dedicated use of local resources through the Climate Resiliency Fund, departmental budgets, or dedicated funding mechanisms or leveraging cost shares can serve as an important tool for implementation. Dedicated revenue sources and designated use frameworks can improve funding predictability and support sustained implementation. To support this effort, the One Water Panel should establish a recurring readiness review process that evaluates project status, funding eligibility, local match availability, grant competitiveness, environmental review progress, and long-term implementation capacity.

Readiness and funding should be considered an implementation trigger alongside climate hazard triggers, regulatory triggers, and infrastructure condition triggers. While climate hazard triggers inform when adaptation measures may become necessary and regulatory triggers may identify projects required by future mandates, funding triggers provide opportunities to advance implementation when significant grant, financing, or partnership opportunities become available. Maintaining a portfolio of implementation-ready projects will improve the City's ability to compete for external funding and accelerate implementation as opportunities arise. Additional discussion of readiness considerations is provided in Appendix K.

FUNDING GOVERNANCE AND INSTITUTIONAL CAPACITY

Implementation of the OWH Plan and future Program efforts will require governance structures capable of supporting long-term coordination across departments, programs, and funding sources.

Several foundational initiatives identified in this Plan, including Stormwater Utility Fee initiative, Stormwater Master Plan, Green Infrastructure Implementation Plan, Reuse Strategy for Redevelopment Areas, and climate monitoring, serve as enabling actions that improve governance, planning, and funding coordination. These efforts help create the institutional and financial framework necessary to support future One Water investments while improving project readiness and implementation capacity.

INSTITUTIONAL INTEGRATION AND POLICY DEVELOPMENT

Long-term implementation of the OWH Program will depend not only on project delivery and funding availability but also on the integration of One Water principles into the policies, procedures, and decision-making processes that guide City operations. Over time, policies can help institutionalize OWH objectives by ensuring that resilience, water resource management, climate adaptation, and multi-benefit outcomes are consistently considered during planning, budgeting, capital investment, and asset management decisions.

Rather than creating a standalone implementation program, the OWH vision should be integrated into existing City processes wherever practical. Embedding One Water principles into established planning and investment frameworks can help ensure that resilience and sustainability objectives are considered alongside other operational, regulatory, and financial priorities. Institutional integration also helps create

How These Integrated Efforts Support Long-Term Advancement of:

Program Governance

- Clarifying agency roles and responsibilities
- Strengthening coordination and oversight
- Establishing decision-making processes

Future Policy Development

- Informing planning and prioritization
- Supporting integration into capital programs
- Aligning resilience objectives across departments

Funding

- Improving competitiveness for funding
- Supporting co-funding opportunities
- Establishing future revenue mechanisms

Project Implementation

- Increasing project readiness
- Improving delivery efficiency
- Creating pathways for larger regional investments

consistency across departments, improves coordination, and supports more strategic use of available funding resources.

Key opportunities for institutional integration include incorporating resilience and adaptation criteria into CIP development and capital planning processes, integrating One Water objectives into departmental planning efforts, and establishing cross-department governance structures that support coordinated implementation and investment decisions. These efforts can help align projects, policies, and funding sources around shared community outcomes while improving the City's ability to leverage investments across multiple service areas.

Project prioritization processes should also evolve to recognize the multiple benefits provided by One Water investments. Incorporating climate risk screening, resilience criteria, and multi-benefit evaluation frameworks into project selection can help ensure that funding decisions support long-term community resilience while maximizing the value of limited public resources. Similarly, integrating resilience performance measures into asset management programs can help inform maintenance, rehabilitation, replacement, and future investment decisions throughout the lifecycle of public assets.

In addition to supporting implementation, institutional integration can improve funding competitiveness by demonstrating that One Water principles are embedded within the City's long-term planning and decision-making framework. Many funding agencies increasingly prioritize projects that demonstrate coordination, resilience planning, and long-term sustainability. Establishing clear policies, governance structures, and implementation procedures can therefore strengthen both program delivery and funding readiness.

Because many One Water projects generate benefits across multiple service areas, funding decisions should increasingly consider benefit-based investment approaches. Under this framework, project funding responsibilities are aligned with anticipated benefits rather than traditional departmental boundaries. This approach can support co-funding decisions, improve affordability, and create more efficient investment strategies for multi-benefit One Water projects.

As the OWH Program matures, these policies and procedures can help transition the program from a collection of individual projects to an integrated approach for planning, funding, delivering, operating, and maintaining water and resilience investments across the City.

COORDINATED FUNDING AND CO-FUNDING STRATEGIES

One Water Honolulu projects generate benefits that extend across multiple departments and community objectives. While traditional budgeting approaches typically allocate funding within individual agencies, One Water projects often provide value across wastewater, water supply, stormwater, watershed management, transportation, parks, public safety, climate resilience, and community development programs. As a result, successful implementation will require coordinated funding approaches that recognize and leverage these shared benefits.

In the near term, implementation opportunities may be advanced through improved coordination of existing departmental funding and capital improvement resources. The City should evaluate opportunities to formalize cost-sharing arrangements, funding agreements, and interdepartmental memoranda of agreement (MOAs) that allow departments to jointly fund planning, design, implementation, operations, maintenance, and monitoring activities. Standardized co-funding procedures can help align investments with project benefits, reduce barriers to collaboration, and facilitate implementation of multi-benefit projects that may not otherwise fit within a single department's budget.

