HONOLULU CITY COUNCIL

KE KANIHELA O KE KALANA O HONOLULU

CITY AND COUNTY OF HONOLULU

No. 24-16

RESOLUTION

ADOPTING CLIMATE READY O'AHU AS A CLIMATE ADAPTATION STRATEGY AND GUIDING POLICY DOCUMENT FOR THE CITY AND COUNTY OF HONOLULU.

WHEREAS, in 2016, Honolulu voters approved a charter amendment establishing the Office of Climate Change, Sustainability and Resiliency within the City and County of Honolulu ("City") to coordinate actions and policies of departments and agencies to mitigate and adapt to climate change-related impacts to the City and promote sustainable and resilient communities; and

WHEREAS, 2023 was the hottest year on record, and over the past century, the Earth's temperature has warmed by 2°F (1.1°C) due to human activities that produce polluting greenhouse gas emissions that trap heat in the atmosphere; and

WHEREAS, this excess heat causes long-term changes in the Earth's climate patterns, increasing climate-related hazards that have already and continue to have environmental and human impacts globally and locally; and

WHEREAS, O'ahu's top climate hazards have been identified as: sea level rise and coastal erosion; increasing temperatures and heat waves; decreasing precipitation, prolonged drought, and wildfire; flash flooding; and hurricanes; and

WHEREAS, locally, impacts from these climate hazards are already felt in the form of hotter summers, winters, and nights; fewer trade wind days; more extreme Kona Lows and King Tides; less predictable rain patterns; disappearing sandy shorelines; and other impacts to marine and terrestrial ecosystems; and

WHEREAS, in 2023, the Honolulu Climate Change Commission published an update to its Climate Change Brief with new projections for future climate impacts, including:

- Increase in sea level of 3.81 to 5.84 feet by 2100;
- Increase in temperature by 1.8°F to 7.2°F warmer by 2100, with the greatest warming potential at higher elevations and on the leeward sides of O'ahu;
- Doubling in the frequency of extreme El Niño events, associated with heat and drought, to roughly one event every decade;

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- Near doubling in the frequency of extreme La Niña events, associated with extreme rainfall, from once every 23 years to once every 13 years;

- More frequent and impactful tropical cyclones with increased maximum wind intensity and more intense rainfall; and

WHEREAS, the City is taking actions to reduce greenhouse gas emissions island-wide on track to meet its climate action policy of achieving net-negative carbon emissions no later than 2045 in order to delay and halt the impacts of climate change; and

WHEREAS, notwithstanding current efforts to reduce emissions, historical emissions have already locked us into a warming path to some degree, meaning O'ahu will continue to experience the impacts of increasingly dangerous and frequent climate hazards for generations to come; and

WHEREAS, these changes will impact all aspects of our community and not in uniform ways, such that frontline communities, those that are geographically, physically, socially, or economically at a greater risk to climate change, will, without action, disproportionately feel its negative impacts; and

WHEREAS, the complexity and scale of adaptation, or action to prepare for and adjust to both the current and projected impacts of climate change, requires unprecedented collaboration and commitment across all City agencies, as well as coordination with the State and federal government, and private and non-profit sectors; and

WHEREAS, Resolution 19-233, adopted by the Honolulu City Council in 2019, adopted the O'ahu Resilience Strategy, and Action 28 therein, calling for the creation of a climate adaptation strategy to assess O'ahu's climate risks and make recommendations to prepare communities for their impacts; and

WHEREAS, Climate Ready O'ahu is a climate adaptation strategy that assesses O'ahu's climate risks and outlines 12 strategies containing 57 actions for the City and its partners to implement to increase O'ahu's ability to adapt to those risks and a changing climate; and

WHEREAS, Climate Ready O'ahu is informed by the guidance of a 40-member Community Advisory Hui, the expertise of City departments, and the voices of over

2,000 residents engaged through surveys, workshops, open houses, and the strategy's public comment period; and

WHEREAS, Climate Ready O'ahu reflects on community values to envision a climate-ready O'ahu as one where:

- All people are empowered with the knowledge, tools, and resources to prepare for climate impacts;
- Connections between people and native ecosystems are cultivated so the 'āina is safeguarded for generations to come; and
- Infrastructure works with natural systems to keep residents safe from climate hazards at home, at work, and everywhere in between; and

WHEREAS, Climate Ready O'ahu includes actions individuals and households can take to be more climate ready in alignment with proposed actions for the City and its partners to implement; now, therefore,

BE IT RESOLVED by the Council of the City and County of Honolulu that it adopts Climate Ready O'ahu, attached hereto as Exhibit A, as a climate adaptation strategy and guiding policy document for the City to coordinate and implement action and investment in climate adaptation across the City to prepare infrastructure, communities, and 'āina for the impacts of climate change; and

BE IT FURTHER RESOLVED that City departments are requested to coordinate with the Office of Climate Change, Sustainability and Resiliency to incorporate actions into existing planning and budgeting efforts, including the General Plan and the Development/Sustainable Communities Plans, the Multi Hazard Pre-Disaster Mitigation Plan, and annual operating and capital improvement program budgets, using information set forth in Climate Ready O'ahu; and

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RESOLUTION

BE IT FINALLY RESOLVED that copies of this resolution be transmitted to the Mayor, the Managing Director, and the Chief Resilience Officer and Executive Director of the Office of Climate Change, Sustainability and Resiliency.

INTRODUCED BY:

(br)

DATE OF INTRODUCTION:

JAN 26 2024

Honolulu, Hawai'i

Councilmembers

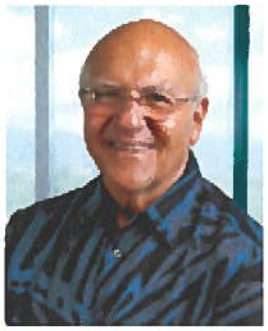
EXHIBIT A

Climate Ready O'ahu

CITY AND COUNTY OF HONOLULU

CLIMATE ADAPTATION STRATEGY

Letters



The impacts of climate change here on O'ahu cannot be denied, affecting both residents and businesses and including everything from a house falling into the ocean to serious infrastructure damages from flooding around the island.

The City and County of Honolulu continues to focus on the need to eliminate greenhouse gas pollution—the root cause of climate change and the source of climate impacts—while also accelerating our adaptation efforts. Climate Ready O'ahu identifies necessary long-term solutions.

The commitment of Honolulu is already reflected in investments and grants received to address flooding, increasing temperatures, and more. This is further highlighted in the strategies and actions here through efforts already underway for our climate preparedness. And still, we know there's much work ahead.

This process surfaced big essential questions including, where are we going; who gets to determine a vision; how do we commit to long-term needs through near-term action; and, what tools do we have and what tools do we need? This strategy puts forward solutions to those challenges and opportunities.

My thanks to the thousands of community voices, the Community Advisory Hui, the technical research team and City Climate Change Commissioners, City Council members, and our City agencies for the vision and commitment.

Rick Blangiardi
Mayor
City and County of Honolulu

I ka nānā no a 'ike (by observing, one learns). Our community, our island has suffered impacts of climate change. Climate adaptation means taking proactive steps that address experienced and current climate impacts, and preparing us for continued climate changes.

There is urgent need to eliminate the greenhouse gas pollution that has and is changing our climate by continuing to implement the City's Climate Action Plan. Rapid climate action gives us a fighting chance in addressing the growing need to adapt to current and escalating climate impacts.

Climate Ready O'ahu focuses on five main local climate hazards and outlines a vision for a climate-ready future consisting of broad adaptation strategies and complementary actions for implementation, including actions you can take to empower individual and community preparedness.

Community participation and ownership were integral to this strategy's development. Climate adaptation is too big a task for the City to tackle alone—it's important to us that Climate Ready O'ahu helps residents and businesses understand how they can abe part of the solution, and how we're committed to partnerships to not just prepare for the worst, but to improve upon community and environmental conditions through climate adaptation. Mahalo for your voice toward O'ahu's climate-ready future and we look forward to implementing the vision together.

Matthew Gonser
Chief Resilience Officer & Executive Director
Office of Climate Change, Sustainability and Resiliency

The front cover features volunteers at the Loko Ea fishpond in Hale'iwa.

Contents

Prologue

Climate change is an unequivocal threat to our future. O'ahu's people, 'āina (land, earth), and infrastructure are all at risk unless we mitigate the impacts of climate change.

As we work hastily to decrease greenhouse gas emissions to slow down the effects of climate change, we must also adopt climate adaptation measures to decrease our vulnerability to hazards so that we can continue to thrive as an island community.

History has shown us that the concept of laulima (many hands working together on a common purpose) is critically important. The official bird of Honolulu, the manu-o-Kū, or white tern, serves as a vivid reminder of the power of laulima. These beloved white seabirds are commonly seen somersaulting past skyscrapers and scooping fish from the surface of the ocean. Historically, Hawaiian navigators and fishermen followed manu-o-Kū to return safely to shore.

Through the community's concerted intervention, we have been able to protect this native bird and help it adapt to Honolulu's changing urban landscape. Educational campaigns and proper tree-trimming practices were key to ensuring manu-o-Kū had a home in Honolulu. Today, they nest only in the outer lying atolls and urban Honolulu. Gracefully adjusting to stark changes in habitat with the help of the community, the manu-o-Kū proves that resilience is possible through adaptation, smart management techniques, and community action.

As climate hazards unfold, we can look up to the manu-o-Kū as our guide, just as Hawaiian voyagers have for generations. The story of the manu-o-Kū is our source of inspiration and encouragement to work together to create a climate-ready O'ahu!

Follow the manu-o-Kū throughout the strategy to learn how you and your 'ohana can become climate ready!

List of Acronyms

City

BWS	Honolulu Board of Water Supply
BFS	Department of Budget and Fiscal Services
CCSR	Office of Climate Change, Sustainability and Resiliency
DDC	Department of Design and Construction
DEM	Department of Emergency Management
DES	Department of Enterprise Services
DFM	Department of Facility Maintenance
DHR	Department of Human Resources
DLM	Department of Land Management
DPR	Department of Parks and Recreation
DPP	Department of Planning and Permitting
DTS	Department of Transportation Services
ENV	Department of Environmental Services
HESD	Honolulu Emergency Services Department
HFD	Honolulu Fire Department
MAY	Mayor's Office
MDO	Managing Director's Office
MOCA	Mayor's Office of Culture and the Arts
OHPC	O'ahu Historic Preservation Commission

State

DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
DOA	Department of Agriculture
DOE	Department of Education
DOH	Department of Health
HI-EMA	Hawai'i Emergency Management Agency
OACA	O'ahu Agriculture and Conservation Association
OHA	Office of Hawaiian Affairs
OIBC	O'ahu Island Burial Council
ORCD	O'ahu Resource Conservation and Development Council
SHPD	State Historic Preservation Division
UH	University of Hawai'i
UH-CTAHR	College of Tropical Ag and Human Resources
UH-ISR	Institute for Sustainability and Resilience
UHSG	Sea Grant College Program

Federal

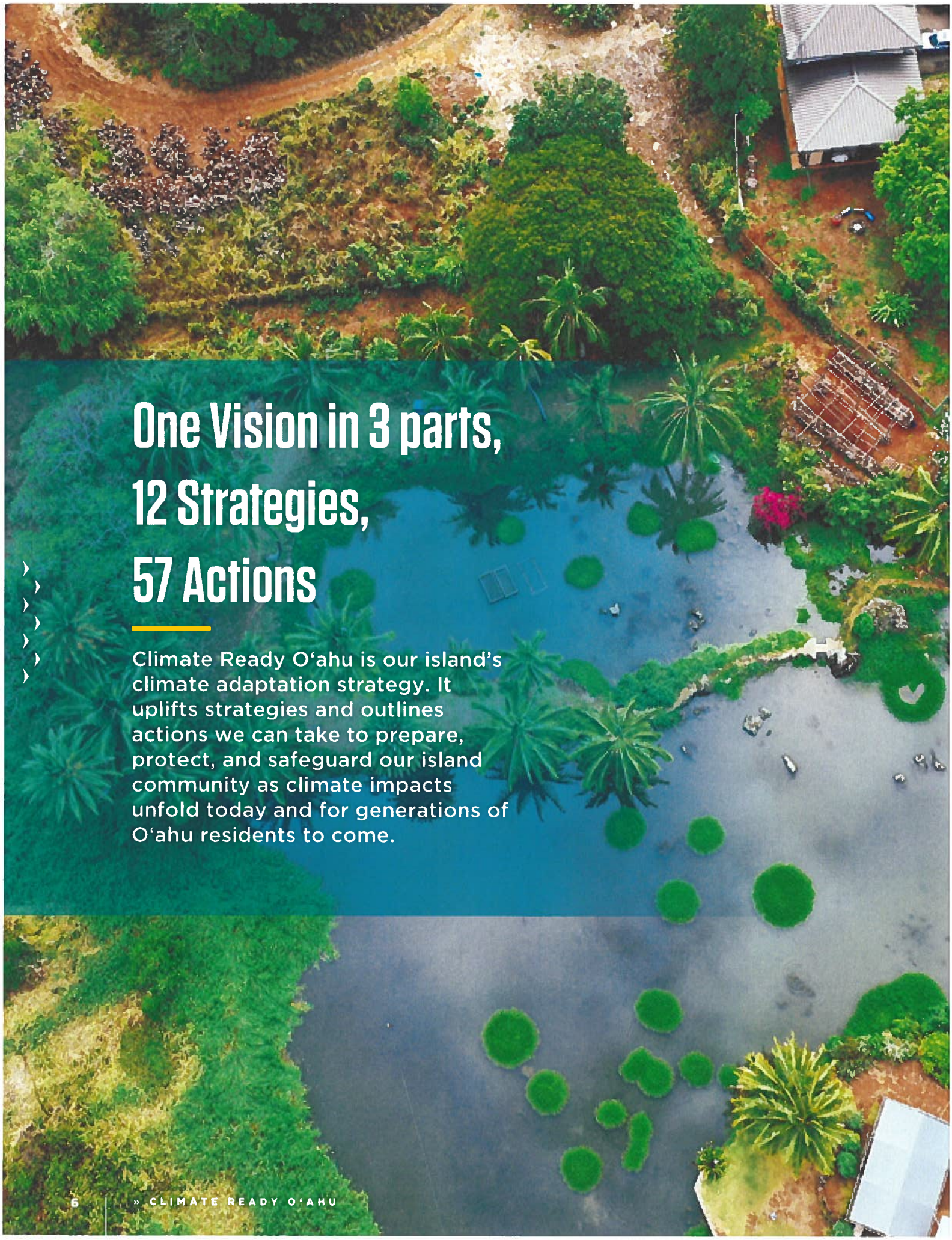
EPA	Environmental Protection Agency
DOE	Department of Energy
FEMA	Federal Emergency Management Agency
NHO	Native Hawaiian Organization
NWS	National Weather Service
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture

Community Organizations

WBSIDA	Waikīkī Beach Special Improvement District Association
MLC	Mālama Learning Center
MLEF	Mālama Loko Ea Foundation
TFHF	Trees for Honolulu's Future
HCF	Hawai'i Community Foundation

Terms

MHHW	Mean Higher High Water
SLR	Sea Level Rise



One Vision in 3 parts, 12 Strategies, 57 Actions

Climate Ready O'ahu is our island's climate adaptation strategy. It uplifts strategies and outlines actions we can take to prepare, protect, and safeguard our island community as climate impacts unfold today and for generations of O'ahu residents to come.

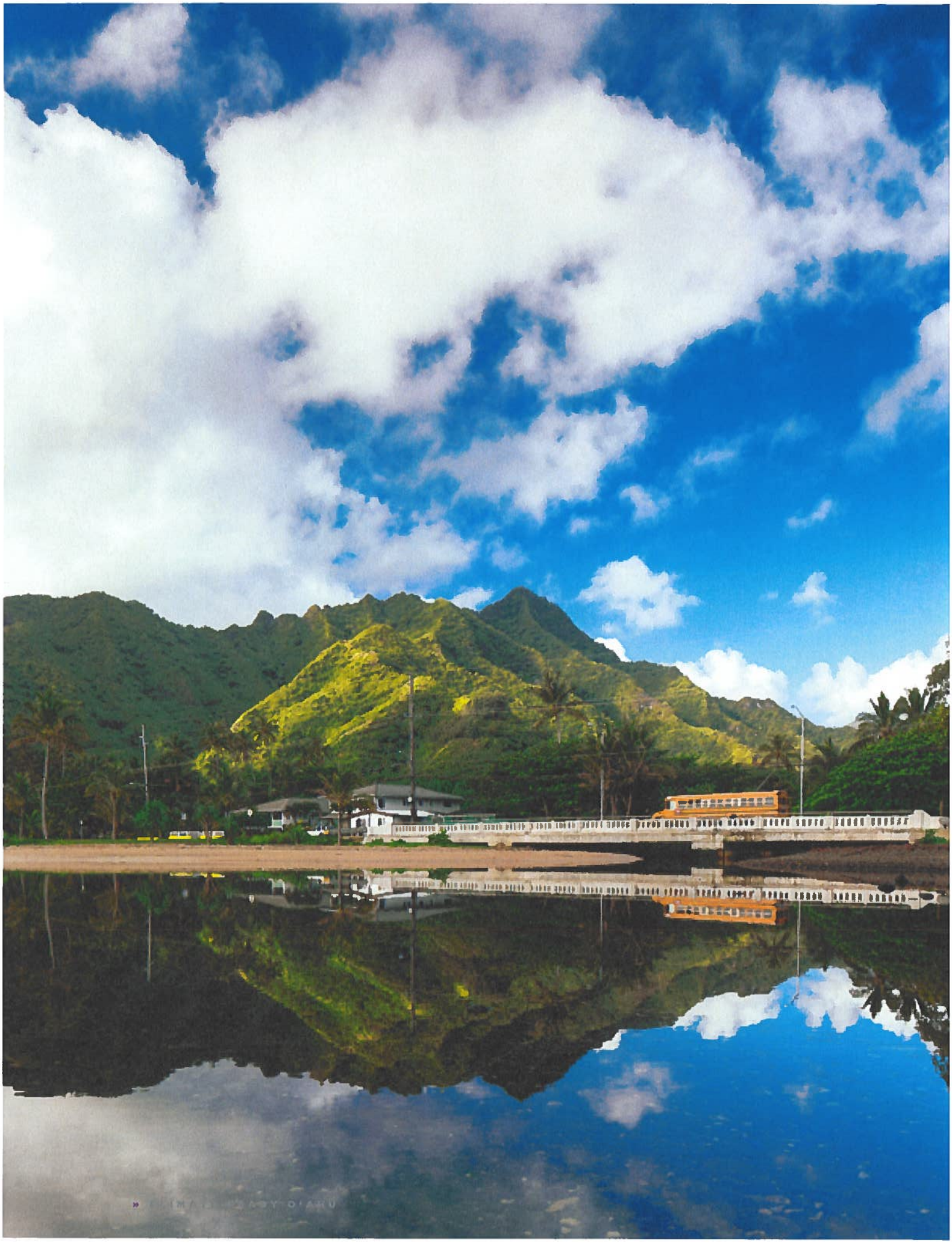
Mālama ʻĀina

I ka wā ma mua, i ka wā ma hope.
Lessons from the past are the key to the future.

Through hundreds of conversations about climate change with community members around Oʻahu, a predominant, recurring theme emerged: a fundamental connection between climate adaptation and mālama ʻāina. "Mālama" means to care for and protect. While "ʻāina" is most often interpreted to mean land, it can also be translated as "that which feeds", including land, resources, and cultural heritage. "Mālama ʻāina" can be translated simply as to care for the land, but its meaning goes beyond the physical actions taken. Mālama ʻāina is deeply rooted in a worldview that recognizes the environment as kin. It is a system of values passed on through generations.

Mālama ʻāina has always implied a shared kuleana (responsibility). It recognizes our obligation to safeguard Hawaiʻi's natural and cultural resources for current and future generations. The Hawaiʻi we enjoy and benefit from today is the result of those committed to the principles and values embodied in mālama ʻāina. It reminds us that we all must acknowledge our role and responsibility in shaping the future to prepare for the climate changes ahead. As a governmental entity, the City and County of Honolulu must acknowledge the tension between recognizing mālama ʻāina as an essential pillar of sustainability while also working to redress the fact that historic actions and policies of the City have been at odds with mālama ʻāina.

I ka wā ma mua, i ka wā ma hope (lessons from the past are the key to the future) reminds us that many of the answers we seek while planning for and adapting to a changing climate can be found by looking at the history of this ʻāina. The City is committed to applying a combination of the best available climate adaptation science and traditional Native Hawaiian knowledge and expertise in land stewardship to make thoughtful and responsible decisions for our future. We must continue to collaborate and draw upon each other's strengths to be more resilient. Climate Ready Oʻahu is a product of this type of collaboration and moving forward, together, we can ensure mālama ʻāina remains integral to our decisions and actions.



Introduction

O'ahu's Climate Future

Over the past century, the Earth's temperature has warmed by 1.1°C (~2°F) due to human activities. Our transportation, electricity, waste, and food systems produce polluting greenhouse gas (GHG) emissions that trap heat in the atmosphere. The more emissions produced, the more warming potential exists. This warming leads to long-term changes in Earth's climate patterns, the impacts of which we can see globally and locally.

As the climate changes, we've become more and more familiar with its impacts here at home. O'ahu is experiencing warmer summers and winters, fewer trade winds, more extreme Kona Lows and King Tides, less predictable rain patterns, and disappearing sandy shorelines. While we often feel the negative human health and safety impacts of these changes most acutely, climate change also poses risks to the health and biodiversity of our natural ecosystems as well as the economy.

2017

37 record flood days compared to the 4-day average.

2018

Hurricane Lane, Hawai'i's wettest tropical cyclone on record, narrowly missed O'ahu at Category 5 intensity.

2019

Historic rains caused a landslide closing the Pali Highway and inconveniencing Windward residents for months.

2021

Intense flooding damaged 65 Hale'iwa homes, many businesses and farms, and resulted in emergency bridge repairs to address erosion and scouring.

2022

Sea level rise and coastal erosion caused a single-family home to fall onto the beach on the North Shore.

2023

Devastating wildland fires on Maui, intensified by tropical storm-fueled winds and pre-existing drought conditions, were the deadliest in over a century.

But even if we stopped emitting all GHGs tomorrow, past emissions have locked us into a warming path to some degree, meaning some climate impacts are unavoidable. By evaluating the likelihood of certain climate hazards and the scale of their potential impacts, we know that O'ahu's top climate hazards are:

Sea Level Rise

Heat

Drought and Wildfire

Flash Flooding

Hurricanes

Though these hazards are not new to O'ahu, the intensity and frequency at which we experience them are expected to increase. For example, according to the City Climate Change Commission's recent Climate Change Brief, sea levels are expected to rise as much over the next 30 years as they have in the last 100. These changes will impact O'ahu for generations to come, and not in uniform ways. Frontline communities, those that are geographically, physically, socially, or economically at a greater risk to climate change, will disproportionately feel its negative impacts.

Climate Change Mitigation

Taking action to reduce and eliminate the emission of heat-trapping gasses in our atmosphere that accelerate climate change.

Examples of mitigation:

- Zero emission transportation
- Clean energy
- Zero waste

Climate Adaptation

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

Examples of climate adaptation:

- Flood resilience protection
- Heat preparedness plans
- Biodiversity stewardship and conservation

No Adaptation Without Mitigation

It is too late to stop some climate impacts, but now is the best time to prevent catastrophic impacts in the future. While Climate Ready O'ahu is focused on actions to adapt to climate impacts, actions to mitigate emissions determine the scale and cost of climate adaptation needed. The benefit of investing in adaptation is saving money on avoided damages in the future; investments in mitigation could help us avoid the need to adapt to more extreme impacts altogether. The City and County of Honolulu's ("City") Climate Action Plan (CAP) lays out actions the City is taking to stabilize our climate and set O'ahu on track towards a zero emission economy no later than 2045. Climate Ready O'ahu complements the CAP by providing a parallel roadmap with adaptation actions aimed towards our top climate hazards and impacts.

Local Impacts Need Local Solutions

Stopping the cause of climate change is a global responsibility, but adapting to impacts is a local one. While O'ahu's top climate hazards may be similar to those in other parts of the Pacific and the continental United States, their impacts will be unique to our places and our people. Leeward wildfires, loss of sandy beaches, threats to endemic and indigenous flora and fauna, and many more climate impacts pose risks to our homes, our community spaces, and our resilience. These local impacts require local solutions.

There is no one that knows this island home and how to mālama (care for) it better than those living here. To ground the adaptation actions presented in Climate Ready O'ahu in our unique needs we learned from local climate experts and scientists, collected best practices from around the world, and heard stories and input from residents and community champions.

Navigating a Climate Ready Future Together

Climate adaptation is a monumental task that cannot be achieved by one entity alone. From Federal, state and city governments, to our communities and their residents, to the visitors we host each year, preparing for climate change requires collaboration from all of us to identify and implement solutions that make sense for us here on O'ahu.

Collaborative planning efforts began back in 2018 through the development of the O'ahu Resilience Strategy, adopted by the City as a guiding policy document. The Resilience Strategy was formed based on residents' perceptions of risk, resilience, and the challenges of our time, determined to be cost of living, natural disasters, climate change, and community cohesion. Action 28 of the Resilience Strategy specifically called for the creation of this climate adaptation strategy to assess O'ahu's climate risks and make recommendations to prepare critical public infrastructure for their impacts. Building upon these previous inputs, the City endeavored to employ new approaches to engagement in the development of this strategy that included communities often left out of traditional government outreach.

Knowing adaptation cannot be undertaken alone, this Climate Ready O'ahu strategy was shaped by and uplifts the voices of over a thousand residents, businesses, community-based organizations, and local experts. Their questions, insights, and suggestions laid the foundation for the development of this strategy, and will continue to be carried forward through its implementation. By aligning our shared values, we envisioned this adaptation strategy. Only by working together to act on those values can we determine our climate-ready future.

Climate Ready O'ahu Development Phases

FALL 2020

1 Identify Vision and Values

Guiding adaptation values and principles were shaped by community voices, climate scientists, and City departments.

- 40-member Community Advisory Hui
- 10 Visions of O'ahu community events

WINTER 2020

2 Investigate Top Climate Hazards

A Climate Risk Assessment determined O'ahu's top five climate hazards and mapped areas most exposed to impacts.

SPRING 2021

3 Co-Design Strategy with Community

Implemented non-traditional, inclusive strategies in partnership with community organizations for deep engagement to understand community needs and identify potential adaptation actions.

- 1100+ residents surveyed
- 2 Climate Ready Games
- 6 community-led workshops and a Climate Ready Open House

SUMMER 2022

4 Weave it All Together

Climate Ready O'ahu drafted using focus areas defined by community and City departments.

WINTER 2023-

5 Adoption and Implementation

Climate Ready O'ahu adopted and partnerships strengthened with community members, businesses, and nonprofits for successful implementation.

Photo Credit: DFM

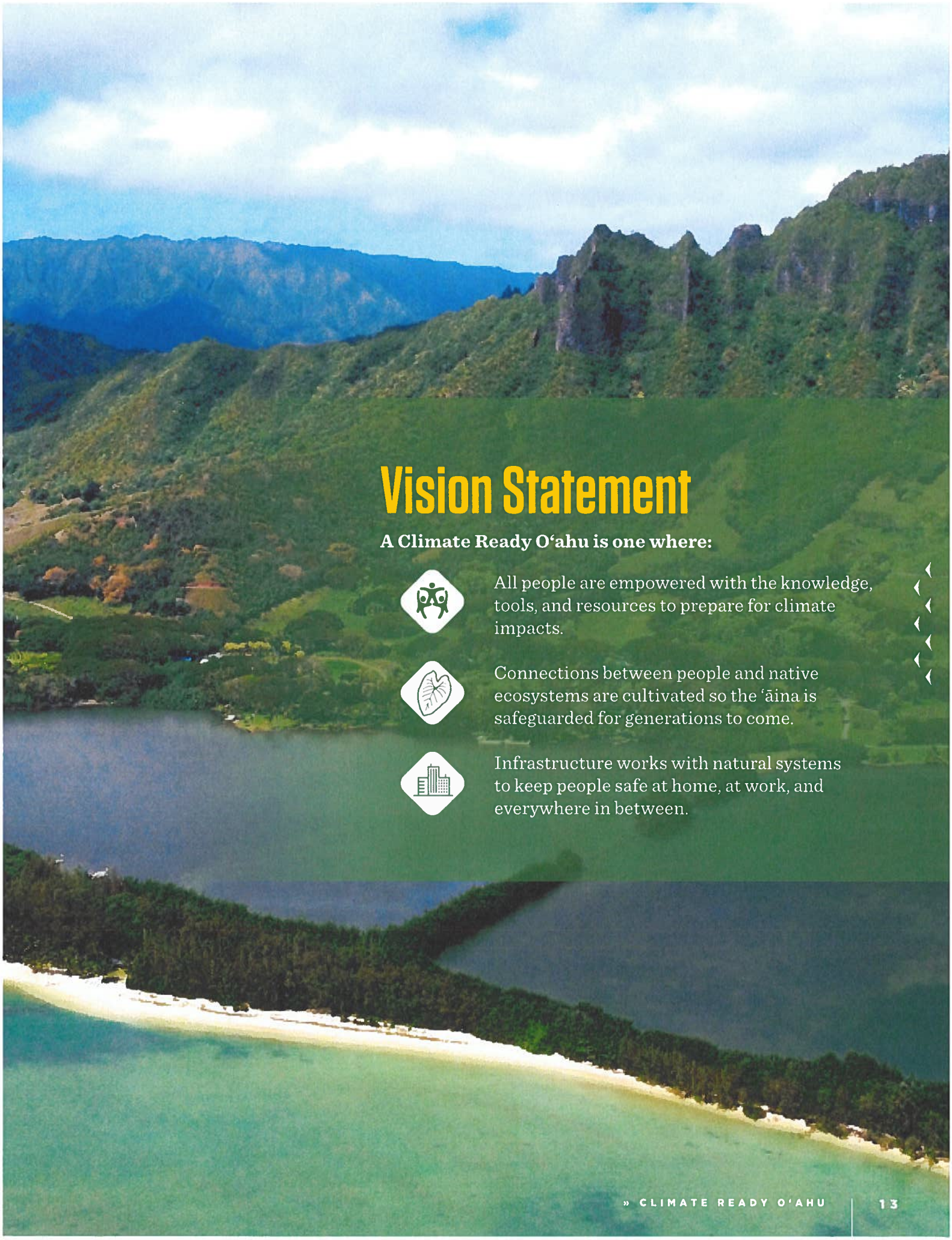
Envisioning a Climate Ready O'ahu

This Climate Ready O'ahu strategy asks us to reflect on our values and imagine the kind of future we want for ourselves, our families, and our future generations. When we understand the risks that climate change presents, we can be better prepared to navigate its challenges on the pathway to a climate-ready future. But what does a climate-ready O'ahu look like?

The City and County of Honolulu's Office of Climate Change, Sustainability and Resiliency had the privilege of meeting people throughout O'ahu who shared their thoughts about our island's future. We created opportunities to hear diverse perspectives and to understand the heart of O'ahu residents. We were pleased with the input we received to formulate this Climate Ready O'ahu plan of action.

Based on the feedback we received, we learned that O'ahu is ready to tackle the climate challenges facing our island. We are unified by a shared, comprehensive vision to prepare our island for the coming changes. We synthesized the community's feedback into a vision with three parts that together envision a Climate Ready O'ahu.

Within this Climate Ready O'ahu strategy, there are 12 strategies and 57 actions. Strategies are designed to be overarching and serve as a guide for the steps needed to achieve our vision. Each action describes a specific policy or program that the City and its partners will implement to advance each strategy and increase O'ahu's ability to adapt to a changing climate.



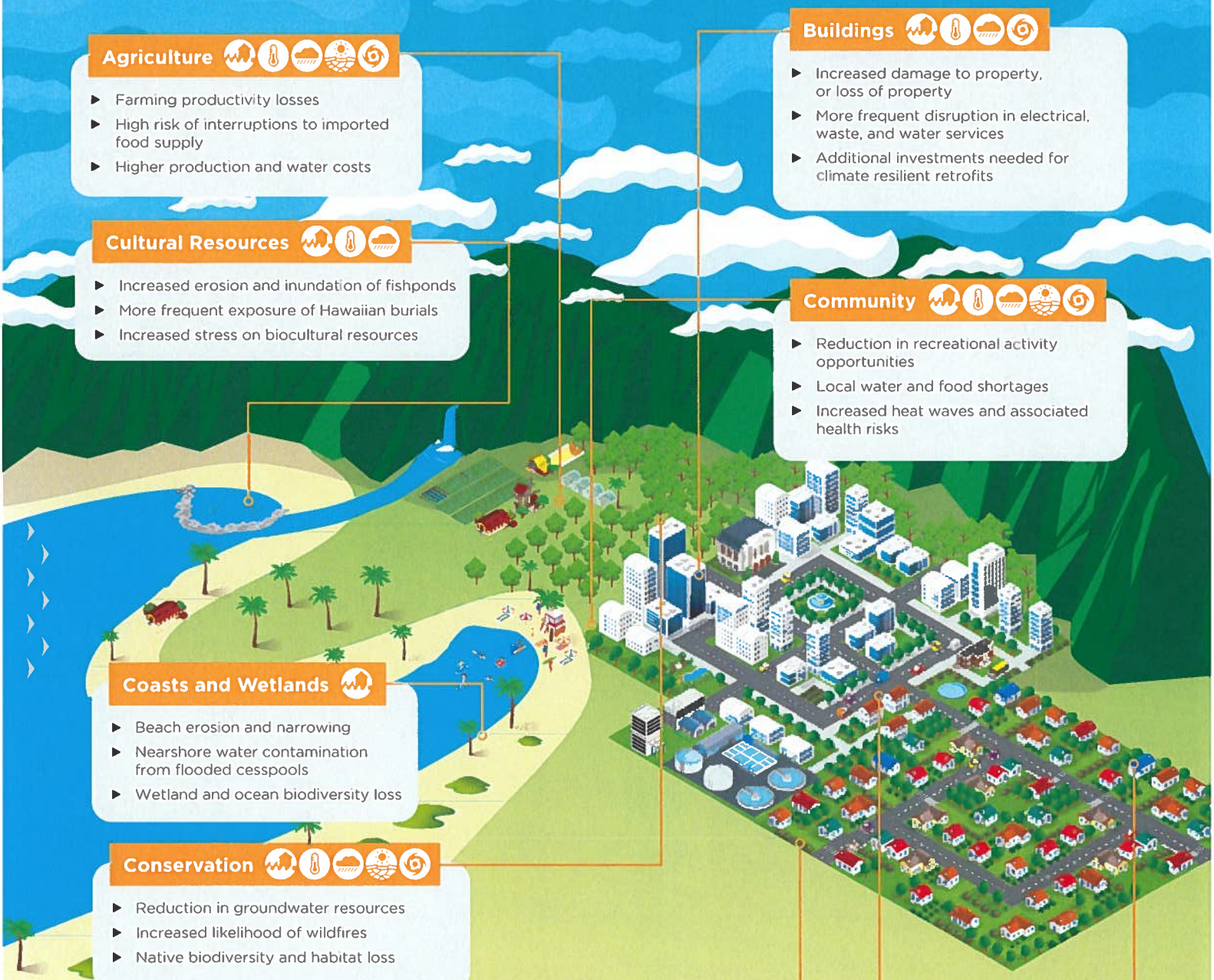
Vision Statement

A Climate Ready O‘ahu is one where:

- All people are empowered with the knowledge, tools, and resources to prepare for climate impacts.
- Connections between people and native ecosystems are cultivated so the ‘āina is safeguarded for generations to come.
- Infrastructure works with natural systems to keep people safe at home, at work, and everywhere in between.

