

APPENDIX D | CLIMATE CHANGE ADAPTATION FRAMEWORK

CONNECTING TO THE ONE WATER PLAN

This appendix provides additional detailed information that correlates to the following sections and figures.

CORRELATING SECTIONS AND INFORMATION

5 Climate Hotspot Identification Process

5.2 Climate Exposure Mapping

App. D Sec. 2.1 further explains which threats and assets were included in the geospatial analysis and the data sources for mapping layers. Also relates to App. E, which contains detail on GIS layers and example maps.

5.3 Risk Scores

App. D Sec. 2.2 contains further elaboration on how risk scores and consequence scores were used to determine total risk scores.

5.5 Hotspot Identification and Prioritization

App. D Sec. 3.1 contains further details on how risk mapping and known areas of concern were used to identify hotspots.

App. D Sec. 3.2 contains further details about the criteria and process used to prioritize hotspots.

CORRELATING SECTIONS AND INFORMATION

6 Results by Planning Region**6.2–6.9 Results of Prioritized Hotspots**

App. D Sec. 3.1 brings together the process of the infrastructure risk screening and known areas of concern.

App. D Sec. 3.2 provides further information on the process and results of hotspot identification and prioritization.

App. D Sec. 3.3 presents the project identification process including brainstorming of goals.

7 Project Development and Prioritization**7.1 Project Identification**

App. D Sec. 3.3 further documents the six steps of project identification and shares examples from the workshops.

7.2 Prioritization Criteria

App. D Sec. 3.4 contains further elaboration on how prioritization scores were assigned and outlines the balancing process to determine the final projects list.

7.3 Project Opportunities and Benefits

App. D Sec. 3.4.2 contains the full list of potential OWH projects, including those that did not make the prioritized list.

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SECTION D.1: CLIMATE CHANGE ADAPTATION FRAMEWORK PURPOSE AND OVERVIEW

D.1.1 PURPOSE

The purpose of this Appendix is to document the processes and content reviewed and analyzed for the Climate Change Adaptation Framework that was developed for the One Water Honolulu Plan (Plan). The Climate Change Adaptation Framework was developed to identify areas with present and future climate risks and support the City and County of Honolulu (City) to build greater resilience. Mapping exposure of the City's water infrastructure to climate hazards like flooding and sea level rise and determining risk scores for these assets helps to identify the island's most vulnerable water infrastructure. Combining potential infrastructure risk with local context from past planning and City knowledge helps to identify and prioritize locations and strategies to support the development of actionable projects to increase infrastructure resilience.

Ultimately, the outcomes of the Climate Change Adaptation Framework inform the Plan's deliverables. The Hotspot Profiles are based on the information collected within the climate risk analysis and can be carried forward into further project planning efforts. The One Water Honolulu Project List, which is incorporated into the Implementation Plan, is based on the results of the project prioritization, and will inform the next steps for the One Water Panel (Panel).

D.1.2 OVERVIEW

The Climate Change Adaptation Framework is a risk screening process that identifies areas and assets on the island that are projected to be most impacted by or at risk from various climate hazards, as well as tsunamis. Each step in the framework is shown on Figure D-1 and further explained in subsequent sections of this Appendix.

The Climate Change Adaptation Framework follows a structured, two-part workflow. It begins with Part 1, a broad, islandwide spatial analysis, before Part 2 focuses on specific areas and regions that are projected to be impacted the most by identified climate risks.

The goal of Part 1 is to screen thousands of threat-asset pairs to identify the highest risk areas. 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:

- **Mapping Exposure:** Using GIS technology to identify the exposure of assets to climate hazards
- **Assessing Consequence:** Estimating the impact of each hazard on each asset type, determined through collaborative discussion with the Panel and Leadership Group

- **Estimating Likelihood:** Estimating how often a climate threat may occur using available literature and historical and projected data for each threat
- **Calculating Risk Scores:** 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. The goal of Part 2 is to support development of a prioritized list of projects that are ready for planning, design, and pursuing funding for implementation. This includes:

- **Known Areas of Concern:** Reviewing past and existing planning efforts, previous stakeholder engagement, and direct input from the 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
- **Adaptation Strategies:** Evaluating a range of options to build resilience for each prioritized hotspot

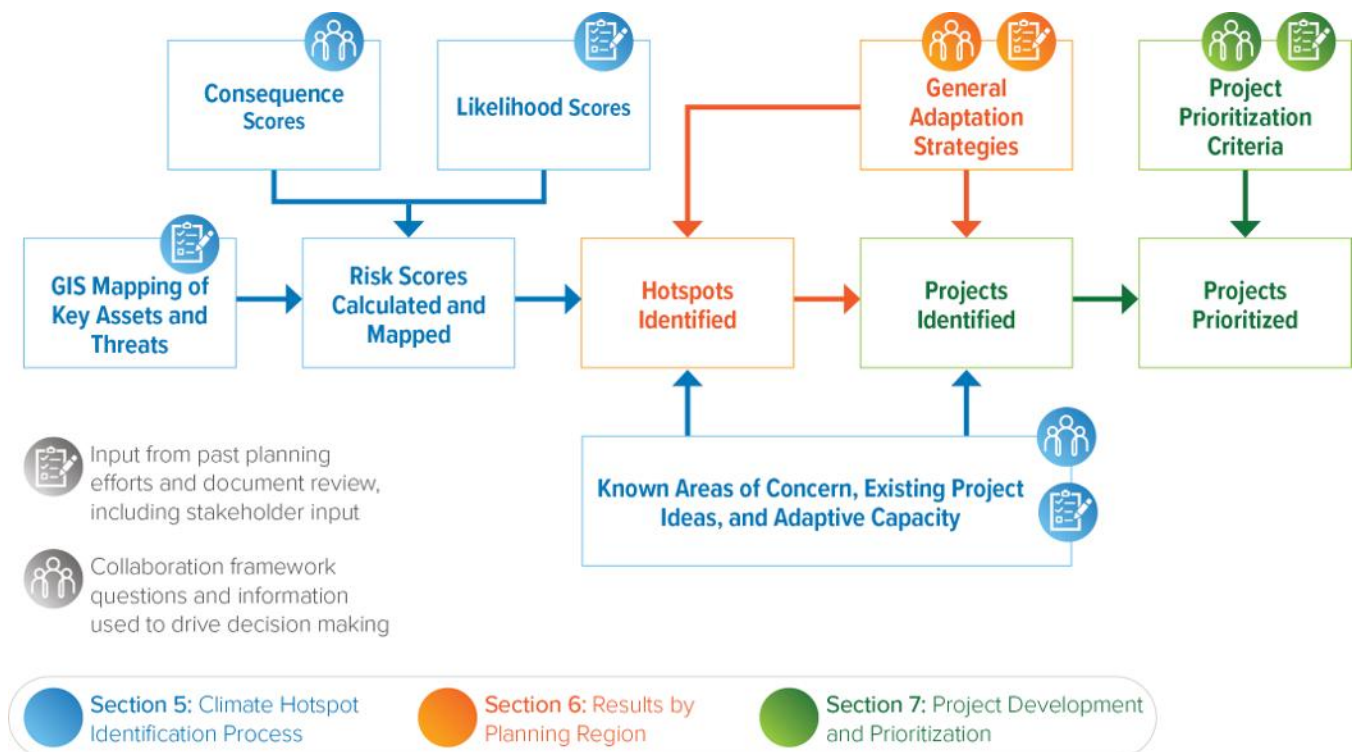


Figure D-1. Climate change adaptation framework

SECTION D.2: PART 1: RISK SCREENING

D.2.1 THREAT AND ASSET MAPPING

The first step in the Climate Change Adaptation Framework is to map climate threats and key water assets to understand where and to what extent water assets are exposed to various climate threats. This section explains which threats and assets were included in this geospatial analysis and the data sources for these mapping layers. These geospatial data were compiled in an ArcGIS mapping tool that was developed specifically for use in this Plan.

D.2.1.1 CLIMATE AND OTHER THREATS

This Plan considers threats—six climate and one natural hazard—relevant to O‘ahu. Each threat is defined by a hazard intensity and each intensity (such as hurricane category or height of sea level rise) is assigned an extent and likelihood. Climate threat mapping involves determining the spatial extent of impact for each hazard. This spatial extent, or “footprint,” determines which assets are affected by the threat. Note that the terms “threat” and “hazard” are used interchangeably throughout this Appendix. Relevant terms to the risk methodology are defined in Table D-1. Data sources for threat and asset mapping are documented in Plan Appendix E.

Table D-1. Glossary of Terms

TERM	DEFINITION
One Water Asset	The physical infrastructure related to water, wastewater, and stormwater including roads, streams, beaches, and parks.
Climate Threat/Hazard	The natural phenomena that can cause damage to assets of interest. In particular, climate hazards are those that are intensified or driven by climate change. The terms “threat” and “hazard” are used interchangeably.
Likelihood	The chance or probability of event occurrence. Annual likelihood is the probability the event (hazard) will occur in any given year. In this Plan, likelihood is reported as the probability that a hazard will occur within two future timeframes: mid-century and end-of-century. Likelihood is a property of a climate threat/hazard.
Exposure	The physical overlap between hazards and assets. An asset with exposure to a given hazard could experience physical impacts from that hazard.
Consequence	The potential impact of a hazard on a particular asset. Consequence often describes damage, loss in functionality, or monetary loss.
Risk	The measure of potential loss, calculated as the product of the likelihood of a climate threat and the consequence to an asset.

SEA LEVEL RISE

Sea level rise (SLR) is expected to impact One Water assets through multiple mechanisms: annual high wave flooding, passive flooding, drainage backflow, coastal erosion, and groundwater rise/inundation. Each of these mechanisms has a different spatial extent of impact; however, they are based on the same underlying SLR assumptions and data. SLR risks for this Plan are based on two planning horizons: mid-century (2050) and end-of-century (2100). SLR data was leveraged from the University of Hawai‘i at Manoa’s (UH’s) Climate Resilience Collaborative. This data shows the spatial extent of flooding for various SLR hazards at 1 foot increments up to 10 feet. The spatial extent is based on modeling conducted by UH based on local projections for Moku o Lo‘e Island tide gauge and data provided by the NASA intermediate high scenario for mid- and end-of-century.¹

Use of the intermediate high scenario is recommended in analyzing potential impacts to critical infrastructure per the Mayor’s Directive No. 18-2 on City and County of Honolulu Actions to Address Climate Change and Sea Level Rise and the O‘ahu Climate Change Commission Guidance 2023 Update. Data from NASA’s intermediate high scenario project an SLR of 1.23 feet for mid-century and 5.83 feet for end-of-century above mean higher high water (MHHW) for Moku o Lo‘e Island tide gauge, as shown on Figure D-2 and Figure D-3. NASA Sea Level Rise for Different Sea Level Scenarios featuring 2100 values for Moku o Lo‘e Island

These values represent “still water” or static conditions, which do not reflect wave dynamics.

¹ According to the Climate Resilience Collaborative: “NASA’s Intermediate High scenario projects a scenario where the rate of rising seas is at the higher end of the spectrum. This projection takes into account potential accelerations in the melting of polar ice and increased warming of the oceans. While this scenario is considered less likely, it is crucial for planners and policymakers to incorporate such possibilities into their long-term strategies to ensure resilience of critical infrastructure in the face of uncertainty.” (Climate Resilience Collaborative, 2026)

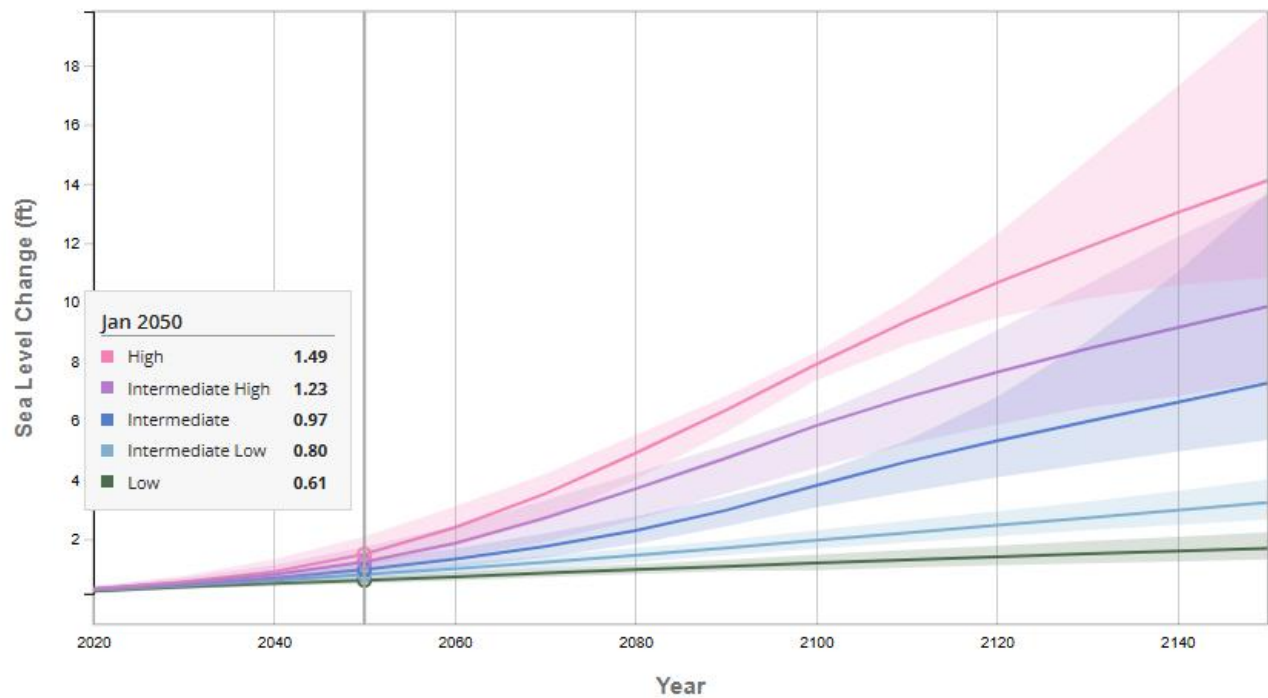


Figure D-2. NASA Sea Level Rise for Different Sea Level Scenarios featuring 2050 values for Moku o Lo'e Island (Source: NASA, 2026)

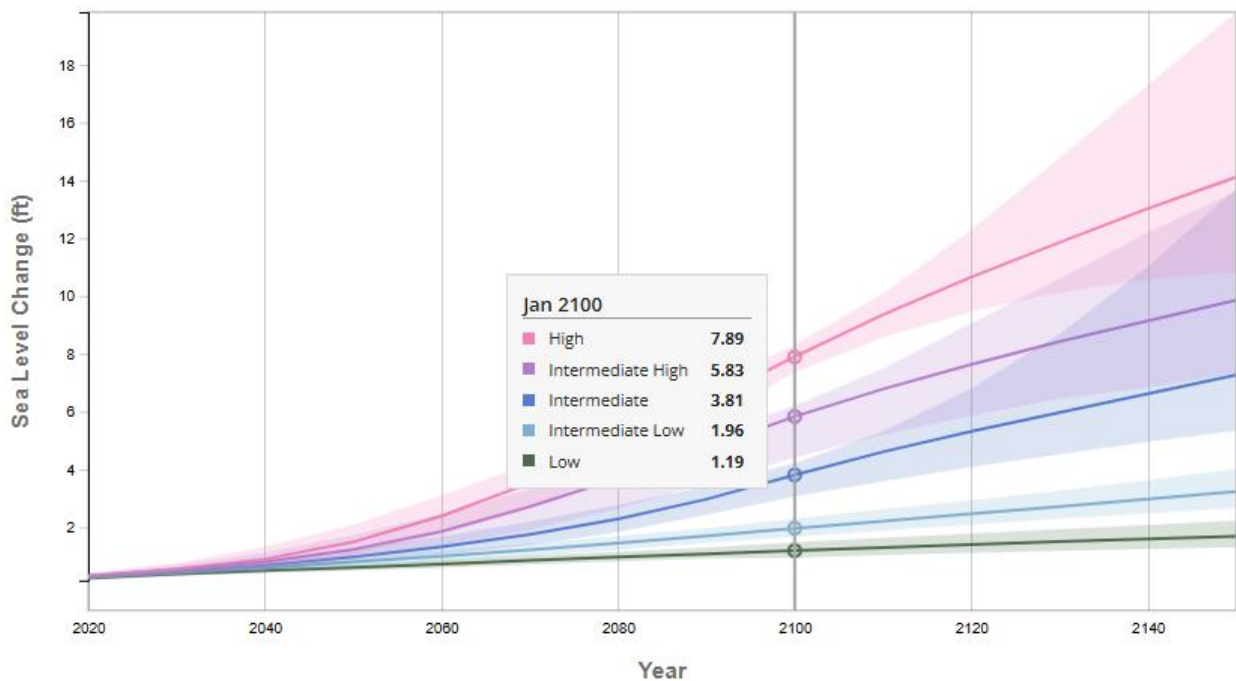


Figure D-3. NASA Sea Level Rise for Different Sea Level Scenarios featuring 2100 values for Moku o Lo'e Island (Source: NASA, 2026)

The City Climate Change Commission recommends adding elevation for planning for projects with low flood tolerance (e.g., critical infrastructure projects). This elevation can be in the form of adding 1 foot for King tides and 1 foot for runoff accumulation or by adding additional depth to account for the 100-year extreme water level. At the Moku o Lo‘e Island tide gauge, the 100-year extreme water level is 1.52 feet above MHHW, as shown on Figure D-4. Thus, a value of 1.52 ft was added to projected mid-century and end-of-century values (1.23 feet and 5.83 feet, respectively) to represent the 100-year extreme water level. This addition results in SLR planning levels of 2.75 and 7.35 feet for mid- and end-of-century, respectively.

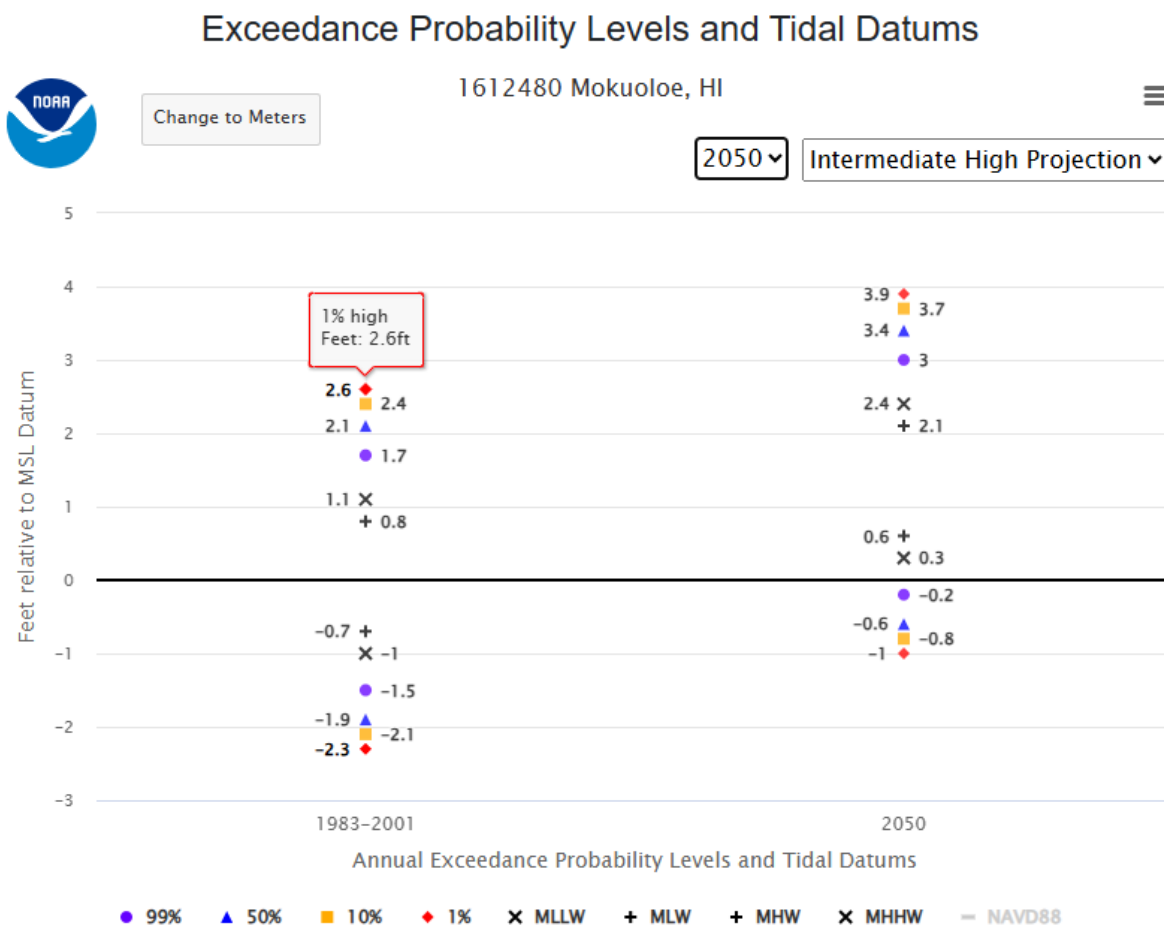


Figure D-4. Exceedance Probability Levels and Tidal Datums page for Moku o Lo‘e Island tide gauge (Source: NOAA, 2026)

Because the SLR projection layers are in 1-foot increments, both values are conservatively rounded up to 3 feet for mid-century and 8 feet for end-of-century. See the call out box on the following page that summarizes the process of determining these numbers. In addition to considering 3 and 8 feet, a 1-foot SLR level was also included in the analysis to identify locations with imminent impacts from SLR.

Approach to SLR Level Selection:

Maps for SLR inundation are pulled from the SLR viewer, which maps mean higher-high water (MHHW) under SLR in 1-foot increments. Levels selected for analysis represent SLR plus the 100-year extreme tide level. The 100-year extreme water level at Moku o Lo‘e Island gauge (similar values to the Honolulu gauge) is 1.52 feet above MHHW. SLR projections for mid-century (2050) and end-of-century (2100) assume the intermediate-high scenario.

The resulting inundation scenarios represent areas flooded by a 100-year extreme water level. All inundation mapping from the viewer is based on “still water” or static conditions, which do not reflect wave dynamics (and therefore do not consider changes in future 100-year extreme water level).

Here's a quick break down of the approach and the **decision** (in **bold**).

Near-Term:

- A **SLR value of 1 foot was included in the analysis** at the request of the One Water Panel to help identify assets most imminently threatened by SLR.
- This scenario represents MHHW (rather than the 100-year extreme water level as described). This level is smaller than the 100-year extreme water level at present day.

Mid-Century:

- Mid-century inundation (relative to historical MHHW): 1.23 feet (projected SLR) + 1.52 feet (100-year extreme water level) = 2.75 feet

Decision made to round up and select 3-foot inundation from SLR viewer layers as a conservative estimate.

End-of-Century:

- End-of-century inundation (relative to historical MHHW): 5.83 feet (projected SLR) + 1.52 feet (100-year extreme water level) = 7.35 feet

Decision made to round up and select 8-foot inundation from SLR viewer layers as a conservative estimate.

The SLR hazard layers obtained from UH include the following flooding mechanisms:

- **Overland (Annual High Wave) Flooding:** The area inundated by annual high wave-driven flooding is mapped for overland flooding and is based on a source model that uses hydrodynamic simulations of wave run-up under future sea levels (Mihami et al., 2022).
- **Passive Flooding:** Data from an initial assessment for passive flooding provided the foundation for spatial data layers that visualize low-lying areas that are susceptible to static inundation under SLR, without considering urban flood mechanisms such as storm drain backup (Anderson et al., 2018).
- **Drainage Backflow:** To consider drainage backflow, the O‘ahu Drainage Backflow layer was used (Habel et al., 2024). This spatial data layer considers the elevation of coastal water above coastal drainage and outflow systems, showing the potential impact of urban flooding in combination with passive SLR.
- **Coastal Erosion:** For coastal erosion, a coastal erosion hazard zone map layer was used (Vitousek et al., 2017). This data layer represents the spatial extent with an 80 percent likelihood of exposure to erosion under probabilistic modeling for a given amount of SLR. The model is based on process-based coastline evolution considering both long-shore and cross-shore wave action under different amounts of SLR (Vitousek et al., 2017). This layer applies to sandy coastline areas but not rocky shorelines; therefore, some areas of the island are not assessed for coastal erosion.
- **Groundwater Inundation and Emergent Groundwater:** Both emergent and shallow groundwater are considered for groundwater inundation. Emergent groundwater includes water within 1 foot of the ground surface (or above the ground surface). Shallow groundwater includes water between 1 to 5 feet of the ground surface. This hazard captures both flooding from groundwater inundation and impacts to subsurface infrastructure. This Plan utilizes map layers that were published during the data collection period of plan development. At that time, emergent groundwater data (Habel et al., 2017) and groundwater inundation (Habel et al., 2020) data layers were available for several but not all regions of O‘ahu; therefore, some areas of the island are not assessed for groundwater rise impacts.

