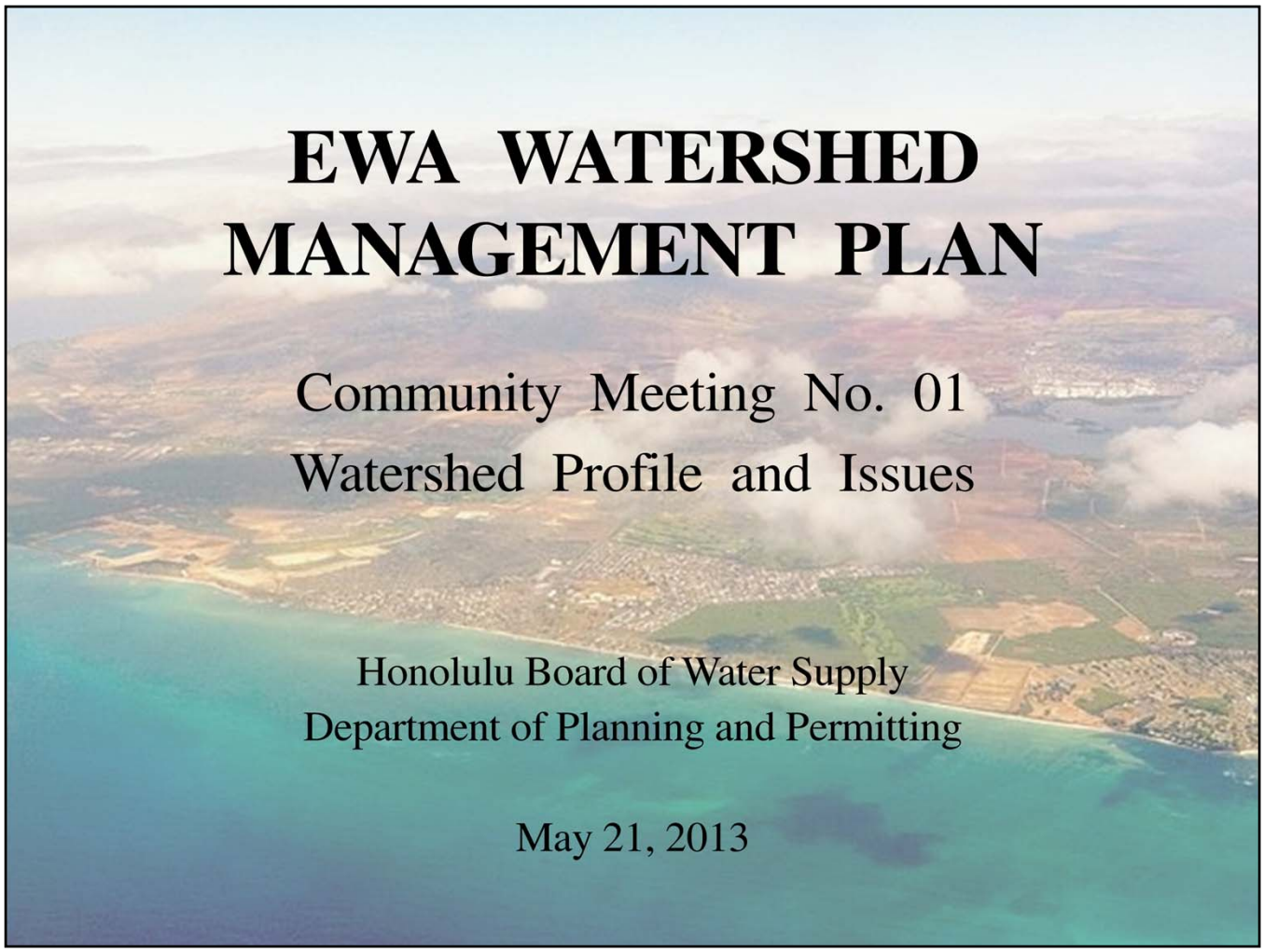

EWA WATERSHED
MANAGEMENT PLAN
Community Meeting No. 01
Watershed Profile and Issues
Honolulu Board of Water Supply
Department of Planning and Permitting
May 21, 2013

Agenda

- Management Plan Background
- ‘Ewa Planning District Profile
- Watershed Issues
- Next Steps

Management Plan Background

Why do we plan for water?

'Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

3

Why do we plan for water?

- To ensure that the various users (cultural, agricultural, domestic, commercial, industrial) have water;
- To ensure that future generations have water;
- To protect the environment;
- And…"Because we have to." It's mandated by:
  - State Water Code, 174-C HRS
  - City Ordinance Chapter 30, ROH, Water Management

Management Plan Background

O‘ahu Water Management Plan

- County level “**Water Use and Development Plans**” are required by the State Water Code, Chapter 174C, HRS.
- **Revised Ordinances of Honolulu Chapter 30** established the “O‘ahu Water Management Plan” comprised of 8 regional plans to be developed by DPP in coordination with BWS & CWRM
- Guiding plans include the **Hawai‘i Water Plan** and the City **Development Plans** and **Sustainable Communities Plans**
- The regional watershed management plans **parallel** the City’s Development Plans/Sustainable Communities Plans to **specifically integrate land use and water planning**
- **Key Planning Principles** for these Plans
  - Community-Based
  - Environmentally Holistic and Economically Viable
  - Ahupua‘a management perspective
  - Action-oriented
  - In alignment with State and City water and land use plans & policies

- The Watershed Management Plans are Oahu’s long-range water resources plans.
- They include policies and strategies that guide future water use and development and watershed management actions.
- Eight district plans will collectively form the updated Oahu Water Management Plan.
- The plans use an *ahupuaa* or watershed approach to resource management.

Management Plan Background

Watershed Management Plan Goal

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

1. The protection, preservation, and management of O‘ahu’s watersheds
2. Sustainable ground and surface water use and development to serve present users and future generations.

The overall goal of the Oahu Watershed Management Plan (OWMP) reflects community, landowner, BWS and other agency values, issues, and concerns. It hopes to balance resource protection with providing water for human consumption and economic growth.

- The purpose of the OWMP is to protect and sustain Oahu water.
- It serves as a road map for protection, conservation, resource management.
- The district-level WMPs fulfill requirements of Code and Ordinance and will be components of the larger OWMP.
- The WMPs also integrate and support the Ewa Development Plan.

Management Plan Background

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; and
5. Meet future water demands at reasonable costs.

The WMP has five overall objectives that are consistent for each of the eight planning districts. They were developed through:

- Community outreach
- Holistic approach
- Objectives drive the plan strategies

The planning team understands that the objectives may be complementary and contradictory at the same time. The goal of he planning process is to balance all five objectives.

Recognizing that each planning district has its own resources and issues, the Plan will identify sub-objectives that are unique to that district. These sub-objectives will be drawn from discussion and feedback from stakeholder interviews and community meetings.

Management Plan Background

Watershed Management Plan Contents

Chapters

Executive Summary

1. O‘ahu Water Management Plan Overview
2. ‘Ewa Watershed Profile
3. Water Use and Projected Demand
4. Plan Objectives and Water Supply and Watershed Management Projects and Strategies
5. Implementation

Appendices

A. O‘ahu Watershed Management Plan Framework
B. Plans, Policies, Guidelines, and controls
C. O‘ahu Water Use Permit Index
D. Overview of O‘ahu Hydrogeology
E. Water Use and Demand – Methodology
F. Neighborhood Board Endorsements

Each WMP has similar contents because they will eventually be referenced into one overall document for Oahu.

Management Plan Background

Watershed Management Plan Overview

Overview section provides context for the regional WMPs, including:

- **Plan goals and objectives** applying the ahupua'a watershed-based approach to holistic resource management;
- Plans, policies, guidelines and controls covering federal laws, **State Water Code**, **Hawaii Water Plan** (WRPP, AWUDP, SWPP & DHHL), Framework, water rights, **public trust doctrine**, the **precautionary principle**, and State & City **land use plans** and ordinances;
- Urban and agricultural **forecasts** by land use district;
- **Sustainable yield, permitted use and water uses** by water management area updated to 2009;
- Mean perennial **stream flows;**
- Existing and potential ground water, surface water and alternative **sources of water to meet demand**;
- Summary of **adequacy of supply**;
- **Uncertainties and contingencies** for ground water and surface water **supplies** and demand **forecasts** including **climate change**; and
- **Plan implementation**.

- Each WMP contains an island-wide overview section that provides the context for the regional WMPs
- The Oahu WMP takes into consideration water-related laws, policies, plans, and needs at various levels.
- The Hawaii Water Plan in particular, provided critical guidance to the policies, projects, and strategies developed.