Climate Change on O'ahu

The following graphic identifies climate impacts due to sea level rise and coastal erosion, increasing temperatures and heat waves, drought and wildfire, flash flooding, and hurricanes.



Agriculture

- Farming productivity losses
- High risk of interruptions to imported food supply
- Higher production and water costs

Buildings

- Increased damage to property, or loss of property
- More frequent disruption in electrical, waste, and water services
- Additional investments needed for climate resilient retrofits

Cultural Resources

- Increased erosion and inundation of fishponds
- More frequent exposure of Hawaiian burials
- Increased stress on biocultural resources

Community

- Reduction in recreational activity opportunities
- Local water and food shortages
- Increased heat waves and associated health risks

Coasts and Wetlands

- Beach erosion and narrowing
- Nearshore water contamination from flooded cesspools
- Wetland and ocean biodiversity loss

Conservation

- Reduction in groundwater resources
- Increased likelihood of wildfires
- Native biodiversity and habitat loss

Transportation

- Washed out highways and road closures
- Loss of roadway connections between communities
- Disruption in emergency services

Urban Areas

- Hotter days and nights
- Groundwater flooding and drainage failure
- Reduced shade from damage to trees

Homes

- Permanent flooding and loss of property
- Additional costs needed to keep homes cool
- Increased likelihood of hurricane damage

Changes to our Island

O'ahu's natural geography sets the literal and figurative landscape for how climate change impacts our island. For example, tradewinds, a dominant feature of O'ahu's climate, bring cool and dry air from the northeast to cool us throughout the year. These winds, combined with the Ko'olau and Wai'anae mountain ranges and many valleys, create a number of microclimates, or small-scale climate variations, throughout O'ahu.

To prepare for climate change, it is crucial to understand what climate change will look like on O'ahu. Climate change shows up in many forms, as it affects the ocean, atmosphere, and weather patterns. Climate Ready O'ahu focuses on five climate hazards: sea level rise and coastal erosion, increasing temperatures and heat waves, drought and wildfire, flash flooding, and hurricanes.

With many issues that our society faces, and especially with climate change, it is in our collective best interest to observe the precautionary principle. This principle states that precautionary measures be taken when scientific evidence about an environmental or human health hazard is uncertain and the stakes are high.

For example, if you were planning an outdoor wedding in February, you would face the decision whether to rent a tent for your event months before the wedding. You can't know for sure whether it will rain on your wedding day, but you must make the decision. You choose to rent the tent — the precautionary choice — based on the information you have (February is the rainy season) and because the stakes are too high to risk it.

When it comes to climate change, we know that climate hazards will impact our community, but there is no scientific certainty of the extent or timing of the potential damages. Climate Ready O'ahu seeks to address climate impacts to give our community the best chance at avoiding health and environmental losses.

Sea Level Rise and Coastal Erosion

A progressive increase in sea level rise will have significant impacts on infrastructure and environmental resources, which in turn impacts the economy, resulting in loss of property, with corresponding physical and mental health consequences. Beach erosion caused by sea level rise will significantly impact coastal properties and recreational activities due to narrowing and/or disappearance of beaches.

Increased sea level rise also threatens valuable coastal ecosystems and wildlife habitats, including endangered species such as honu (sea turtle) and ʻīlioholoikauaua (Hawaiian monk seal). Sea level rise is already impacting customary and traditional practices such as salt harvesting, fishpond maintenance, and gathering from fisheries near the coast. In the next century, it will further limit access to culturally significant sites and lands. In addition to eroding coastlines, sea level rise will lead to groundwater flooding and higher tides that could permanently flood roads and other infrastructure as well as disrupt tourism. Impacts may be greater for communities in coastal and low-lying areas.

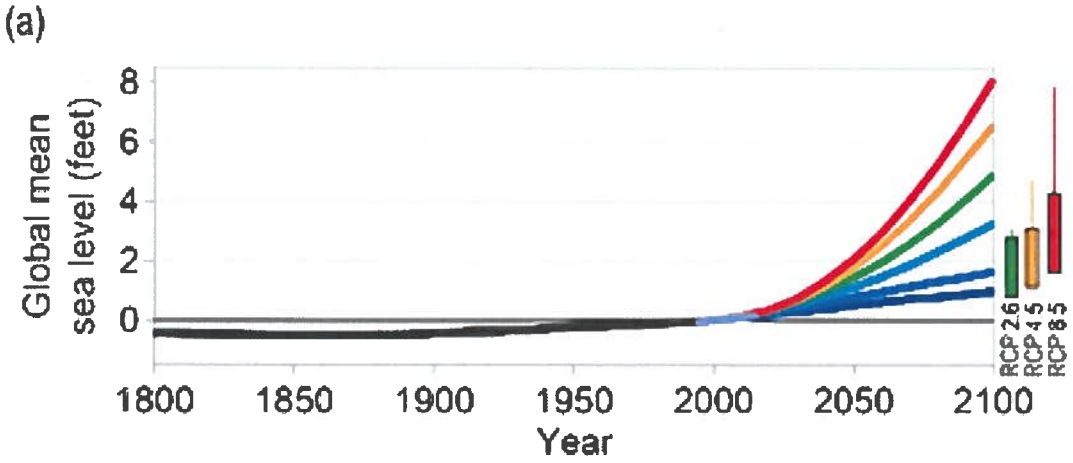


Figure 1: Observed (black) and projected (colored) global mean sea levels under different emissions scenarios (RCP).[1]

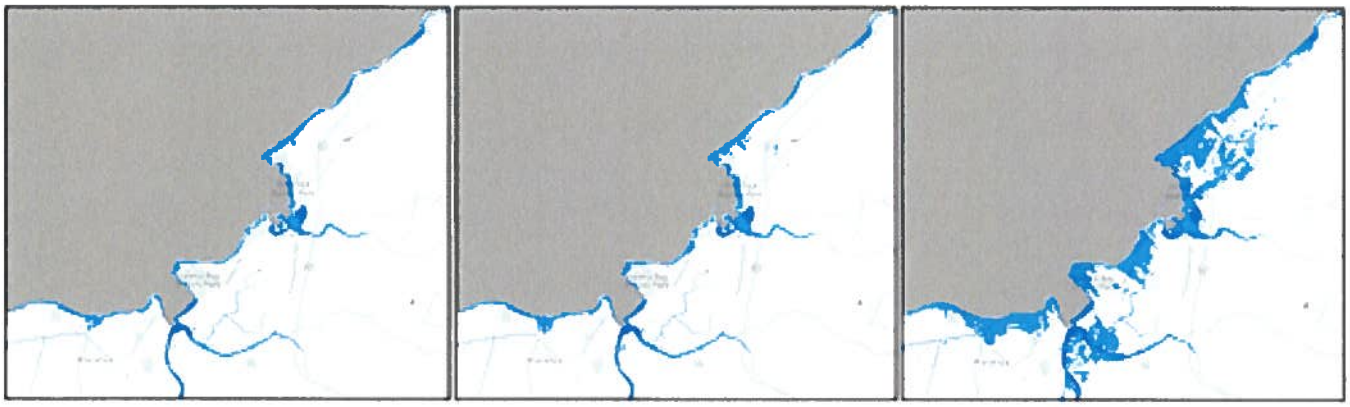


Figure 2. Projected sea level rise and coastal erosion exposure area along the North Shore at Waialua and Haleʻiwa. From left to right, 0.5 feet (2030 estimate), 1.1 feet (2050 estimate), and 3.2 feet (2070 estimate) of sea level rise.[2]

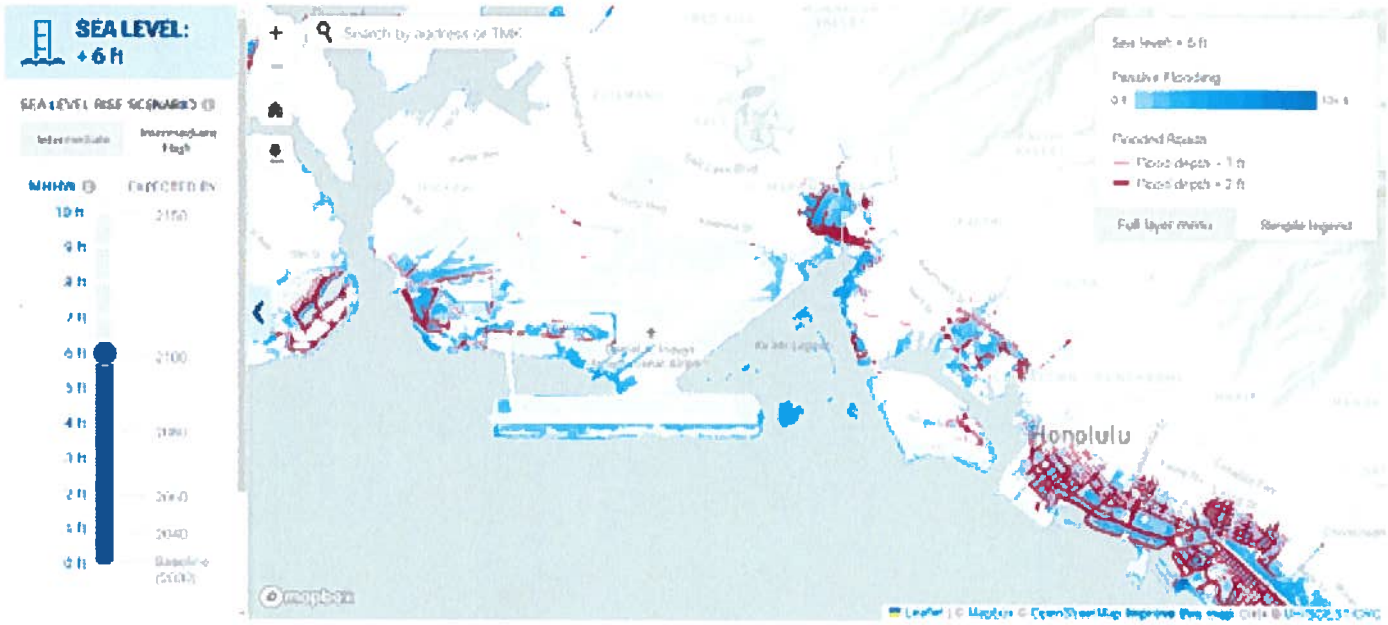


Photo Credit: UH CRC

Figure 3: Coastal flooding and affected roads under 6 feet of sea-level rise.[3]

Historic Data:

- Late 2020 and early 2021 saw record high monthly average sea levels.[4]
- Tides have already risen by over half-a-foot in the last century.[4]
- Frequency of high tide flooding in Honolulu since the 1960s has increased from 6 days per year to 11 days per year.[4]
- 60% of beaches on O'ahu are in a chronic state of erosion; 5.5 miles of beach on O'ahu have already been lost to erosion.[5]

Future Risk Data:

- By 2050, sea levels in Honolulu are projected to rise between 0.95 and 1.21 feet, compared to 2000 levels. In a high-emission scenario, 1.48 feet is also possible.[5]
- By 2100, sea levels in Honolulu are projected to rise between 3.81 and 5.84 feet, compared to 2000 levels. In a high-emission scenario, 7.91 feet is also possible.[5]
- Up to 58 days of minor flooding (20 inches above MHHW) per year by 2050 and permanent moderate flooding (32 inches above MHHW) by 2100.[6]

Increasing Temperatures and Heat Waves

Temperatures will vary across O'ahu depending on green spaces, tree canopy coverage, and the concentration of concrete, buildings, and asphalt. However, a progressive increase in average annual temperature islandwide will lead to an increase in the frequency of days with high temperatures that cause ecosystem and habitat changes. The severity of this scenario will be further heightened due to decreased tradewinds as a direct result of higher temperatures worldwide.[4]

A change in temperature of even a few degrees can have significant impacts on human health, air conditioning usage and energy demand, and the environment. The populations most vulnerable to heat-related death and illness are the elderly, young children, individuals experiencing houselessness, outdoor workers, those living in homes without air conditioning, and those living in poorly ventilated homes. While this section focuses on direct impacts of heat, it is important to mention that an increase in average annual temperature also contributes to drought and wildfires.

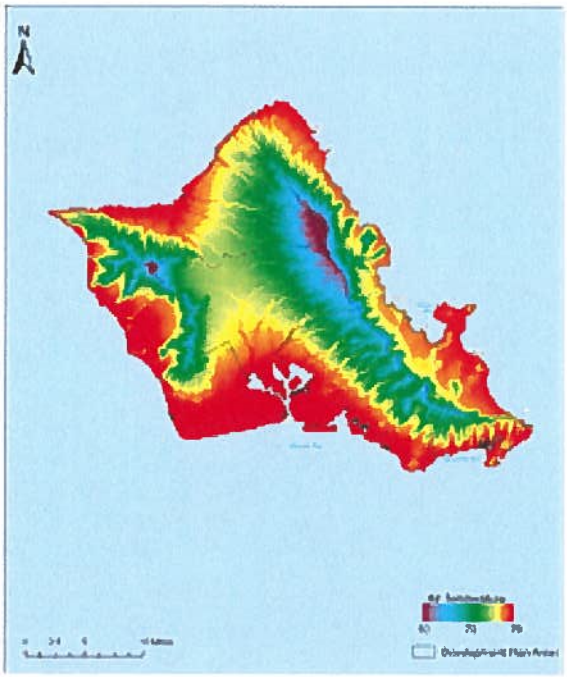


Figure 4: Average annual afternoon temperatures for O'ahu.

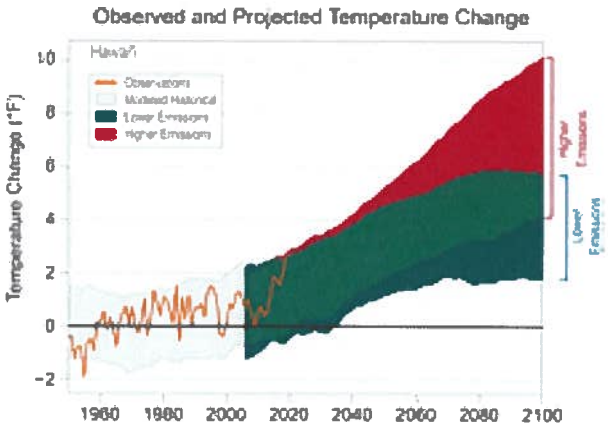


Figure 5: Observed and projected changes (compared to the 1951–1980 average) in near-surface air temperature for Hawai'i.

Historic Data:

- Since 1950, average air temperatures in Honolulu have risen by 1.4°C (2.6°F) with a sharp increase in warming over the last decade.[4]
- The number of hot days (≥90°F) and very warm nights (≥75°F) between 2015 and 2020 were more than double historic averages, and are only expected to increase.[4]
- During the strong El Niño of 2015, Honolulu set or tied 11 days of record heat. This compelled Hawaiian Electric to issue emergency public service announcements to curtail escalating air conditioning use that stressed the electrical grid.[4]

Future Risk Data:

- By 2100, O'ahu is projected to experience temperatures that are between 1.8-7.2°F warmer.[4]
- Greatest warming potential is at the highest elevations and on the leeward side of O'ahu.[6]

Drought and Wildfire

Projected changes in total rainfall for Hawai'i are not consistent across recent studies. Different climate models predict increases or decreases in annual precipitation over various time spans within this century. Dynamical and statistical downscaling are two approaches to taking information from global climate models and "scaling them down" into local-scale models that can make projections at a higher resolution. For Hawai'i, dynamical models tend to project an increase in frequency in heavy rainfall events, while statistical downscaling models tend to project a reduction in total rainfall. However, historic data has shown that 90% of Hawai'i has experienced a decline in rainfall and there has been a statewide increase in drought frequency, duration, and magnitude.[4] At the same time, total burned area statewide has increased more than fourfold in the last century and fire propagates rapidly in dry non-native grasslands.[4] Statewide, non-native, flammable grasses and shrubs cover 25% of all land.[4]

Decreasing precipitation and increasing drought will have significant impacts on agricultural productivity, wildfire risk, and local culture. Water shortages could have major economic impacts for our island economy that is heavily reliant on tourism. Dry conditions can result in crop failures and low agricultural yields, while increasing operational costs associated with potentially increased water prices. Additionally, reduced water availability could lead to increased competition for resources, such as drinking water and irrigation for agriculture, and more severe drought conditions that can increase wildfire risk. If groundwater sources are not able to be replenished, water availability could also become a chronic concern over time.

Historic Data:

- Over 90% of Hawai'i experienced a decline in rainfall from 1920-2012, with changes in precipitation varying on each island. The period since 2008 has been particularly dry.[4]
- Drought frequency, duration, and magnitude increased statewide and on O'ahu from 1920-2019.[4]
- Streamflow in Hawai'i has declined over approximately the past 100 years, consistent with observed decreases in average annual rainfall and leading to an increase in the number of no-flow days in drier areas.[4]

Future Risk Data:

- More frequent and severe droughts, particularly on the leeward side of the island where precipitation is expected to decrease 60%.
- Loss of native forest cover causes increased erosion and runoff, more coastal brownouts.[4]

Percent Change in Annual Rainfall at the End of the Century: O'ahu
Statistical vs. Dynamical Downscaling

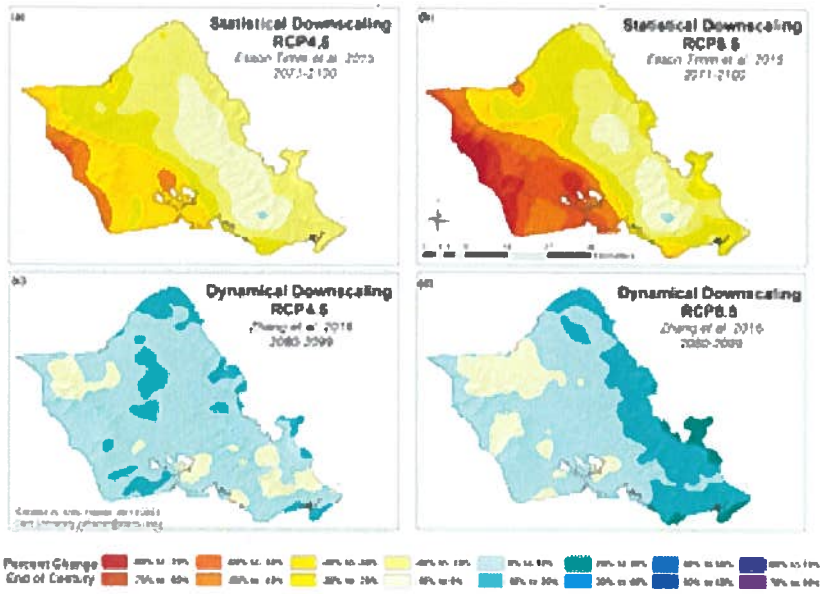


Figure 6: Projections of precipitation under a moderate emissions scenario (RCP 4.5), left, and a high emissions scenario (RCP 8.5), right.

Flash Flooding

Flash flooding occurs when heavy rainfall causes flooding within three to six hours of the onset of a rain event.[7] Warming ocean and air temperatures due to climate change influence precipitation patterns, causing an increase in intense rainstorms in some areas and exacerbating drought in others.

A progressive increase in heavy rain storms will lead to flash flooding that endangers people, damages transportation infrastructure, causes power outages, and disrupts local agriculture and small business operations. Landslides and washed out roadways can lead to road closures, while excess water runoff could strain sewage and drainage systems, leading to potential pollution of the ocean and coastal areas. Damage to homes and small businesses from flooding can cause millions in economic damages and increase the potential for homeowners to become houseless if they do not have sufficient insurance coverage. Additionally, standing water following a flood can lead to an increase in water-borne health diseases and exacerbate damage to homes. Projected sea level rise could also exacerbate the impacts of flash flooding in low-lying areas as the water may not be able to drain due to higher ocean levels.

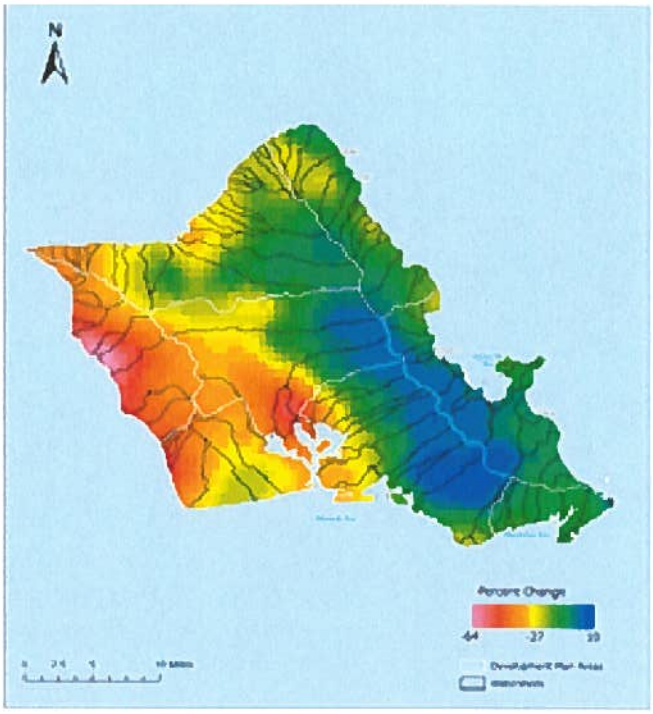


Figure 7: Map illustrating projected change in precipitation during wet season.

Historic Data:

- On average, O'ahu has experienced up to four days of severe flash flooding events (4+ inches of rainfall over a 24-hour period) annually.[6]
- Millions of dollars in damages as a result of flooding, landslides, damage to stream drainage channels, boulder basins, and homes.
- Across the state of Hawai'i, extreme precipitation events are more frequent in La Niña years and less frequent in El Niño years.[4]

Future Risk Data:

- Increase in consecutive wet days statewide.[4]
- Models project a near doubling in the frequency of future extreme La Niña events, associated with extreme rainfall in Hawai'i, from one in every 23 years to one in every 13 years.[4]

Hurricanes

Warmer ocean and air temperatures are fueling stronger and more frequent hurricanes that are more difficult to predict and track. If a hurricane were to hit O'ahu, we are at risk of significant economic and social consequences to infrastructure, homes, and public safety. Storm surge is especially dangerous in combination with high tides, which can flood homes, cut off access to critical health and emergency services, damage important cultural sites on the shoreline, and disrupt the supply chain of lifeline resources such as food, water, and other important deliveries statewide. High winds can damage power lines and separate roofs from homes. Additionally, storm surges and intense rain may increase the risk of hazardous materials, landfill waste, and household contaminants polluting drinking water and natural ecosystems. Additionally, O'ahu's hurricane shelters only have holding capacity for a Category 1 or less intense storm, and only one of these shelters is located on the upper windward side of the island. Loss of housing infrastructure or limited access to shelters can amplify health impacts of hurricanes, particularly for low-income and elderly residents.

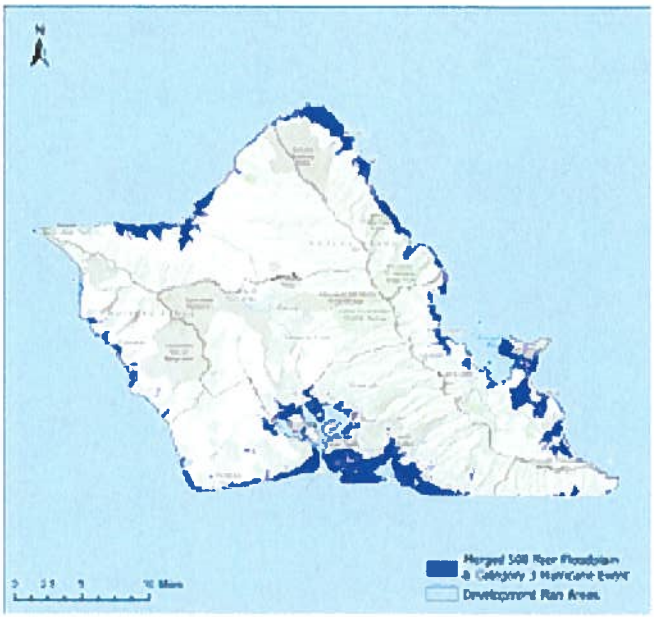


Figure 8: Exposure map of the flood zones from both FEMA Flood Insurance Rate Maps (FIRM) and NOAA-modeled storm surge from a Category 3 hurricane.

Historic Data:

- Hawai'i has had an annual 25.2% chance of severe storms of any magnitude (tropical storm up to category 4 hurricane).[6]
- A storm of hurricane strength has never made landfall on O'ahu for as long as records are available. Passing hurricanes have caused rainfall flooding, storm surge flooding, wind damage, and fueled wildfire impacts.

Future Risk Data:

- More frequent tropical cyclones are projected near Hawai'i, though models are uncertain. This is not necessarily because there will be more storms forming in the east Pacific; rather, it is projected that storms will follow tracks that bring them into the vicinity of Hawai'i more often. (Climate Change Commission, 2023).[4]
- However, Hawai'i will likely experience more tropical cyclones during El Niño years, a period of unusually warm ocean temperatures. The frequency of intense El Niño events is projected to double this century, with extreme events occurring roughly once per decade (Climate Change Commission, 2023).[4]

Climate Impacts to Our Home

The five climate hazards describe expected changes due to climate change. The way that those climate hazards affect our lives is called a climate impact. For example, while climate change will cause sea levels to rise, the climate impacts of sea-level rise might include beach loss or flooding. Some impacts may generate a sequence of additional impacts, creating a domino effect of negative social, economic, and environmental consequences known as cascading impacts. For example, an extreme heat wave can put a strain on the electric grid, resulting in power outages that exacerbate heat illnesses and hospital visits. Additionally, altered weather patterns can result in more frequent or severe natural disasters, such as hurricanes and droughts, increasing the likelihood of wildfires, increasing potential loss of cultural resources, and affecting the tourism economy if hotels, businesses, and recreation areas are damaged. Cascading impacts emphasize the urgency of mitigating climate change and implementing adaptation solutions to minimize devastating consequences to our planet and lives. Climate impacts can also combine to amplify the effect of other impacts. For example, extreme heat may increase the effect of droughts on plant life, increasing risk of wildfires.

The following tables outline likely climate impacts from sea level rise, heat, drought and wildfire, flash flooding, and hurricanes. Unless otherwise noted, these impacts were identified in the Climate Ready O'ahu Risk Assessment. Each climate hazard relates to the three parts of Climate Ready Oahu's vision: people, 'āina, and infrastructure. The climate adaptation strategies and actions in Climate Ready O'ahu were selected based on the following understanding of climate impacts to O'ahu.

PEOPLE IMPACTS

SEA LEVEL RISE AND COASTAL EROSION

- Over 13,000 people are at risk of property damage or loss leading to potential displacement[8]
- Exposure of 550 Hawaiian cultural sites statewide to chronic flooding could result in their damage or loss[8]
- Loss of access to and productivity from traditional food sources reliant on reefs, loko i'a, and agricultural lands near coastal areas
- Increased water contamination that exposes the public to potential health risks
- Limited access to land, impacting customary and traditional practices such as salt cultivation, fishpond maintenance, and gathering from fisheries near the coast
- Individuals living in areas with significant groundwater and storm drain backflow flooding may be subject to health risks from mold exposure and loss of their homes
- Beach loss and potential closures impact recreation activities
- Damage to coastal infrastructure could create public health issues if utility services (water, electricity) are disrupted
- Economic impacts and hardships to individuals and manufacturers dependent on tourism industry revenue
- Stress and mental health impacts related to managing household flood damages and loss of cultural places may increase in locations with greater flood risk to sea level rise

PEOPLE IMPACTS

INCREASING TEMPERATURES AND HEAT WAVES

- Increase in heat-related deaths and illnesses, such as heat stroke, kidney disease, and respiratory illnesses, particularly for children (<2 years old), individuals experiencing houselessness, low-income individuals, and elderly (65+ years old) populations
- Many homes, schools, and buildings do not have air conditioning, increasing occupants' potential sensitivity to rising temperatures
- Increased energy use, resulting in higher energy expenses that may increase economic hardships for low-income residents
- Commuting via walking or biking or waiting in open-air bus and rail facilities will become increasingly uncomfortable for residents and visitors
- Outdoor workers may need special accommodations such as evening work hours, increased breaks, or specialized clothing

DROUGHT AND WILDFIRE

- Water shortages island-wide can decrease water availability for agriculture and community
- Browning and water-stressed vegetation could make experiences in outdoor spaces less enjoyable
- Loss of access to and productivity from traditional food sources reliant on loʻi and agricultural lands
- Increased water costs due to decreased availability
- Potential increase in wildfires due to drought could destroy businesses and homes, leading to economic losses, forced displacement and fatalities
- Decreased water and air quality from wildfire smoke and infrastructure debris

FLASH FLOODING

- Flooded roads or landslides can disrupt access to health care facilities, recreational spaces, and workplaces
- Increased mold and mildew growth from standing floodwaters
- Contaminated flood waters can increase the potential for disease and pose other public health risks
- Increased risk of drownings, particularly for children and elderly
- Economic problems and loss of cultural resources caused by flooded homes and community spaces could increase mental health stress and houselessness

PEOPLE IMPACTS

HURRICANES

- Damage to roads and ports can disrupt emergency services, the supply chain of lifeline resources, such as food and water, and access to jobs, school, and tourism activities
- Downed or damaged power lines can cause loss of power, increase risk of wildfire, and prevent charging of electric vehicles
- Reduced food and water access, particularly among households and individuals not able to hold a recommended 14-day food supply reserve
- Forced displacement, relocation, and loss of land and belongings as a result of severe storms can diminish a sense of place and exacerbate mental health and economic challenges, especially for individuals already experiencing houselessness
- Damage to the coastlines may impact local fishing and cultural practices as well as diminish portions of Hawaiian Home Lands, resulting in disruption to community cohesion, especially for Native Hawaiians
- Building back post-storm is a financial strain on businesses and residents
- Federal funding possibly depleted as disasters from hurricanes increase nationwide
- Livelihoods and employment may be impacted from loss of property

ʻĀINA IMPACTS

SEA LEVEL RISE AND COASTAL EROSION

- Potential flooding of 9,400 acres of land[8]
- Eroding beaches may impact local fishing and cultural practices as well as diminish portions of Hawaiian Home Lands, resulting in disruption to community cohesion, especially for Native Hawaiians
- Increased water contamination can cause health impacts to wildlife via bioaccumulation of pollutants
- Added stress to native coastal habitats, which can lead to a shift in habitat range, extinction, and coral bleaching, particularly impacting native seabirds, sea turtles, monk seals, and native dune plants
- Near-shore and low-lying habitats and ecosystems may be lost or damaged due to salt water intrusion and water pollution
- Exposure and loss of nearly 1,300 acres of state designated agricultural land and 1,860 acres of conservation land, including beaches and wetlands[6]

ʻĀINA IMPACTS

INCREASING TEMPERATURES AND HEAT WAVES

- Increased potential for brush fires that could diminish park usage
- Added heat stress to native flora and fauna, which can lead to a shift in habitat range and extinction of natural species
- Potential increase in the prevalence of pests, diseases, and invasive species that can adapt and thrive in warmer temperatures
- The urban tree canopy will experience heat and water stress without irrigation and landscaping maintenance

DROUGHT AND WILDFIRE

- Decrease in freshwater supplies for residential and commercial use
- Decrease in native forest cover as drought resistant invasive species replace natives
- Increased erosion and water runoff due to lack of vegetation
- Surface water reservoirs could experience high concentrations of algal blooms and bacteria due to lower water levels, lower oxygen levels, and increased pollutant concentrations
- Loss in productivity from agricultural and livestock farms
- The overall health of the watershed may decrease as streams and vegetation dry out
- Habitat loss or degradation, leading to a decrease in Oʻahu's biodiversity
- Drought conditions may "impair, diminish, or impede the exercise of traditional and customary practices" for Native Hawaiians, including the collection of plants, animals, and minerals that rely on a healthy watershed and environment[9]

FLASH FLOODING

- Destruction of crops and agricultural land resulting in reduced yields and decreased income for farmers, particularly traditional taro farmers who rely on aquaculture
- Contamination of water and soil from debris, impacting the health of forests, wetlands, and reef ecosystems
- Stream blockages due to landslides, rockfall, or debris