For all spatial data layers discussed, the SLR levels of 1, 3, and 8 feet were used to assess potential exposure of infrastructure assets to hazards.

HURRICANE

Hurricane hazard is assessed for four intensity levels: Hurricane Categories 1 through 4 on the Saffir-Simpson scale. Hurricane inundation is based on model projections, calibrated to historical data. Hurricane categories are based on the Saffir-Simpson wind scale, which uses sustained wind speeds (measured in miles per hour [mph]) to determine the hurricane’s rating, shown in [Table D-2](#). Higher category numbers represent more intense storms, measured by wind speed but also affecting the

amount of storm surge. Footprint areas for the inundation from each of the Category 1 to 4 hurricanes on Hawai‘i are from the National Oceanic and Atmospheric Administration (NOAA) Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model. The Maximum of Maximums (MOMs) version of the SLOSH model was used, which gives the maximum surge height across all simulated hurricanes, regardless of storm trajectory, speed, or landfall location (NOAA, 2018). Category 5 hurricanes are excluded from SLOSH maps for the state of Hawai‘i and thus are not included in this risk assessment.

Table D-2. Hurricane Categories on the Saffir-Simpson Scale

HURRICANE CATEGORY	SUSTAINED WIND SPEEDS
1	74–95 mph
2	96–110 mph
3	111–129 mph
4	130–156 mph
5	157+ mph

Each map of hurricane storm surge inundation from Category 1 to 4 hurricanes is combined into a binary footprint of areas that are within or outside the inundation area. Areas are thus generated for each category storm, with overlap (i.e., the area inundated by a Category 3 storm is also inundated in a Category 4 storm).

TSUNAMI

Tsunami is a seismic (non-climate) hazard but is included due to local relevance. Tsunami hazard has two intensities that are considered in the analysis. The coastal zone that would be impacted by tsunami inundation is called the Tsunami Evacuation (Evac) Zone. This spatial extent covers areas that would be affected by most tsunami occurrences. A zone slightly inland of this coastal zone is defined as the Extreme Tsunami Evacuation Zone (Hawai‘i Statewide GIS, 2025a). This zone would only be impacted by extreme tsunamis, such as one generated by a Magnitude 9.0 event in the Eastern Aleutian Islands (USGS, 2016). These two zones are defined by present-day sea level conditions, and while future SLR could expand the spatial extent of tsunami impact, this change is not considered in this Plan.

100-YEAR STORM

The 100-year storm is defined by the present-day Federal Emergency Management Agency (FEMA) 100-year floodplain. The O‘ahu Digital Flood Insurance Rate Map (DFIRM) is an updated set of FEMA Special Flood Hazard Areas (SFHAs) within the City. SFHAs are defined as areas that will be inundated by the 100-year, or 0.01 annual probability, flood (Hawai‘i Statewide GIS Program, 2025b). The 100-year floodplain is based on model simulation, calibrated to historical data. All areas that are

in SFHA zones are mapped as the hazard area for the 100-year storm. This mapping used O‘ahu’s 2025 preliminary Flood Insurance Rate Maps (FIRMs) that were adopted in June 2026.

WILDFIRE

Wildfire hazard is mapped based on the Department of Land and Natural Resources (DLNR) Communities at Risk (CAR) from Wild-Land Fires mapping project. The GIS data is available from the Hawai‘i Statewide GIS Program, giving direct Fire Risk Areas as polygons (Hawai‘i Statewide GIS Program, 2024). Areas within these polygons are deemed to be wildfire hazard areas. Wildfire risk areas are based on fuel, community engagement, water and firefighting resources, and preparedness (DLNR, 2024). Areas with high wildfire likelihood are termed “high risk” in the CAR report, and in decreasing likelihood are designated “medium risk” and “low risk.” For consistency in terminology, these areas are called high, medium, and low likelihood in this report. The GIS data layers maintain the source data names. Therefore, the three hazard footprints that are mapped are the Low Likelihood Area, Medium Likelihood Area, and High Likelihood Area.

DROUGHT

Drought hazard area is determined from the Revised Hawai‘i Drought Plan (DLNR, 2017). The drought footprint encompasses areas identified as being at risk of agricultural drought and/or water supply drought. Drought exposure areas are based on historical data. Low, medium, and high risk areas are defined in the DLNR report by the vulnerability of the area to drought, defined by the Standardized Precipitation Index. Areas with high dependence on surface water are considered higher risk than those that have sufficient groundwater. While these areas are defined by “risk” in the DLNR report, this Plan refers to them as “susceptible” in the hazard definition for consistency in terminology. Therefore, there are three defined drought hazard areas:

- **Low:** Low susceptibility areas are areas that are only expected to be impacted by extreme drought.
- **Medium:** Medium susceptibility areas are areas that are expected to be impacted by severe or extreme drought.
- **High:** High susceptibility areas are areas that are expected to be impacted even by moderate drought.

EXTREME HEAT

The Department of Design and Construction (DDC) Climate Change Design Guidelines (internal City document) define extreme heat as days with a high ambient air temperature over 90 degrees Fahrenheit (°F). Extreme heat is based on historical data. Single-day heat values were measured on August 31, 2019, which was a record high temperature day (CCH GIS, 2022). Values were measured in heat index, which determines the perceived heat by humans by accounting for relative humidity and ambient air temperature. Because the mapping was measured by citizen science, the spatial

extent is not complete but focused on areas in O‘ahu’s Urban land use category. Given that most water infrastructure assets are also in Urban locations, the lack of heat mapping in some inaccessible areas is not likely to affect this analysis. Afternoon values are taken as the high temperature measurement, and areas are categorized by their high temperature: those with a heat index measurement above 90 °F, those with a heat index measurement above 85 °F (but below 90 °F), and all other areas. These three areas are used to define hazard footprints for extreme heat.

D.2.1.2 ONE WATER ASSETS

The One Water assets that are included in the risk assessment include water, wastewater, and stormwater infrastructure, as well as roads, dams, and base yards. Within each of these categories, many specific assets are included. There are a total of approximately 512,000 One Water assets included in this City analysis.

For water infrastructure, Board of Water Supply (BWS) wells, BWS well treatment plants, and water pipes were included in this analysis, with the number of each asset shown in Table D-3. Available water asset data is limited but provides a reasonable approximation of areas with water assets and a good estimate of the distribution of risk among these areas.

Table D-3. Water Infrastructure One Water Assets and Count

ASSET	NUMBER OF ASSETS
BWS Wells	375
BWS Well Treatment Plants	11
Water Pipe	114,026

Wastewater infrastructure includes sewer submersible pumps, sewer treatment plants, sewer pump stations, sewer mains, sewer laterals, and priority cesspools. Cesspools are not City infrastructure as they are privately-owned. The count of each wastewater asset type is shown in Table D-4.

Table D-4. Wastewater Infrastructure One Water Assets and Count

ASSET	NUMBER OF ASSETS
Sewer Submersible Pump	973
Sewer Treatment Plant	12
Sewer Pump Station	93
Sewer Main	54,427
Sewer Lateral	165,692
Priority Cesspool	82,141

Stormwater assets include stormwater structures, stormwater conduits, perennial streams, and intermittent streams. The count of each stormwater asset type is in Table D-5. Available stormwater

asset data is limited. All the stormwater structures included are catch basins. Stormwater conduits include pipelines, culverts, and open channels.

Table D-5. Stormwater Infrastructure One Water Assets and Count

ASSET	NUMBER OF ASSETS
Stormwater Structures	31,323
Stormwater Conduits	58,724
Perennial Stream	851
Intermittent Stream	1,399

The rest of the One Water infrastructure assets include base yards, dams, and roads. Road infrastructure is limited to major streets, which is a limitation of the assessment. Specific asset types and counts for the additional One Water infrastructure are listed in Table D-6.

Table D-6. Additional One Water Infrastructure Assets and Count

ASSET	NUMBER OF ASSETS
Base Yard	20
Dam	124
Major Street	1,602

The initial 512,000 One Water Assets were reduced for the risk analysis due to computational limitations and the need to focus the analysis on more critical assets for which failure would impact the ability to serve customers and communities. To focus on high-value assets, minor assets, including sewer laterals, sewer pipelines with a diameter of less than 12 inches, sewer pipelines labeled as “modeling links,” stormwater catch basins, and stormwater grates and drains, were removed from analysis. In the risk analysis, a total of 233,802 assets were given risk scores. Note that following the completion of this risk analysis, beaches and minor roads were added to the definition of “One Water Assets.” These assets were considered during the project development phase of the Climate Change Adaptation Framework but were not retroactively added to the risk assessment.

D.2.1.3 COMMUNITY ASSETS

Additional assets that serve the community, termed “community assets,” including electrical transmission lines and substations, hospitals/clinics, police stations, schools, fire stations, and bridges are also included in the mapping tool developed for this assessment, but not in the risk assessment itself. These community assets are not considered One Water assets, so they are not included in the risk analysis, but they are used to identify additional concerns and are considered within the known areas of concern documented from past and current planning efforts and input from City department staff. These support identification of exposed non-water infrastructure assets during the hotspot identification process. Community assets are useful to understand the broader impact of

infrastructure failure in those locations. Sources for community assets are documented in Plan Appendix E.

ECOLOGICAL FEATURES

Spatial data layers for ecological features are also visible in the risk mapping tool to provide additional context for potential hotspots. Ecological features included aquifers, elevation contours, watersheds, reserves, critical habitat ecosystem, coral reefs, and wetlands.

SOCIO-CULTURAL RESOURCES

Additional socio-cultural resources are included in the risk mapping tool for additional context used in identifying and characterizing hotspots. Socio-cultural resources include Hawaiian Homelands, land use zoning, and the O‘ahu Social Vulnerability Index (SoVI).

D.2.2 RISK SCORES

In order to assess which One Water assets are most vulnerable to climate threats, a risk scoring system was developed to assign risk scores to individual assets across the island of O‘ahu. Risk scores are a combination of threat likelihood, exposure, and consequence. Threat likelihood refers to the probability of occurrence of the climate hazard over a specific planning horizon. Exposure to a threat is considered as binary, so a climate threat poses a risk to a specific asset if it is within the footprint of that hazard and poses no risk from that threat if it is not within the footprint (i.e., not exposed to the hazard). The exposure component is embedded in the likelihood scores. Consequence refers to the potential impact of a threat to a particular asset. The consequence component reflects the damages or loss of functionality that each asset is expected to experience given the impact of the threat.

In this framework, risk is defined as the potential for damage to physical water infrastructure assets and/or reduced operating capacity of those assets. The total risk score is a summation of the risk scores to a single infrastructure asset over the considered threats. Within each threat, if an asset could be exposed to multiple severities of hazard (e.g., hurricane Category 1, Category 2, and Category 3), then the likelihood is the average across all severities. For the other hazards that do not have overlapping severities, such as wildfire and drought, each asset is only in one severity or likelihood zone.

D.2.2.1 LIKELIHOOD SCORES

The purpose of likelihood scores is to capture the probabilities of climate hazard impacts occurring. Likelihood scores vary spatially for each threat based on the estimated footprint of that threat; if an area is not expected to be exposed to a climate threat, that area gets a likelihood score of 0. Areas that are expected to be exposed to that threat are assigned a score between 1 and 5, depending on the relative likelihood of that threat. The 1 through 5 likelihood scale was developed based on the

Intergovernmental Panel on Climate Change (IPCC) likelihood scale (IPCC, 2023). The definitions of each of the probability ranges converted to a likelihood score are shown in Table D-7. Likelihood scores are assigned to each threat for two future time horizons: 2055 and 2100. The mid-century time horizon (2055) aligns with the 30-year planning horizon for the One Water Capital Improvements Program (CIP). The end-of-century time horizon (2100) allows for the consideration of future impacts to existing and planned infrastructure as climate conditions continue to change and become more severe.

Table D-7. Likelihood Scores and their Definitions

LIKELIHOOD SCORE	DEFINITION
0	Area not exposed to threat
1	Extremely unlikely, <5% chance of occurring over the planning horizon
2	Unlikely, 5–33% chance of occurring over the planning horizon
3	Possible, 33–66% chance of occurring over the planning horizon
4	Likely, 66–95% chance of occurring over the planning horizon
5	Extremely likely, >95% chance of occurring over the planning horizon

Likelihood scores are assigned based on the climate threat itself and vary across O‘ahu due to the spatial extent of each threat with respect to the island. Note that likelihood scores do not vary by asset type (i.e., all asset types within the spatial footprint of a given climate threat will receive the same likelihood score. Likelihood scores for each climate threat are documented in Table D-8. The first column describes the threat and impacted area that receives each of the scores. For every threat, areas outside of the defined areas receive a score of 0 for that hazard.

Table D-8. Likelihood Scores for Each Climate Threat for 2055 and 2100

THREAT AND IMPACTED AREA	SCORE (2055)	SCORE (2100)	SOURCE
SLR & Coastal Erosion – 1 ft	5	5	NOAA Likelihood by Scenario
SLR & Coastal Erosion – 3 ft	3	4	
SLR & Coastal Erosion – 8 ft	1	1	
Hurricane Category 1 Area	3	5	AWWA J100 Approach
Hurricane Category 2 Area	3	5	
Hurricane Category 3 Area	1	1	
Hurricane Category 4 Area	1	1	
Tsunami Evacuation Zone	5	5	Historical Record & Earthquake Probability
Extreme Tsunami Evacuation Zone	1	1	
100-Year Storm	3	4	Historical Record & Projected Climate Change Increase
Wildfire – Low Likelihood Area	2	2	Qualitative, DLNR CAR Mapping
Wildfire – Medium Likelihood Area	3	3	
Wildfire – High Likelihood Area	4	4	
Drought – High Susceptibility Area	5	5	DLNR Drought Risk and Vulnerability Assessment
Drought – Medium Susceptibility Area	5	5	
Drought – Low Susceptibility Area	4	5	
Extreme Heat – 2019 > 90 °F Area	5	5	Historical Record & Projected Climate Change Increase
Extreme Heat – 2019 > 85 °F Area	3	4	

SEA LEVEL RISE AND COASTAL EROSION

SLR likelihood scores are applied to multiple threats driven by SLR: overland flooding, coastal erosion, and groundwater rise. While each of those threats has a different consequence, they are all driven by the same underlying SLR, so they have the same likelihood score. Three impacted areas are used for SLR, corresponding to 1, 3, and 8 feet of inundation (rounded). These footprints account for inundation level above present-day local mean sea level. “Static” SLR levels of 1.2 and 5.8 feet were selected as a planning threshold representing mid- and end-of-century levels (see SLR content in Section 2.1.1). While the hazard extents include the extreme tide, making them equate to 3 and 8 feet of inundation, the likelihood scores are based on the underlying 1.2 and 5.8 foot levels. Also included in the analysis was 1 foot of SLR to identify which assets would likely be the first to be impacted by SLR. Given that temporary inundation similar to 1 foot of SLR already has a 50 percent likelihood of

happening in any given year due to high tides, as shown on Figure D-4, 1 foot of SLR was assigned a likelihood of 5, or “extremely likely,” for both the mid- and end-of-century time frames.

Likelihood for SLR inundation levels is based on the NOAA report containing various trajectories of climate change from the IPCC for the United States context (Sweet et al., 2022). For 2055, scores are based on SLR projections at the Moku o Lo‘e Island tide gauge. At the Moku o Lo‘e Island tide gauge, over a foot of SLR is within the likely range by mid-century for the Intermediate, Intermediate High, and High SLR scenarios, as shown on Figure D-2. Based on this, the likelihood for 1.2 feet of inundation is qualitatively interpreted as a score of 3 (possible). However, for 2055, 5.8 feet of sea level rise falls outside the likely range for even the highest SLR scenario, so it is assigned a likelihood score of 1 (extremely unlikely).

For the 2100 score, global mean sea level rise projections are used, as they have more directly quantified likelihoods, shown on Figure D-5 (Sweet et al., 2022). While probabilities are not formally assigned to individual emissions scenarios, probabilities are assigned to SLR levels given a particular emissions trajectory. Likelihood is based on 2.0 to 3.0 degrees Celsius (°C) of warming by 2100. These scenarios align with the current best estimate trajectory for the end of century, which ranges from 1.8 to 3.6 °C for the three moderate scenarios (IPCC, 2023). As shown on Figure D-5, under these degrees of warming, the likelihood of 1.2 feet (approximately 0.37 meters) of global mean SLR is between 50 and 82 percent, given a score of 4 (likely) by 2100. For the same scenarios, likelihood of 5.8 feet (approximately 1.78 meters) of global mean SLR is <1 percent, given a score of 1 (extremely unlikely) by 2100 (see Figure D-5).

Global Mean Surface Air Temperature 2081–2100	1.5°C	2.0°C	3.0°C	4.0°C	5.0°C	Unknown Likelihood, High Impact – Low Emissions	Unknown Likelihood, High Impact – Very High Emissions
Closest Emissions Scenario–Based GMSL Projection	Low (SSP1-2.6)	Low (SSP1-2.6) to Intermediate (SSP2-4.5)	Intermediate (SSP2-4.5) to High (SSP3-7.0)	High (SSP3-7.0)	Very High (SSP5-8.5)	Low (SSP1-2.6), <i>Low Confidence</i> processes	Very High (SSP5-8.5), <i>Low Confidence</i> processes
Total (2050)	0.18 (0.16–0.24)	0.20 (0.17–0.26)	0.21 (0.18–0.27)	0.22 (0.19–0.28)	0.25 (0.22–0.31)	0.20 (0.16–0.31)	0.24 (0.20–0.40)
Total (2100)	0.44 (0.34–0.59)	0.51 (0.40–0.69)	0.61 (0.50–0.81)	0.70 (0.58–0.92)	0.81 (0.69–1.05)	0.45 (0.32–0.79)	0.88 (0.63–1.60)
Bounding Median Scenarios in 2100	Low to Intermediate-Low	Intermediate-Low to Intermediate	Intermediate-Low to Intermediate	Intermediate-Low to Intermediate	Intermediate-Low to Intermediate	Low to Intermediate-Low	Intermediate-Low to Intermediate
Probability > Low (0.3 m) in 2100	92%	98%	>99%	>99%	>99%	89%	>99%
Probability > Int.-Low (0.5 m) in 2100	37%	50%	82%	97%	>99%	49%	96%
Probability > Int. (1.0 m) in 2100	<1%	2%	5%	10%	23%	7%	49%
Probability > Int.-High (1.5 m) in 2100	<1%	<1%	<1%	1%	2%	1%	20%
Probability > High (2.0 m) in 2100	<1%	<1%	<1%	<1%	< %	<1%	8%

Figure D-5. Table of global mean surface air temperature changes in degrees Celsius, total in Global Mean Sea Level (GMSL) projected rise in meters, and probability of global sea level rise thresholds by 2100 (Source: Sweet et al., 2022)

HURRICANE

Each hurricane category has a different likelihood for O‘ahu. The scoring approach for hurricanes follows the American Water Works Association (AWWA) Standard J100 Risk and Resilience Management of Water and Wastewater Systems approach (AWWA, 2023) using historical hurricane strike frequencies from the Creating Resilient Water Utilities Tool (EPA, 2025). From 1900 until 2022, O‘ahu experienced one Category 1 and one Category 2 hurricane strike, with no historical hurricane strikes from Categories 3 to 5. Thus, the historical annual likelihood of Category 1 and Category 2 hurricanes is approximately 1 in 122 or 0.8 percent. By 2100, hurricane likelihood near O‘ahu is expected to become 2 to 6 times higher due to changes in tropical cyclone genesis, tracks, and nonlinearity, consistent with increases in precipitation, mid-level humidity, and low-level relative vorticity—or spin—in the atmosphere (Murakami et al., 2013). Depending on this rate of increased likelihood, there is a 25 to 73 percent chance of a Category 1 or 2 hurricane occurring by 2055. Thus, Category 1 and 2 hurricanes are each assigned a likelihood score of 3 (possible) for the mid-century planning horizon. Based on the historical rates and potential increasing likelihood, it is estimated that between one and four Category 1 and Category 2 hurricanes will impact O‘ahu by 2100. Therefore, they are assigned a likelihood score of 5 (extremely likely) for the end-of-century time horizon.

Because no Category 3 to 5 events occurred within the historical record, and there is low confidence in projections of high intensity storms, Category 3 and 4 are assigned a score of 1 (extremely unlikely) for both 2055 and 2100.

TSUNAMI

Historical records of tsunamis on the Hawaiian islands from 1819 through 2002 include 26 tsunamis with flood elevations greater than 3.3 feet (1 meter), with 10 having caused significant damage on O‘ahu (Fletcher et al., 2002). Because there have been no additional tsunamis with significant flooding impacts since 2002, the estimated recurrence interval for tsunamis impacting O‘ahu is 21 years. Assuming no change in the occurrence rates due to climate change, one to two damaging tsunamis are anticipated to impact O‘ahu by 2055, and three to four are anticipated to impact O‘ahu by 2100. These projections result in a likelihood score for Tsunami Evacuation Zone of 5 (extremely likely). The extreme Tsunami Evacuation Zone is based on a possible Magnitude 9 earthquake in the Eastern Aleutian Islands, which has a <5 percent probability of occurrence over the next 50 years that is not expected to increase under climate change (Butler et al., 2016). By both 2055 and 2100, the resulting likelihood score is 1 (extremely unlikely).

100-YEAR STORM

The 100-year storm is inherently defined by its annual rate of occurrence (0.01). The climate hazard considered in this Plan reflects the current 100-year storm, meaning the storm intensity and spatial extent that is reflected in FEMA 100-year flood maps (Hawai‘i Statewide GIS Program, 2025b). Precipitation events are generally expected to get more frequent and severe in the future, so flooding due to the future 100-year storm will likely be more severe than the present-day 100-year storm. The primary driver of 100-year storm inundation in O‘ahu is extreme precipitation and resulting riverine flooding, as opposed to coastal storm surge. Thus, projections for changes in rainfall are used to inform the likelihood of the current 100-year storm under a future climate. Based on present-day likelihood, there is about a 30 percent chance of a 100-year storm occurring by 2055. Conservatively, presuming some increase in frequency of this level of rainfall event, the likelihood score assigned is 3 (possible). Projections for the end-of-century estimate indicate the frequency of events over 50 millimeters per day (mm/day) (current extreme rainfall rates in the study area are 40 to 60 mm/day) will increase by about 10 percent (Zhang et al., 2016). For 2100, the likelihood of occurrence without an increase in frequency is 75 percent, which is assigned a likelihood score of 4 (likely)—with or without an increase in the expected frequency of 10 percent.

WILDFIRE

Wildfire likelihood is assessed based on records within O‘ahu of seven wildfires within a 4-year period from 2018 to 2022. There is near certainty that a wildfire will occur somewhere in Hawai‘i each year (Department of Emergency Management, 2025), and climate projections and current trends both indicate increased wildfire occurrences under future climate conditions (IPCC, 2023). Based on

qualitative analysis, due to a lack of probabilistic projections, areas designated by the CAR mapping are used to distinguish between the wildfire likelihood (DLNR, 2014). Areas with high wildfire likelihood are assigned a likelihood score of 4 (likely) for both 2055 and 2100, areas with medium likelihood are given a score of 3 (possible) for both 2055 and 2100, and areas with low likelihood are given a score of 2 (unlikely) for both 2055 and 2100. These qualitative rankings reflect the differentiation from wildfire hazard mapping and avoid the extreme ends due to the spatial uncertainty in where a wildfire will impact Hawai‘i.