Potential approaches include:

- Shared cost-allocation frameworks based on project benefits.
- Joint funding agreements for planning and implementation activities.
- Cross-department cost-sharing arrangements.
- Interdepartmental MOAs and partnership agreements.
- Benefit-based investment and prioritization frameworks.
- Regional and interagency partnership funding opportunities.

Because affordability is an important consideration for long-term implementation, coordinated investments should also seek opportunities for project bundling, shared delivery, and joint implementation. These approaches can improve efficiency, strengthen grant competitiveness, reduce duplication of effort, and lower the overall cost of delivering resilience projects compared to independent implementation efforts.

Experience from other One Water and resilience-focused programs demonstrates that successful implementation is often supported by a combination of coordinated governance structures and diversified funding approaches. Programs such as Philadelphia's Green City, Clean Waters; Washington D.C.'s Stormwater Retention Credit Program; and Miami's Forever Bond Program

illustrate how dedicated funding sources, innovative financing tools, and cross-agency coordination can help sustain long-term investments in resilience, green infrastructure, and climate adaptation. While individual funding programs and mechanisms evolve over time, these examples demonstrate the importance of establishing governance structures and funding frameworks capable of supporting implementation over multiple decades.

BUILDING SUSTAINTABLE FUNDING CAPACITY

Long-term implementation will ultimately require dedicated and predictable revenue sources in addition to grants and traditional capital funding. While external funding can reduce local costs and accelerate project delivery, grants alone are unlikely to support ongoing adaptation planning, watershed stewardship, green infrastructure maintenance, flood resilience programs, and other One Water priorities over the long term. **The City should therefore continue evaluating sustainable funding mechanisms that can provide local support for implementation. Priority opportunities include implementation of a Stormwater Utility Fee, strategic expansion of the Climate Resiliency Fund, development of Green Bond financing capabilities, enhanced use of revolving loan programs, and exploration of public-private partnership opportunities where appropriate.** Collectively, these mechanisms can help provide the stable funding needed to support the planning, implementation, operation, maintenance, monitoring, and future adaptation of One Water investments.

Key Implementation Principle

The long-term success of the One Water Honolulu Program will depend less on any individual grant program and more on the City's ability to coordinate investments, maintain implementation-ready projects, align funding with project benefits, and establish sustainable local funding capacity. Funding programs and financing opportunities will continue to change over time; therefore, implementation efforts should focus on creating durable governance and funding framework that can adapt to evolving opportunities while continuing to advance One Water priorities.

FUNDING COORDINATION AND PROGRAM MANAGEMENT

Implementation will require ongoing organizational capacity to identify opportunities, pursue funding, coordinate investments, and track progress.

The City should consider establishing a coordinated funding function to:

- Maintain readiness information.
- Coordinate grant pursuits.
- Support local match strategies.
- Track resilience investments.
- Monitor funding outcomes.
- Support climate budget tagging.
- Improve reporting and accountability.

This function can strengthen competitiveness while reducing duplication of effort across participating departments.

Over time, success could be reflected not only in terms of the funding secured, but also in the City's ability to consistently advance projects from planning through implementation. Key indicators may increase increased grant awards, improved project readiness, greater coordination across departments, expanded use of dedicated funding sources and successful delivery of OWH projects.

FUNDING ROADMAP

The funding assessment recommends a three phase implementation roadmap (shown below and discussed in Appendix K) that aligns funding development with project maturity and institutional growth. This phased approach allows the City to advance priority projects immediately while building the long-term financial foundation needed to support resilience investments across future generations. Each phase provides a framework for advancing implementation from current state while building the long-term financial capacity needed to deliver the OWH Program.

Phase 1: Priority Recommendations to Build the Foundation (2026-2035)

Phase 1 focuses on building the project, funding, and institutional foundations needed to compete for funding and advance future implementation.

- Advance **project readiness**, including planning, environmental review, preliminary engineering, adaptation planning, and pilot projects.
- Develop and maintain a pipeline of **implementation-ready OWH projects** aligned with City priorities.
- Strengthen **funding coordination and governance** across departments to support integrated planning and investment decisions.
- Implement **project tracking, performance management, and climate budget tagging** to improve accountability and funding alignment.
- Secure and strategically deploy **local matching funds**, including use of the Climate Resiliency Fund where appropriate.
- Advance development of **long-term funding mechanisms**, including evaluation of a Stormwater Utility Fee and other sustainable funding approaches.
- Establish the **institutional and financial framework** needed to support larger-scale implementation and long-term program delivery.

Phase 2: Scaling Project Delivery and Implementation (2035-2045)

Phase 2 focuses on transitioning from planning to implementation by deploying dedicated funding mechanisms, leveraging financing tools, and coordinating investments across departments to deliver priority projects.

- Advance priority OWH projects from planning into design, construction, and implementation.
- Expand the use of diversified funding and financing strategies to support larger capital and resilience investments.
- Leverage and refine dedicated funding mechanisms and co-funding approaches established during Phase 1.
- Strengthen cross-departmental coordination to maximize the benefits of integrated One Water investments.
- Prioritize investments that deliver multiple benefits across water reliability, watershed health, flood resilience, climate adaptation, and community outcomes.
- Balance implementation goals with affordability, equity, and financial sustainability considerations.
- Establish the financial and governance structures necessary to support broader city-wide implementation and long-term program delivery.