ʻĀINA IMPACTS

HURRICANES

- Historical and cultural resources near the shore may be vulnerable to damage from storm surges, which may deplete communities of important meeting sites or culturally valuable places
- Over 5,800 acres of agricultural land are within the 500-year severe storm flood hazard zone, making them vulnerable to flooding from hurricanes[6]
- Wetlands, watersheds, coral reefs, and beaches are vulnerable to damage from high winds and contaminated water

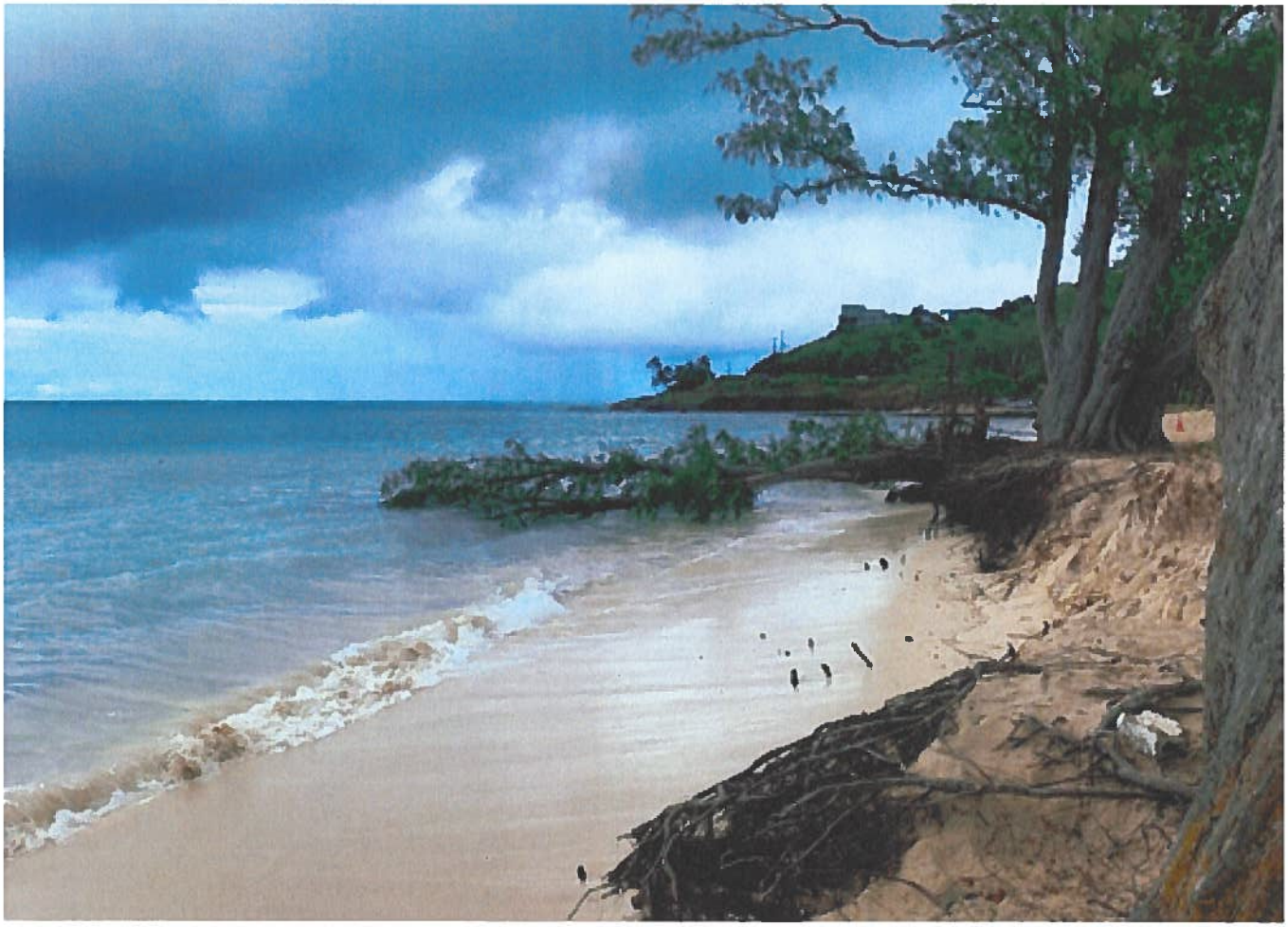


Photo Credit: DPR

INFRASTRUCTURE IMPACTS

SEA LEVEL RISE AND COASTAL EROSION

- With 3.2 feet of sea level rise, estimated $12.9 billion in losses of private land and structures, including agricultural land[8]
- Flooding of 17.7 miles of major roads and 3,880 structures[8]
- Seawater corrosion damage to 76 miles of pipelines providing water island-wide[10]
- Erosion damage to coastal roads could impact public transportation access and cost – from rerouting in the short-term to service changes and/or permanent route reconfiguration in the long-term, affecting access to school, work, and homes
- Safety issues at beaches (for example, unsafe comfort station facilities or beach accessways) related to coastal erosion could force beaches to close
- Increased potential for inland flooding from tidal water backs up through the drainage system and spills out onto streets, which is particularly likely during king tide events
- Low-lying properties that provide housing to low-income or houseless populations (for example, Hale Mauliola and Citron Street project) are at significant risk of flooding
- Destruction of coastal waste management facilities at elevations near hide tide or high groundwater level (septic tanks, wastewater and sewage treatment and disposal systems, storage and disposal sites for hazardous materials and waste) could disrupt the systems and potentially release their contents into nearby waters and habitats

INCREASING TEMPERATURES AND HEAT WAVES

- Residents, tourists, businesses, and the City are all likely to increase air conditioning use, thereby, increasing demand on the electrical grid during high temperatures that could lead to system-wide blackouts
- Increased potential for cracking of road pavement, overheating of vehicles, or airport tarmac failures
- Building retrofits to increase comfort and heat safety may require building redesign efforts

INFRASTRUCTURE IMPACTS

DROUGHT AND WILDFIRE

- Increased potential for development and spread of wildfires that threaten critical infrastructure such as utilities, roads, bridges, and personal property
- Small businesses impacted by wildfire will face economic losses
- Increased need for irrigation in urban green spaces

FLASH FLOODING

- High risk of rockfall at 66 sites on our highways
- Power lines may be badly damaged or destroyed from landslides or fast-moving water, resulting in loss of power from days to weeks and increased public health risks as water treatment and sewage facilities require electricity to run
- Storm drains may be clogged with debris and require cleaning, exacerbating consequences of flooding
- Washed out roads and bridge damage, potentially cutting off communities due to a lack of detour options
- O'ahu's transition to electric buses may be stifled by a heavy precipitation event as power outages greater than 1-2 days may limit the ability to charge them

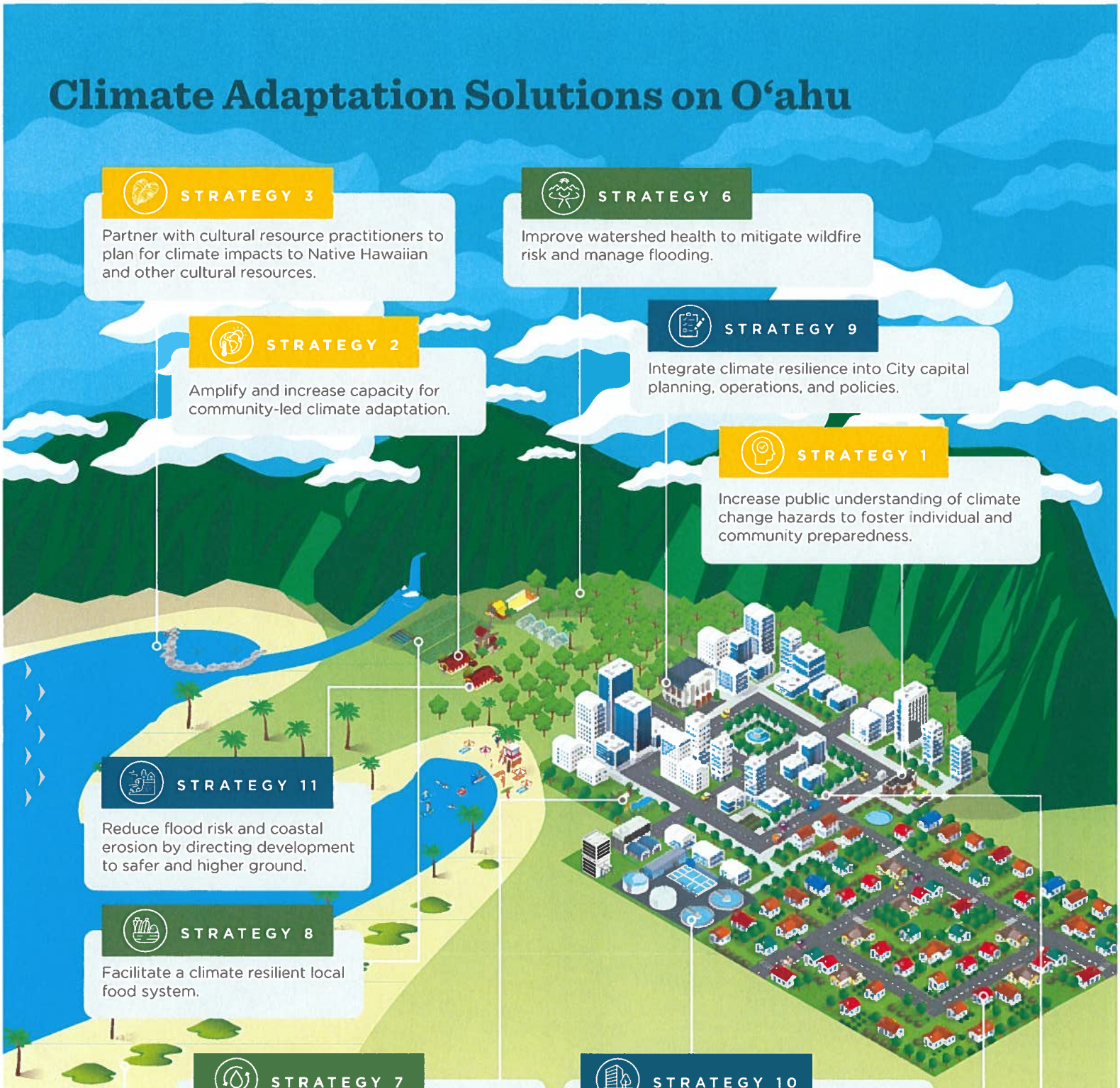
Photo Credit: DFM

INFRASTRUCTURE IMPACTS

HURRICANES

- Up to 65% of the current residential housing stock is projected to be severely damaged or destroyed in a Category 1 hurricane
- Small businesses will face increased economic losses as many lack generators and recovery plans
- Hurricane-induced flooding could affect 23,739 buildings, 198 miles of roadway, 183 bridges, 3 fire stations, 5 hospitals, and 10,218 acres of urban land
- Bus and rail services are required to shut down during a major hurricane
- Of O'ahu's critical infrastructure, 60% is located within a mile of the coast making infrastructure highly vulnerable to wind and storm surge events
- Estimated losses of $637 million to essential facilities if a Category 2 hurricane made landfall on O'ahu
- The interruption of critical services such as ports, airports, utility services, and other public services as a result of a hurricane are likely to disrupt virtually all forms of economic activity, including resident and visitor travel
- Storm surge could cause road washouts, sinkholes, and bridge washouts on O'ahu, isolating communities reliant on a single coastal roadway for connection to urban Honolulu
- Small businesses are likely to be less resilient after a severe storm event as many lack generators, operate out of buildings that are not constructed to withstand high winds, and lack recovery or continuity plans
- Storm debris and material cleanup may result in a loss of landfill capacity

Climate Adaptation Solutions on O'ahu



STRATEGY 3

Partner with cultural resource practitioners to plan for climate impacts to Native Hawaiian and other cultural resources.

STRATEGY 6

Improve watershed health to mitigate wildfire risk and manage flooding.

STRATEGY 2

Amplify and increase capacity for community-led climate adaptation.

STRATEGY 9

Integrate climate resilience into City capital planning, operations, and policies.

STRATEGY 1

Increase public understanding of climate change hazards to foster individual and community preparedness.

STRATEGY 11

Reduce flood risk and coastal erosion by directing development to safer and higher ground.

STRATEGY 8

Facilitate a climate resilient local food system.

STRATEGY 7

Strengthen fresh water security by improving water conservation and reuse.

STRATEGY 10

Make buildings, homes, and infrastructure more climate resilient.

STRATEGY 5

Strengthen climate resilience of beach and wetland ecosystems through preservation and restoration.

STRATEGY 4

Center equity in climate change adaptation.

STRATEGY 12

Keep our communities cool as temperatures rise and during heat waves.

Climate Equity in Adaptation

Climate change affects everyone, but climate impacts are not evenly distributed or evenly felt. Across O'ahu, different climate hazards will impact some areas more than others; for example, leeward areas are more impacted by drought than windward areas. At the same time, communities with more resources have a greater ability to adapt to climate impacts than communities with fewer resources. This ability to adapt is called "adaptive capacity." Differences in adaptive capacity are often the consequence of existing historical patterns of inequity and colonization, socioeconomic status differences, and/or systemic environmental injustices. When differences in adaptive capacity are layered on top of the uneven exposure to climate hazards, we can see the full picture of "social vulnerability" across the island. In Climate Ready O'ahu, we define social vulnerability to climate change as: "certain socioeconomic, housing, transportation, and other variables that can be stressors to better plan for a community's capacity to prepare for and respond to environmental shocks such as hurricanes, sea level rise, or extreme heat".

In 2020, the Honolulu City Council adopted Resolution 20-206, which defined areas with high social vulnerability as "frontline communities".[11] Frontline communities are places that are highly vulnerable to climate impacts like heat, drought, or flooding, while also having a lower adaptive capacity. Those who are more likely to experience climate impacts due to high levels of social vulnerability often have the fewest resources to cope with, adapt to, or recover from impacts of climate change. For instance, frontline communities do not often have equitable access to well-maintained infrastructure, diverse social and economic opportunities, safe and affordable housing options, and quality education — all of which form the critical foundation for resilience in the face of climate change.

Climate equity begins with recognizing and addressing unequal burdens within communities that are made worse by climate change, while ensuring that all people share the benefits of climate adaptation efforts. Additionally, climate equity amplifies the strengths and abilities of vulnerable populations to respond and thrive in the presence of climate hazards.

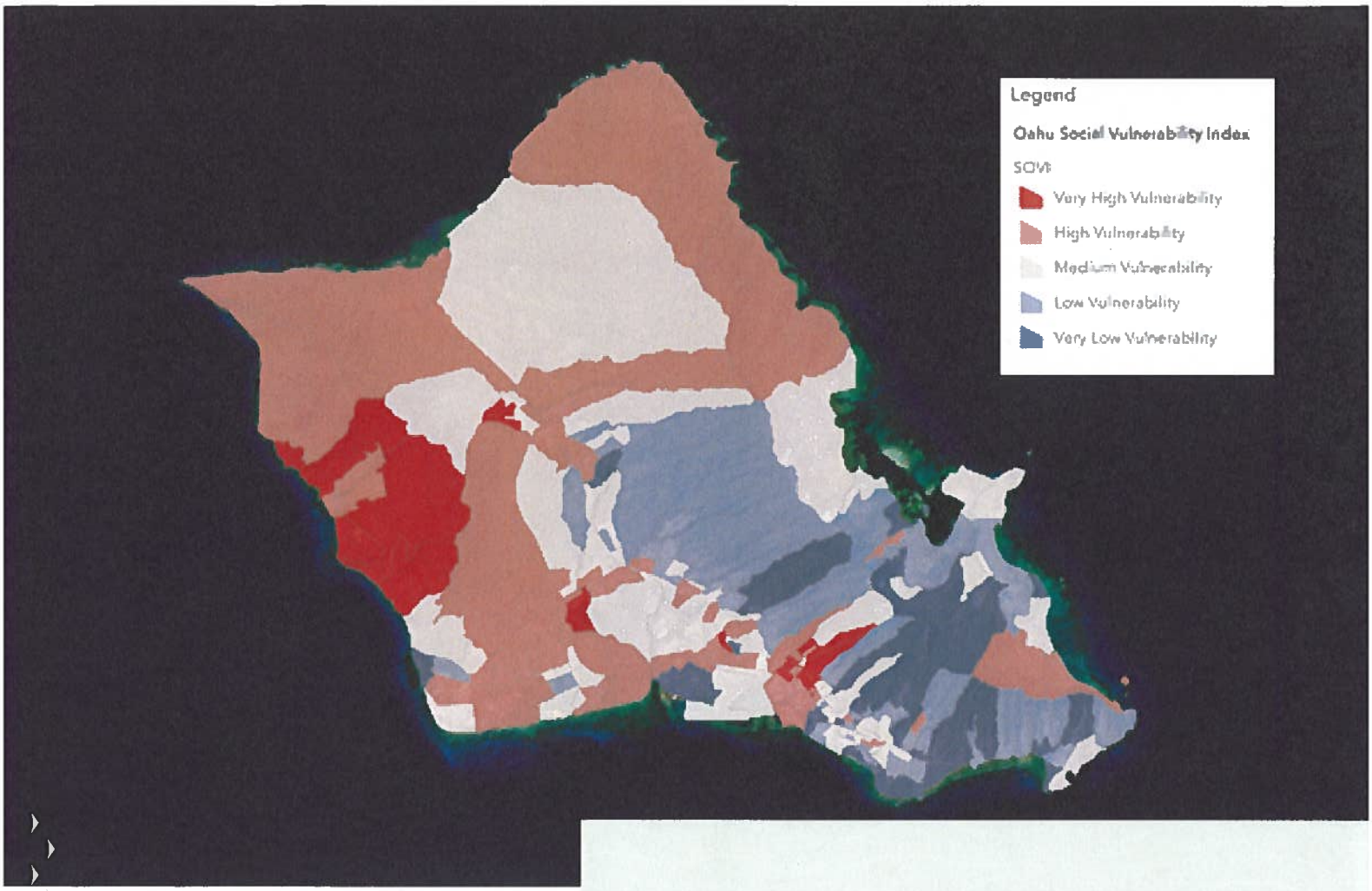


Figure 8: The 2020 O'ahu Social Vulnerability Index (SOVI)

Frontline Communities on O'ahu

- Native Hawaiian communities
- Asset Limited Income Constrained Employed (ALICE) populations
- Kūpuna
- Keiki
- People with disabilities
- Compact of Free Association and Pacific Islander communities
- Black, Indigenous, and people of color (BIPOC communities)
- People experiencing houselessness
- Farmers
- Renters and those at risk of displacement
- Immigrants and refugees

(Source: City Resolution 20-206)

O'ahu Social Vulnerability Index

Which residents and communities are most vulnerable to disaster hazards? A Social Vulnerability Index (SOVI) can assess and rank a community's resilience by considering vulnerability and adaptive capacity across multiple indicators, as well as, in this case, across different climate hazards. A customized index of social vulnerability was developed for O'ahu during the development of the Ola Resilience Strategy. This index accessed five dimensions of social vulnerability to hazards on O'ahu. Household composition included family size, percentage of keiki and kūpuna in the family, and families with single parents. Socioeconomic status included factors such as median income, unemployment rate, and education. Minority status/language considered languages spoken in the household and disability status. The final dimension was exposure to hazards such as Sea Level Rise and Tsunami evacuation zones. These dimensions and indicators were mapped to create a SOVI for O'ahu, which can show us where vulnerable populations tend to live, what drives the vulnerability of these communities, and what steps may be helpful to lessen vulnerability.

Honolulu's Commitment to Climate Equity

The City is committed to ensuring climate equity in all that we do. Equity was a priority in the development of Climate Ready O'ahu through robust stakeholder engagement and community input. For example, the City's Office of Climate Change, Sustainability and Resiliency (CCSR) hosted a series of six engagement workshops in partnership with local organizations in vulnerable communities to guide the development of this Strategy *(see more in Community Voices)*.

The City is committed to continuing and strengthening efforts to build deep, accountable relationships with frontline communities, especially with Native Hawaiian community leaders whose indigenous knowledge and practices are internationally recognized as a major source of climate change adaptation (*Adger et al 2014*). To ensure Honolulu's frontline communities are meaningfully engaged in the implementation of adaptation solutions, the City will promote the use of an Equity Screening Tool developed using best practices from Climate Ready O'ahu engagement efforts and best practices from equity practitioners *(see Strategy 4: Center equity in climate change adaptation for more information)*.

Equity is a process and a practice that will intentionally and continuously evolve throughout time as new research and best practices emerge. Climate Ready O'ahu is just one of many places that we aim to normalize equity in city government. For the past three years, the City has conducted equity training for City employees to learn about what it means to lead with equity, be mindful of implicit biases, and put anti-discriminatory principles into practice in the workplace. Climate Ready O'ahu's equity approach is meant to guide the City's consideration of climate equity in everything the City does to achieve climate justice outcomes for all residents.


2023 Hawai'i Green Growth Annual

Community Voices

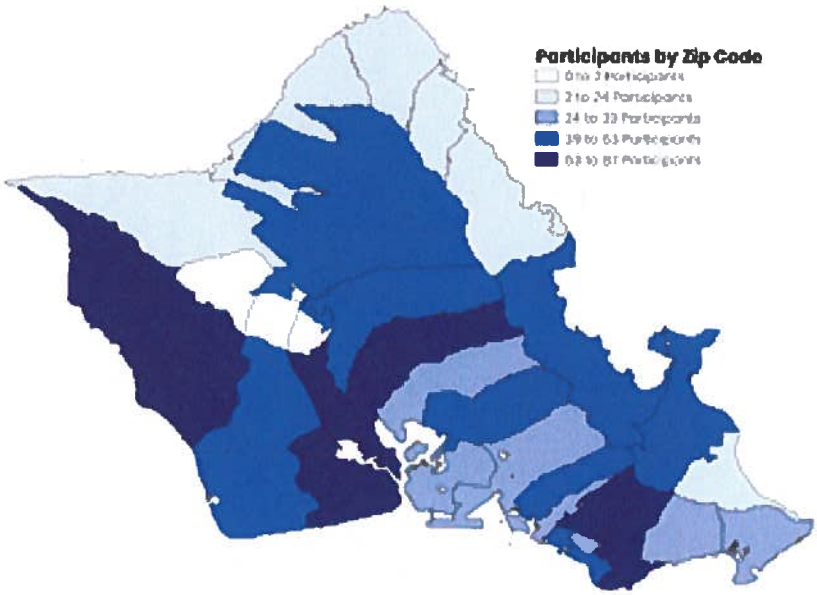
The engagement philosophy for the Climate Ready O'ahu project team is rooted in co-creation with the community. Its efforts build on the City's existing conversations with the community through comprehensive plans like the O'ahu General Plan and Sustainable Community Plans. In order for adaptation solutions to provide benefits to everyone, people must be at the center of adaptation. Thus, we implemented numerous virtual and in-person outreach strategies to co-create this strategy with communities across O'ahu. Our goals were to:

1. Empower community members with an understanding of O'ahu's climate hazards and risks.
2. Identify community resources, needs, and opportunities for implementing climate adaptation solutions.

Community Outreach By the Numbers:

- **12** community engagement workshops
- **20** farmer's markets
- **40** member Community Advisory Hui
- **2** island-wide surveys
- **2** award-winning Climate Ready Games
- **32** meetings with City departments
- **6** community engagement workshops
- **2** open houses
- **33** out of **35** zip codes represented
- **2,000+** voices heard
- **1,200+** comments recorded

Total Participants in Climate Ready O'ahu Engagement



Feedback received during the public engagement process was reviewed by the City, community partners, and Advisory Hui members to ensure the resulting Climate Adaptation Strategy represents voices of the O'ahu community. Although the engagement phase to provide input for Climate Ready O'ahu has concluded, building a climate-ready O'ahu will require work beyond the publication of this document. We look forward to continuing to partner with communities to implement solutions and update actions as the impacts of climate change unfold.

Community Outreach Activities

Community Advisory Hui: The first convening of the Climate Ready O'ahu Advisory Hui ("Advisory Hui") in late 2020 marked the official launch of the strategy engagement process. Composed of 40 community leaders, this group convened throughout the strategy's development to provide valuable insight at key decision points. See the complete list of Advisory Hui members in the Acknowledgments.

Visions of O'ahu Tour: We hosted a Visions of O'ahu tour where we set up tables at farmers markets and malls to hear what a climate-ready future looks like in communities across the island. To ensure the Strategy would best reflect the needs and perspectives of frontline communities that had been underrepresented in previous engagement efforts, we designed an outreach campaign in partnership with organizations in Wai'anae and the North Shore.

Community Surveys: We conducted two rounds of surveys. Both surveys asked O'ahu residents how much people felt climate change was already impacting their lives, their level of knowledge about climate hazards, and priorities about adaptation actions.The first survey, conducted in late 2020, reached 196 residents. To increase our response rate, we partnered with SMS to conduct a second round of surveys in the summer of 2021, which had 791 respondents. Respondents hailed from every council district and represented a diverse cross-section of our community.

Community Engagement Workshops: With leadership support from Mālama Learning Center, we partnered with MA'O Organic Farms, Kuhiawaho, Ka'ala Cultural Learning Center, the Mālama Loko Ea Foundation, and Mālama Pupukea-Waimea to design and host six workshops unique to the communities in which they were held. Recognizing the presentations sometimes do not adequately foster conversations and collaborative thinking, we created the "Are You Climate Ready?" interactive, graphics-based board games tailored to Hawai'i's context and challenges.

Climate Ready Games: We developed two "Are You Climate Ready?" games, called "Beat the Heat" and "Sea Level Wise" to engage the community in discussions on climate impacts. Both games simulate a journey from present to future that requires players to strategically select climate adaptation actions over multiple decades in order to adapt to either rising temperatures or rising sea levels impacting their health, property, and environment. As they are investing in adaptation actions, players also grapple with periodic climate events like heat waves or 10-year storms that can set them back. To win the game, players must adapt as a team and make it out of the identified "danger zones" together. The Hawai'i Chapter of the American Planning Association awarded CCSR the Excellence in Public Outreach and Education Award for the games.

Open House: Following the engagement workshops, we hosted the Climate Ready Open House at the Blaisdell Center to cross-check with the community the strategies designed via community input. At the event, community members were given the opportunity to indicate a level of support for the draft adaptation strategies and provide inputs as to what types of actions each strategy should include.

What the community shared

> *The increasing cost of living combined with many people that are low income make it hard for people to adapt to climate change. Housing, food, childcare, are all integral to adapting to climate change."*

> *[CRO should] elevate kānaka science: blending knowledge systems for equitable and effective resiliency training."*

> *Climate adaptation is a kākou thing. There are many different factors to consider but we need to come together in order to succeed in adapting to climate change."*

> *Climate change adaptation should be used as an opportunity to increase social equity and environmental justice."*

> *We can't continue to invest in what's not working. Adaptation activities must be diversified to provide the best chance for adaptation that saves lives and our culture."*

> *"We should implement and invest in community solutions as early as possible to adapt to climate change."*

> *It's important to think about who will be alive in 60 years and what they'll need to survive."*

> *Government needs to do a better job of getting the community engaged. Using accessible information, language, educational tools, etc. is essential for climate adaptation."*

KEY MESSAGE

Climate adaptation can positively impact people's daily lives

Where it's incorporated: Individual actions included throughout the actions within the Strategy.

KEY MESSAGE

Different communities need different adaptation solutions

Where it's incorporated: Creation of an equity screening tool and equity strategy in Vision 1: Empowered and Prepared People.

KEY MESSAGE

Emphasize traditional and cultural knowledge

Where it's incorporated: Actions that prioritize and uplift cultural knowledge in Vision 2: Safeguarded and Stewarded ʻĀina.

KEY MESSAGE

Support nature-based solutions

Where it's incorporated: Tree planting actions can be found in Vision 2: Safeguarded and Stewarded ʻĀina.

KEY MESSAGE

Climate adaptation work should be done collectively and collaboratively

Where it's incorporated: Actions centered on partnerships and uplifting community efforts in Vision 1: Prepared and Empowered People.

KEY MESSAGE

Diversify adaptation actions

Where it's incorporated: Each climate hazard has multiple adaptation actions to address impacts.

KEY MESSAGE

Invest now in long-term solutions

Where it's incorporated: Actions on innovative financing in Vision 3: Safe and Reliable Infrastructure.

KEY MESSAGE

Expand education and outreach

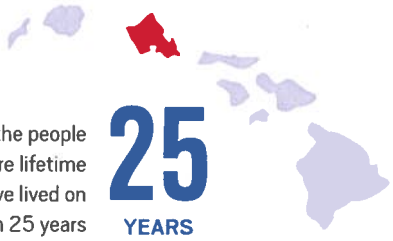
Where it's incorporated: Expanding education and outreach actions can be found in Vision 1: Empowered and Prepared People.

Community Perspectives

Demographics

Roughly half of all participants were under the age of **35**

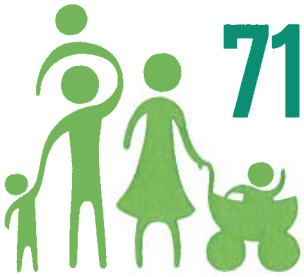
More than ½ of the people who participated were lifetime residents or have lived on island for more than 25 years **25 YEARS**



Key Stats on Actions

OVER **70%** of island residents support preparing for climate impacts

>75% of residents feel that climate change impacts are of concern



71% of residents expect children to be worse off because of climate change impacts

83% of residents are concerned to extremely concerned about climate change impacts

Residents support requirements for increasing tree cover in private and public spaces; investing in restoring and preserving forests, streams, and wetlands; updating building codes for water efficiency and hurricane safety; and facilitating hurricane and fire retrofits.

77% of residents are concerned to extremely concerned over a decreasing fresh water supply, particularly for Native Hawaiians

>50% of island residents support rezoning coastal properties and relocating highways vulnerable to sea level rise and coastal erosion

Key Stats on Impacts

4/5 Native Hawaiians have already reported experiencing climate change impacts from the five climate hazards, more than any other ethnic group

NEARLY **1/2** of all residents have reported experiencing extreme heat impacts

Vision Statement

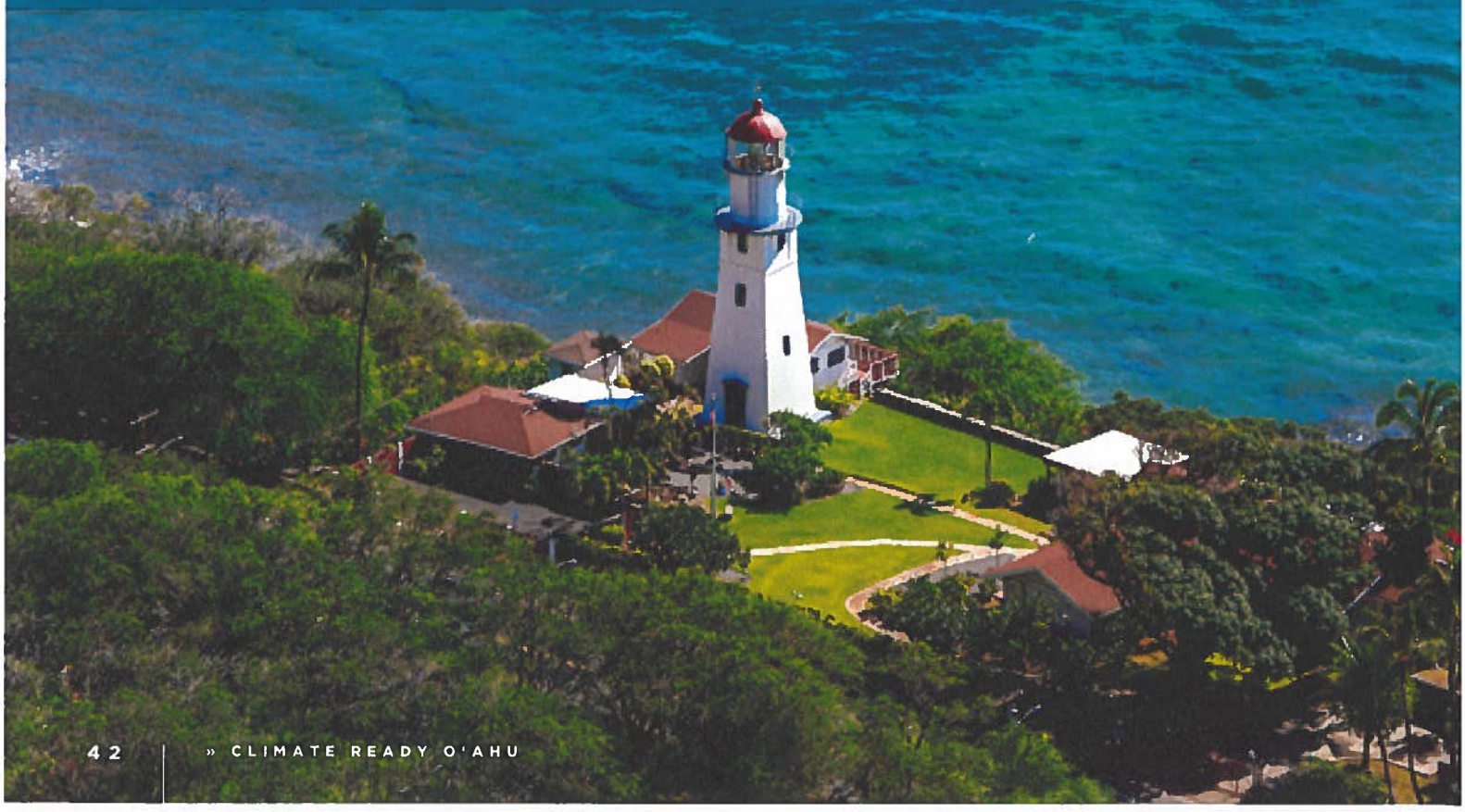
Our vision for a Climate Ready O'ahu has three parts:

PART 1: A Climate Ready O'ahu is one where all people are empowered with the knowledge, tools, and resources to prepare for climate impacts.

PART 2: A Climate Ready O'ahu is one where connections between people and native ecosystems are cultivated so the 'āina is safeguarded for generations to come.

PART 3: A Climate Ready O'ahu is one where infrastructure works with natural systems to keep people safe from climate hazards at home, at work, and everywhere in between.