DROUGHT

Drought likelihood is based on the UH report Drought Risk and Vulnerability Assessment (University of Hawai‘i, 2003), which distinguishes between stages of drought (Mild, Moderate, Severe, and Extreme), as well as drought duration. It is expected that only the extreme droughts impact the low risk areas, while at least severe droughts impact the medium risk areas, and at least moderate droughts impact the high risk areas. While these areas are defined by “risk” in the UH report, we refer to their “susceptibility” in the hazard definition for consistency in terminology.

Drought frequencies are estimated using present-day frequencies over the planning horizons, as future climate drought mapping is not readily available for O‘ahu. Moderate and severe drought are expected to occur multiple times by 2055 (and, therefore by 2100). Therefore, the high and medium susceptibility areas receive likelihood scores of 5 (extremely likely) for both time horizons. Extreme drought is expected to occur multiple times by 2100, but there is a 70 percent chance of occurrence by 2055. Therefore, the low susceptibility area receives a score of 4 (likely) for 2055 and 5 (extremely likely) for 2100.

EXTREME HEAT

Extreme heat likelihood reflects the occurrence probability of at least one extreme heat event occurring in a given year. The DDC Climate Change Design Guidelines (internal document) define extreme heat as days with a high over 90 °F. Climate projections show high temperatures increasing slightly by the end of the century. Coupled Model Intercomparison Project Phase 6 (CMIP6) downscaled projections expect an additional 0 to 7 days of extreme heat (defined for CMIP6 as days above 95 °F) by 2100 (U.S. Federal Government, 2025). Average temperatures in Hawai‘i are expected to increase between 2 to 7 °F by 2100 (Zhang et al., 2016). Based on 2019 single-day mapping, many areas of O‘ahu already experience maximum high temperatures over 90 °F, and even over 95 °F. Regardless of low agreement from climate models on the change in annual high temperature for Hawai‘i, due to the widespread historical data from 2019 showing high temperatures in the DDC extreme heat definition, likelihood is set based on the historical record and anticipated minor increase in temperatures under climate change. Areas with existing annual high temperatures above 90 °F have an extreme heat likelihood score of 5 (extremely likely) for both 2055 and 2100. Due to the anticipated temperature increase, areas that currently (as of 2019 data) experience annual high temperatures of 85 to 90 °F are given extreme heat likelihood scores of 3 (possible) for 2055 and 4

(likely) for 2100. All assets fell within areas that measured at least 85 °F in the historical heat mapping data, so extreme heat likelihoods for areas measuring less than 85 °F were not developed for this analysis.

D.2.2.2 CONSEQUENCE SCORES

Consequence scores are used to define the level of damage and inoperability that would be incurred by exposure of an asset to a particular hazard. In this framework, the severity of the threat is considered as binary, so an asset either is or is not impacted by a threat, and all of the same asset type within the footprint of threat are impacted to the same degree. These scores were developed heuristically with input from experts and stakeholders with deep knowledge of the infrastructure assets. Consequence scores were workshopped at a meeting with the Panel in February 2025 and later reviewed and confirmed by members of the Panel. In the meeting, Panel members ranked the level of consequence as either minimal (little or no impact to operations, little or no repair required), moderate (reduced operation, some repair or replacement needed), or significant (complete failure, inoperable for a long period, significant repair or total replacement needed). Participants used dot stickers to indicate their anticipated level of consequence between the three options on a chart listing asset type in the rows and threats in the columns. Responses from the meeting are shown on Figure D-6. This expert input was translated from minimal, moderate, and significant into consequence scores of 1, 3, and 5, then averaged across the responses to develop consequence scores for each threat/asset pair on a 1 to 5 scale. Definitions of the 1 to 5 consequence scores are shown in Table D-9. The average scores for each broad asset category (slab-mounted equipment, building facilities, pipelines, tanks, dams and earthen reservoirs, outfalls and drains, and roads and bridges) were then converted to specific infrastructure asset types to match the GIS threat and asset categories. This conversion was based on infrastructure and climate threat impact domain knowledge.



Figure D-6. Images from Panel input on qualitative consequences on different infrastructure to various hazards during the February 3, 2025 workshop. Different color dots represent panel input on infrastructure vulnerability.

Table D-9. Definitions of Each Numeric Consequence Score

CONSEQUENCE SCORE	DEFINITION
1	No impact to operations and/or no repair required
2	Minimal impact to operations and/or some repair required
3	Reduced operation and/or meaningful repair or some replacement required
4	Inoperable for a period of time and/or significant repair or partial replacement required
5	Complete failure and/or total replacement needed

Table D-10 shows the final consequence scores disaggregated by threat and asset type. Each asset in the inventory is assigned to an asset type. If no assets of that type are exposed to a particular threat, the consequence score was not evaluated and is marked as N/A. General trends signify that drought is

a low-consequence threat to most of the infrastructure types considered, with the exception that an extreme drought may pose significant consequences to the functionality of wells, and reduced functionality of earthen dams/reservoirs. Extreme heat is similarly low consequence for most of the infrastructure. On the higher-consequence side of the spectrum, permanent above-ground inundation from SLR poses significant consequences to the majority of infrastructure asset types. Wildfire is expected to cause high consequences for all except stormwater infrastructure, and other relatively high consequence events across most asset types are tsunami, hurricane, 100-year flood, coastal erosion, and groundwater rise (SLR).

Threat impact severity is implicitly included in the consequence scores, with no differentiation between the intensity of hazards. This simplification reflects the level of available information, both regarding the assets and threats, and provides a straightforward way to differentiate the risk scores. Severity is effectively a binary measure, so each asset either is or is not exposed to the threat, but there is no differentiation by, for example, the depth of flooding from one asset to another.

Table D-10. Consequence Scores for Specific Asset Types within the Various Water Systems for Impacts from Different Threats

SYSTEM	ASSET TYPE	TSUNAMI	HURRICANE	100-YR FLOOD	SLR – ABOVE-GROUND ²	SLR - GW ³	COASTAL EROSION	WILDFIRE	EXTREME HEAT	MILD DROUGHT	MODERATE DROUGHT	EXTREME DROUGHT
Wastewater	Sewer Submersible Pump	2	2	2	4	3	4	2	1	1	1	1
	Sewer Treatment Plant	4	4	4	5	4	N/A ⁴	4	2	1	1	1
	Sewer Pump Station	4	4	3	5	4	4	4	2	1	1	1
	Sewer Gravity Main	3	3	3	4	4	4	2	1	1	1	1
	Sewer Force Main	2	2	2	3	4	4	2	1	1	1	1
	Sewer Outfall	3	3	3	3	3	5	N/A ⁴	1	N/A ⁴	N/A ⁴	N/A ⁴
Stormwater	Stormwater Manhole	2	2	2	4	2	4	1	1	1	1	1
	Inlet/Outlet	4	4	4	5	3	5	1	1	1	1	1
	Other Structures	4	4	4	5	3	4	1	1	1	1	1
	Stormwater Conduits	4	4	4	5	3	4	2	1	1	1	1
Water	Wells	4	4	4	N/A ⁴	N/A ⁴	N/A ⁴	4	2	2	3	4
	Water Mains	2	2	2	3	4	4	3	1	1	1	1
	Booster Pumps ¹	4	4	3	5	4	4	4	2	1	1	1
	Treatment Facilities ¹	4	4	4	N/A ⁴	N/A ⁴	N/A ⁴	4	1	1	1	1
	Tanks ¹	4	4	4	5	3	4	4	2	1	1	1
	Dams/Earthen Reservoirs	N/A ⁴	N/A ⁴	N/A ⁴	N/A ⁴	N/A ⁴	N/A ⁴	4	3	1	2	3
Other	Base Yards	4	4	N/A ⁴	5	N/A ⁴	N/A ⁴	4	2	1	1	1
	Major Streets	4	4	4	5	4	5	4	1	1	1	1

Notes:

1) Not included in GIS mapping

2) Includes Annual High-Wave Driven Flooding, Passive Flooding, Drainage Backflow, Drainage Failure

3) Includes Groundwater Inundation, Emergency Groundwater 1-5ft, Emergent Groundwater <1ft

4) N/A indicates no assets of this type are exposed to this threat. If a specific asset is not exposed to a threat, the risk score is equal to 0.

D.2.2.3 RISK SCORES

The final risk scores result from multiplying the likelihood scores for each threat by the consequence score of each asset type, then summing over all considered threats for each asset. A risk score is calculated for each individual asset in the inventory, excluding minor assets such as lateral pipelines, for a total of 233,802 assets. Each asset is assigned a likelihood score for each threat based on its location, as described in Section D.2.2.1. This likelihood score accounts for both the likelihood of the hazard itself as well as the exposure of the asset, as the likelihood of a threat will be 0 in locations that are not exposed to that threat. Each asset is also assigned a consequence score based on the type of asset, as described in Section D.2.2.2. For each threat, the risk score is a multiplication of the likelihood score (0 to 5) by the consequence score (1 to 5), obtaining a possible risk score as a subset of 0 to 25. The total risk score is the sum of risk scores for each threat. A snapshot of a subset of the threat and total risk scores for some high-risk hazards is shown on Figure D-7.

Asset Type	Tsunami Evac Zones	Hurricane Surge Cat 2	100-yr Flood - VE	Coastal Erosion 1 ft	Drought Risk - Medium	Annual High- Wave Driven Flooding 1 FT	Ground Water Inundation 1 FT	Extreme Heat	Fire Risk - High	Total Risk
Major Streets	20	12	12	25	0	25	20	5	16	103
Major Streets	20	12	0	25	5	25	20	5	16	101
Major Streets	20	12	12	25	0	25	20	5	16	101
Major Streets	20	12	12	25	0	25	20	5	16	101
Major Streets	20	12	12	25	0	25	20	5	16	100
Major Streets	20	12	12	25	0	25	20	5	16	98
Major Streets	20	0	0	25	0	25	20	5	16	95
Stormwater Conduits	20	12	12	20	5	25	15	5	8	94
Stormwater Conduits	20	12	12	20	5	25	15	5	8	94
Stormwater Conduits	20	12	12	20	5	25	15	5	8	94
Stormwater Conduits	20	12	12	20	5	25	15	5	8	94
Stormwater Conduits	20	12	12	20	5	25	15	5	8	94
Stormwater Conduits	20	12	12	20	5	25	15	5	8	94
Wells	20	12	0	0	0	25	25	6	0	94
Sewer PumpStation	20	0	0	20	5	25	20	10	16	94

Figure D-7. Risk scores of the highest risk assets, shown for a subset of individual threats separately and total

For most threats, any given asset is in a single footprint area, and therefore has a single likelihood associated with threat impact. However, the hurricane threat accounts for the possibility of multiple category storms, as well as the fact that the same area can be subject to multiple categories of hurricane. For the hurricane risk calculation, risk is calculated pair-wise for each category, having a changing likelihood score (and spatial extent) based on the category storm and the map of inundation runup. Because severity is considered binary, the consequence of a hurricane impact is not differentiated between categories. The final hurricane risk score is then an average of the hurricane risk score for a Category 1, 2, 3, and 4 storm.

SECTION D.3: PART 2: ADAPTATION PROJECT DEVELOPMENT

D.3.1 HOTSPOT IDENTIFICATION

The hotspot identification process was designed to transition from the islandwide, automated risk screening of individual assets to a focused, manual assessment of high-priority geographic areas. This two-part approach allowed the project team to efficiently screen thousands of threat-asset pairs before developing a grouped list of priority areas in which to develop prioritized projects. These projects, once prioritized, support the implementation of a phased One Water Project List. The final identification of hotspots is the result of integrating technical risk score mapping, reviews and information from previous planning efforts, and expert input from the One Water Panel.

D.3.1.1 RISK SCREENING RESULTS

Following the completion of the automated risk scoring process for more than 233,000 infrastructure assets, each asset was categorized into one of five risk levels based on its total score. Note that risk scores for all assets ranged from 3 to 103. As shown in Table D-11, these categories—Very Low Risk, Low Risk, At Risk, High Risk, and Very High Risk—allow for a clear breakdown of vulnerability across the island’s assets.

Table D-11. Risk Screening Results

	VERY LOW RISK	LOW RISK	AT RISK	HIGH RISK	VERY HIGH RISK
Risk Score	<35	36–45	46–60	61–70	>70
# Assets	150K	60K	15K	4K	1K
% of Assets	66%	26%	6%	1.5%	0.5%

Once an asset was labeled, it was assigned a color to support the visual identification of clusters via mapping. This color-coding was used to produce the islandwide Water Infrastructure Risk Score Map, shown on Figure D-8.

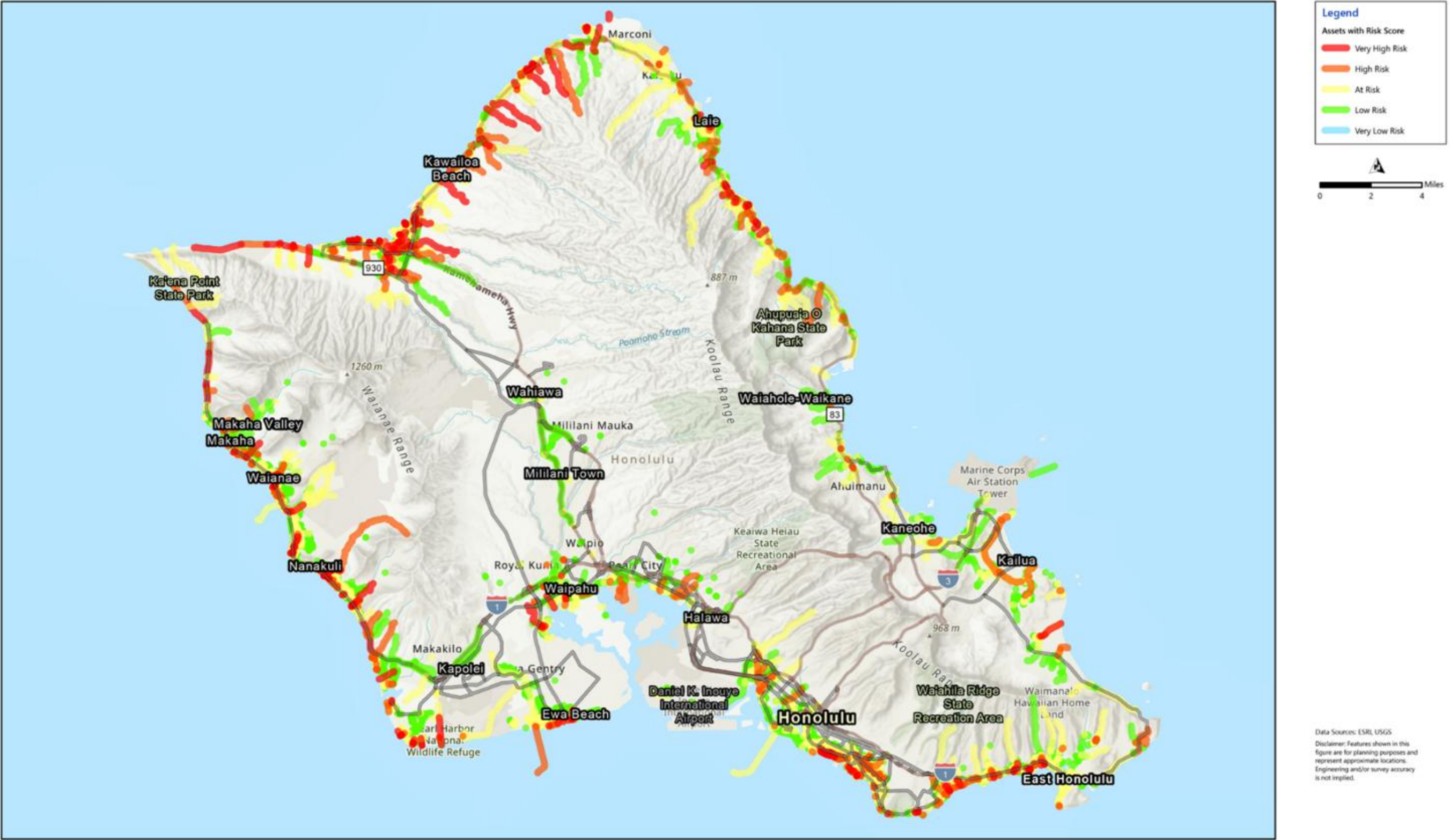


Figure D-8. Islandwide Water Infrastructure Risk Score Map, with “Very Low Risk” excluded for clarity

The first workflow utilized the quantitative results of the infrastructure risk screening to identify geographical clusters of high-risk infrastructure. The following steps were used to identify hotspots:

1. **Identifying Critical Assets:** Using the mapping tool, areas containing at least one "Very High Risk" asset (indicated in red) were identified. These assets represent the top 0.5 percent of all screened assets, with total risk scores exceeding 70.
2. **Cluster Analysis:** Nearby "High Risk" (orange, scores 61 to 70) and "At Risk" (yellow, scores 46 to 60) assets were then identified to find geographic groupings of risk.
3. **Community Integration:** Nearby community assets were identified to understand the broader impact of infrastructure failure in those locations. This information was used in the documentation of hotspot profiles and is related to content identified in the review of known areas of concern.
4. **Boundary Delineation:** Approximate preliminary boundaries for hotspots were drawn to encompass these grouped infrastructure and community assets. This information was used in the documentation of hotspot profiles.

The second workflow, the review of known areas of concern, was initiated in parallel to the infrastructure risk screening workflow.

D.3.1.2 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. Information used to identify known areas of concern included contents of the Regional Summaries for all eight Regional Planning Districts provided in Plan Appendix C and summarized in Plan Section 4, as well as meetings and workshops with key City staff. This information includes and extends beyond infrastructure assets and supports the identification of hotspots.

The use and analysis of this information included the following steps and supported a more comprehensive understanding of risks in combination with the infrastructure risk screening:

1. **Data Review and Documentation:** Information from previous planning documents, especially those that included past engagement efforts, such as Climate Ready O‘ahu (CRO), and existing studies were reviewed and synthesized into Regional Summaries for each Regional Planning District. The information provided contextual data as identified in Table D-12 to understand known issues at regional and ahupua‘a scales.

Table D-12. Information Used in Identifying Known Areas of Concern

REGIONAL SUMMARY FIELD	INFORMATION INCLUDED
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 lo'i kalo, and fishponds identified for local communities.
Specific Locations	Identified locations, especially streams and roads, where past hazards have occurred, such as localized flooding
‘Āina 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

2. Working Group Meetings: Several meetings were held with City staff to discuss the findings from the Regional Planning District Summaries and to address the following two key questions:

- Are there any existing projects that should be considered for existing adaptive capacity and/or potential adaptation projects?
- Are any areas missing that have known concerns (e.g., neighborhood, important roadway, key facility)?

These working group meetings also included a recap of the previously identified issues that were shared during the initial kickoff workshop for the Plan (see Figure D-9).

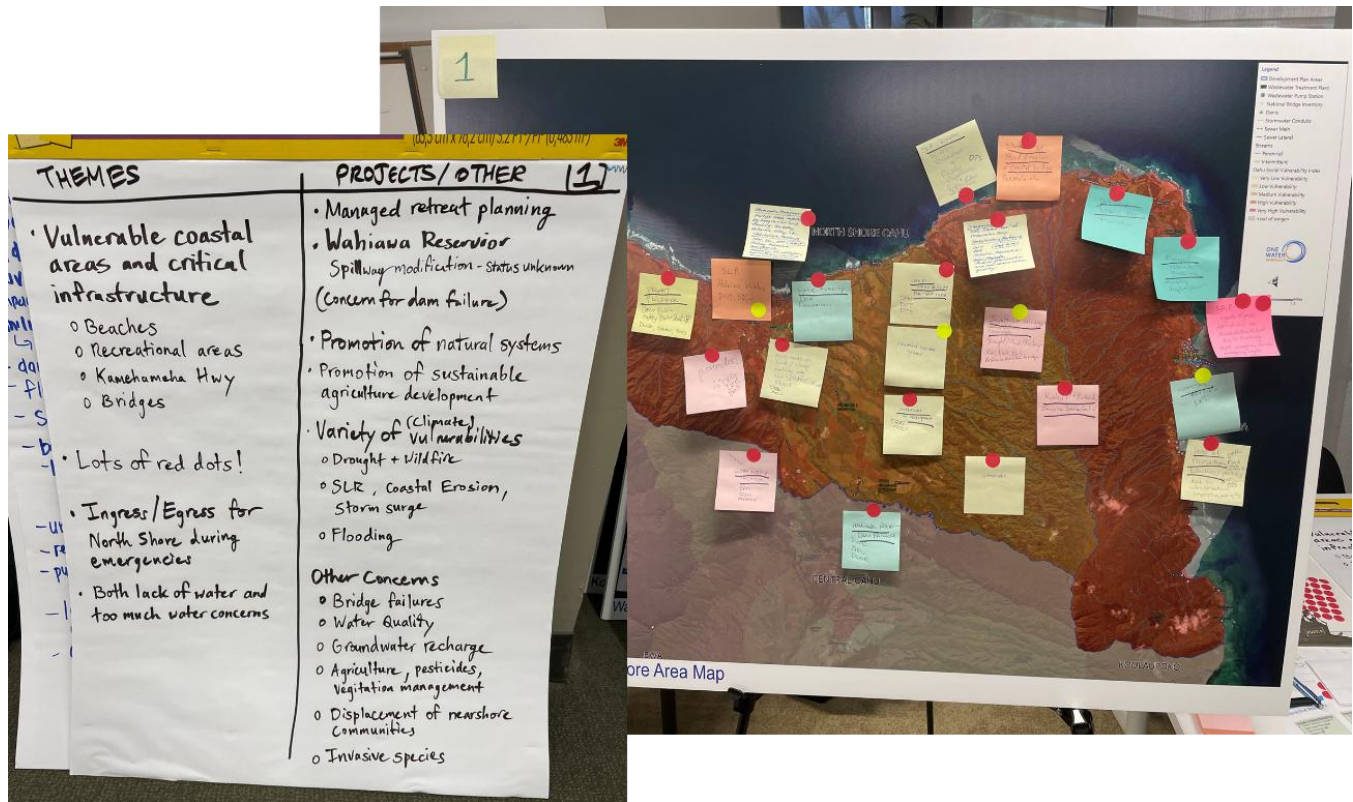


Figure D-9. Images from OWH Plan Kickoff Workshop on May 23, 2024, identifying potential issues and projects for North Shore.

Input on these two questions was received and incorporated into a list of existing projects and known areas of concern specific to each region.

3. Panel Validation: Panel meetings were used to discuss the results of these working group meetings and to provide additional opportunities for collective comment and discussion on known issues. This part of the process helps enable a collective understanding of potential “hotspots” across the island. The Panel provided direct input on the Regional Summaries, confirmed known concerns, and reviewed existing projects.

Information from this process was used to support characterization of potential hotspot areas and supported the identification and refinement of an initial list of hotspot profiles.

D.3.1.3 HOTSPOT IDENTIFICATION RESULTS

Following the two-part workflow of infrastructure risk mapping and known areas of concern, all gathered information was incorporated into hotspot profiles, which are included in Plan Appendix F. New hotspots were added as needed to represent specific areas of concern identified by the Panel that were not captured by automated mapping alone. A total of 92 hotspots were identified across the

island of O‘ahu. The primary purpose of these hotspots was to designate potential areas where future climate adaptation projects could be located. It is important to distinguish the role of hotspots within the One Water Honolulu framework:

- **Hotspots are Not Projects:** The identification of a hotspot does not automatically constitute a planned project; rather, it identifies a geographic area of concern.
- **Scale of Intervention:** A single hotspot may contain the potential for multiple individual projects, or conversely, a hotspot may not lead to any recommended projects for the final One Water Projects List.
- **Naming Conventions:** The names assigned to hotspots were used purely for location identification and spatial cues; they do not have a direct relationship to any potential project names that may be developed later in the planning process.

