PRIMARY URBAN CENTER
WATERSHED MANAGEMENT PLAN

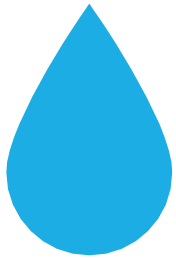
Community Meeting #3
Issues, Projects, Programs & Strategies

October 2018

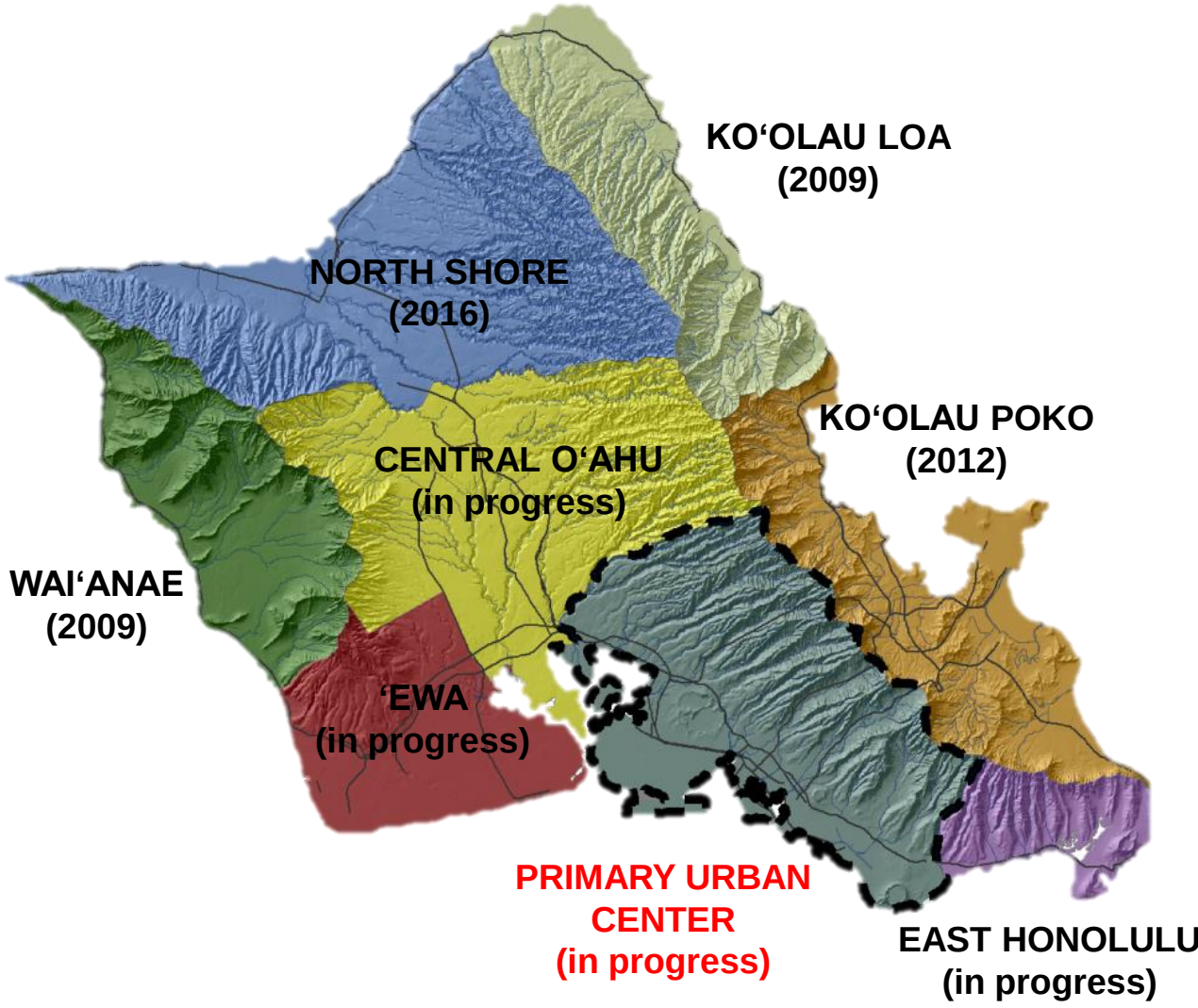
PRESENTATION TOPICS

- Introduction & Project Overview
- Issues and Watershed Management Projects, Programs, and Strategies
- Priority Watersheds and Catalyst Projects
- Next Steps

Introduction and Project Overview

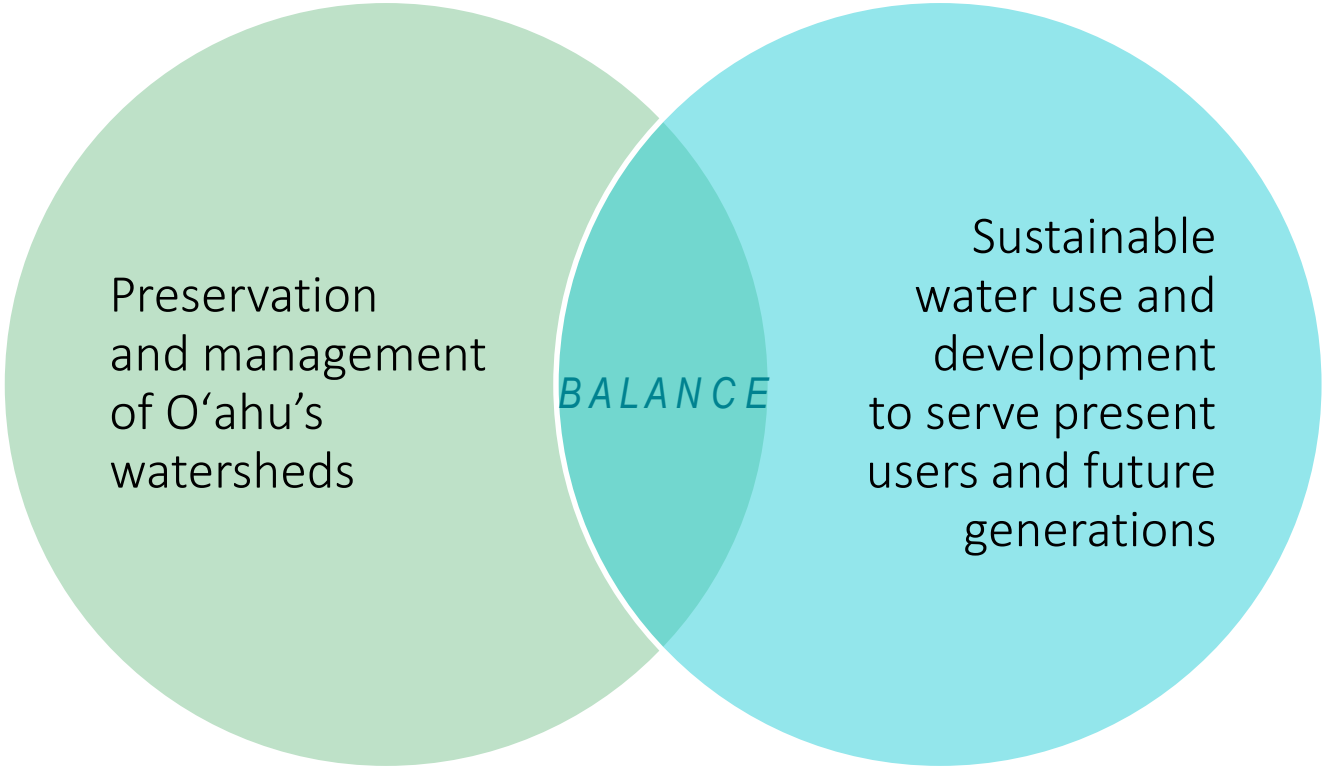


- 8 Watershed Management Plans
  - → O‘ahu Water Management Plan
  - → Required by State Water Code and mandated by County Ordinance



Overall Management Plan Goal

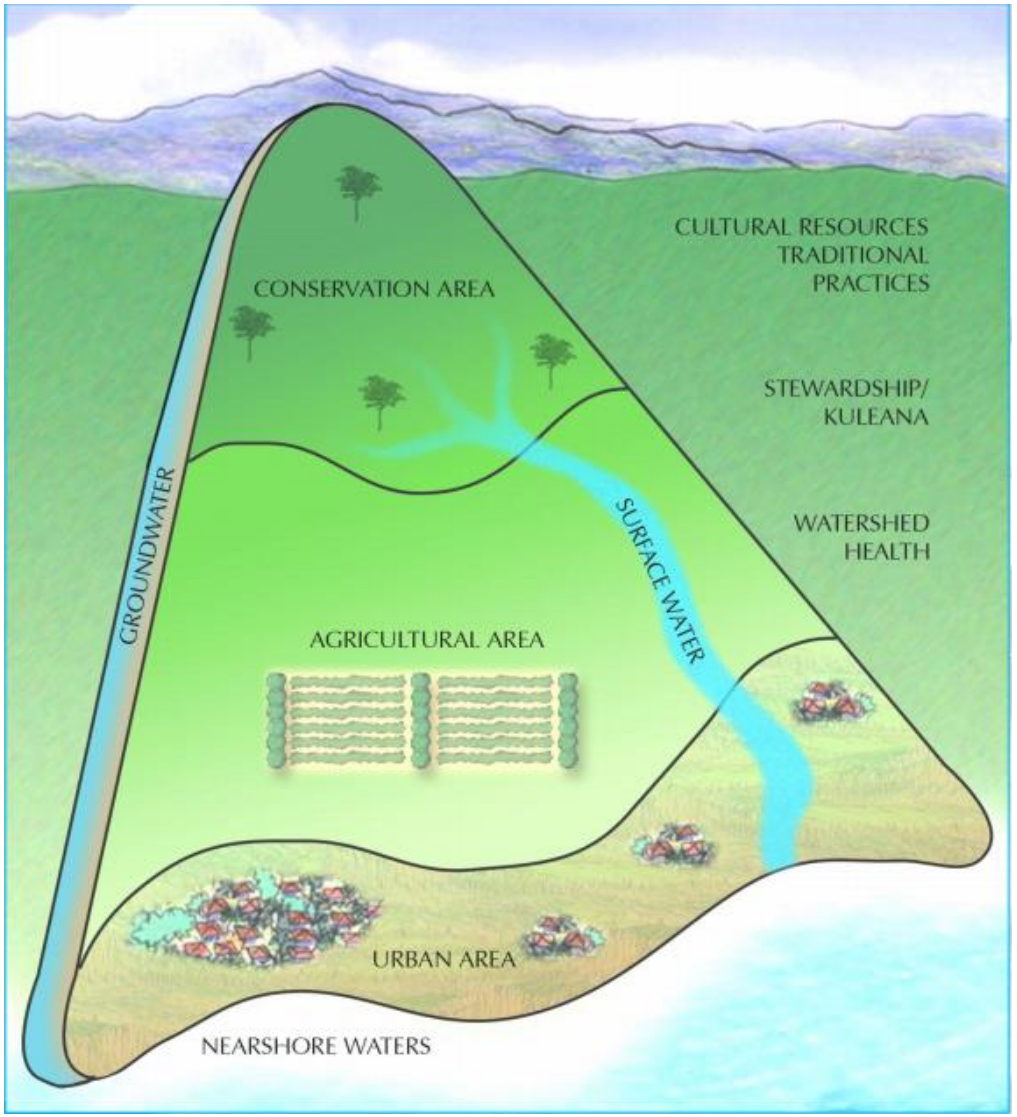
*To formulate an **environmentally holistic, community-based**, and **economically viable** watershed management plan that will provide a **balance** between:*



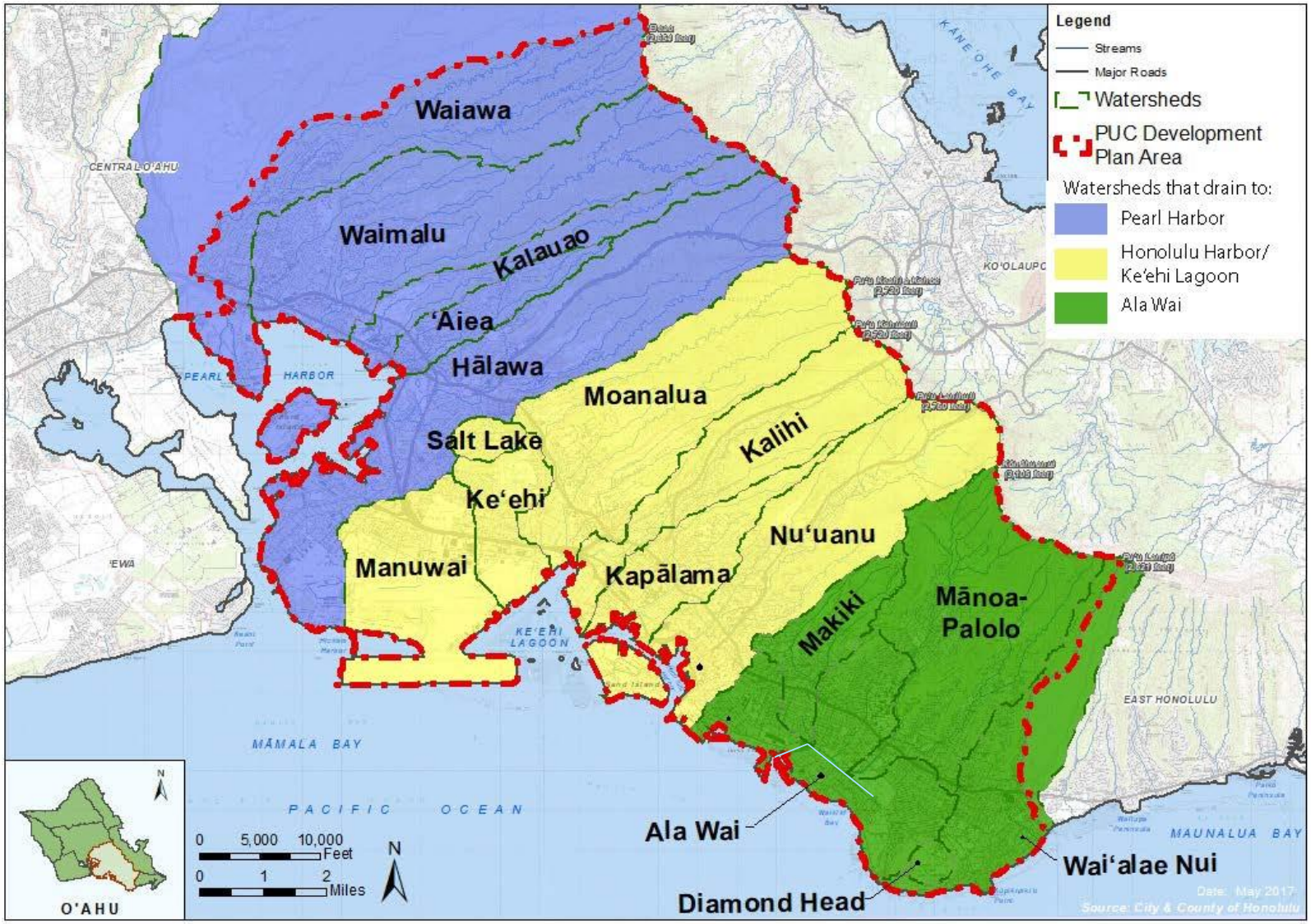
Watershed Management Plan Objectives

1. **Promote sustainable watersheds**
2. **Protect and enhance water quality and quantity**
3. **Protect native Hawaiian rights and traditional and customary practices**
4. **Facilitate public participation, education, and project implementation**
5. **Meet future water demands at reasonable costs**

Ahupua‘a Approach



Primary Urban Center (PUC):
Three Main Drainage Areas



PUC WMP Stakeholder Outreach

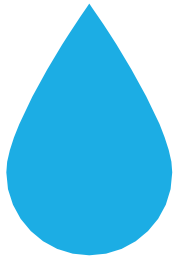
50+ In-person talk story with entities, organizations, and individuals + **17 Neighborhood Boards** + **4 Series of Community Meetings (12 total meetings)**

Community Meeting Schedule

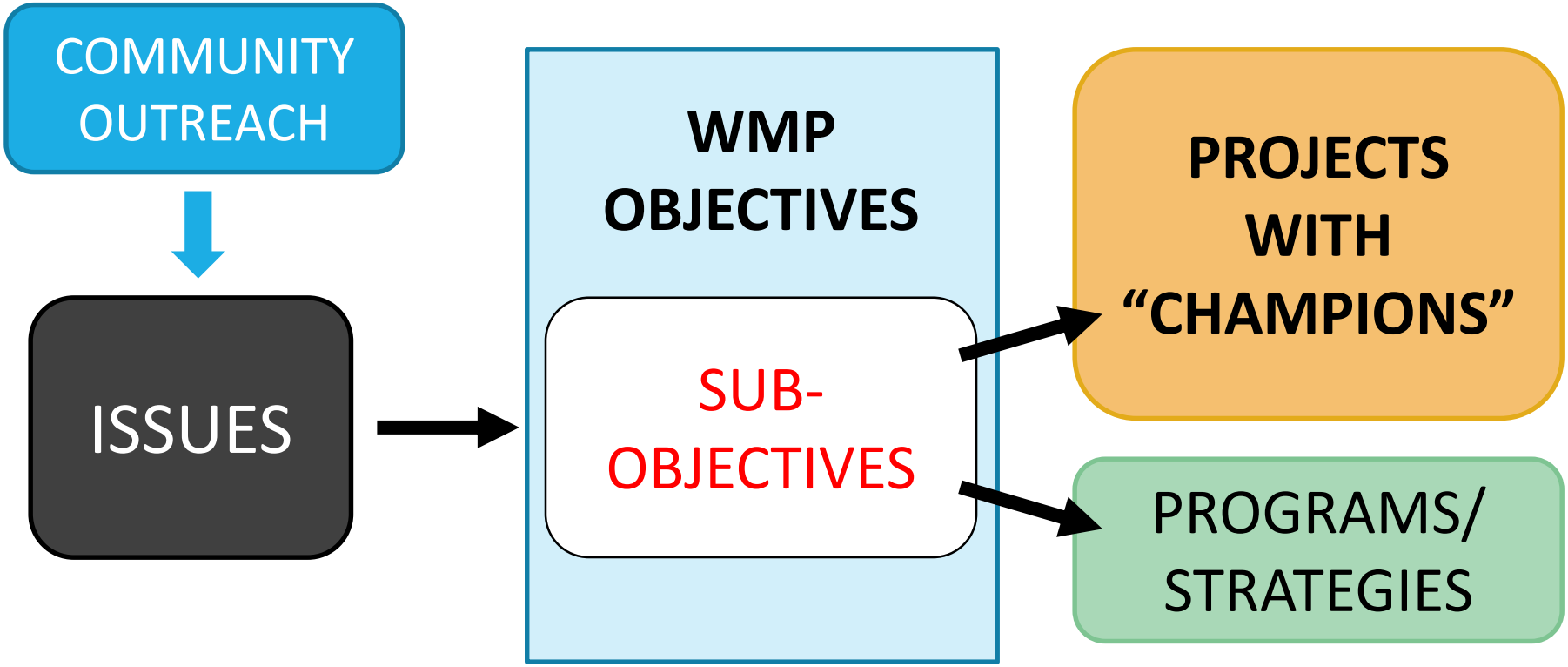
1st Series (May 2017)	2nd Series (March 2018)	3rd Series (Oct 2018)	4th Series (1st Qtr 2019)
• PUC Watershed Overview and Critical Issues	• PUC Water Use and Future Water Demands	• **PUC Watershed Projects, Programs and Strategies**	• PUC WMP Public Review Draft