Each part of the vision has overarching strategies and implementable actions. Strategies are designed to be big ideas that will serve as guides far into the future. The strategies also contain actions that the City and its partners can begin to implement to advance the strategies and increase O'ahu's ability to adapt to a changing climate.



How to Read an Action

Although faced with significant challenges, our capacity as an island community to act is strong. From individuals to whole communities, each one of us has an important role in bringing about a future that is healthier, safer, and more resilient. The strategies and actions contained here will require changes from all of us to protect, maintain, and enhance what we love.

There are 57 actions identified in Climate Ready O'ahu, with every action following a consistent format. Each action is identified with a title, description, and further accessed into five fields. As seen below, the five fields are aimed to address an action's benefits, partners, timeframe, existing efforts, and associated hazard(s).

Expected benefits
Social, ecological, and economic benefits and co-benefits from the action

Hazards
The associated climate hazard(s) relevant to the action

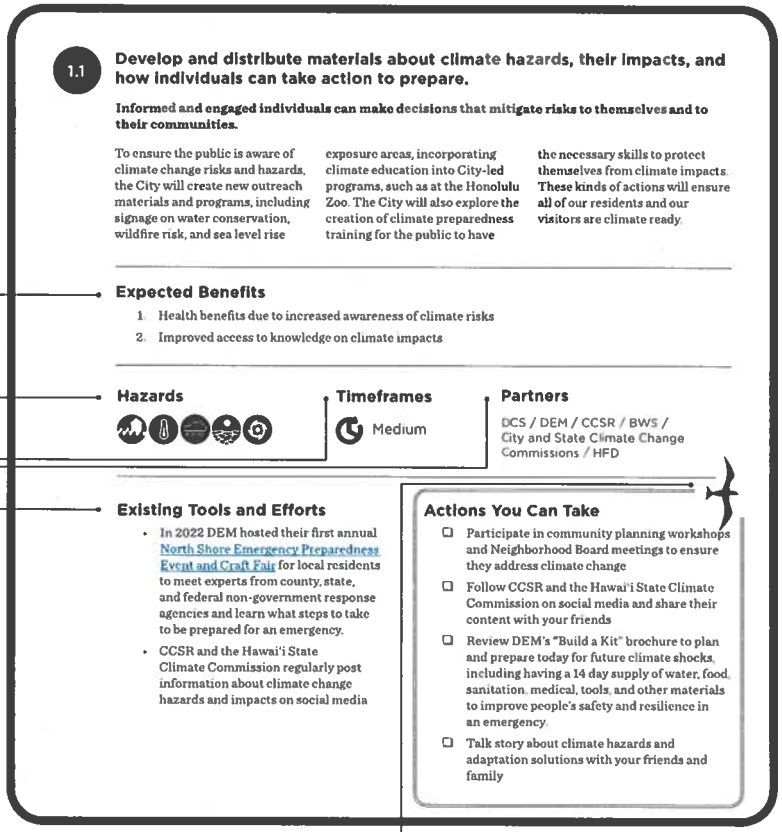
Timeframe
An action's timeframe reflects the first key milestone determined from an adaptation pathways approach, which assumes that adaptation strategies will evolve over time to address the range of possible future conditions

- Near - present-5 years
- Medium - 5-10 years
- Long - 10-20 years
- Far - 20+ years

Partners
These are key stakeholders who should be engaged as part of implementation. You can find a glossary of acronyms at the beginning of the document.

Existing efforts
Current local efforts that are related to the action

Manu-o-Kū
Look out for this symbol to find actions that you can do as an 'ohana



1.1 **Develop and distribute materials about climate hazards, their impacts, and how individuals can take action to prepare.**

Informed and engaged individuals can make decisions that mitigate risks to themselves and to their communities.

To ensure the public is aware of climate change risks and hazards, the City will create new outreach materials and programs, including signage on water conservation, wildfire risk, and sea level rise exposure areas, incorporating climate education into City-led programs, such as at the Honolulu Zoo. The City will also explore the creation of climate preparedness training for the public to have the necessary skills to protect themselves from climate impacts. These kinds of actions will ensure all of our residents and our visitors are climate ready.

Expected Benefits
1. Health benefits due to increased awareness of climate risks
2. Improved access to knowledge on climate impacts

Hazards

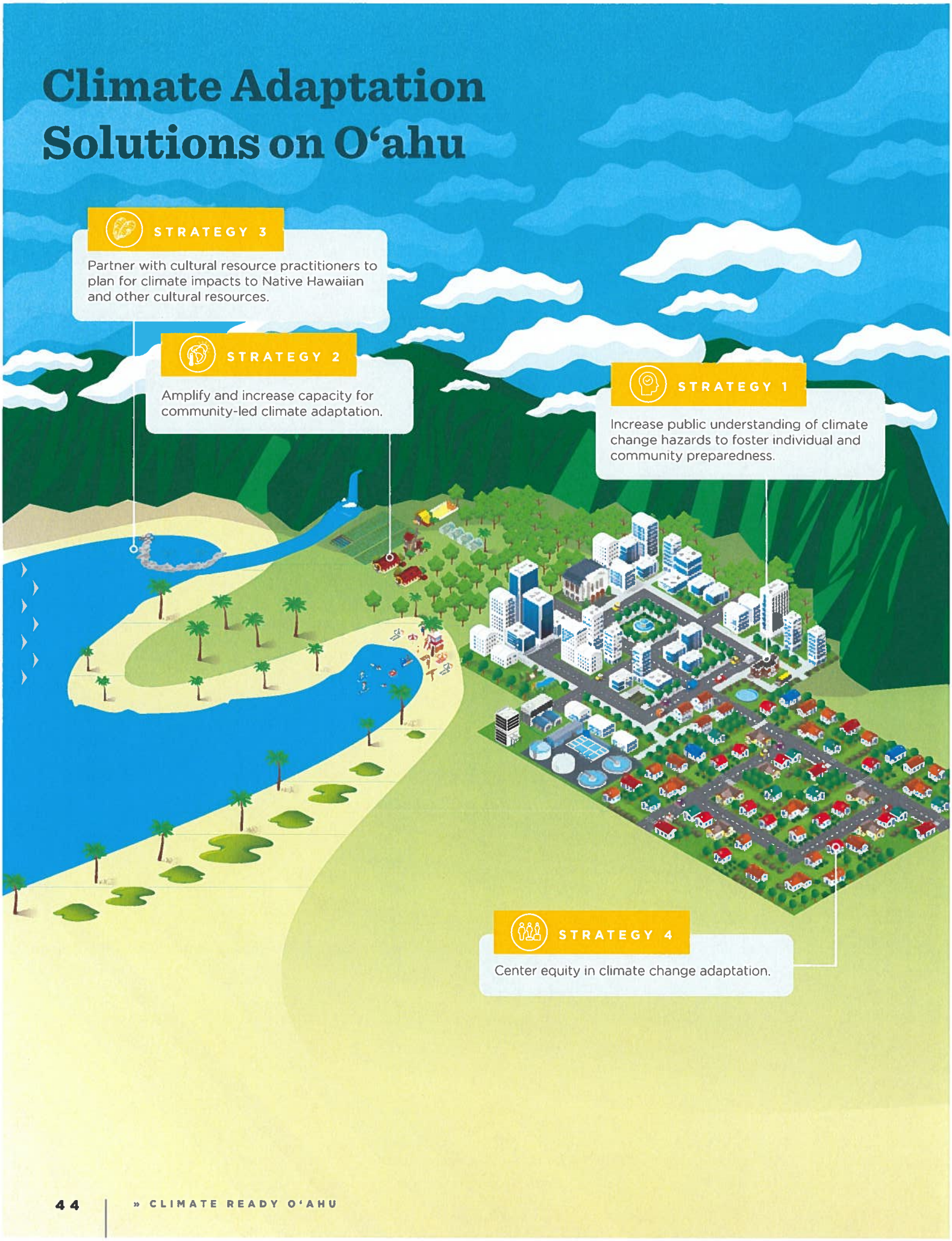
Timeframes
Medium

Partners
DCS / DEM / CCSR / BWS / City and State Climate Change Commissions / HFD

Existing Tools and Efforts
- In 2022 DEM hosted their first annual North Shore Emergency Preparedness Event and Craft Fair for local residents to meet experts from county, state, and federal non-government response agencies and learn what steps to take to be prepared for an emergency.
- CCSR and the Hawai'i State Climate Commission regularly post information about climate change hazards and impacts on social media

Actions You Can Take
- ☐ Participate in community planning workshops and Neighborhood Board meetings to ensure they address climate change
- ☐ Follow CCSR and the Hawai'i State Climate Commission on social media and share their content with your friends
- ☐ Review DEM's "Build a Kit" brochure to plan and prepare today for future climate shocks, including having a 14 day supply of water, food, sanitation, medical, tools, and other materials to improve people's safety and resilience in an emergency.
- ☐ Talk story about climate hazards and adaptation solutions with your friends and family

Climate Adaptation Solutions on O‘ahu



VISION

Part 1: Empowered and Prepared People

A Climate Ready O'ahu is one where all people are empowered with the knowledge, tools, and resources to prepare for climate impacts.

A Climate Ready O'ahu is where residents islandwide are informed of local climate hazards, connected to resources and to each other, and practicing climate adaptation in their daily lives. Everyone has access to climate information in their preferred language and receives updates online and through a network of community partners. Residents are climate champions and can easily find information to get involved and join workdays to remove invasive species, restore loko i'a (fishponds), and assist community-based organizations with local adaptation efforts.

Equity considerations are at the center of City plans, which prioritize our island's frontline communities to ensure nobody is left behind and unfairly impacted as climate change unfolds. With support from the City, community-based organizations, friends, family, and neighbors feel empowered and prepared to adapt to climate change.

As the climate changes, people change with it. Residents practice emergency response routes to mitigate risks from hazard events. Communities join together to restore beach systems and protect cultural resources, such as iwi kūpuna (ancestral remains), from the effects of rising sea levels and flooding.

As average rainfall decreases, educational campaigns and financial assistance programs make conserving water the norm. Residential rain gardens and permeable pavements are installed in neighborhoods to slow flooding caused by the higher occurrence of heavy, localized rain. As temperatures continue rising to an unprecedented degree, more public safety staff and caregivers are trained to recognize and report heat illnesses. On particularly hot days, communities have systems in place to check on heat-vulnerable neighbors, especially kūpuna and keiki.

When climate hazards strike, residents are at ease because they have been able to continuously use their voice and experiences to monitor changes and inform updates to adaptation solutions they need to thrive.

STRATEGY 1

Increase public understanding of climate change hazards to foster individual and community preparedness.

What we don't know *can* hurt us. As the threat of climate change increases, so too does the need for accessible information and expertise to support climate-resilient communities. Being aware of climate change impacts and ways to adapt can help communities avoid costly property damage, protect natural and cultural resources, and keep people safe. For example, upon learning about climate hazards, a family in need of a new roof for their home may take advantage of the opportunity to install hurricane clips to keep their roof from detaching during a hurricane or opt for a metal roof that is more fire resistant and can reduce temperatures inside the home. To reduce heat, residents who plant trees near their house today will enjoy the cooling benefits of shade for decades into the future, including cheaper energy bills and a comfortable spot to sit outside. In both cases, being aware of the impacts of climate change empowers residents to make more informed decisions that prepare them for the future.

Easy access to accurate climate information ensures residents, particularly vulnerable residents, can adapt to changes confronting our island. This information can be delivered through both traditional media and virtual outreach tools, such as websites and social media, and physical outreach tools, such as flyers shared by non-profit organizations or during in-person training sessions. The City will deploy a mix of virtual and in-person tools, including expanding partnerships with organizations that support frontline communities, to ensure all residents have access to climate-related information. Empowering O'ahu residents to become self-sufficient starts by increasing their awareness of local climate risks and providing timely information to help them prepare for the new realities created by our changing climate.

Designing for Equity:

- Work with communities to co-develop culturally appropriate educational materials
- Prioritize accessibility of information to ensure those living in the most vulnerable areas are the first to be informed
- Use various forms of media to communicate climate risks and adaptation solutions
- Nurture partnerships with organizations that serve frontline communities to collaboratively distribute climate-related information
- Expand partnerships with organizations that serve kūpuna, keiki, unhoused people, and those with disabilities

1.1 Develop and distribute materials about climate hazards, their impacts, and how individuals can take action to prepare.

Informed and engaged individuals can make decisions that mitigate risks to themselves and to their communities.

To ensure the public is aware of climate change risks and hazards, the City will create new outreach materials and programs, including signage on water conservation, wildfire risk, and sea level rise exposure areas, incorporating climate education into City-led programs, such as at the Honolulu Zoo.

The City will also explore the creation of climate preparedness training for the public to have the necessary skills to protect themselves from climate impacts. These kinds of actions will ensure all of our residents and our visitors are climate ready.

Expected Benefits

1. Health benefits due to increased awareness of climate risks
2. Improved access to knowledge on climate impacts

Hazards

Timeframes

Near

Partners

DCS / DEM / CCSR / BWS / City and State Climate Change Commissions / HFD

Existing Tools and Efforts

- In 2022, DEM hosted their first annual North Shore Emergency Preparedness Event and Craft Fair for local residents to meet experts from county, state, and federal non-government response agencies and learn what steps to take to be prepared for an emergency.
- CCSR and the Hawai'i State Climate Commission regularly post information about climate change hazards and impacts on social media
- CCSR created two award-winning Climate Ready games: "Are you Heat Ready?" and "Are you Sea-Level wise?"

Actions You Can Take

- ❑ Participate in community planning workshops and Neighborhood Board meetings to ensure climate change is addressed
- ❑ Follow CCSR and the Hawai'i State Climate Commission on social media, sign up for their newsletters, and share their content with your friends
- ❑ Review DEM's "Build a Kit" brochure to plan and prepare today for future climate shocks, including having a 14-day supply of water, food, sanitation, medical, tools, and other materials to improve safety and resilience in an emergency.
- ❑ Talk story about climate hazards and adaptation solutions with your friends and family

1.2 Expand the City's network of partners who serve frontline communities to check in on vulnerable neighbors during climate "shocks."

Climate shocks, like hurricanes, heat waves, flash floods, and wildfires are major events that cause harm in a short period of time.

During climate shocks, keiki, kūpuna, migrants, and unhoused community members are especially vulnerable, yet are often harder to reach with emergency information. Community-based organizations that specialize in providing services to these populations are essential partners for getting information and resources to those who need it. Expanding this network will require the City to continue to build new partnerships, communication strategies, resources, and tools that will reach frontline communities and ensure all communities are informed about how to protect themselves from climate impacts. When faced with climate shocks, this network will serve an integral role in keeping our communities safe.

Expected Benefits

1. Reduced stress on 'ohana and frontline communities during climate shocks
2. Improved thermal comfort and health benefits
3. Improved social cohesion among residents who can provide support following climate events

Hazards

Timeframes

Near

Partners

DEM / ESD / CORE / HFD / HPD / CCSR

Existing Tools and Efforts

- "Be Ready" community groups, churches, and community-based organizations
- In 2014, the North Shore Disaster Preparedness Committee prepared a Disaster Preparedness Resilience Action Plan that highlights the four-phase disaster cycle (Preparedness Period, Response/Emergency Management, Relief, and Recovery) to reduce risks to their community and save lives.
- In 1993, FEMA created the Community Emergency Response Team (CERT) program which is a free 20-hour public training program "that teaches essential disaster management and response skills to prepare individual citizens and their families before a disaster strikes."
- American Red Cross of Hawai'i is a community organization with a workforce primarily made of volunteers to assist with disaster preparedness education and emergency response in the event of an emergency.

Actions You Can Take

- ❑ Help your community beat the heat by checking in with your neighbors before, during, and after high heat days
- ❑ Fill a large container with tap water or keep a case of bottled-water at home
- ❑ Develop and practice your plans for hurricanes, flooding, and heat events
- ❑ Participate in the Community Emergency Response Team (CERT) training offered by the Department of Emergency Management
- ❑ Volunteer with American Red Cross Hawai'i's Disaster Action Team

1.3 Provide training to public-service safety staff, outdoor workers, and caregivers to recognize and report patterns of heat-related illnesses and injuries.

As O'ahu gets hotter, the City will protect people by training more individuals to recognize signs of heat-related illness.

The City will incorporate extreme heat safety education and training into existing training procedures for department Safety Officers and appropriate new City employees. By incorporating these practices into City procedures, the City will continue to increase the number of people year after year who can recognize signs of heat-related illness and potentially save lives. Additionally, the City will review and strengthen existing resources and partnerships for delivering heat preparedness training to community members who serve as outdoor workers and caregivers. Impacts on indoor workers in facilities without air conditioning, such as certain factories, will also be considered. Examples of heat preparedness activities for the community include new early warning outreach strategies before high heat days and monthly heat-ready workshops throughout the island. With the right access and participation in heat preparedness training, heat- related illnesses and deaths can be prevented.

Expected Benefits

1. Health benefits to outdoor workers
2. Cost savings from reduced compensation and health insurance claims due to heat-related illnesses
3. Prevented heat illnesses in care facilities and in homes

Hazards

Timeframes

Near

Partners

DHR / DFM / DPR / ENV / HESD

Existing Tools and Efforts

- In 2022 HIOSH, published a Directive for the National Emphasis Program (NEP) Outdoor and Indoor Heat-Related Hazards to protect employees from risking heat injuries and illnesses in industries such as construction, maritime, and agriculture.
- City Safety Specialists plan and execute industrial safety educational and informational programs, including heat illness prevention training.

Actions You Can Take

- ❑ Review the Occupational Safety and Health Administration's (OSHA) workers rights to heat safe practices at work and share with your co-workers
- ❑ Learn the signs and symptoms of heat stroke

STRATEGY 2

Amplify and increase capacity for community-led climate adaptation.

From restoring native ecosystems and increasing local food access to expanding public education and providing healthcare services, O'ahu's community-based organizations (CBOs) are integral to community well-being. Out of over 9,000 registered nonprofit organizations across the state of Hawai'i, nearly 6,000 are based in the Urban Honolulu metro area.[13] These local organizations strengthen community resilience in good times and under challenging circumstances. For example, when the COVID-19 pandemic disrupted essential services, CBOs and volunteers stepped up as critical responders, distributing essential resources and translating materials into the languages spoken in their community.[14]

Community leadership and response to the pandemic revealed that strong relationships with one another is our island's most important asset when dealing with a crisis due to their knowledge of community-wide social networks. This knowledge enables CBOs to address and react to community needs in real time. Although many CBOs are already playing a critical role in adapting to climate change, they require capacity building support, financial resources, and recognition to achieve the most impact.

Virtual resource hubs that promote community engagement in volunteer days, map grant opportunities, and provide space to share best practices between organizations address each of these gaps. Additionally, recognizing and celebrating the efforts of CBOs can encourage more community members to take part in helping CBOs implement adaptation solutions, while fostering a sense of ownership for climate adaptation among the community. By increasing capacity and celebrating positive impacts of climate adaptation in the community, the City can promote continued participation in climate adaptation activities.

Designing for Equity:

- Identify and prioritize selection of climate champions from frontline communities and aim to provide compensation for their efforts
- Prioritize the leeward side of O'ahu, which is more vulnerable to heat and drought, in roll-out of wildfire prevention and preparation efforts
- Celebrate climate adaptation efforts across O'ahu to raise awareness and encourage community involvement

2.1 Create a Climate Champions program to encourage local climate leadership.

During community engagement workshops for the development of Climate Ready O'ahu, community-based organizations (CBOs) and residents expressed a need to better understand their role in climate adaptation.

In response, the City intends to create a Climate Champions program that pairs CBOs with individuals from their community to implement adaptation projects. These individuals will be known as Climate Champions who, with training and support from the City and local organizations, will help improve the well-being and climate readiness of their community. To support the community-based organizations and Climate Champions, the City will provide guidance on project development, aid in recruitment, and host professional development workshops. Working together to implement climate adaptation solutions will strengthen relationships and awareness of climate risks among the City, residents, and community organizations which all have essential roles in helping O'ahu become climate-ready.

Expected Benefits

1. Increased capacity for community organizations implementing climate solutions
2. Enhanced networking and skill-building opportunities for our local community
3. Strengthened social cohesion for adapting to climate impacts

Hazards

Timeframes

Near

Partners

CCSR

Existing Tools and Efforts

- In 2023, CCSR piloted the Climate Champions Program with five CBOs: Mālama Learning Center, KEY Project, Mālama Pu'uloa, Hawai'i Wildfire Management Organization, and Mālama Loko Ea Foundation.
- In 2023, CCSR was awarded a $1 million federal grant, "Environmental Justice Government to Government" to support this paid partnership between community and local government through 2026.

Actions You Can Take

- ❑ Individuals can sign up to serve as a Climate Champion with the City and its community partners

2.2 Encourage and support neighborhoods to become certified Firewise Communities.

About the same proportion of land in Hawai'i burns each year as in the most fire-prone U.S. states.[15]

On O'ahu, impacts are broad and long-lasting, including sediment-smothered coral reefs, loss of native forests and plants, and reduced air quality. With changes in land use and climate on O'ahu, wildfire is a significant and growing hazard. Preventative measures, such as clearing flammable vegetation or limiting campfires and equipment that sparks on dry and windy days, are effective yet underutilized tools for reducing wildfire risk.

Firewise USA is a national program that teaches people how to adapt to living with wildfire and encourages neighbors to collaborate on taking action that prevents the spread of wildfires. The City will partner with the Hawai'i Wildfire Management Organization (HWMO) to support residents in organizing Firewise communities by convening workshops and providing outreach materials. Once established, resident leaders become part of the statewide Hawai'i Firewise Network and have opportunities to connect and share resources and best practices with other Firewise-recognized neighborhoods across the state. Together, residents can protect their local businesses, homes, parks, natural landscapes, and neighbors from wildfires.

Expected Benefits

1. Strengthened social cohesion within community
2. Open doors to funding for support of community actions

Hazards

Timeframes

Medium

Partners

HWMO / HFD / DLNR / CCSR

Existing Tools and Efforts

- Since 2015, Hawai'i Wildfire Management Organization has helped 14 communities across the Hawaiian Islands — including Mariner's Cove on O'ahu — achieve the nationally-recognized Firewise Communities status.

Actions You Can Take

- ❑ Residents of Firewise communities qualify for a free home assessment on fire risks from the Hawai'i Wildfire Management Organization

2.3 Create a resource hub to promote opportunities for engaging in community-led climate adaptation.

Local organizations are advancing a climate-ready O'ahu through a range of efforts including tree planting, loko i'a restoration, and educational events that empower the public to be part of climate adaptation efforts.

To recognize these efforts and support local organizations, the City will create a centralized resource hub for climate-related resources and information. This hub could promote local and federal funding opportunities and grant writing workshops, provide climate-related education materials produced by the City, or include a public forum for organizations to connect, peer-learn, and share resources. This resource hub will also serve as a database of engagement opportunities, sourced from community organizations, with the aim of empowering community members and City employees to participate in work days that support adaptation efforts.

Expected Benefits

1. Strengthened social cohesion for adapting to climate impacts
2. Enhanced community and CBO awareness of funding opportunities
3. Impacts felt directly in neighborhoods benefiting from climate work
4. Greater public awareness of climate-related volunteer opportunities
5. Improved access to employment opportunities in green job industries

Hazards

Timeframes

Near

Partners

CCSR

Existing Tools and Efforts

- Hawai'i Conservation Alliance created an online resource platform, Conservation Connections, to help people find stewardship opportunities to work, volunteer, research and learn by category of interest.
- Travel2Change is an online resource that promotes a variety of free and at cost fun and unique opportunities to connect with places across O'ahu dedicated to cultural education and restoration activities.

Actions You Can Take

- ❑ Sign up for a community workday and bring a friend with you

2.4 Celebrate community action on climate adaptation.

With State and community partners, the City will host an annual celebration to honor the collective efforts of community-based organizations contributing to climate adaptation solutions.

This event will provide a platform for organizations to showcase their impactful work and share resources with others, while actively engaging the public in adaptation initiatives. By celebrating the community's collective efforts, the City aims to foster a sense of shared responsibility toward a climate-ready future and recognize the work being done island-wide.

Expected Benefits

1. Increase awareness of climate adaptation efforts within communities
2. Empower community members to engage in climate adaptation solutions
3. Encourage more CBOs to implement climate adaptation efforts

Hazards

Timeframes

Medium

Partners

CCSR

Existing Tools and Efforts

- In 2023, Hawai'i Climate Week debuted to showcase climate action efforts state-wide and raise awareness on climate risks facing our islands.

Photo Credit: Office of Economic Revitalization

STRATEGY 3

Partner with cultural resource practitioners to plan for climate impacts to Native Hawaiian and other cultural resources.

Climate change will exacerbate cultural resource loss. Drought threatens traditional food sources like kalo, polluted water from flooding threatens subsistence limu gathering practices, and sea level rise threatens beach access, salt cultivation, and heiau, while exposing ancient burial grounds and iwi kūpuna (ancestral remains). Nearly 550 cultural sites across the state and 189 cultural sites on O'ahu would become chronically flooded with 3.2 feet of sea level rise. In some areas of O'ahu, climate impacts to cultural sites have already occurred. For example, beachgoers found iwi kūpuna exposed at Ka'a'awa Beach in 2021[16] and this beach is expected to continue receding under future sea level rise scenarios. Although protocols and management plans exist for relocating iwi kūpuna, there are barriers to timely and considerate action, including limited finances, gaps in education, and lack of managerial capacity.

The City has a responsibility to support the perpetuation of cultural practices. A first step towards protecting cultural resources from climate impacts is understanding what is at risk and when it is most likely to be impacted. Identifying risks and vulnerabilities will require collaborating with cultural resource practitioners to integrate cultural heritage and historical changes with climate science on expected impacts. These relationships are integral for defining adaptation solutions that are cognizant of historical and cultural historic sites and landmarks, while ensuring their ability to thrive under climate change. Actions may require allocating resources and establishing policies to ensure timely and respectful actions for relocating iwi kūpuna and protecting cultural sites from further harm.

Since many traditional practices have been threatened over time, curating educational resources on their important contributions to community well-being and adaptation will also ensure that these practices are passed down to future generations. By proactively and collaboratively safeguarding cultural resources, the City can honor its commitment to cultural resilience, while strengthening the social fabric of O'ahu.

Designing for Equity:

- Open new opportunities for Native Hawaiian leadership to design best practices to manage cultural resources impacted by climate change
- Recognize adaptive value of cultural resources and indigenous practices

3.1 Recognize and compile educational resources on how Native Hawaiian cultural practices positively contribute to climate adaptation.

Native Hawaiians hold a unique wealth and depth of knowledge of the natural landscapes to which they are connected.

The knowledge reflects generations of interactions and relationship-building with the land and sea by which there is no definitive line where nature begins and culture ends. This connection to place has empowered strong community well-being and traditional practices which are essential for adapting to climate change. The City will connect with Native Hawaiian leaders to learn from their practices and co-create educational resources that shed light on traditional ecological knowledge as a best practice for adaptation. The process for designing these resources will be aligned with guidance from Native Hawaiian leaders. These resources could encompass a wide range of topics, including sustainable agricultural practices, traditional resource management techniques, and strategies for maintaining strong social cohesion in times of change. By recognizing the wisdom embedded in the cultural practices of our island, we can raise awareness among individuals, schools, City employees, and organizations about the importance of incorporating Native Hawaiian cultural practices into contemporary adaptation efforts.

Expected Benefits

1. Improved social cohesion that can provide support following climate impacts
2. Affirmation of ʻāina-based restoration work
3. Increased ability for ʻāina-based organizations to tie their work to climate funding
4. Strengthened partnerships between Native Hawaiian communities and the City
5. Protected access to traditional ecological resources
6. Increased public support for Native Hawaiian conservation efforts.

Hazards

Timeframes

Near

Partners

Native Hawaiian Organizations (NHO) / DLNR / MOCA / CCSR

Existing Tools and Efforts

- The Hawai'i Cultural Resource Information System (HICRIS) was developed by the Department of Land and Natural Resource's State Historic Preservation Division (SHPD) to oversee and maintain a broad range of data and information about Hawai'i's architectural, historic, cultural and archaeological properties.

3.2 Research climate impacts on Native Hawaiian cultural practices and resources

This action recognizes the inherent connection between climate, culture, and community.

Native Hawaiian cultural practices, including limu and salt harvesting, flower and foliage collecting for lei and hula, and native feather gathering, have all been impacted by climate change and Western land-use practices. Limited research exists on the continued impacts of climate hazards on these and other cultural resources. From conducting targeted assessments to documenting ʻike kūpuna, studying climate impacts on cultural resources will foster a deeper understanding of the interdependence between cultural heritage and nature. The City will use this knowledge to inform the development of adaptation solutions to foster resilience of ecosystem landscapes and cultural traditions for centuries to come.

Expected Benefits

1. Improved understanding and awareness of climate risks of culturally important resources
2. Strengthened partnerships between Native Hawaiian communities and the City
3. Improved preservation and safeguarding of traditional knowledge, practices, and resources
4. Facilitate prioritization of Native Hawaiian cultural practice and resources

Hazards

Timeframes

Medium

Partners

MOCA / CCSR

Existing Tools and Efforts

- In 2021, the University of Hawaiʻi Sea Grant College Program compiled the *Kūlana Noiʻi*, a guidance document that assists with navigating community-research partnerships by encouraging open conversation and clearly communicated expectations.[17]
- The Limu Hui: Kuaʻāina Ulu ʻAuamo (KUA) regularly convenes traditional limu practitioners to perpetuate limu gathering practices.[18]

3.3 Assess and mitigate risk to iwi kūpuna from sea level rise and coastal erosion.

Native Hawaiian coastal burials are increasingly vulnerable to sea level rise and coastal erosion.

Unfortunately, several sacred sites have already experienced exposure as a result of higher tides.[19] The first step to protecting iwi kūpuna is understanding the potential risks. While the O'ahu Island Burial Council (OIBC) and the State Department of Land and Natural Resources work together to inventory and protect Native Hawaiian burial sites, the City will provide burial site risk assessments in support of these efforts. Scientific analysis, community engagement, and traditional knowledge will be core components of this assessment. Future actions could include establishing best management practices and City-wide training for protecting, preserving, or relocating iwi kūpuna from sea level rise in partnership with those who are already working together to establish cultural protocols related to the handling of iwi kūpuna.[20]

Expected Benefits

1. Protected and preserved iwi kūpuna
2. Strengthened partnerships between Native Hawaiian communities and the City
3. Improved understanding of the significance of iwi kūpuna community-wide

Hazards

Timeframes

Medium

Partners

DLNR / MOCA / DPP / DPR / OHA / OIBC / NHOs

Existing Tools and Efforts

- In 2023, Senate Bill 734 approved the creation of a program within the state Department of Land and Natural Resources to locate and potentially move Hawaiian burial sites that could be impacted by coastal erosion.
- Project Iwi Kuamo'o - 'Aha Kāne created a program to address the location, movement, relocation and restoration of Hawaiian burial sites that are exposed or likely to be exposed by coastal erosion due to climate change.[21]
- In 2020, DLNR State and Historic Preservation District (SHPD) launched the Hawai'i Cultural Resource Information System (HICRIS) that will allow SHPD to effectively manage preservation projects and communicate with stakeholders statewide.
- The O'ahu Island Burial Council (OIBC) meets once a month to discuss relocation vs. preservation of identified Native Hawaiian burial sites; assist DLNR in developing a burial site inventory; and to make reservations regarding management, treatment, and protection of these sites.[22]

3.4 Produce tools and guidance specific to climate indicators defined by Native Hawaiian communities.

In addition to assessing climate impacts, traditional Native Hawaiian knowledge offers a deep understanding of resilience, community well-being, and cultural identity that can complement adaptation metrics.

The City recognizes the invaluable wisdom embedded into Native Hawaiian traditions and practices through observation of the land and sea for centuries. The City will collaborate with Native Hawaiian community leaders and cultural practitioners to conduct inclusive dialogues and consultations that define success metrics aligned with traditional knowledge systems that define adaptation in their communities. Traditional indicators for success may include the strength of community relationships and the ability to maintain cultural practices. Further, the City will develop guidance to empower Native Hawaiian communities to monitor, assess, and respond to climate impacts in a way that addresses their specific needs. This approach will enhance the capacity of Native Hawaiian communities to effectively respond to climate impacts, while fostering a collaborative approach to adaptation that is culturally-sensitive and promotes inclusive adaptation pathways.

Expected Benefits

1. In 2022, the Mālama Implementation Tool was created by Hawai'i Green Growth Local2030 Hub in collaboration with 'Āina Aloha Economic Futures and Stantec to assist in planning, assessing and implementing projects which advance the central value of mālama.

Hazards

Timeframes

Near

Partners

DHHL / CCSR

Existing Tools and Efforts

- In 2022, the Mālama Implementation Tool was created by Hawai'i Green Growth Local2030 Hub in collaboration with 'Āina Aloha Economic Futures and Stantec to assist in planning, assessing and implementing projects which advance the central value of mālama.

3.5 Identify and plan for climate impacts to historic sites and landmarks.

Oʻahu is home to dozens of significant historic sites and landmarks, such as ʻIolani Palace, extensive networks of loko iʻa (fishponds), historic towns like Haleʻiwa, Pearl Harbor, and landmarks such as the Moana Surfrider Hotel.

Recognizing the cultural significance of many beloved historic sites as essential components of community pride, educational resources, and community identity, the City will assess the vulnerabilities of historic sites and landmarks to climate impacts and establish strategies for their long-term preservation. The planning process will leverage expertise of community representatives, historians, and climate scientists to identify climate risks that can inform the prioritization for preservation efforts including retrofitting, relocation, and improved impact monitoring systems. By planning for climate impacts, the City can ensure the continuity of cultural narratives and strengthen the resilience of the physical and cultural components of historic sites and landmarks.