Phase 3: Institutionalizing One Water and Sustaining Long-Term Resilience (2045-2055 and Beyond)

Phase 3 focuses on fully integrating One Water principles into City planning and operations, sustaining long-term funding capacity, and ensuring resilience investments continue to provide benefits throughout their lifecycle.

- Integrate One Water principles into planning, budgeting, capital improvement programming, and asset management practices across City departments.
- Maintain sustainable funding and financing strategies that support long-term implementation and resilience objectives.
- Prioritize investments that deliver regional, multi-benefit outcomes across water supply, watershed health, flood resilience, and climate adaptation.
- Coordinate investments and partnerships to maximize the value of integrated One Water projects.
- Ensure adequate funding for the full lifecycle of assets, including operations, maintenance, monitoring, rehabilitation, and adaptive management.
- Monitor performance and incorporate lessons learned to support continuous improvement and adaptive decision-making.
- Institutionalize governance, funding, and asset management practices that support long-term resilience and community benefit.

Long-term success will depend not only on delivering new projects, but also on maintaining the governance, funding, and operational resources needed to sustain them over time. By integrating One Water principles into City decision-making and establishing lifecycle funding strategies, the City can ensure that resilience investments continue to provide benefits for future generations.

NEAR TERM FUNDING PRIORITIES (2026-2035)

During the first phase of implementation, the City should focus on building project readiness while maximizing near-term funding opportunities. Priority investments include adaptation planning, watershed and drainage studies, water reuse planning, climate monitoring systems, and resilience-focused planning efforts that establish the foundation for future capital improvements. These projects are typically highly competitive for federal and state grant funding and can position larger implementation projects for future financing.

Particular emphasis should be placed on pursuing external funding for adaptation plans through FEMA, NOAA, and State of Hawai‘i programs; leveraging General Fund and Climate Resilience Fund resources to advance the Stormwater Master Plan; pursuing Bureau of Reclamation WaterSMART funding for water reuse planning efforts; and utilizing EPA and CWSRF funding programs to support implementation of the Green Infrastructure Plan. Federal grants and local CIP resources can also support expansion of climate and groundwater monitoring networks that improve long-term decision-making and trigger-based implementation.

To support these efforts, the OWH Program should prioritize climate budget tagging, grant readiness, project tracking, local match identification, interdepartmental funding coordination, use of the Climate Resiliency Fund, and evaluation of a future Stormwater Utility Fee framework. Together, these actions will strengthen competitiveness for external funding and create the institutional foundation needed to advance larger capital investments during future implementation phases.

Table 8-7. Available Funding Mechanisms for Near Term Priorities

IMPLEMENTATION PRIORITY	FUNDING APPROACH
Adaptation Plans	State of Hawai‘i grants, FEMA, NOAA
Stormwater Master Plan	General Fund, Climate Resiliency Fund
Reuse Strategy	Reclamation WaterSMART Programs
Area Adaptation Plans	FEMA, NOAA, State Resiliency Program
Green Infrastructure Plan	EPA Non-Point Source, DOH CWSRF
Monitoring Networks	Federal grants, local CIP budget

ALIGNING FUNDING STRATEGIES WITH PROJECT TYPES

One Water Honolulu projects span a diverse range of project types, including water reuse, stormwater management, watershed restoration, flood resilience, climate adaptation, and planning initiatives. Because these projects vary significantly in scale, maturity, and anticipated benefits, no single funding approach is appropriate for all implementation activities.

Instead, funding strategies should be aligned with project characteristics and development phase. Planning and readiness activities may be best supported through grant funding and resilience-focused programs, while larger capital projects often require a combination of grants, local funding, utility revenues, and financing tools. Nature-based and watershed restoration projects may benefit from environmental and ecosystem restoration funding opportunities, while water reuse and infrastructure projects may be better positioned for utility-supported financing and capital investment programs.

As projects advance from planning through design, construction, and long-term operations, funding approaches should evolve accordingly. Maintaining flexibility and aligning funding strategies with project needs will improve implementation efficiency and increase the City's ability to leverage future funding opportunities.

Detailed project-specific funding pathways are provided in Appendix K, while Table 8-8 and 8-9 provide example funding pathways by project type and illustrative pathways across project phases.

Table 8-8. Funding Pathways by Project Type

PROJECT TYPE	FUNDING PATHWAYS	PROJECTS
Water Reuse Projects	• Reclamation WaterSMART Title XVI • DOH CWSRF/DWSRF • EPA WIFIA • USDA (pending community size)	• Honouliuli • Waimānalo • Whitmore • NASED
Stormwater and Flood Resiliency	• DOH CWSRF • FEMA BRIC/HMGP • EPA OSG • USDA (pending community size)	• Stormwater Master Plan • Iwilei • Māpunapuna • Ala Wai
Watershed Restoration	• NOAA • NFWF • EPA Non-Point Source • AERP	• Kahawai Stream • Stream Restoration • Fireshed Partnerships
Climate Adaptation Planning	• FEMA • NOAA • State Resiliency Programs • Climate Resiliency Fund	• Adapt Waikīkī • Area Adaptation Plans • Managed Retreat Study