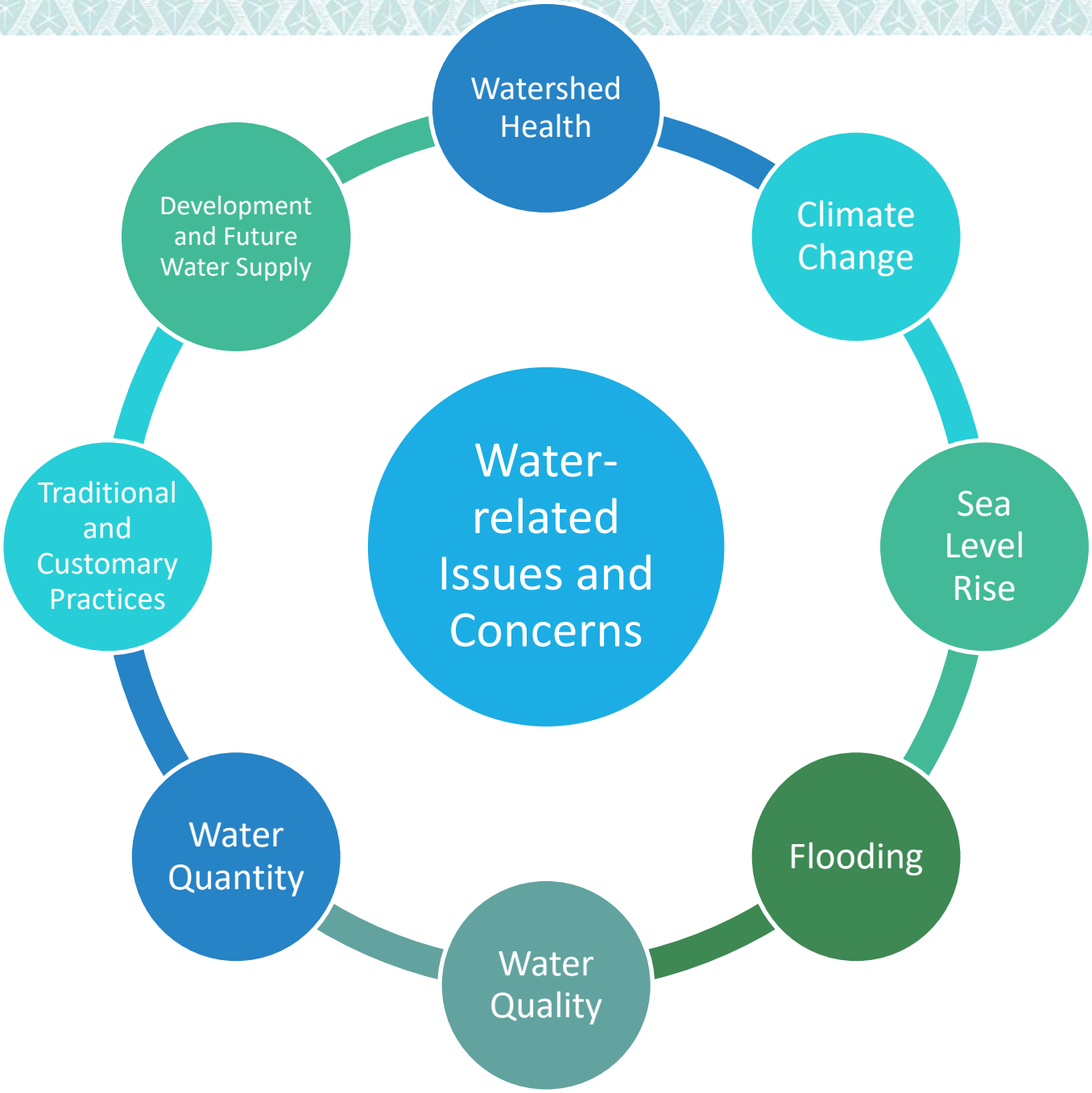
Issues and Concerns

Watershed Management Projects, Programs, and Strategies



PUC-Specific Sub-Objectives, Projects and Programs/Strategies Development




Water-related Issues and Concerns
Watershed Health
Climate Change
Sea Level Rise
Flooding
Water Quality
Water Quantity
Traditional and Customary Practices
Development and Future Water Supply

Issue: Watershed Health

- Degraded conditions of some of the forest lands
- Impacts of invasive plant species, feral pigs and recreational activities
- Reduced rainfall in some areas due to climate change

Issue: Watershed Health

Objective #1: Promote Sustainable Watersheds

Sub-Objective 1.1
Improve the overall health and water-absorbing capacity of PUC forest lands.

PROJECTS

- ❑ Native Forest Ecosystem Restoration
- ❑ Fencing and Ungulate Control
- ❑ Mānoa Valley Loʻi Restoration, Education, and Stewardship
- ❑ Hoʻoulu ʻĀina

PROGRAMS/STRATEGIES

- ❑ Albizia Removal and Reuse
- ❑ Native Plant Propagation and Outplanting Program
- ❑ Coordinated Pig Hunting Program
- ❑ Stream Restoration and Maintenance

Issue: Watershed Health

Native Forest Ecosystem Restoration

- 45% of PUC watersheds classified as "non-native" (USGS GIS data)
  - O'ahu Invasive Species Committee (OISC) and Ko'olau Mountains Watershed Partnership (KMWP) target specific non-native plant species
- BWS funding for watershed management projects:
  - Authorization to fund 4% of CIP budget (or approximately $3.3 million) a year
  - FY16-18, about **$754k** for Ko'oalu specific watershed projects, including to OISC, KMWP, and DOFAW

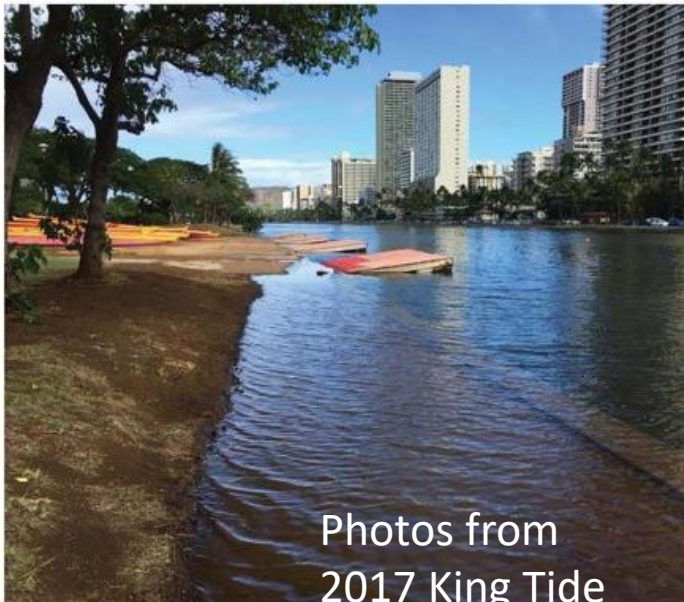
View of Kōnāhuanui
Photo credit: Katie Ersbak

Issue: Impacts of Sea Level Rise on Infrastructure and Development

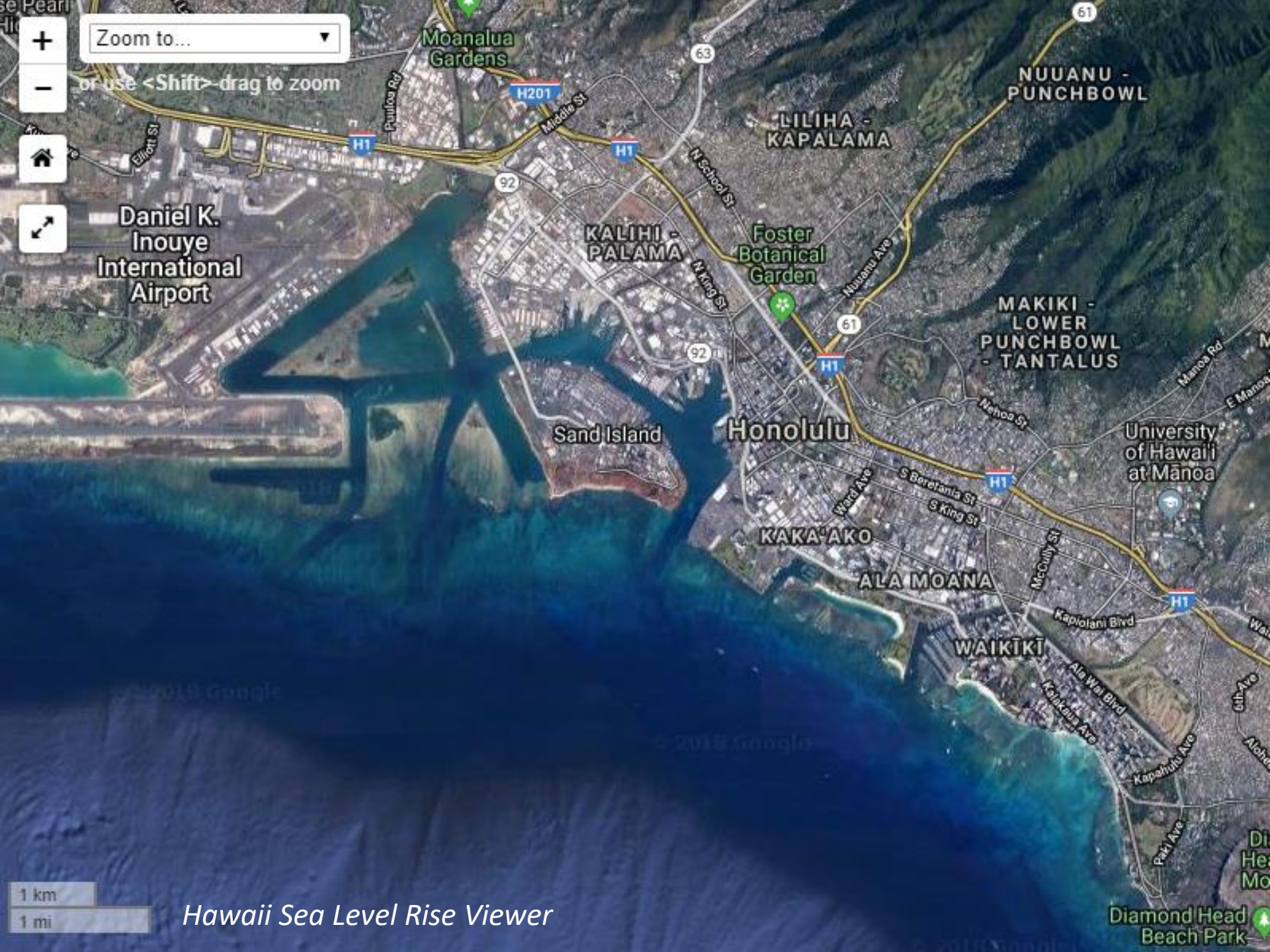






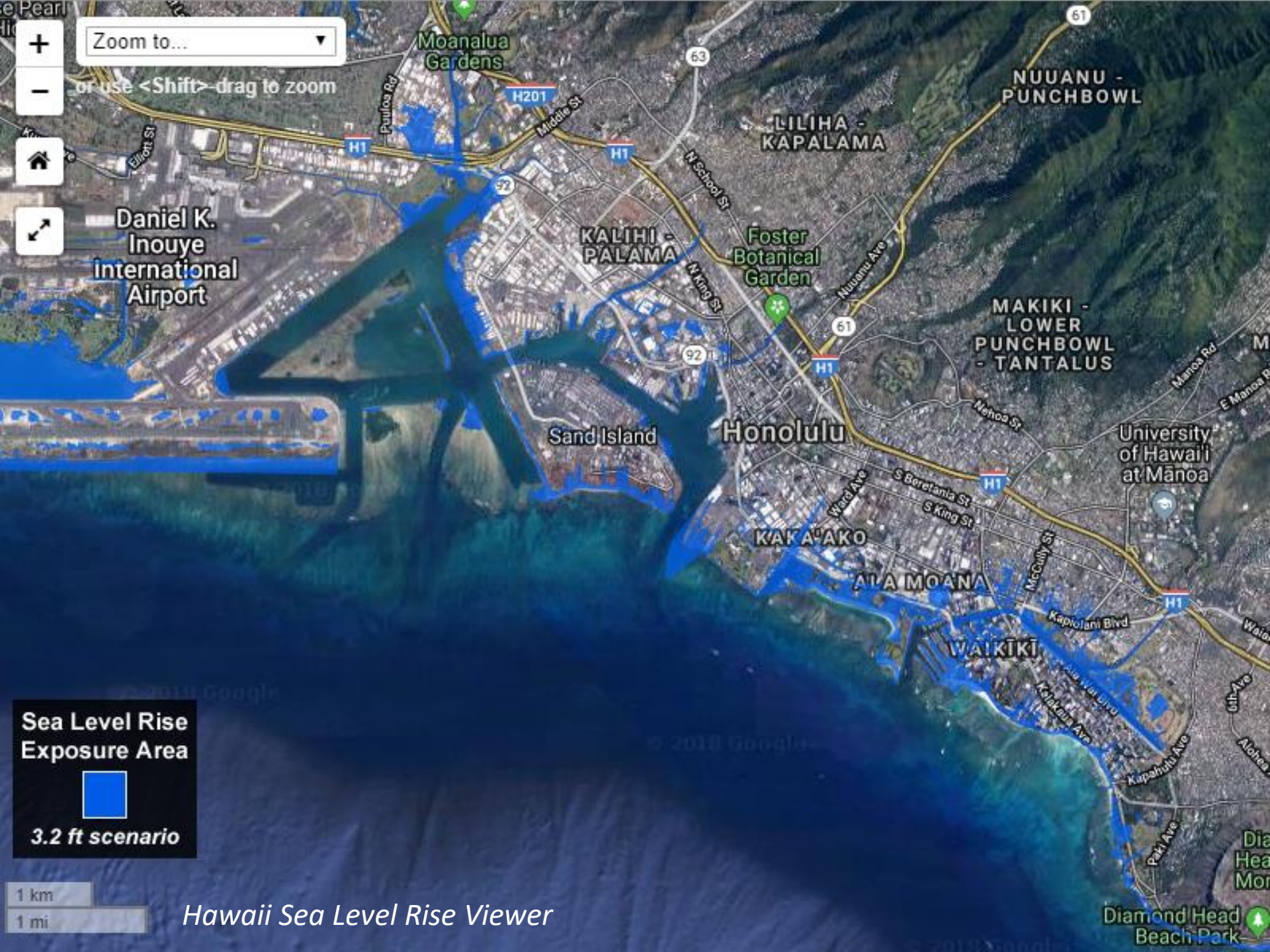


Photos from
2017 King Tide



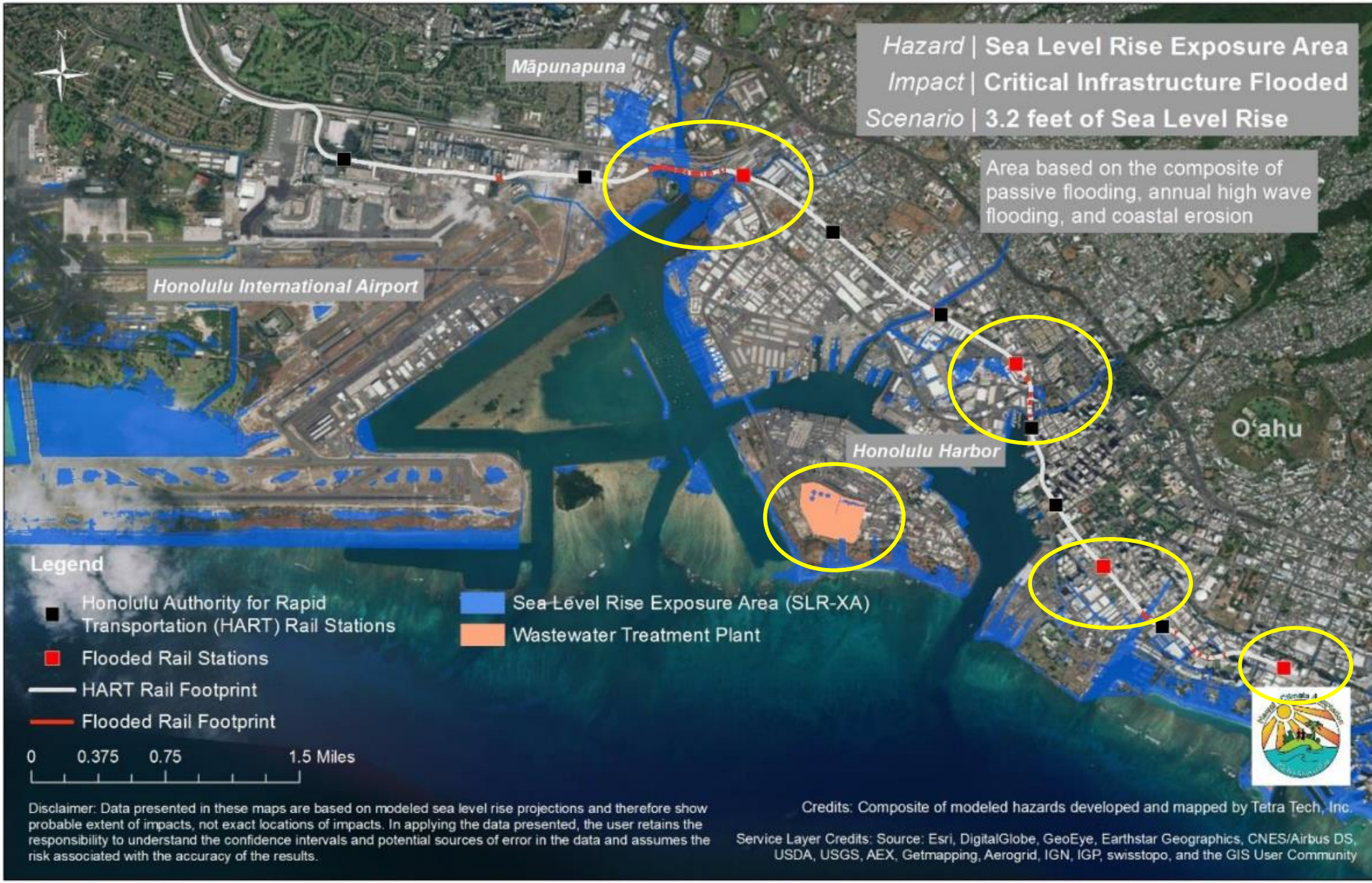
Hawaii Sea Level Rise Viewer

Hawaii Sea Level Rise Viewer



Hawaii Sea Level Rise Viewer

NOAA Sea Level Rise Viewer



Critical infrastructure in the SLR-XA with 3.2 feet of sea level rise
Source: Hawai'i Sea Level Rise Vulnerability and Adaptation Report (2017)

Issue: Impacts of Sea Level Rise on Infrastructure and Development

Objective #1: Promote Sustainable Watersheds

Sub-Objective 1.2
Adapt to and plan for climate change and sea level rise, particularly its impacts on coastal infrastructure and people of the PUC.

