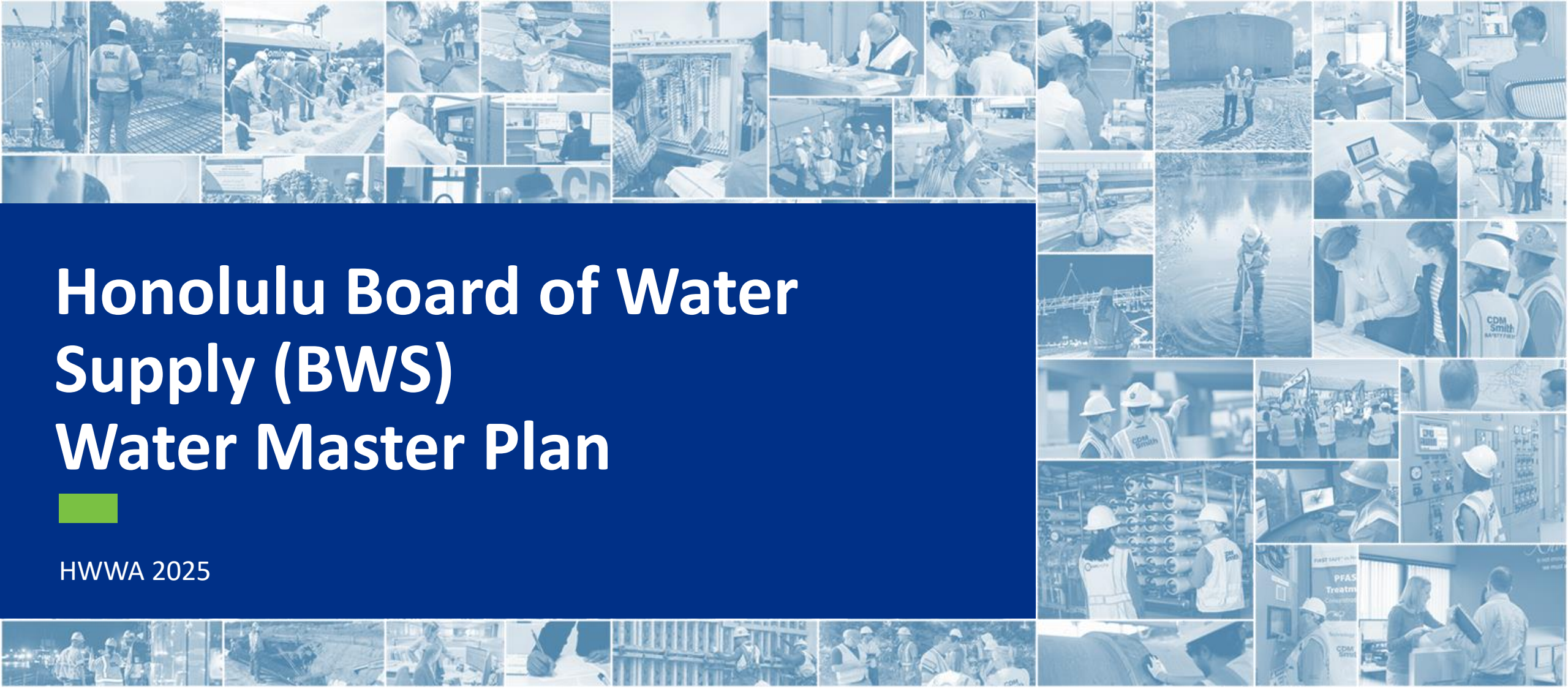


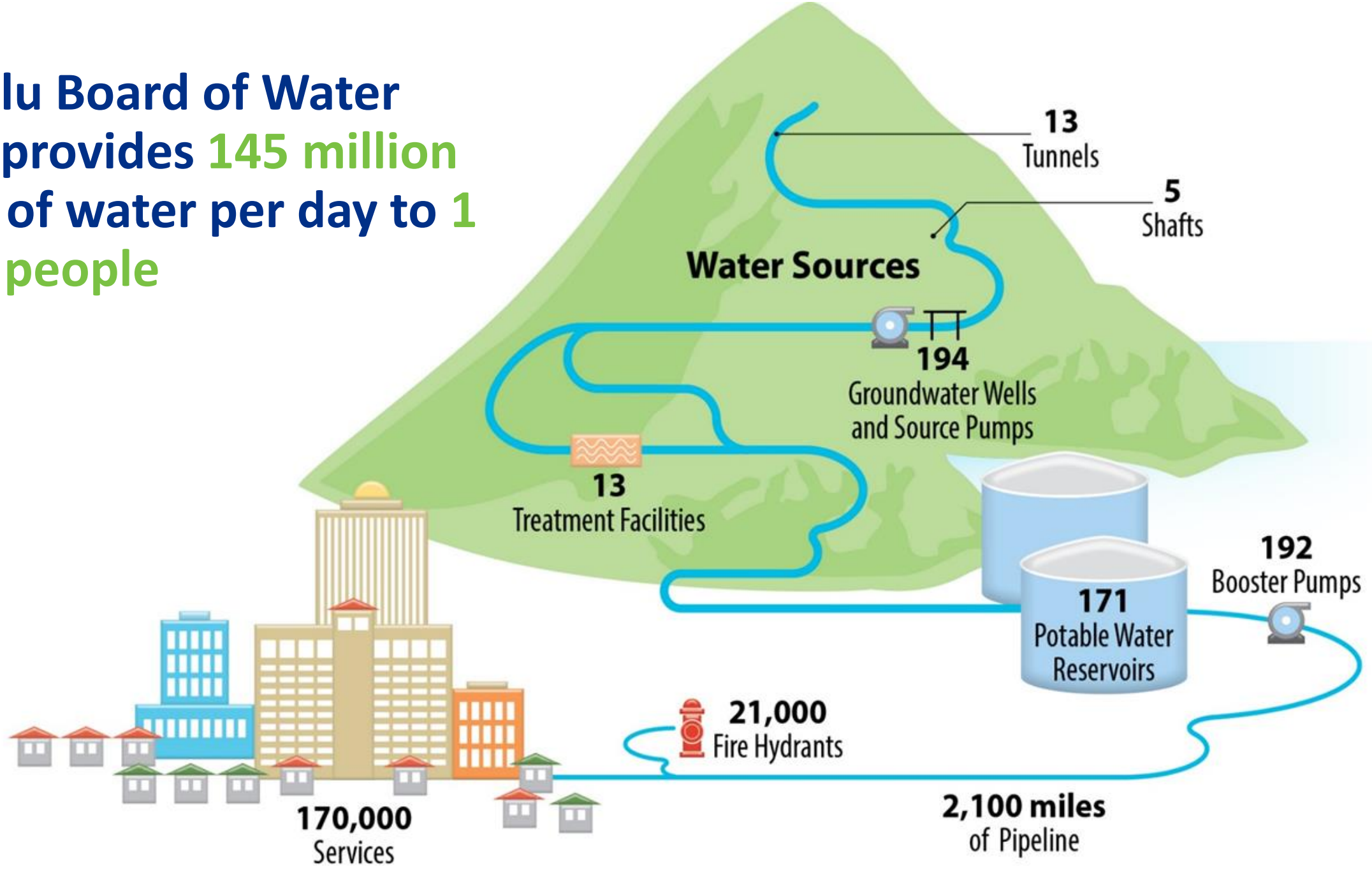
Honolulu Board of Water Supply (BWS) Water Master Plan