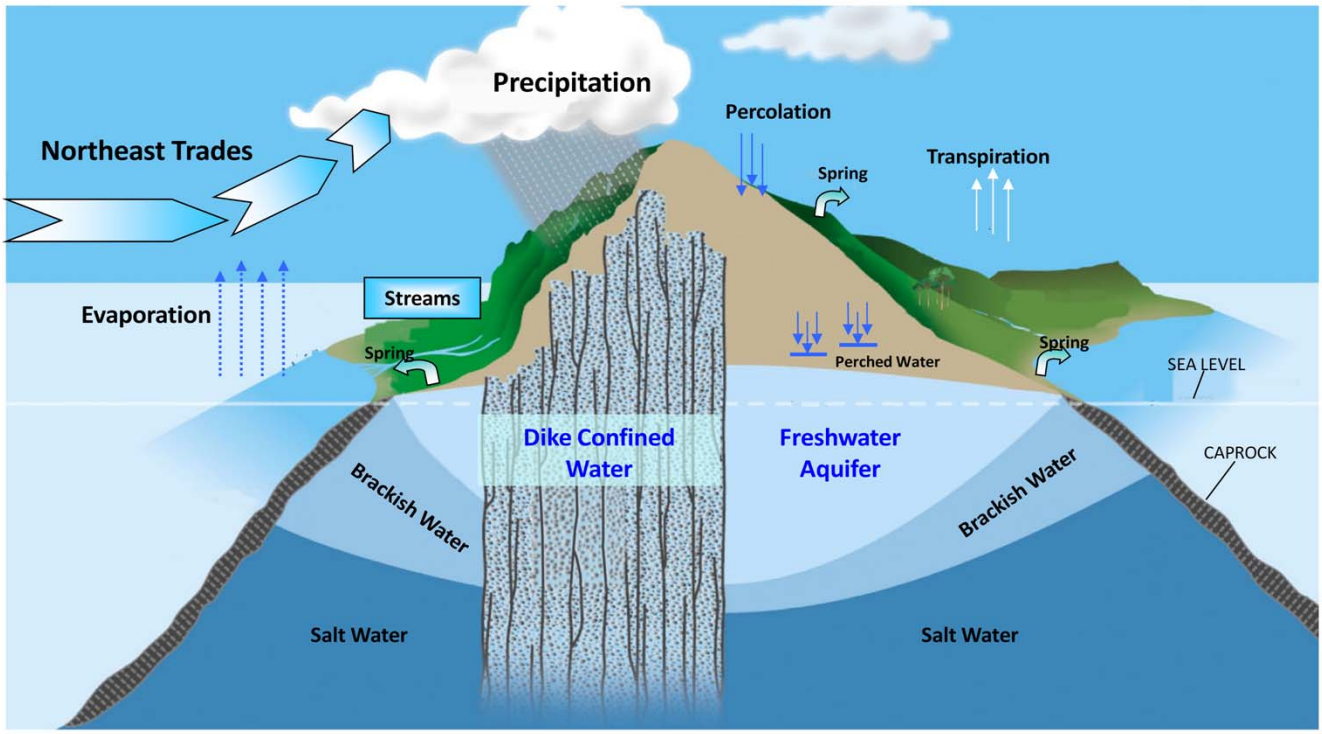
‘Ewa Planning District
Regional Hydro-Geology

‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013
9

Oahu’s hydro-geology is made up of three major formations:

- Basal aquifers of the central corridor and in Honolulu.
- High-level dikes along the crests of the Koolau and Waianae mountains. The dikes are smaller in volume than the basal aquifers and therefore are more prone to drought.
- The coral and marine sediment caprock in blue confines the basal water from leaking out into the oceans. Caprock areas were submerged in the past.

‘Ewa Planning District
Regional Hydrology



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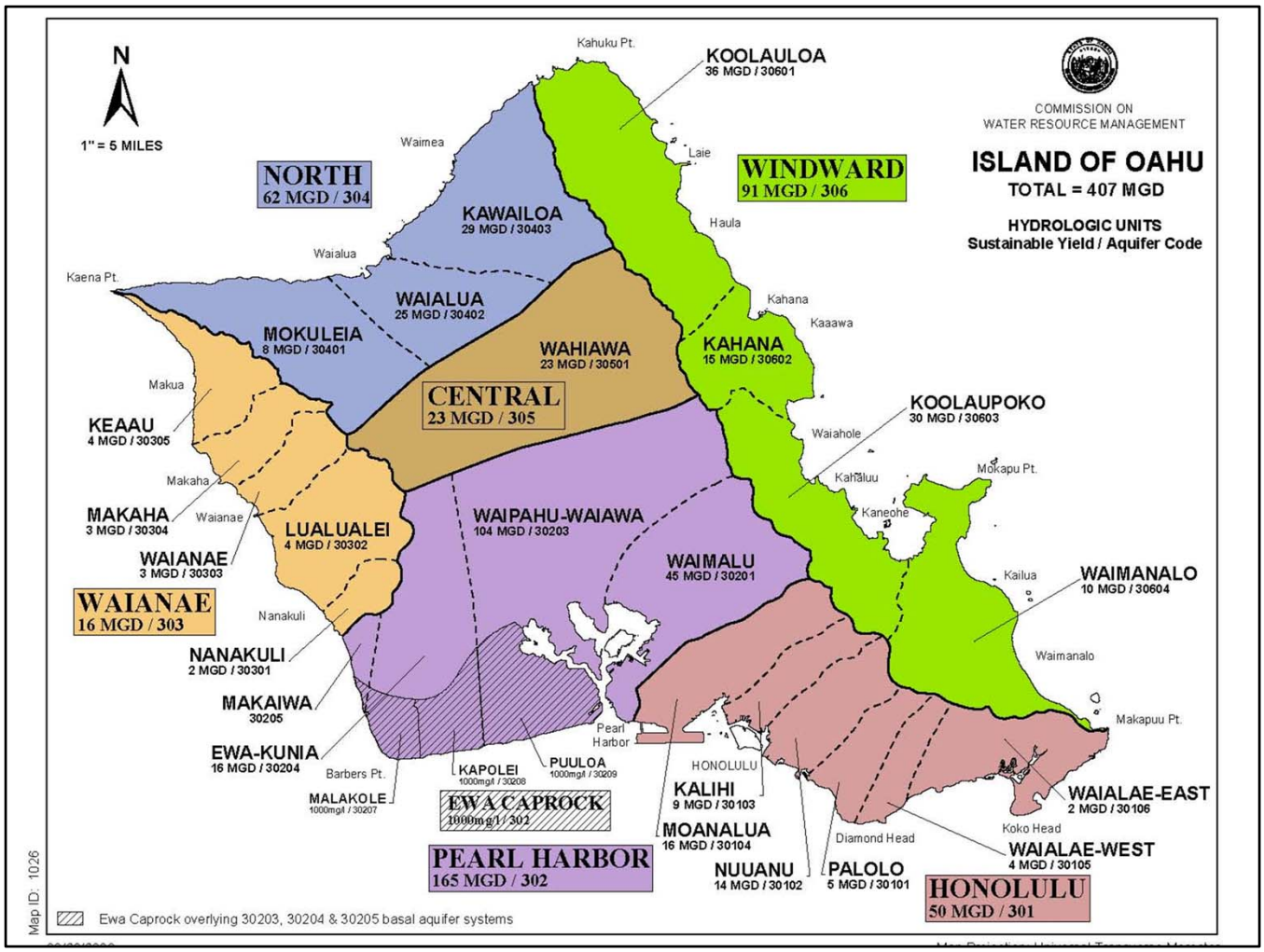
Community Meeting #1 – May 21, 2013
10

This is a cross-section of Oahu showing the high level dikes and basal aquifers.
The basal aquifers are thicker, up to 700’ thick, than on other islands due to the confining nature of the caprock.
Due to density differences, fresh water sits over salt water and there is an intermediate brackish transition zone.

The diagram also shows how northeast tradewinds uplift due to the Koolau mountains, where temperatures cool the moist tradewinds and it condenses and falls as rain.

Approximately 60% of Oahu’s rainfall comes from this uplifting or orographic rain, called windward and mauka showers.
Approximately 40% of Oahu’s rainfall comes from Kona storms or frontal systems moving West to East.