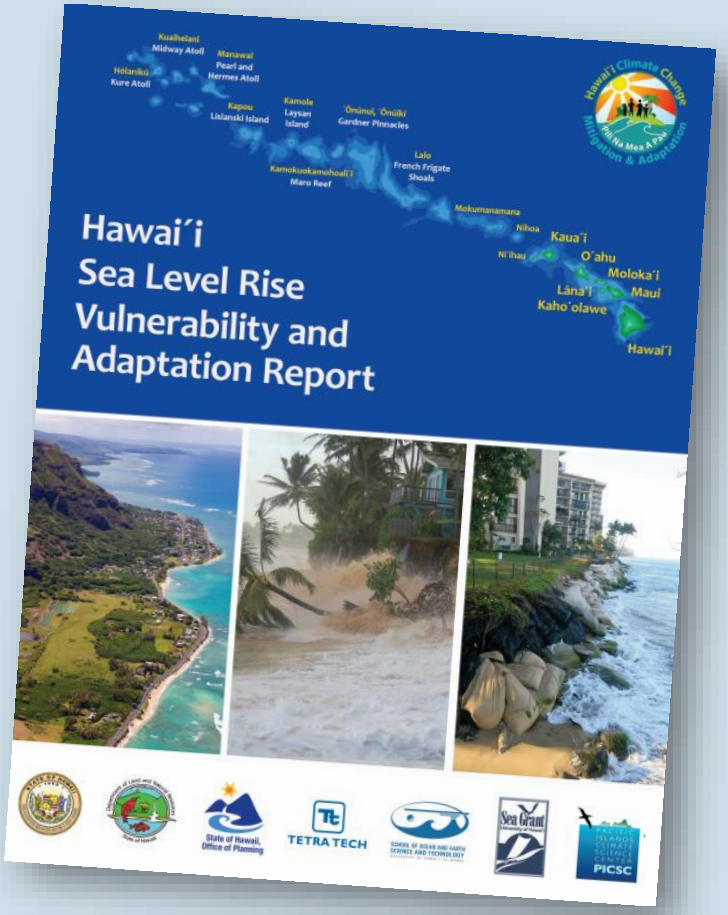
PROJECTS

- ❑ Execute the Mayor's City-wide Directive on Climate Change and Sea Level Rise
- ❑ City-wide Infrastructure Resiliency- Integrated Response to Sea Level Rise and Flooding due to Climate Change

Issue: Impacts of Sea Level Rise on Infrastructure and Development

Execute the Mayor's City-wide Directive on Climate Change and Sea Level Rise

- Directive issued July 2018
  - Responsibilities for implementation
  - References the Commission's Guidance and Brief, and State's Report and Hawaii Sea Level Rise Viewer
  - Revisions to amend shoreline rules and regulations
  - SLR targets
    - Up to 3.2 ft of high tide flooding by mid-century
    - Up to 6 ft of high tide flooding by 2100, **especially for critical infrastructure with long expected lifespans and low risk tolerance**



Issue: Water Quality

- Polluted runoff
- Impacts of urban land uses on nearshore and surface waters, and ground water

Issue: Water Quality

Objective #2: Promote and Enhance Water Quality and Quantity

Sub-Objective 2.1
Reduce polluted urban runoff and to improve the quality of the PUC's nearshore waters.

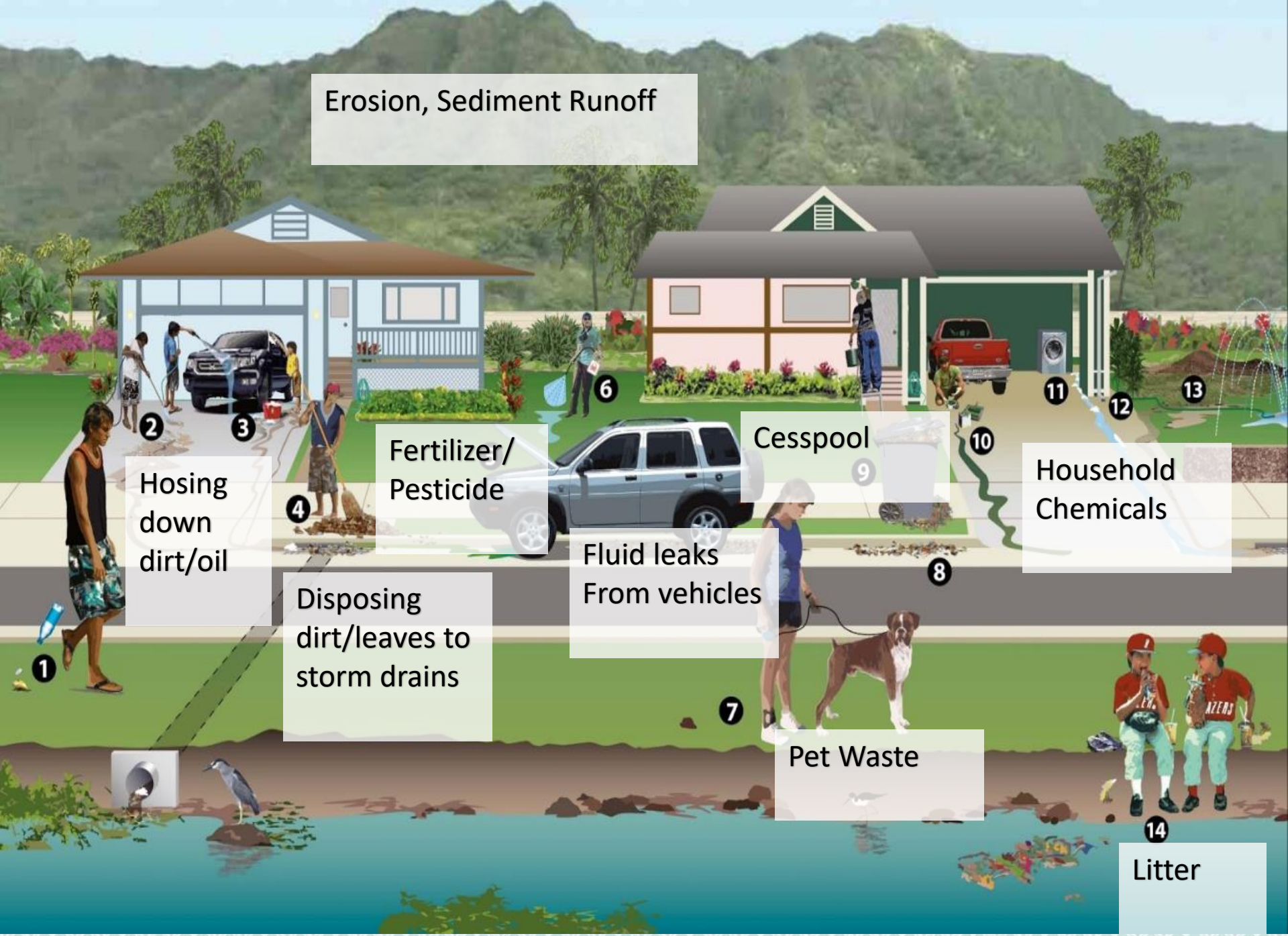
Sub-Objective 2.2
Protect the quality of the PUC's ground water resources from urban land uses.

PROJECTS

- ❑ Pearl Harbor Estuary Water Quality Improvement & Ecosystem Restoration
- ❑ Abandoned Well-Sealing Program
- ❑ Red Hill Fuel Tanks Rehabilitation
- ❑ Potable Source Water Protection

PROGRAMS/STRATEGIES

- ❑ Stream Restoration and Maintenance
- ❑ Incorporate Low Impact Development Techniques
- ❑ Upgrade Cesspools to Septic Systems or Connect to Sewer System


Erosion, Sediment Runoff
Hosing down dirt/oil
Fertilizer/ Pesticide
Cesspool
Household Chemicals
Disposing dirt/leaves to storm drains
Fluid leaks From vehicles
Pet Waste
Litter
1
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14

Project, Programs and Strategies to Protect Water Quality

Issue: Flooding

- Undersized and not well maintained stream channels
- Threat to health and safety, and property

March 2006: overflowing of Makiki Stream during rain storm

Issue: Flooding

Objective #2: Promote and Enhance Water Quality and Quantity

Sub-Objective 2.3
Restore the function of perennial streams of the PUC, including Mānoa Stream and Nu'uanu Stream.

Sub-Objective 2.4
Use a watershed approach to improve water quality and mitigate major flooding of the Ala Wai Canal and its tributaries.

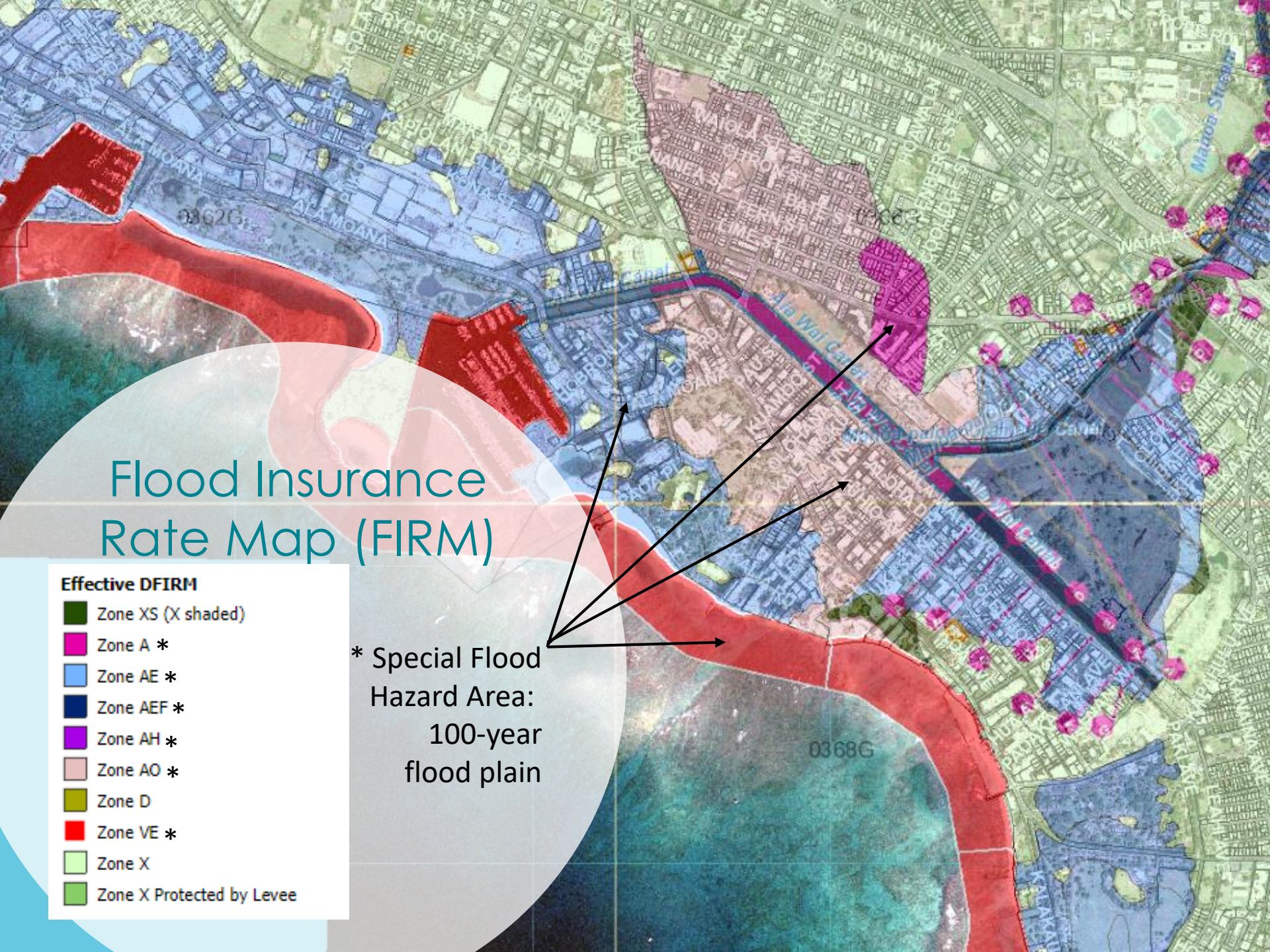
PROJECTS

- ❑ Ala Wai Flood Mitigation
- ❑ Ala Wai Watershed Collaboration

PROGRAMS/STRATEGIES

- ❑ Stream Restoration and Maintenance

Flood Insurance Rate Map (FIRM)

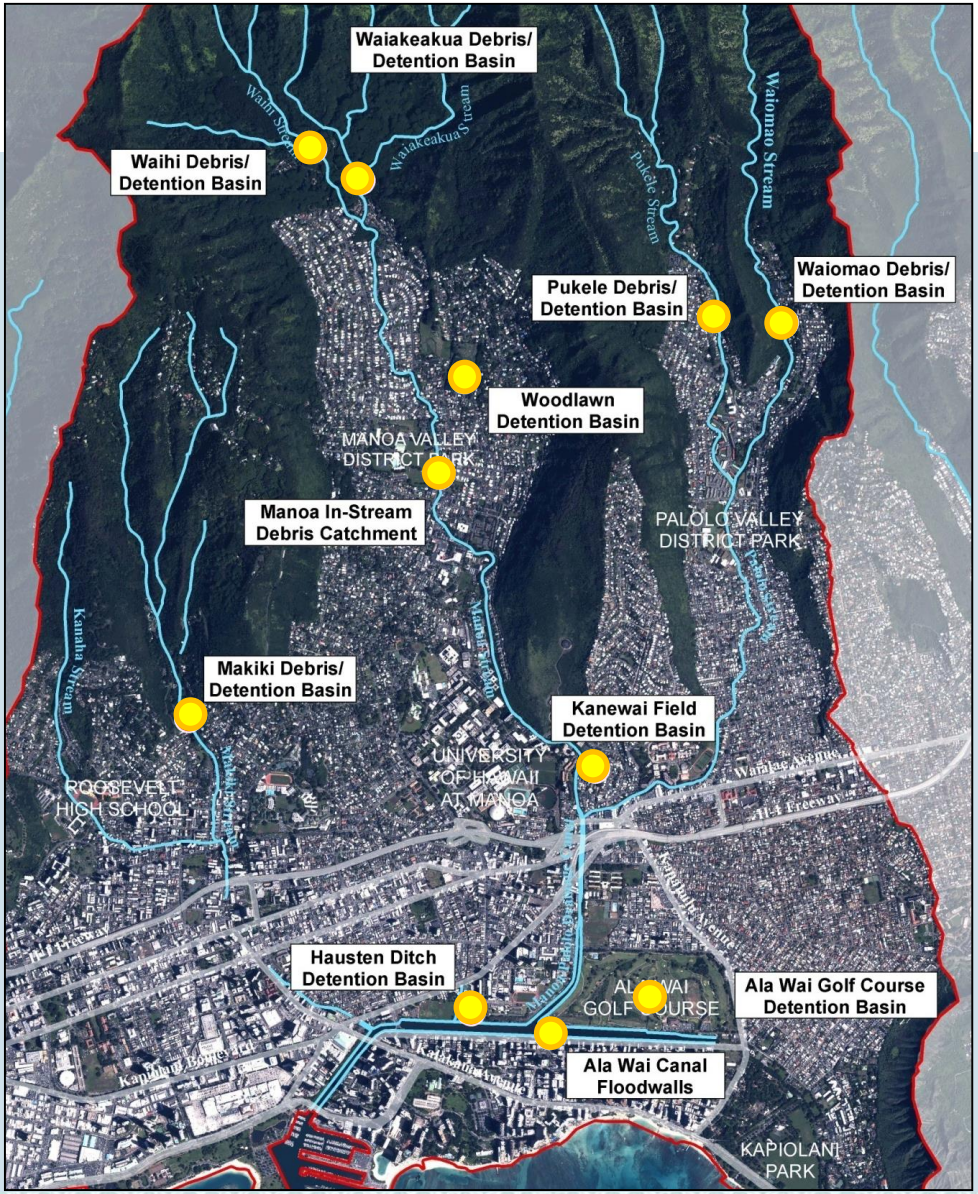


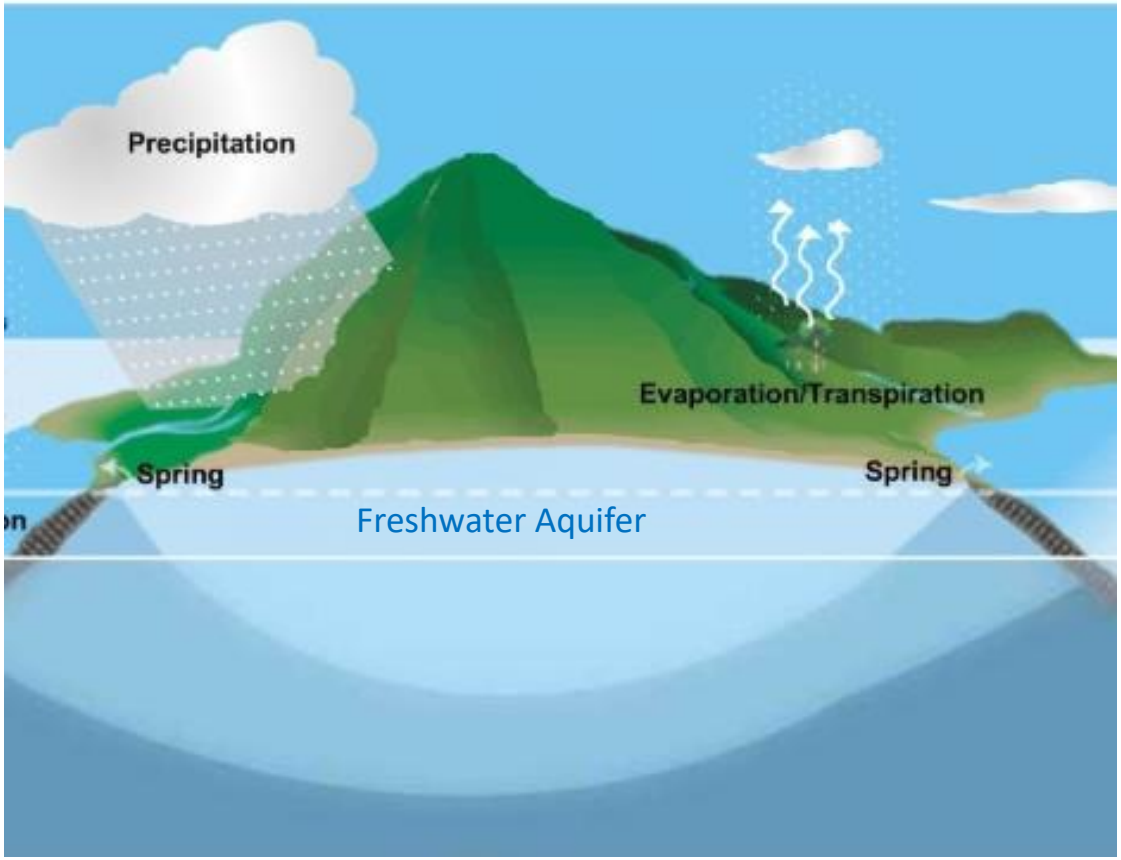
Issue: Flooding

Ala Wai Canal Flood Mitigation

- USACE completed Feasibility Study with EIS (May 2017)
- U.S. Congress appropriated bill (2018) for the design and construction of the project; need a "local sponsor" to commit to funding 35% of design

Makiki Debris and Detention Basin





Issue: Water Quantity

- Much of the PUC's natural ground water supply is being used for human consumption.
- Climate change may decrease rainfall in the PUC, reducing the sustainable yield of PUC aquifers.