Table 8-9. Illustrative Funding Pathways Across Project Development Phases

PROJECT	NEAR-TERM FUNDING	MID-TERM FUNDING	LONG-TERM FUNDING
Stormwater Master Plan	General Fund, Climate Resiliency Fund	DOH CWSRF, EPA OSG	Stormwater Utility Fee
Adapt Waikiki	FEMA, NOAA	FEMA BRIC, HMGP	Dedicated Resiliency Funding
Reuse Projects	WaterSMART	DOH CWSRF, WIFIA Reclamation	Utility Revenue
Mapunapuna Flood Improvements	FEMA Planning	FEMA BRIC, HMGP	Bonds + CIP Funding
Kahawai Stream Restoration	NOAA, NFWF Planning	Reclamation, EPA Non-Point Source, AERP	CIP Funding and Watershed Funding

AFFORDABILITY AND FINANCIAL SUSTAINABILITY

Implementation of the OWH Program should balance long-term infrastructure and resilience needs with affordability considerations. Given the scale and diversity of OWH initiatives, leveraging grants, low-interest financing, partnerships, and co-funded investments will be important for minimizing potential impacts on ratepayers while maximizing community benefits. Funding decisions should continue to consider both financial capacity and the value generated by multi-benefit investments. This includes consideration of environmental benefits, resilience outcomes, risk reduction, water resource reliability, and community quality-of-life improvements. Through a combination of diversified funding sources, project readiness, coordinated governance, and long-term planning, the City can advance implementation of the OWH Program while maintaining fiscal responsibility and supporting community affordability objectives. Additional information regarding funding opportunities, financing mechanisms, funding matrices, project-specific funding pathways, and implementation funding strategies is provided in Appendix K.

OPPORTUNITIES FOR COLLABORATION THROUGH EXISTING CAPITAL INVESTMENTS

The OWH Program is intended to complement and strengthen existing capital improvement investments rather than create an entirely separate infrastructure program. The OWH Program does not propose a separate CIP; instead, OWH projects would be integrated into existing City, ENV, and BWS capital improvement programs as funding becomes available and projects advance to implementation.

One of the immediate opportunities to advance OWH implementation is through coordination with existing City and BWS capital improvement projects. Aligning OWH priorities with already programmed investments can accelerate implementation, improve efficiency, and reduce overall funding needs through coordinated delivery and co-funding opportunities. Table 8-10 presents existing projects and funding opportunities that overlap with or are complementary to projects on the final One Water Honolulu Project List presented in Section 7, presenting opportunities for collaboration for project execution.

Table 8-10. Related Existing CIP Projects

ONE WATER PLAN PROJECTS				EXISTING CIP PROJECTS		
PROJECT ID	PROJECT NAME	REGION	LEAD AGENCY	PROJECT NAME	RELEVANT CIP	PROJECT ID
9	Stream Restoration & Rehabilitation	East Honolulu	DFM	• Wailupe Stream Flood Control	CCH CIP 2027–2032	2001016
53	Coastal Management Plan for Erosion & Flooding	Koʻolau Poko	DPP	• Kāneʻohe Stream Bank Restoration Near Keole Place • Green Fee Community Stewardship Program (coastal): Support coastal ecosystem restoration to improve coastal resilience to storms, floods and climate disasters	CCH CIP 2027–2032	1998514
103	Iwilei Drainage Improvements	PUC	DFM	• Storm Drainage Best Management Practices, Downtown-Chinatown	CCH CIP 2027–2032	2018076
123	Ala Wai Watershed Integrated Stormwater Management	PUC	DFM	• Storm Drain Outlets Near Ala Wai Canal • NPDES MS4 Erosion-Prone Area Improvements	CCH CIP 2027–2032 CCH CIP 2027–2032	2018082 2018071
145	Mākaha Roads Drainage Study and Improvements	Waiʻanae	DFM	• NPDES MS4 Structural BMPs for Trash Reduction	CCH CIP 2027–2032	2018074

8.7 CONCLUSION

Increasing resilience of O'ahu's water infrastructure and our island community is the primary focus of the OWH Plan.

An important outcome of this effort is the development of a proposed City framework for collaboration and adaptation that sustains and builds climate resilience now and for years to come. This Plan supports the mandate of the One Water Panel and identifies selected areas where adaptive options can be prioritized and strategically implemented. The goal is to start small, leverage early wins, and build toward larger scale successes by first setting up a collaboration and adaptation framework that can be practically implemented and long-lasting.

The Plan addresses existing vulnerabilities and identifies strategies to assist the city in the preparation and implementation of adaptation strategies. Priority locations and various adaptation strategies were identified to address potential impacts to existing One Water infrastructure from a suite of potential climate-related hazards.

Coordination and integration of efforts of affected agencies and private sector entities who share common goals and objectives associated with the impacts of climate change is critical. Many companion planning initiatives and studies are currently ongoing, and these efforts should seek to avoid duplication, and instead capitalize on the findings and recommendations of each successive effort. At the same time, there are important and essential studies and analyses, including planning and policy considerations, needed for immediate or near-term implementation. For example, regional drainage plans should be updated to incorporate SLR implications while at the same time financing mechanisms for funding of near-, mid-, and long-term adaptation measures should be identified and/or adopted to support these initiatives.

The uncertainty of the magnitude and timing of climate change impacts, along with ongoing research and evolving projections, highlights the importance of providing practical yet flexible solutions to adapt as information and conditions change.

Many of the recommended projects appropriately recognize the need for flexibility and the adoption of an iterative and adaptive management process to successfully implement adaptation strategies that may seek to address cumulative hazards and provide multiple benefits. At the same time some of the recommendations do not immediately establish specific triggers or milestones for when such actions should occur. Triggers will need to be established and refined based on new information, and current vulnerabilities may need to be reprioritized as conditions change. These initial projects and the lessons learned through the early implementation of recommended actions will be important in helping guide future government and private sector efforts.