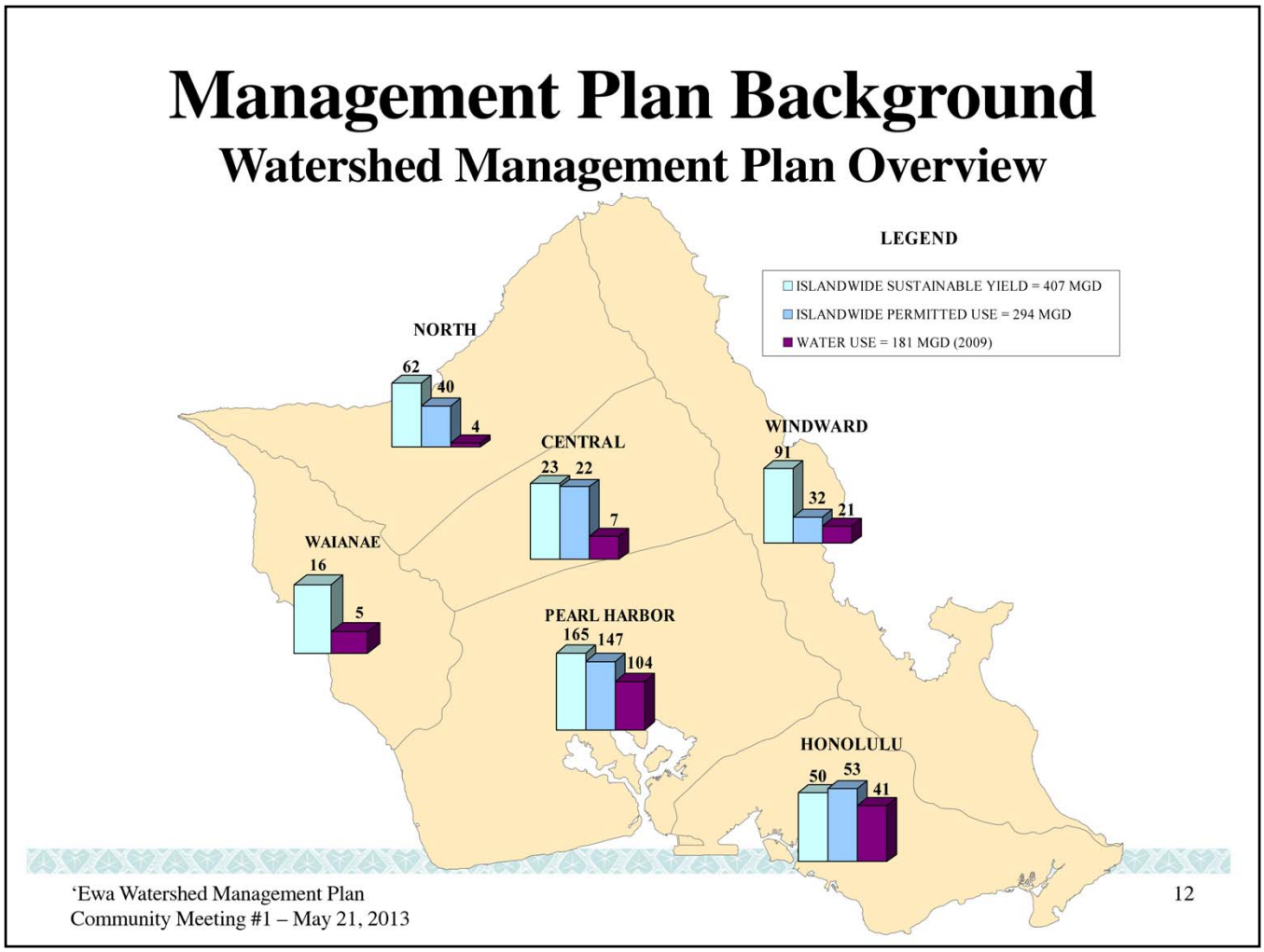
Sustainable yields, based on CWRM's Water Resources Protection Plan (2008), (see CWRM webpage)

There are 26 aquifer system areas on Oahu.

Sustainable yields are defined in the State Water Code as the maximum rate at which water may be withdrawn from a water source without impairing the utility or quality of the water source as determined by the commission.

The total sustainable yield on Oahu is 407 million gallons per day (mgd).

1 mgd can serve about 2,000 homes +or –



Graphic shows the aquifer system sectors on Oahu with:

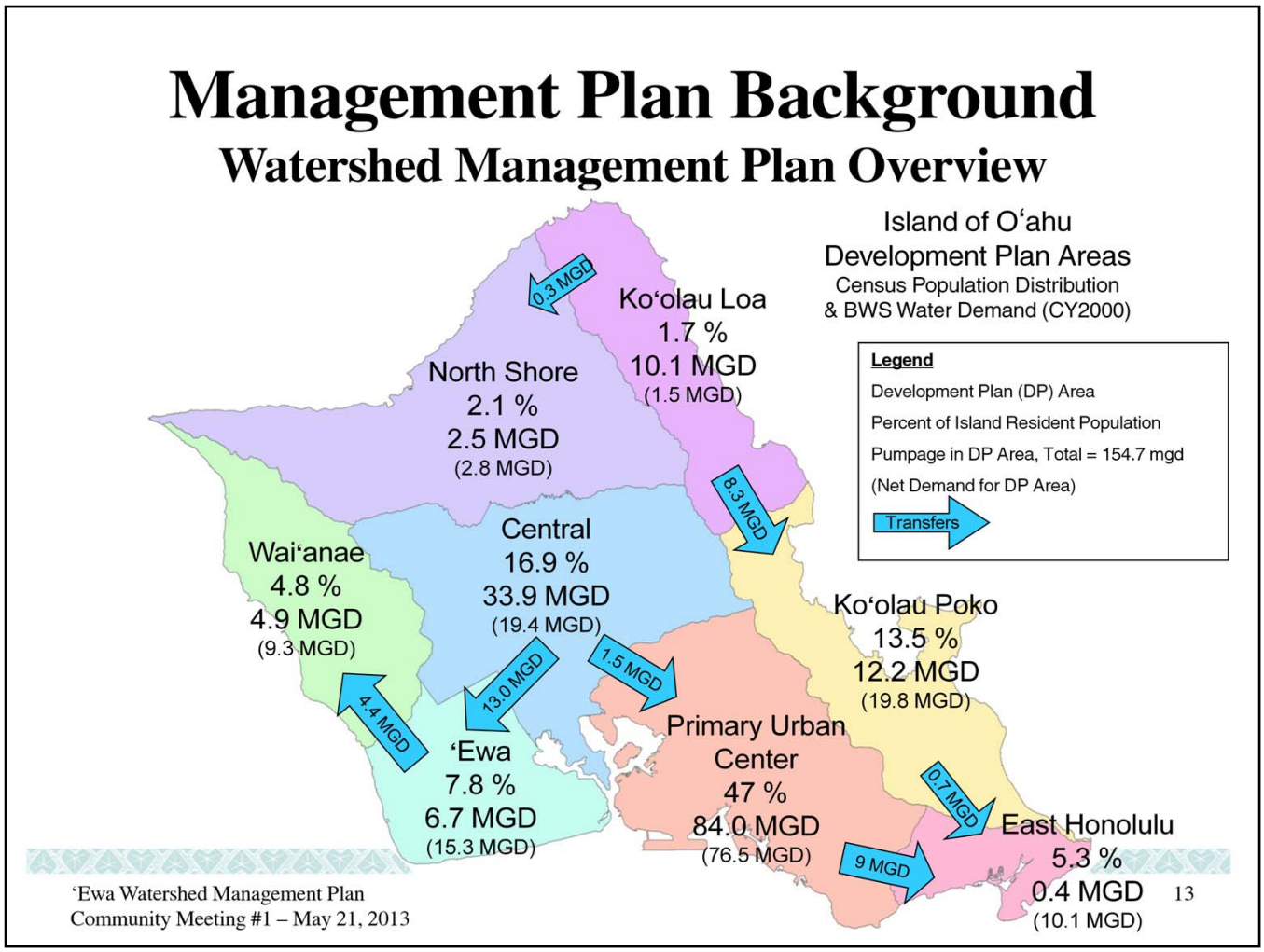
- Sustainable yield in the left bar
- Permitted use in the middle bar
- Pumpage in the right bar

Most of the unused water exists in the Pearl Harbor, Central and North sectors.

Sustainable yields in Waianae and Windward are dike aquifers that have less volume and are difficult locate and costly to develop.

About ¾ of Oahu's 407 mgd sustainable yield is permitted, but less than half of Oahu's water is used.