Issue: Water Quantity

Objective #2:
Promote and Enhance Water Quality and Quantity

Sub-Objective 2.5
Protect and enhance the sustainability of PUC ground water aquifers.

PROJECTS

- ❑ Native Forest Ecosystem Restoration
- ❑ Fencing and Ungulate Control
- ❑ Nu‘uanu Hydroelectric and Managed Aquifer Recharge

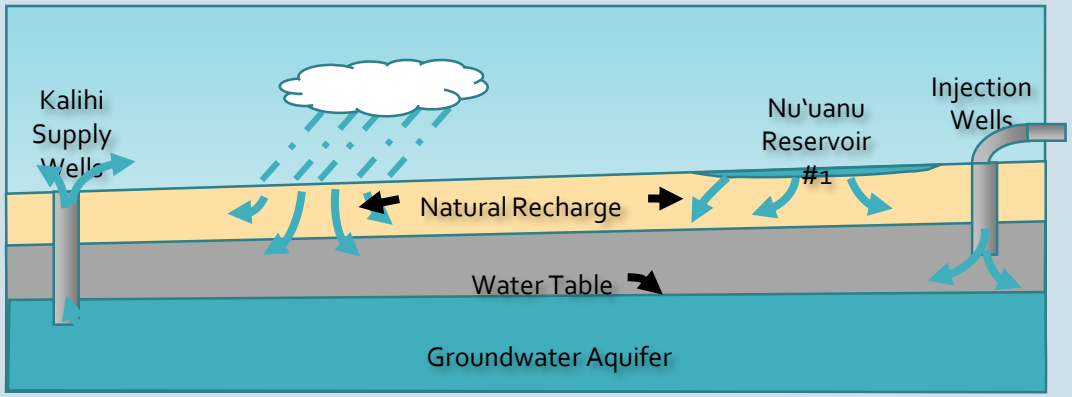
PROGRAMS/STRATEGIES

- ❑ Incorporate Low Impact Development Techniques

Issue: Water Quantity

Nu‘uanu Hydroelectric and Managed Aquifer Recharge

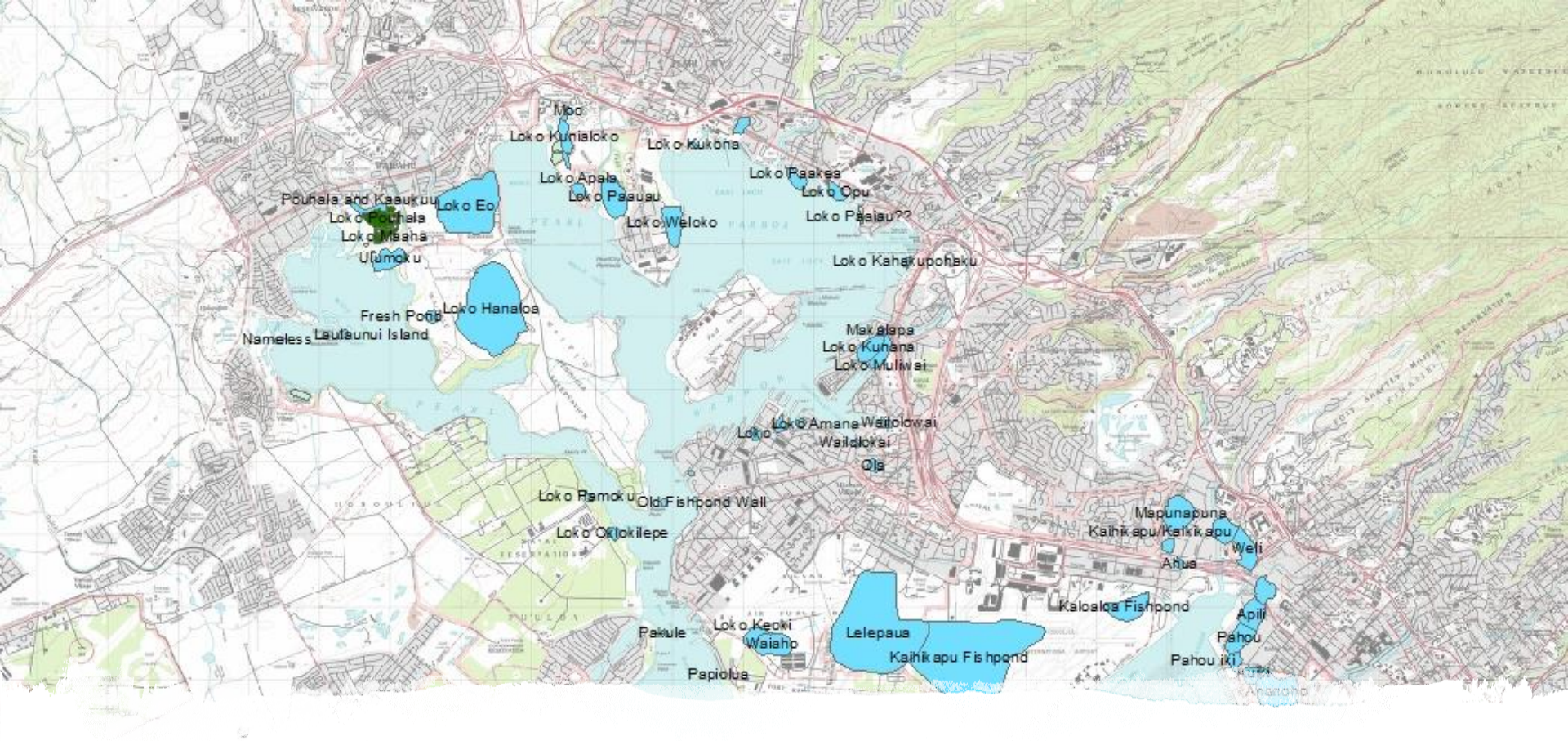
- Capture stormwater at BWS Reservoir
- Generate hydroelectricity
- Filter and inject stormwater into Kalihi aquifer
- Enhance ground water aquifer recharge
- Allows Kalihi Pump Station to sustain or increase pumping levels
  - Increase water supply by 1 to 2 million gallons per day (mgd)
- BWS needs to complete a feasibility study and environmental review



Issue: Impacts to Traditional and Customary Practices

- Urbanization
  - Impacts to water availability and spring and stream flows
  - Reduced feasibility of traditional farming and aquaculture practices
- Overall forest health
  - Fewer places to gather
  - Overharvesting
- Restricted access from fencing

Mānoa Valley



- Fishpond Detectives: Mapping project by the Nature Conservancy of Hawaii's historical fishponds
- 50+ fishponds in the PUC, including Pu'uloa (Pearl Harbor)
  - Many destroyed, overgrown, filled in and built upon

Issue: Impacts to Traditional and Customary Practices

Objective #3: Protect Native Hawaiian Rights and Traditional and Customary Practices

Sub-Objective 3.1

Provide assistance to non-profit entities that are engaged in environmental restoration, teaching and practicing traditional agriculture and aquaculture in the PUC.

PROJECTS

- ❑ Loko I‘a Restoration, Education, and Stewardship
- ❑ Mānoa Valley Lo‘i Restoration and Cultural Learning Site
- ❑ Kalauao- Lo‘i Restoration, Education, and Stewardship
- ❑ Ho‘oulu ‘Āina

PROGRAMS/STRATEGIES

- ❑ Watershed Talk Stories
- ❑ Native Plant Propagation and Outplanting Program

Issue: Impacts to Traditional and Cultural Practices

Mānoa Valley Loʻi Restoration and Cultural Learning Site

- 5.5-acre site owned by BWS
- Cleared more than 50 albizia trees, constructed loʻi kalo
- Goal to create a space for place-based education programs, hands-on learning, watershed protection and restoration work.
  - Draft Environmental Assessment (EA) is being prepared for BWS
- Protect and preserve "pockets" of resources and practices that exist within the PUC

Issue: Development & Future Water Supply

"Is there enough water for current populations and future planned development?"

Issue: Development & Future Water Supply

Objective #5: Meet Public Water Demands at Reasonable Costs

Sub-Objective 5.1
Plan and implement programs that will increase water efficiency, provide a greater diversity of water supplies, and increase resiliency of water sources.

PROJECTS

- ❑ BWS Conservation and Education Programs
- ❑ Ala Wai Golf Course Water Recycling Facility
- ❑ Expand Usage of the BWS Kalauao Springs Non-Potable Water System

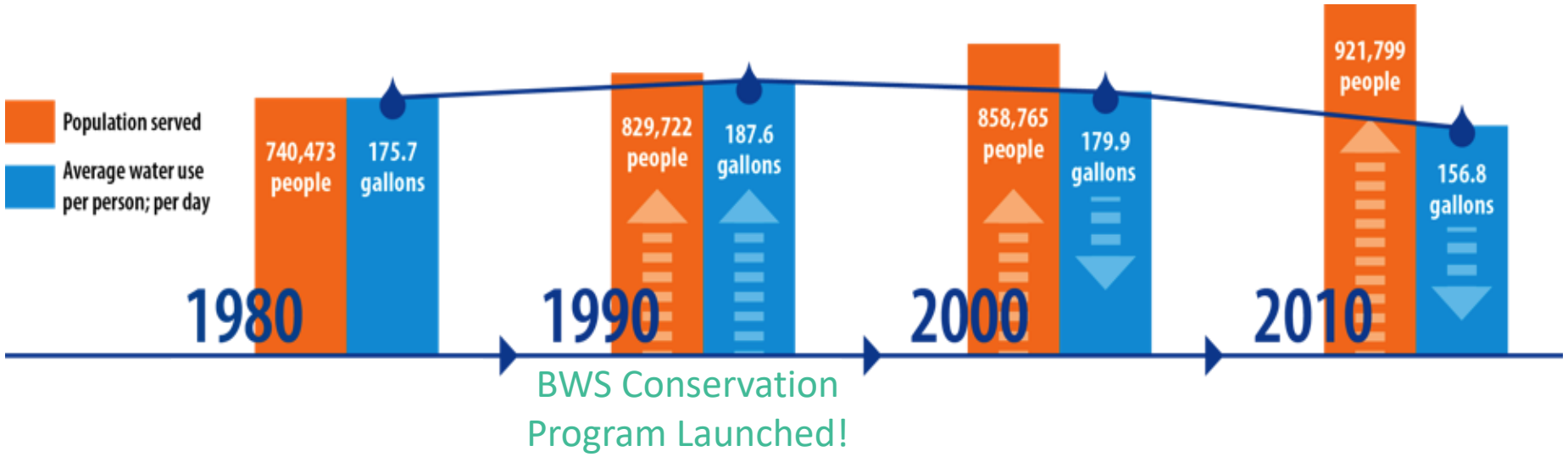
PROGRAMS/STRATEGIES

- ❑ Gray Water Reuse
- ❑ Incorporate Low Impact Development Techniques

Issue: "Is there enough water for future development?"

Current BWS Water Conservation & Education Programs

O'ahu's Water Conservation Success Story



10 billion gallons per year are now saved for other uses today vs.1990

Projections for Future Water Demand

Why project future water demand?

- ✓ To determine how much and when water may be needed in the future
- ✓ To indicate when increased demands might require infrastructure upgrades
- ✓ To provide guidance for responsible land and water use decisions

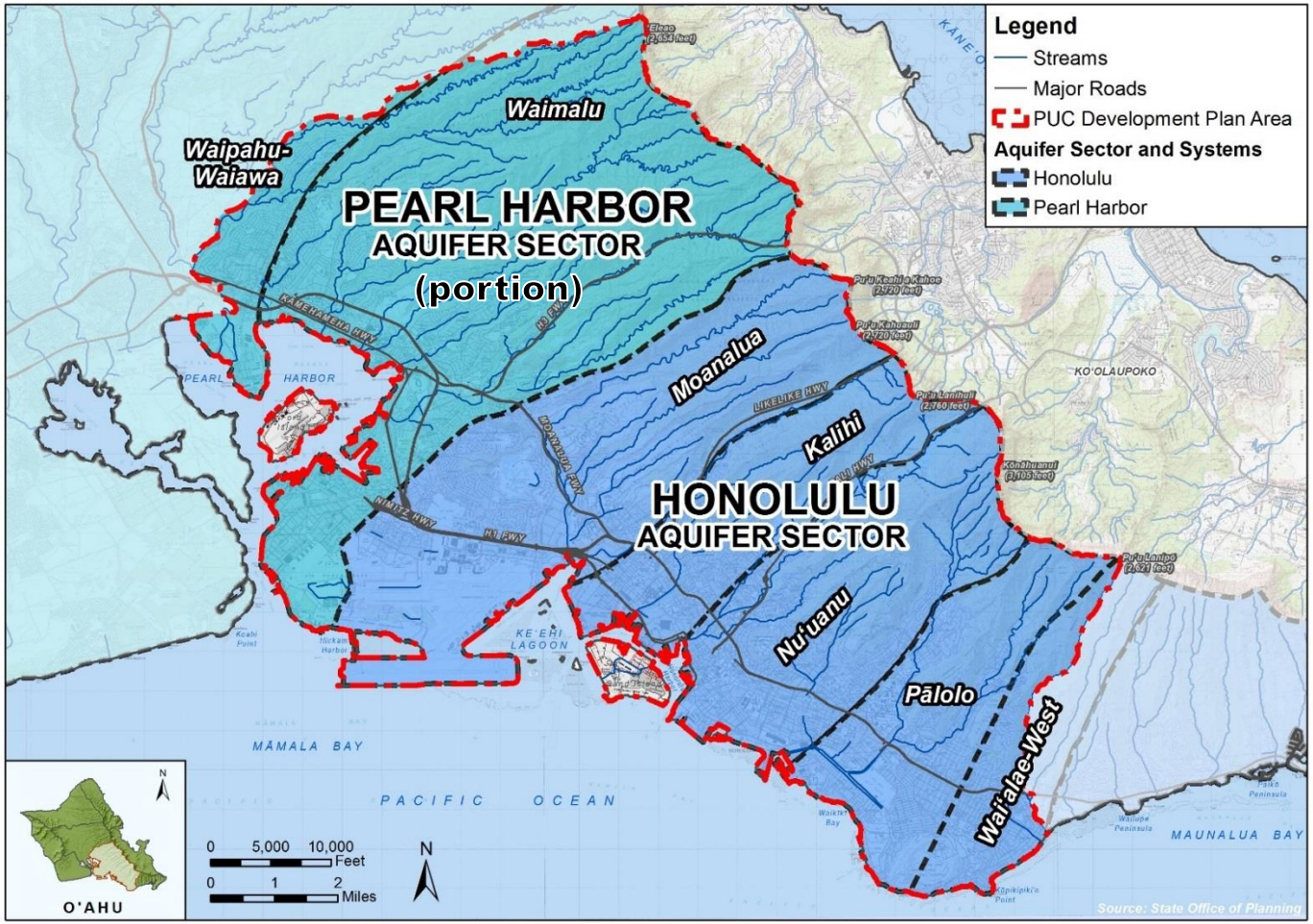
Issue: "Is there enough water for future development?"

Projections for Future Water Demand

Scenario	Summary of Storyline	BWS-Served Pop. Change from 2010
Most Probable (2040)	• City population projection is based on General Plan and PUC Development Plan • BWS implements significant water conservation measures, reducing the per capita water demand for existing and future users (140 gallons per capita per day) from present-day per capita demand	+ 28,500 *(6% increase)*
Ultimate (2100)	• After a period of high growth and development in the beginning of the 21st century, the impacts of climate change significantly slow growth in the second half of the century • Decreased rainfall due to climate change causes a 23% increase in irrigation water demand • The per capita water demand of the BWS-served population is the same as in the Most Probable Scenario after the year 2040	+ 125,400 *(27% increase)*

Issue: "Is there enough water for future development?"

PUC Potable Ground Water Resources

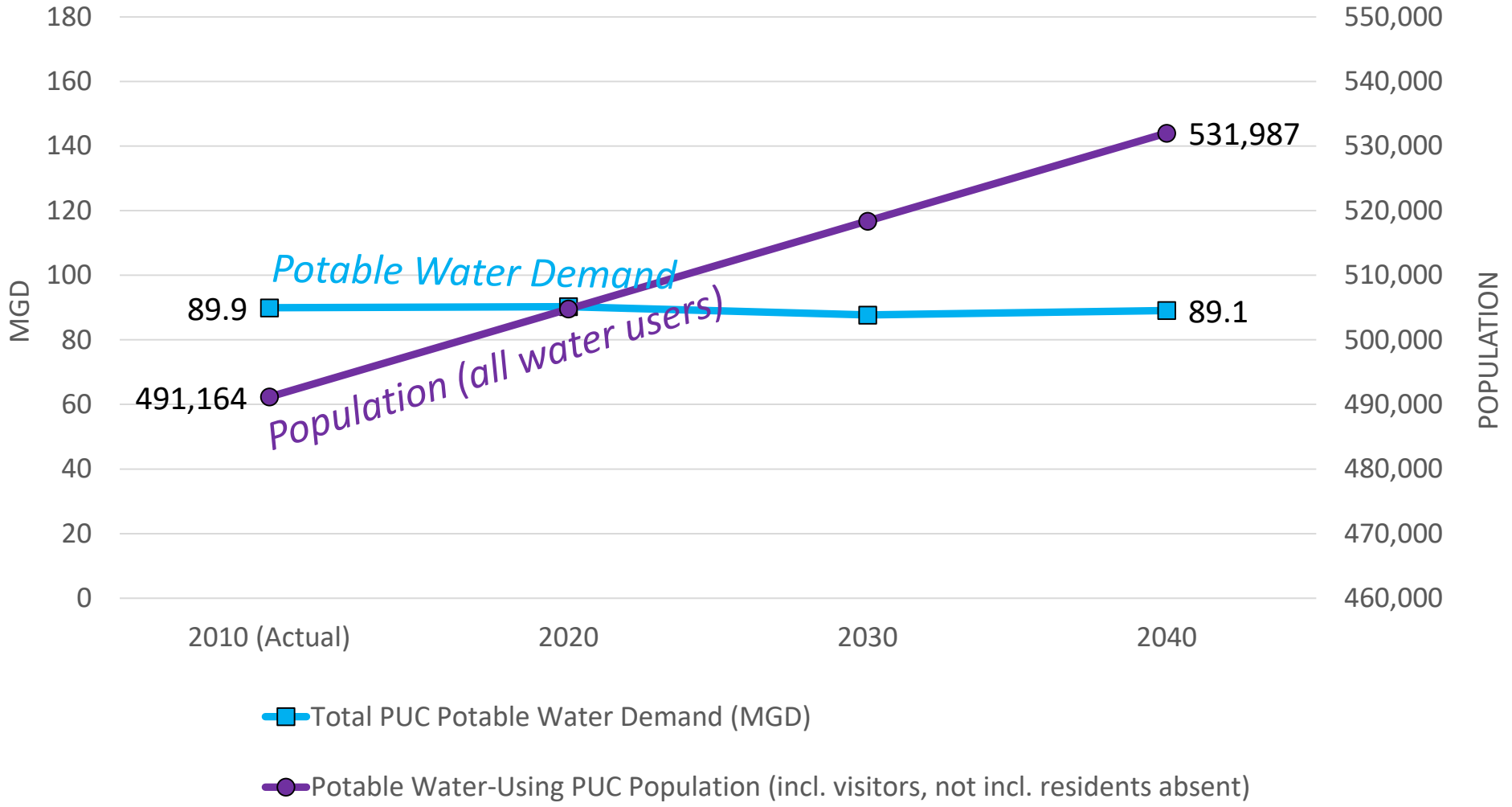


AQUIFER SUSTAINABLE YIELD	
PEARL HARBOR SECTOR AREA	
Waipahu-Waiawa (only partially in PUC)	104
Waimalu	45
HONOLULU SECTOR AREA	
Moanalua	16
Kalihi	9
Nu'uanu	14
Pālolo	5
Wai'alae-West (only partially in PUC)	4
TOTAL	**197**