HWWA 2025

Carl Lundin

October 16, 2025

Honolulu Board of Water Supply provides 145 million gallons of water per day to 1 million people



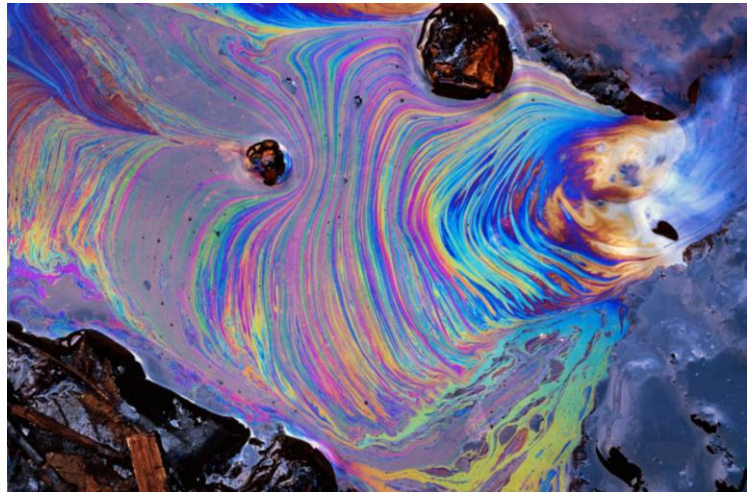
Current Challenges

Climate Change

Emerging Contaminants

Residual COVID Impacts

Regulatory Changes

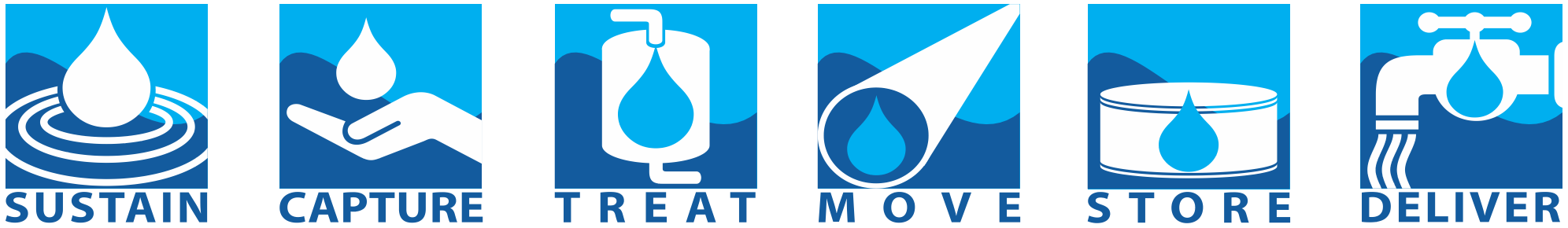


Contamination Events

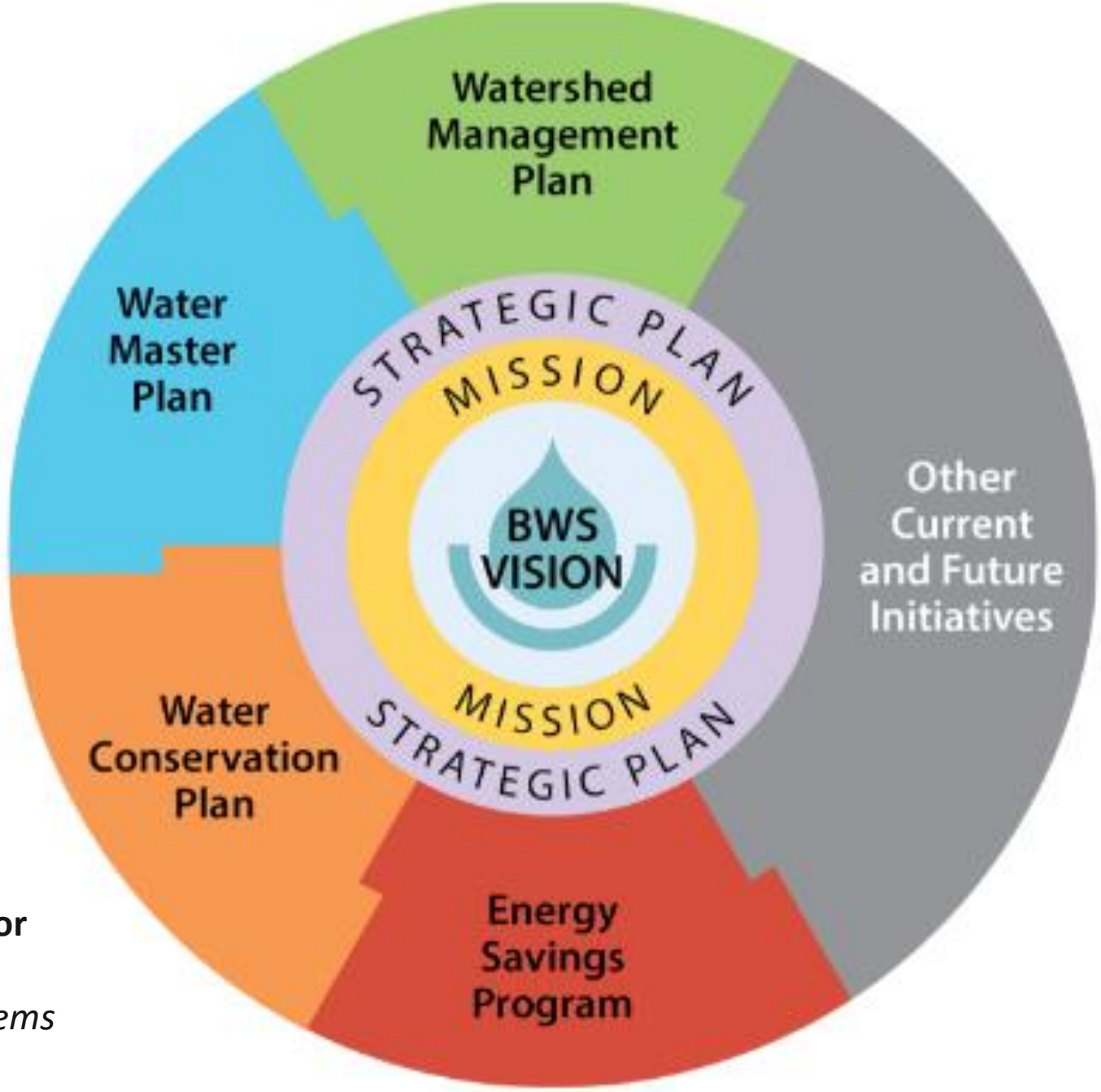
Aging Infrastructure

Are we prepared to provide safe, dependable, and affordable water for the next generation?

BWS's Six Primary Functions