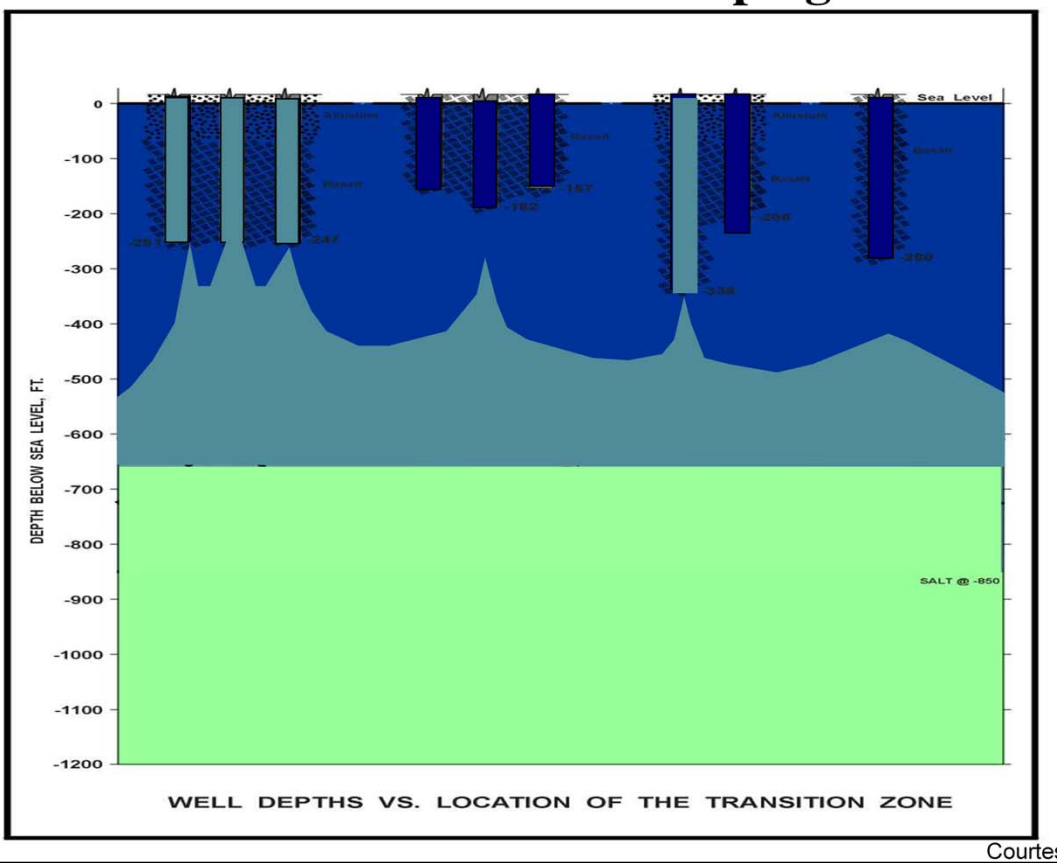
There is ample unused water supply on Oahu, however, the development of the remaining water will be more costly due to the remote location of water supply relative to the areas of demand.



This map shows how the water moves within the BWS potable system among land use districts.

- The resident population is shown by % of the total population in calendar year 2000
- The number below this is the water pumpage within each district
- The number in parentheses is the water use within each district
- The arrows show the water transfers directions and quantities between districts.

Well Upconing Due to Loss of Recharge and Concentrated Pumping

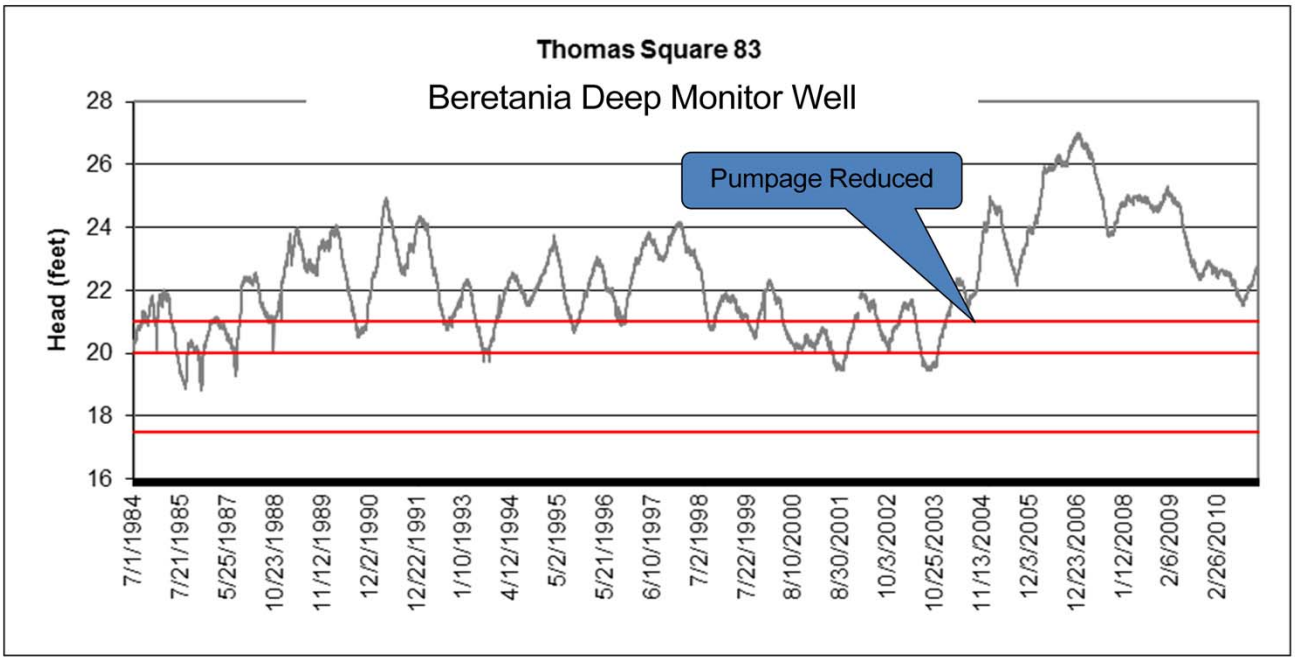


Courtesy of CWRM

Concentrated pumpage and loss of aquifer recharge and storage can cause upconing of brackish water into drinking water wells.

BWS monitors water levels, called head levels and chloride content to determine freshwater lens thickness.

BWS Monitors Head & Manages Pumping to Meet Demand



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Community Meeting #1 – May 21, 2013
15

BWS monitors head and manages pumping to meet demand while ensuring freshwater lens thickness is maintained.

The three red lines are the BWS low groundwater levels in its 14 index monitor wells:

- Top line is Caution level
- Mid line is Alert level
- Bottom line is Critical level.

- BWS low groundwater levels are described in the BWS Rules and Regulations, Chapter 3.
- http://www.boardofwatersupply.com/cssweb/display.cfm?sid=1362

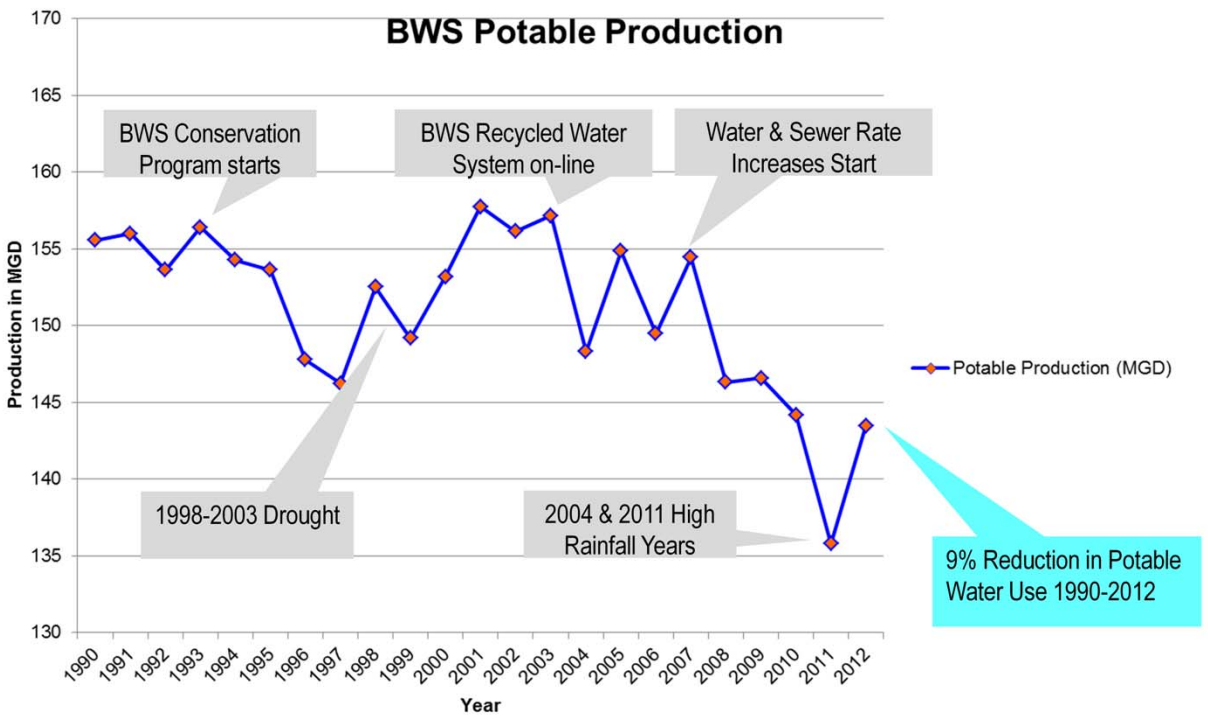
- Head levels in our Beretania Index well have risen since 2004 because BWS reduced pumpage from 7 mgd to 5 mgd.
- BWS was able to reduce pumpage due to successful water conservation programs.