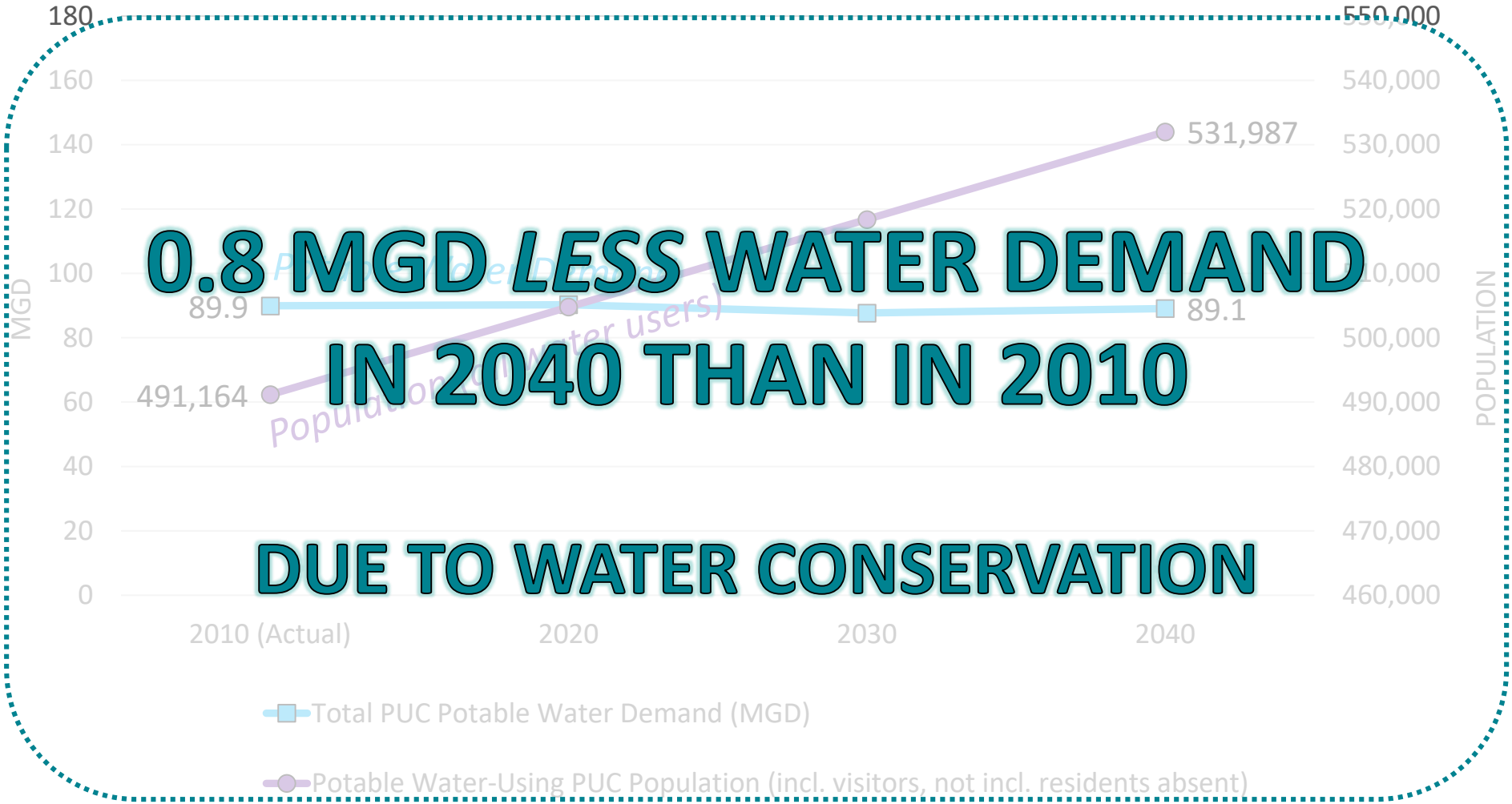
DEMAND & SUPPLY PROJECTIONS:
Year 2040 "Most Probable" Scenario

Issue: "Is there enough water for future development?"

Year 2040: Potable Water Demand for the "Most Probable" Scenario



Year 2040: Potable Water Demand for the "Most Probable" Scenario

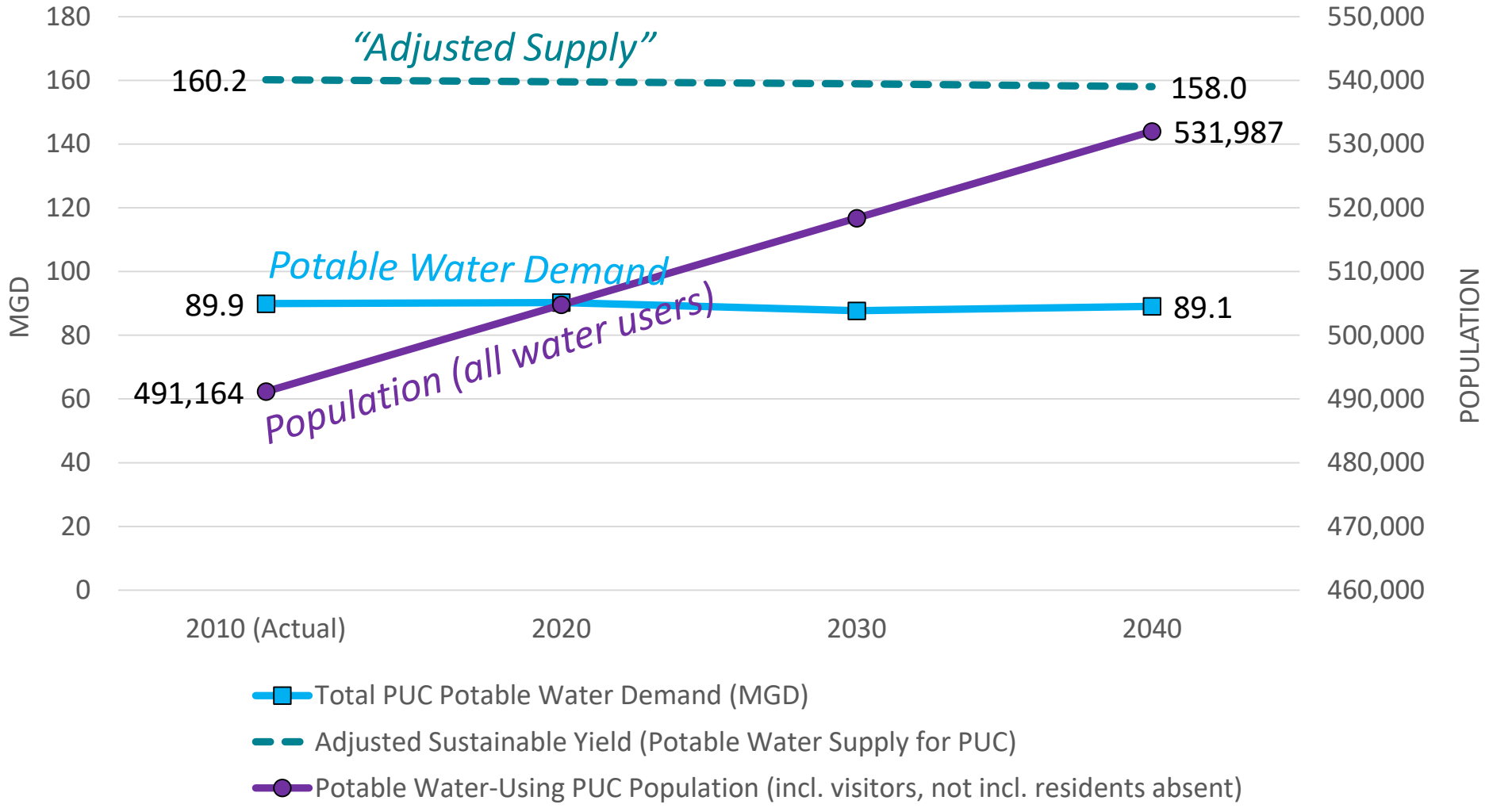


0.8 MGD *LESS* WATER DEMAND IN 2040 THAN IN 2010

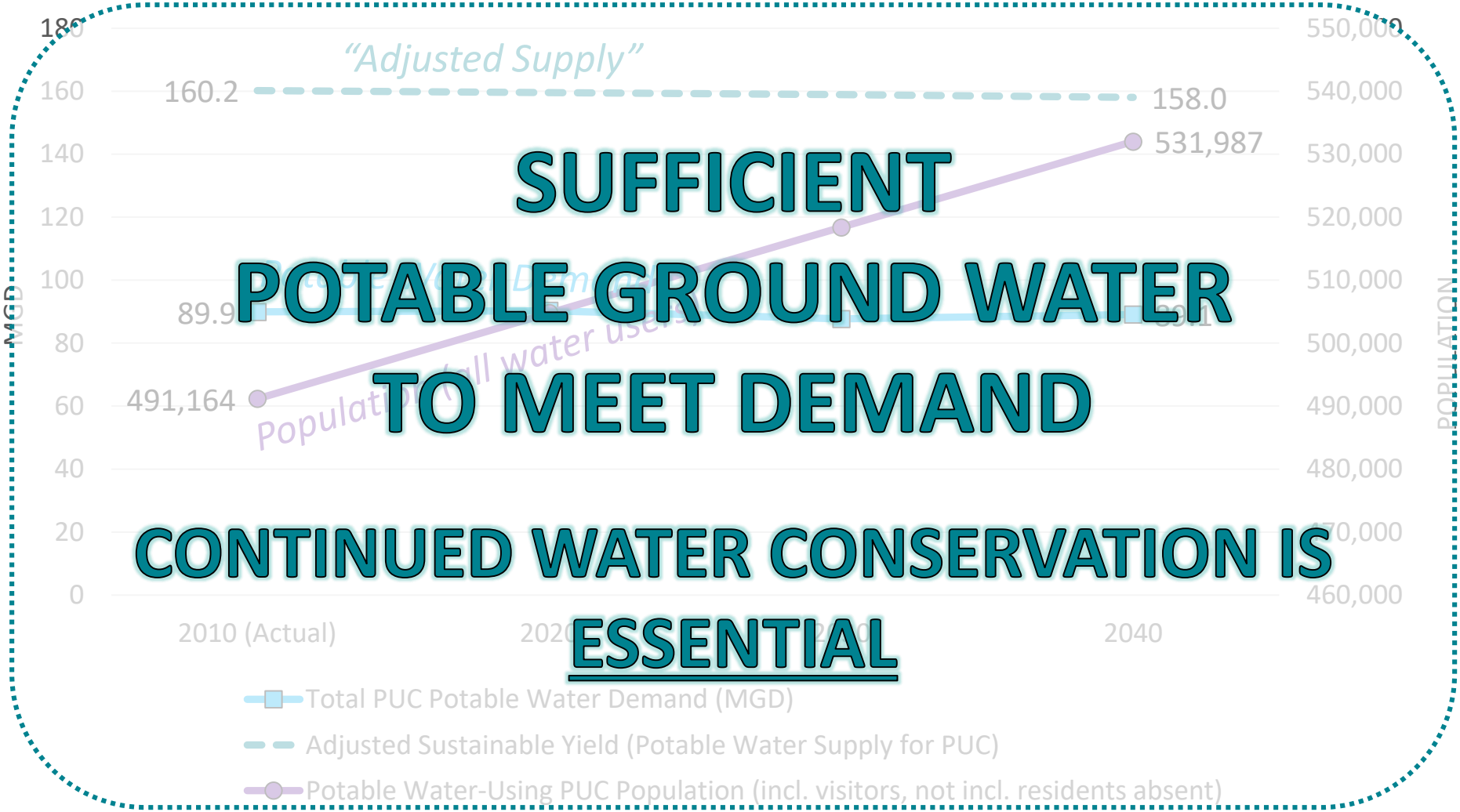
DUE TO WATER CONSERVATION

Issue: "Is there enough water for future development?"

Year 2040: Potable Water Demand & Supply for the "Most Probable" Scenario



Year 2040: Potable Water Demand & Supply for the "Most Probable" Scenario



SUFFICIENT POTABLE GROUND WATER TO MEET DEMAND

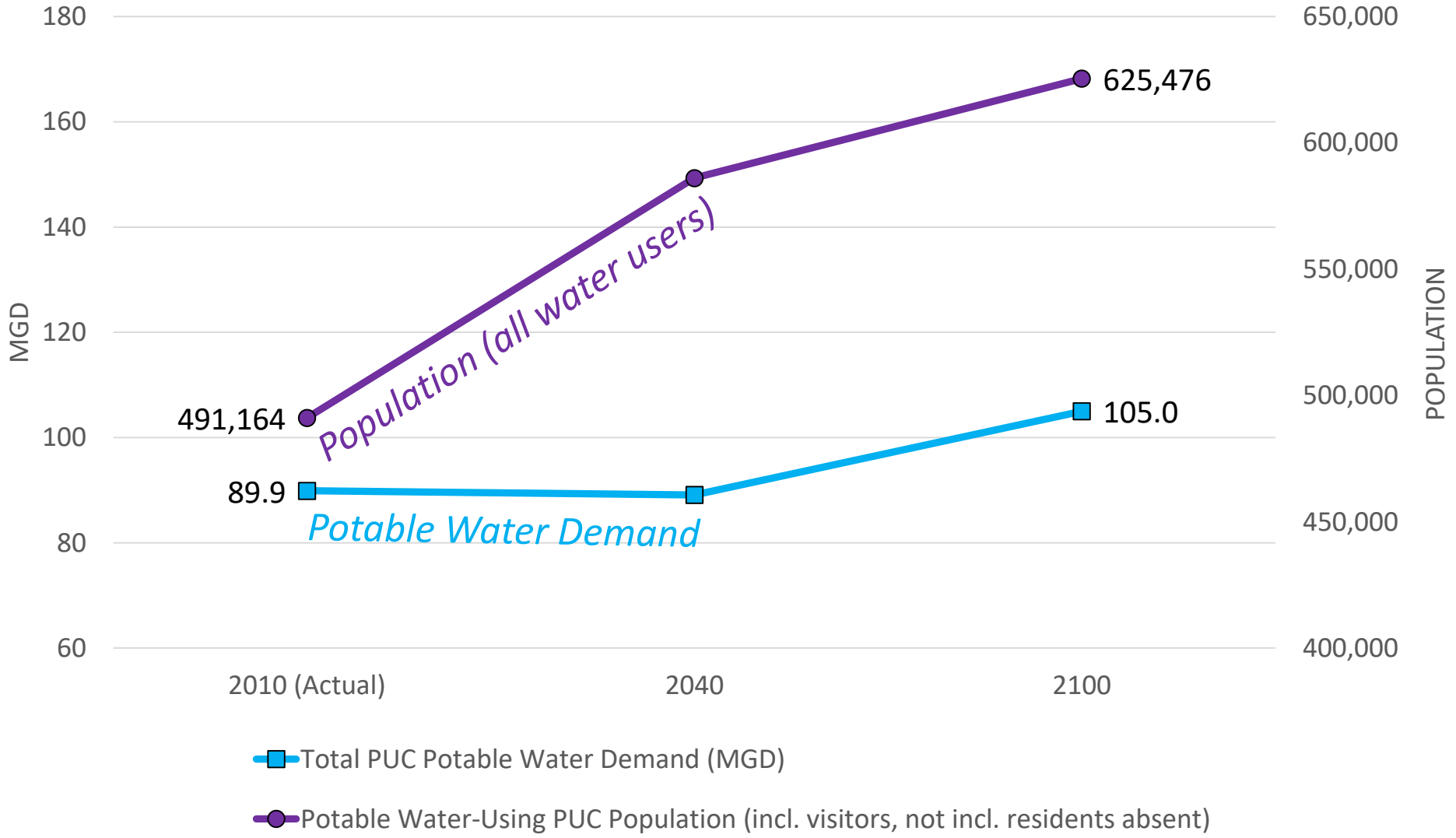
CONTINUED WATER CONSERVATION IS ESSENTIAL

DEMAND & SUPPLY PROJECTIONS:

Year 2100 Scenario

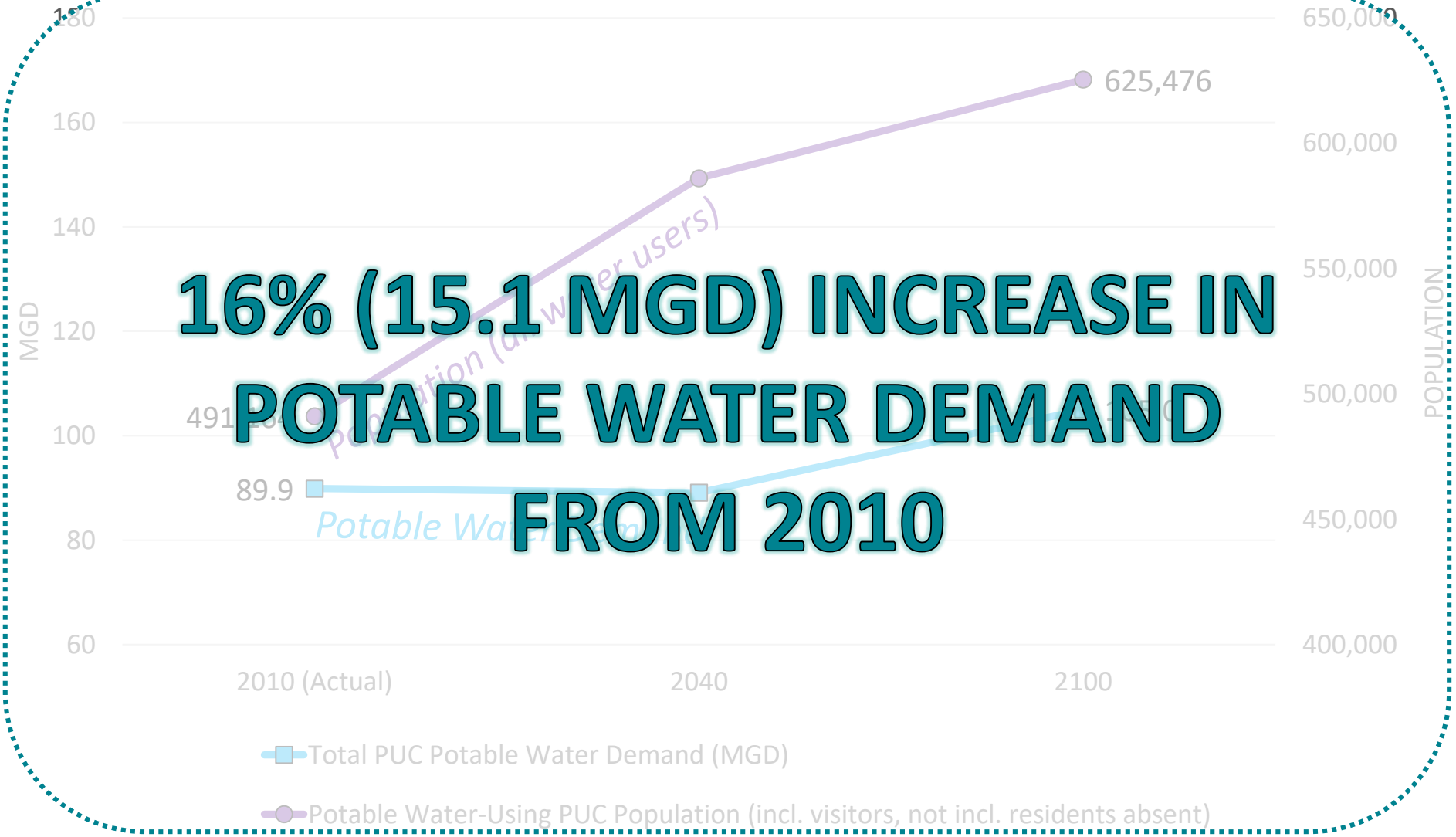
Issue: "Is there enough water for future development?"