BWS's Planning Structure



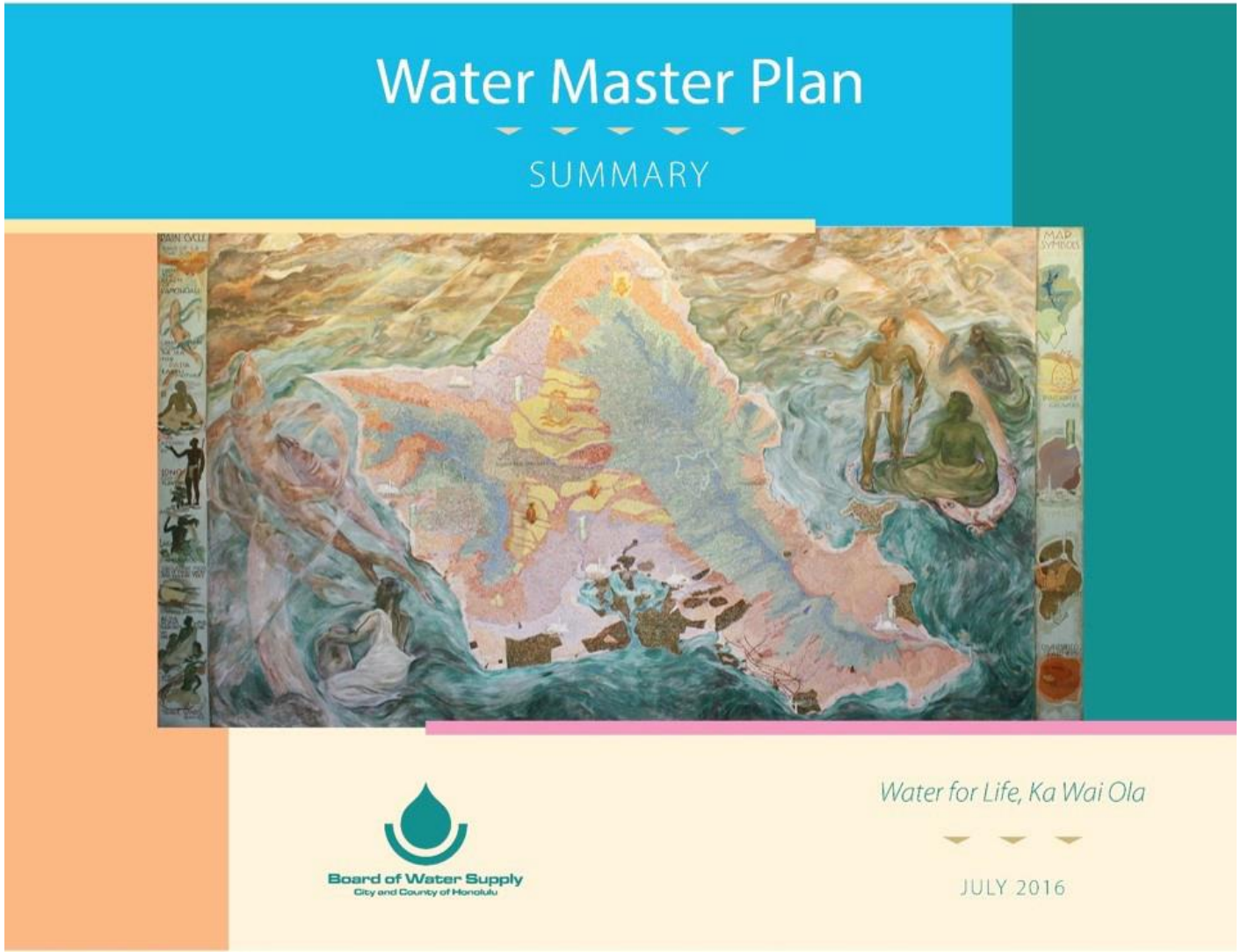
BWS recognized in the February 2018 Journal AWWA for leadership in planning and community engagement.
Assessing the Sustainability of Urban Water Supply Systems (Journal AWWA 110:2 Feb 2018)

The BWS Water Master Plan (WMP)…

- Looks ahead 30 years
- Plans for current realities and future challenges
- Evaluates the entire water system
- Identifies necessary improvements
- Balances needs with costs to efficiently provide water to customers

Wait… Didn't we just do this?