Water Conservation is the KEY

Conservation Reduces Pumping Costs and Reduces Main Breaks

- Demand Side Management
- Leak Detection and Proactive Repair
- Pipe Corrosion Control
- Rain Barrel Catchments for Irrigation
- Education & Costs Incentives to Reduce Water Use
- Recycled Water

These are some of BWS's successful water conservation programs.



'Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

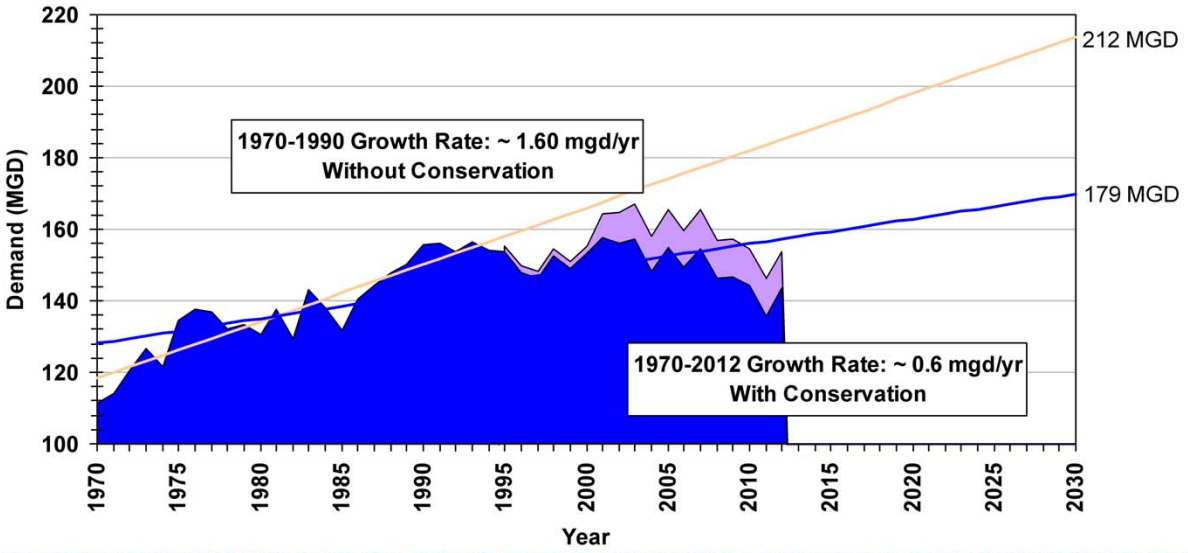
17

- Oahu's potable water production has dropped 9% from 1990-2012 and conservation is the key.
- This is the overall potable water system production for Oahu. Individual water systems will differ.
- Honolulu water demand dropped by about 15 mgd, while Ewa has increased due to major development growth.

Management Plan Background

Watershed Management Plan Overview

BWS Potable Water System Demand Projections
Historical Potable & Nonpotable Water Use



'Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

18

Historic trends and projected water demand.

- Blue is potable water.
- Purple is BWS recycled and non-potable production.