Expected Benefits

1. Continued preservation of historic sites and landmarks
2. Decreased costs associated with preventative preservation and restoration efforts

Hazards

Timeframes

Medium

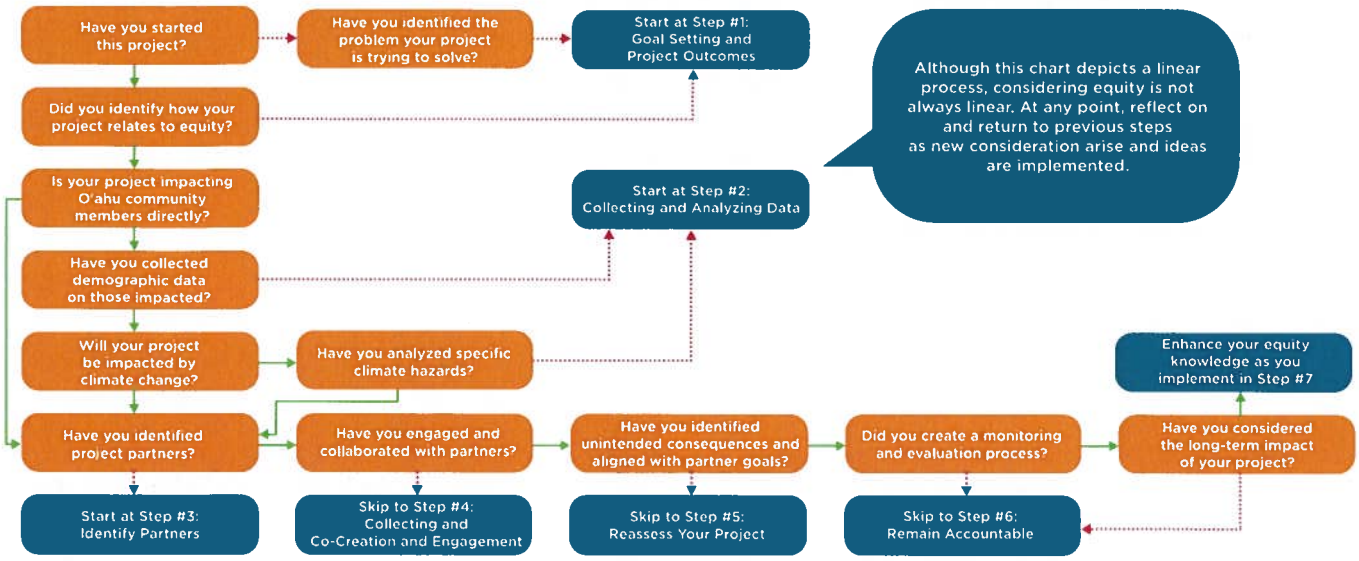
Partners

OHPC / SHPD / DPP / CCSR

Existing Tools and Efforts

- In 2023, the first nine members of the Oʻahu Historic Preservation Commission were appointed and confirmed to serve on the Commission, which advises City officials and members of the Honolulu City Council on matters related to the preservation of historic and cultural sites across the island of Oʻahu.

Where are you at in your Equity Journey?



Follow dotted "red" pathway if answer to question is "no".
Follow "green" pathway if answer to question is "yes".

STRATEGY 4

Center equity in climate change adaptation.

Climate change impacts everyone. However, not everyone is impacted equally or has the same resources, knowledge, and relationships to adapt and respond. The ability to manage and thrive in the face of climate change is known as "adaptive capacity." By identifying what areas have limited adaptive capacity, the City can design equity standards into policy and development to alleviate pressures felt as a result of climate change.

Climate Ready O'ahu's success in strengthening the adaptive capacity of the island's residents will be measured by its ability to address the needs of frontline communities, many of whom already suffer social and economic challenges. Some barriers limiting frontline communities' ability to adapt include lack of access to storm shelters or resources for retrofitting their homes for hurricane high winds, poor credit ratings that complicate borrowing and funding opportunities, and language barriers for understanding and acting on climate hazards. For example, although 27.8% of Honolulu County's population speaks a language other than English at home[23], the City currently only has two translation partners that require a 24-48 hour window for services, making it difficult to translate weather-related information that often arises within a 24 hour time-period.

To effectively build equity into climate adaptation planning and implementation, it is essential that the City is designing for equity and institutionalizing methods that dismantle barriers preventing frontline communities from thriving. Intentionally dismantling barriers begins with understanding the challenges and identifying partnerships for implementing solutions.

Centering equity is about identifying unique needs of every community and using that information to determine priorities. Involving communities should include people who not only live in a place, but also those who may have a familial, cultural, historic, stewardship, or even recreational relationship to that place. All of these stakeholders should be invited to develop and evaluate adaptation measures ensures that the metrics assessing adaptation progress are relevant and reflect outcomes that matter to the community being served. Further, metrics informed by community are more likely to lead to greater community buy-in and engagement in City practices, making this an essential step in institutionalizing equity in adaptation. In addition to inclusive decision-making, translating climate-related information and education resources into diverse languages is an essential step for building an inclusive and informed community. Centering the community in adaptation planning ensures a shared understanding of climate risks and opportunities, which are necessary for a climate ready future. This strategy ensures every action the City takes will be intentional in making climate adaptation accessible to everyone on O'ahu.

4.1 Operationalize an Equity Screen for City projects to ensure equitable implementation of climate ready actions.

An Equity Screen is a tool intended to help urban planning practitioners better leverage existing capacity within the community and identify gaps in support for achieving a climate ready future.

It empowers City staff to strengthen relationships with communities impacted by their work and eliminate potential unintended consequences, while finding ways to improve quality of life for frontline communities in the face of climate change. To operationalize the tool, the City will convene a City Equity Hui to pilot the tool's use and identify barriers to fully integrate equity into City work. Following the pilot, the City will update the tool and identify opportunities to normalize its use city-wide, especially for projects related to climate adaptation.

Expected Benefits

1. Reduces vulnerability of frontline communities to climate impacts by prioritizing changes in their community
2. Enhances City employees' understanding of equity and how it interfaces with their work

Hazards

Timeframes

Near

Partners

CCSR

Existing Tools and Efforts

- In 2020, the City launched an Equity Foundations Training to provide capacity-building and skills for employees to learn about equity, historical injustices, and tools they can use to lead with equity in their work.
- In 2020, the City created an Equitable Stakeholder Engagement Guide to assist city employees in brainstorming and implementing effective engagement strategies that prioritize the needs of frontline communities and impacted stakeholders.

Actions You Can Take

- ☐ Start conversations about how equity is considered in your work and what you can do to better center it

4.2 Develop and monitor key adaptation metrics in collaboration with frontline community members.

It is important that adaptation metrics are informed by what frontline communities identify as their needs.

To understand the intersection of risk and ability to adapt to hazards within each community, the City will create an Adaptive Capacity Index. An adaptive capacity index compares the intersection of risks and the ability to adapt to hazards within each community. When overlayed with social vulnerability indicators, it can serve as an early warning system to anticipate and proactively plan adaptation responses. To inform the creation of the Index, the City will collaborate with community partners to map the existing adaptation assets and develop key monitoring metrics that reflect the community's adaptation capacity. To ensure metrics reflect changing community needs as impacts unfold, the City will routinely gather feedback on the implementation of adaptation strategies and measures of success. Adjusting adaptation strategies aligned with community needs will foster a responsive and inclusive approach to climate adaptation.

Expected Benefits

1. A more comprehensive picture of the impacts of actions
2. Builds buy-in from communities by aligning the success of actions with the goals of the community

Hazards	Timeframes	Partners
	Near	CCSR

Existing Tools and Efforts

- In 2019, the City created a Social Vulnerability Map that accounts for Very Low to Very High socioeconomic factors and local climate hazards across regions and districts using color coding
- In 2019, the State Climate Change Climate Mitigation and Adaptation Commission released an overview study of eight different local and federally recognized social vulnerability tools and their evaluation standards to assess which tools are the best to implement here for a climate-ready Hawai'i.
- In 2022, the Institute for Sustainability and Resilience at UH Mānoa published a Social Vulnerability Index Report. The aim of this report was to work with the Commission, its members and stakeholder groups, to understand how existing social vulnerability indicators (SVI) and other spatially-explicit climate-related data tools are currently being used to aid in decision-making for climate change adaptation.

4.3 Improve language accessibility of climate-related information

Enhancing language accessibility is an essential step towards enabling O'ahu's diverse community to participate fully in adaptation efforts.

The City will map organizations offering translation services and actively seek to expand partnerships to facilitate the translation of climate change information and awareness-raising materials. Moreover, the City will work with these translation partners to establish well-defined communication channels for the timely translation and dissemination of emergency information related to climate shocks.

The City also recognizes that language accessibility will be increasingly vital as climate migrants relocate to O'ahu from other Pacific islands due to climate-related displacement. Breaking down language barriers will empower all community members to make informed decisions and take proactive actions to prepare for climate risks.

Expected Benefits

1. Increased inclusivity and access to climate-related information
2. Workforce development opportunities for translation support
3. Safer and more prepared communities

Hazards

Timeframes

Near

Partners

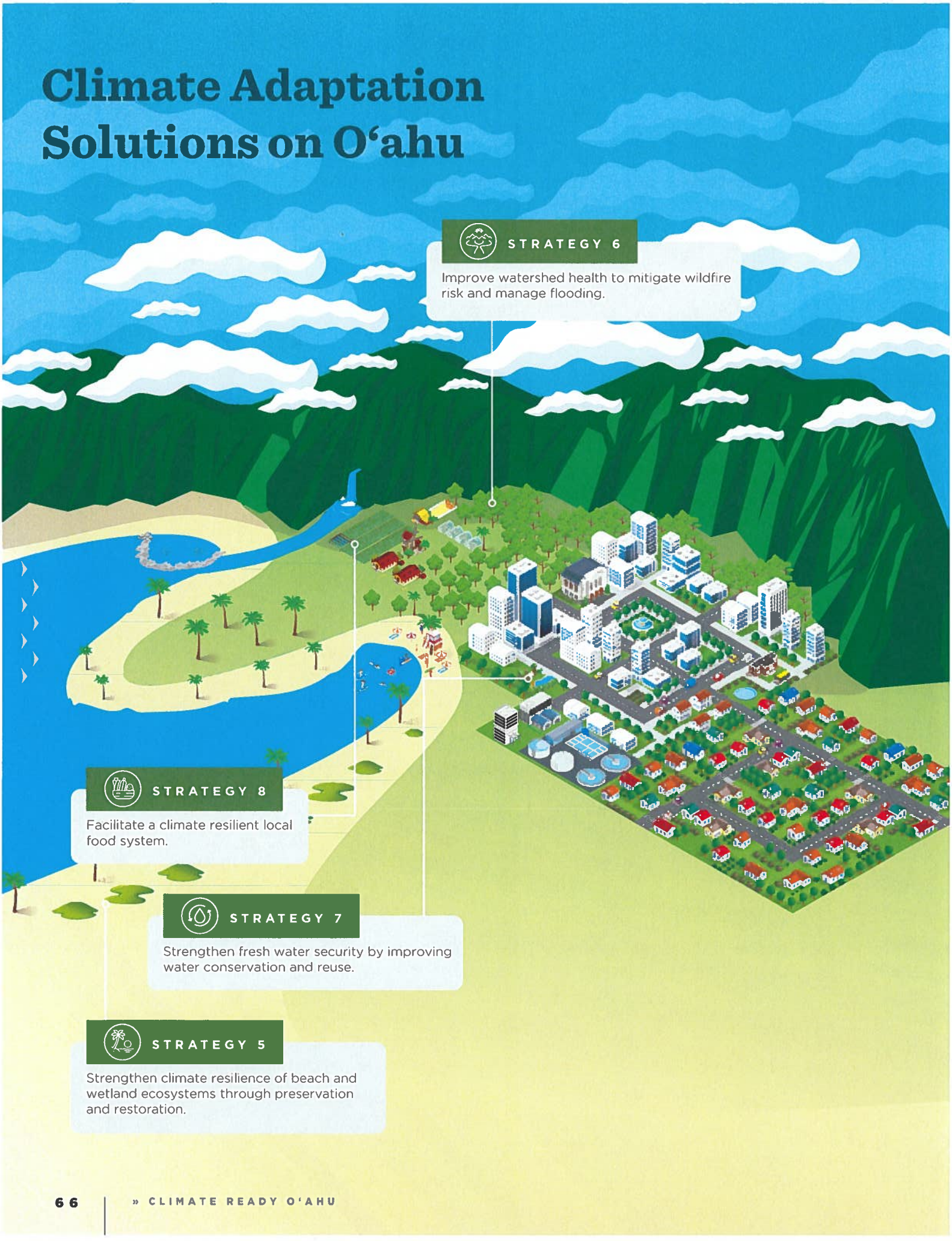
CCSR / DEM

Existing Tools and Efforts

- In 2021, the Department of Community Services published a Language Access Plan to ensure Limited English Proficient (LEP) Persons can access and benefit from available programs and activities.[24]
- The City has a partnership with Helping Hands and Language Services Hawai'i to provide translated materials upon request.
- Hawaiian Electric provides a free Emergency Preparedness Handbook that explains what to do during emergency situations power outages; this handbook has been translated into Vietnamese, Cantonese, Ilocano, and Korean.[25]
- The Department of Emergency Management provides a Hurricane Preparedness Build a Kit Guide that explains what each family should store for a potential disaster situation.[26]


NO

Climate Adaptation Solutions on O‘ahu



VISION

Part 2: Safeguarded and Stewarded ʻĀina

A Climate Ready Oʻahu is one where connections between people and native ecosystems are cultivated so the ʻāina is safeguarded for generations to come.

A Climate Ready Oʻahu is where communities, organizations, and governments contribute to safeguarding and stewarding ʻāina. Through the efforts of all Oʻahu residents working together, the ʻāina adapts to changes in our climate.

People live in harmony with the ʻāina, adapting as it changes over time. Local beaches provide space for families, friends, sports, and good books. Although sea levels continue to rise and erode beaches, communities slow the rate of erosion by joining together to restore natural beach dune systems.

Widespread restoration and conservation efforts enable wetlands to thrive and provide critical habitat for native and migratory waterbirds. Streams are cleaner than ever thanks to partnerships to maintain and support healthy streams.

As rainfall moves through our communities, it is given enough space and time to seep underground and recharge Oʻahu's aquifers. Invasive plants are replaced with native species to protect watersheds as average rainfall decreases. Communities and green spaces are intentionally designed to slow and hold runoff water, preventing water pollution and neighborhoods from flooding. Cesspools are tools of the past; our freshwater and oceans are now safe from sewage spills. Use of recycled and non-potable water resources maintains access to freshwater during increasing periods of drought.

Reversing our dependence on imported food, Oʻahu regains food sovereignty through access to cutting-edge research, land access, and financial assistance that supports climate-resilient local agriculture. As temperatures continue to rise, local studies assess the impact on agriculture, and these findings enable farmers to maintain food production, and even increase it. As hurricanes become more likely, food storage and distribution is prepared, with disaster responses in place.

When climate hazards strike, the ʻāina is resilient because residents have given it space to adapt and embraced solutions that work with natural systems instead of against them.

STRATEGY 5

Strengthen climate resilience of beach and wetland ecosystems through preservation and restoration.

Wetlands and dune ecosystems play crucial roles in providing clean water supplies, shoreline erosion control, protection from storm surges and flooding, natural habitat for native seabirds, and recreational spaces. However, they are threatened by human activities. An estimated 65% of O'ahu's wetlands have been lost due to human development.[27] If current sea level rise and shoreline erosion trends continue, by 2050 as much as 40% of O'ahu's beaches could be lost.[28] As sea level rise brings saltwater further inland, O'ahu's wetlands, which are primarily located in coastal zones, are at risk of disappearing due to being permanently inundated with saltwater. Flooding and coastal erosion also increases the exposure of our drinking water and oceans to sewage leaking from the 11,000 cesspools on O'ahu, threatening the health of reef ecosystems and the quality of our drinking water.[29]

As sea levels rise, beaches will either drown or need space to migrate inland. Shoreline "hardening" which means building seawalls and other structures to block wave energy, interrupts natural shoreline retreat and accelerates beach loss on neighboring properties. A 1997 study found that around 10.7 miles of beaches on O'ahu were fronted by coastal armoring.[30] By 2012, a newer study found that the number had increased to 19.2 miles. Beaches fronting armoring lost an average of 36% of their width per year, while beach widths along unarmored coasts were relatively stable.[31] In contrast with shoreline hardening, healthy dune systems can foster natural sand replenishment and help protect our beaches from erosion during storm surge, higher tides, and powerful wave events. In addition to restoration and protection, one of the best ways to support beach migration is by removing infrastructure and allowing the beach to return to its natural state. With fewer structures in the way, the beach has room to grow even as the shoreline retreats inward. Thriving beach and dune ecosystems provide natural protection from storms, reduces erosion that could impact homes, and helps maintain the cultural identity of our beloved beach-side communities.

Degraded wetlands increase the risk for flooding because their ability to store water is compromised. As the intensity of storms increases, water will need more space to move or interventions to slow down the flow as a tool to manage flooding. Wetlands act as natural filters to remove pollutants from water runoff and reduce flood impacts by absorbing water, reducing risk of damage to property and water quality. Strengthening restoration efforts of our valuable wetlands and beaches will ensure they can continue providing natural protection against climate impacts, and offer a space for community gathering. With resilient beaches and wetlands, we can keep our island healthy and habitable for generations to come.

Designing for Equity:

- Where appropriate, prioritize beach and wetland ecosystems over development
- Prioritize the removal of cesspools in areas with high flood vulnerability to minimize water contamination of water resources
- Provide funding for the conversion of cesspools in low-income communities

5.1 Utilize the expanded scope of the Clean Water and Natural Lands Fund to better protect and maintain beaches and wetlands.

Long-term upkeep of conservation lands and remediation of polluted lands is challenging and financially burdensome for non-profits, public trusts, and landowners seeking to maintain the health of our valuable ecosystems.

As a result, many conservation lands are overwhelmed by invasive species and overburdened with maintenance needs. The Clean Water and Natural Lands (CWNL) fund was voted into existence in 2006 by Oʻahu residents who supported a revision to the City Charter to dedicate 0.5% of real-property tax revenue for land conservation purposes (Revised Ordinances of Honolulu Chapter 2, Section 9-204 (a)). The CWNL was restricted to conservation and protection efforts until late 2022, when Oʻahu voters expanded its scope to include funding for operations, maintenance, and management of existing and future natural lands acquired by the fund. This fund currently helps conserve places such as Hakipuʻu Loʻi Kalo, Turtle Bay Mauka, Maunawila Heiau, Ka Iwi Coast Mauka Lands, Wailupe Nature Preserve Expansion, Puʻukua in Waimea Valley, and Kānewai Spring.[32] Following the recent amendment and hiring of the City's first dedicated CWNL program manager in 2021, the City will increase outreach to organizations who could benefit from the fund and develop new strategies for promoting the acquisition and maintenance of beaches and wetlands in partnership with non-profits, land trusts, and landowners.

Expected Benefits

1. Reduced coastal erosion due to maintained beaches
2. Increased funding for local organizations that maintain our vital ecosystems
3. Improved beach and wetland habitats

Hazards

Timeframes

Near

Partners

DLM / DPR / BFS

Existing Tools and Efforts

- In 2007, the City established the Clean Water and Natural Lands Fund (Ordinance 07-18) along with the Clean Water and Natural Lands Advisory Commission (Resolution 07-355 CD1).
- DLM consults and advises agencies on best practices in land management, property management, and conservation to support climate resilient land-use practices.

Actions You Can Take

- ❑ Attend a virtual CWNL Advisory Commission meeting (held monthly) to learn more.

5.2 Establish wetland protection and restoration goals.

Historically, Hawai'i had 59,000 acres of wetlands, but has lost over 12 percent of its original wetland acreage and over 30 percent of its natural lowland wetlands.[33]

Setting a target for wetland protection and restoration serves as a starting place for addressing wetland loss. In recognition of the integral role that wetlands play in the safety of our coastlines, ecosystems, and communities, 20 states have adopted a "no net loss" wetland goal, while six states have a "net increase" goal. Such goals are especially important as wetlands are threatened by sea level rise. Without adequate upland space to move to, wetlands ecosystems are in danger of becoming permanently submerged. In Hawai'i, the City and County of Honolulu is the only county that has adopted wetland protection policies into its Special Management Area ordinances. While many wetlands themselves are managed by the State, the City often regulates land use where the wetlands need to migrate. Additionally, the City will work with ongoing wetland restoration projects at Kawainui Marsh, Pu'uloa, and He'eia wetlands to identify best practices. Guided by targets and the knowledge of community-led protection efforts, the City will be able to develop effective strategies to ensure the long-term, health and vitality of wetland ecosystems that provide valuable protection against climate impacts.

Expected Benefits

1. Increased habitats for migratory and native bird species
2. Reduced impacts of stormwater flooding
3. Increased buffers to mitigate flooding caused by sea level rise
4. Improved health of local watersheds and drinking water
5. Increased carbon capture

Hazards

Timeframes

Medium

Partners

DPP / DLM / DLNR

Existing Tools and Efforts

- In 2016, HonoluluGIS Office (HOLIS) partnered with the U.S. Fish and Wildlife Service to provide geospatial information of wetlands across the US and its territories; including wetland data for O'ahu.
- In 2019, Kauluakalana, a community-based, non-profit began the restoration of Kawainui Marsh, Lo'i kalo, which is the second largest fishpond and largest remaining wetland in Hawai'i.
- In 2021, local nonprofit Hui o Ko'olaupoko began restoring 20 wetland acres in the Kawainui Marsh with support from the Department of Land and Natural Resources Division of Forestry and Wildlife and the North American Wetlands Conservation Act[34]
- He'eia National Estuarine Research Reserve recently updated their Management Plan for 2023 - 2028 in partnership with NOAA and the National Estuarine Research Reserve (NERR).

5.3 Increase partnerships and investments to support cesspool conversions islandwide

There are 7,491 cesspools on Oʻahu[35], which the State of Hawaiʻi defines as, "concentrated wastewater in one location, often deep within the ground and in direct contact with groundwater, causing groundwater contamination".[29]

In 2016, the State banned the construction of new cesspools in order to protect public health, drinking water, streams and ocean waters.[29] In 2017, the State passed Act 125, requiring all existing cesspools to be converted to other waste management options by the year 2050.[36] Sea level rise calls for even more urgent cesspool conversion in areas susceptible to flooding. In 2023, the State Cesspool Conversion Working Group recommended updates to near-term conversion deadlines[37] to ensure the high priority cesspools are converted by 2030 and the remaining cesspools by 2050.[38] As we progress toward total conversion by 2050, the City will explore funding opportunities to support homeowners in converting cesspools to cleaner options, such as septic tanks and underground connections to Wastewater Treatment Facilities. The City will prioritize efficient and effective cesspool conversion, beginning with properties in flood risk areas with high social vulnerability.

Expected Benefits

1. Reduced impacts of flooding from stormwater and sea level rise
2. Improved health of local watersheds
3. Improved drinking water quality
4. Healthier reef ecosystems that support recreation and local economic activity

Hazards

Timeframes

Near

Partners

ENV / DOH / WAI

Existing Tools and Efforts

- In 2017, the Legislature passed Act 125, which required the replacement of all cesspools by 2050 to be directed by the Hawaiʻi Department of Health (DOH)
- In 2018, the Hawaiʻi Department of Health's Environmental Management Division created a report Relating to Cesspools and Prioritization for Replacement in response to Act 25. This report discusses 14 critical areas with high concentrations of cesspools that should receive priority for replacement, which together represent approximately half of all inventoried cesspools in the state.
- In 2023, the City adopted Resolution 23-165: Relating to the construction of a sanitary sewerage system in the Ewa District. The Department of Environmental Services determined sewer service is needed in the largest subdivision area, currently being served by private cesspools.
- In 2023, the DOH's Statewide Cesspool Conversion Working Group released an updated report containing cesspool prioritization and conversion options by 2050.

Actions You Can Take

- ☐ Connect to the sewer or upgrade your cesspool to a more advanced form of wastewater treatment with the assistance of an engineer or technical advisor.
- ☐ Check out your neighborhood on the Hawaiʻi Cesspool Prioritization Tool.

5.4 Collaborate with the community to restore beach and dune systems in City beach parks.

Oʻahu is home to dozens of organizations that actively care for and protect our beaches, while providing detailed education to residents and visitors about the significance of our coasts.

Being connected with beach ecosystems on a day-to-day basis equips these organizations with knowledge on how they are changing and what may be needed to restore their health. Recognizing the critical role these organizations play, the City aims to strengthen partnerships with local leaders to provide additional capacity for restoring our beaches by establishing an Adopt-a-Beach program, providing guidelines for best beach management practices, and other initiatives. This will help reduce barriers to beach management of already impacted and increasingly at risk City beach parks, and empower residents to care for their local beaches.

Expected Benefits

1. Reduced coastal erosion due to better maintained beaches
2. Protected nearshore cultural and natural resources
3. Accessible beaches that support recreation
4. Strengthened social cohesion for managing our beaches

Hazards

Timeframes

Near

Partners

DPR / DLM

Existing Tools and Efforts

- Since 2015, Mālama Learning Center has leveraged City and community partnerships to remove invasive plants and fish, replant native plants, and utilize Genki balls to improve water quality at the Nānākuli Muliwai, the estuary at Nānākuli Beach Park.[39]
- In 2017, the North Shore Community Land Trust partnered with agencies at the county and state level to mitigate coastal erosion at Paumalū by designating beach access points and planting coastal native plants that direct foot traffic.
- In 2022, the University of Hawai'i Sea Grant College Program published a Hawai'i Dune Restoration Manual that provides guidance for dune restoration projects in partnership with Hawai'i Sea Grant community extension agents.[40]
- In 2023, the City piloted a new cross-departmental Right of Entry agreement to streamline access for Hui o Hoʻohonua to do their work across several areas managed by multiple City departments along the Pearl Harbor Bike Path.

Actions You Can Take

- ❑ Pick up trash and plastic everytime you go to the beach to help keep our beaches clean
- ❑ Don't walk on or disturb coastal vegetation

5.5 Explore the potential for a statewide Coastal Conservancy in coordination with the State and other counties.

The shoreline is a complex intersection of jurisdictions and property interests. As sea level rise changes the shoreline, it's clear that this widespread problem needs specific and specialized attention.

The legal shoreline is the boundary between private and public land; as the sea moves inland, so does this boundary. As the legal shoreline moves mauka, private and public landowners along the coast will be forced to grapple with similar issues and questions. Although Hawai'i has robust state and county coastal management programs, they were not designed with sea level rise in mind. There is broad recognition that we should continue to explore new tools and governance structures to deal with the new challenges posed by sea level rise. A Coastal Conservancy, a non-regulatory state agency, is one such governance structure that could address the challenge of transitioning land from developed to public open space. The Conservancy could be a lead or facilitate partnerships with community based organizations, land trusts, and other related conservators. All forms of a Conservancy should be explored, for example, a State Coastal Conservancy could advance nature-based coastal adaptation projects and pilots and more effectively leverage competitive federal dollars such as the National Coastal Resilience Fund.

Expected Benefits

1. Provides a path for coastal properties affected by sea level rise to eventually become public land
2. Conservation of coastal lands ensures continued public access to the beach
3. More effectively go after and leverage competitive federal funding
4. Streamline processes and serve as a resource for coastal landowners and communities facing sea level rise

Hazards

Timeframes

Medium

Partners

DPP / DPR / DLNR-OCCL / OPSD-CZM / State Parks / Four County Sustainability Network

Existing Tools and Efforts

- In October 2022, a community-driven collaboration called the North Shore Coastal Resilience Working Group, identified exploration of the establishment of a statewide Coastal Commission and/or Coastal Conservancy as an adaptation priority.[41]

Photo Credit: Kellen Apuna

STRATEGY 6

Improve watershed health to mitigate wildfire risk and manage flooding.

Prior to colonization, ʻauwai (irrigation ditches) and loʻi (flooded agricultural terraces) covered Honolulu's landscape. Water flowed from streams and between loʻi patches before returning, filtered, to the ocean and fishponds. Today, very little of this intricate irrigation network exists. Streams have been buried, channelized and diverted into human-made canals, native plants were outcompeted by more flammable invasive species, while coastal plains have been developed with water-hungry homes, hotels, and businesses. While sugar plantations have departed Oʻahu, the water diversions that were made for sugar in the Waiʻanae Valley are a contributing factor to the invasive forest plants inhabiting the valley and the diminished shared access to water.[42] Rather than capturing and utilizing the precious water that falls on our island, the stormwater system has been designed to flush it out to sea as quickly as possible.

As an island with only one natural source of water to draw from, rain is our most valuable resource. Currently, nearly a third of all rainwater travels down to the ocean,[43] capturing pollutants from sewage, streets, homes, and cesspools, and depositing them into streams and nearshore waters. Polluted stormwater discharging onto our coastlines has damaging impacts to aquatic life systems like coral reefs, and limits our ability to enjoy our beaches when health warnings are issued to stay out of the water. From November 2019 to March 2023, there have been over 500 notifications and/or brown water advisories announced from the Hawaiʻi Department of Health's Clean Water Branch.[44] In addition to pollution, sudden flooding can lead to power outages, damaged infrastructure from flowing debris, and overflowing streams. This occurred in December 2021 when 10 inches of rain fell on Oʻahu in a 24 hour period.[45]

In addition to providing clean drinking water, water availability is critical for fighting wildfires. As drought and grasslands from abandoned agricultural land increase across the island, so does our wildfire risk. Limited access to freshwater and contiguous stretches of dry grasslands can cause fires to burn for much longer. For example, dry, invasive vegetation made it increasingly challenging for the Lāhainā fire in August 2023 to be extinguished before it reached the ocean. Impacts of a wildfire on the watershed continue long after the fire is extinguished, including invasive species growth, increased flood risk downstream due to lack of vegetation, and decreased rainfall infiltration and possible contamination of freshwater.

To sustain the quality and quantity of Oʻahu's streams and groundwater supplies, and protect communities from wildfires, we must care for, protect and preserve rain where it falls in our watersheds. Restoring watershed health starts with restoring our upper forests and vegetated areas along streams, known as stream buffers, including the revitalization of buried streams and maintenance of invasive species. It also means re-evaluating how the City works with private landowners that have streams running through their properties to collaboratively restore and manage stream health. Restored and maintained streams can hold more water, reducing the amount of water that reaches downstream areas, especially where our homes and buildings are located, and giving water more time to infiltrate into our groundwater.

City parks, such as golf courses, open spaces, and spaces along roads, can also play a role in slowing and holding water runoff. City parks can serve as green infrastructure to manage stormwater quality and quantity through adopting rain gardens and temporarily storing flood water during heavy rain events. Permeable pavements and bioswales near roads can also capture water runoff, enabling water to seep into our aquifers by design and minimizing the impacts of flooding. In addition to increasing water storage, reducing flammable vegetation and creating fire buffers along transmission lines and near critical infrastructure is critical for protecting communities from wildfires. Designing our spaces to hold and slow water runoff prevents immediate flooding downstream, and restoring watersheds allows us to better manage wildfire risk, recharge groundwater, minimize pollution, and replenish our water resources.

Designing for Equity:

- By temporarily using our parks and open spaces to hold water, we will reduce the impact of flooding for vulnerable communities
- Enhance stream maintenance support in low-income and flood vulnerable communities
- Develop mechanisms to mitigate issues related to affordability of water conservation tools for low-income tenants, small businesses, and affordable housing
- Prioritize fire breaks on the Westside of Oʻahu where wildfire risk is higher

6.1 Slow and hold runoff in parks, open spaces, and roads to improve water quality and reduce flooding.

Stormwater runoff floods our communities and picks up pesticides, dirt, and bacteria that makes its way through storm drains and waterways to our streams and oceans.

Green infrastructure restores or mimics natural systems to slow and hold rain where it falls, while mitigating flooding, promoting groundwater recharge, and reducing pollution. Green infrastructure for stormwater management may include urban forests, green roofs, rain gardens, bioswales, and permeable pavements. The City is creating a Green Infrastructure Plan to explore options for implementing permeable pavements, using parks as temporary water storage spaces during high rain events, and incorporating natural infrastructure into urban design, such as rain barrels, bioswales, and rain gardens, to slow, clean, and hold water. Following the completion of the Plan, the City will prioritize implementation of green infrastructure in areas most vulnerable to flooding.

Expected Benefits

1. Reduced impacts of stormwater flooding
2. Improved health of local watersheds
3. Improved drinking water quality
4. Reduced carbon emissions
5. Avoided costs of infrastructure damage and health consequences from flooding

Hazards

Timeframes

Near

Partners

DPR / DFM / DES / DTS / DDC

Existing Tools and Efforts

- In 2012, a Complete Streets ordinance was adopted to make streets safe, convenient, and accessible for all. Ongoing projects and future plans include adding permeable pavers in places such as curb extensions, bikeways, and highway shoulders.[46,47,48]
- The Hawai'i Department of Health's Clean Water Branch (DOH - CWB) has a Water Quality Advisory search tool that provides a map viewer with current listed notifications of locations experiencing higher than acceptable chemical or bacterial contamination levels.
- The Ala Wai Watershed Collaboration is a network of government, business, and community partners committed to restoring and strengthening the resilience of the Ala Wai Watershed.
- DES has implemented several National Pollutant Discharge Elimination System (NPDES) projects at Ala Wai Golf Course, Ted Makalena Golf Course, and West Loch Golf Course, specifically designed for preventing runoff from entering the storm drains and going into nearby streams.

Actions You Can Take

- ❑ Review the Green Infrastructure for Homeowners Manual and the Hawai'i Backyard Conservation Handbook for ideas on how to conserve and reuse water
- ❑ Purchase a 55 gallon rain barrel through BWS's rebate program
- ❑ Build a rain garden[49]
- ❑ Maximize the permeable area of your property with permeable pavement or other alternatives to asphalt and concrete
- ❑ Subscribe to the Department of Health's Water Quality Advisory System to be notified of any potentially harmful levels of water contamination

6.2 Expand support of conservation, maintenance, and reforestation across all priority watersheds.

Healthy watersheds play an important part in mitigating the impacts of flooding, preserving biodiversity, and strengthening water security.