The identification of the 92 hotspots represents the conclusion of the spatial and regional risk assessment, but it is not the final step in the project planning process. These hotspots serve as the initial starting point for a subsequent prioritization phase. Because the Plan aims to address a wide range of climate threats with limited resources, the identified hotspots underwent a rigorous prioritization process to determine which areas may require the most immediate intervention. This prioritization phase evaluated hotspots based on a series of criteria. These criteria were used to refine the original 92 hotspots into an initial set of locations from which to ideate a suite of actionable One Water Projects. Ultimately, a project list based on these hotspot locations supports directing investments toward areas with the highest potential for risk reduction and community benefits.

D.3.2 HOTSPOT PRIORITIZATION

The goal of hotspot prioritization is to reduce the 92 identified hotspots down to a reasonable number that can move forward into the project development stage within this One Water planning effort. Hotspot prioritization is based on two parts: prioritization criteria and area classifications (see area classifications first described in Plan Section 5.5 of the One Water Honolulu Plan). First, hotspot prioritization criteria and area classifications were assigned to each hotspot in parallel. Then, scores from the criteria were ranked and the highest priority hotspots were selected within each Regional Planning District. The final step was a check that the selected list represents each area classification and all climate risks, as identified in Plan Section 2.1.1.

The definitions of hotspot prioritization criteria and area classification are given in Table D-13. The prioritization criteria are used to understand how to rank the hotspots, giving them a numerical score. The purpose of the hotspot criteria is to guide which areas to focus on project development first. These criteria are based on City, local, and community issues expressed in past planning and stakeholder engagement efforts.

The area classifications are used to categorize similar areas, as defined by their common characteristics. These classifications are focused on categorization, collectively being general enough to describe the entire island while being specific enough individually to provide easily replicable adaptation approaches within a given area classification. Each hotspot is categorized within a single area classification and is described further in Appendix D.3.2.2.

Table D-13. Hotspot Prioritization Criteria Versus Area Classification Definitions

HOTSPOT PRIORITIZATION CRITERIA	AREA CLASSIFICATION
- Purpose: Rank hotspots within each region and guide which areas to focus on first - Defined by: City identified local and community issues - Focus: Preference; elevates single characteristic of an area to communicate greater urgency	- Purpose: Categorize areas to more easily replicate adaptation approaches across the island - Defined by: Common characteristics - Focus: Categorization; general enough to provide coverage of the island collectively while also representing a range of diverse areas and specific enough to provide guidance on adaptation strategy application and project development

D.3.2.1 HOTSPOT PRIORITIZATION CRITERIA

Hotspot prioritization criteria were selected through an iterative and collaborative process. The purpose of the criteria was to elevate important characteristics identified by the City. The hotspots that meet the most criteria were ranked highest and prioritized for project development. Each hotspot was evaluated for six criteria:

- Known Flooding Issues
- Known Water Quality Issues
- Vulnerability to 1 foot of Sea Level Rise
- Vulnerability to 4 feet of Sea Level Rise
- Area Identified Through Panel Experience
- Impact to ‘Āina (Rural/Agricultural Land)

The first two criteria represent existing water challenges: known flooding issues and known water quality issues. These criteria prioritize hotspots with existing climate impacts and present-day needs and are supported by information documented in the known areas of concern process. The second two criteria focus on anticipated climate impacts from two levels of SLR, 1 foot and 4 feet. The two levels are used to emphasize areas with near-term concerns (1 foot), as well as areas with longer-term climate impacts (4 feet). The last two criteria are used to incorporate stakeholder input and local and community issues. The fifth criterion gives an additional point to areas that are identified by the Panel as an area of particular concern. This criterion allows locations that do not fit particularly under the flooding and sea level rise focus of the earlier criteria but have concern due to vulnerable

infrastructure, existing high climate risk, City investment priorities, or other reasons as determined by the Panel. Finally, the last criterion assigns an additional point to locations with impact to ‘āina, specifically for hotspots that primarily represent rural or agricultural land as this reflects the cultural and ecological value of the land beyond urban development. This criterion reflects a concern that urban areas were over-represented in the initial list of hotspots and helps increase representation of communities with lower density land uses.

These six criteria are considered on a binary scale, with a 0 assigned if the criterion does not apply, and a 1 assigned if the criterion does apply. The prioritization score is a sum of the points from the six criteria. The criteria are weighted equally (unweighted), so a possible score is between 0 and 6.

D.3.2.2 AREA CLASSIFICATIONS

Area classifications categorize the locations across O‘ahu to represent the variety of different characteristics across the island. Locations within a given area classification exhibit similar characteristics such as level of development and population density. Locations within the same area classification can utilize similar adaptation strategies. Future projects in hotspots that are not prioritized in this Plan will benefit from the current project development by replicating adaptation strategies from within their area classification. In addition, this area classification is useful to select a wide variety of hotspots through the prioritization process. This variety is enforced through a check after hotspot prioritization, so that at least one hotspot from each area classification is chosen. The six identified area classifications are:

- Major Hubs & Economic Centers
- Opportunities within Redevelopment & Growth
- Mid-Density Communities
- Country Towns and Rural Coastline
- Major Linear Network Corridors
- Recharge and Runoff Management Opportunities

Each hotspot is categorized into one of these area classifications based on its primary land use and population density. Major hubs and economic centers include Waikiki . Major linear network corridors include highways such as Kalaniana‘ole Highway and Mākaha Stream/Farrington Highway. Opportunities within redevelopment and growth include Māpunapuna and Iwilei/Chinatown within the Primary Urban Center. Recharge and runoff management opportunities represent less developed watershed areas such as Waipahu/Pouhala Marsh and Waimea Bay. Country towns and rural coastline include Pōka‘i Bay Street and Waimānalo, among many others. Finally, mid-density communities represent residential areas with populations between urban hubs and rural areas, focusing on hotspots within larger towns such as ‘Ewa Beach. 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.

D.3.2.3 HOTSPOT PRIORITIZATION RESULTS

The hotspot prioritization criteria were applied to the 92 identified hotspots, and scores were assigned. The highest score received was a 5 (out of 6), and those hotspots are deemed “Very High” priority. Those with a score of 4 are considered “High” priority, and 3 considered “Medium” priority. The highest priority hotspots were selected to move forward into project identification and are listed in Table D-14. These 14 hotspots represent each of the planning regions: Central O‘ahu, East Honolulu, ‘Ewa, Ko‘olau Loa, Ko‘olau Poko, North Shore, Primary Urban Center, and Wai‘anae, with a geographic distribution that spans the island of O‘ahu, shown on

Figure D-10.

The first step in ranking the scored hotspots was to separate them by Regional Planning District. The hotspots were ranked from highest priority (larger scores) to lowest priority (smaller scores). From each planning district, the highest priority hotspot, or hotspots if two were tied, were selected. Separating by planning district results in a geographic spread across O‘ahu. After this step, the list of hotspots was checked to represent each area classification, and the highest priority hotspot from any missing area classification was added to the list. This process resulted in 13 selected priority hotspots, detailed in Table D-14 with their planning region, area classification, score from the prioritization criteria, and selection justification.

In addition to those prioritized by score, OWH Panel input justified adding Iwilei/Chinatown to the priority hotspot list due to ongoing TOD planning and ongoing redevelopment projects that will inform private development guidelines. Table D-14 demonstrates that every planning region and area classification is represented, and the hotspots have prioritization scores ranging from 3 to 5. All hotspots that received a score of 5, or “Very High,” are included in the final list.

Five of the selected hotspots represent combinations of hotspots that are closely located and have similar prioritization and classification. Those hotspots are considered holistically moving forward and represent projects that will impact the whole area. Those five hotspots are Kalaniana‘ole Highway, Kamehameha Highway, Kāne‘ohe, Hale‘iwa, and Waikiki.

Table D-14. Selected Hotspots with Results from Hotspot Prioritization Process

HOTSPOT	PLANNING REGION	AREA CLASSIFICATION	PRIORITIZATION SCORE	SELECTION JUSTIFICATION
Waipahu/Pouhala Marsh	Central O'ahu	Recharge and Runoff Management Opportunities	4 (High)	Highest priority hotspot in region
Kalaniana'ole Hwy	East Honolulu	Major Linear Network Corridors	4 (High)	Highest priority hotspot in region
Pupu St/Pupu Pl	'Ewa	Mid-Density Communities	3 (Medium)	Highest priority hotspot in region
Ka'a'awa/Kahana	Ko'olau Loa	Major Linear Network Corridors	5 (Very High)	Highest priority hotspot in region (tied)
Kamehameha Hwy	Ko'olau Loa /Ko'olau Poko	Major Linear Network Corridors	5 (Very High)	Highest priority hotspot in region (tied)
Kāne'ohe	Ko'olau Poko	Country Towns and Rural Coastline	4 (High)	Highest priority hotspot in region (tied)
Waimānalo	Ko'olau Poko	Country Towns and Rural Coastline	4 (High)	Highest priority hotspot in region (tied)
Hale'iwa	North Shore	Country Towns and Rural Coastline	5 (Very High)	Highest priority hotspot in region (tied)
Waimea Bay/ Pūpūkea	North Shore	Recharge and Runoff Management Opportunities	5 (Very High)	Highest priority hotspot in region (tied)
Waikīkī	Primary Urban Center	Major Hubs & Economic Centers	4 (High)	Highest priority hotspot in classification
Māpunapuna	Primary Urban Center	Opportunities within Redevelopment and Growth	5 (Very High)	Highest priority hotspot in region
Iwilei/Chinatown	Primary Urban Center	Opportunities within Redevelopment and Growth	4 (High)	Due to current TOD planning and redevelopment projects that will inform private development guidelines
Mākaha Stream/ Farrington Hwy	Wai'anae	Major Linear Network Corridors	5 (Very High)	Highest priority hotspot in region (tied)
Pōka'i Bay Street	Wai'anae	Country Towns and Rural Coastline	5 (Very High)	Highest priority hotspot in region (tied)

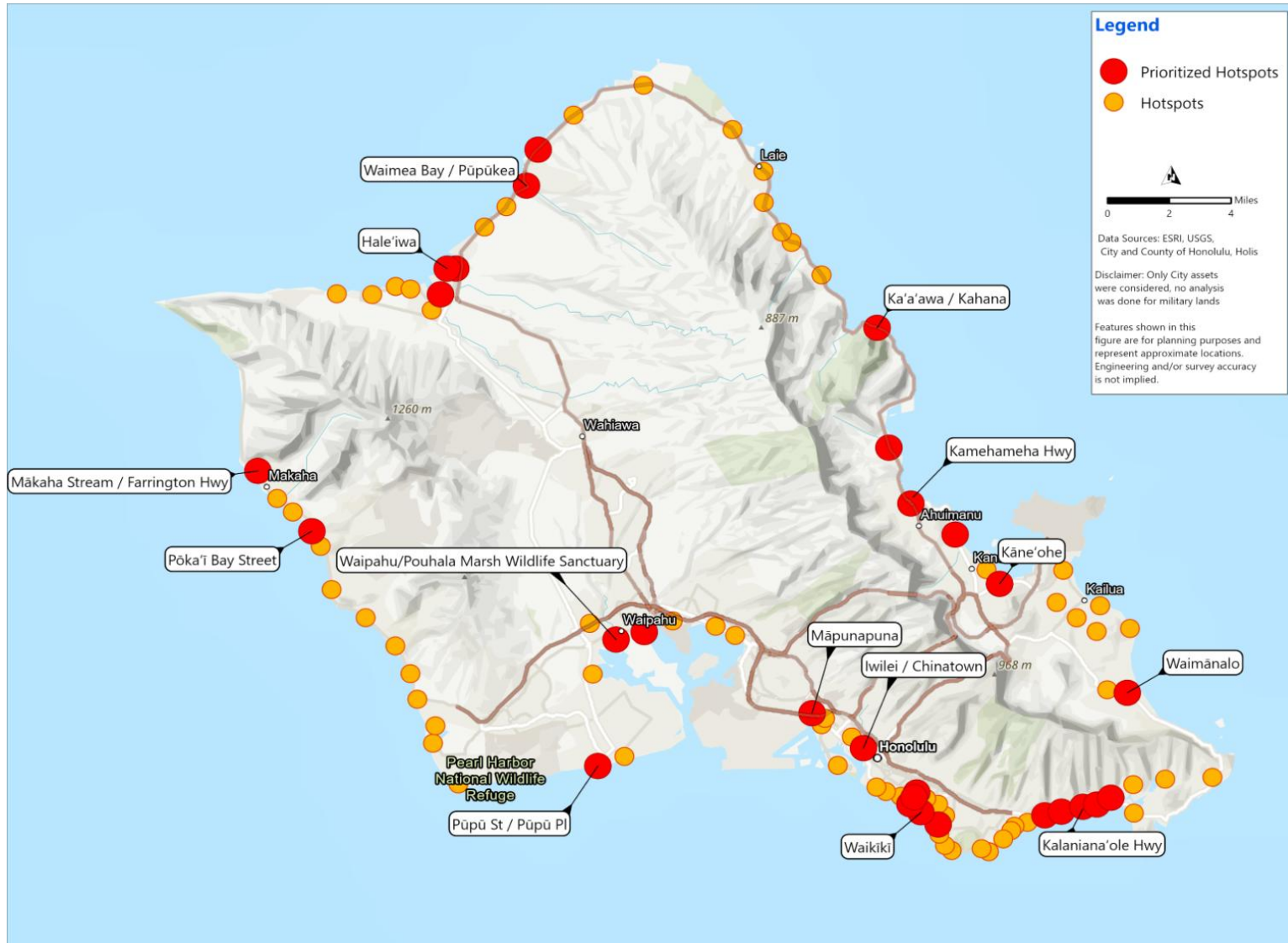


Figure D-10. Map of O'ahu with hotspots (small orange circles) and priority hotspots (larger red circles)

The 14 prioritized hotspots additionally represent all climate threats, with risk levels shown in Table D-15. While preference was given to hotspots with anticipated sea level rise impacts and existing flooding or water quality issues, these hotspots generally represent high climate risks from the array of climate hazards considered.

Table D-15. Climate Threats for Each of the Prioritized Hotspots

HOTSPOT	SLR	100- YEAR FLOOD	WILDFIRE	DROUGHT	HURRICANE	TSUNAMI	EXTREME HEAT
Waipahu/Pouhala Marsh	Impacts at 2 ft	Partial Inundation	High Risk	Medium Risk	Complete Inundation	Extreme Evac Zone	> 90 °F
Kalaniana'ole Hwy	Impacts at 1 ft	Partial Inundation	Medium Risk	Low Risk	Complete Inundation	Evac Zone	> 90 °F
Pupu St/Pupu Pl	Impacts at 2 ft	Partial Inundation	High Risk	Medium Risk	Complete Inundation	Evac Zone	> 90 °F
Ka'a'awa/Kahana	Impacts at 1 ft	Complete Inundation	Low Risk	Low Risk	Complete Inundation	Extreme Evac Zone	> 90 °F
Kamehameha Hwy	Impacts at 1 ft	Partial Inundation	Low Risk	Low Risk	Complete Inundation	Extreme Evac Zone	> 90 °F
Kāne'ohe	Impacts at 2 ft	Complete Inundation	Low Risk	Low Risk	Complete Inundation	Evac Zone	> 90 °F
Waimānalo	Impacts at 4 ft	Partial Inundation	Low Risk	Low Risk	Complete Inundation	Evac Zone	> 90 °F
Hale'iwa	Impacts at 1 ft	Complete Inundation	High Risk	Low Risk	Partial Inundation	Evac Zone	> 90 °F
Waimea Bay/ Pūpūkea	Impacts at 1 ft	Partial Inundation	Medium Risk	Low Risk	Partial Inundation	Evac Zone	> 90 °F
Waikīkī	Impacts at 2 ft	Partial Inundation	Low Risk	Low Risk	Complete Inundation	Evac Zone	> 90 °F
Māpunapuna	Impacts at 1 ft	Complete Inundation	Low Risk	Low Risk	Complete Inundation	Evac Zone	> 90 °F
Iwilei/Chinatown	Impacts at 4 ft	Partial Inundation	Low Risk	Low Risk	Complete Inundation	Extreme Evac Zone	> 90 °F
Mākaha Stream/ Farrington Hwy	Impacts at 1 ft	Partial Inundation	High Risk	Medium Risk	Complete Inundation	Evac Zone	> 90 deg
Pōka'i Bay Street	Impacts at 1 ft	Partial Inundation	High Risk	Medium Risk	Complete Inundation	Evac Zone	> 90 °F

D.3.3 PROJECT IDENTIFICATION

Once priority hotspots were identified, the next step in the Climate Change Adaptation Framework process was to ideate and identify potential projects within each hotspot. The prioritized projects resulting from this process are included in the One Water Plan as part of the One Water Project List (included in Plan Chapter 7), have an accompanying factsheet that details key project information (Plan Appendix H), and are included in the Trigger Based Implementation Plan (Plan Appendix I). Project identification followed the steps shown on Figure D-11.



Figure D-11. Six-step process of project identification and prioritization for each hotspot area.

The first step to review hotspot information was prepared by the project team and reviewed by the Panel. Steps 2–4 were primarily carried out during a workshop with the Panel in January 2026. Initial starting points for each step were generated in preparation of the workshop and then further refined in discussions with the Panel and City staff during a multi-day workshop. The fifth step, project identification, was executed during the workshop with both the project team and the Panel contributing project ideas based on identified needs and opportunities, as well as building from previous efforts or planning upcoming projects. Additional project information was developed by the project team in collaboration with Panel agency staff following the January workshop. Steps 1–5 were completed for each priority hotspot, and the identified projects were then prioritized in the sixth step. Each of the steps are detailed in the following sections.

D.3.3.1 REVIEW HOTSPOT INFORMATION

The first step in project identification was to review the hotspot information for each of the priority hotspots described in Section 3.2.3. This step included a review of the previously developed hotspot profiles, which were created for each hotspot and organized by Regional Planning Districts. Reviewing the profiles included a review of the relevant infrastructure, climate threats, community issues, environmental issues, and existing project efforts present in and around the hotspot. In addition, the Panel contributed further information on ongoing projects and context for the specific priority hotspot areas. An example portion of the hotspot profile for Iwilei is shown on Figure D-12. This profile includes a map of the risk scores for the infrastructure across Iwilei, lists of the key infrastructure and community assets, known areas of concern (e.g., such as specific streets or areas that flood), as well as relevant climate threats to the area. This information is summarized in each hotspot profile to get a general sense of what should be addressed by the following steps.

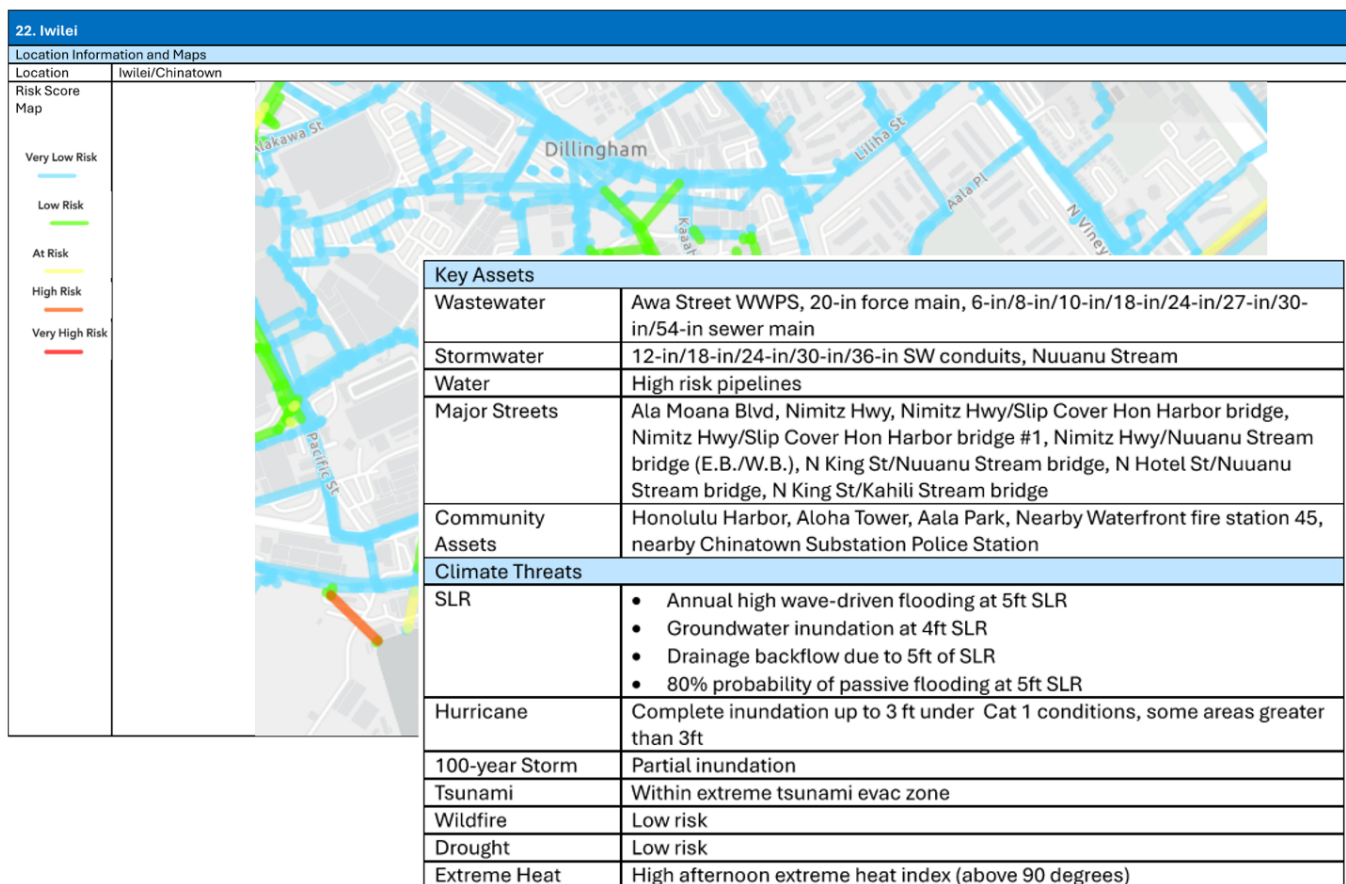


Figure D-12. A portion of the hotspot profile for Iwilei, including a map of the risk score and list of the key assets and climate threats.

D.3.3.2 BRAINSTORM GOALS FOR AREA

The second step in the process is to brainstorm goals for the specific hotspot areas. Based on the overarching pillars from Climate Ready O‘ahu, goals were identified for each hotspot that prioritize people, ‘āina, and infrastructure. The key questions used to generate goals were:

- **People:** What are the goals for this area related to the people (e.g., residents, businesses, visitors)?
- **‘Āina:** 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?

Initial goals were generated based on information from Regional Summaries, Hotspot Profiles (including known areas of concern), with feedback including changes and new goals generated during the Panel workshop. This process was started using the Iwilei hotspot as a pilot during a workshop held in October 2025. Ideas for goals were produced by in-person and virtual workshop attendees, as shown on Figure D-13.