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- Simple linear projection of historical growth in water use defining a possible range in future water demand by 2030.
- Note the island-wide benefit of demand-side management and recycled water between 1970-1990 and 1970-2009.
- Capital cost savings in projected system capacity benefits water rate payers.
~~~~~

Water Scenario Planning

- Low Demand / High Supply Scenario
  - Successful conservation in urban demand
  - Large drop in pumpage from Sugar's close
- But in a period of transition
  - Climate Change reducing supply
  - Urban & Ag demand forecast to increase
- High Demand / Low Supply scenario

Currently, Oahu is in a Low Demand / High Supply Scenario

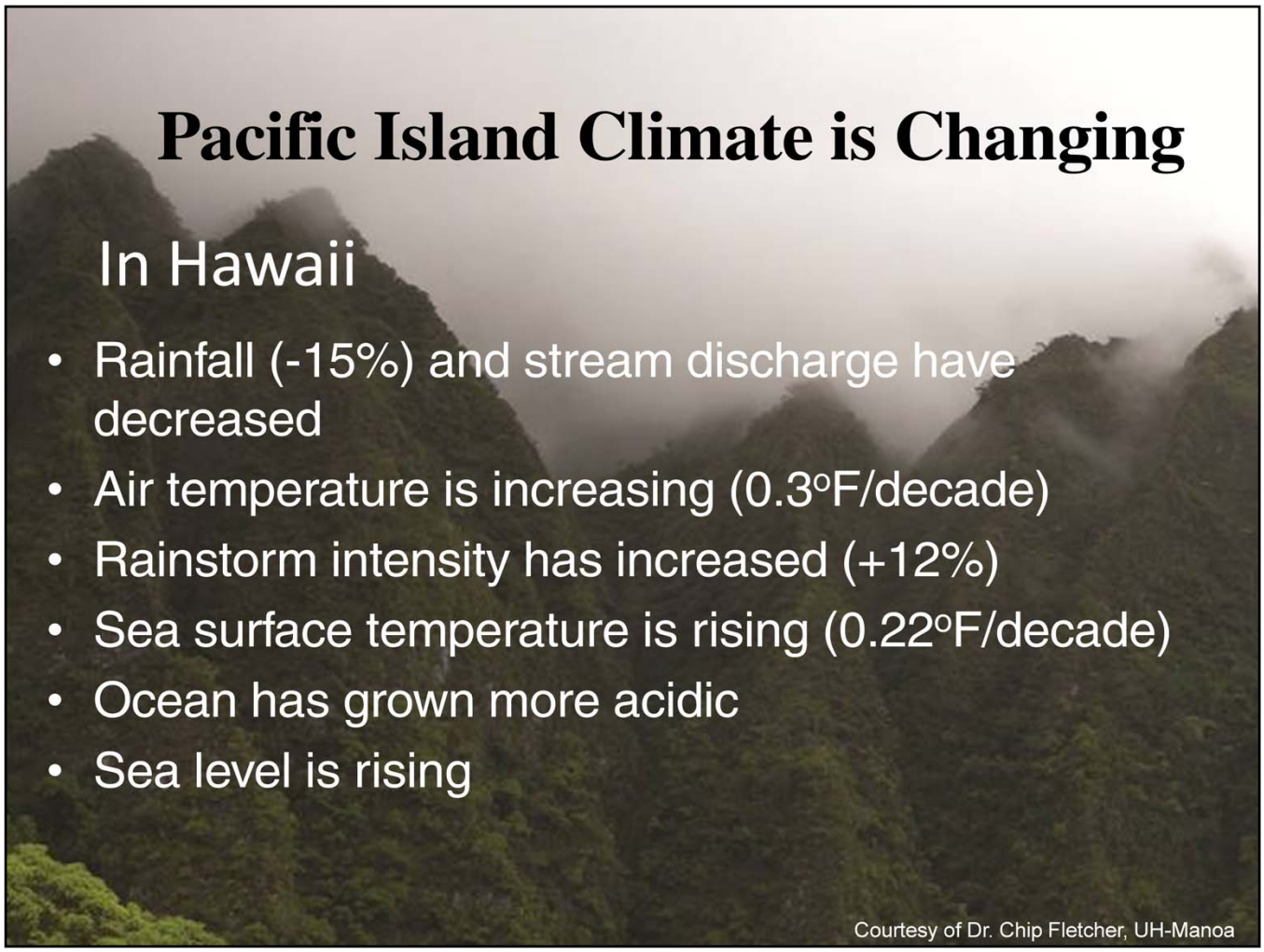
- Successful conservation in urban demand.
- Large drop in pumpage due to the closing of sugar plantations.

But we believe we are in a period of transition

- Climate Change reducing supply
- Urban & Ag demand forecast to increase

Due to climate change, we may be moving to a High Demand / Low Supply scenario

We need to understand climate change impacts and plan accordingly.



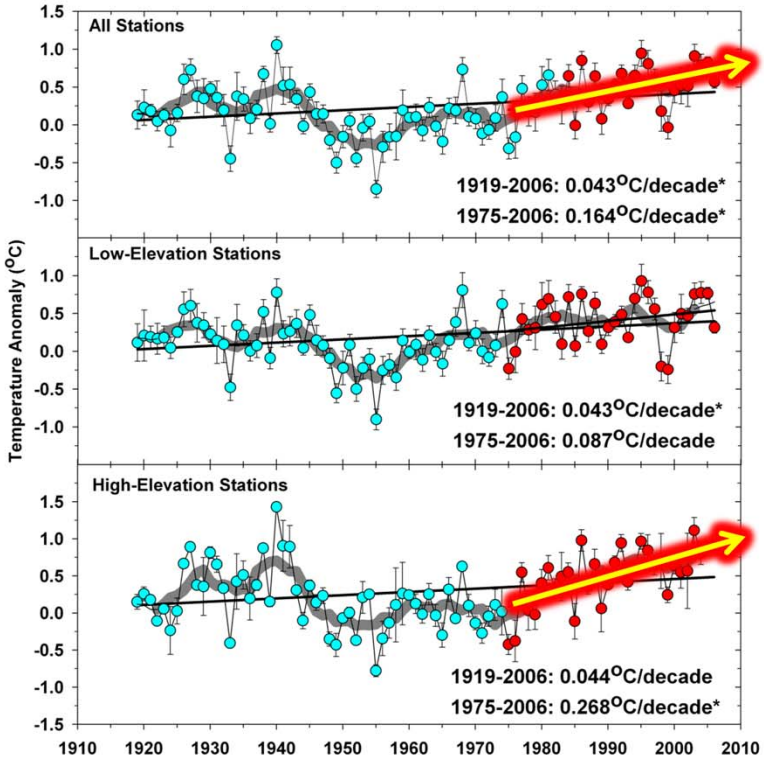
UH, USGS and NOAA research indicates that:

- Rainfall (-15%) and stream discharge have decreased
- Air temperature is increasing (0.3˚F/decade)
- Rainstorm intensity has increased (+12%)
- Sea surface temperature is rising (0.22˚F/decade)
- Ocean has grown more acidic
- Sea level is rising

Climate Change Extremes

Extreme drought and flood are already occurring

Hawai‘i Temperature Index



30-yr change = +0.9°F

30-yr change = +1.4°F

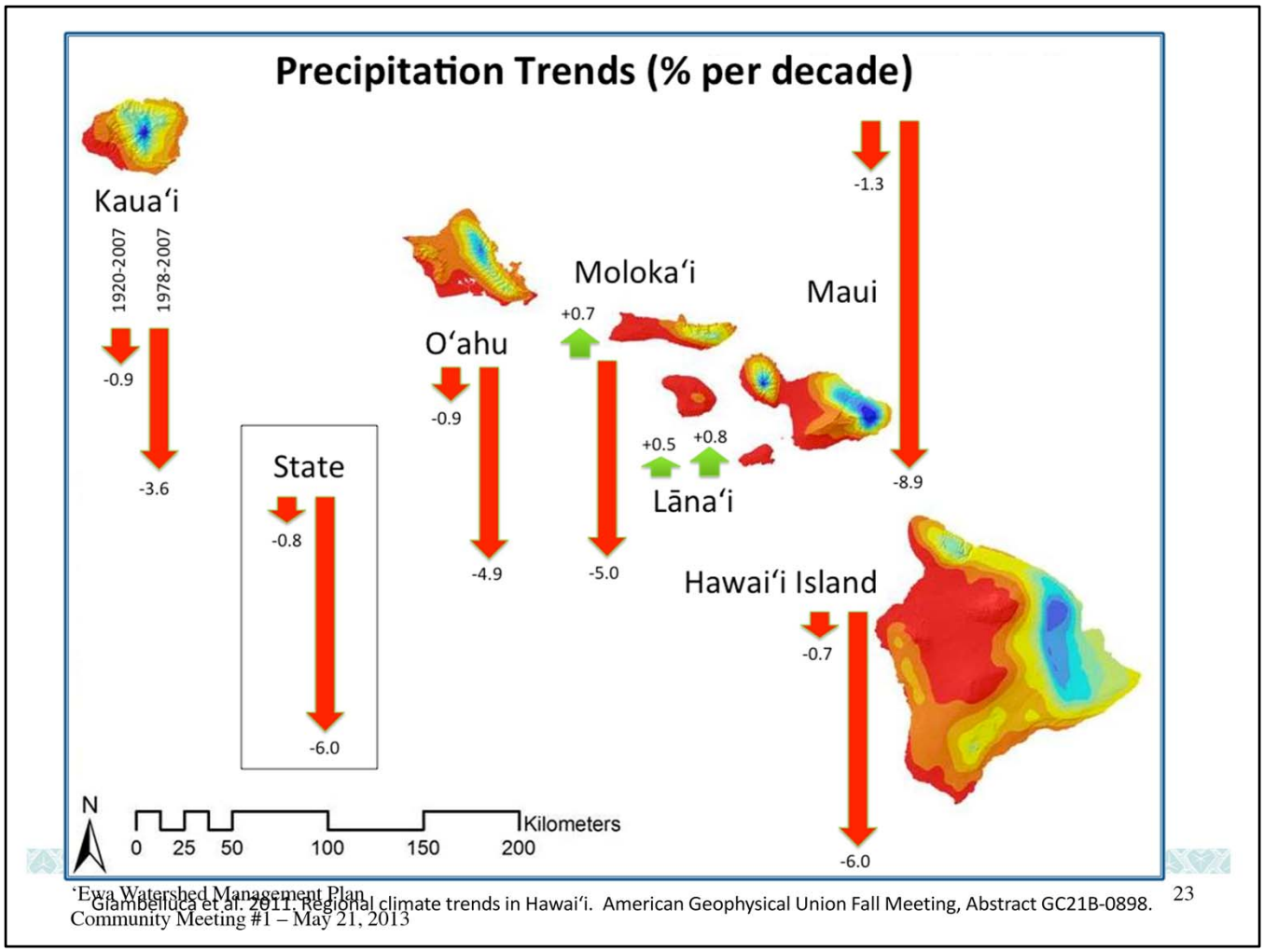
Giambelluca, T.W., Diaz, H.F., and Luke, M.S.A. 2008. Secular temperature changes in Hawai‘i. *Geophysical Research Letters* 35, L12702, doi:10.1029/2008GL034377.

‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

22

UH research shows air temperatures are rising and the percent change has accelerated in the past 30 years for all stations.

- High elevations above 0.5 miles have increased at a faster rate.
- Oahu’s mountain tops are at about the 2,600 foot elevation and we are seeing decreased rainfall at the crests.



'Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

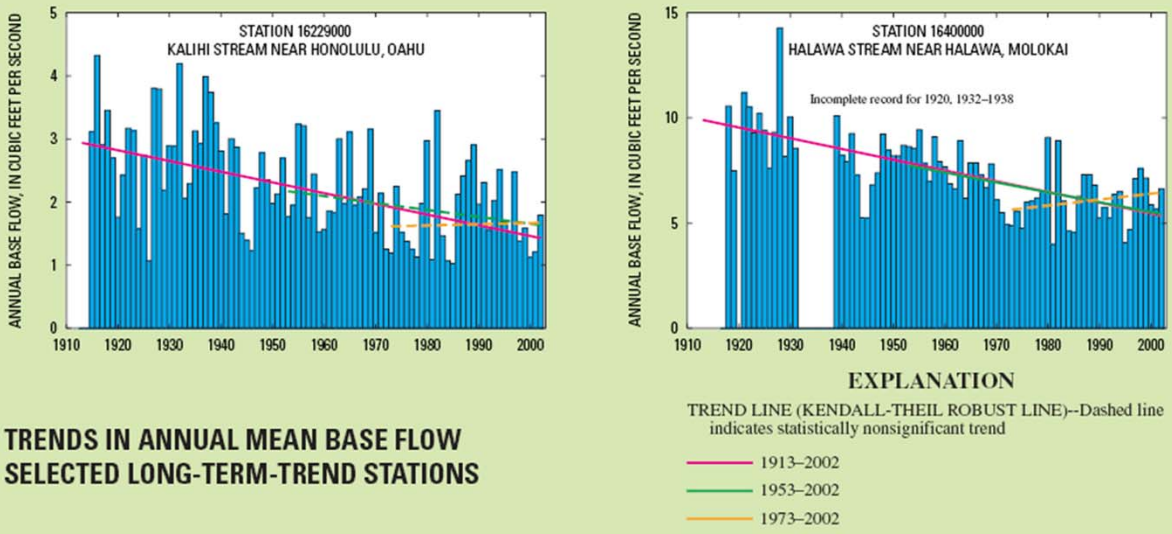
Giambelluca et al. 2011. Regional climate trends in Hawai'i. American Geophysical Union Fall Meeting, Abstract GC21B-0898.

23

Precipitation trends show an accelerated decrease in precipitation per decade from 1978 to 2007.

-4.9% on Oahu