- 2016 Water Master Plan
  - Built all new distribution system models
  - Condition assessment on all reservoirs, PSs, and treatment
  - Pipeline risk model and partial condition assessment
  - Water Source, Quality, and Treatment evaluation
  - CIP, Financial Plan, Rate Model
  - Stakeholder Advisory Group
- It's time for the 10-year refresh

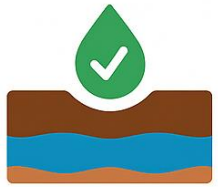


So, what's the focus this time? WMP Goals

Understand Sources of Water Loss

Assess Condition of Assets

Forecast Water Demand



Evaluate Groundwater Quality and Quantity

Plan for Climate Change

Update Capital Improvement Program

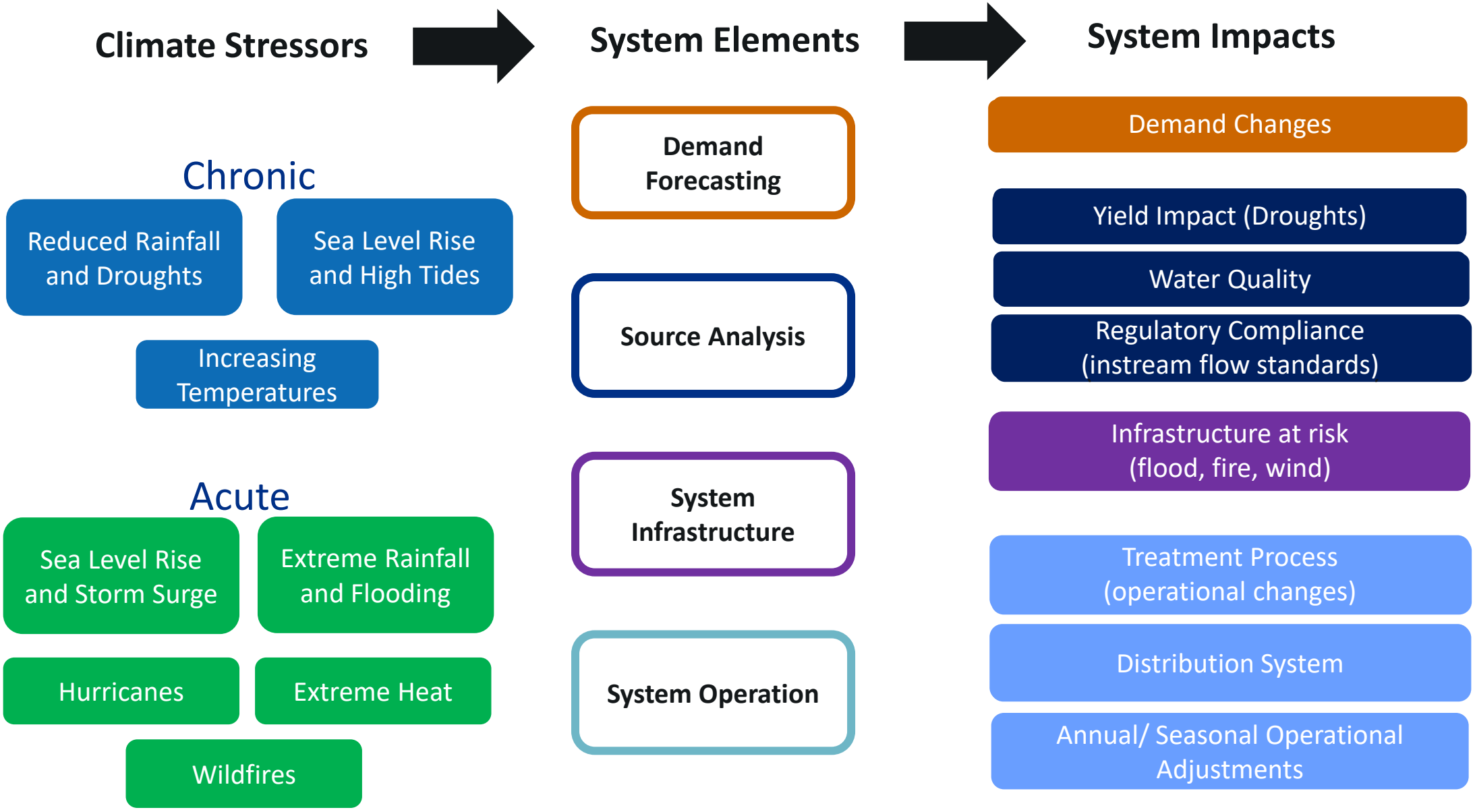
Plan for Climate Change

- Background:
  - Climate change is changing the frequency and severity of natural hazards (e.g., droughts, storms, sea level rise, etc.)
    - These hazards may pose a risk to BWS sources, infrastructure, and operations
- Goal:
  - Determine the increased frequency and severity of natural hazards due to climate change (to 2045)
  - Identify how climate change may impact BWS' system
  - Create a plan to reduce the risk from these hazards by improving climate resilience or minimizing interruption of service duration