Year 2100: Potable Water Demand Projection



Issue: "Is there enough water for future development?"

Year 2100: Potable Water Demand Projection



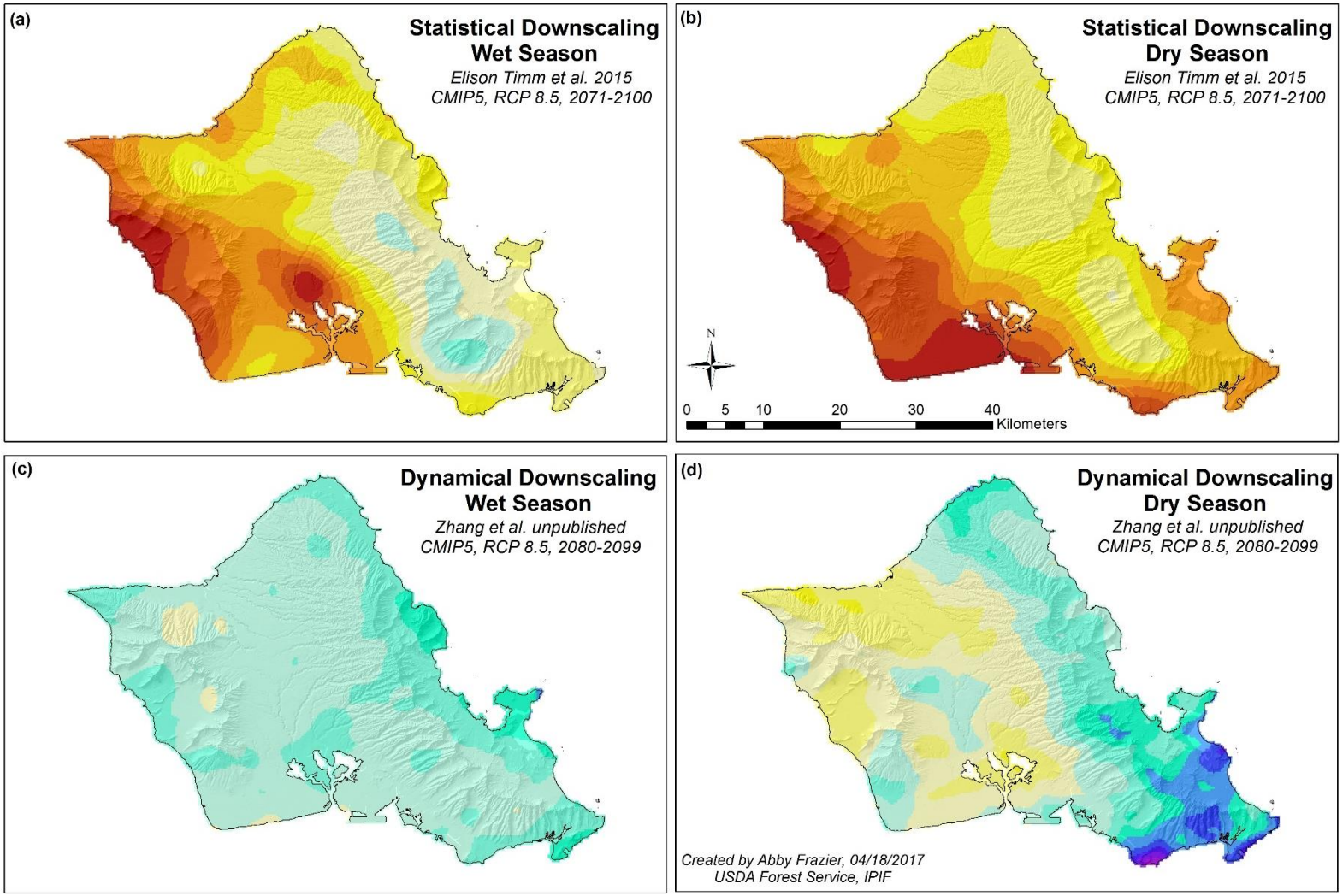
16% (15.1 MGD) INCREASE IN POTABLE WATER DEMAND FROM 2010

Issue: "Is there enough water for future development?"

Year 2100: Climate Change Projections

Drier = "Worst Case"

Wetter = "Best Case"

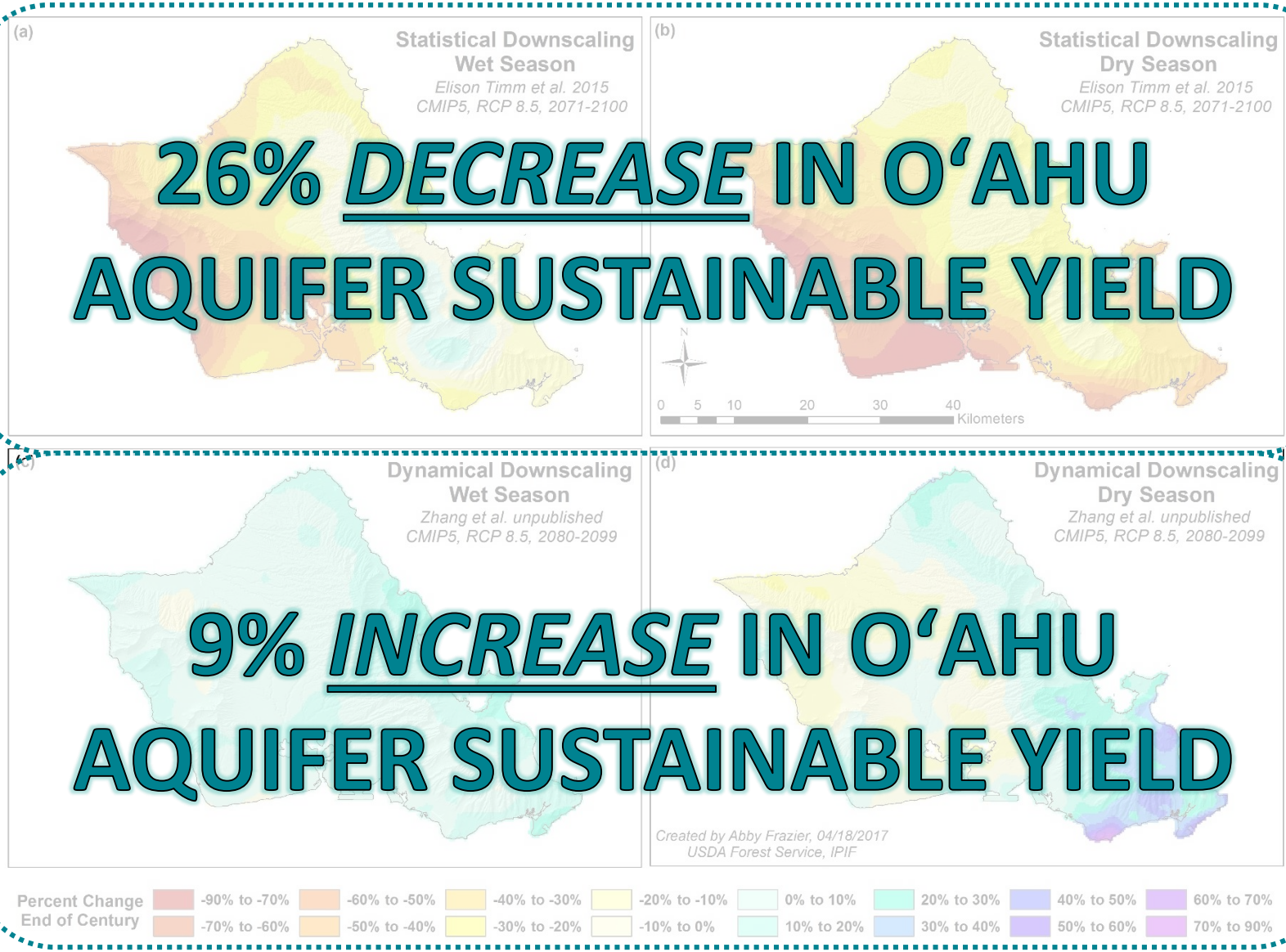


Issue: "Is there enough water for future development?"

Year 2100: Climate Change Projections

Drier = "Worst Case"

Wetter = "Best Case"

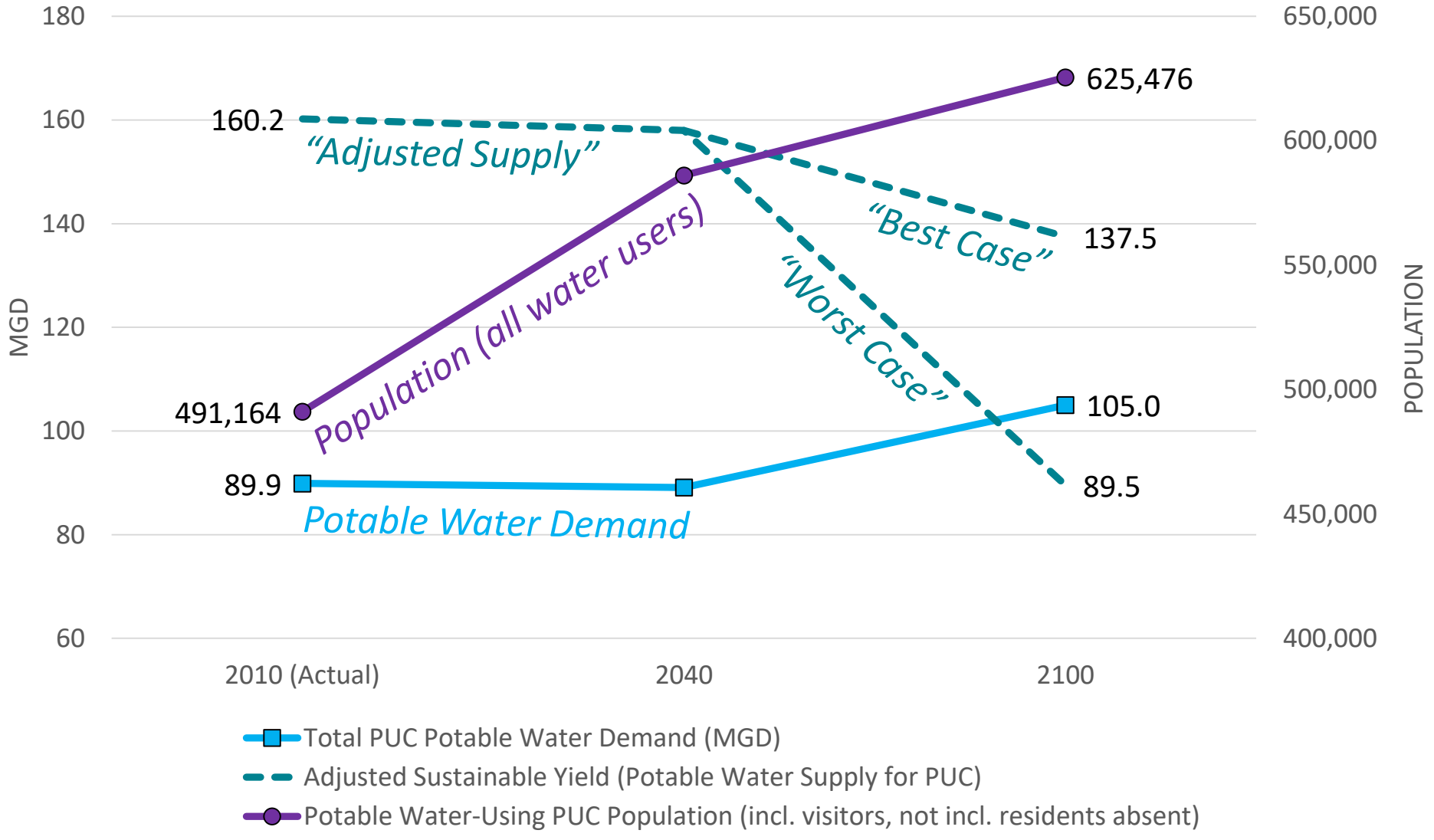


26% *DECREASE* IN O'AHU AQUIFER SUSTAINABLE YIELD

9% *INCREASE* IN O'AHU AQUIFER SUSTAINABLE YIELD

Issue: "Is there enough water for future development?"

Year 2100: Potable Water Demand & Supply Projections



Year 2100: Potable Water Demand & Supply Projections

"Best Case" sustainable yield scenario:

- Sufficient potable ground water to meet demand
- Other environmental issues anticipated (e.g. flooding)

"Worst Case" sustainable yield scenario:

- Significant strain on ground water resources
- Need to implement aggressive water conservation measures to reduce per capita demand

Priority Actions for "Worst Case" Climate Change Scenario

- ✓ Continue to reduce per capita demand using water conservation strategies
  - 2010 PCD in PUC: 151 GPCD
  - Goal 2100 PCD: 100 GPCD

PCD = Per capita demand

GPCD = Gallons per capita per day

- ✓ Protect and manage watersheds
- ✓ Pursue new technologies & innovative techniques
  - Example: BWS Hydroelectric and Managed Aquifer Recharge Project

Water Conservation Strategies

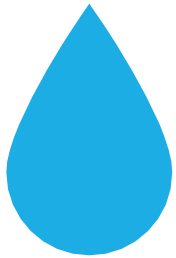
- Replace leaking pipes to reduce water loss
  - BWS district-wide water loss in the PUC was ~ 13.9% in 2015
  - BWS' Leak Detection, Repairs, and Maintenance Program: Detect and repair significant leaks
  - BWS target: Reduce water loss to < 8.1% (2012 national median water loss estimate)
- Plumbing code updates
- Rebate, retrofit, and incentive programs for domestic water users
- Landscape irrigation conservation and incentives
- Conservation technologies (e.g. water reuse)
- Regulatory enforcement (e.g. prohibition on wasting water)
- Public education and outreach
- Financial methods (water conservation pricing)

Options to Increase Water Supply

- Conservation
- Increase transfers into PUC from Central O'ahu
- Assert Public Trust Water Rights for Domestic Use
- Stormwater capture
- Gray water
- Recycled water
- Desalination
- Indirect potable re-use

Note: These options are more costly than continuing to use ground water

Priority Watersheds and Catalyst Projects



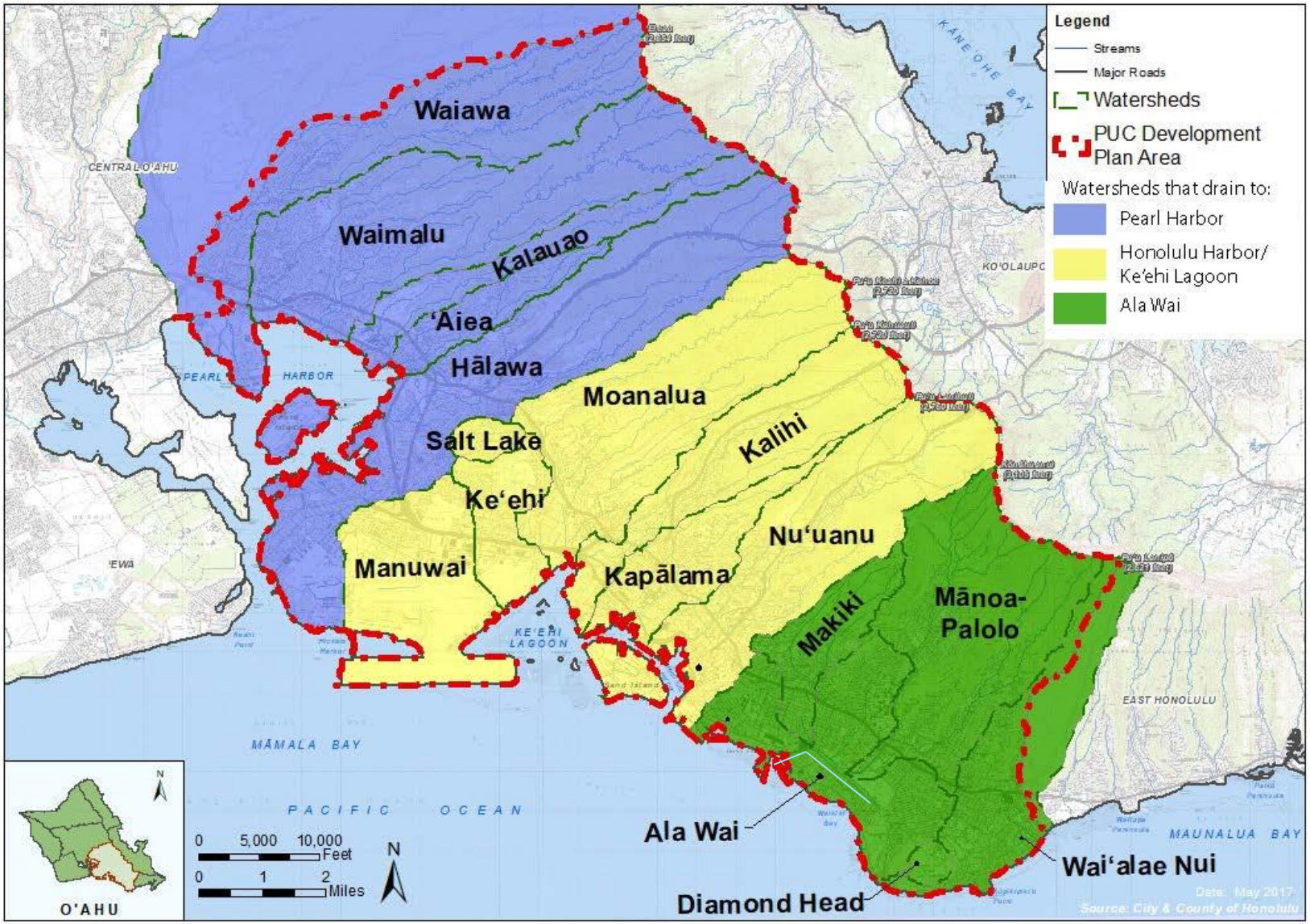
What is a Priority Watershed?

- Watersheds that supply critical drinking water sources
  - → High ground water recharge ("water in") and ground water production ("water out")
  - → Generally ALL watersheds in the PUC are BWS priority watersheds

What is a Catalyst Project?