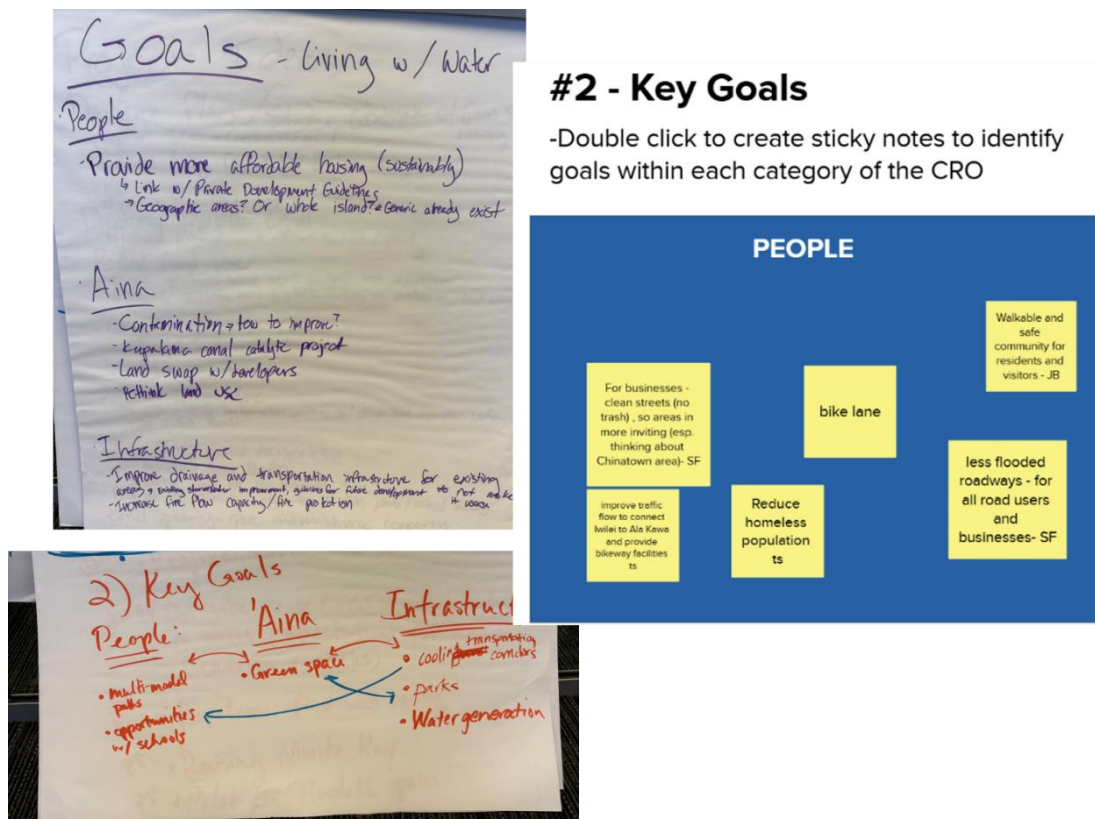


Figure D-13. The Panel brainstormed key goals for Iwilei from the October 2025 workshop. Images show in-person and virtual ideation boards.

These goals for the Iwilei hotspot were summarized from the ideated goals in the October 2025 workshop to the following based on input from Panel and Leadership Group members:

- Improve community access to multi-modal transport
- Improve water supply and water quality
- Improve drainage to reduce community flooding

The development of goals for all other priority hotspots was conducted during the January 2026 project development workshops.

D.3.3.3 IDENTIFY ADAPTATION STRATEGIES

The next step in the project identification process was to identify relevant adaptation strategies. First, this step required a review of the list of climate hazards and assets at risk in the hotspot area. A review of the key goals generated in the previous step is also important to steer the adaptation strategies toward addressing potential needs and issues of the particular hotspot.

A large menu of approximately 100 adaptation strategy options was developed for this Plan drawing on previous planning efforts including the Climate Resilient Design Guidelines (CCH 2024a), Multi-Hazard Pre-Disaster Mitigation Plan (CCH, 2021), Hawai‘i Department of Transportation (HDOT) Climate Action Plan (HDOT, 2021), Climate Ready O‘ahu (CCH, 2024b), the Sand Island Facilities Plan (Carollo, 2025), and the Ko‘olau Poko Readiness Review (Brown and Caldwell, 2025). These adaptation strategies are organized by relevance for climate hazards as well as asset type and can be found in Attachment D.1. This menu of adaptation strategies was reviewed to identify the most relevant strategies that could address the combination of climate hazards and assets at risk, keeping in mind the local constraints and issues identified in the hotspot profile. As an example, the identified potential adaptation strategies for Iwilei are shown in Table D-16. As shown, most of the identified adaptation strategies are focused on flood mitigation appropriate for a dense, urban area given the characteristics of the Iwilei hotspot and the identified goal, “Improve drainage to reduce community flooding.”

Table D-16. Adaptation Strategies Identified as Relevant for the Iwilei Hotspot Based on Infrastructure and Climate Risks

TYPE	ADAPTATION STRATEGY
Physical Infrastructure	Incorporate or Upsize Perimeter Floodwalls or Levees (e.g., barrier railing, raised feature, earthen levee, raised roadway, raised pathway), Including Operable Flood Gates
Physical Infrastructure	Incorporate Groundwater Seepage Barrier
Physical Infrastructure	Dry Floodproof the Building/Asset/Utility (e.g., seal windows, doors, vents, drainage systems, manholes)
Physical Infrastructure	Wet Floodproofing: Incorporate Flood-Damage-Resistant Materials (e.g., concrete, brick, tiles, latex paint, pressure-treated plywood, cement, glass) and Incorporate Openings in Project Infrastructure for Water Egress
Physical Infrastructure	Incorporate Flood/Submersible Pumps for Surface Water or Groundwater
Physical Infrastructure	Elevate Access Road and Associated Utilities
Physical Infrastructure	Elevate Site Grade
Physical Infrastructure	Elevate Occupied Spaces Above Flood Elevations (e.g., second floor)
Physical Infrastructure	Raise Building Ground Floor Elevation
Physical Infrastructure	Implement Low Impact Design (LID)/Green Infrastructure Stormwater Management Strategies
Physical Infrastructure	Incorporate Backwater Flow Prevention Devices (e.g., tidal gates, check valves)
Physical Infrastructure	Upsize Pumping Capacity
Physical Infrastructure	Upsize Stormwater Drainage Capacity or Sanitary Sewer Capacity
Physical Infrastructure	Incorporate Native Vegetation
Physical Infrastructure	Incorporate Corrosion Resistant Materials and Coatings
Physical Infrastructure	Relocate or Abandon Facility
Plans & Studies	Refine Flood Risk Mapping to Account for Climate Change and/or Increase Resolution
Plans & Studies	Study to Incorporate Native Hawaiian Practices for Resilient Design

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.

If a physical infrastructure project includes a preliminary planning phase, the project is categorized as infrastructure. If a plan is a standalone project or a precursor to multiple infrastructure projects, such as a drainage study, that project is categorized as plan/study.

Note that adaptation strategies are general approaches that could be applied to many different locations or infrastructure types, depending on the needs of a specific hotspot. The application of a general adaptation strategy to a specific location to meet a specific need is the start of a project concept. Similar to area classifications, these general adaptation strategies promote the applicability of projects across different hotspot locations.

D.3.3.4 GENERATE ONE WATER PROJECT IDEAS

Using the generated short-list of adaptation strategies as a starting point, potential project ideas were identified for each of the hotspots. The goal of this step was to identify opportunities across current efforts, as well as to generate new project ideas.

To help guide the project identification process, the following criteria were developed by the Panel and project team to define a One Water Project as a project that:

- Supports CRO strategies
- Addresses one or more OWH objectives and aligns with the OWH mission and vision
- Addresses climate risk(s)
- Includes initial focus on City One Water infrastructure
- Requires collaboration between two or more agencies

One Water Project concepts were identified by the project team and the Panel during the January 2026 workshops and generally fell into two categories:

- **Opportunities to Leverage Existing or Planned Efforts:** Project concepts in this category generally consist of projects already in a single City agency's pipeline that could be adopted as a One Water Project. Sometimes the planned project already encompassed all of the components of a One Water Project and sometimes planned projects were expanded to incorporate new collaborative or climate-focused elements to turn them into One Water Projects. These projects were typically put forward by the City agency that had already started planning the project and was discussed by the Panel to determine its appropriateness as a One Water Project.
- **New Project Ideas:** In situations where the goals for a hotspot were not addressed by already planned projects, the Panel and project team developed new project ideas to meet these goals. This process typically starts with consideration of a general adaptation strategy (as discussed in Section 3.3.3) with contributions of local expertise from the Panel to tailor that strategy to the specific needs of a hotspot.

Given the different ways project concepts were generated, the resulting list of project concepts contained a wide range of details, from concepts with fully developed feasibility studies already completed to brand new ideas resulting from in-person workshop discussions.

For the Iwilei hotspot example, project ideas were generated both in person and online during the October 2025 Panel meeting, with the results of the idea generation shown on Figure D-14. Ideas from the generation stage were consolidated by the consultant team to create a list of approximately 150 potential projects across the 14 priority hotspots.



Figure D-14. One Water Project idea generation sticky note boards for the Iwilei hotspot from the October 2025 Panel meeting.

D.3.3.5 IDENTIFICATION OF PROJECTS AND PROJECT INFORMATION

The fifth step in the process was to further develop the project concepts and detail project information. Once the project ideas were generated, specific details were documented for each project as available. This helped support the creation and consolidation of ideas into one potential project list that was used as a basis for further project refinement and prioritization.

Three important aspects of this process supported generating specific enough information to move forward with project prioritization. These aspects are identifying and understanding the scale of the project, the policies that are relevant to the geographic area or that may be necessary to precede an infrastructure project, and the collaboration framework key questions to identify stakeholders that would be involved in the project. The collaboration framework key questions include the following:

- Who owns the project corridor/project site and surrounding sites?
- What are potential project components?

- Who owns or will own critical project infrastructure?
- Who may design and build?
- Who may operate and maintain?
- Which other agencies will this project impact or benefit?
- Are there existing or planned City projects in the project vicinity? Are there existing similar City projects to learn from/replicate process?
- Are there planned or in-progress large private development projects in the vicinity?

These collaboration framework questions are typically answered by the City agencies involved in a given project idea to clarify ownership and involvement in the proposed projects. These questions can be used to identify the core team for a given project moving forward and to understand whose input is necessary as a more detailed project concept is created.

Initial project details were necessary to determine if the potential projects meet under the One Water Project criteria, as well as to understand which timeline the project falls into (near-, mid-, or long-term), and to get a sense of the potential resilience and community benefits. Known or possible project information was discussed with the Panel to document the climate threats that could be addressed, the One Water assets that would be involved, and the OWH and CRO objectives that are supported. Finally, any anticipated challenges, additional considerations, general engineering feasibility, and concerns about public acceptance that came up in discussions was documented for each project idea.

After identifying this initial information for each project idea and then consolidating project ideas, approximately 100 projects remained to begin the project prioritization stage.

D.3.4 PROJECT PRIORITIZATION

The intention of project prioritization is to identify the top projects to be prioritized for implementation from the initial list of project concepts. The prioritization goal for this Plan was to select the top 50 (or so) projects from the initial list of approximately 100 project ideas that were generated during the January 2026 workshop. These top 50 projects will be further developed and documented in factsheets to prepare them for future implementation. Project prioritization criteria were developed with Leadership Group and Panel input from workshops and Panel meetings and were applied by the consultant team.

Project prioritization follows a three-step process, illustrated on Figure D-15. The first step is to check that the project fits the One Water Project requirements, as described in Section 3.3.4. If the project meets all five of the One Water criteria, it passes through the “Yes/No Gate” to Step 2. Projects that don’t meet all of these criteria are documented separately from the One Water Projects List as they may be appropriate for implementation outside of the One Water purview.

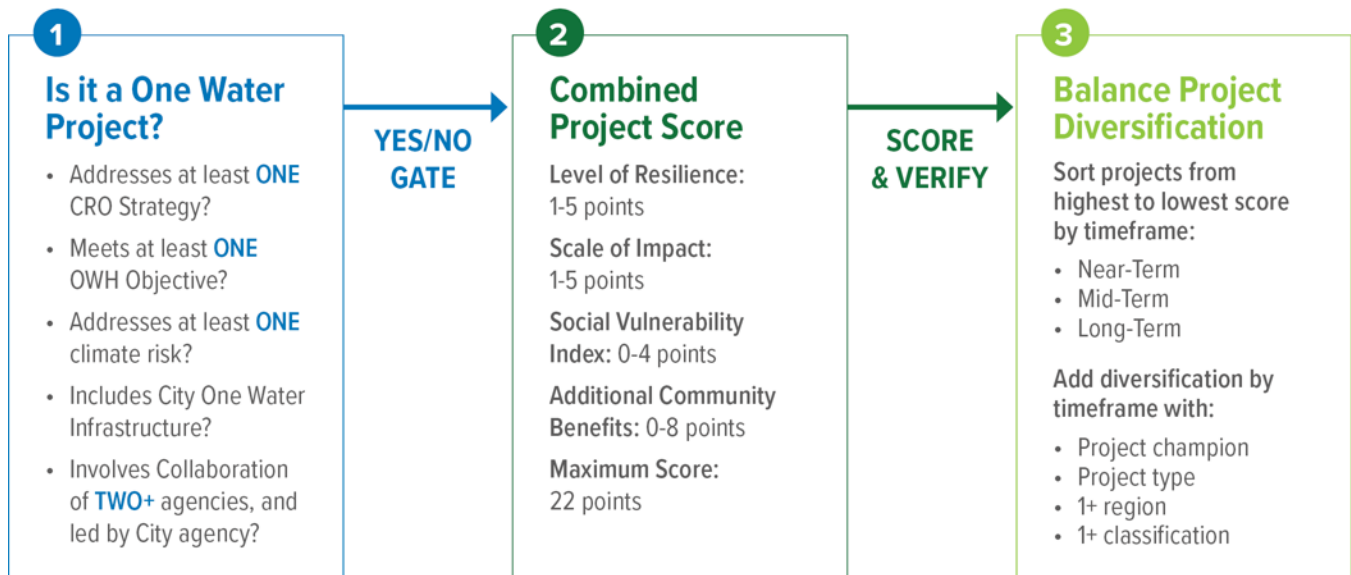


Figure D-15. Flow chart of the three-step process of project prioritization, with considerations for each step of the process.

Step 2 of the prioritization process is to score projects using the prioritization criteria developed for this One Water Plan. The project score consists of four components: the Level of Resilience, the Scale of Impact, the Social Vulnerability Index, and additional Community Benefits. Each of these project score components are discussed in detail in the following sections. From this step, each project receives a score from 2 to 22 from the project team with verification from the Panel. 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 to 25 years), and long-term (25+ years). 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 the project prioritization score as well as the presence of a project champion and finding an appropriate balance of projects by type, region, and area classification. This three-step process results in the prioritized list of approximately 50 projects that move on to project development.

D.3.4.1 PROJECT PRIORITIZATION CRITERIA

The project prioritization criteria include the One Water Project criteria, project prioritization scores, and project diversification.

ONE WATER PROJECT CRITERIA

Each of the One Water Project criteria is a yes or no question, and the answer to all of the questions must be yes for the project move on to Step 2 and receive a project prioritization score. The One

Water Project criteria were developed with input from the Panel and are shown in Section D.3.3.4 and in Figure D-15.

Most commonly, projects that do not pass through the One Water Project Yes/No Gate were determined to be single-agency projects that would not involve collaboration (funding, project development, and/or significant contributions) from another agency. In addition, projects that did not involve City One Water infrastructure were not moved forward for further consideration. The City One Water infrastructure includes water, wastewater, and stormwater infrastructure, as well as roads, streams/channels, beaches, and parks. Finally, projects were filtered out if they are to be led by a state agency or a private entity, as those would not be appropriate to include in the City CIP or operational budgets. This filter largely identified projects that would be led by a state agency—HDOT or DLNR. Projects that did not meet all One Water Project criteria are documented in Table D-24. These projects may still be valuable for individual City agencies to pursue or to collaborate on with state agencies. All projects that pass the One Water criteria move forward to be assigned a project prioritization score.

PROJECT PRIORITIZATION SCORES

The project prioritization scores include criteria for Level of Resilience, Scale of Impact, the Social Vulnerability Index, and additional Community Benefits. The total score that a project can receive is between 2 and 22 points. Projects were scored by the project team and scores were verified by the Panel. Final scores fell between 5 to 16 points for the One Water Projects.

Level of Resilience captures the climate resilience potential of each project. Level of Resilience is scored from 1 to 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. Definitions for each level of resilience are documented in Table D-17, 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 D-17. Definitions for Levels of Resilience Along With Example Projects for Each

SCORE	RESILIENCE LEVEL	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

For physical infrastructure or programmatic projects, the resilience score relates to the actual risk reduction that can be anticipated from that project. For plans and studies, the resilience benefit depends on the projects that the study enables; for example, a legal study on managed retreat receives a resilience score of 5 (High) for the long-term permanence of managed retreat itself and the significant risk reduction from multiple hazards that managed retreat would provide. For Area Adaptation Plans and other broad planning efforts, the level of resilience score is 3 (Medium). Because many plans have unknown outcomes, this score reflects their potential contribution without assuming too many benefits in comparison to other projects.

The second criterion 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 D-18, the five scales of impact are defined as site/block, community, ahupua'a, moku, and islandwide, worth 1 to 5 points, respectively. This criterion gives priority to projects that have a wider scale of impact. This criterion implicitly prioritizes projects that may impact the most people, as well as provide the widest range of ecological benefits. For example, improvements to an entire ahupua'a watershed are prioritized over more localized stream restoration. While some improvements may be made on a specific site, such as expanding a wastewater treatment plant (WWTP), the benefits would impact an entire community, so the project receives 2 points for the scale of impact, rather than the scale of the project itself.

Table D-18. 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	Ahupua'a (Watershed)	Mauka Watershed Improvements
4	Moku (Region)	Coastal Road Raising Program
5	Islandwide	Managed Retreat Legal and Policy Study

The O'ahu Social Vulnerability Index (SoVI) score is the third contribution to the project prioritization score. The O'ahu SoVI index was developed by the Office of Climate Change, Sustainability and Resiliency (CCSR) specifically for the island of O'ahu and captures many dimensions of social vulnerability including exposure to hazards, socioeconomic status, household composition, minority status/language, and housing/transportation. The O'ahu 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. O'ahu SoVI values have been assigned to each Census tract on O'ahu, from Very Low, Low, Medium to High, and Very High (CCH, 2019). The SoVI across O'ahu is shown on Figure D-16. These qualitative SoVI levels are assigned scores from 0 to 4, respectively. Depending on the location of a project, it is assigned the highest SoVI score in the area it benefits. For example, if a linear park would cross between High and Very High SoVI areas, it receives a score of 4 to acknowledge the project benefits to a Very High SoVI area. While some areas, such as North Shore, have a single SoVI value, denser urban areas, such as the Primary Urban Center (PUC), have much more spatial variation in the SoVI. To avoid inflating the scores of islandwide projects, they are assigned a SoVI score of 2. This score balances the fact that they benefit areas with all SoVI indices, including, but not prioritizing, socially vulnerable populations and areas.

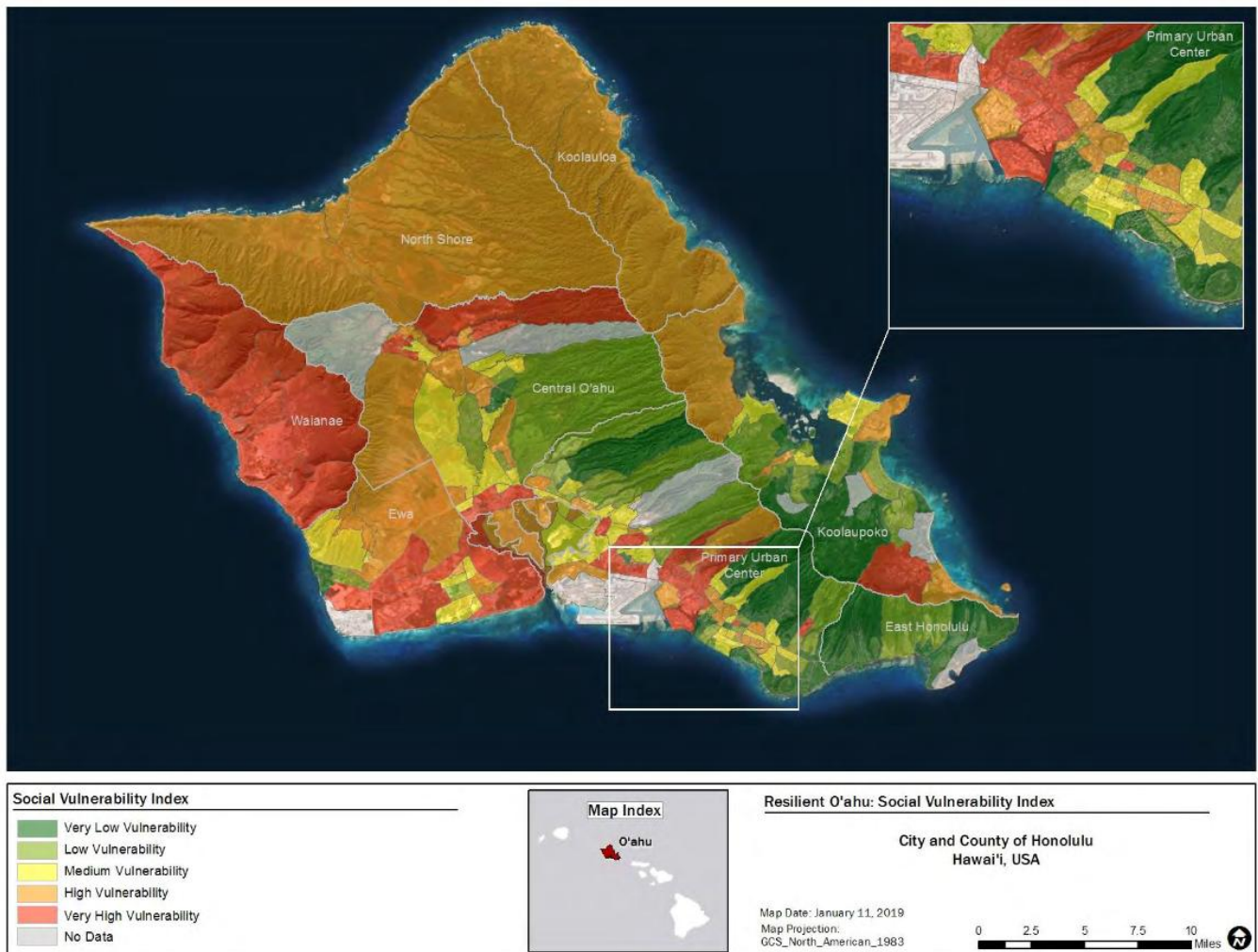


Figure D-16. Map of O'ahu with colors indicating the O'ahu SoVI for each Census tract.
(Source: O'ahu Resilience Strategy, CCH (2019))

The final component of prioritization scores are the Community Benefits. Each project is assessed for its contribution to eight community benefits, described in Table D-19. If the project will certainly provide that benefit, as it is a key component or driver of the project, then the project scores a 1. If the criterion does not apply to the project, it receives a score of 0. If a project could incorporate the community benefit, but it is not a known component of the project description, the project receives an “X.” The “X” signifies that this benefit should be considered during project development as it is a potential add-on benefit to the project, but it does not receive a point for this in the project prioritization process as it is not certain to be realized. The total points available for the Community Benefits range from 0–8. The Community Benefits include cultural benefits of protecting cultural sites and incorporating living and traditional Hawaiian practices, public safety benefits of reducing community flooding and increasing public awareness, ecological benefits of improving water quality and providing ecosystem restoration, and recreational benefits of improving public access to

community spaces and enhancing recreational spaces. Each of the Community Benefits is defined in Table D-19.

Table D-19. Definitions of Each of the Eight Community Benefits With Example Projects for Each

COMMUNITY BENEFIT	DEFINITION	EXAMPLE
Protects Cultural Sites	Project protects or restores lo'i kalo, loko i'a, heiau, burial sites, and/or Hawaiian Homelands from climate impacts. Cultural sites are identified using the O'ahu 'Āina Inventory . Streams are also considered cultural resources. Therefore, stream restoration is considered protection for a cultural site asset.	Stormwater Capture/Use Upstream of Cultural Site Location (Reduces Flood Risk at Site)
Incorporates Living and Traditional Hawaiian Practices	Project uses the ahupua'a -based planning approach, 'auwai 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 i'a, lo'i kalo, kapu, and restoring native vegetation, among others.	Lo'i Restoration
Reduces Community Flooding	Project will reduce flooding, especially from frequent, small events (e.g., 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, 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 (e.g., towns with one access road).	New/Improved Beach Access
Enhances Recreational Spaces	Project creates additional recreational opportunities through multi-use pathways, expanded parks, beaches or open space, or added amenities to recreational spaces.	Resilient Corridor (Adding Shared-Use Lane 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 assessment, which would inform future stormwater infrastructure projects, receives points for increasing community flood protection and improving water quality, as these are central to stormwater management. That same study receives an “X” for providing ecosystem restoration, as stream restoration would be a possible outcome but is not a core tenet of the study. Area Adaptation Plans are awarded points for every component that they have the opportunity to address, which is often all the community benefits. This designation is because of the wide range of topics and goals that Area Adaptation Plans cover, reasonably addressing all of the community benefits.