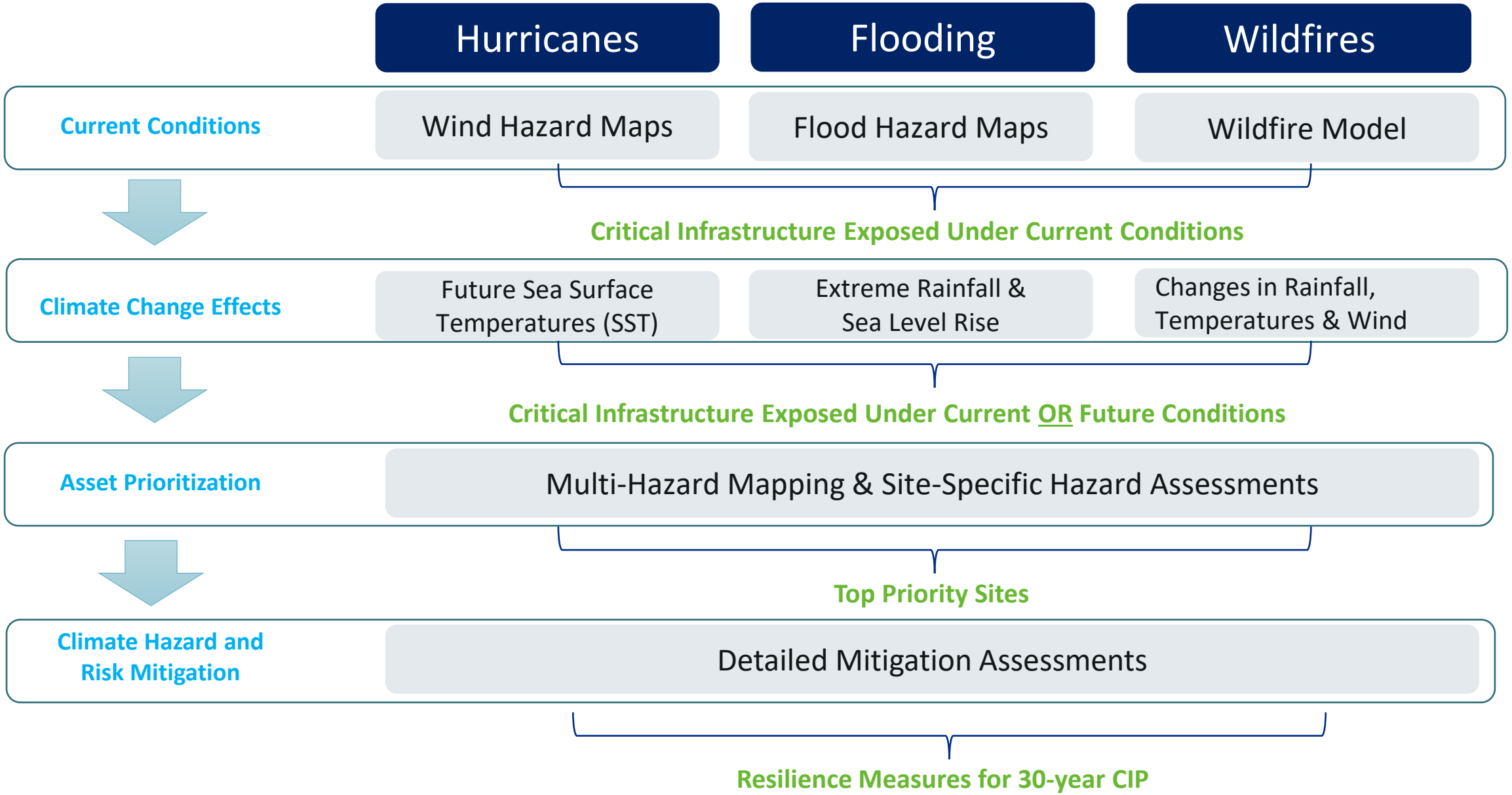
Wildfire Modeling (Breakout Session 5) - Michael Cubas

2024 King Tide Flooding Māpunapuna Area

How will climate change affect our water system?



Natural Hazards and Future Conditions



Understand Sources of Water Loss

- Background:
  - Water loss: difference between the water supplied and the authorized consumption (i.e., customer water use)
  - Water loss can consist of:
    - Physical water loss (e.g., leaks, breaks, FD use, etc.)
    - Nonphysical water loss (e.g., data handling errors, meter inaccuracies, etc.)
- Goal:
  - Evaluate BWS data to identify areas with the most significant water loss
  - Recommend actions to reduce loss, which promotes water conservation, increases BWS revenue, and improves billing / reporting accuracy

Understand Sources of Water Loss

- Recently water loss has been trending higher
  - Unclear the relative impact of physical vs non-physical losses
- Water loss is a significant driver of demand
- So far:
  - Evaluated data sources
  - Identified sources of high disparity
  - Working to determine root cause

Assess Condition of Assets

- Background:
  - Condition assessments: systematic process to evaluate current state of an asset
  - Aim to identify deficiencies and vulnerabilities to hazards like high winds, floods, and wildfires
- Goal:
  - Understand rate of degradation
  - Improve maintenance and replacement timing
  - Identify assets that may be impacted by climate change
  - Ensure BWS gets the most out of its assets