USGS Trends in Annual Mean Stream Base Flow 1913-2002



- Will the downward trends in base flows & rain continue or is it a part of a long-term cycle?
- What are the physical causes for the detected trends and variations in streamflow?
- Can regional climate indicators be used to predict streamflow trends and variations?

'Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013
24

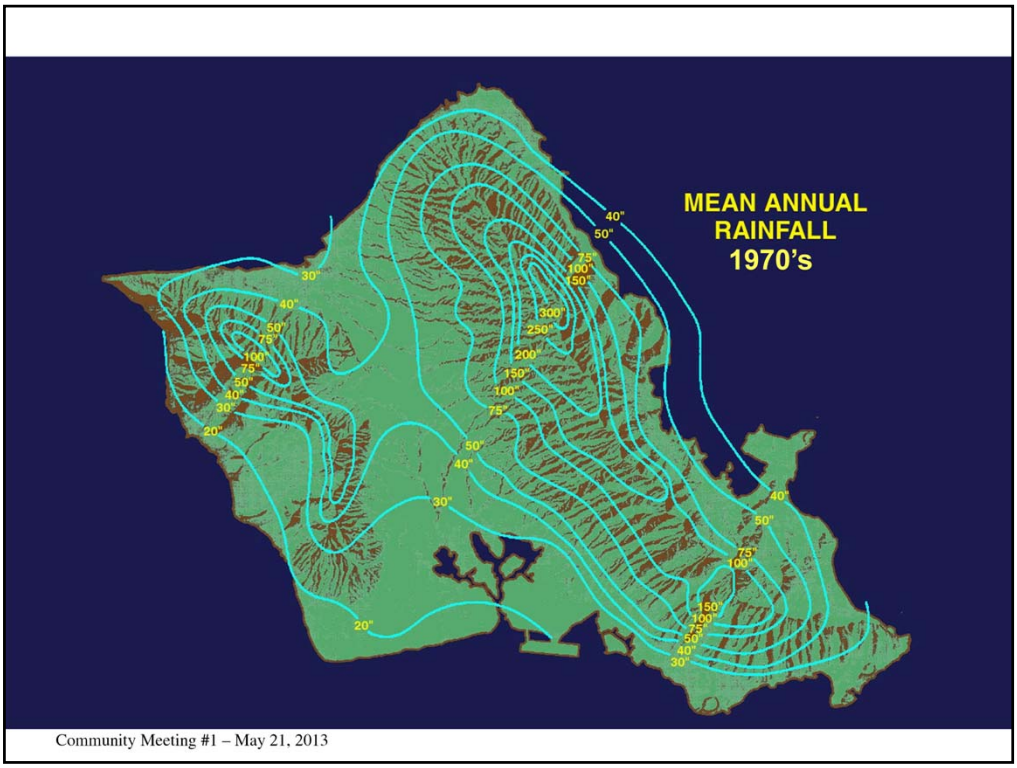
The 2004 USGS *Fact Sheet Trends in Streamflow Characteristics in Hawaii, 1913-2002*, show a decreasing trend in stream base flows.

- USGS suggests a direct correlation between streamflow and rainfall in selected streams.
- Kalihi Stream above the stream gage has NO water sources, so data is indicative of storage replenished by rain as there are no pumpage impacts.

What we don't know:

- Will the downward trends in base flows and rain continue or is it a part of a long-term cycle?
- What are the physical causes for the detected trends and variations in streamflow? Climate Change? Urbanization? Forest degradation?
- Can regional climate indicators be used to predict streamflow trends and variations? What about at a watershed level? This is unlikely, but we will continue to monitor the situation.

More research is needed.



"The rain follows the forest but the mountains create the rain."

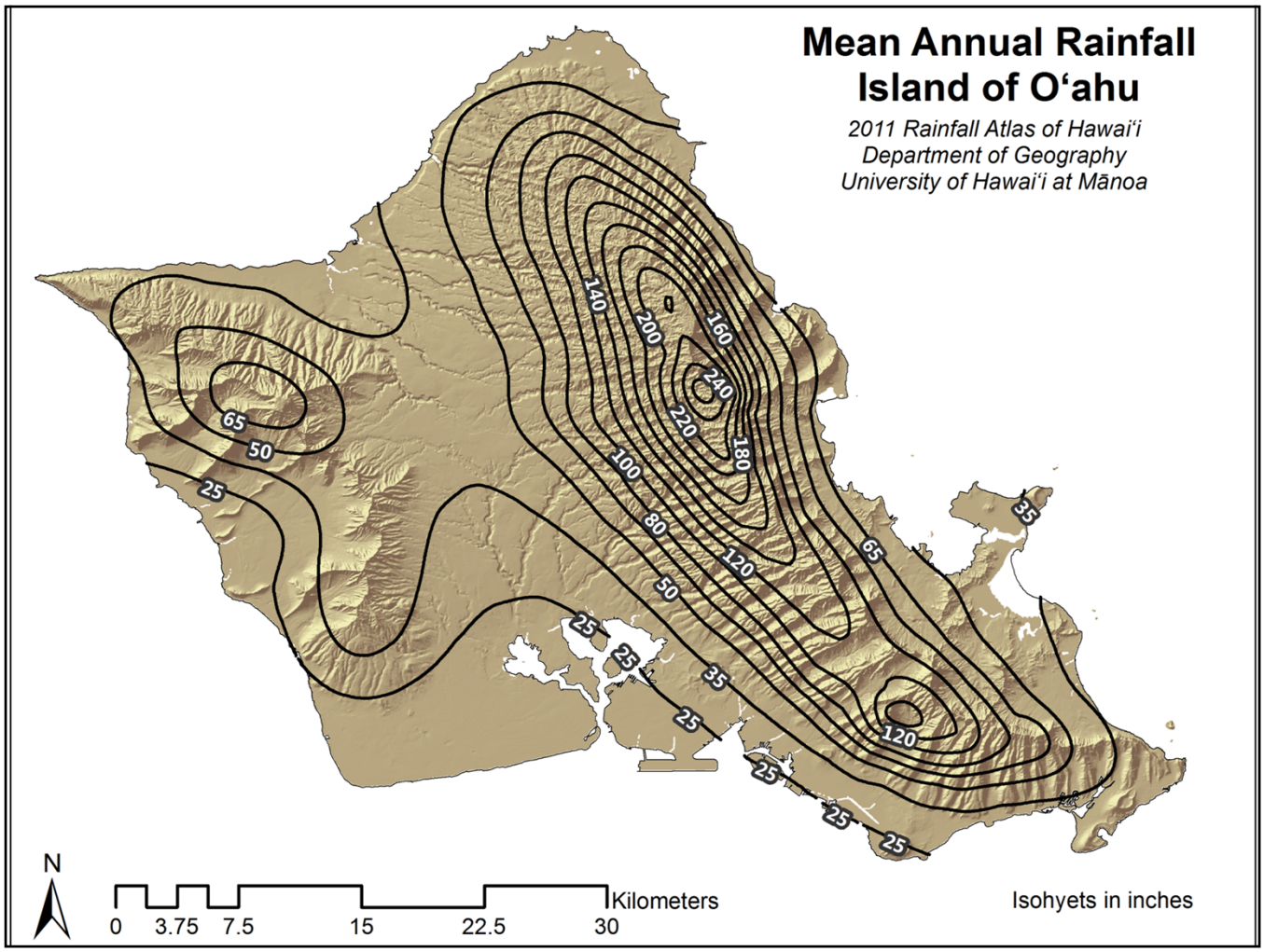
This is an rainfall isohyet graphic or lines of equal annual rainfall from 1970's data.

Rainfall over the coastal ocean is low, like Ewa at 20" annually. At the mountain crests of Wahiawa-Kahana-Punaluu, it was 300", Manoa was 150" and Kaala was 100."

Rainfall is decreasing (see next slide for 2011 rainfall isohyets). There are two hypotheses:

1. Northeast tradewinds hit the Koolau Mountains head-on and are uplifted creating windward and mauka showers.
    a. Pao Shin Chu of UH documented a cyclic shifting of the tradewind direction from predominantly Northeast to Easterlys.
    b. Eastery tradewinds hit the Koolau Mountains at an angle reducing the amount of uplift and subsequent rainfall.

2. As air temperatures rise, the Koolau Mountains become too short. Uplifted moisture doesn't cool enough to condense and fall as rain.
    a. Tradewind moisture therefore passes over the mountains.
    b. An extreme case of the mountains that are too short is Koohalawe, which is very dry.

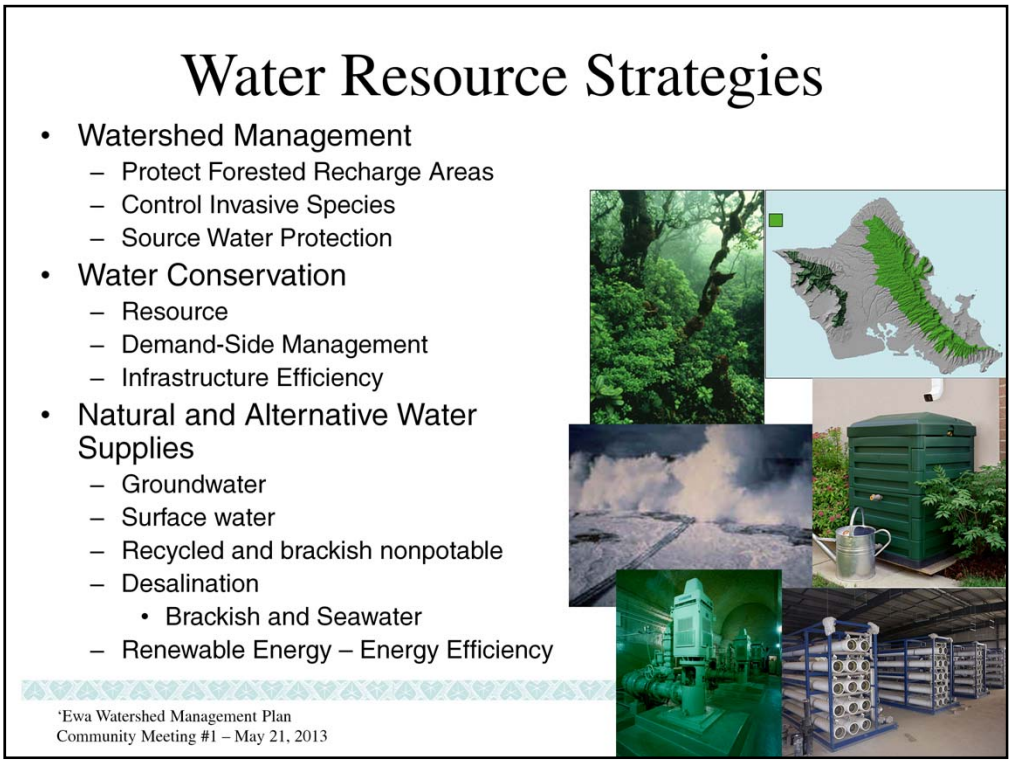


Rainfall decreased from 1970’s to 2011. Reduction in rainfall is from climate change.