Invasive species like miconia, albizia, and strawberry guava can destabilize soil and increase erosion. Removing invasive species and restoring native species, especially in BWS's priority watersheds, and regularly monitoring watersheds for invasive species and functionality will help preserve the integrity of watersheds. Although BWS already helps to fund organizations, like the Koʻolau Mountains Watershed Partnership, they need additional capacity. The City will increase watershed conservation, restoration, and maintenance by expanding funding opportunities for partner organizations that work to conserve and restore our watersheds.

Expected Benefits

1. Reduced impacts of stormwater flooding
2. Improved health of local watersheds and increase in clean drinking water
3. Enhanced management and reduction of invasive species
4. Increased carbon sequestration
5. Strengthened social cohesion for managing wetlands

Hazards

Timeframes

Medium

Partners

BWS / DEM

Existing Tools and Efforts

- In 2004, BWS created watershed management plans for Oʻahu's eight planning districts to provide guidance on sustainable water best management practices specific to each district's geographic needs.[50]
- In 2017, DOFAW released the Pupukea Forest Reserve Management Plan to address the health and conservation efforts needed within the northern Koʻolau Mountain Range.[51]
- In 2022, The University of Hawai'i at Mānoa's cooperative extension program, Ecosystems Work, conducted a study to collect information on community restoration and conservation needs, ranging from training and education, to data and funding; these findings can guide action to best support local conservation efforts.[52]
- The State's Division of Forestry and Wildlife (DOFAW) developed an Oʻahu Forest Reserve Program, using GIS mapping, that identifies 18 forests within the upper watershed limits to conserve and protect the remaining forest and increase local water supply.[53]

Actions You Can Take

- ☐ Volunteer with the Clean Water Hero Program to "Adopt-a-Block" or "Adopt-a-Stream" near your community. Check out their Events Calendar for volunteer opportunities.
- ☐ Plant native trees and remove invasive species in your yard, especially if your yard is connected to a stream.

6.3 Expand capacity and partnerships for stream maintenance.

As rainwater travels from the mountains to the ocean, everything from pollutants and fallen trees to improperly disposed trash comes with it, leading to streams clogged with debris and heightened flood risks.

On Oʻahu, the health of our streams is everyone's concern as stream owners on private property and public lands are responsible for debris clearance and maintenance. Despite this responsibility, streams are often ill-maintained due to lack of funding, capacity, and education on preventing erosion and cleaning streams. The City will improve outreach to stream owners to ensure they understand the appropriate maintenance requirements as well as investigate barriers to timely stream maintenance on public lands. In addition to outreach, the City will explore improvements to the current stream maintenance model, such as using sensors to identify flooding from blocked drains. New collaborative models for stream maintenance, such as easements on parts of streams that run through private property or partnerships with loko ʻia practitioners for collecting rocks blocking stream flow, will also be investigated as options for strengthening stream maintenance activities.

Expected Benefits

1. Improved communication between private property stream owners and the City
2. Reduced erosion from streams
3. Reduced impacts of stormwater flooding

Hazards

Timeframes

Medium

Partners

DFM / BWS / DLM

Existing Tools and Efforts

- The Department of Facility Maintenance runs a Channel Cleanup program where groups can adopt a section of a City-maintained stream for two years to perform at least four stream clean-up events.[54]
- DFM's SWQ Division has an online Learning Center dedicated to providing information on how to be a Clean Water Hero for keiki, teachers, homeowners, property managers and industries like retail and construction

Actions You Can Take

- ❑ Join the City's Channel Cleanup program
- ❑ Call the City's Clean Stream Hotline 808-768-7890 or use the 311 App to report stream blockages
- ❑ Review the 2021 Hawaiʻi Streamside Guide for tips for streamside property owners including best practices for maintaining stream banks and choosing stream-friendly plants.

6.4 Adopt stream buffers to reestablish natural stream systems.

Daylighting streams, which is the practice of uncovering and restoring buried streams, and improving vegetated stream buffers alongside streams are among the best ways to slow and clean water.

To re-establish natural stream systems, the City will adopt a local stream buffer ordinance to protect stream buffers from development and identify opportunities for daylighting streams in our urban environment. Because property owners also have a responsibility to manage portions of the stream they own, the City will create informational materials on how to restore stream buffers for property owners and community leaders. By revitalizing our streams, the City will reduce stream debris and pollution, while mitigating flash flooding.

Expected Benefits

1. Reduced impacts of stormwater flooding
2. Increased filtering of pollution that improves water quality for farming, loʻi, and drinking
3. Restored natural habitat
4. Increased shade along the stream to keep waters cool

Hazards

Timeframes

Medium

Partners

DPP / DFM / BWS / DLM

Existing Tools and Efforts

- As far back as 2011, five of Oʻahu's eight planning districts have highlighted the importance of stream buffers in their Development Plan or Sustainable Communities Plan

Actions You Can Take

- ❑ Avoid siting structures on your property near the stream bank
- ❑ Replace invasive species in your yard with native species, especially if your yard is connected to a stream

6.5 Increase and improve the quality of buffer areas around wildfire prone areas.

Wildfire buffer zones, also known as fire or fuel breaks, are gaps in vegetation in areas around buildings and wildfire prone landscapes that reduce the spread of wildfires by interrupting their fuel source and providing a pathway for firefighters.

In addition, managing buffer zones around power lines and dry grasslands can mitigate risk of igniting wildfires. The City will work with the Hawaiian Electric Company (HECO) to ensure adequate buffers around power lines on City-managed land are maintained. Further, the City will strengthen collaboration with communities in high risk areas to identify additional priority areas for increasing and maintaining buffer zones, such as by granting access to city land for maintenance efforts with community organizations.

Expected Benefits

1. Reduced fire risk in vulnerable communities
2. Strengthen community collaboration efforts to ensure fire safety

Hazards

Timeframes

Near

Partners

DEM / CCSR / HWMO / HECO / DLNR / HFD / DPP

Existing Tools and Efforts

- Hawaiʻi Wildfire Management Organization (HWMO) is working with the City and communities in Waiʻanae to establish firewise communities that can support maintenance of buffer zones.

Actions You Can Take

- ❑ Review the Wildland Fire Action Guide and other resources on hawaiiwildfire.org
- ❑ Remove groundcover and shrubs within 5 to 10 feet of your home to create a buffer
- ❑ Minimize flammable materials around your home and yard, such as charcoal and fire-starter fluids.

STRATEGY 7

Strengthen fresh water security by improving water conservation and reuse.

Over the last century, drought frequency, duration, and magnitude have increased statewide. In the past 30 years, rainfall has decreased by 18% in Hawai'i,[55] and in 2020, unusually hot weather and low rainfall led the Board of Water Supply to issue a voluntary conservation notice for Windward and East Honolulu.[56] Continuous reduction in water availability or water pollution can lead to a water shortage, which is a condition that occurs when water supply is not available to meet existing or future water demands. Water shortages have the potential to limit freshwater availability for human consumption and agricultural irrigation, increase prices of water, and exacerbate wildfire risk.

Responding to drought and avoiding increasingly likely water shortages will require us to increase water system reliability by developing new resilient water sources and decrease per capita water demand. Increasing water conservation is among the most inexpensive and impactful ways to extend limited water supplies. Through public conservation campaigns, such as Conserve808 and BWS rebates for high-efficiency water fixtures, residents have already employed numerous strategies to conserve water. However, with further decreasing precipitation expected, additional conservation efforts will be essential in all homes, buildings, and practices. Expanding conservation efforts through revising water efficiency requirements in the plumbing code, increasing availability of incentives for community members to implement water efficiency upgrades, and enhancing financial incentives for consumers to use less water are all important conservation strategies.

In addition to using less water on the supply side, a significant portion of water demand can be met with increased reliance on graywater and recycled water. Recycled water is defined as reclaimed wastewater that has been filtered and disinfected for reuse, whereas graywater refers to non-potable water from showers, bathroom sinks, clothes washers, and bathtubs. Recycled water can be used for irrigation, landscaping, industrial processing and other non-drinking purposes.[57] Using graywater for toilets and laundry can reduce freshwater demand by up to 36%.[58] When coupled together, using both recycled water and graywater can significantly reduce the demand for freshwater to avoid water shortages under decreasing precipitation patterns.

Designing for Equity:

- Develop strategies to reduce impact of higher water bills under drought conditions on ALICE communities
- Increase recycled water distribution lines in drier communities to reduce impacts of drought
- Prioritize water restriction efforts in non-essential service areas (for example, landscape irrigation and aesthetic water features)
- Explore ways to enable affordable water conservation efforts, while avoiding passing on retrofit costs to tenants

7.1 Expand recycled water infrastructure and plans for water reuse.

The City currently has two recycled water facilities, the Honouliuli Water Recycling Facility, producing up to 14 million gallons of recycled water per day for large landscaped areas such as golf courses, parks, schools, landscaping along roadways, commercial and residential developments, dust control in new construction, agriculture and demineralized recycled water for power plants and refineries;[59] and the Lāʻie Water Recycling Facility, which produces around 0.5 million gallons per day for irrigation.

This innovative and large-scale technology, recognizable due to its characteristic purple pipes, has been successful in meeting the demand for its distribution area and proven to be economical for years. As water abundance decreases, relying on recycled water can help stretch our finite water resources and offer more affordable water rates, reducing customer bills. The City will map out potential areas for additional water recycling facilities around existing wastewater treatment facilities, prioritizing Westside communities where drier conditions are expected. In addition to new facilities, the City will expand the current distribution of recycled water to adjacent communities.

Expected Benefits

1. Increase irrigation flow for additional parks, street landscaping, and industry uses
2. More reliable source of irrigation water during droughts
3. Greener parks for improved quality of life for residents

Hazards

Timeframes

Far

Partners

BWS / ENV / CCSR

Existing Tools and Efforts

- In 2014, the Commission on Water Resource Management published the Central Oʻahu Non-Potable Water Use Master Plan providing clear recommendations and guidelines on graywater and stormwater reuse, rooted in stakeholder engagement and best practices.
- In 2018, the Hawaiʻi Community Foundation released a publication titled "*A Blueprint for Action - Water Security for an Uncertain Future*" as their Fresh Water Initiative. This report synthesizes two years of research on strategies to create 100 million gallons per day (MGD), of additional and reliable fresh water capacity by 2030.
- In 2021, BWS updated their Recycled Water Program Publication highlighting the Honouliuli Water Recycling Facility's treatment process and distribution locations.

7.2 Adopt a plumbing "reach code" to incentivize water efficiency.

A "reach code" within the water context is a local code that surpasses minimum requirements by the state intended to strengthen water efficiency efforts.

The City will update the Uniform Plumbing Code based on best practices such as high-efficiency WaterSense labeled toilets and water fixtures, many of which are already commercially available. Further, the City will expand the Plumbing Code options for recycled and graywater technology in residential and commercial properties and incorporate recent advancements in plumbing technology. Mandating the use of WaterSense certified products in new and retrofitted buildings that are designed to use less water and enforcement of stricter water efficiency regulations for construction and renovation projects will also be explored. Revising the plumbing code will support significant reductions in water usage that can help reduce the potential for water shortages under drier conditions island-wide.

Expected Benefits

1. Encourage environmentally conscious developers to go beyond the minimum required by the regular plumbing code
2. Help develop the market and lower costs for more efficient products

Hazards

Timeframes

Medium

Partners

BWS / DPP / CCSR

Existing Tools and Efforts

- In 2022, the City adopted the State code with amendments requiring more efficient water fixtures, and other water saving measures

Actions You Can Take

- ❑ Save water, energy, and money with appliances that are more efficient than the minimum required by the plumbing code. Just look for WaterSense labeled products.

7.3 Incentivize water efficiency upgrades in buildings and homes.

Increasing water efficiency is one of the easiest ways to conserve water to protect public drinking resources and maintain aquatic ecosystems.

Water efficiency is the smart use of water resources through the implementation of water-saving technologies. The BWS Water Sensible rebate program currently has a variety of residential and commercial rebates and awareness-raising events. The list of incentives is still expanding and does not cover all possible water-efficiency upgrades. The City will expand the use of financial incentives, such as subsidies and grants to assist homeowners and businesses with the installation of water efficient features. Examples of additional water efficient upgrades may include smart meters that can detect leaks, shut off valves remotely, and estimate the average water use of all plumbing fixtures to improve your home's water efficiency. Sub-meters on irrigation systems and pool fill lines will enable the owner to audit water use, detect leaks and make repairs of leaky pipes. A turf replacement incentive can reduce the irrigation demand on gold courses on BWS potable water and in City parks. The City will raise awareness about water conservation and financial incentives through workshops, public service announcements, and social media campaigns to spread this information to homes and businesses across Oʻahu. These technologies will not only save households and businesses money in the long term, but will also contribute to a community-wide effort to use our precious, limited water sources responsibly.

Expected Benefits

1. Using more efficient fixtures and appliances reduces water waste
2. Reduction in water bills
3. Energy savings due to decreased water pumping and treatment

Hazards

Timeframes

Medium

Partners

BWS / CCSR / Hawai'i Energy

Existing Tools and Efforts

- In 2022, BWS released their Water Sensible Program which includes the Food Service Incentive Program. This program gives participating food service operations the opportunity to install water conserving equipment in their facilities. Additionally, "Water Upon Request" table cards are available in English, Chinese, Japanese, and Hawaiian.[60]
- In 2022, BWS updated the Water Sensible Program to include rebates for residential rain barrels and water-efficient upgrades for toilets, weather-based irrigation controllers, and clothes washers; and commercial equipment for landscaping, plumbing, kitchen operations, and cooling towers.[61,62]
- In June of 2020, The EPA created the Water Budget Tool to ensure a measure of efficiency and regional suitability for the amount of water applied to a landscape based on local climate data.

Actions You Can Take

- ☐ Save water and money by upgrading your appliances to the highest level of water efficiency. Just look for WaterSense labeled products.
- ☐ Sign up for BWS "Water Matters" quarterly newsletter to stay informed on seasonal water-related information
- ☐ Test your toilet using leak detection dye tablets available for free from BWS.

7.4 Expand the use of non-potable water.

Non-potable water is water that does not meet the State Department of Health graywater or recycled water reuse guidelines and is not suitable for human consumption.

It can include stream water, collected rainwater, agricultural runoff and wash water, and swimming pool water, among others. Non-potable water is not suitable for drinking, but it can have various other uses that can help reduce the demand for potable water sources in everyday activities, such as yard and landscape irrigation, and construction dust control. The City will research best practices to inform the use of non-potable water island-wide and build on existing state health guidelines for non-potable water use to ensure all practices are aligned with health and safety in mind. Following best practice research, the City will prepare resources for guiding use and draft new recommendations supporting implementation of non-potable water uses.

Expected Benefits

1. Increased conservation of freshwater
2. Reduction in water bills
3. Reduced strain on freshwater infrastructure, increasing its longevity

Hazards

Timeframes

Near

Partners

BWS / CCSR

Existing Tools and Efforts

- In June of 2009, the Hawai'i State Department of Health issued Guidelines for the Reuse of Gray Water designed for homeowners, land users, contractors, and engineers to have enough information to make informed decisions on whether gray water systems are good alternatives for them in comparison to traditional sourcing methods.
- Since June 2023, the Hawai'i State Department of Health has allowed graywater reuse in buildings for toilet flushing on a project by project review and approval basis, such as the Kuilei Place redevelopment.

Actions You Can Take

- ❑ Collect and use rainwater for non-potable uses like watering plants and flushing toilets
- ❑ Collect the gray water that drains from your washing machine for non-potable uses like flushing toilets.

STRATEGY 8

Facilitate a climate resilient local food system.

One third of land on O'ahu is designated for agricultural use, which includes traditional farming and aquaculture practices, but due to barriers such as access to land and farming technology, only a fraction of this land is used to grow food.[63] This is reflective of a statewide issue; Hawai'i's agricultural census data from 2017 revealed that only 8% of the state's agricultural lands were used for agriculture.[64] As a result, nearly 90% of food on Hawai'i is imported, all of which arrives on O'ahu before further distribution to the neighbor islands.[65] To bolster O'ahu's food sovereignty, the City will support local agricultural and food processing operations in addressing climate change risks.

Agriculture has always been highly dependent on weather conditions, but local climate hazards are further exacerbating the challenges that farmers and Native Hawaiian agricultural practitioners face. A pattern of drought can lead to wildfires that damage crop yields and financially strain farmers as the price of water increases. In 2018, farmers of the Wai'anae Agricultural Park were harshly impacted as a Wai'anae brush fire damaged 17 state-lots and caused 75% of the crops to be severely damaged.[66] One bad flood can erode topsoil, filling fishponds used for centuries with mud brought downstream during erosion and polluting coastal habitats. Sea level rise and flash flooding can cause agricultural land loss and saltwater intrusion, which could contaminate water resources.[67]

Adapting to climate impacts requires piloting new climate smart growing practices, financial support, resource sharing, and education. Although the impacts of climate change have been observed anecdotally by farmers and Native Hawaiian agricultural practitioners, few scientific studies on the impacts of climate change to local agriculture exist. Commissioning a study on climate impacts on agriculture across O'ahu as well as potential solutions utilized by communities facing similar risks is an important step for understanding climate risks to agriculture. Offering solutions to challenges will be equally as important. Climate smart agricultural guidelines that provide knowledge on climate-resilient practices, such as agroforestry, conservation agriculture, wildfire fuel reduction, and efficient water use, as well as resource networks for sharing of best practices will help farmers adapt to climate variability and shocks.

Food system infrastructure is just as fragile as agricultural practices to climate change. If a hurricane hits tomorrow, O'ahu would have just five days worth of food based on current food storage and growing capacities. Increasing access to agricultural land and decentralizing storage and distribution capacity among farmers and expanding the use of agricultural lands will be essential to mitigate potential impacts of hurricanes and other hazards that could reduce crop yields, obstruct access to grocery stores, or block imports coming to O'ahu.

Increasing O'ahu's climate smart food sovereignty will enhance food security, while increasing farmers' ability to continue practicing a livelihood meaningful to them.

Designing for Equity:

- Strengthen affordability of climate-smart agricultural technology and capacity-building resources, especially for low-income farmers
- Ensure adequate food storage capacity in communities whose access could be disrupted due to climate hazards.
- Expand community garden opportunities in underserved areas
- Prioritize piloting new climate smart growing practices and education in ALICE communities

8.1 Evaluate underutilized City lands to grow the local food system.

The City will evaluate its real property portfolio to identify underutilized, City-owned land that could support agriculture, aquaculture, agroforestry, loʻi kalo, and loko iʻa.

The City will also evaluate options to use the Clean Water and Natural Lands Fund to acquire land parcels that are currently designated as agricultural lands, but are at risk of being converted to other uses. The goal would be to lease out these parcels to groups that are interested in starting agricultural and aquacultural operations or for the purposes of food storage and distribution. Long-term leases from the City would provide greater land security and encourage farmers to invest in management practices that strengthen the long term resilience of their operations. By mitigating the land access barrier to starting agricultural operations, the City will support community growers and bolster the resilience of local food systems.

Expected Benefits

1. Increased local agriculture production and economic security of farmers
2. Enhanced protection of Native Hawaiian farming and aquaculture practices
3. Enhanced relationships between the City and farming/aquaculture practitioners

Hazards

Timeframes

Near

Partners

DLM / OER

Existing Tools and Efforts

- The Clean Water and Natural Lands Fund supports agricultural use on four of its conservation properties. [63,68]

8.2 Catalyze the use of climate-smart agricultural practices and technologies.

Climate-smart agriculture promotes sustainable practices to enhance agricultural productivity, mitigate greenhouse gas emissions, and support farmers ability to adapt to climate change.[69]

Climate-smart agriculture could include: new climate-smart crop varieties, artificial intelligence-driven data management, drones and other remote monitoring for fire prevention, automated weather stations, or remote sensing for soil health. It should also include important principles from agroecology such as: traditional indigenous practices that have long operated on climate-smart principals, such as ahupuaʻa land management, silviculture, fish ponds, rotational grazing, and perennial food forests. Climate-smart agriculture and agroecology offer numerous benefits to farmers, such as increased productivity, improved livelihoods for farmers, increased wildfire resilience, and strengthened food security.

The City will develop a Climate-Smart Agriculture Resource Guide to promote specific, locally appropriate sustainable agricultural practices and technologies that prepare local farmers for the impacts of climate change. To support the implementation of climate-smart practices from the guide, the City will leverage federal and philanthropic grants to create opportunities to support local growers with financial resources, education, and legislative support. Through regular convenings, the City will continue to be attentive to the stresses and desires of local farmers to support the hard work of growers who strengthen Oʻahu's food security and help prepare our island for any disasters that may disrupt our food supply.

Expected Benefits

1. Increased economic security for Oʻahu's farmers
2. Strengthened appeal of agriculture careers
3. Increased local food production
4. Improved mental health of farmers
5. Increased access to farming technology
6. Stronger social cohesion among the farming community
7. Increased wildfire resilience

Hazards

Timeframes

Medium

Partners

OER / DOA / DOFA
UH-CTAHR / DOFAW

Existing Tools and Efforts

- In 2023, the City launched the Agriculture Grants Program to support local farmers, ranchers, and growers impacted by COVID-19 with grants totaling $3 million.
- In 2023, the City approved an $8 million Food System Grant program.

8.3 Commission a study on impacts of climate change on agriculture.

Globally, crop yields are predicted to decrease 30% by 2050 due to climate change;[70] however, there is a lack of information on the potential climate impacts to agriculture at the local level.

The City will commission a study that identifies local, climate-related challenges to agriculture. The study will enable a more accurate assessment of vulnerabilities and risks of climate change on agriculture to inform best practices and opportunities to strengthen farmers' resilience. With ongoing climate impact studies, we can help ensure our farmers are equipped with the knowledge and technology they need to continue growing food on Oʻahu.

Expected Benefits

1. Identification of priority investments to increase local agriculture production and economic security of farmers
2. Identification of barriers to agricultural careers
3. Better understanding of climate challenges faced by local farmers

Hazards

Timeframes

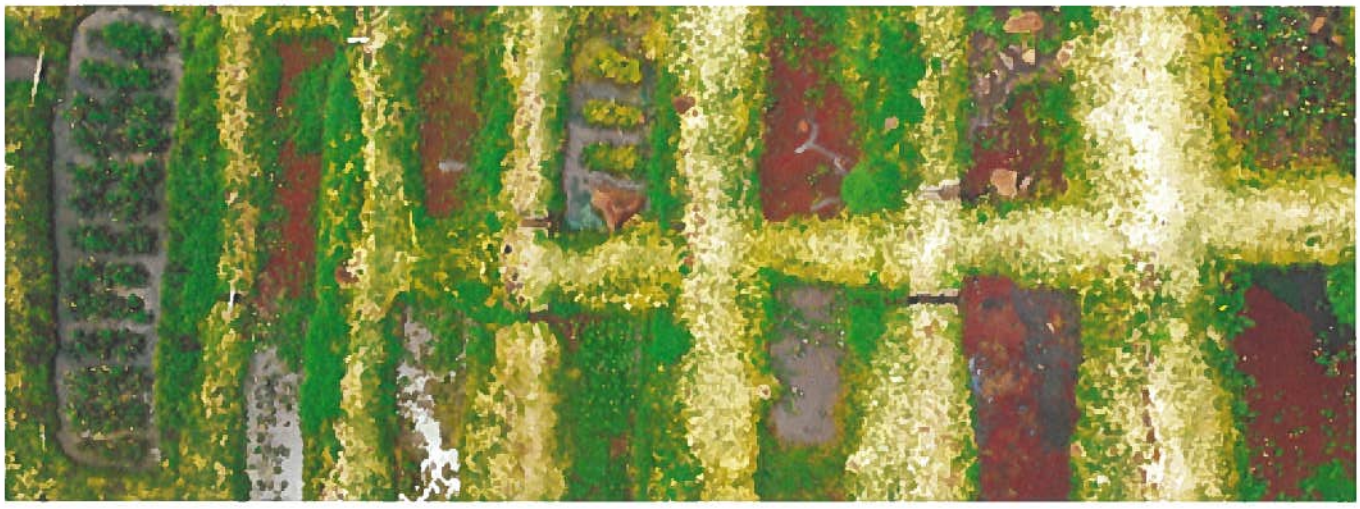
Near

Partners

OER / DOA / DOFA
UH-CTAHR

Existing Tools and Efforts

- None yet identified



8.4 Create a climate adaptation resource network for farmers and food system stakeholders.

Farmers across Oʻahu will have to pilot and integrate new strategies for adapting to climate change, such as switching to drought-resistant crops.

Implementing new agricultural practices can be overwhelming and worrisome for farmers due to added financial burdens, limited access to information, and the fear of failure that new practices will not be effective. The City will create a resource network that farmers can access to learn about the latest scientific advancements and share their own experiences to alleviate concerns and strengthen adaptation efforts. This network will be an open discussion platform with learning announcement opportunities for new journal articles, webinars, and workshops on climate adaptation best practices. By working together with farmers, the City can strengthen farmers' capabilities to sustain both themselves and our community amidst the challenges posed by climate change.

Expected Benefits

1. Increased local agriculture production and economic security of farmers
2. Improved mental health of farmers
3. Enhanced protection of Native Hawaiian farming and aquaculture practices
4. Stronger social cohesion among the farming community

Hazards

Timeframes

Near

Partners

OER

Existing Tools and Efforts

- Oʻahu Agriculture and Conservation Association (OACA) supports sustainable agriculture conservation through education, training, research, and partnerships.
- Oʻahu Resource Conservation and Development Council (ORCD) programs focus on the social, economic, and environmental nexus of sustainable agriculture, local food production, and watershed restoration.

8.5 Expand the City's community garden network in underserved neighborhoods.

The Community Recreational Gardening Program was created in 1975 to provide access to garden plots, especially in densely populated urban communities.

Currently, 8 out of 10 community gardens within the City's community gardening program are located in dense urban areas where residents have expressed a desire for access to growing space. However, community garden benefits, such as learning about horticulture, strengthening community ties, and increased access to green space, should be available island-wide. Many parts of the island are now rapidly urbanizing and residents in non-urban areas may not have access to land because they are renters.

The City will prioritize building new community gardens in underserved neighborhoods. By doing so, the City aims to ensure that all residents, regardless of their location, have the opportunity to participate in community gardening activities. These new community gardens will serve as inclusive spaces for individuals to connect with the land and their community, building cohesion and resilience island-wide.

Expected Benefits

1. Improved social cohesion among residents that can provide support following climate impacts
2. Mental and physical health benefits, such as increased access to fresh fruits and vegetables
3. Skills and ʻike are transferred between plot owners
4. Growing plants helps to capture carbon

Hazards

Timeframes

Medium

Partners

DPR / BWS

Existing Tools and Efforts

- Across the 10 existing gardens, community members have access to over 1,000 garden plots.[71,72]

8.6 Support increased long-term capacity to store, refrigerate, and distribute food.

Hawai'i is the most geographically isolated food import-dependent community in the world.

If food supply were to be interrupted due to a hurricane or climate-related event impacting food imports or Honolulu Harbor, commercial food stocks would only supply enough food for the local population and visitors for five to seven days. Maintaining a reliable food supply in the face of climate change will require increased storage, refrigeration, and distribution capacity island-wide. The City will review barriers to increasing storage and distribution of food, such as zoning restrictions, to inform the creation of new Food Hubs, which are organizations that manage the distribution, storage, and marketing of local producers to strengthen farmers' ability to meet demand needs. Implementing this action will require collaboration between the City, private sector, and farmers to facilitate knowledge exchange and pool resources to expand storage and distribution infrastructure. Building a climate-ready, comprehensive food network across O'ahu will enable the City to be prepared to supply food as climate impacts unfold.

Expected Benefits

1. Increased local agriculture production and economic security of farmers
2. Improved mental health of farmers
3. Improved food access

Hazards

Timeframes

Medium

Partners

OER / DLM / DEM / Hawai'i Foodbank / Elepaio Social Services

Existing Tools and Efforts

- Organizations, such as O'ahu Fresh, Kalihi Roots, Kahumana Farms, and Farm Link, are engaging farmers, businesses, and families across the island to help facilitate the local sourcing, storage, and distribution of food.
- The O'ahu Compost Project (OCP) pilot in Chinatown is partnering with food service businesses to decrease food waste, improve health and safety, and increase access to local compost for agricultural producers. Quality excess food from businesses is redistributed to feed people, while food scraps are composted to make rich soil products.[73]

Climate Adaptation Solutions on O‘ahu

STRATEGY 9

Integrate climate resilience into City capital planning, operations, and policies.

STRATEGY 11

Reduce flood risk and coastal erosion by directing development to safer and higher ground.

STRATEGY 10

Make buildings, homes, and infrastructure more climate resilient.

STRATEGY 12

Keep our communities cool as temperatures rise and during heat waves.

VISION

Part 3: Safe & Reliable Infrastructure

A Climate Ready O'ahu is one where infrastructure works with natural systems to keep people safe from climate hazards at home, at work, and everywhere in between.

A climate-ready O'ahu has City facilities, businesses, utilities, and residences that are prepared and retrofitted to withstand climate impacts. Efforts from the City, community-based organizations, friends, family, and neighbors, to integrate climate resilience into planning efforts contribute to ensuring O'ahu's infrastructure is safe and reliable in the face of climate change impacts.

Continuously updated inventory and risk assessments of infrastructure inform the timeline of adaptation actions. The increasing risk of hurricanes coincides with more incentives for homes, businesses, and City buildings to undergo hurricane-safe retrofits.

Development and roads have been moved inland to keep people and property safe while giving the ocean and beach room to migrate as sea levels rise. In response to rising sea levels, new developments are safely built outside of the sea level rise exposure area.

As people walk around O'ahu, trees and other structures, like solar panel awnings and drinking fountains, provide shade and water to keep residents cool. An increase in urban green spaces keeps people cool and reduces energy bills. Updates to street and subdivision standards reduce the heat island effect and lower the risk of heat-related illnesses as temperature records are set.

As average rainfall decreases, government agencies collaborate on a "One Water" work plan that integrates operations into a comprehensive water management strategy. The City uses updated flood maps that reflect the increasing occurrence of heavy rain events, sea level rise, and the rise in groundwater levels, to provide communities with current information regarding flood risk.

When climate hazards strike, infrastructure holds strong because we have taken steps to proactively prepare and improve our homes, roads, and buildings.

Photo Credit: Natalie Iwasa

STRATEGY 9

Integrate climate resilience into City capital planning, operations, and policies.

With change coming to our shoreline, the way the City operates must also change. City department coordination is essential for proactively addressing potentially life-threatening hazards and impacts to critical infrastructure from climate change. Operationalizing climate resilience will require the City to retool how departments work independently and together to plan and budget for climate impacts. Rethinking how departments work could mean changes to existing operations or policies, like updated flood maps to account for sea level rise, or doing something new altogether, like creating climate resilience design guidelines for capital improvements.

The longer we wait to adapt, the more costly the impacts will become as losses may be irreversible, the cost of new infrastructure will continue to increase, and greater damage to property can occur. Additionally, some investments, like trees, take time to mature to provide adaptation benefits, highlighting the importance of investments today for tomorrow's climate.

Guiding climate-smart investments and design by providing, for example, budget guidelines for climate resilient infrastructure will help ensure that climate impacts and cost-effective solutions are integrated into City operations. Further, financing tools such as green bonds and special improvement districts have shown to be effective adaptation approaches to garner additional resources needed for early adaptation investments. By investing in adaptation solutions early, the City will create long-term benefits that offset initial costs and protect infrastructure from climate hazards over time.

Designing for Equity:

- Prioritize resources and projects in frontline communities to ensure they are among the first to receive investments in safe and reliable infrastructure
- Develop metrics to track island-wide distribution of investments in adaptation funding

9.1 Coordinate resilient infrastructure investments through the One Water Honolulu Panel.

In accordance with Revised Ordinances of Honolulu §2-10.13, CCSR convenes the City's eight-agency One Water panel to collaboratively prepare water resources and infrastructure for climate change.

The panel aims to integrate the management of stormwater, wastewater, and freshwater as one asset to create resource and financial efficiencies. The panel received federal grant funds to create a One Water planning framework which will establish plans for coordinated infrastructure development, identify priority projects, and develop project scopes and budgets. The panel will also maintain a multi-year infrastructure investment strategy for projects to proactively tackle climate change impacts. Creating and maintaining the panel's work plan will foster cross-collaboration between City agencies necessary to coordinate investments and improvements decades into the future across infrastructure types.

Expected Benefits

1. Reduced impacts of stormwater flooding
2. Improved health of local watersheds and drinking water
3. Improved reliability of our water system infrastructure
4. Improved partnership for water management

Hazards

Timeframes

Medium

Partners

CCSR / BWS / ENV / DFM / DDC / DPP / DPR / DTS

Existing Tools and Efforts

- The City participates in the statewide Hawai'i Freshwater Initiative that is advancing water security in an uncertain future through three priority action areas: conservation, recharge, and reuse.
- In 2023, the City initiated the development of a One Water Plan to establish a framework for interagency collaboration and identify opportunities for infrastructure adaptation projects.

9.2 Integrate climate resilience principles into City budgeting processes.

Turning climate adaptation commitments into action requires considering climate risks and impacts in all that the City does.

Embedding climate considerations into City budgeting processes will operationalize Climate Ready O'ahu by turning its long-term strategies into annual investments. For example, during the planning and design phase of the City's Capital Improvement Program, City projects will be screened for vulnerability to climate hazards and adaptive design measures will be proposed to minimize impacts and future repair costs. Climate resilient budgeting ensures the most important actions are prioritized and financed, while promoting cost-savings associated with investing early in climate adaptation solutions.

Expected Benefits

1. Avoided damages and long-term infrastructure and facility maintenance cost increases
2. Continued responsible City spending by directing investment into durable, long-lasting assets
3. Maintained and/or improved City bond rating by demonstrating how the City is making climate-informed financial decisions

Hazards

Timeframes

Near

Partners

BFS / CCSR / DDC

Existing Tools and Efforts

- In 2021, the City began developing Climate Change Design Guidelines to identify the need for climate-resilient design considerations in public works projects.
- In 2022, DDC issued guidance for departments to begin integrating climate change considerations into the Capital Improvement Program.