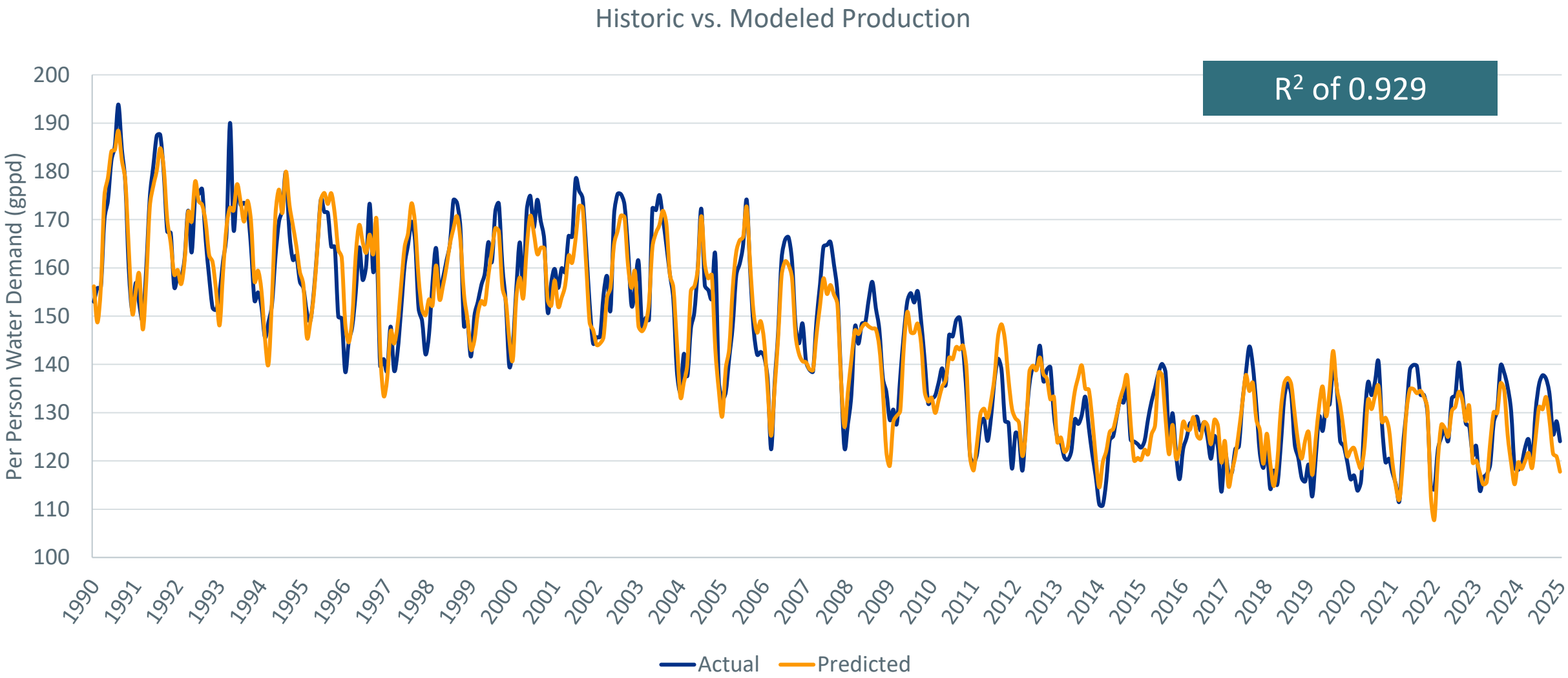
Reservoir Condition Assessment Status

- Complete inspections, calibrated degradation rates with 2015 inspections
- Piloted new inspection technology (drone, IR, LIDAR)

Forecast Water Demand

- Background:
  - Changes to water demand impacted by:
    - Seasonal impacts: patterns within a year
    - Long-term impacts: trends over years or decades
  - Water demand impacted by a combination of drivers such as conservation, plumbing efficiency, climate, etc.
- Goal:
  - Understand how water demand has changed over time
  - Estimate future water demand using a water demand model, climate data, and population projections

Water Demand Model Captures Long-term And Seasonal Variability



Variables that had significant demand correlation

Variable	Coefficient
Consecutive Days with No Rain	0.02
Monthly Average Daily Max Temperature	1.05
Total Monthly Precipitation	-0.03
Previous Month's Total Precipitation	-0.03
Unemployment Rate	-0.02
Average Price of Water (Volumetric bill, per 9kgal)	-0.18
Nonrevenue Water (Percent Loss)	0.14

- The coefficient tells us how much water demand would change if a variable was increased by 1%
- When the **average monthly daily max temperature** increases by 1%, the demand ***increases*** by 1.05%

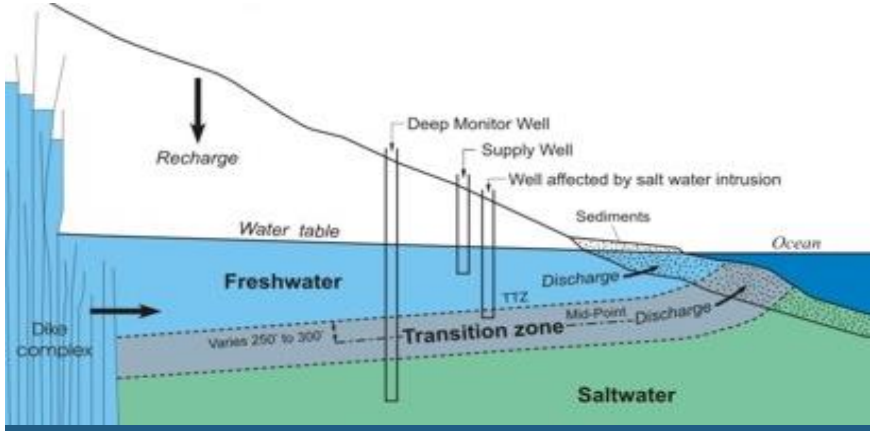
ENV Water Price Elasticity (Breakout Session 4) - Roger Babcock/David Ebersold

Evaluate Groundwater Quality and Quantity

- Background:
  - Groundwater quality and quantity are impacted by long-term pumping patterns, contamination risks, and climate variability
  - Several BWS groundwater sources have been identified as at-risk to quality or quantity impairment
- Goal:
  - Understand the impact of historical and future pumping rates on the water quality BWS's most critical groundwater sources
  - Assess additional needs for sources that have been identified as at-risk
  - Evaluate availability of additional /alternative sources

Halawa Shaft (Date: 12/28/2021)