The cultural benefit criteria are informed by traditional Hawaiian practices. Cultural sites are defined as lo‘i kalo, loko i‘a, ahupua‘a, heiau, burial sites, and Hawaiian Homelands. Any projects that protect these sites from climate impacts are given a point for cultural site protection. Natural resources are also considered cultural resources, so projects that restore streams or other natural resources receive this point. Living Hawaiian practices include restoration of these cultural sites or native vegetation, as well as practices using natural and traditional water capture and distribution. Projects that promote land use for seasonal water irrigation and promote water connectivity in the boundaries of ahupua‘a also receive a point for living and traditional Hawaiian practices. Green infrastructure projects receive an “X” for this criterion because the project needs to go beyond green infrastructure, but nature-based solutions provide more opportunity to incorporate traditional Hawaiian practices than traditional gray infrastructure projects.

The public safety benefit criteria are focused on reduced flooding in the community and increased public awareness. To obtain a point for the community flood reduction criterion, projects must go beyond flood protection for water infrastructure and provide reduced flooding in residential or business areas. This criterion is especially focused on frequent nuisance flooding, which is not captured as a climate risk, but also applies to flood reduction in the community from a 100-year storm, SLR, and hurricanes. A point is awarded for increasing public awareness and education if a project explicitly incorporates public awareness beyond what is necessary for a standard infrastructure project. This criterion applies to the few projects that are specifically focused on public outreach and engagement, but it is a possibility to be incorporated into many more projects, which will be taken into account as possible benefits in individual project fact sheets.

The ecological benefit criteria award points to prioritize nature-based solutions and methods that improve water quality and restore the ecosystem. Projects receive a point for water quality if they improve the quality of groundwater, sea water, streams, or drinking water. This point can be given for grey or green infrastructure initiatives that have a water quality focus or benefit. Ecosystem restoration requires more of a low-impact design project, particularly green infrastructure and

nature-based solutions that are able to restore habitat, implement native plants, and/or restore open space in previously developed areas.

The recreational benefits are awarded for increased public access to community spaces and enhanced recreational spaces. Increased access creates additional or enhanced access to community spaces, either through new or expanded roads/pathways or minimizing climate impacts to existing single points of connection. One example would be raising an access road that is the only way in/out of a town or beach and otherwise would flood during a storm. A point for enhanced recreational spaces requires new recreational opportunities including multi-use paths, expanded parks, or new or improved amenities within parks such as showers, restrooms, or benches.

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.

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 (in 10 to 25 years), and long-term (25+ years). 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 the project prioritization score as well as the presence of a project champion and finding an appropriate balance of projects by type, region, and area classification, as described in the following list:

- **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. 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.
- **Project Type:** The project types are Plan/Study, Program, and Physical 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 tends to land in

the mid- and long-term due to longer implementation timelines, so the balance is achieved over the total list of recommended projects.

- **Region:** To spread projects geographically across O‘ahu, the recommended project list was checked to confirm that it has at least one project in each planning region. In addition to planning regions, project information includes the congressional, legislative, and council districts and neighborhood board. Due to the large number of boards and districts, it is not feasible to represent each one, especially because priority hotspot locations do not cover all legislative districts or neighborhoods.
- **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 (as defined in Section D.3.2.2).

The project diversification step is useful to curate a recommended project list that represents a wide range of project types and geographies, as well as to receive support from City agencies. While lead and supporting agencies are identified in project ideation, the diversification stage or project prioritization is the main opportunity for representatives from each agency to confirm their ownership over particular projects and to check that the number of projects recommended for each agency to lead is reasonable. In addition, this stage is an important opportunity to prioritize important precursor projects that will enable the implementation of other recommended projects. While creating balance between infrastructure, plans/studies and programs, this step allows the project team to check that studies necessary to inform later-stage projects pass through the prioritization stage. The results of the project prioritization process are shown in the next section, including the recommended One Water Honolulu Project List.

D.3.4.2 PROJECT PRIORITIZATION RESULTS

Overall, project prioritization scores of all of the approximately 100 projects that met One Water Honolulu Project criteria and thus were carried forward to the second step of project prioritization fall between 5 and 16, with the distribution of total scores shown on Figure D-17. The recommended One Water Project List generally includes projects with prioritization scores of 10 and above, with some lower-scored projects included due to the presence of strong project champions or other project balancing considerations.

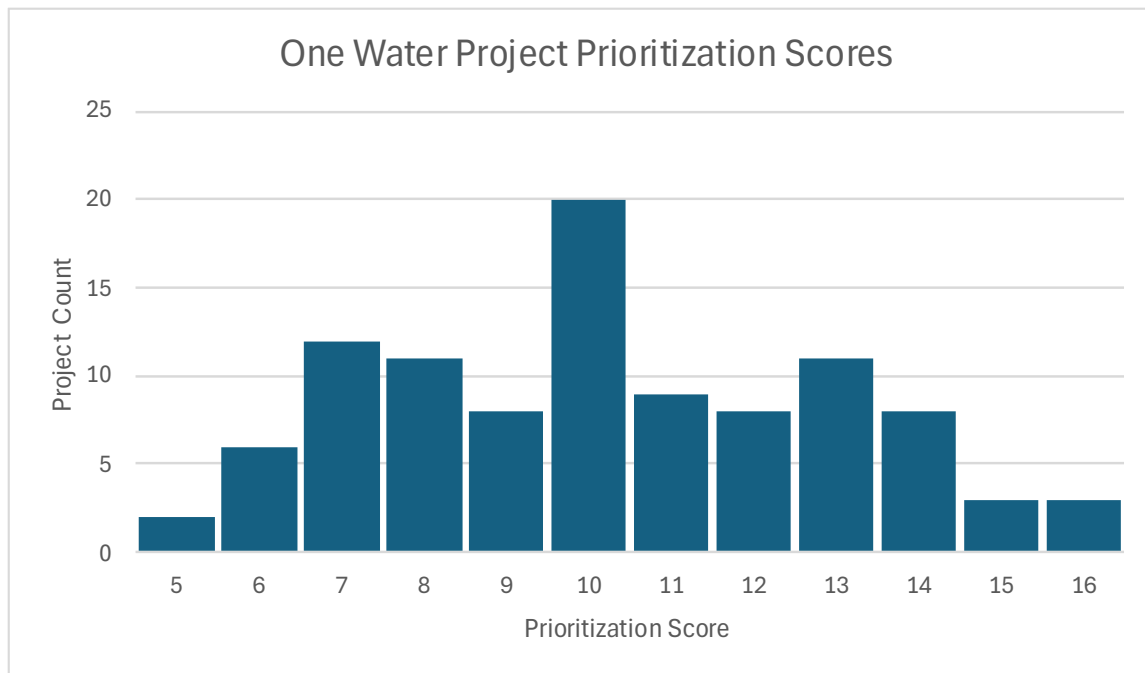


Figure D-17. Spread of project prioritization scores across all ~100 project ideas that met One Water Project criteria. Note that the possible prioritization scores are from 2 to 22, and all One Water Projects included in this Plan fell between 5 and 16.

From the diversification step, the considerations were included to create balance along each dimension:

- Timeframe:** The final One Water Honolulu Project List is skewed toward near-term projects, with 24 near-term, 16 mid-term, and 9 long-term projects for a total of 49 projects. This emphasis on near-term projects reflects a focus on upcoming and anticipated work, while recognizing that the near-term time frame of the next 10 years still captures a significant amount of time to reasonably implement projects, particularly for plans and studies. The distribution of recommended projects by timeframe is shown in Figure D-18.

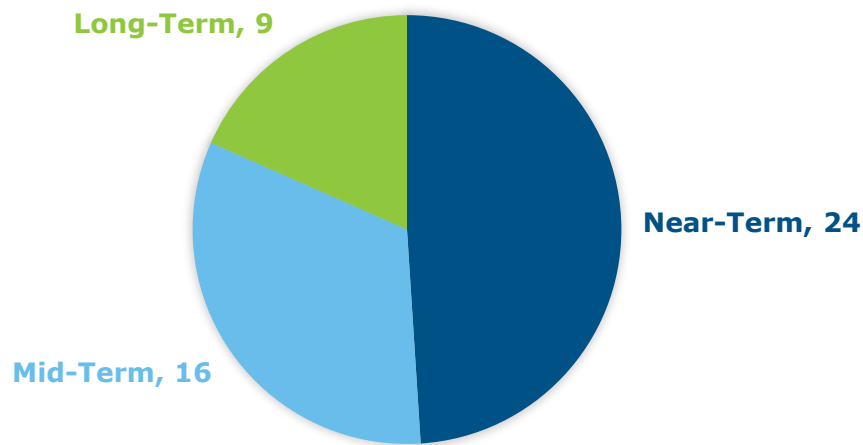


Figure D-18. Pie chart showing projects by timeframe.

- **Project Champion:** Sorting the projects based solely on prioritization scores yielded an unreasonable number of projects to be led by the Department of Facility Maintenance (DFM), so the diversification step prioritized projects led by other agencies, particularly BWS and Department of Environmental Services (ENV). The final balance of recommended projects still represents a large number of DFM-led projects, but when considering the number of projects that each agency is supporting, there is a relative balance between the infrastructure-owning City agencies and many projects among planning agencies. The final number of near-term recommended projects that are led or supported by each City agency is shown on Figure D-19. As a confirmed project champion was not a requirement for mid- and long-term projects, those projects were not explicitly balanced by project champion.

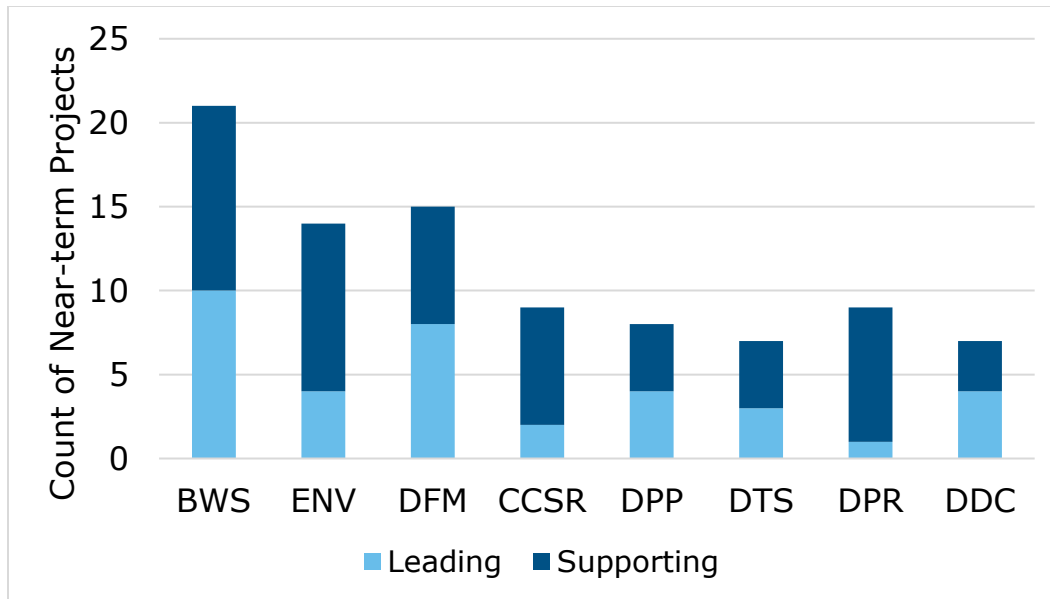


Figure D-19. Count of the 24 near-term projects that are led or supported by each City agency.

- Project Type:** During the project diversification step, the project team elevated a few programs to the recommended list, because they were missing from the list when sorting by prioritization score alone. The final balance is about two-thirds physical infrastructure to one-third plans/studies and programs, as shown on Figure D-20. **Error! Reference source not found.**

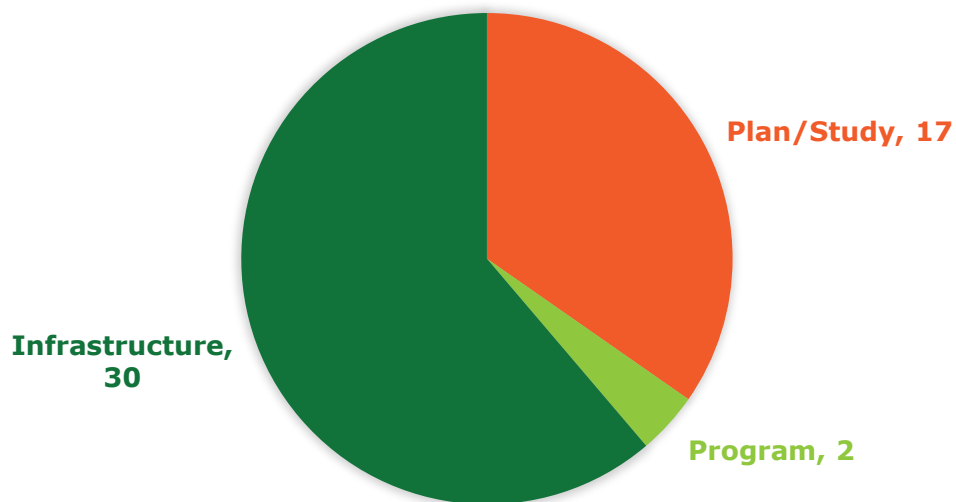


Figure D-20. Pie chart showing the portion of project types among the 49 recommended projects.

- Region:** Based on scores alone, no projects located in the Ko‘olau Loa planning region made the recommended list. This is largely because Ko‘olau Loa had fewer One Water Projects due to the state highway and state park leading to many state-led projects in the region and the overall lower amount of CCH-owned One Water infrastructure present in the region. In addition, there was an over-emphasis on projects in Ko‘olau Poko. During the diversification step, the project team elevated a lower-scored project from Ko‘olau Loa and consolidated or removed several projects from Ko‘olau Poko. The final spread of the projects list has the largest representation of PUC, Islandwide, Ko‘olau Poko, and Wai‘anae, as shown on Figure D-21. The large representation in PUC reflects ongoing projects and development in that area. The proportion of islandwide projects reflects studies and planning efforts that aim to benefit the entire island.

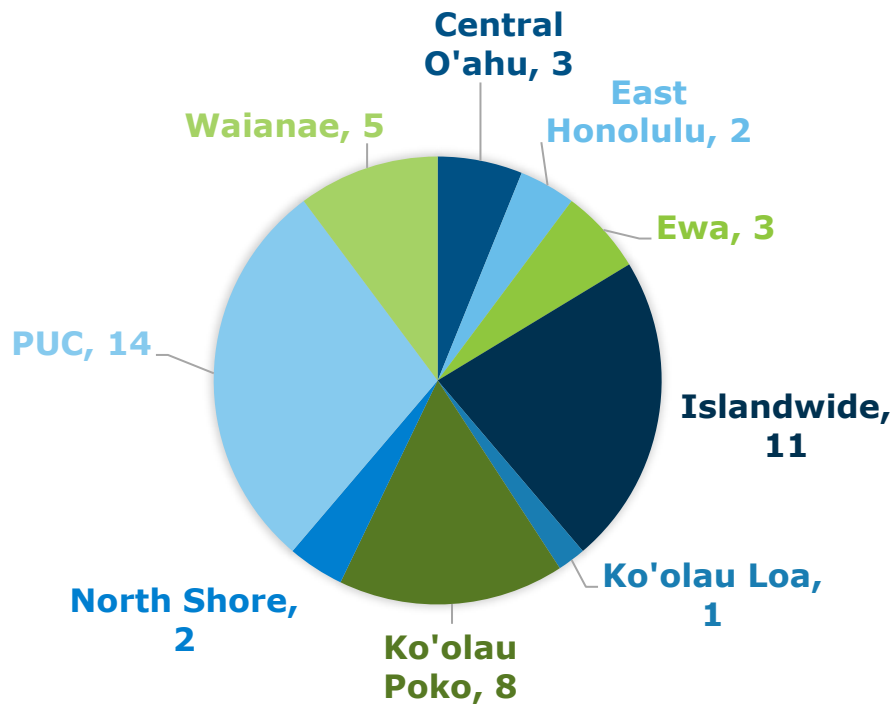


Figure D-21. Pie chart showing the 49 projects by their region, with the number of projects per region as shown

In addition to the planning regions, projects are distributed among the Congressional Districts (Figure D-22), Legislative Districts (Figure D-23), Council Districts (Figure D-24), and Neighborhood Boards (Figure D-25). Excluding islandwide projects, the number of projects in each district is shown in its respective figure.

CONGRESSIONAL DISTRICT

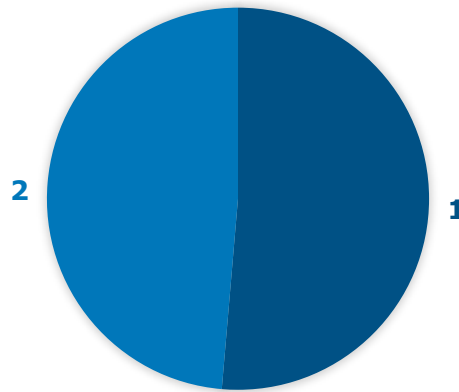


Figure D-22. Pie chart showing distribution of projects across both Congressional Districts (district number)

LEGISLATIVE DISTRICTS

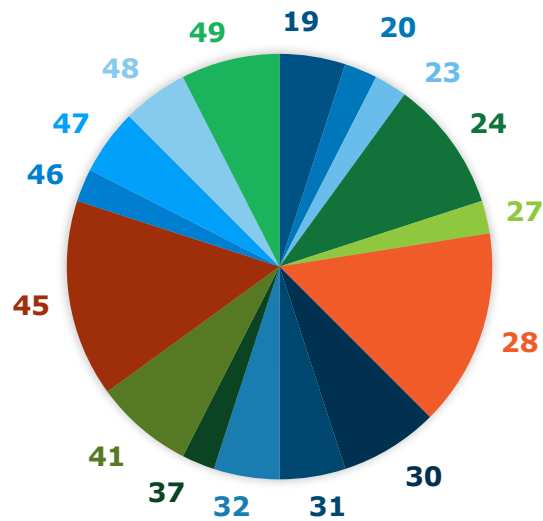


Figure D-23. Distribution of projects across represented Legislative Districts (district number)

COUNCIL DISTRICT

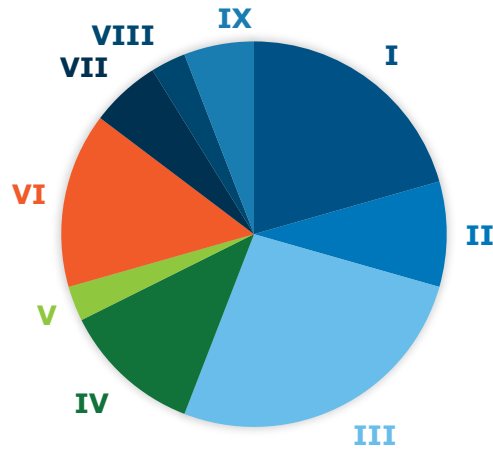


Figure D-24. Distribution of projects across all Council Districts (district number)

NEIGHBORHOOD BOARDS

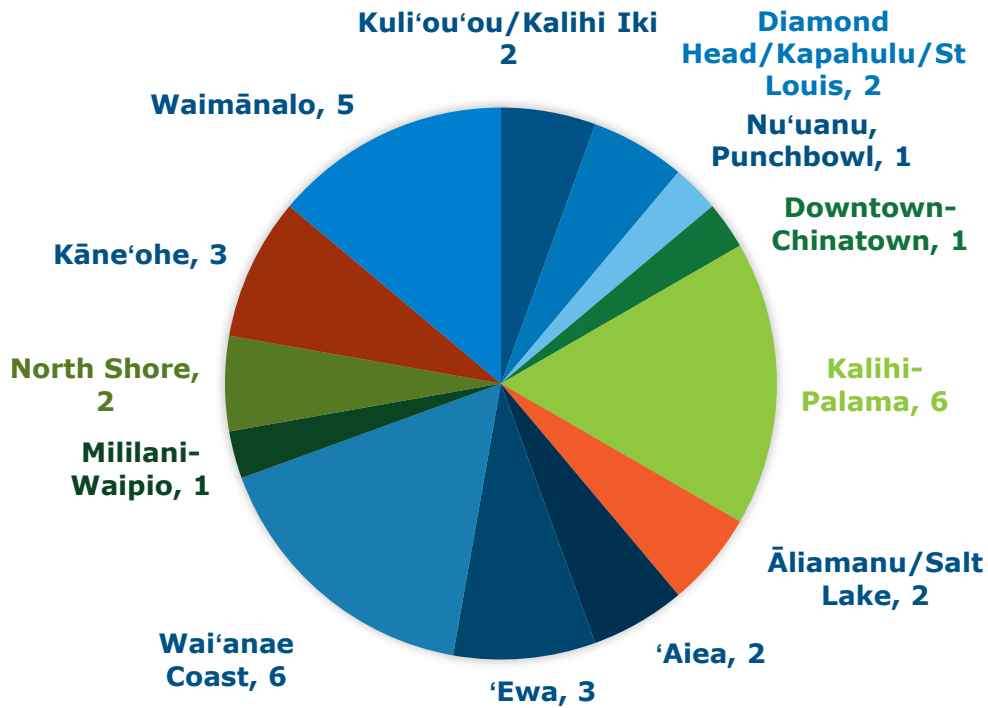


Figure D-25. Distribution of projects across represented Neighborhood Boards, with count of projects for each

- **Area Classification:** With the diversification across regions, the recommended project list naturally achieved diversity in area classification, so no additional balancing was necessary for this metric. Country Towns and Rural Coastline makes up the largest individual classification, with representation of all six classifications (and islandwide). The final balance in area classification is shown on Figure D-26.

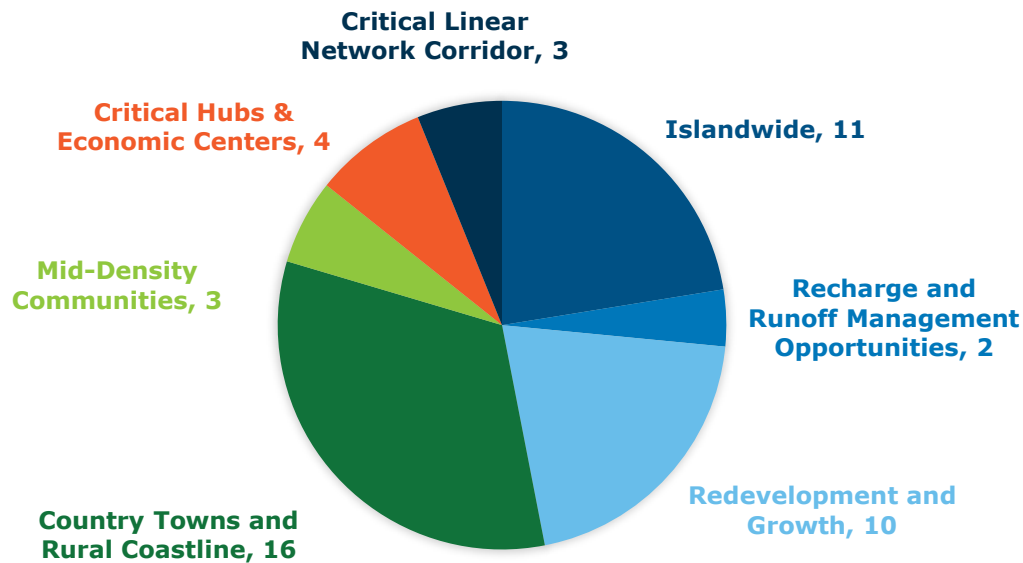


Figure D-26. Pie chart showing the distribution of the 49 projects by area classification

Before project prioritization, approximately 150 projects came out of the project ideation phase. After applying the One Water Project criteria, approximately 100 One Water Projects remained on the list. The project diversification step of the prioritization process resulted in 49 recommended One Water Projects, including 11 new projects that were added to the list resulting from near-term project champion discussions. The results of project prioritization are below for near-term, mid-term, and long-term projects in Table D-20, Table D-21, and Table D-22, respectively. Each table shows project region and type, as well as the overarching criteria scores and total prioritization score. Each project included in these tables is considered part of the recommended One Water Project List and has an accompanying factsheet (included in Plan Appendix H) that includes project details such as:

- Project Concept Name
- General Description
- Timeframe
- Champion Agency (for near-term projects)/Potential Champion (for mid-and long-term projects)
- Potential Partnerships

- Adaptation Strategy Type
- Location of Project
- Congressional District
- Council District
- Legislative District
- Neighborhood Board
- O‘ahu SoVI
- Infrastructure Assets at Risk
- Community Assets at Risk
- Climate Resilience
- Project Components
- Adaptation Strategies Applied
- Community Benefits
- Hotspot Goals
- OWH Objectives
- CRO Strategies
- Potential Challenges and Additional Considerations
- Expected Timeline & Triggers
- Planning Level Cost

The rest of the One Water Projects are included on a lower priority One Water Project list, which can be drawn from in future planning efforts. This list includes the projects that were removed due to redundancy with other efforts or other balancing considerations during the diversification step. Within project balancing, projects were removed due to lack of support from City agencies, lack of alignment with current City priorities, or overlap with projects that remained on the recommended project list. The projects are listed by region first and lead agency second. All of these projects require cross-agency collaboration, per the One Water classification criteria. The lower priority projects are listed in Table D-23, sorted by their prioritization score.