The "who, what, where, and when" questions associated with climate change adaptation will require many City voices to answer, and more importantly must be pursued together under an agreed upon framework for implementation. The OWH Plan lays the foundation for focused discussions beginning with the proposed Collaboration Framework and Climate Change Adaptation Framework set forth in the Plan. The methods used and proposed process for collaborative development of adaptation strategies, and the "template" for strategy implementation represents a viable interagency and private sector approach that can serve as a potential model for other counties.

The recommended actions to address projected impacts of climate change will require ongoing monitoring of climate trends, continued evaluation of projected triggers for project implementation, and establishment of milestones and metrics for measuring success and leveraging lessons learned along the way.

A deliberate and programmatic approach requires the identification of appropriate and sustainable funding for the planning, design, construction, operation and maintenance of near-, mid-, and long-term actions to address current and projected impacts.

High-level recommended steps include:



PRESENT – 3 YEARS

- Review and decide on climate condition thresholds to avoid for (e.g., specific sea level to avoid) and agree on initial triggers to monitor these conditions.
- Establish and continuously carry out monitoring of triggers for specific areas and projects.
- Continue leveraging concurrent stakeholder engagement efforts and consider key themes from the community in the OWH Program and related efforts moving forward.
- Consider implementing and formalizing the recommended program-level and project-specific processes in Appendix A.
- Consider the provided islandwide profile and Regional District Profiles in other near-term climate adaptation efforts and in near-term development of One Water projects.
- Consider the prioritized hotspots in other near-term relevant efforts.
- Consider the risk scores and known areas of concern information in other near-term relevant efforts.
- Implement Governance Strategies supporting actions recommended for the Present – 3 Years timeframe *(refer to Section 8.1 for the list of actions)*.

3 – 5 YEARS

- Implement Governance Strategies supporting actions recommended for the 3 – 5 Years timeframe *(refer to Section 8.1 for the list of actions)*.

5 – 10 YEARS

- Update the islandwide profile and Regional District Profiles as necessary based on changing conditions and in future Plan updates.
- Repeat the provided prioritization process for future prioritization of hotspots as needed.
- Repeat this project development and prioritization process as needed and in future Plan updates.
- Develop the 10-Year update of the OWH Plan.

ONGOING (PRESENT – 25+ YEARS)

- Implement near-term, mid-term, and long-term recommended OWH policies, projects, plans, studies, and programs.
  - Advance project implementation through funding, feasibility analysis, or further scoping.
- Update the islandwide profile and Regional District Profiles as necessary based on changing conditions and in future Plan updates.
- Utilize the One Water Honolulu Implementation Plan guidance including triggers, project sequencing, checklists, and funding strategy to inform decisions and formalize an institutional framework.
- Throughout the One Water Honolulu Program, pursue timely engagement of stakeholder groups -— informed by aligning major decisions and actions.
- Implement Governance Strategies supporting actions recommended as Ongoing *(refer to Section 8.1 for the list of actions)*.

Continue using the best available information to understand climate change vulnerabilities and implement adaptation strategies to advance the One Water Honolulu Program.

The climate will continue to change, new projections and modeling results will become available, and lived experiences and local knowledge will all continue to inform the understanding of climate risks and how to address them across Oʻahu. There will also be new regulations and policies to address growing environmental and/or community concerns. To keep pace with these changes, the Plan should be updated by the City every 10 years. Smaller-scale updates to data, triggers, and projects on a more frequent basis may be needed to incorporate the latest data and scientific knowledge, lessons learned from the implementation of near-term projects. Updates will also be made based on the shared information from collaboration with other agencies on local, regional, and state-wide adaptation as well as coordination with the development community.

Advancing the One Water Honolulu Program to the next level in the WRF One Water Cities Self-Assessment will further require a transition into adaptive implementation and a collective, inspired organization that supports greater community engagement and feedback as projects identified in the Plan move toward implementation. The Plan already demonstrates a long-term commitment building from existing and continued collaboration opportunities that can be measured and enhanced through the next step of establishing benchmarking and performance indicators. These opportunities and commitment to sustain collaboration are essential because no one department can do it alone; but together, the City can continue building climate resilience for generations to come through the One Water Honolulu Program.



9 | References

The following section contains references for One Water Honolulu Plan sections where applicable.

SECTION 1: INTRODUCTION

City and County of Honolulu (CCH), 2020, Ordinance 20-47. https://onewaterhonolulu.org/wp-content/uploads/2025/04/ORD20-047.pdf

CCH. (2024b). *Climate Ready O'ahu*. https://drive.google.com/file/d/1YOQSw1ERdJLC4iFegGYY39_lDfidH0Ag/view

CCH. 2022. One Water Honolulu 2022 Annual Report. https://onewaterhonolulu.org/wp-content/uploads/2025/04/MM-08623.pdf

SECTION 2: COLLABORATION PROCESS

CCH official websites (accessed August 2025)
https://www.honolulu.gov/departments/
https://www.honolulu.gov/legislative-branch/

CCH Climate Change Commission Guidance Documents: https://www.resilientoahu.org/climate-change-commission

CCH Mayor's Directive 18-2 City and County of Honolulu Actions to Address Climate Change and Sea Level Rise, 2018. https://static1.squarespace.com/static/5e3885654a153a6ef84e6c9c/t/5ef3b2774954db49fc136b20/1593029239884/Mayor%27s%2BDirective%2B18-02.pdf

U.S. Census Bureau, 2023, https://www.census.gov/quickfacts/fact/table/honolulucountyhawaii/PST045225.