Objectives for Water Source Evaluation in WMP



Groundwater Quantity and Quality

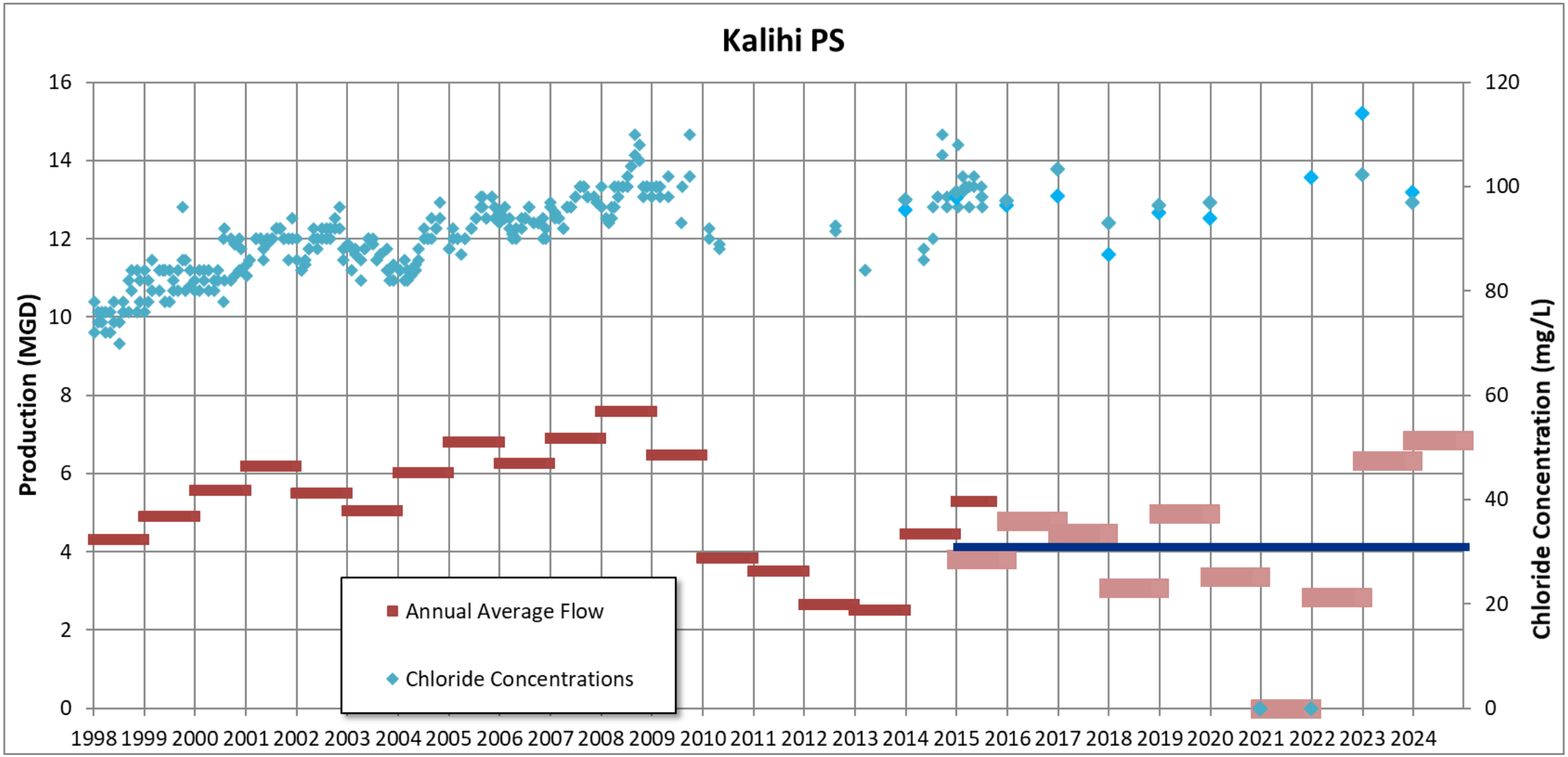
Water Shortage Plans

ONE WATER HONOLULU

One Water Collaboration

Future Supplies

Kalihi Pumping vs WQ



WMP 2016 Suggested Pumping Rates

Source	Permit Value (mgd)	5 Year Average Pumping (2011- 2015) (mgd)	Approximate Stable Period (CY)	Suggested Average Flow During Stable Period (mgd)	5 Year Average Pumping (2020 - 2024) (mgd)
Kalihi	6.95	3.4	2014-2015	4.0	3.9
Kaimukī	4	4.0	2011-2012	3.9	4.1
Kalauao	11.75	8.7	2012-2015	8.0	7.5
Punanani	11.97	10.8	2010-2013	10.0	10.3
Beretania	7	6.0	2007-2010	5.0	5.2
Totals	**41.67**	**32.9**		**30.9**	**31.0**

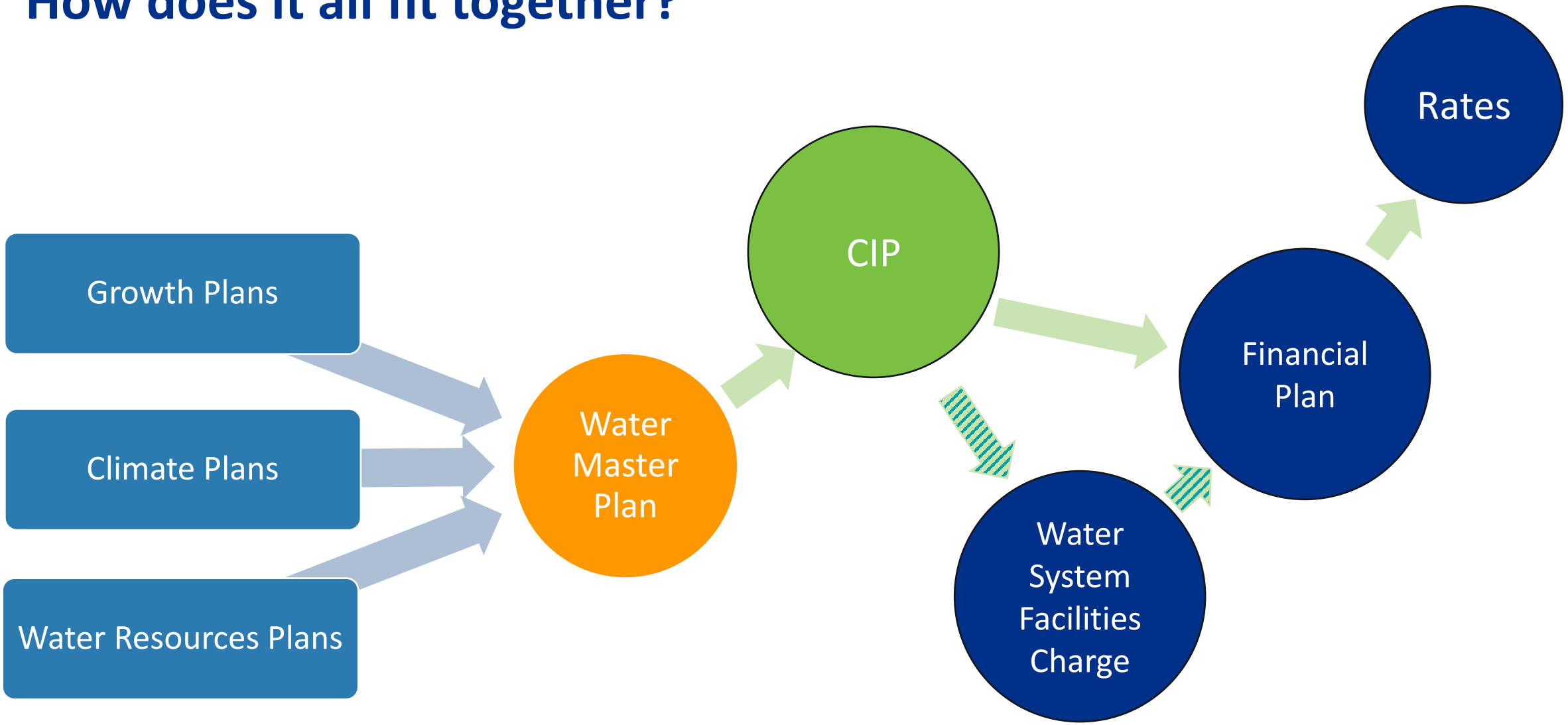
Update Capital Improvement Plan (CIP)