- A high priority project that will provide energy, connectivity, information, and inspiration for other projects and programs within the priority watershed area
  - → A CATALYST for positive action and change

Priority Watersheds and Catalyst Projects

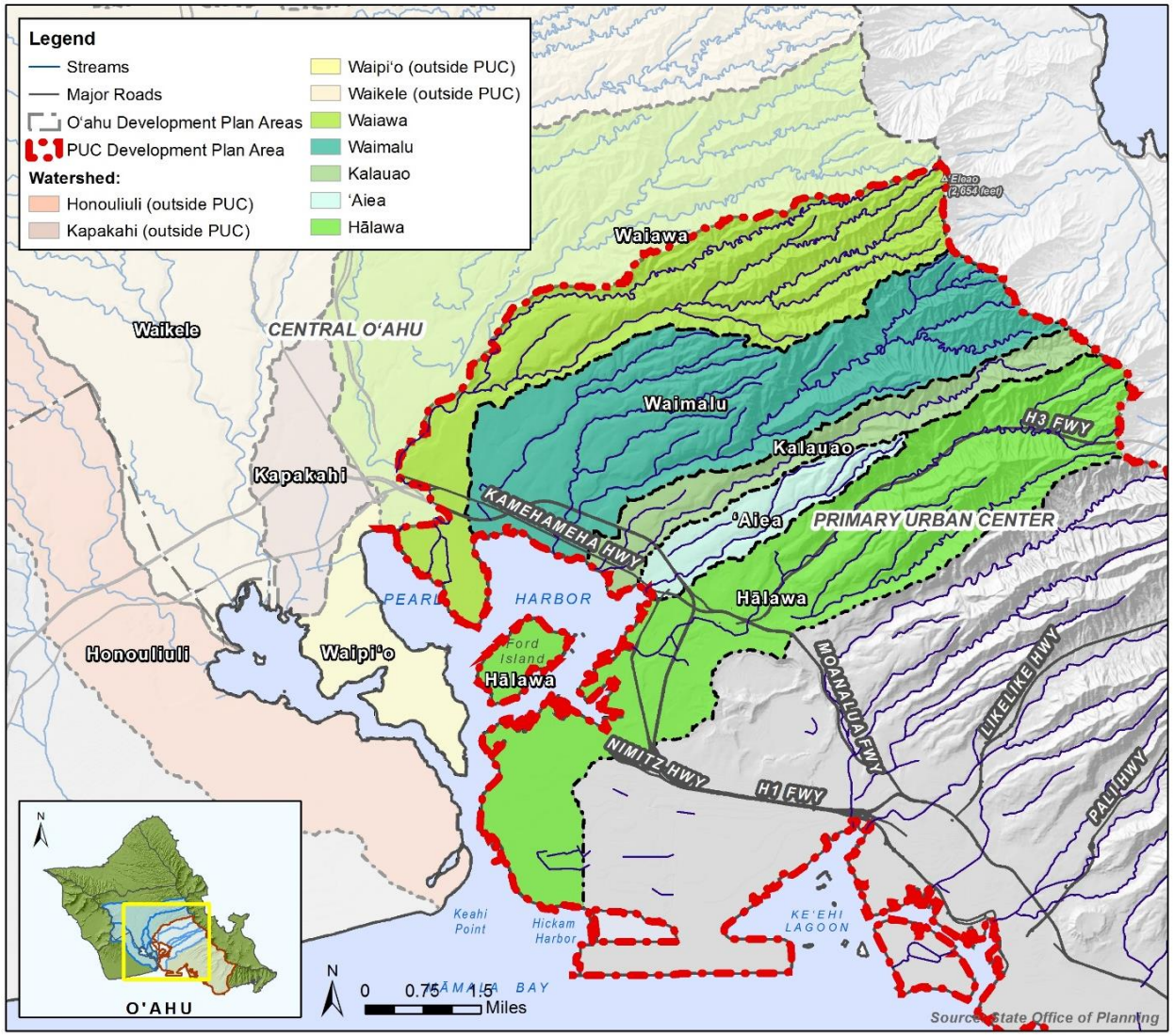


Catalyst Project per Drainage Area

- Pearl Harbor
  - Pearl Harbor Estuary Water Quality Improvement & Ecosystem Restoration
- Honolulu Harbor/Keʻehi Lagoon
  - Iwilei Sea Level Rise Adaptation Action Plan
- Ala Wai
  - Ala Wai Flood Mitigation Project

Pearl Harbor: 5 watersheds in the PUC

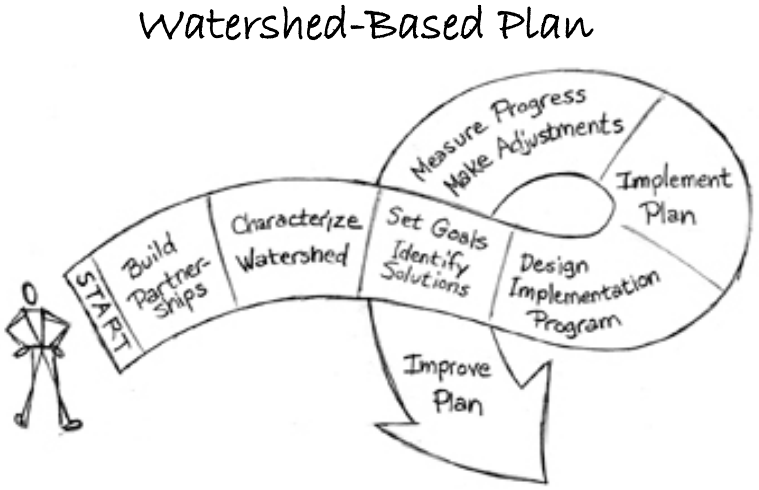
- Largest estuary in Hawai‘i
- Receives runoff from 20% of O‘ahu’s land area
- Valuable community asset; past and present significance of cultural and natural resources in area
- Numerous environmental and water quality issues threaten the Pearl Harbor watersheds



Catalyst Project: Pearl Harbor Estuary Water Quality Improvement & Ecosystem Restoration

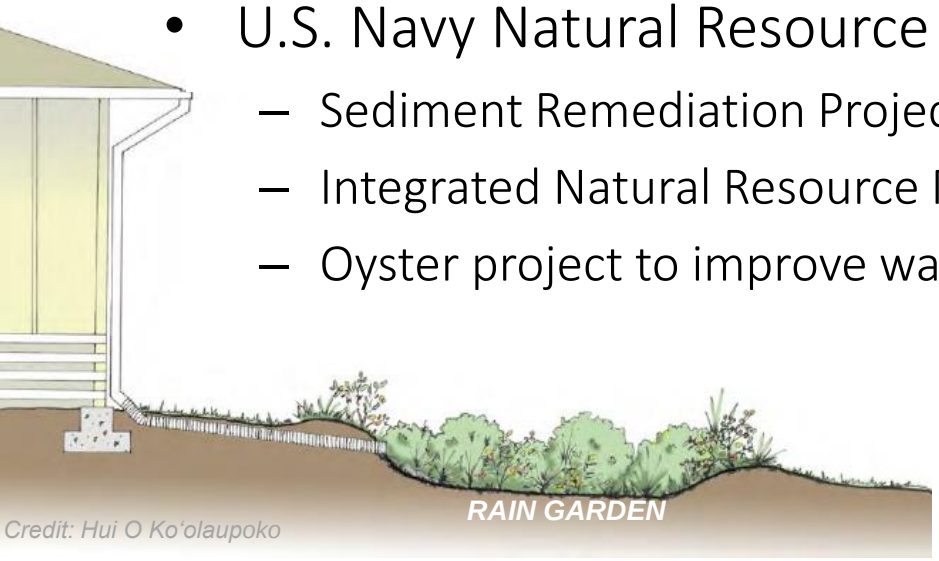
- Develop a "Pearl Harbor Watershed-Based Plan" to assess and prioritize management practices and projects
- Use an ahupua'a approach to managing resources
- Emphasize the mauka to makai connection

Waiawa Unit of Pearl Harbor National Wildlife Refuge



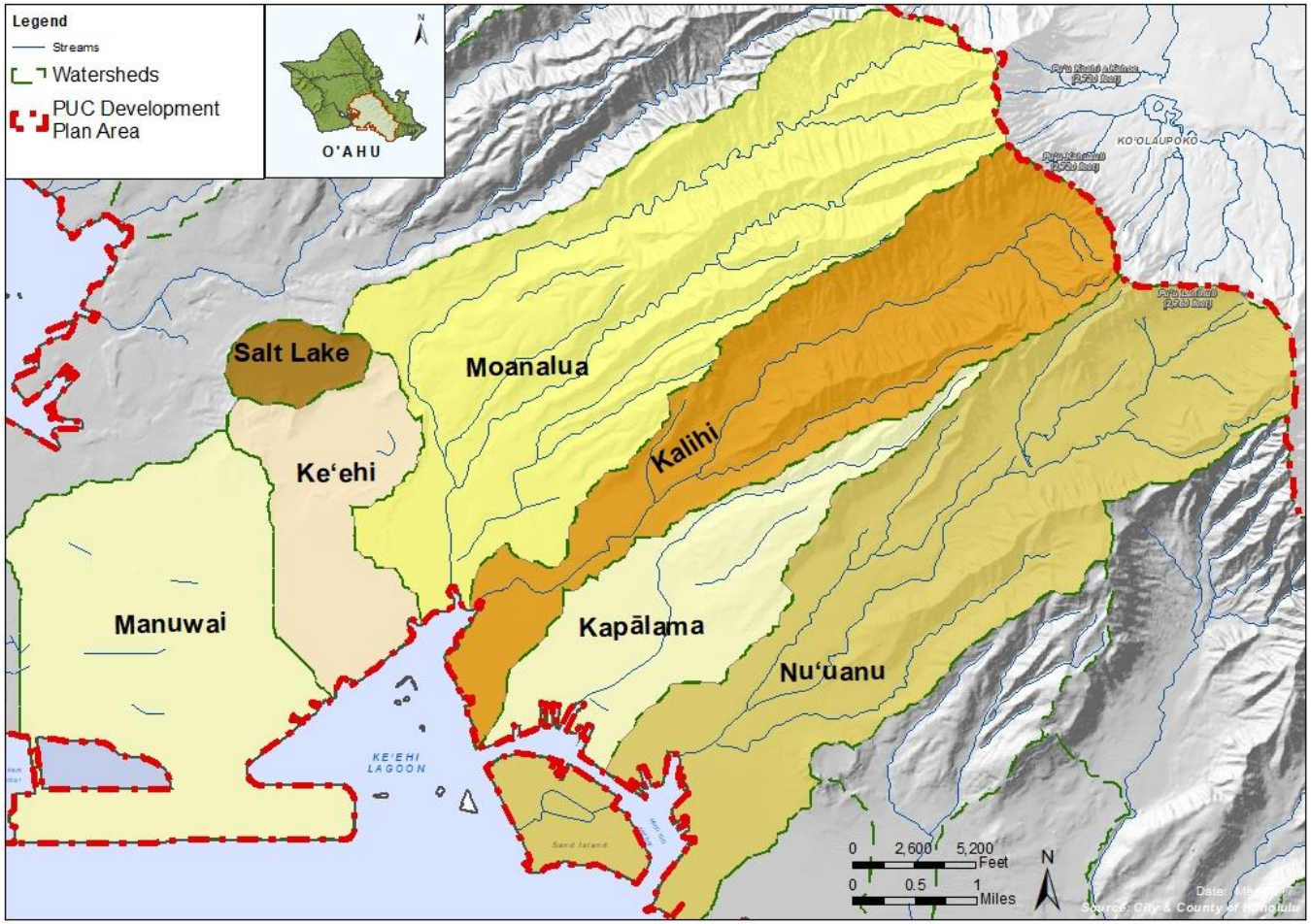
Examples of Projects to Improve the Health of the Pearl Harbor Watersheds & Estuary

- Native Forest Protection and Management
- Low-Impact Development
- Stormwater Capture and Reuse
- Stream Restoration and Maintenance
- Loko Pa‘aiau restoration (fishpond at Kalauao)
- U.S. Navy Natural Resource & Environmental Projects
  - Sediment Remediation Project
  - Integrated Natural Resource Management Plan
  - Oyster project to improve water quality

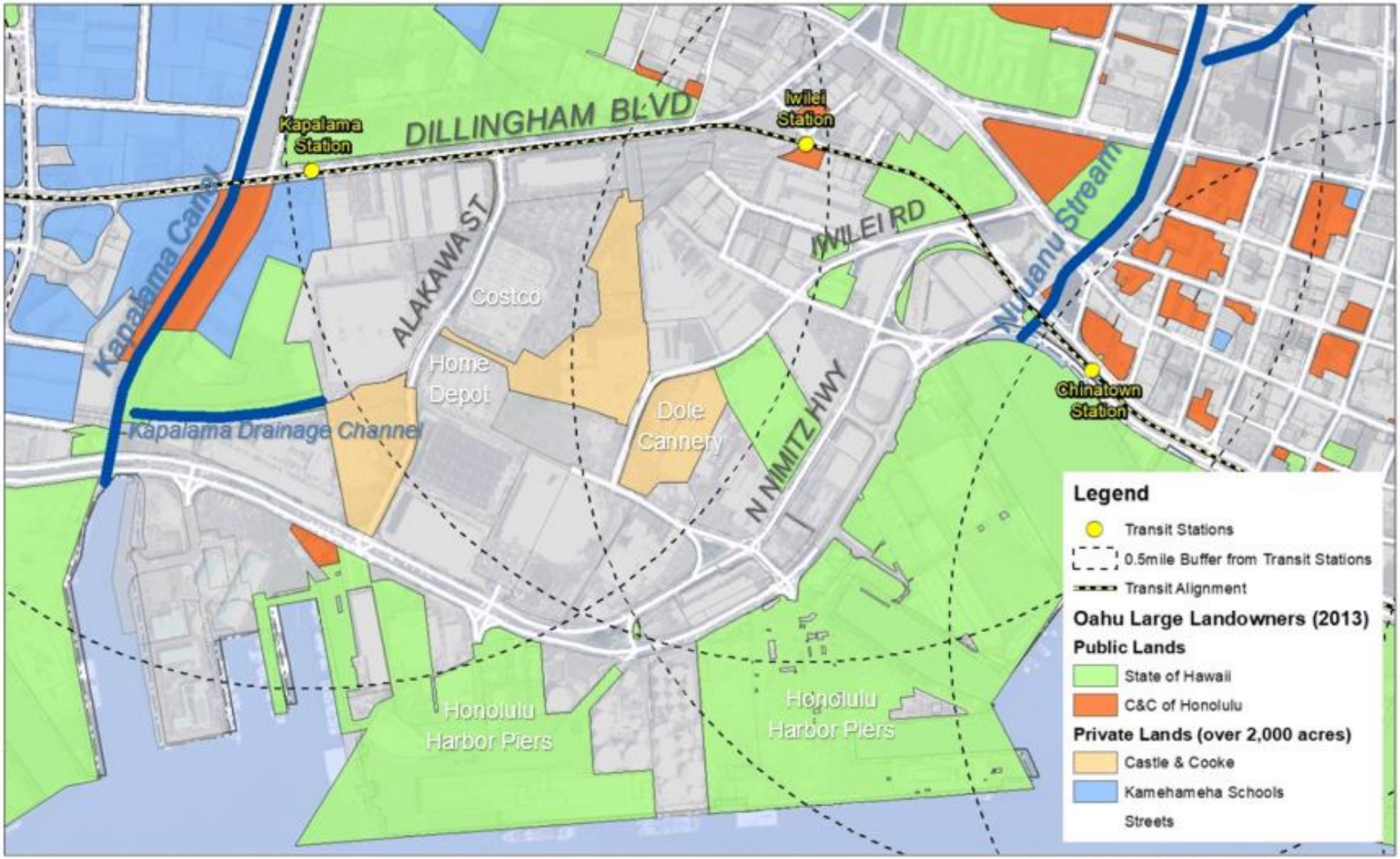


Honolulu Harbor/Ke‘ehi Lagoon: 7 Watersheds

- 40 square miles (~25,600 acres)
- Includes Moanalua, Kalihi, Kapālama, and Nu‘uanu streams
- Iwilei (Kapālama, and Nu‘uanu watersheds)
  - Major redevelopment planned with TOD



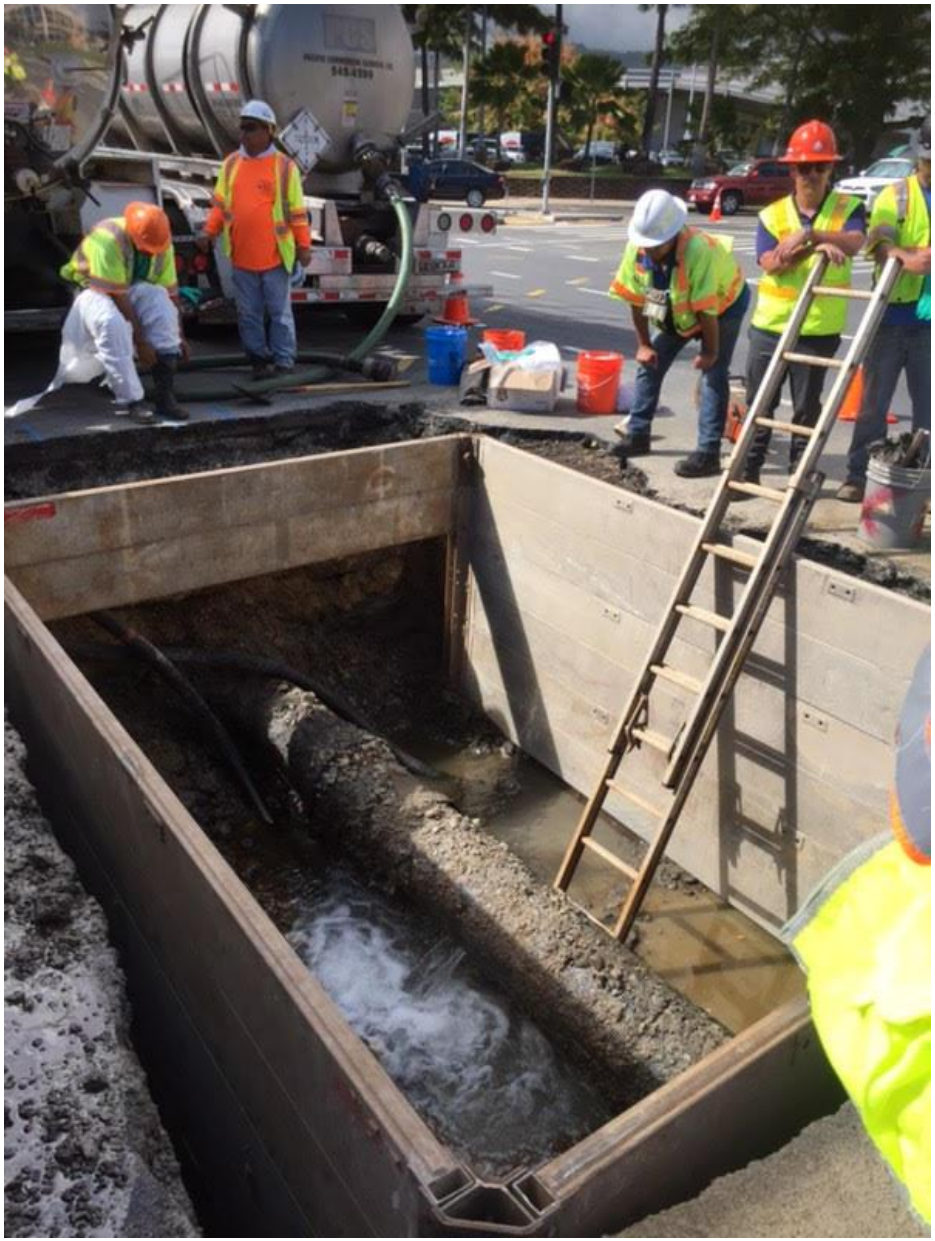
Catalyst Project Area: Iwilei



Primary Urban Center Watershed Management Plan - Iwilei Catalyst Project


Shopping Plaza
Impacts from 6ft SLR
Source: NOAA Sea Level Rise Viewer
Honolulu Harbor-Piers 36-38
Iwilei
1. Retreat
2. Adapt
Chinatown
Aala International Park
Honolulu Harbor-Piers 31-35
Honolulu Harbor-Piers 19-29
USCG Isc