9.3 Improve understanding of flood risks by expanding and updating flood maps.

Regulatory flood maps are used to identify hotspots for potential flooding from rivers or the coast.

For the City and private property owners alike, these maps are one of the best tools for understanding flood risk to structures and properties they own or are thinking of buying. However, existing maps are based only on historic records and do not account for rising sea levels and groundwater or unusually heavy rainfall that can backup drainage and cause flooding - even when it's not raining. The City will support the design and integration of new flood maps that take sea level rise, groundwater, and heavy rainfall data into account. The updated maps will inform flood management, risk evaluation, mitigation, and preparedness efforts among property owners and environmental resource practitioners to reduce the potential impacts of flooding island-wide.

Expected Benefits

1. Insurance and redevelopment savings to property owners
2. Improved data to inform floodproofing priorities
3. Increased communication of flood risks
4. Reduced public service interruptions due to floods

Hazards

Timeframes

Medium

Partners

DPP / DEM / CCSR

Existing Tools and Efforts

- The State Sea Level Rise Viewer gives users key information on which coastal areas are most at risk for coastal erosion, coastal flooding, and sea level rise impacts.
- The Climate Ready O'ahu Web Explorer features climate impact data from the City, state, and federal governments representing best available science for a variety of climate change stressors and other regulatory layers for O'ahu.
- The State Flood Hazard Assessment Tool is an informational mapping viewer that displays flood zones from FEMA's Digital Flood Insurance Rate Maps (DFIRMs).

Actions You Can Take

- ☐ Check out Get Flood Ready resources and take action to prepare your home

9.4 Create a toolbox of innovative funding mechanisms for climate adaptation.

Funding is among one of the main constraints to effective and proactive climate adaptation.

The City will better leverage existing funding mechanisms, like the traditional Capital Improvement Program (CIP) and expanded authority from the state to create special improvement districts; however, new funding mechanisms will be needed to implement all climate adaptation solutions, especially as impacts unfold over time. As a starting point, the City will explore the following funding mechanisms to fund climate adaptation projects:

Special Improvement Districts (SID): Defined geographic areas, such as houses along a beach, in which property owners provide funding for specific projects to support adaptation in their community.

Public/Private Partnership (P3): Long term arrangements between private institutions and governments for the purpose of funding large infrastructure projects that have risk management complexities and require flexibility.

Resilience Bonds: Green bonds raise capital for climate resilient investments that reduce climate risks, improve innovative technologies, and unlock development benefits (GCA, 2020).

Property Assessed Resilience Funds: Funding streams, such as "Commercial Property Assessed Clean Energy and Resilience" (C-PACER), where a property owner borrows funding for resilience improvements to their property and the debt is repaid via property tax assessments charged by the City.

Expected Benefits

1. Adaptation projects that meet the needs of local residents
2. Increased funding for climate resilience projects at all scales
3. Improved social cohesion and partnerships for climate adaptation
4. Reduced risk of maladaptation that exacerbates impacts on more vulnerable communities

Hazards

Timeframes

Medium

Partners

BFS / DPP / CCSR

Existing Tools and Efforts

- In 2021, the State passed SB 794 giving counties authority to create Special Improvement Districts (SIDs) for natural hazard mitigation, including sea level rise adaptation
- In 2015, the Waikīkī Beach Special Improvement District Association (WBSIDA) was created to provide consistent and credible beach management for future revitalization

Actions You Can Take

- ❑ Sign up for the WBSIDA newsletter to receive important information and updates pertaining to Waikīkī's resilience efforts

9.5 Reduce the urban heat island effect by adding more shade to codes and standards.

The urban heat island effect occurs when a city experiences warmer temperatures than nearby suburban and rural areas due to increased density of buildings, wide roads, and paved surfaces that absorb heat throughout the day. Current special design district, street design standards, subdivision standards, and land use ordinances do not include specifications on analyzing or mitigating potential urban heat island impacts on communities.

To minimize the urban heat island effect, the City will update necessary standards to analyze heat and provide options for heat reduction, such as increasing shading of parking lots and streets, reducing impervious surfaces on roadways, and requiring tree planting and ground cover in new developments. Taking action to reduce the urban heat island effect will increase thermal comfort as our island warms.

Expected Benefits

1. Reduction in outdoor heat illnesses
2. Improved habitats for native birds and insects
3. Improved walkability, increasing foot traffic to local businesses and stimulating local economy
4. Health benefits from reduced air pollution and increased increased shade
5. Safer streets that facilitate community gathering, commerce, and play
6. Reduced energy usage and lower electricity bills

Hazards

Timeframes

Near

Partners

DPP / DTS / DPR / DFM / TFHF

Existing Tools and Efforts

- The State Urban and Community Forestry Program has produced a summary of each City department's role in urban forestry through the project, "How Hawai'i's Counties Regulate Trees."
- DOFAW and the U.S. Forest Service partnered to create an interactive, online canopy viewer in Hawai'i.

Actions You Can Take

- ☐ Plant trees on your property and add your planting to the 100k Trees O'ahu Map.

STRATEGY 10

Make buildings, homes, and infrastructure more climate resilient.

Infrastructure powers our homes and places of work, provides our water and sanitation, and helps us get where we need to go. As infrastructure is impacted by climate change, reliability will be increasingly important. Improvements made to Honolulu's aging infrastructure will ensure our transportation, shelter, and water systems are resilient and allow our communities to continue to thrive.

In 2015, Honolulu set or tied 11 days of record heat, which compelled Hawaiian Electric to issue emergency public service announcements to curtail escalating air conditioning use that stressed the electrical grid.[4] In 2019, Honolulu experienced its hottest year on record. As temperatures and drought continue to rise, conducting a baseline heat and wildfire risk assessment is beneficial in further understanding the risks to infrastructure and building resiliency. The most comprehensive assessments consider factors related to the vulnerability of buildings to rising temperatures and wildfires, the potential for heat and wildfire related power outages, and impact of heat on critical infrastructure systems. Identifying areas with high heat and wildfire risk will allow the City to prioritize necessary upgrades to buildings and implement targeted adaptation strategies to mitigate heat risks.

The increased intensity of storms, droughts, and sea level rise means homes and City facilities will be impacted by heavier flooding, storms, and wildfires. On O'ahu, due to the age of homes and the wind standards at the time of construction, it is assumed that up to 65% of residential homes are at risk of severe damage or being totally destroyed by a Category 1 hurricane.[4] Meanwhile, more than 30% of homes across the state face extreme flood risk and 23.1% of O'ahu is under threat from wildfires,[9,74] both of which are expected to increase under climate change. Retrofits or upgrades, like installing hurricane resistant windows, installing fire resistant roofs, and improving drainage systems, are essential for reducing impacts from climate change on physical structures. Investing in retrofits early can also create long-term economic benefits by avoiding significant damage and maintenance costs. A program created to incentivize wind and flooding retrofits can help reduce the financial cost of these projects and every dollar invested in disaster mitigation saves up to six dollars in future disaster recovery.[75]

In addition to building retrofits and improved building design, upgrades to road and parking infrastructure will also be essential for managing storms and flooding. Unlike traditional surfaces, such as concrete or asphalt, permeable pavements allow water to soak through the paving and recharge the groundwater system. Permeable pavements could help to divert 70% to 80% of stormwater directly into the ground.[76] Increasing the use of permeable pavements and de-paving land where possible, will help reduce stormwater runoff that contributes to floods and carries pollutants into the ocean.

Investments in safeguarding infrastructure and homes now, will ensure communities are safe and have access to critical services, shelters, and cooling solutions as climate impacts unfold.

Designing for Equity:

- Prioritize retrofits in frontline communities who may not have the insurance or income to rebuild
- Retrofit City facilities that provide essential and emergency services first
- Explore ways to enable affordable retrofits, while avoiding passing on retrofit costs to tenants

10.1 Retrofit City facilities at risk from storms and flooding.

To maximize the benefits of retrofits, the City will create a working group to develop an inventory of vulnerable facilities and assess potential impacts to their operations.

The working group may include members from state or federal agencies, and members of the public. The inventory should consider structural factors (like building age), building purpose, number of occupants, and community value, as well as the vulnerability to storm surges and flooding. Following the vulnerability inventory, the working group will assess retrofit opportunities, identify funding mechanisms, and establish an implementation timeline within the CIP planning process informed by projected climate risks.

Expected Benefits

1. Enhanced safety of residents and employees that work in or utilize City facilities
2. Improved reliability of City operations during and following emergencies
3. Avoided carbon emissions associated with new construction

Hazards

Timeframes

Far

Partners

DFM / DPR / ENV / BWS / DTS / DLM / DCS / DEM

Existing Tools and Efforts

- In 2012, under the International Building Code (IBC) and International Residential Code (IRC), new construction was required to be designed with one foot freeboard above current Base Flood Elevation (BFE) in hazardous flood zones.
- In 2017, the City released a manual titled, "StormWater BMP Guide for New and Redevelopment" that provides details on post-construction measures to mitigate flood impacts and reduce pollution associated with stormwater runoff.[77]
- In 2020, the City's Transit Oriented Development branch created Climate Adaptation Design Principles for Urban Development that recommends tools and best practices for private development to consider in designing climate resilient buildings and structures near rail stations.

10.2 Assess risk to public infrastructure from extreme heat.

Extreme heat threatens critical infrastructure island-wide, including the potential buckling of roadways, heat-related power outages, and overburdening of healthcare facilities due to heat-related health threats to the community.

A heat risk assessment is the first step for understanding local risks to heat and sets the foundation for effective heat management actions. To assess heat risk to public infrastructure, the City will create a Baseline Heat Risk Assessment using meteorological data, heat sensors, and guidance from the Environmental Protection Agency and Honolulu Climate Change Commission. Following the assessment, findings will be incorporated into the City's Pre-Disaster Hazard Mitigation Plan for implementation.

Expected Benefits

1. Clear instructions for identifying priority heat adaptation areas
2. Health and comfort benefits of air conditioning upgrades in municipal buildings, including fire stations and schools
3. Dependable energy supply for first responders

Hazards

Timeframes

Near

Partners

DFM / DDC / HECO / DPP / HSEO / CCSR

Existing Tools and Efforts

- In 2016, HECO created the O'ahu Outage Map to give the public real time information related to all power outages across O'ahu, efforts to restore power, and if first responders are en route.
- In 2022, HECO proposed a new Climate Adaptation Transmission and Distribution Resiliency Program which would make substantial investments to critical infrastructure, bolstering system reliability.

10.3 Incentivize wind, wildfire, and flooding retrofits for homes and businesses, especially in areas with low shelter availability.

From assessing vulnerabilities and insurance to implementing home improvements, the cost of retrofitting is a major barrier in climate-proofing for our residents.

The City will conduct a study on vulnerability to wind, wildfire, and flooding impacts among property owners, including mapping previous insurance claims. Findings from this study will inform the development of an incentive program for property owners to implement hurricane, wildfire, and flood retrofits, including low or no-cost options for low-income home-owners. Retrofits could include hurricane roof clips, subsidies for fire-rated roof replacements, and subsidies for flood-proof wall coatings. The City will explore various innovative funding opportunities and work with the non-profit and private sectors to identify additional incentives, including insurance discounts and credit programs to fund the incentives.

Expected Benefits

1. Avoidance or reduction of costly damages to a property's structure or contents.
2. Enhanced safety of residents and business owners
3. Individual and community-wide discounts on flood insurance premiums

Hazards

Timeframes

Near

Partners

DEM / CCSR / HI-EMA

Existing Tools and Efforts

- In 2015, the State of Hawai'i's Department of Commerce and Consumer Affairs published a, "Guide to Hurricane Strengthening for Hawai'i Single-Family Residences" which provides detailed analysis of the importance of retrofitting older, more vulnerable homes on O'ahu.
- In 2019, the University of Hawai'i Sea Grant College Program published the fourth edition of the Homeowner's Handbook to Prepare for Natural Disasters.
- In 2021, FEMA published a Natural Hazards Retrofit Program Toolkit that provides insight to local governments on designing and developing a 'building retrofit program for disaster preparedness'
- In 2021, the City conducted a Repetitive Loss Area Analysis using historical flood data to identify properties that have been flooded multiple times within a short amount of time, highlighting areas of high need for flood retrofitting.

Actions You Can Take

- ❑ Regularly clean your roof, gutters, decks, and the base of outdoor walls to avoid the accumulation of fallen leaves and other flammable materials
- ❑ Create a fire buffer by removing vegetation and flammable materials within a 5-foot distance of your home
- ❑ The next time you repair or replace your roof, consider investing in a fire-resistant roof and hurricane clips

10.4 Develop sea level rise adaptation pathways for high priority infrastructure assets.

The amount and timing of sea level rise experienced island-wide will depend on local and global action to reduce carbon pollution and other greenhouse gas emissions.

Adaptation pathways provide flexibility to address climate impacts over time based on thresholds or predetermined "triggers" that signal the need for action. For example, a stretch of coastal highway flooding repeatedly could trigger planning for highway realignment. Pathways are not meant to show every possible solution, but rather map out how a sequence of actions accomplish goals over time. The City will develop adaptation pathways for managing high priority City owned or operated assets and coordinate with state and federal stakeholders on adaptation pathways for other critical infrastructure that are vulnerable to sea level rise. Adaptation pathways can provide options that range from actions to accommodate sea level rise, such as coastal and wetland restoration, to actions that retreat from sea level rise, such as relocating an entire road or facility. By creating adaptation pathways, the City will be able to implement cost-effective and necessary strategies to accommodate sea level rise over time.

Expected Benefits

1. Reduced long-term maintenance and redevelopment costs
2. Health and safety benefits of stronger infrastructure
3. Improved analysis of best practices to manage sea level rise as industry knowledge advances

Hazards

Timeframes

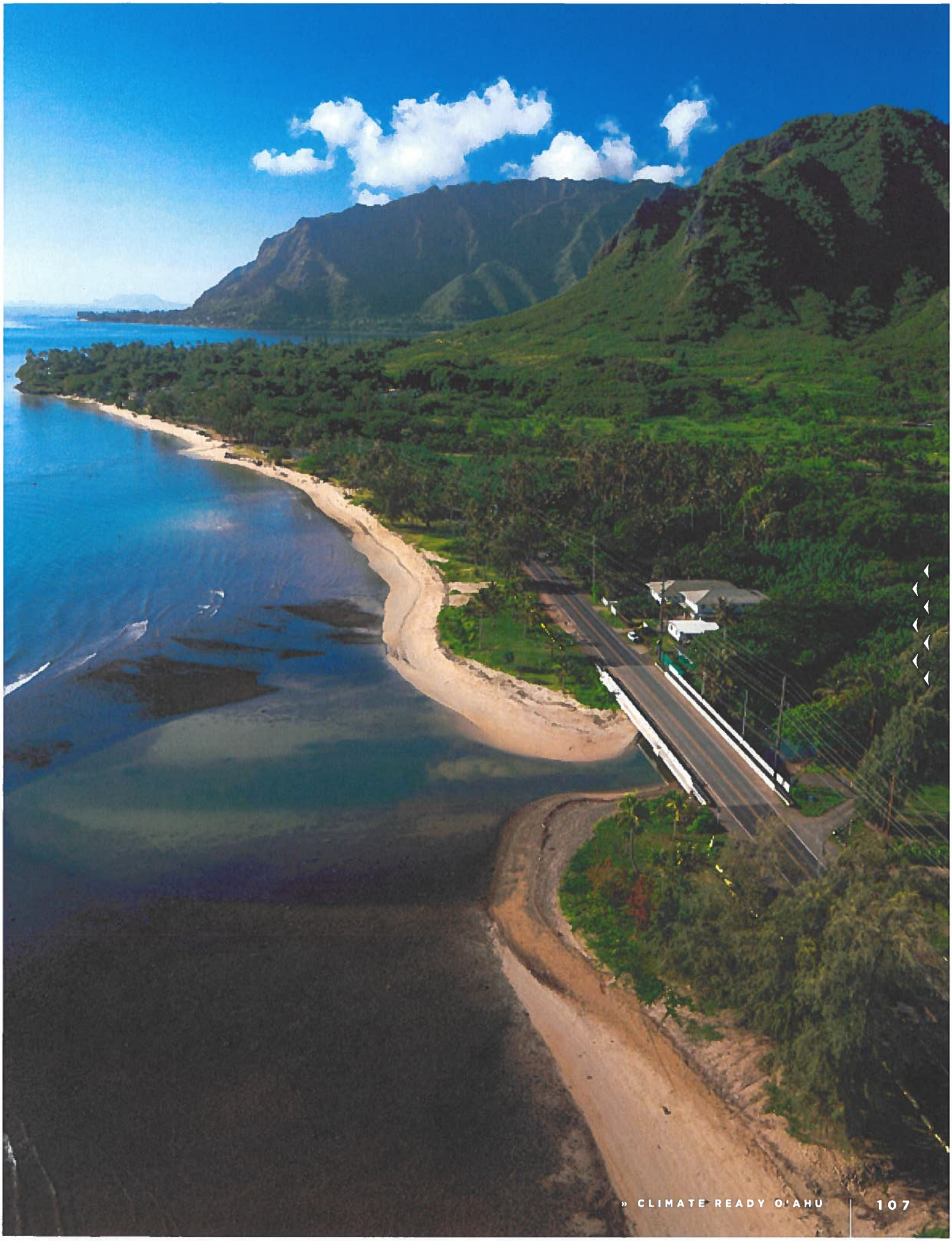
Medium

Partners

CCSR / DPP / BWS / ENV / DTS
DFM / DDC / DPR

Existing Tools and Efforts

- None yet identified



ACTION 10.4 HIGHLIGHT

Adaptation Pathways

Adaptation pathways are a decision-focused approach to incorporate flexibility into decision-making and account for future uncertainties. Pathways can be plotted out as a sequence of decisions that need to be from now into the future as climate impacts unfold. Originally inspired by subway maps, each line represents an adaptation strategy, and the triangles represent points that signal the end of line is coming up i.e., where your current strategy no longer works. At that point, you will need to decide which new adaptation approach you will "transfer" to to get you where you need to go. You can compare each combination of routes to each other to compare costs, effectiveness, and pros and cons.

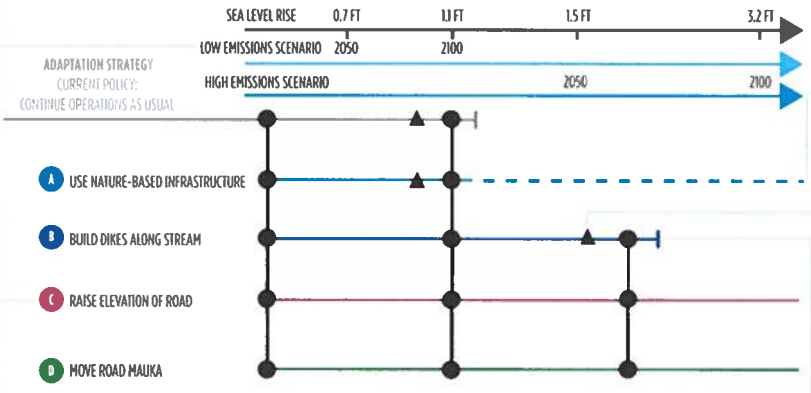
For example, as sea levels rise and potentially impact coastal roads, using an adaptation pathway may be a reasonable option to determine the best course of action and when to utilize each tool. Therefore, our future action would not be dependent on a certain timeline, but a pre-designated tipping point, for example, we may decide not to move the road until it's flooded multiple times a year during high tides. The use of pathways represents a shift in planning that acknowledges an uncertain future and plans for all possible outcomes. If successful, adaptation pathways can be used to plan for climate hazards and other issues that our City faces.
Sources: Haasnoot et al., (2013); Kwakkel et al., (2016)

How to read an Adaptation Pathway

Preserve functionality of Waipahu Depot Street under sea level rise through 2100

Changes in climate are represented under a low and high emissions scenario (RCP 4.5 and RCP 8.5) as arrows along the top of the diagram. Time periods at which certain thresholds are met vary by scenario.

Over time, there may be a preference to change strategies based on public opinion, funding, or a variety of other factors. There may also be a need to change strategies if one is no longer effective at achieving the pathway objective. These "transfer points" between strategies are denoted by circles.



Staff should consider appropriate lead time needed for planning to implement a given action

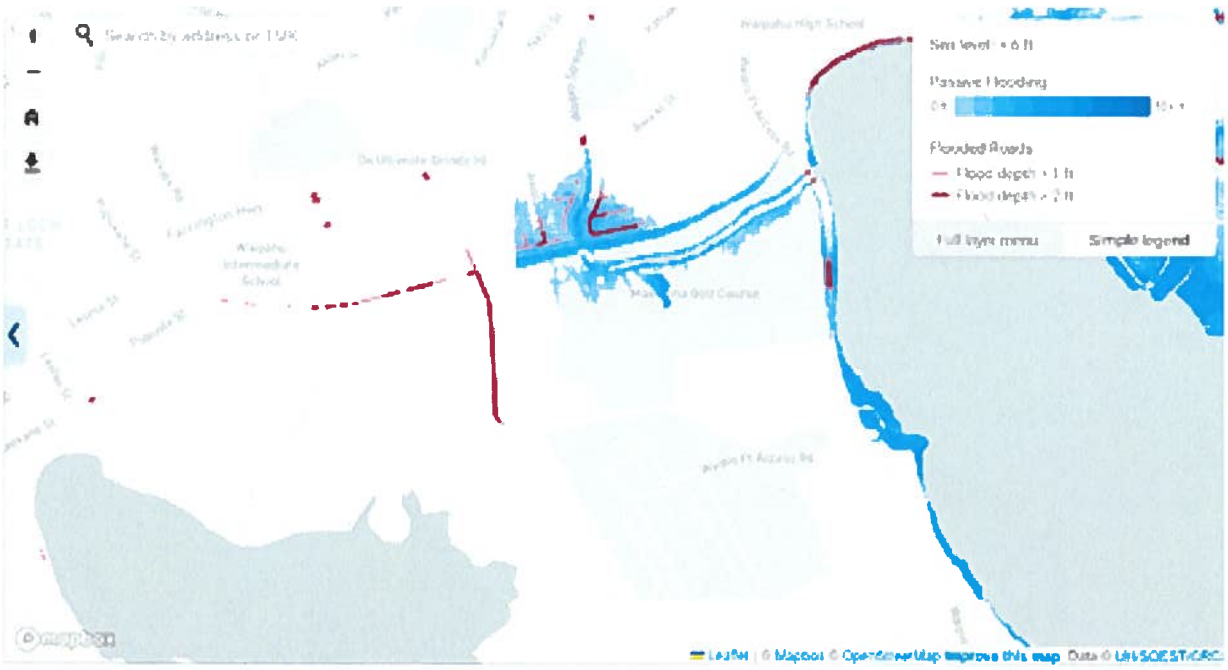
A dashed line means continued investment will still provide enhanced adaptation services if paired with other strategies (i.e., the strategy cannot achieve the objective on its own but could enhance other strategies).

A triangle is used to signal that a strategy is nearing the end of its individual effectiveness and that more advanced or aggressive strategies are needed to cope with increasing climate hazards indicating that planning for a transition should begin. Exact timing of when triggers are reached is estimated and will require monitoring to determine specifc effective transfer periods

A short black vertical line is used to illustrate the end of viability for that strategy, signifying that the strategy can no longer independently provide effective risk mitigation.

POTENTIAL PATHWAYS	COST*	EFFECTIVENESS	PROS	CONS
A B C or A B D	$$$$$$	•••	• Progresses from least costly strategy (A) to most costly and complex (C and D) to allow time for decision-making and funding	• Overall cost is high, and while cost is spread out over time, this pathway may not be the most cost-effective • There may be environmental concerns with building dikes along stream
A D	$$$$	••	• Allows for relatively easy strategy A to mitigate risk first while planning out D for the long-term • Would reduce the duration of flooding in the near-term	• If sea level rise is more severe than expected, A may not last long and implementation of D may be rushed
B D	$$$$$	•••	• Requires few strategies to be carried out while still achieving high effectiveness • Strategy B could mitigate risk for a long time while DTS plans and obtains funding for strategy D	• There may be environmental concerns with building dikes along stream
C	$$$	••	• Depending on how high the road is raised, strategy C by itself could mitigate risk; if sea levels surpass the threshold for C, DTS could implement strategy D	• Because C may take a while to implement, the unprotected road may still experience flooding in the near-term • Requires high up-front expenditure of funds • There is still uncertainty in whether C can mitigate risk by itself

**Costs will vary based on site and project specifics (e.g., materials used)*



10.5 Pilot cool and permeable alternatives to traditional pavements in parking lots, roads, and recreational spaces.

According to the Environmental Protection Agency (EPA), about 40% of all urban areas are paved with asphalt or concrete, [78] contributing to increased urban heat and flooding. Cool and permeable pavements are emerging technologies used to reduce the impact of heat in urban areas.

Cool pavements, such as light colored asphalts, light colored coatings, or grass paving, store less heat compared to conventional pavements, while permeable pavements are porous urban surfaces that capture and store runoff water. The City will pilot cool and permeable pavement projects in parking areas, roads, and recreational spaces in combination with bioswales and rain gardens to reduce urban heat. Temperature and flooding measurements will be recorded before and after pavement changes to determine the impact of each alternative. In addition to pavement alternatives, the City will identify areas to pilot replacing pavement with natural ground cover (also known as "de-paving") to minimize urban heat and flooding. Based on the pilot findings, the City will identify priority areas where pavement alternatives or depaving could be useful, starting with the most vulnerable communities.

Expected Benefits

1. Reduced carbon emissions
2. Improved stormwater management resulting in cleaner water and higher soil retention during floods
3. Public health benefits
4. Reduced long-term maintenance costs due to decreased potential for potholes and road erosion

Hazards

Timeframes

Near

Partners

DTS / DFM / DPR / CCSR

Existing Tools and Efforts

- Various types of permeable pavement are installed around the island: grass blocks at Kapi'olani Regional Park, permeable concrete at Ala Wai Elementary School and the Kahala McDonalds.

10.6 Require use of Climate Change Design Guidelines for all Capital Improvement Projects.

The City initiated a Climate Change Design Guidelines project that provides steps for analyzing climate risks to projects and engineering options for addressing vulnerabilities.

The Design Guidelines were in response to Mayor's Directive 18-2 issued in July 2018, and implemented with the Resilience Strategy Action 14. Once completed, they will serve as a recommended resource to be used in City CIP project planning and design. The Design Guidelines will be introduced as a recommended resource to be used before and during the planning and design stage for City CIP projects. The Design Guidelines include a process for determining the level of risk and will make different recommendations based on a number of factors such as hazard exposure, risk, and cost. Following an initial introduction and adjustment period, the City will draft a policy to institutionalize the guidelines by requiring their use for planning and design of all future City capital projects.

Expected Benefits

1. Reduced long-term maintenance and redevelopment costs
2. Health and safety benefits from more resilient infrastructure
3. Reduced carbon emissions
4. Lower operating costs for building owners due to improved energy efficiency

Hazards

Timeframes

Near

Partners

DDC / CCSR

Existing Tools and Efforts

- In 2020, DPP published Climate Adaptation Design Principles for urban development.

STRATEGY 11

Reduce flood risk and coastal erosion by directing development to safer and higher ground.

There are 3,800 structures, 5,640 acres of urban land, and miles of electrical and sewer services on O'ahu located in the sea level rise exposure areas. Unfortunately, we are already seeing impacts today. In February 2022, sea level rise-driven coastal erosion caused a house on the North Shore to collapse onto the beach. Thousands of homes are currently or soon to be exposed to similar risk. While attempts to defeat the ocean with seawalls, sandbags, or even stilts may provide a temporary sense of relief, all of these approaches will eventually be undermined by the sea, and have environmental and social impacts on our beaches.

The only truly effective strategy for keeping people and structures unharmed from impacts from sea level rise is to build or relocate on safer –and higher– ground. Overlay zones, which are used to regulate land uses in communities through zoning, can provide a framework for building and relocating above the sea level rise exposure area (SLR-XA) in specific vulnerable communities. In addition to overlay zones, market-based tools, like a transfer of development rights program, spending tools, like special improvement districts, and planning tools, like a managed retreat strategy, are all significantly important for keeping people and structures safe from sea level rise. The City will assess the use-case for each of these options to identify the best way to strategically prepare for sea level rise and evaluate the trade-offs between repairing structures and relocation.

Although building in safe spaces is the best option, it is not always possible. Buildings constructed in flood exposure areas should be built to a higher standard that reflects their increased risk. This may require changing climate resilient design standards for buildings close to the shoreline. For example, freeboarding is a common floodproofing design standard that requires a structure's lowest floor to be floodproofed or elevated at a certain height to avoid damage from flooding. To inform design standards it is critical to understand and model conditions that may result in flooding due to sea level rise. Incorporating data for sea level, precipitation, temperature, and runoff into existing flood models will be essential for improving predictions and informing planning efforts.

Embracing and preparing for the changes to our shorelines today will help avoid irreversible losses to homes and belongings impacted by sea level rise.

Designing for Equity:

- Explore ways to enable managed retreat, while avoiding passing on retrofit costs to tenants
- Develop solutions to safeguard access to elevated homes and buildings for kūpuna

11.1 Update Flood Ordinance to require freeboard in certain special flood hazard areas.

The City's current floodplain management regulations mandate that development in special flood hazard areas must be constructed at or above the base flood elevation (BFE) set by FEMA.

However, the existing BFE models do not consider sea level rise. To address this, the City will update its Flood Ordinance (Chapter 21A: Flood Hazard Areas) and introduce a concept called "freeboard." Freeboard is the additional height above base flood elevation at which some localities require new structures to be built. For example, if the BFE for a new structure is 6, and 3 feet of freeboard are required, the structure must be elevated to 9 feet. Higher freeboard results in significantly lower flood insurance rates because the higher a structure is elevated, the less likely it is to flood. FEMA encourages communities to adopt at least 1 foot of freeboard. Some cities require freeboard because they have been experiencing more frequent flooding at higher levels than the BFE suggests, some are anticipating changes in maps that will raise the BFE and want structures to be prepared, and some are preparing for sea level rise, among other reasons. A higher freeboard provision can gain a large number of points in the Community Rating System, which can lead to lower rates for all flood insurance policyholders.

Expected Benefits

1. Keep people and property higher and safer from flooding
2. Reduced flood insurance premiums for property owners
3. Reduced long-term maintenance and redevelopment costs of properties in the floodplain

Hazards

Timeframes

Near

Partners

DPP / CCSR

Existing Tools and Efforts

- In 1990, the City and County of Honolulu added Revised Ordinances of Honolulu (ROH) Chapter 21A: Flood Hazard Areas, establishing flood hazard areas and regulations of construction in areas subject to flood hazards.
- In 2022, the 2018 International Building Code (2018 IBC) came into effect in the City and County as an interim code. The IBC 2018 includes freeboard for some types of structures built in special flood hazard areas.
- In 2023, the City and County of Honolulu passed Ordinance 23-3, which requires freeboard for construction of structures in SLR-XA (if they could not be set back adequately)

11.2 Assess the adoption of a sea level rise overlay zone.

The City is responsible for regulating land uses in communities through zoning and floodplain ordinances.

Overlay zones can be imposed to add additional regulations in specifically defined geographical areas based on special characteristics, like sea level rise vulnerability, to address challenges that may not have existed when the zoning codes were made. For example, current City regulations require developers to consider flood risk in their plans; however; flooding and erosion impacts related to sea level rise are not factored into the required risk calculations. With the availability of more robust data on sea level rise, which can show exposure risk down to the scale of individual properties, it should be ensured that our rules reflect the risk accordingly. To address sea level rise risks, the City will assess the option of adopting a sea level rise overlay zone that requires developers who build within this zone to consider sea level rise in the decision-making process. Consideration for sea level rise could include requirements for raising the minimum building elevation, siting buildings, restricting the types of buildings allowed in that area, and guiding new development to safer and higher ground. This overlay zone will enhance the long-term sustainability of buildings on O'ahu by mandating new climate resilient development standards in high risk areas to keep people and homes safe.

Expected Benefits

1. Property protected from sea level rise impacts
2. Reduced long-term maintenance costs by accounting for flood risk
3. Avoided costs of retrofits to comply with future flood safety standards

Hazards

Timeframes

Medium

Partners

DPP / CCSR

Existing Tools and Efforts

- Kaua'i County created a Sea Level Rise Constraint District that depicts future projections of annual high wave run up and passive flooding due to rising sea levels to inform development planning.
- In 2023, the City and County of Honolulu passed Ordinance 23-3 establishing a shoreline setback that prohibits the new construction of buildings along the shoreline as a protective measure against rising sea levels.
- State of Hawai'i Sea Level Rise Viewer is an interactive mapping tool developed by the Pacific Islands Ocean Observing System that provides visualizations of hazard exposure projections and vulnerabilities related to sea level rise.

11.3 Critically evaluate the costs of relocating infrastructure out of the sea level rise exposure area versus maintaining and repairing infrastructure in place.

Infrastructure like roads and water lines that are located in areas vulnerable to sea level rise are at risk of costly damage and disruptions caused by flooding and erosion.

Residents have become familiar with the consequences: road closures, traffic jams, and disrupted water or sewer service. The maintenance of infrastructure in these areas is not cheap; in 2020 alone, the state Department of Transportation spent $2 million on emergency repairs to stabilize and support the ocean side of Kamehameha Highway after a section of road fell into the water.

The City will evaluate existing infrastructure to assess whether the cost of maintenance and repair is expected to exceed the cost of relocation. This approach can help reduce the long-term cost of infrastructure maintenance and repair, and ensure the continued provision of essential services to communities in the face of a changing climate.

Expected Benefits

1. Longer life expectancy of City infrastructure
2. Lower costs associated with maintenance and repairs

Hazards	Timeframes	Partners
	 Medium	DPP / CCSR / DDC / BFS

Existing Tools and Efforts

- State of Hawai'i's Climate Change Mitigation and Adaptation Sea Level Rise Guidance Tool acts as a flow chart for prospective developers for initial planning which includes projected Sea Level Rise data.