- Background:
  - A CIP identifies and prioritizes infrastructure investments (e.g., upgrades, replacements, etc.) a long-term planning horizon
  - CIP development is an opportunity to:
    - Reassess priorities
    - Align infrastructure needs with available funding, regulatory requirements, and system challenges
- Goal:
  - Develop a 30-year CIP which considers the project needs identified throughout development of WMP and balances with rate impacts

CIP Tools

- Updates to CIP Cost and Schedule Estimating
- New projects into long-term CIP
- Revision to 6-year CIP
- Growth vs R&R Projects

How does it all fit together?



WMP Purpose

Understand O‘ahu’s water supplies, needs, and system

Provide a roadmap to meet future needs

Establish BWS priorities

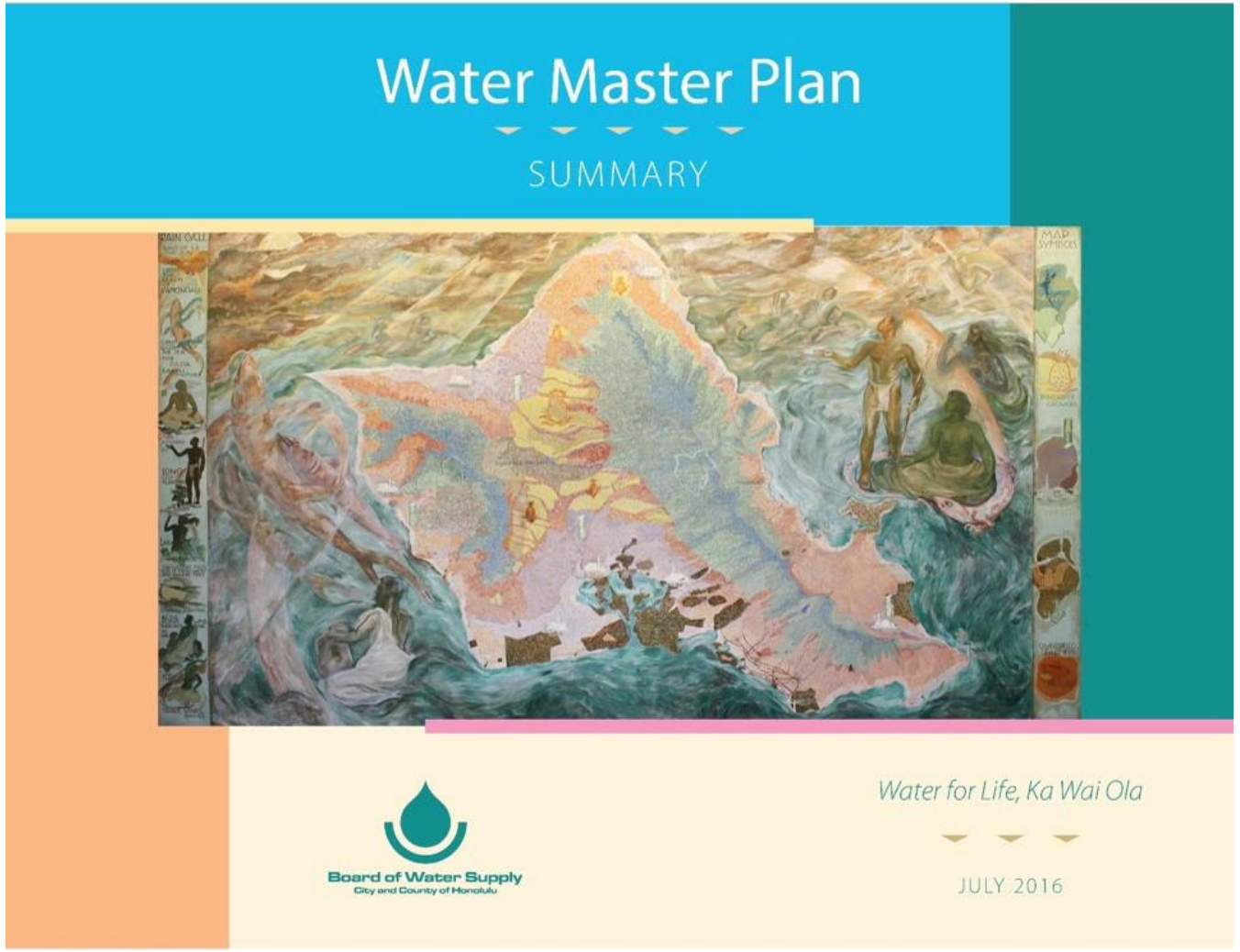
Identify projects to reflect WMP findings

Ultimate Goal:
A Long-Term Plan
For Our Water Future

WMP Status

- Working on update
- 2016 Water Master Plan available on BWS website:

https://www.boardofwatersupply.com/water-resources/water-planning/water-master-plan



Questions?

Mahalo