Source:
Iwilei/Kapalama TOD Infrastructure Master Plan Slideshow (January 2016)

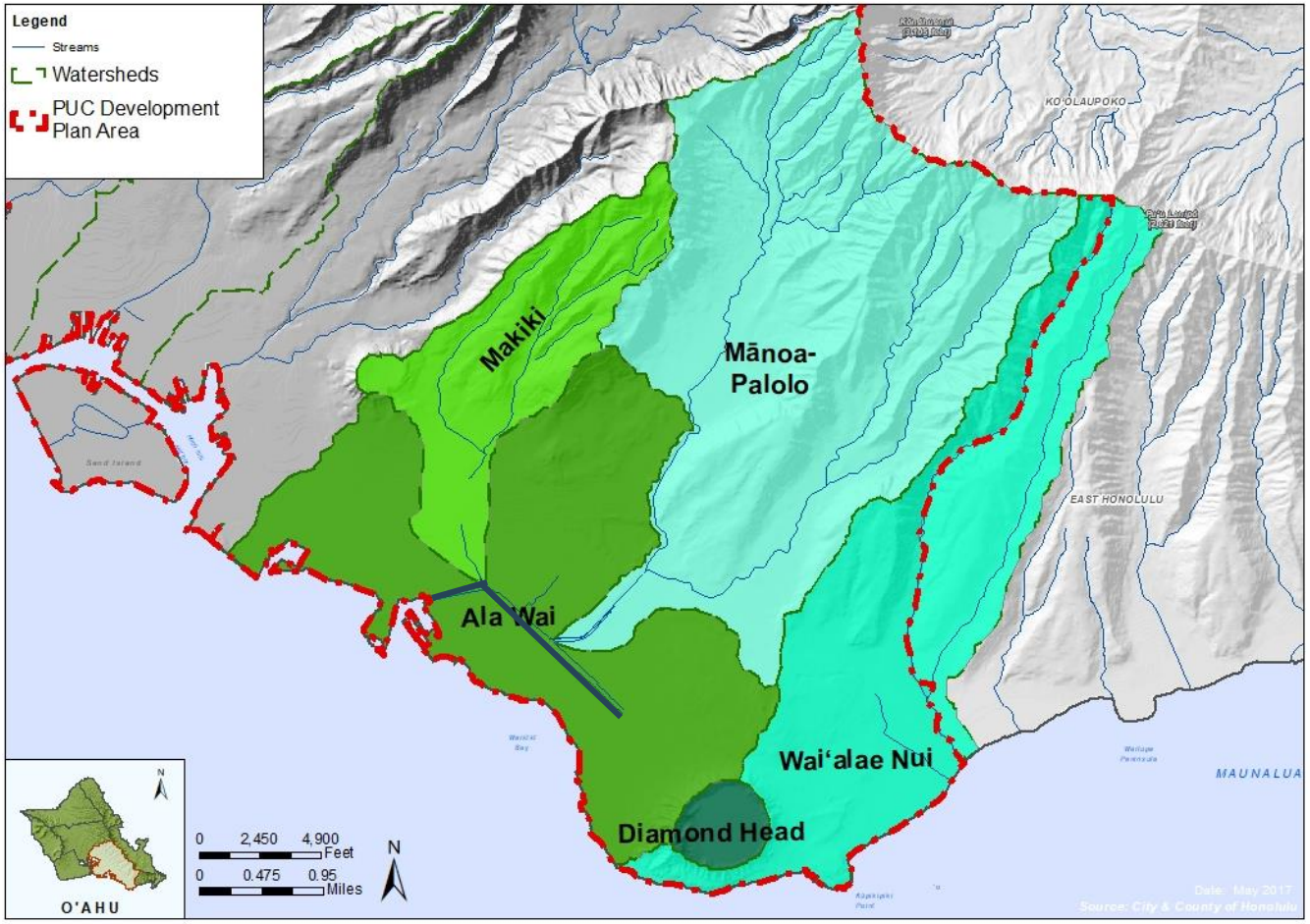


Catalyst Project: Iwilei Sea Level Rise Adaptation Action Plan

- Adaptation strategies
- Opportunity for large scale redevelopment vs. “piecemeal” basis
  - Consideration of drainage from mauka areas
- May need to create a City Redevelopment Authority

Ala Wai: Makiki, Mānoa-Pālolo, Ala Wai Watersheds

- 19 square miles (12,064 acres)
- Includes Makiki, Mānoa, and Pālolo streams
- 40% zoned as Conservation District
- Heavily urbanized, ~200,000 residents

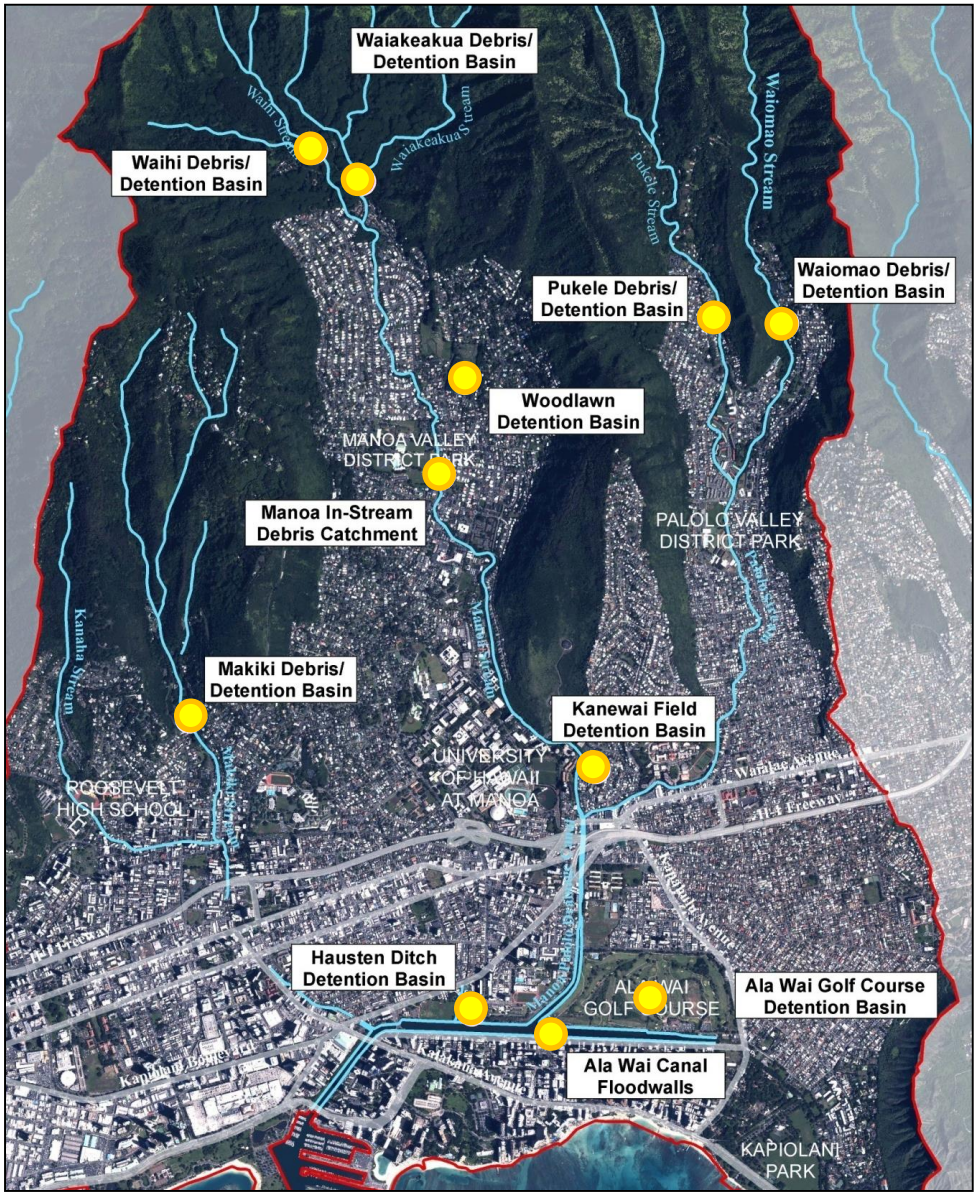


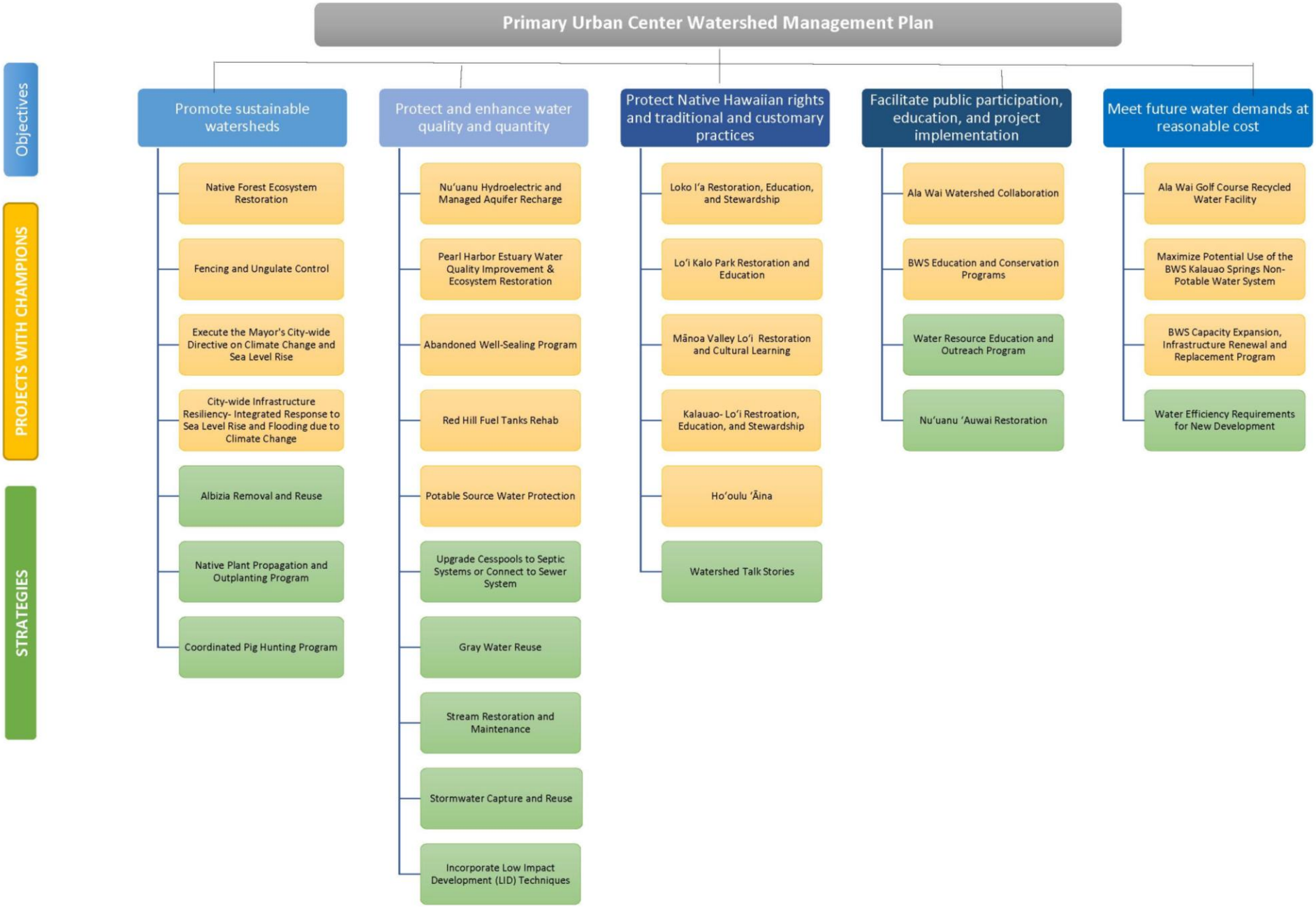
Impacts from 100-year flood

- 1,358 acres, including 3,000+ properties, estimated $1.4 billion damages to structures
- Economic loss
- Possible loss of life

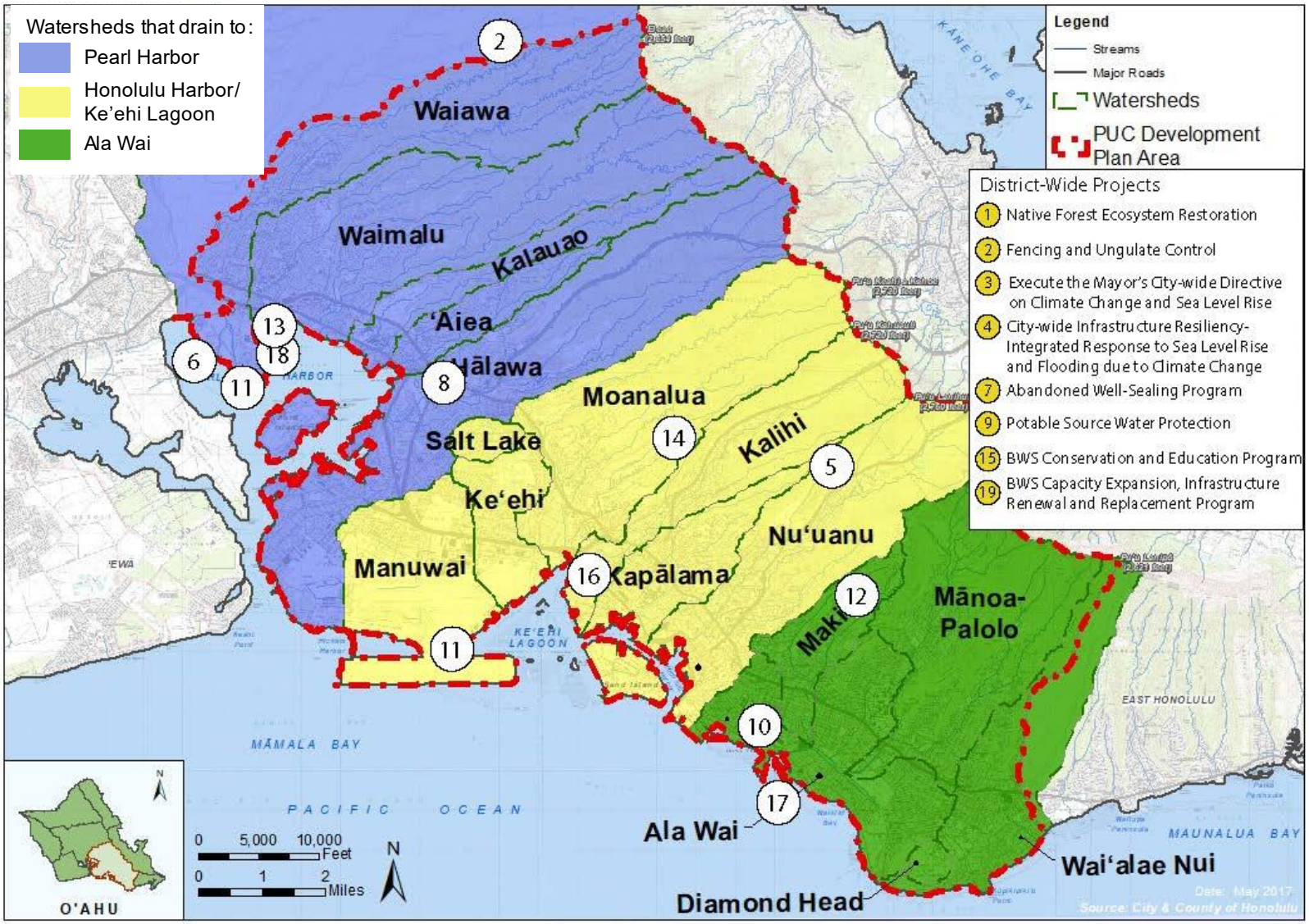
Catalyst Project: Ala Wai Flood Mitigation Project

- Total estimate for design and construction
  - $345 million
- Need local sponsor to:
  - Commit to fund 35%: approx. $120 million
  - Operation, maintenance, repair, replacement, and rehabilitation: approx. $985,000 per year
- Ala Wai Watershed Collaboration
  - Watershed district
  - Stormwater fee




Primary Urban Center Watershed Management Plan
Objectives
PROJECTS WITH CHAMPIONS
STRATEGIES
Promote sustainable watersheds
Native Forest Ecosystem Restoration
Fencing and Ungulate Control
Execute the Mayor's City-wide Directive on Climate Change and Sea Level Rise
City-wide Infrastructure Resiliency- Integrated Response to Sea Level Rise and Flooding due to Climate Change
Albizia Removal and Reuse
Native Plant Propagation and Outplanting Program
Coordinated Pig Hunting Program
Protect and enhance water quality and quantity
Nu'uanu Hydroelectric and Managed Aquifer Recharge
Pearl Harbor Estuary Water Quality Improvement & Ecosystem Restoration
Abandoned Well-Sealing Program
Red Hill Fuel Tanks Rehab
Potable Source Water Protection
Upgrade Cesspools to Septic Systems or Connect to Sewer System
Gray Water Reuse
Stream Restoration and Maintenance
Stormwater Capture and Reuse
Incorporate Low Impact Development (LID) Techniques
Protect Native Hawaiian rights and traditional and customary practices
Loko I'a Restoration, Education, and Stewardship
Lo'i Kalo Park Restoration and Education
Mānoa Valley Lo'i Restoration and Cultural Learning
Kalauao- Lo'i Restroation, Education, and Stewardship
Ho'oulu 'Āina
Watershed Talk Stories
Facilitate public participation, education, and project implementation
Ala Wai Watershed Collaboration
BWS Education and Conservation Programs
Water Resource Education and Outreach Program
Nu'uanu 'Auwai Restoration
Meet future water demands at reasonable cost
Ala Wai Golf Course Recycled Water Facility
Maximize Potential Use of the BWS Kalauao Springs Non-Potable Water System
BWS Capacity Expansion, Infrastructure Renewal and Replacement Program
Water Efficiency Requirements for New Development

PUC WMP Projects and Catalyst Projects



Next Steps: PUC WMP Schedule

Year	2016		2017				2018				2019		
Quarter	3	4	1	2	3	4	1	2	3	4	1	2	3
Stakeholder Consultation													
Watershed Profile				★									
Water Demand Analysis							★						
Projects and Strategies									★				
Implementation Plan													
Public Review Draft											★		
Approvals Process													

★ = Community Meetings

Questions:

- Are there other water-related issues and concerns for the PUC that we missed?
- How aggressively should we implement water conservation strategies *now* to prepare for a possible "worst case" *future* scenario?

QUESTIONS?

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For more information, please visit:
http://www.boardofwatersupply.com/water-resources/watershed-management-plan/primary-urban-center-plan

Draft Sea Level Rise Action Strategy