Projects that did not pass the One Water Project criteria are shown in Table D-24, along with a reason for why they did not fit the criteria. These projects are sorted by the lead agency so that they can be easily passed, identified, and potentially implemented by individual City agencies outside of the One

Water process. Finally, state- or federal-led projects do not fit on the City One Water Projects List as they are not City projects. These state and federal projects are documented in Table D-25.

Table D-20. Recommended Near-Term One Water Honolulu Projects (24)¹

ID #	PROJECT TITLE	REGION	PROJECT TYPE	PROJECT CHAMPION	COMMUNITY BENEFITS SCORE	SOVI SCORE	SCALE OF IMPACT SCORE	RESILIENCE SCORE	TOTAL SCORE
33	Managed Retreat Legal and Policy Investigation Study	Islandwide	Plan/Study	DPP	2	2	5	5	14
30	Stormwater Utility Fee	Islandwide	Program	DFM	3	2	5	3	13
35	Road Raising Strategy	Islandwide	Plan/Study	DTS/DDC	1	2	5	4	12
165	Stormwater Master Plan	Islandwide	Plan/Study	DFM	2	2	5	3	12
109	Green Infrastructure Implementation Plan	Islandwide	Infrastructure	DFM	2	2	5	3	12
150	Expand Tidal Groundwater Well Monitoring Network	Islandwide	Plan/Study	BWS	2	4	4	2	12
39	Onsite Stormwater Management Incentives	Islandwide	Program	DFM	3	2	5	1	11
41	Beach Shower NPDES Compliance Improvements	Islandwide	Infrastructure	DFM	2	2	5	1	10
169	Expand Non-Potable Water to Large Parks and Water Loss Control	Islandwide	Infrastructure	DPR/DDC/BWS	1	2	5	2	10
172	Country Town Resilient Sidewalk & Path Improvements for Unimproved Roadways	Islandwide	Infrastructure	DTS	2	2	1	2	7
75	Waimānalo Effluent R-1 Reuse Feasibility Study	Koʻolau Poko	Infrastructure	ENV	1	3	3	3	10
101	Iwilei Area Adaptation Plan	PUC	Plan/Study	DPP/DFM/CCSR	7	4	2	3	16
122	Adapt Waikīkī Phase 2	PUC	Plan/Study	DPP	7	2	2	3	14
115	Māpunapuna Area Adaptation Plan	PUC	Plan/Study	DPP/DFM/CCSR	7	2	2	3	14
123	Ala Wai Watershed Integrated Stormwater Management	PUC	Infrastructure	DDC	4	1	3	3	11
106	Reuse Strategy for Redevelopment Areas	PUC	Plan/Study	BWS	1	3	4	2	10
162	NASED Regulatory Requirements for Reuse	PUC	Infrastructure	BWS	1	3	2	2	8
170	University Avenue Urban Complete Streets Depaving and Green Infrastructure	PUC	Infrastructure	DTS/DDC/DFM	2	2	1	2	7
155	Ala Wai Golf Course Non-Potable Irrigation Study	PUC	Plan/Study	BWS	1	1	1	2	5
163	Nuuanu Reservoir Hydro Managed Aquifer Recharge	PUC	Infrastructure	BWS	0	2	2	1	5
168	Reuse and Potable Water Services for Whitmore Agriculture	Central Oʻahu	Infrastructure	BWS/ENV	0	3	2	2	7
167	Central Oʻahu Water Recycling Facilities, Mililani	Central Oʻahu	Plan/Study	BWS/ENV	0	2	2	2	6
164	Potable Reuse Pilot Honouliuli	ʻEwa	Infrastructure	BWS/ENV/DOH	0	2	2	2	6
129	Develop Cooperative Fireshed Partnerships	Waiʻanae	Infrastructure	BWS	3	4	4	2	13

DOH = Department of Health, DPP = Department of Planning and Permitting, DPR = Department of Parks and Recreation, DTS = Department of Transportation Services

(1) Each project shows the region and type, as well as the overarching score contributions and total prioritization score.

Table D-21. Recommended Mid-Term One Water Honolulu Projects (16)¹

ID #	PROJECT NAME	REGION	PROJECT TYPE	COMMUNITY BENEFITS SCORE	SOVI SCORE	SCALE OF IMPACT SCORE	RESILIENCE SCORE	TOTAL SCORE
166	Projects from the Integrated Plan	Islandwide	Plan/Study	TBD	TBD	TBD	TBD	TBD
92	Hale'iwa Area Adaptation Plan	North Shore	Plan/Study	8	3	2	3	16
90	Stormwater Retention, Recharge, and Reuse in Mauka Lands	North Shore	Infrastructure	5	3	3	4	15
64	Beach Park Erosion and Flood Resilience	Ko'olau Loa	Infrastructure	4	4	3	3	14
53	Coastal Management Plan for Erosion and Flooding	Ko'olau Poko	Plan/Study	7	2	4	2	15
70	Kahawai Stream Restoration Strategy	Ko'olau Poko	Plan/Study	4	3	3	2	12
68	Waimānalo Roads Drainage Study and Improvements	Ko'olau Poko	Infrastructure	2	3	3	5	13
59	Stormwater Retention along Kamo'oali'i Stream	Ko'olau Poko	Infrastructure	3	0	3	4	10
61	MCBH R-1 Recycled Water Upgrade	Ko'olau Poko	Plan/Study	1	2	3	3	9
9	Stream Restoration & Rehabilitation	East Honolulu	Infrastructure	4	0	3	3	10
104	Kapālama Canal Linear Park	PUC	Infrastructure	5	4	2	5	16
102	Pilot Floodable Spaces	PUC	Infrastructure	5	4	2	3	14
103	Iwilei Drainage Improvements	PUC	Infrastructure	5	3	3	3	14
105	Resilience Corridors and Road Raising	PUC	Infrastructure	4	4	1	5	14
110	Māpunapuna Flood Improvements	PUC	Infrastructure	1	2	2	5	10
4	Honouliuli R-1 Distribution System Expansion	Central O'ahu	Infrastructure	3	3	2	2	10

(1) Each project shows the region and type, as well as the overarching score contributions and total prioritization score.

Table D-22. Recommended Long-Term One Water Honolulu Projects (9)¹

ID #	PROJECT NAME	REGION	PROJECT TYPE	COMMUNITY BENEFITS SCORE	SOVI SCORE	SCALE OF IMPACT SCORE	RESILIENCE SCORE	TOTAL SCORE
67	State Agriculture Water System Connection to Future R-1	Koʻolau Poko	Infrastructure	0	3	3	3	9
60	Resilience Corridor and Pedestrian Accessibility Study	Koʻolau Poko	Infrastructure	2	1	1	3	7
8	Regional Shoreline Adaptation	East Honolulu	Infrastructure	4	0	2	4	10
26	Long-range Post-retreat Study	ʻEwa	Plan/Study	2	3	2	1	8
19	Raise Main Arterials Further Inland	ʻEwa	Infrastructure	2	3	1	5	11
145	Mākaha Roads Drainage Study and Improvements	Waiʻanae	Infrastructure	1	4	4	4	13
141	Mākaha Stormwater Infrastructure	Waiʻanae	Infrastructure	2	4	3	4	13
130	Increase Green Infrastructure and Green Space	Waiʻanae	Infrastructure	2	3	3	2	10
132	Dry Flood Proof High Risk Areas	Waiʻanae	Infrastructure	0	3	4	3	10

(1) Each project shows the region and type, as well as the overarching score contributions and total prioritization score.

Table D-23. Remaining One Water Projects That Are Not Included in the Recommended Projects List¹

ID #	PROJECT NAME	REGION	HOTSPOT	PROJECT TYPE	PROPOSED LEAD AGENCY	SUPPORTING AGENCIES	PRIORITIZATION SCORE
97	Pūpūkea Special Improvement District + Area Adaptation Plan	North Shore	Pūpūkea/Waimea Bay	Plan/Study	DPP	ENV, DFM, BWS, CCSR	16
62	Study Opportunities for Stream Restoration	Koʻolau Poko	Kāneʻohe	Plan/Study	BWS	DFM	15
1	Living Levee at Pouhala Marsh	Central Oʻahu	Waipahu/Pouhala Marsh	Physical Infrastructure	CCSR	DLNR, DFM	14
65	Stormwater Management at Olomana Golf Links	Koʻolau Poko	Waimānalo	Physical Infrastructure	DFM	BWS, DES	14
2	Subsurface Stormwater Retention Pilot in Mauka Parks (Capture & Use)	Central Oʻahu	Waipahu/Pouhala Marsh	Physical Infrastructure	DFM	DPR, BWS, ENV	13
57	Stormwater Storage Berms around Heʻeia Wetlands	Koʻolau Poko	Kāneʻohe	Physical Infrastructure	DFM	CCSR, BWS	13
81	Restore and Remediate Waiheʻe Valley Nature Park	Koʻolau Poko	Kamehameha Hwy	Plan/Study	BWS	DFM, DPR	13
134	Program for Partnerships with Cultural Practitioners for Adaptation Planning	Waiʻanae	Pōkaʻī Bay St	Program	CCSR	BWS, DPR	13
144	Create Floodable Area around Mākaha Stream	Waiʻanae	Mākaha Stream/Farrington Highway	Physical Infrastructure	DFM	DPR	13
40	Explore Feasibility of Standard Stream Buffer Areas	Islandwide	Islandwide	Plan/Study	DFM	DPP	12
108	Implementation of New and Upsized Water, Wastewater, SW System	PUC	Iwilei	Physical Infrastructure	BWS	HDOT, ENV, DFM, HECO	12
15	Conduct an Analysis of Adaptation and Retreat Options for Pupu Place	ʻEwa	Pūpū St/Pūpū Pl	Plan/Study	CCSR	DPP	11
32	Design Guidelines for LID and GI that Reflect the Character of the Community	Islandwide	Islandwide	Plan/Study	DFM	BWS, DDC/DPP	11
63	Removal of Invasive Species/Albizia Trees	Koʻolau Poko	Kāneʻohe	Program	CCSR	BWS	11
84	Comprehensive Stream Maintenance Program for Private Owners	Koʻolau Poko	Kamehameha Hwy	Program	DFM	BWS	11
86	Study to Identify Potential Floodable Spaces	Koʻolau Poko	Kamehameha Hwy	Plan/Study	DFM	BWS, DPR	11
133	Berm Around Open Space (Waiʻanae Elementary)	Waiʻanae	Pōkaʻī Bay St	Physical Infrastructure	DFM	BWS, DPR	11
3	Green Streets & Bike Path – Farrington Hwy and Leoku St	Central Oʻahu	Waipahu/Pouhala Marsh	Physical Infrastructure	DTS	DFM, HDOT	10
5	Stormwater Pre-Treatment Installations (at Catch Basins and in Streams)	Central Oʻahu	Waipahu/Pouhala Marsh	Physical Infrastructure	DFM	HDOT, DTS	10
11	Subsurface Stormwater Capture & Use	East Honolulu	Kalanianaʻole Hwy	Physical Infrastructure	DFM	BWS, DPR, CCSR	10
71	Drainage Study	Koʻolau Poko	Waimānalo	Plan/Study	DFM	DTS	10
74	Invasive Species Management Program	Koʻolau Poko	Waimānalo	Program	CCSR	BWS	10
82	Comprehensive Emergent Groundwater Mitigation Plan and Coordinate with Tree Planting to Mitigate Heat	Koʻolau Poko	Kamehameha Hwy	Plan/Study	BWS	CCSR, DFM	10
114	Hydrogeological and Environmental Impact Assessment	PUC	Māpunapuna	Plan/Study	DFM	DPP, BWS	10
118	Drainage Master Plan (including Condition Assessment)	PUC	Waikiki	Plan/Study	DFM	DTS	10

ID #	PROJECT NAME	REGION	HOTSPOT	PROJECT TYPE	PROPOSED LEAD AGENCY	SUPPORTING AGENCIES	PRIORITIZATION SCORE
136	Water Conserving Showers at Comfort Stations	Wai‘anae	Pōka‘ī Bay St	Physical Infrastructure	BWS	DFM	10
7	Groundwater Contamination Study	Central O‘ahu	Waipahu/Pouhala Marsh	Plan/Study	BWS	DPR, DDC, DPP	9
25	Makai Side Dune Restoration and Natural Buffers	‘Ewa	Pūpū St/Pūpū Pl	Physical Infrastructure	CCSR	DLNR, DPP	9
38	One Water Community Engagement Program	Islandwide	Islandwide	Program	CCSR	BWS, DFM, ENV, DDC	9
58	Dry/Wet Floodproofing of All City Assets	Ko‘olau Poko	Kāne‘ohe	Physical Infrastructure	DDC	ENV, BWS, DFM	9
117	Waikiki Resilience Corridor Program	PUC	Waikiki	Physical Infrastructure	DDC	ENV, BWS , DTS, DPP, DFM	9
137	All Beach Parks: Rethinking Tree Growth	Wai‘anae	Pōka‘ī Bay St	Plan/Study	DPR	CCSR	9
21	Drainage Master Planning	‘Ewa	Pūpū St/Pūpū Pl	Plan/Study	DFM	DTS	8
27	Adaptation Financial Alternatives Study	Islandwide	Pūpū St/Pūpū Pl	Plan/Study	CCSR	BFS	8
54	Water Conservation Pilot Program	Ko‘olau Poko	Kāne‘ohe	Program	BWS	CCSR	8
78	Create Floodable Area in He‘eia Pond	Ko‘olau Poko	Kamehameha Hwy	Physical Infrastructure	DFM	BWS	8
87	Cesspool Conversion Plan (including Kahaluu Conversion Pilot)	Ko‘olau Poko	Kamehameha Hwy	Plan/Study	ENV	DLNR, DOH	8
119	Stormwater Capture at Park (Ainahau Triangle/Fort DeRussy)	PUC	Waikiki	Physical Infrastructure	DFM	DPR	8
83	Tree Plantings to Mitigate Heat	Ko‘olau Poko	Kamehameha Hwy	Physical Infrastructure	CCSR	DPR	7

(1) These lower priority projects are sorted by prioritization score.

BFS = Department of Budget and Fiscal Services

DES = Department of Enterprise Services

HECO = Hawaiian Electric Company

Table D-24. Projects That Do Not Meet the One Water Criteria, With Justification Why the Project is Not One Water, Sorted by the Lead Agency

LEAD AGENCY	PROJECT NAME	REGION	HOTSPOT	JUSTIFICATION/REASON WHY IT IS NOT ONE WATER
Private	Trash Reduction Structures at Kawa Stream	Ko‘olau Poko	Kāne‘ohe	This is under private ownership, so it does not meet the criterion of being led by a City agency.
Multiple	Evaluate Infrastructure Needs in Subdivided Former Dole Property	North Shore	Hale‘iwa	This project does not pass the One Water criterion of addressing existing OWH infrastructure.
BWS/ENV	Elevate and/or floodproof BWS booster pumps and ENV pump stations (East Honolulu-Kalaniana‘ole Hwy)	East Honolulu	Kalaniana‘ole Hwy	This project does not meet the One Water criterion of collaboration between multiple agencies because this is two separate projects for ENV and BWS.
BWS	Floodproof BWS Waihe‘e Line Booster Station	Ko‘olau Poko	Kamehameha Hwy	BWS project only. Does not meet multi-agency requirement.
BWS	Native plant nursery	Wai‘anae	Pōka‘ī Bay St	BWS project only. Does not meet multi-agency requirement.
BWS	Groundwater Management Area Designation	Wai‘anae	Pōka‘ī Bay St	BWS project only. Does not meet multi-agency requirement.
BWS	Watershed Fence Restoration (prevent illegal access to land/dirt bikes and ungulates)	Wai‘anae	Mākaha Stream/Farrington Highway	BWS project only. Does not meet multi-agency requirement.
CCSR	Climate Adaptation Community Education and Engagement Plan	‘Ewa	Pūpū St/Pūpū Pl	This project does not meet the One Water criterion of addressing OWH infrastructure.
CCSR	Engagement Program with Incentives	Islandwide	Islandwide	This project does not fit the criteria of addressing existing OWH infrastructure and does not necessarily include collaboration between multiple City agencies.
CCSR	Cool Roofs on Warehouses	PUC	Māpunapuna	This project does not address OWH infrastructure.
CCSR	Plan for Iwi Kupuna Reinterment	Wai‘anae	Pōka‘ī Bay St	Does not address City One Water assets.
DEM	Create/Update Emergency Response Plans	‘Ewa	Pūpū St/Pūpū Pl	This project does not address OWH infrastructure.
DFM	Regular Maintenance Strategy for Wailupe, Kuli‘ou‘ou, Niu Valley Streams, Including Dredged Sand Reuse	East Honolulu	Kalaniana‘ole Hwy	DFM project only. Does not meet multi-agency requirement.
DFM	Stormwater Pumping and Backflow Prevention At Outfalls	‘Ewa	Pūpū St/Pūpū Pl	DFM project only. Does not meet multi-agency requirement.
DFM	Flow Path Mapping for Green Infrastructure Opportunities	Islandwide	Islandwide	DFM project only. Does not meet multi-agency requirement.
DFM	Submerged Outfalls Alternatives Assessment Plan	Islandwide	Islandwide	DFM project only. Does not meet multi-agency requirement.
DFM	Detention Basin/Pond at Bayview Golf Course	Ko‘olau Poko	Kāne‘ohe	This is under private ownership, so it does not meet the criterion of being led by a City agency.
DFM	Soil Conservation Plan Development Support	North Shore	Hale‘iwa	DFM project only. Does not meet multi-agency requirement.
DFM	Regular Maintenance Program for Waimea River Outlet	North Shore	Pūpūkea/Waimea Bay	DFM project only. Does not meet multi-agency requirement.
DFM	Debris Management Infrastructure Upgrades at Moanalua Stream	PUC	Māpunapuna	DFM project only. Does not meet multi-agency requirement.
DFM	Pumping Management Plan	PUC	Waikīkī	DFM project only. Does not meet multi-agency requirement.
DFM	Trash and Debris Management Program for Ala Wai Canal	PUC	Waikīkī	Does not address a climate hazard.
DPP	Study into Legal and Jurisdictional Questions for Climate Adaptation Projects under Multiple State and City Agencies	Islandwide	Islandwide	Does not address any existing OWH infrastructure or climate risk directly.
DPP	Shoreline Hardening and Seawalls (Coordination with DLNR)	‘Ewa	Pūpū St/Pūpū Pl	DPP project only. Does not meet multi-agency requirement.
DPR	Pilot Projects to Streamline Resilience Project Permitting on Historical Land	Islandwide	Islandwide	DPR project only. Does not meet multi-agency requirement or address a specific climate hazard.
DPR	Beach Access Improvements	North Shore	Pūpūkea/Waimea Bay	Does not involve One Water infrastructure or address a CRO strategy.
DTS	Pupu Place ROW Improvements	‘Ewa	Pūpū St/Pūpū Pl	This project does not address a CRO strategy.
DTS	Plan for Emergency Access	Wai‘anae	Pōka‘ī Bay St	DTS project only. Does not meet multi-agency requirement.

DEM = Department of Emergency Management

Table D-25. State- and Federal-Led Projects

LEAD AGENCY	PROJECT NAME	REGION	HOTSPOT
USACE	Waialele Stream Flood Mitigation Project	Koʻolau Loa	Outside Hotspot Areas
NAVFAC	Loʻi Restoration – Lualualei	Waiʻanae	Pōkaʻī Bay St
ADC	Improvements of Wahiawa Irrigation System	North Shore	Haleʻiwa
HDOT	Elevate and Upgrade Kamehameha Highway Road and Underground Utilities at Kamehameha Highway Near Kahaluʻu	Koʻolau Poko	Kamehameha Hwy
HDOT	Elevation or Relocation of High-Risk Highway Segments	East Honolulu	Kalanianaʻole Hwy
HDOT	Study the Impact of Hwy Subsurface Hardening on Groundwater Flows and Runoff/Streams Flooding	Islandwide	Islandwide
HDOT	Elevate Kamehameha Highway and Harden Coastline, Phase 1: Study Routes, Phase 2: Construction	Koʻolau Loa	Kaʻaʻawa/Kahana
HDOT	Flood Barrier Along the Coast to Protect Communities, Roadway, and Utilities	Koʻolau Loa	Kaʻaʻawa/Kahana
HDOT	Climate Adaptation Action Plan (HDOT)	Koʻolau Loa	Kaʻaʻawa/Kahana
HDOT	Resilient Corridor along Kalanianaʻole Highway	Koʻolau Poko	Waimānalo
HDOT	South Kalanianaʻole Highway Erosion Study	Koʻolau Poko	Waimānalo
HDOT	Flood Barrier along Coastline near Waiāhole Stream Outlet	Koʻolau Poko	Kamehameha Hwy
HDOT	Regional Highway Relocation Plan and Design Guidelines in Coordination with Long-Range Plan for Kamehameha Highway in Coordination with HDOT	Koʻolau Poko	Kamehameha Hwy
HDOT	Relocate/Move Mauka or Abandon Roadway and Create Recreational Path	Koʻolau Poko	Kamehameha Hwy
HDOT	Resilience Corridor and Pedestrian Accessibility Planning Study	Koʻolau Poko	Kamehameha Hwy
HDOT	Road and Asset Raising Study along Kamehameha Highway	North Shore	Pūpūkea/Waimea Bay
HDOT	Roadway Raising Prioritization Study (Phase 1), and Raising Roads Implementation (Phase 2)	PUC	Waikīkī
HDOT	Coordinate with State to Consider Hardening for Farrington Highway	Waiʻanae	Mākaha Stream/Farrington Highway
HDOT	Coordinate with State for Bridge Raising at Mākaha Stream	Waiʻanae	Mākaha Stream/Farrington Highway
DLNR	Shoreline Protection Methods (Piers/Jetties – Work with State)	Koʻolau Loa	Kaʻaʻawa/Kahana
DLNR	Dune Restoration in Haleʻiwa Beach Park	North Shore	Haleʻiwa
DLNR	Conserve and Restore the Ecosystem of Kahana Valley	Koʻolau Loa	Kaʻaʻawa/Kahana

ADC = Agribusiness Development Corporation
NAVFAC = Naval Facilities Engineering Systems Command
USACE = U.S. Army Corps of Engineers

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ATTACHMENT D.1

The full menu of adaptation options are included in this Attachment, sorted by Category. These adaptation strategies are organized by relevance for climate hazards as well as asset type. Each strategy also includes a timeframe (near/mid/long), relative cost (low/medium/high), and level of resilience (as defined in Section D.3.4). These adaptation strategies draw on previous planning efforts including the Climate Resilient Design Guidelines (CCH 2024a), Multi-Hazard Pre-Disaster Mitigation Plan (CCH, 2021), Hawai‘i Department of Transportation (HDOT) Climate Action Plan (HDOT, 2021), Climate Ready O‘ahu (CCH, 2024b), the Sand Island Facilities Plan (Carollo, 2025), and the Ko‘olau Poko Readiness Review (Brown and Caldwell, 2025).