SECTION 3: ISLANDWIDE PROFILE

City and County of Honolulu Office of Climate Change (CCSR), Sustainability and Resiliency, *Climate Ready O'ahu: Climate Adaptation Strategy*, City and County of Honolulu, 2024.

Honolulu Board of Water Supply; State of Hawai'i Commission on Water Resource Management (CWRM), *O'ahu Watershed Management Plan*, Revised Ordinances of Honolulu Chapter 30 framework, City and County of Honolulu, 2024.

Climate Change Portal, State of Hawai'i, May 2026, https://climate.hawaii.gov/hi-facts/temperature/.

SECTION 4: REGIONAL PLANNING DISTRICT PROFILES

Board of Water Supply (BWS), n.d., *WAI 101 Wai'anae Watershed Management Plan Update,* City and County of Honolulu, https://www.boardofwatersupply.com/media/u0ockbz2/wwmp-wai-101-critical-water-resource-areas-handout-2025-03-19.pdf

BWS, 2009, *Ko'olau Loa Watershed Management Plan*, City and County of Honolulu, https://www.boardofwatersupply.com/media/4x4hozlk/koolau-loa-wmp-prefinal-plan-rev2-2009-07-27.pdf

BWS, 2009, *Wai'anae Watershed Management Plan*, City and County of Honolulu, https://www.boardofwatersupply.com/media/qazetszn/waianae-wmp-final-report-full-2009-08.pdf

BWS, 2012, *Ko'olau Poko Watershed Management Plan*, City and County of Honolulu, https://files.hawaii.gov/dlnr/cwrm/planning/wudpoa2012kp.pdf

BWS, 2016, *North Shore Watershed Management Plan*, City and County of Honolulu, https://www.boardofwatersupply.com/media/5kwnqmg5/north-shore-wmp-final-2016-12-compressed.pdf

BWS, 2017, *'Ewa Watershed Management Plan*, City and County of Honolulu, https://www.boardofwatersupply.com/media/5k2jtjfy/ewa-wmp-public-review-draft-2017-05.pdf

BWS, 2019, *Water Master Plan Summary Update*, City and County of Honolulu, https://www.boardofwatersupply.com/media/05epicf0/bws-water-master-plan-summary-final-2019-09-23.pdf

BWS, n.d., *Waiʻanae Watershed Management Plan Fact Sheet*, City and County of Honolulu, https://www.boardofwatersupply.com/media/tswiredz/waianae-watershed-management-plan-fact-sheet-2026-03-18.pdf

City and County of Honolulu, 2001, *Pearl Harbor Historic Trail Master Plan*, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/12/PearlHarborHistoricTrail.pdf

Commission on Water Resource Management (CWRM), 2019, *Hawai'i Water Plan – Water Resources Protection Plan*, State of Hawaiʻi, https://files.hawaii.gov/dlnr/cwrm/planning/wrpp2019update/WRPP_ALL_201907.pdf

Hawaiʻi Community Development Authority (HCDA), 2016, *Kakaʻako Community Development District TOD Overlay Plan*, State of Hawaiʻi, https://dbedt.hawaii.gov/hcda/files/2016/05/Final-TOD-Overlay-Plan-Draft-31816.pdf

Department of Design and Construction (DDC), n.d., *Ala Wai Flood Risk Management Project*, City and County of Honolulu, https://www.honolulu.gov/ddc/ala-wai/home/

Department of Facility Maintenance (DFM), 2021, *Storm Water Management Program Plan*, City and County of Honolulu, https://www4.honolulu.gov/docushare/dsweb/Get/Document-293930/SWMPP_2021%20Final.pdf

Department of Planning and Permitting (DPP), 2026, *Oʻahu's Eight Regional Planning Areas*, City and County of Honolulu, Development Plans and Sustainable Communities Plans, https://www.honolulu.gov/dpp/planning/applying-for-changes/dp-scp/

DFM, 2023, *Storm Water Strategic Plan*, City and County of Honolulu, https://www.honolulu.gov/swq/wp-content/uploads/sites/32/2023/11/sw-strategic-plan.pdf

DPP, 1992, *ʻEwa Villages Master Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2024/07/Ewa_Villages_Master_Plan_1992.pdf

DPP, 1995, *Waipahu Town Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/WaipahuTownPlan1995.pdf

DPP, 1998, *Waipahu Livable Communities Initiative*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/WaipahuLivableCommunities1998.pdf

DPP, 2001, *Pearl Harbor Historic Trail Master Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/12/PearlHarborHistoricTrail.pdf

DPP, 2004, *Aiea-Pearl City Livable Communities Plan*, City and County of Honolulu, honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/AieaPearlCityLCP.pdf

DPP, 2004, *Kalihi-Pālama Action Plan*, City and County of Honolulu, DPP, 2004, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/12/KalihiPalamaActionPlan2004.pdf

DPP, 2005, *Waialua Town Master Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/WaialuaTownMasterPlan2005.pdf

DPP, 2009, *Mākaha Special Area Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/MakahaSAP2009.pdf

DPP, 2011, *North Shore Sustainable Communities Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/NSSCP_2011.pdf