11.4 Develop priority options for resilient redevelopment and managed retreat in areas vulnerable to sea level rise.

Areas that we know to be vulnerable to sea level rise are difficult to plan for. Over 3,800 structures in the SLR-XA could be flooded by 3.2 ft of sea level rise.[8]

Ultimately, we will need a framework by which to decide as a community in which areas we should continue to rebuild and reinvest, and where it is preferable to gradually retreat. This decision-making framework may take many forms, but should be rooted in community participation, and take into account multiple factors such as degree of vulnerability, impact to beaches and wetlands, risk tolerance, and long term cost comparisons. The framework could evaluate an array of options for feasibility on O'ahu. One option is managed retreat, or the process of shifting development inland from the coast either by the physical movement of structures or changing the restrictions and management of coastal areas. Other options include Transfer of Development Rights (TDR), a zoning technique used to permanently protect land with conservation value (such as farmland, community open space, or other natural or cultural resources) by redirecting development that would otherwise occur on this land (the sending area) to an area planned to accommodate growth and development (the receiving area). Additionally, the City may adjust land regulations to adapt to the ongoing threats. One way to do this is to downzone high-risk land areas to limit the amount of development that can occur within these zones.

Expected Benefits

1. Preserve and protect sensitive rural ecosystems
2. Promote infill housing
3. Provide some economic return for owners who are displaced from coastal property by sea level rise

Hazards	Timeframes	Partners
	Medium	DPP / CCSR

Existing Tools and Efforts

- In 2019, the state Office of Planning and Sustainable Development published a report assessing the feasibility and implications of managed retreat strategies for vulnerable coastal areas in Hawai'i.
- The State of Hawai'i Climate Change Portal provides facts and information on Sea Level Rise and associated increased flood risks using data gathered by NOAA State Climate Summaries.

STRATEGY 12

Keep our communities cool as temperatures rise and during heat waves.

In 2019, O'ahu had its hottest year ever recorded, and set or tied 135 high temperature records.[79] It is only projected to get hotter. By 2050, average temperatures on O'ahu could rise by up to 4.5°F, and by 2100, this increase could be as much as 7.2°F.[6] Exposure to heat can compromise the body's ability to regulate internal temperature, resulting in heat-related strokes, heat exhaustion, severe dehydration, and death. As temperatures rise, outdoor and indoor spaces without cooling systems in place may become increasingly uncomfortable, resulting in an increase in heat-related illnesses, a reduction in the appeal of outdoor commuting choices and recreational activities, and stress on electricity supply and the environment.

Considering that heat causes more deaths in the U.S. than any other extreme weather event, there is a need to predict and plan for the impacts of heat on local populations. Heat mortality studies use historical temperature data and mortality rates to understand heat impacts on human health, enabling the identification of communities that are at higher risk for heat-related illness. In most cases, low shade coverage and subsequent higher occurrences of heat-related illnesses is associated with lower income communities. This study will support the City in navigating heat as a health risk, especially in low-income and more vulnerable communities.

Historically, residential buildings across O'ahu have relied on the trade winds rather than air conditioning to manage moderately warm temperatures. As homes get hotter, retrofits for cooling equipment will be essential for keeping indoor spaces cool. Further, in urban and neighborhood environments, the difference between standing directly in the sun and under the shade of a tree can be up to 10 degrees.[80]

Increasing shade, especially within urban areas, and implementing cooling solutions are essential for mitigating extreme heat. Enhancing access to air conditioning systems can help maintain comfortable indoor temperatures during heatwaves, while implementing cool roof technologies, such as reflective coatings or green roofs, can reduce heat absorption and energy consumption for cooling. Moreover, integrating a quota for total shade in building regulations and development, requiring a percentage of land area to be dedicated to trees, green spaces, and shade structures, can guarantee a sufficient cooling benefits to residents. Both natural and man-made structures will be important for increasing shade. Natural shade structures could include trees, green roofs, and vertical green walls, while solar shade structures over parking lots are effective shade providers. Ensuring thermally comfortable routes and recreation spaces through enhancing shade coverage can make walking, biking, and playing outside more enjoyable as temperatures rise.

Protecting the health and safety of our community is the City's top priority. By mitigating heat impacts both inside and outside of homes and buildings, O'ahu residents can continue to enjoy their favorite activities without getting ill from the increasing heat.

Designing for Equity:

- Increase access to affordable cooling solutions without passing on costs to homes, tenants, and small businesses
- Develop mechanisms to support energy-efficient upgrades for low-income tenants, small businesses, and affordable housing
- By investing in energy efficiency and cooling solutions, we will make indoor air temperatures more comfortable for vulnerable communities
- Prioritize tree plantings in heat vulnerable neighborhoods that may not have had the benefits of past investments

12.1 Update the City's street and park tree inventory to better maintain and grow the urban tree canopy.

Not all neighborhoods have the same amount of trees, making each communities' vulnerability to heat different from one another.

Tree inventories are a useful tool for mapping the landscape of shade within a given area by recording the location and type of trees to identify areas that lack tree coverage and keep track of tree health as temperatures change. The City will assemble a comprehensive tree inventory of City street and park trees using tree data from non-profit partner Smart Trees Pacific and Citizen Forester volunteers. Understanding local trees will improve the effectiveness of tree maintenance schedules and management efforts. The City will use the findings from the tree inventory to develop a data-driven strategy for increasing the tree canopy island-wide. Tree canopy, or the amount of leaves and branches above the ground, will provide critical shade and cooling benefits under warmer conditions, while improving stormwater management, energy efficiency, and health. These simultaneous efforts to increase urban tree canopy will result in cooler communities and walkable streets even as temperatures rise.

Expected Benefits

1. Better maintenance of existing trees reduces costly tree replacements
2. Promote the establishment of habitats for pollinators such as birds and insects
3. Adjacent areas experience a temperature gradient that improves soil moisture content, lowers water demand for growth, and creates larger green space.
4. Enhanced tree coverage in historically underserved communities
5. Increased carbon capture and health benefits from reduction in air pollution and improved shade
6. Mental health benefits known to result from access to nature

Hazards	Timeframes	Partners
	Near	DPR / DPP / CCSR

Existing Tools and Efforts

- The O'ahu TreePlotter Inventory GIS Map is an urban tree inventory co-created with our Citizen Forestry Program that trains community members to identify and map the health of our urban trees.
- Mayor's Directive 20-14 (2020) already requires the City to preserve and protect trees that do not pose a threat to safety or undermine an essential government function with the aim of expanding the urban tree canopy.
- In 2022, the City launched the creation of a Master Street Tree Plan for Transit-Oriented Development neighborhoods to identify the range of tree species and locations where new trees should be planted.
- In 2019, CCSR partnered with the Department of Parks and Recreation Urban Forestry Division to develop O'ahu's first Urban Tree Plan to highlight the social, environmental and economic benefits of trees and lay out strategies for increasing the urban tree canopy.

12.2 Facilitate cooling solutions and retrofits to protect residents from increasing temperatures.

High indoor temperatures can make it uncomfortable to perform daily activities and difficult to sleep, reducing overall well-being.

During heatwaves, spaces without air conditioning can become deadly for vulnerable residents, especially kūpuna and keiki. There are connections between high heat and decreased learning in children. Natural cooling solutions, such as planting more trees and installing green roofs, and manufactured cooling solutions, such as energy efficient air conditioning units, more reflective exterior paint colors, and reflective roofs, are important methods for keeping communities cool indoors. The City will seek partnerships with local utilities to provide incentives and subsidies that encourage homeowners and building owners to adopt cooling retrofits. Additionally, the city will collaborate with local organizations to provide guidance on available cooling options. By facilitating and promoting the use of cooling solutions and retrofits, the City will improve thermal comfort of residents indoors, while reducing energy consumption.

Expected Benefits

1. Green roofs and trees also help control stormwater runoff and reduce pollution in streams and the ocean
2. Lower operating costs for building owners and lower energy bills for occupants
3. Improved thermal comfort and reduced potential for heat illnesses

Hazards

Timeframes

Medium

Partners

OER / CCSR

Existing Tools and Efforts

- Hawai'i Energy offers rebates for energy star certified window air conditioners, central A/C retrofits, and fans.
- The International Energy Conservation Code, and local amendments, offer the most current baseline standards for cool roofs and reflective walls. While not required in existing buildings, these standards can be used as a reference for buildings re-roofing or re-painting.
- The Cool Roof Rating Council provides resources about cool roofs, cool walls, as well as codes, factsheets, and FAQs.[81]

Actions You Can Take

- ❑ Upgrade to a cool roof and energy efficient air conditioner the next time you're renovating or repairing your home
- ❑ Plant native trees and plants in your yard to create shade
- ❑ Sign up for the Resilient O'ahu newsletter to be notified when financial assistance programs to heat pumps and rooftop solar are available.

12.3 Establish shade quotas along multi-modal transit corridors, in public recreation spaces, and in other public facilities.

Low-income and working-class communities on O'ahu are disproportionately impacted by heat due to being more likely to work outdoors, rely on public transportation, and live in neighborhoods with a lack of trees.

To increase shade equity, the City will use a community heat-related illness study and tree inventory to establish a shade quota, or a minimum shade requirement, for transit corridors, outdoor recreation spaces, and public facilities. Shade quotas will guide the implementation of cooling solutions, such as planting of additional street trees, increasing the number of bus routes to reduce outdoor waiting times, and engineering more shade structures along active transportation routes. The City will integrate shade quotas into urban tree plans and design standards and reassess them as temperatures rise.

Expected Benefits

1. Increased thermal comfort for bicyclists, multi-modal transit users, and walkers
2. Health benefits from reduced air pollution and shade
3. Increased stormwater management due to additional green spaces

Hazards

Timeframes

Medium

Partners

DPR / DTS / DFM / CCSR
DPP

Existing Tools and Efforts

- In 2020, the Mayor's Directive 20-14 established a goal to enhance existing shade along multi-modal transit corridors and recreation spaces by preserving and protecting trees in development areas.
- In 2007, the City partnered with Urban Forest Research Center to conduct the Municipal Forests Resource Analysis report that combined results of a partial citywide inventory with benefit-cost modeling data to produce four types of information (Structure, Function, Value, Management) on the city-managed street tree resource.

12.4 Develop a "Heat Hazard Annex" for the Emergency Operations Plan.

For climate shocks, like hurricanes and flooding, the City is prepared with Emergency Operations Plans intended to guide emergency response efforts.

Being prepared to ensure the health and safety of residents under increasing temperatures will be important for avoiding heat illnesses among our residents. The City will expand its Emergency Operations Plan to include a Heat Annex. The Heat Annex will lay out City emergency services to be activated during a heat wave, such as emergency transportation support and electrical grid conservation efforts, and provide strategies to support community members accessing cool spaces and medical services. Further, it will outline strategies for alerting the community of potential heat waves to secure their safety and avoid heat-related health impacts.

Expected Benefits

1. Reduced heat mortality due to increased preparedness of emergency workers
2. Improved access to heat relief resources island-wide

Hazards

Timeframes

Near

Partners

DEM / CCSR

Existing Tools and Efforts

- None yet identified

12.5 Assess risk to community health and safety from increasing temperatures and heat waves.

Rising heat exposure in cities is an accelerating threat to public health and one for which few municipal or state governments have the information needed to develop effective responses.

The City will conduct a heat mortality study to determine the impacts to understand and communicate the extent and geographic distribution of heat risk. This study will further inform City heat action planning, heat mitigation activities, and potentially help leverage external resources such as federal or philanthropic funding opportunities. This study will ensure the City understands extreme heat as a hazard to human health, including life safety, and aims to be able to provide quantitative estimates of the human health benefits of heat management. Heat-related mortality alone does not show the full scope of heat-related health impacts. Future assessments could include looking into heat morbidity-related updates to occupational safety rules, or exploring the relationship between heat and domestic violence.

Expected Benefits

1. Reduced heat mortality due to improved access to heat relief resources island-wide
2. Improved data that can inform heat adaptation priorities

Hazards

Timeframes

Near

Partners

CCSR / DOH

Existing Tools and Efforts

- In 2019, volunteers across O'ahu collected a total of 77,456 measurements of temperature and humidity. The maximum heat index recorded was 107.3 degrees Fahrenheit (°F), with a highest concurrent heat index differential of 22.3°F. These findings were published in a Heat Watch Report and are being used to explore the intersection of urban heat and social vulnerability.
- The City Climate Change Commision is currently working on an Urban Heat Guidance document to recommend strategies for addressing heat-related health risks.

12.6 Increase availability of public drinking fountains.

Repairing drinking fountains and installing new ones creates opportunities for people vulnerable to the negative health impacts of heat to cool off and avoid dehydration.

The City will assess the condition and locations of existing public drinking fountains to determine maintenance and operational needs, and opportunities for expanded services such as water bottle refill stations. This effort will strengthen equitable water access to communities island-wide, while maintaining the ability for City's parks and public spaces to be used for recreational activities as temperatures rise.

Expected Benefits

1. Providing access to drinking water
2. Improved health and wellness of community members

Hazards

Timeframes

Medium

Partners

DFM / DPR / CCSR

Existing Tools and Efforts

- To promote waste prevention, Action 8.5 from the City's Climate Action Plan calls for expanding the location of public drinking water fountains and retrofitting existing public drinking fountains to include devices capable of refilling reusable water flasks, cups and containers.

12.7 Maximize installation of solar PV over parking lots to mitigate urban heat.

Parking lots account for nearly half of all paved surfaces in cities.[82] Parking lots are massive heat sinks that can hold heat long after the sun is down, resulting in surrounding air temperatures being up to 10 degrees hotter at night.

Installing solar photovoltaics (PV) over parking lots provides instant protection from the sun and generates clean energy that can be used to charge electric vehicles and power nearby buildings. The City will continue to evaluate the opportunity to install solar PV on its own portfolio of existing and new parking lots. Where conditions allow, the City will prioritize adding solar PV to parking lots with the highest heat vulnerability and conditions favorable to PV installation. In addition to City lots, the City will explore barriers to solar PV installation over private parking lots and work with owners of those lots to identify solutions for empowering their participation in installing solar PV. Installing solar PV on parking lots can create a win-win solution because they provide shade, while helping us reach our renewable energy goal of 100% clean energy by 2045.

Expected Benefits

1. Increased thermal comfort
2. Health benefits from reduced air pollution and shade
3. Lower energy bills for adjacent buildings
4. Extended life of asphalt and pavement from blocked solar radiation
5. Contribution to the City and State's 100% renewable energy goal by 2045

Hazards

Timeframes

Medium

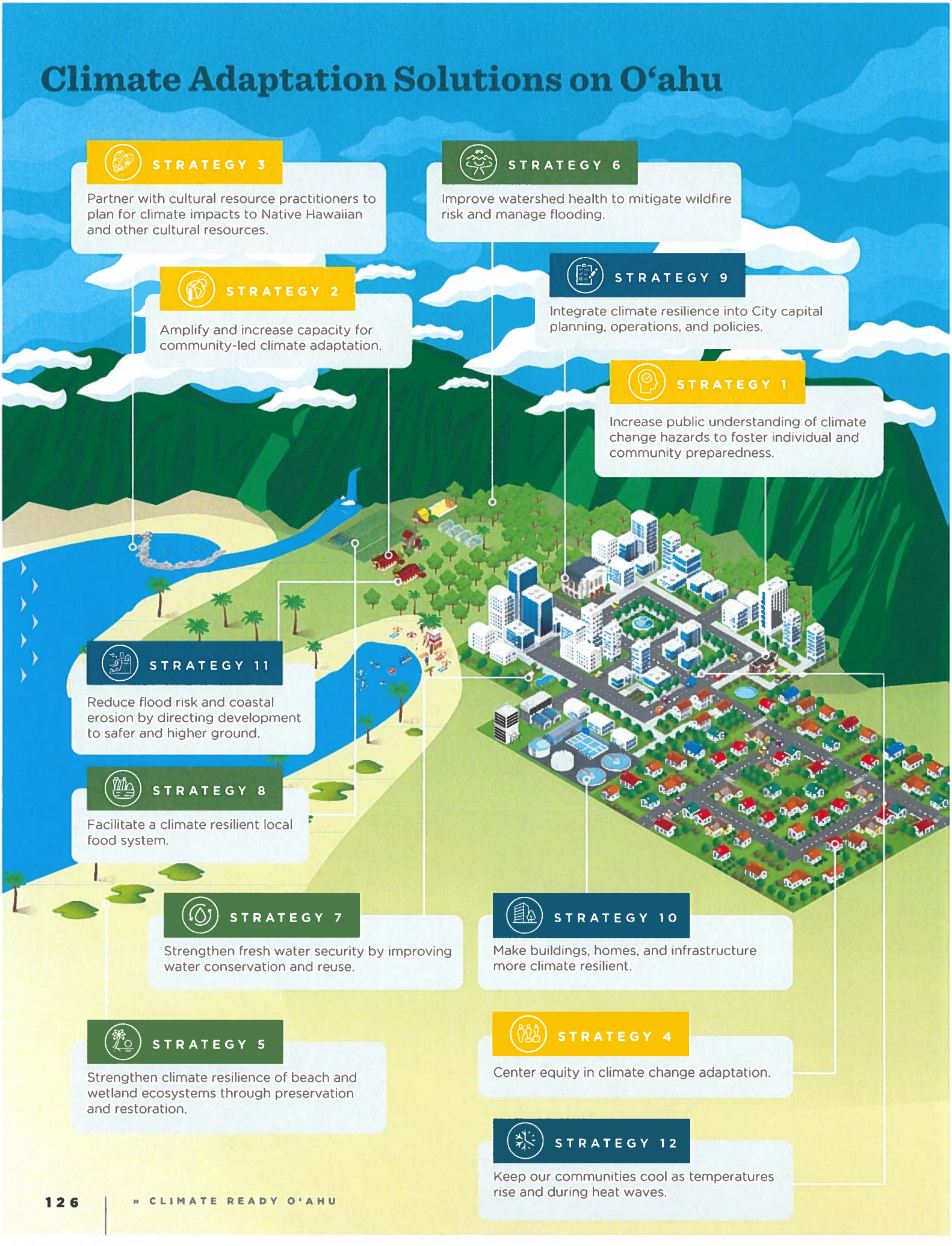
Partners

DDC / DPP / DES / DPR / DTS / CCSR

Existing Tools and Efforts

- Honolulu's Climate Action Plan promotes the addition of solar structures over parking lots in action 6.2 with the aim of increasing renewable energy capacity by 200%.
- The Board of Water Supply, University of Hawai'i at Mānoa, as well as numerous community colleges, high schools, and shopping malls on O'ahu have demonstrated the benefit of PV carports on surface parking lots and top levels of parking structures. The City has several similar installations in the pipeline, including at Kapolei Hale, the Blaisdell Center, and more.

Climate Adaptation Solutions on O'ahu



STRATEGY 3

Partner with cultural resource practitioners to plan for climate impacts to Native Hawaiian and other cultural resources.

STRATEGY 6

Improve watershed health to mitigate wildfire risk and manage flooding.

STRATEGY 2

Amplify and increase capacity for community-led climate adaptation.

STRATEGY 9

Integrate climate resilience into City capital planning, operations, and policies.

STRATEGY 1

Increase public understanding of climate change hazards to foster individual and community preparedness.

STRATEGY 11

Reduce flood risk and coastal erosion by directing development to safer and higher ground.

STRATEGY 8

Facilitate a climate resilient local food system.

STRATEGY 7

Strengthen fresh water security by improving water conservation and reuse.

STRATEGY 10

Make buildings, homes, and infrastructure more climate resilient.

STRATEGY 5

Strengthen climate resilience of beach and wetland ecosystems through preservation and restoration.

STRATEGY 4

Center equity in climate change adaptation.

STRATEGY 12

Keep our communities cool as temperatures rise and during heat waves.

IMPLEMENTATION

Adapting Together

At the heart of this Strategy lies the commitment to build a climate-ready future for O'ahu — where every member of our community thrives in the face of changing climate conditions. On their own, the strategies and actions in Climate Ready O'ahu are not enough to completely prepare for the many impacts of climate change. As we embark on this journey together, we are guided by the values of collaboration, equity, and community-driven action.

Implementation and Collaboration

Implementing Climate Ready O'ahu is a collaborative effort, woven with the threads of cooperation between the City and County of Honolulu, state and federal governments, community-based organizations, businesses, residents, and visitors. By combining our strengths and resources, we will bring our strategies to life. Our actions will be strategic, agile, and adaptable, taking into account the dynamic nature of both climate change and community needs.

Measuring Progress and Accountability

We have an unwavering commitment to accountability. We recognize the importance of measuring our progress and learning from our achievements and challenges. To this end, we will establish key metrics to track the effectiveness of our adaptation strategies. These metrics will provide us with a clear view of our advancements and areas that require more attention. Accountability is not just a duty; it's an affirmation of our dedication to the well-being of all who call O'ahu home.

Community-Driven Climate Championship

Empowerment goes hand in hand with community-driven leadership. We believe that each member of our diverse community has a unique perspective, insight, and role to play in ensuring O'ahu's resilience. Through our concept of "community-driven climate champions," we aim to nurture and amplify the voices of those who are deeply connected to our island and its well-being. Whether you're engaged as a resident, an organization, or a local business, your involvement is pivotal in shaping our collective journey toward a climate-ready future.

Call to Action

As we begin this transformative path, we encourage every individual and entity on O'ahu to take action. Engage with our office, explore the strategies outlined in this document, and find your place in building a climate-ready O'ahu. From participating in community initiatives to advocating for sustainable practices, your contributions matter. Together, we can forge a future that honors our past, nurtures our present, and safeguards our island for generations to come.

Let's stand united as a community, embracing the challenges and opportunities that climate change presents. With shared purpose, determination, and the spirit of aloha, we will not only adapt to change, but also flourish in the face of it.

Action Summary

EMPOWERED AND PREPARED PEOPLE

Action #	Action Name	Hazards	Timeframe
	Strategy 1: Increase public understanding of climate change hazards to foster individual and community preparedness.		
1.1	Develop and distribute materials about climate hazards, their impacts, and how individuals can take action to prepare.		Near
1.2	Expand the City's network of partners who serve frontline communities to check in on vulnerable neighbors during climate "shocks."		Near
1.3	Provide training to public-service safety staff, outdoor workers, and caregivers to recognize and report patterns of heat-related illnesses and injuries.		Near
	Strategy 2: Amplify and increase capacity for community-led climate adaptation.		
2.1	Create a Climate Champions program to encourage local climate leadership.		Near
2.2	Encourage and support neighborhoods to become certified Firewise Communities.		Medium
2.3	Create a resource hub to promote opportunities for engaging in community-led climate adaptation.		Near
2.4	Celebrate community action on climate adaptation.		Medium
	Strategy 3: Partner with cultural resource practitioners to plan for climate impacts to Native Hawaiian and other cultural resources.		
3.1	Recognize and compile educational resources on how Native Hawaiian cultural practices positively contribute to climate adaptation.		Near
3.2	Research climate impacts on Native Hawaiian cultural practices and resources		Medium
3.3	Assess and mitigate risk to iwi kūpuna from sea level rise and coastal erosion.		Medium
3.4	Produce tools and guidance specific to climate indicators defined by Native Hawaiian communities.		Near
3.5	Identify and plan for climate impacts to historic sites and landmarks.		Medium
	Strategy 4: Center equity in climate change adaptation.		
4.1	Operationalize an Equity Screen for City projects to ensure equitable implementation of climate ready actions.		Near
4.2	Develop and monitor key adaptation metrics in collaboration with frontline community members.		Near
4.3	Improve language accessibility of climate-related information		Medium

SAFEGUARDED AND STEWARDED ʻĀINA

Action #	Action Name	Hazards	Timeframe
	Strategy 5: Strengthen climate resilience of beach and wetland ecosystems through preservation and restoration.		
5.1	Utilize the expanded scope of the Clean Water and Natural Lands Fund to better protect and maintain beaches and wetlands.		Near
5.2	Establish wetland protection and restoration goals.		Medium
5.3	Increase partnerships and investments to support cesspool conversions islandwide		Near
5.4	Collaborate with the community to restore beach and dune systems in City beach parks.		Near
5.5	Explore the potential for a statewide Coastal Conservancy in coordination with the State and other counties.		Medium
	Strategy 6: Improve watershed health to mitigate wildfire risk and manage flooding.		
6.1	Slow and hold runoff in parks, open spaces, and roads to improve water quality and reduce flooding.		Near
6.2	Expand support of conservation, maintenance, and reforestation across all priority watersheds.		Medium
6.3	Expand capacity and partnerships for stream maintenance.		Medium
6.4	Adopt stream buffers to reestablish natural stream systems.		Medium
6.5	Increase and improve the quality of buffer areas around wildfire prone areas		Near
	Strategy 7: Strengthen fresh water security by improving water conservation and reuse.		
7.1	Expand recycled water infrastructure and plans for water reuse.		Far
7.2	Adopt a plumbing "reach code" to incentivize water efficiency.		Medium
7.3	Incentivize water efficiency upgrades in buildings and homes.		Medium
7.4	Expand the use of non-potable water.		Near
	Strategy 8: Facilitate a climate resilient local food system.		
8.1	Evaluate underutilized City lands to grow the local food system.		Near
8.2	Catalyze the use of Climate Smart Agricultural practices and technologies.		Medium
8.3	Commission a study on impacts of climate change on agriculture.		Near
8.4	Create a climate adaptation resource network for farmers and food system stakeholders.		Near
8.5	Expand the City's community garden network in underserved neighborhoods.		Medium
8.6	Support increased long-term capacity to store, refrigerate, and distribute food.		Medium

SAFE & RELIABLE INFRASTRUCTURE

Action #	Action Name	Hazards	Timeframe
Strategy 9: Integrate climate resilience into City capital planning, operations, and policies.			
9.1	Coordinate resilient infrastructure investments through the One Water Honolulu Panel.		Medium
9.2	Integrate climate resilience principles into City budgeting processes.		Near
9.3	Improve understanding of flood risks by expanding and updating flood maps		Medium
9.4	Create a toolbox of innovative funding mechanisms for climate adaptation.		Medium
9.5	Reduce the urban heat island effect by adding more shade to codes and standards		Near
Strategy 10: Make buildings, homes, and infrastructure more climate resilient.			
10.1	Retrofit City facilities at risk from storms and flooding.		Far
10.2	Assess risk to public infrastructure from extreme heat.		Near
10.3	Incentivize wind and flooding retrofits for homes and businesses, especially in areas with low shelter availability.		Near
10.4	Develop sea level rise adaptation pathways for high priority infrastructure assets.		Medium
10.5	Pilot cool and permeable alternatives to traditional pavements in parking lots, roads, and recreational spaces.		Near
10.6	Require use of Climate Change Design Guidelines for all Capital Improvement Projects.		Near
Strategy 11: Reduce flood risk and coastal erosion by directing development to safer and higher ground.			
11.1	Update Flood Ordinance to require Freeboard in certain special flood hazard areas.		Near
11.2	Assess the adoption of climate resilient development standards via a sea level rise overlay zone.		Medium
11.3	Critically evaluate the cost of relocating infrastructure out of the sea level rise exposure area versus repairing and maintaining infrastructure in place.		Medium
11.4	Develop priority options for smart redevelopment and managed retreat for areas vulnerable to sea level rise.		Medium
Strategy 12: Keep our communities cool as temperatures rise and during heat waves.			
12.1	Update the City's street and park tree inventory to better maintain and grow the urban tree canopy.		Near
12.2	Facilitate cooling solutions and retrofits to protect residents from increasing temperatures.		Medium
12.3	Establish shade quotas along multi-modal transit corridors, in public recreation spaces, and in other public facilities.		Medium
12.4	Develop a "Heat Hazard Annex" for the Emergency Operations Plan.		Near
12.5	Assess risk to community health and safety from increasing temperatures and heat waves.		Near
12.6	Increase availability of public drinking fountains.		Medium
12.7	Maximize installation of solar PV over parking lots to mitigate urban heat.		Near

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Budget and Fiscal Services

Culture and the Arts

Design and Construction

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Enterprise Services

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Facility Maintenance

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Glossary

Adaptation Pathway: A planning approach for identifying, assessing, and sequencing climate change adaptation options over time based on future predictions of climate hazards.

Adaptive Capacity: The ability to manage and thrive in the face of climate-driven impacts.

Ahupua'a: Land division usually extending from the uplands to the sea so called because the boundary was marked by a heap (ahu) of stones surmounted by an image of a pig (pua'a).

Aquifer: A body of porous rock or sediment filled with groundwater.

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

Cesspool: Large holes underground that store and discharge raw, untreated human waste.

Clean Water and Natural Lands Fund: A fund for acquiring real estate or land in the City and County of Honolulu for the purpose of protecting watershed health; preserving forests, beaches, coastal areas,buffer zones, and agricultural lands; maintaining access to beaches and mountains for outdoor recreation and education; preserving historic or culturally important land areas and sites; and conserving land to reduce erosion, floods, landslides, and runoff.

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

Climate Adaptation Strategy: A suite of goals, strategies, and actions for addressing current and projected impacts of climate change that are informed risk and vulnerability assessments, climate science, and community priorities.

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

Climate Equity: Taking actions to address unequal burdens within communities that are made worse by climate change, while ensuring that all people share the benefits of climate adaptation efforts in a way that amplifies the strengths and abilities of vulnerable populations to respond and thrive in the presence of climate hazards.

Climate Mitigation: Taking action to reduce and eliminate the emission of heat-trapping gasses in our atmosphere that accelerate climate change.

Climate-Smart Agriculture: An approach to help the people who manage agricultural systems respond effectively to climate change. This approach pursues the triple objectives of sustainably increasing productivity and incomes, adapting to climate change and reducing greenhouse gas emissions where possible.

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

Coastal Conservancy: A non-regulatory agency charged with protecting and improving coastal areas, through land management and nature-based solutions.

Coastal Erosion: The process by which local sea level rise, strong wave action, and coastal flooding wear down or carry away rocks, soils, and/or sands along the coast.

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

Critical Infrastructure: Network of highways, connecting bridges and tunnels, utilities and buildings necessary to maintain normalcy in daily life, such as access to electricity and water.

Downzoning: A change in the zoning laws for a particular area that decreases the amount or types of development and/or land uses that can take place in that zone.

Flash Flooding: Flooding that occurs within minutes to hours of heavy rainfall. Because it develops rapidly, flash floods are dangerous and may seriously threaten life and property.

Firewise Communities Program: A nationwide program that helps communities adapt to living with wildfires by encouraging neighbors to work together and take action now to prevent losses.

Frontline Communities: Communities that are disproportionately exposed and vulnerable to health threats, climate-based disruptions, and economic dislocation and that have fewer resources, capacity, safety nets, or political agency to respond to and withstand those risks.

Hazard Annex: An emergency operations plan that describes procedures, actions, roles, and responsibilities for managing the impacts of a specific hazard type.

Houselessness: Families or individuals who have a primary nighttime residence that is a public or private place not designed for, or ordinarily used as, a regular sleeping accommodation for human beings, including beaches, parks, automobiles, and streets.

Iwi Kūpuna: Native Hawaiian ancestral remains.

Graywater: Non-potable water from showers, bathroom sinks, clothes washers, and bathtubs, unsafe for human consumption but potentially useful for other applications.

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

Non-potable Water: Water that does not meet drinking water standards set by the Department of Health and not meant for human consumption.

One Water: A strategy that integrates the management of stormwater, wastewater, groundwater, sea water, freshwater, graywater, and recycled water in order to promote collaboration and create financial efficiencies for present and future water needs.

Potable Drinking Water: Water that meets the drinking standards set by the Department of Health.

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

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

Resilience: The capacity of individuals, communities, institutions, businesses and systems within a city to survive, adapt and thrive no matter what kinds of chronic stresses or acute shocks they encounter.

Resilience Hub: Community-led or operated physical spaces (usually an existing building) used to help communities meet many different resilience needs and goals.

Glossary

Retrofit: Making changes to an existing building to protect it from climate hazards like flooding, high winds, heat, or fire.

Sea Level Rise: The increase in average Global Sea Levels, primarily due to climate-related ice melt and warmer waters causing thermal expansion.

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

Social Cohesion: The extent of connectedness among groups in a community rooted in the sense of belonging and the relationships among members within the community itself.

Social Vulnerability: "Social vulnerability" considers certain socioeconomic, housing, transportation, and other variables that can be stressors to better plan for a community's capacity to prepare for and respond to environmental shocks such as hurricanes, sea level rise, or extreme heat.

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

Transfer of Development Rights: A zoning technique used to permanently protect land with conservation value (such as farmland, community open space, or other natural or cultural resources) by redirecting development that would otherwise occur on this land (the sending area) to an area planned to accommodate growth and development (the receiving area).

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

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

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

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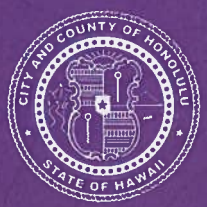
Climate Ready O'ahu



Prepared by
OFFICE OF CLIMATE CHANGE,
SUSTAINABILITY & RESILIENCY

www.resilientoahu.org

CITY COUNCIL
CITY AND COUNTY OF HONOLULU
HONOLULU, HAWAII

CERTIFICATE

RESOLUTION 24-16

Introduced: 01/26/24 By: TOMMY WATERS - BY REQUEST Committee: HOUSING, SUSTAINABILITY AND HEALTH (HSH)

Title: ADOPTING CLIMATE READY O'AHU AS A CLIMATE ADAPTATION STRATEGY AND GUIDING POLICY DOCUMENT FOR THE CITY AND COUNTY OF HONOLULU.

Voting Legend: * = Aye w/Reservations

01/26/24	INTRO	Introduced.
02/07/24	HSH	Reported out for adoption. CR-52 4 AYES: DOS SANTOS-TAM, KIA'ĀINA, OKIMOTO, WEYER 1 ABSENT: TULBA
02/28/24	CCL	Committee report and Resolution were adopted. 9 AYES: CORDERO, DOS SANTOS-TAM, KIA'ĀINA, OKIMOTO, SAY, TULBA, TUPOLA, WATERS, WEYER

I hereby certify that the above is a true record of action by the Council of the City and County of Honolulu on this RESOLUTION.

GLEN I. TAKAHASHI, CITY CLERK

TOMMY WATERS, CHAIR AND PRESIDING OFFICER