Strategy Number	Category	Type	Adaptation Strategy	100 Year Flood	Hurricane	Tsunami	SLR - Above Ground	SLR - Groundwater	Coastal Erosion	Wildfire	Extreme Heat	Drought	Relevant For										Precursor	Timeframe	Relative Cost	Level of Resilience	Source
													Pump Station	Pipeline	Stream	Treatment Facility	Outfall	Drain Inlet	Well	Distribution Tank	Dam/Reservoir	Baseyard					
1	Alternative Water Supplies	Physical Infrastructure	Utilize Alternative Water Sources: Nonpotable Reuse, Indirect Potable Reuse, On Site Reuse, Desalination									x		x		x	x	x						Mid	High	Low-Med	Climate Resilient Design Guidelines, Ko'olau Poko MIRR
2	Alternative Water Supplies	Physical Infrastructure	Stormwater Capture and Use	x								x	x	x	x			x						Long	High	Med-High	
3	Building and Asset Flood Protection	Physical Infrastructure	Dry Floodproof the Building/Asset/Utility (e.g., seal windows, doors, vents, drainage systems, manholes)	x	x	x	x	x	x				x			x	x							Near	Low	Low	SI Fac Plan, Climate Resilient Design Guidelines
4	Building and Asset Flood Protection	Physical Infrastructure	Wet Floodproofing: Incorporate Flood Damage-Resistant Materials (e.g., concrete, brick, tiles, latex paint, pressure-treated plywood, cement, glass) and Incorporate Openings in Project Infrastructure for Water Egress	x	x	x	x	x	x				x			x				x				Near	Low	Low	Climate Resilient Design Guidelines
5	Building and Asset Flood Protection	Physical Infrastructure	Incorporate Flood/Submersible Pumps for Surface Water or Groundwater	x	x	x	x	x	x				x			x								Long	Medium	Medium	Climate Resilient Design Guidelines
6	Building and Asset Flood Protection	Programs	Deployable Flood Barriers (e.g. Sandbag Entrance and Openings)	x	x	x							x			x				x				Near	Low	Low	SI Fac Plan, Climate Resilient Design Guidelines
7	Coastal and Shoreline Resilience	Physical Infrastructure	Reef Facilitation	x	x	x			x				x	x		x	x	x				x		Long	Low	Low-Med	Ko'olau Poko MIRR (example from Lowcountry Parris Island MIRR)
8	Coastal and Shoreline Resilience	Physical Infrastructure	Breakwater/Revetments	x	x	x			x				x	x		x	x	x				x		Long	High	Med-High	Ko'olau Poko MIRR (example from Lowcountry Parris Island MIRR)
9	Coastal and Shoreline Resilience	Physical Infrastructure	Restore Beach, Dune Systems, and Coastal Floodplain	x	x	x	x		x				x	x		x	x	x				x		Long	High	Med-High	Ko'olau Poko MIRR, Climate Ready Oahu, SI Fac Plan, MHMP, Climate Resilient Design Guidelines
10	Coastal and Shoreline Resilience	Physical Infrastructure	Build a Living Levee	x			x		x				x	x		x	x					x		Long	High	Med-High	
11	Community Engagement	Programs	City Network of Partners Who Serve Frontline Communities to Check in on Vulnerable Neighbors During Climate "Shocks"	x	x	x	x	x	x	x	x	x												Near	Low	Low-Med	Climate Ready Oahu (1.2)
12	Community Engagement	Programs	Educational Resources on How Native Hawaiian Cultural Practices Positively Contribute to Climate Adaptation	x			x		x	x	x	x	x			x	x		x					Near	Low	Low	Climate Ready Oahu
13	Community Engagement	Programs	Incorporate Non-Structural Hazard Mitigation Measures (e.g., watershed/district scale communication network, public education)	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x		x	Precursor	Near	Low	Low-Med	Climate Resilient Design Guidelines
14	Community Engagement	Programs	Incorporate Awards and Recognition Programs																					Near	Medium	Low	Expanding Stormwater Opportunities on Oahu, OWOW
15	Community Engagement	Programs	Onsite Stormwater Management Incentives	x									x	x	x	x	x							Near	Low	Low	
16	Create Floodable Space	Physical Infrastructure	Mauka stormwater treatment, retention, and infiltration	x					x						x		x							Long	High	Med-High	
17	Create Floodable Space	Programs	Conservation or Open Space Easement to Provide Floodable Space	x	x	x	x			x	x		x		x	x		x	x	x		x	Precursor	Mid	Medium	Medium	Ko'olau Poko MIRR (example from Lowcountry Parris Island MIRR)
18	Create Floodable Space	Programs	Agricultural Practices (Kalo Farming)	x			x									x								Near	Low	Low	Ko'olau Poko MIRR

Strategy Number	Category	Type	Adaptation Strategy	100 Year Flood	Hurricane	Tsunami	SLR - Above Ground	SLR - Groundwater	Coastal Erosion	Wildfire	Extreme Heat	Drought	Relevant For										Precursor	Timeframe	Relative Cost	Level of Resilience	Source
													Pump Station	Pipeline	Stream	Treatment Facility	Outfall	Drain Inlet	Well	Distribution Tank	Dam/Reservoir	Baseyard					
19	Ecosystem Protection/Restoration	Physical Infrastructure	Riparian and Wetland Buffers	x	x	x	x		x	x	x	x	x		x						x		Long	High	Med-High	Climate Ready Oahu (6.1), Climate Resilience Design Guidelines	
20	Ecosystem Protection/Restoration	Physical Infrastructure	Bank Grading/Planting						x		x	x			x						x		Near	Low	Low	Ko'olau Poko MIRR (example from Lowcountry Parris Island MIRR)	
21	Ecosystem Protection/Restoration	Physical Infrastructure	Incorporate Heat and Drought Resilient Vegetation	x	x	x					x	x									x		Near	Low	Low	Climate Resilient Design Guidelines	
22	Ecosystem Protection/Restoration	Physical Infrastructure	Incorporate Native Vegetation	x	x	x	x	x	x	x	x	x									x		Near	Low	Low	Climate Resilient Design Guidelines	
23	Ecosystem Protection/Restoration	Physical Infrastructure	Incorporate Salt and Flood Resilient Vegetation		x	x	x	x	x		x				x						x		Near	Low	Low	Climate Resilient Design Guidelines	
			Increase or Preserve Site Tree Canopy Coverage, Natural Planted Areas, or Wetlands																							Climate Resilient Design Guidelines, Ko'olau Poko MIRR	
24	Ecosystem Protection/Restoration	Physical Infrastructure		x	x	x					x										x		Mid	Low	Low-Med		
25	Ecosystem Protection/Restoration	Physical Infrastructure	Restoration of Io'i kalo	x					x			x											Mid	Low	Low		
26	Ecosystem Protection/Restoration	Plans & Studies	Soil Conservation Plans	x					x														Precursor	Near	Low	Low-Med	
27	Ecosystem Protection/Restoration	Plans & Studies	Maintenance plan for Rivers and Streams	x											x								Precursor	Near	Low	Low-Med	
28	Ecosystem Protection/Restoration	Programs	Stream Restoration	x											x								Mid	Medium	Medium		
		Physical Infrastructure																									
29	Elevation of Infrastructure	Physical Infrastructure	Elevate Critical Assets/Equipment	x	x	x		x					x			x	x				x		Near	Medium	Medium	SI Fac Plan, Climate Resilient Design Guidelines	
30	Elevation of Infrastructure	Physical Infrastructure	Elevate Access Road and Associated Utilities	x	x	x	x	x	x				x	x		x					x	x	Mid	High	High	SI Fac Plan, AW Climate Commission PPT	
		Physical Infrastructure																									
31	Elevation of Infrastructure	Physical Infrastructure	Elevate Site Grade	x	x	x	x	x					x				x	x			x	x	Mid	High	High	SI Fac Plan, Climate Resilient Design Guidelines	
			Elevate Occupied Spaces Above Flood Elevations (e.g.,																								
32	Elevation of Infrastructure	Physical Infrastructure	second floor)	x	x	x	x	x	x							x							Mid	Medium	High	Climate Resilient Design Guidelines	
33	Elevation of Infrastructure	Physical Infrastructure	Raise Building Ground Floor Elevation	x	x	x	x	x	x							x					x		Mid	Medium	High	Climate Resilient Design Guidelines	
			Harden Baseyards to Provide Pre-Hurricane Staging of																								
34	Emergency Response	Physical Infrastructure	Debris Clearing Equipment & Personnel		x																x		Mid	Medium	Medium	MHMP, Action 31	
35	Emergency Response	Plans & Studies	Assess Departmental Emergency Response Capabilities	x	x	x	x	x	x	x	x												Near	Low	Low-Med	HDOT Climate Action Plan, pg 18	
			Incorporate Non-Structural Emergency Response Measures (e.g., emergency warning systems, evacuation routes/signage, public education)																								
36	Emergency Response	Programs		x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	Near	Low	Low	Climate Resilient Design Guidelines	
		Physical Infrastructure																									
37	Facility Hardening and Protection	Physical Infrastructure	Install Fencing Around Exterior Equipment		x	x							x			x					x		Near	Low	Low	SI Fac Plan	
38	Facility Hardening and Protection	Physical Infrastructure	Incorporate Geotechnical Stabilization/Reinforcement Practices for Facility Foundations					x	x				x			x					x		Near	Medium	Medium	SI Fac Plan	
39	Facility Hardening and Protection	Physical Infrastructure	Incorporate Corrosion Resistant Materials and Coatings	x	x	x	x	x	x		x		x	x		x							Near	Low	Low	Climate Resilient Design Guidelines	
			Incorporate or Upsize Perimeter Floodwalls or Levees (e.g., barrier railing, raised feature, earthen levee, raised roadway, raised pathway), including operable																								
40	Flood Barriers and Containment	Physical Infrastructure	flood gates	x	x	x	x	x	x				x				x	x			x	x	Long	High	Med-High	SI Fac Plan, Climate Resilient Design Guidelines	
41	Flood Barriers and Containment	Physical Infrastructure	Incorporate Groundwater Seepage Barrier	x	x	x	x	x	x				x				x	x			x	x	Mid	High	Medium	Climate Resilient Design Guidelines	
			Incorporate Breakwaters (e.g. floating wave attenuator, aquatic habitat)																								
42	Flood Barriers and Containment	Physical Infrastructure			x	x	x	x	x													x	Long	High	Med-High	Climate Resilient Design Guidelines	
43	Flood Barriers and Containment	Physical Infrastructure	Raise Marine Structures (e.g., elevated wharf, pier)		x	x	x	x	x							x						x	Long	High	High	Climate Resilient Design Guidelines	

Strategy Number	Category	Type	Adaptation Strategy	100 Year Flood	Hurricane	Tsunami	SLR - Above Ground	SLR - Groundwater	Coastal Erosion	Wildfire	Extreme Heat	Drought	Relevant For											Precursor	Timeframe	Relative Cost	Level of Resilience	Source
													Pump Station	Pipeline	Stream	Treatment Facility	Outfall	Drain Inlet	Well	Distribution Tank	Dam/Reservoir	Baseyard	Beach					
44	Flood Barriers and Containment	Physical Infrastructure	Add/Improve Floodgates to Stormwater Channels	x																		x			Long	High	Med-High	
45	Green/Gray/Blue Stormwater Infrastructure	Physical Infrastructure	Modify Site Drainage, Storage, and Infiltration	x	x	x							x			x					x				Mid	Medium	Medium	Climate Resilient Design Guidelines
46	Green/Gray/Blue Stormwater Infrastructure	Physical Infrastructure	Implement Low Impact Design (LID)/Green Infrastructure Stormwater Management Strategies	x	x	x	x	x	x		x	x				x							x	Precursor	Mid	Low	Low-Med	Climate Resilient Design Guidelines, AW Climate Commission PPT, Ko'olau Poko MIRR
47	Green/Gray/Blue Stormwater Infrastructure	Physical Infrastructure	Daylight On-Site Stream/Drainage - restoring streams and drainage to be aboveground	x	x	x					x			x											Long	Medium	Medium	Climate Resilient Design Guidelines
48	Green/Gray/Blue Stormwater Infrastructure	Physical Infrastructure	Incorporate Backwater Flow Prevention Devices (e.g., tidal gates, check valves)	x	x	x	x	x	x							x	x								Mid	Low	Low-Med	AW Climate Commission PPT, Climate Resilient Design Guidelines
49	Green/Gray/Blue Stormwater Infrastructure	Physical Infrastructure	Incorporate Green Roof Design	x	x	x					x					x									Mid	Medium	Low	Climate Resilient Design Guidelines
50	Green/Gray/Blue Stormwater Infrastructure	Plans & Studies	Drainage System Plan	x	x	x												x						Precursor	Mid	Low	Medium	MHMP, Action 12
51	Green/Gray/Blue Stormwater Infrastructure	Plans & Studies	Debris Management Plans and Systems													x								Precursor	Near	Low	Low-Med	
52	Green/Gray/Blue Stormwater Infrastructure	Programs	Incorporate a Downspout Disconnection Program	x	x							x											x		Near	Medium	High	Expanding Stormwater Opportunities on Oahu, OWOW
			Implement Cool Alternatives to Traditional Pavements for Roads and Sidewalks																								AW Climate Commission PPT, Climate Ready Oahu 10.5, Ko'olau Poko MIRR, Climate Resilient Design Guidelines	
53	Heat Management and Cool Infrastructure	Physical Infrastructure	Incorporate Heat Resilient Materials								x		x			x					x		x		Near	Low	Low	Climate Resilient Design Guidelines
54	Heat Management and Cool Infrastructure	Physical Infrastructure	Incorporate Passive Solar Cooling and Ventilation Systems								x					x		x	x						Near	Low	Low	Climate Resilient Design Guidelines
55	Heat Management and Cool Infrastructure	Physical Infrastructure	Incorporate Mechanical Cooling System								x					x									Near	Low	Low	Climate Resilient Design Guidelines
56	Heat Management and Cool Infrastructure	Physical Infrastructure	Select Solar Reflective Index Appropriate Roof ("Cool Roof") Designs								x					x								Precursor	Near	Low	Low	Climate Resilient Design Guidelines
57	Heat Management and Cool Infrastructure	Physical Infrastructure	Incorporate Shade and Cooling Structures								x					x								Near	Low	Low	Climate Resilient Design Guidelines	
58	Heat Management and Cool Infrastructure	Physical Infrastructure	Incorporate Heat Sensors for Critical Equipment								x											x			Near	Low	Low	Climate Resilient Design Guidelines
59	Heat Management and Cool Infrastructure	Physical Infrastructure	Upsize Pumping Capacity	x	x	x	x	x	x				x			x			x						Mid	Medium	Medium	Climate Resilient Design Guidelines
60	Increase System Capacity	Physical Infrastructure	Upsize Stormwater Drainage Capacity or Sanitary Sewer Capacity	x	x	x	x	x	x																Mid	Medium	Medium	Climate Resilient Design Guidelines, Ko'olau Poko MIRR
62	Increase System Capacity	Plans & Studies	Infiltration and Inflow Study					x							x	x		x	x					Precursor	Near	Low	Medium	External Plans (example from Northern Virginia Regional Commission MIRR)
63	Managed Retreat and Relocation	Physical Infrastructure	Relocate or Abandon Facility	x	x	x	x	x	x	x			x	x		x	x	x	x	x	x		x		Long	High	High	SI Fac Plan, Climate Resilient Design Guidelines, AW Climate Commission PPT
64	Managed Retreat and Relocation	Plans & Studies	Timeline for City to Provide Services to Private Property at Risk of SLR				x		x				x	x					x				x	Precursor	Near	Low	Medium	

Strategy Number	Category	Type	Adaptation Strategy	100 Year Flood	Hurricane	Tsunami	SLR - Above Ground	SLR - Groundwater	Coastal Erosion	Wildfire	Extreme Heat	Drought	Relevant For												Precursor	Timeframe	Relative Cost	Level of Resilience	Source
													Pump Station	Pipeline	Stream	Treatment Facility	Outfall	Drain Inlet	Well	Distribution Tank	Dam/Reservoir	Baseyard	Beach	Street					
65	Monitoring	Programs	Invest in User-friendly, Modern Technologies for Data Collection and Analysis (drones for monitoring hard-to-access locations, real-time monitors for shifting slopes, tablets for field inspection & maintenance)	x			x	x	x	x	x	x												x		Near	Low	Low	HDOT Climate Action Plan, pg 19
66	Risk Assessment and Planning	Plans & Studies	Preliminary Study on Tsunami and Coastal Flood Mitigation Defense	x		x							x	x		x	x	x	x	x	x	x	x	Precursor	Mid	Low	Medium	MHMP, Action 40	
67	Risk Assessment and Planning	Plans & Studies	Public Infrastructure Services Adaptation Phasing Study for Permanent SLR Flooding				x	x					x	x	x	x	x	x	x	x	x	x	x	Precursor	Long	Low	Medium	AW Climate Commission PPT	
68	Risk Assessment and Planning	Plans & Studies	General and Community Plan Updates - Integrate Natural Hazard Policies	x	x	x	x	x	x	x	x	x												Precursor	Mid	Low	Medium	MHMP, Action 1	
69	Risk Assessment and Planning	Plans & Studies	Heat Management Plan								x												x	Precursor	Near	Low	Low-Med	AW Climate Commission PPT	
70	Risk Assessment and Planning	Plans & Studies	Pre-disaster Recovery and Redevelopment Plan	x	x	x				x															Near	Low	Medium	AW Climate Commission PPT	
71	Risk Assessment and Planning	Plans & Studies	Refine Flood Risk Mapping to account for climate change and/or increase resolution	x	x	x	x	x					x	x	x	x	x		x	x	x	x	x	Precursor	Near	Low	Medium	Ko'olau Poko MIRR, MHMP	
72	Risk Assessment and Planning	Plans & Studies	Study most effective responses to rising groundwater					x					x	x							x	x	x	Precursor	Near	Low	Medium		
73	Risk Assessment and Planning	Plans & Studies	Area Adaptation Plan	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Precursor	Near	Low	Medium		
74	Roadway Resilience	Physical Infrastructure	Stabilize Roadbeds and Protect Roadbed Integrity	x			x	x	x														x		Long	High	Med-High	AW Climate Commission PPT, Ko'olau Poko MIRR	
75	Roadway Resilience	Physical Infrastructure	Improve materials and construction practices of roadways						x														x		Long	Medium	Medium	MHMP, Action 19	
76	Roadway Resilience	Physical Infrastructure	Bridge Retrofit and Replacements	x	x	x	x		x					x	x								x		Long	High	Med-High	Ko'olau Poko MIRR (example from Lowcountry Parris Island MIRR)	
77	Roadway Resilience	Plans & Studies	Pilot Study on the Use of an Adaptive Design Process (for Highways)	x			x	x	x														x	Precursor	Near	Low	Med-High	HDOT Climate Action Plan, pg 20	
78	Staff Training and Capacity Building	Programs	Provide Comprehensive and Cross-agency Staff Training of Different Components of Department's Climate Adaptation and System Resiliency Efforts	x	x	x	x	x	x	x	x	x											x		Near	Low	Low	HDOT Climate Action Plan, pg 22	
79	Support Climate-Resilient Native Practices	Plans & Studies	Study to Incorporate Native Hawaiian Practices for Resilient Design	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Precursor	Near	Low	Low-Med		
80	System Redundancy	Physical Infrastructure	Incorporate Alternative/Back-Up Power Sources (e.g., back-up generators, off-grid solar panels, microgrids)	x	x	x					x		x			x		x	x	x					Near	Low	Low	Climate Resilient Design Guidelines, Ko'olau Poko MIRR, MHMP	
81	System Redundancy	Physical Infrastructure	Incorporate Asset/Utility Redundancy	x	x	x	x	x	x		x		x				x	x	x						Mid	Medium	Medium	Climate Resilient Design Guidelines	
82	System Redundancy	Physical Infrastructure	Increase Passive Survivability of Assets/Systems During Power Outages	x	x	x	x	x	x		x		x	x			x	x	x						Mid	Medium	Medium	Climate Resilient Design Guidelines	
83	Water Conservation and Efficiency	Programs	Water Conservation and Leak Detection Improvements									x		x									x		Near	Low	Low	Ko'olau Poko MIRR, MHMP, Climate Resilient Design Guidelines, AW Climate Commission PPT	
84	Water Conservation and Efficiency	Programs	Water Loss Control									x													Near	Low	Low		
85	Water Conservation and Efficiency	Programs	Stormwater Utility Fee	x									x	x	x	x	x							Precursor	Near	Low	Medium		
86	Wildfire Preparedness and Management	Physical Infrastructure	Water Tanks at Fringes of Threatened Communities for Fire Suppression							x								x							Mid	Low	Low-Med	MHMP, Action 50	
87	Wildfire Preparedness and Management	Physical Infrastructure	Wildfire Setbacks and Fire Lanes							x			x			x	x	x	x	x					Long	Low	Low-Med	MHMP, Action 52	

Strategy Number	Category	Type	Adaptation Strategy	100 Year Flood	Hurricane	Tsunami	SLR - Above Ground	SLR - Groundwater	Coastal Erosion	Wildfire	Extreme Heat	Drought	Relevant For										Precursor	Timeframe	Relative Cost	Level of Resilience	Source
													Pump Station	Pipeline	Stream	Treatment Facility	Outfall	Drain Inlet	Well	Distribution Tank	Dam/Reservoir	Baseyard					
88	Wildfire Preparedness and Management	Physical Infrastructure	Incorporate Fire and Ignition Resistant Materials and Coatings							x		x	x	x		x	x	x	x	x				Near	Low	Low-Med	Climate Resilient Design Guidelines
89	Wildfire Preparedness and Management	Plans & Studies	Wildfire Analysis and Inventory							x			x		x	x	x	x				Precursor	Near	Low	Medium	MHMP	
90	Wildfire Preparedness and Management	Programs	Maintenance of Fire Roads and Breaks							x											x		Mid	Low	Low	MHMP, Action 48	
91	Wildfire Preparedness and Management	Programs	Grassland Management for Wildfire Prevention							x			x			x	x	x	x				Near	Low	Low	Ko'olau Poko MIRR	
			Urban Heat Index Reduction with Enhanced Green Spaces																				Near	Low	Low		
92	Wildfire Preparedness and Management	Physical Infrastructure	Urban-Wildland Interface Development							x	x	x			x					x	x	x		Mid	Low	Low	
93	Wildfire Preparedness and Management	Physical Infrastructure	Distribution System Improvements							x							x						Mid	Medium	Low-Med		
94	Wildfire Preparedness and Management	Physical Infrastructure	Drinking Water Treatment Resilience							x		x					x	x					Mid	Medium	Low-Med		
95	Wildfire Preparedness and Management	Physical Infrastructure	Wastewater Treatment Resilience							x													Mid	Medium	Low-Med		
96	Wildfire Preparedness and Management	Physical Infrastructure	Distribution System Resilience							x					x								Mid	Medium	Low-Med		
97	Wildfire Preparedness and Management	Physical Infrastructure	Stormwater System Resilience	x	x	x				x				x				x	x				Mid	Medium	Low-Med		
98	Wildfire Preparedness and Management	Physical Infrastructure	Add dip tanks to surface water reservoirs for wildfire suppression							x								x					Mid	Medium	Low-Med		
99	Wildfire Preparedness and Management	Plans & Studies	Improved Wildfire Detection and Response							x													Near	Low	Medium		
100	Wildfire Preparedness and Management	Programs	Source Water Protection							x				x			x	x					Near	Low	Low		
101	Wildfire Preparedness and Management	Programs	Incentivize Less Flammable Vegetation							x		x									x		Near	Low	Low		
102	Wildfire Preparedness and Management	Programs	Forest and Vegetation Management							x	x	x								x			Near	Low	Low		
103	Wildfire Preparedness and Management	Programs																									