DPP, 2012, *Waiʻanae Sustainable Communities Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/WaianaeSCP2012.pdf

DPP, 2014, *Aiea-Pearl City TOD Neighborhood Plan*, City and County of Honolulu, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Aiea_Pearl_City_TOD_Plan_Adopted.pdf

DPP, 2017, *Kalihi TOD Neighborhood Plan*, City and County of Honolulu, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Kalihi_TOD_Plan_Adopted.pdf

DPP, 2017, *Koʻolau Poko Sustainable Communities Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/Koolau_Poko_SCP_2017.pdf

DPP, 2017, *Waipahu Town Action Plan*, City and County of Honolulu, DPP, 2017, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Waipahu_Town_Action_Plan_9-17.pdf

DPP, 2020, *Downtown TOD Neighborhood Plan*, City and County of Honolulu, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Downtown_TOD_Plan_Adopted.pdf

DPP, 2020, *East Kapolei TOD Neighborhood Plan*, City and County of Honolulu, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/East_Kapolei_TOD_Plan_Adopted.pdf

DPP, 2020, *ʻEwa Development Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2024/07/Ewa_DP_2013_Amended_2020_Ordinance_20-46.pdf

DPP, 2020, *Hālawa TOD Neighborhood Plan*, City and County of Honolulu, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Halawa_TOD_Plan_Adopted.pdf

DPP, 2020, *Ko ʻolau Loa Sustainable Community Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/Koolau_Loa_SCP_2020.pdf

DPP, 2021, *Ala Moana TOD Neighborhood Plan*, City and County of Honolulu, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Ala_Moana_TOD_Plan_Adopted.pdf

DPP, 2021, *Central O ʻahu Sustainable Communities Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/11/CentralOahuSCP2021.pdf

DPP, 2021, *O'ahu General Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/12/General_Plan_RESO_21-23_CD1.pdf

DPP, 2022, *Airport Area TOD Plan*, City and County of Honolulu, https://www.honolulu.gov/tod/wp-content/uploads/sites/73/2025/02/Airport_TOD_Plan_Adopted.pdf

DPP, 2022, *East Honolulu Sustainable Communities Plan*, City and County of Honolulu, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/10/EHSCP_2022.pdf

DPP, 2023, *Proposed Plan – October 2023 Primary Urban Center Development Plan*, City and County of Honolulu

DPP, 2024, *East Honolulu Watershed Management Plan*, City and County of Honolulu, https://hnldoc.ehawaii.gov/hnldoc/document-download?id=22834

DPP, 2025, *Primary Urban District Development Plan*, City and County of Honolulu, https://www4.honolulu.gov/docushare/dsweb/Get/Document-355089/PUCDP%202025.pdf

DPP, 2025, *Public Draft Review North Shore Sustainable Communities Plan*, City and County of Honolulu, https://www.northshorescp.com/

Barbers Point Naval Air Station Redevelopment Commission, 2000, *Kalaeloa Redevelopment Plan*, State of Hawai‘i, https://www.honolulu.gov/dpp/wp-content/uploads/sites/56/2025/12/KalaeloaSpecialArea.pdf

Hawai‘i Department of Transportation (HDOT), 2022, *Kalanianaole Highway Improvements project to be substantially completed by the end of 2022*, Highways Division, State of Hawai‘i, https://hidot.hawaii.gov/highways/kalanianaole-highway-improvements-project-to-be-substantially-completed-by-the-end-of-2022/

Hawai‘i State Department of Health Wastewater Branch, 2016, *Reuse Guidelines Volume 1: Recycled Water Facilities*, https://health.hawaii.gov/wastewater/files/2021/10/V1_RWFacilities1.pdf

Hawai‘i State Department of Health, 2021, *Hawai‘i Nonpoint Source Management Plan 2021 – 2025*, State of Hawai‘i, https://health.hawaii.gov/cwb/files/2021/04/2021-HI-NPS-Management-Plan.pdf

Office of Climate Change, Sustainability & Resiliency (CCSR), 2024, *Climate Ready O'ahu*, City and County of Honolulu, https://drive.google.com/file/d/1YOQSw1ERdJLC4iFegGYY39_lDfidH0Ag/view

Office of the Governor, March 26, 2026, *Office of the Governor — News Release — Governor Green Submits Request for Presidential Disaster Declaration Following Devastating Kona Low Storms*, https://governor.hawaii.gov/newsroom/office-of-the-governor-news-release-governor-green-submits-request-for-presidential-disaster-declaration-following-devastating-kona-low-storms/

SECTION 5: CLIMATE ADAPTATION PROCESS

Adapt Waikiki 2050 Presentation on AW2050 Area Adaptation Plan presented to the O'ahu Climate Change Commission (March 7, 2025)

Anderson, T. R., Fletcher, C. H., Barbee, M. M., Romine, B. M., Lemmo, S., & Delevaux, J. M. S. (2018). Modeling multiple sea level rise stresses reveals up to twice the land at risk compared to strictly passive flooding methods. *Scientific Reports*, *8*(1), 14484. https://doi.org/10.1038/s41598-018-32658-x

Brown & Caldwell (2025). *Ko'olau Poko Readiness Review*. Climate Resilience Collaborative and City and County of Honolulu Office of Climate Change, Sustainability and Resiliency. *https://www.soest.hawaii.edu/crc/crc-projects/ko%ca%bbolau-poko-readiness-review-2/*

CCH. (2021). *Multi-Hazard Pre-Disaster Mitigation Plan for the City and County of Honolulu*.

CCH. (2024a). *Climate Change Design Guidelines*.

CCH. (2024b). *Climate Ready O'ahu*. https://drive.google.com/file/d/1YOQSw1ERdJLC4iFegGYY39_lDfidH0Ag/view

CCH ENV. (2025). *Sand Island Facilities Plan*.

CCH GIS. (2022). *Afternoon Heat Index—Overview*. https://www.arcgis.com/home/item.html?id=fcbce7e1873941a1a5e83d7af55e0aff

DLNR. (2017, May). *Revised Hawai'i Drought Plan*. https://files.hawaii.gov/dlnr/cwrm/planning/HDP2017.pdf

Habel, S., Fletcher, C. H., Barbee, M. M., & Fornace, K. L. (2024). Hidden Threat: The Influence of Sea-Level Rise on Coastal Groundwater and the Convergence of Impacts on Municipal Infrastructure. *Annual Review of Marine Science*, *16*(Volume 16, 2024), 81–103. https://doi.org/10.1146/annurev-marine-020923-120737

Hawai‘i Statewide GIS Program. (2024). *Fire Risk Areas*. https://geoportal.hawaii.gov/datasets/fire-risk-areas/about

Hawai‘i Statewide GIS Program. (2025). *Flood Hazard Areas (DFIRM)—Honolulu County*. https://geoportal.hawaii.gov/datasets/flood-hazard-areas-dfirm-honolulu-county/about

HDOT. (2021). *Hawai‘i Highways Climate Adaptation Action Plan: Strategies for a More Resilient Future*.

Ko ʻolau Poko Readiness Review. (2025). https://imina.soest.hawaii.edu/crc/pdf/Koolau_Poko_Readiness_Review_Full%20Report.pdf

Mihami, F.-Z., Roeber, V., & Morichon, D. (2022). Efficient Numerical Computations of Long-Wave Run-Up and Their Sensitivity to Grid Nesting. *Water Waves*, *4*(3), 517–548. https://doi.org/10.1007/s42286-022-00070-8

NOAA. (2018). *Hawai‘i (Category 4 SLOSH MOMs) Storm Surge Inundation*. https://noaa.hub.arcgis.com/maps/noaa::hawaii-category-4-slosh-moms-storm-surge-inundation/about

Vitousek, S., Barnard, P. L., Limber, P., Erikson, L., & Cole, B. (2017). A model integrating longshore and cross-shore processes for predicting long-term shoreline response to climate change. *Journal of Geophysical Research: Earth Surface*, *122*(4), 782–806.

SECTION 6: RESULTS BY PLANNING REGION

References under Sections 4 and 5 are also applicable to Section 6.

SECTION 7: PROJECT DEVELOPMENT PRIORITIZATION

CCSR. (2019). *O‘ahu Resilience Strategy*. https://static1.squarespace.com/static/5e3885654a153a6ef84e6c9c/t/5f10eaf7cb44284ef9c93e4d/1594944287505/Ola_Oahu_Resilience_Strategy.pdf

SECTION 8: IMPLEMENTATION PLAN

Board of Water Supply (BWS), 2022, *BWS Water Shortage Response and Recovery Plan*, City and County of Honolulu, https://www.boardofwatersupply.com/water-resources/bws-initiatives/water-shortage-plan

Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), 2016, *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments*, U.S. Department of Health and Human Services, https://archive.cdc.gov/#/details?url=https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf

Department of Planning and Permitting (DPP), 2026, *Development Plans and Sustainable Communities Plans*, City and County of Honolulu https://www.honolulu.gov/dpp/planning/applying-for-changes/dp-scp/ (accessed June 8, 2026)

Frazier, A.G., et al., 2022, *A Century of Drought in Hawai'i: Geospatial Analysis and Synthesis across Hydrological, Ecological, and Socioeconomic Scales*, Sustainability, 14(19), 12023, https://doi.org/10.3390/su141912023

National Integrated Drought Information System (NIDIS), n.d., *Drought Impacts*, Drought.gov, https://www.drought.gov/impacts.

National Oceanic and Atmospheric Administration (NOAA) and National Weather Service (NWS), *WetBulb Globe Temperature (WBGT)*, https://www.weather.gov/tsa/wbgt

State of Hawai'i Department of Land and Natural Resources (DLNR), Commission on Water Resource Management (CWRM), 2017, *Revised Hawai'i Drought Plan: 2017 Update*, State of Hawai'i, https://files.hawaii.gov/dlnr/cwrm/planning/HDP2017.pdf

U.S. Department of Agriculture (USDA) Forest Service, 2024, *Wildfire Risk to Communities Layer Explorer*, https://experience.arcgis.com/experience/78e7e78bcef64dfc98cf13e2e0eae156

WHAT GUIDES OUR ACTIONS

Community | ʻĀina | Wai | Infrastructure

Our actions work toward a resilient natural and built environment for our communities and ʻāina. These actions enable us to advance projects to address climate impacts on City infrastructure, including water, wastewater, stormwater, roads, and facilities. The One Water Honolulu Plan is a holistic and collaborative approach to investing in infrastructure across our water cycle that will improve critical services for our communities.

Download the One Water Honolulu Plan and track our implementation progress at **www.onewaterhonolulu.org**.

One Water Honolulu Plan

www.onewaterhonolulu.org