Comparing the two slides: At the mountain crests of Wahiawa-Kahana-Punaluu was 300” and is now 240”, Manoa was 150” and is now 120” and Kaala was 100” and is now 65.”

Although Windward receives the most rainfall on Oahu, its dike aquifers are small and prone to drought impacts. The 2008 drought resulted in voluntary conservation for Windward only.

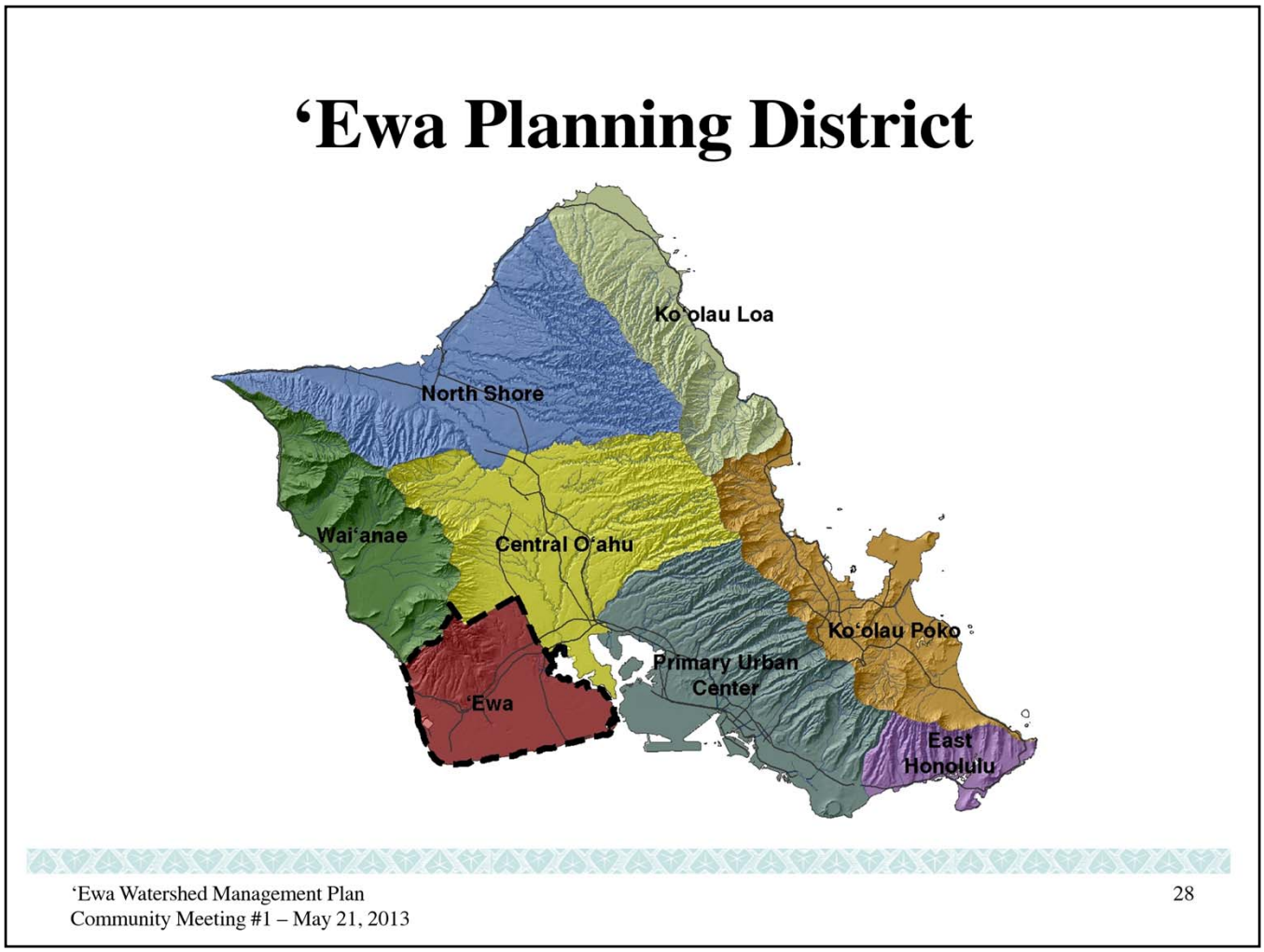
We need balanced water resource strategies to ensure sustainable pumping levels for meeting demand, drought mitigation, and reduced detrimental impacts to watersheds, streams and near shore waters.



Long-term sustainability on an island with limited land and water resources requires a strategic and balanced approach to water resource management. Because land and water is so interconnected, a holistic, watershed-based approach to resource management is a viable model that balances resource protection, development, and conservation.

There are three main water resources strategies that BWS is pursuing to ensure resource sustainability for Oahu:

- **Watershed management and land use planning protects the supply**
  - We help protect forested recharge areas. Zoning districts of Conservation, Urban and Ag help with this balance.
  - We help to control invasive species through participation in the Koolau and Waianae mountain watershed partnerships
  - We condition land use approvals to ensure source water protection
- **Water Conservation preserves the resource by promoting wise use of water**
  - Water conservation conserves the resource for future generations;
  - Demand side management programs reduce water use;
  - Our infrastructure efficiency programs reduce water loss in delivery systems.
- **Diversifying water supplies ensures system adequacy and reliability**
  - Our drinking water is 100% groundwater;
  - Surface water is used for agriculture and kept in streams;
  - Recycled and brackish nonpotable irrigation extends potable water resources;
  - Desalination utilizes new technology and renewable energy systems reduces costs and dependence on imported oil. Desalination through a filtering process called reverse osmosis is how most bottled water is made. Desalination produces high quality water supply.
- **Climate change preparedness and adaptation is needed**
  - We need to ensure forests are healthy and pursue conservation to reduce demand on natural resources. We also need to develop drought-proof sources of supply like reuse and desalination. Combined we achieve this goal.



BWS decided to do regional WMPs that would be components of the island-wide water plan because it:

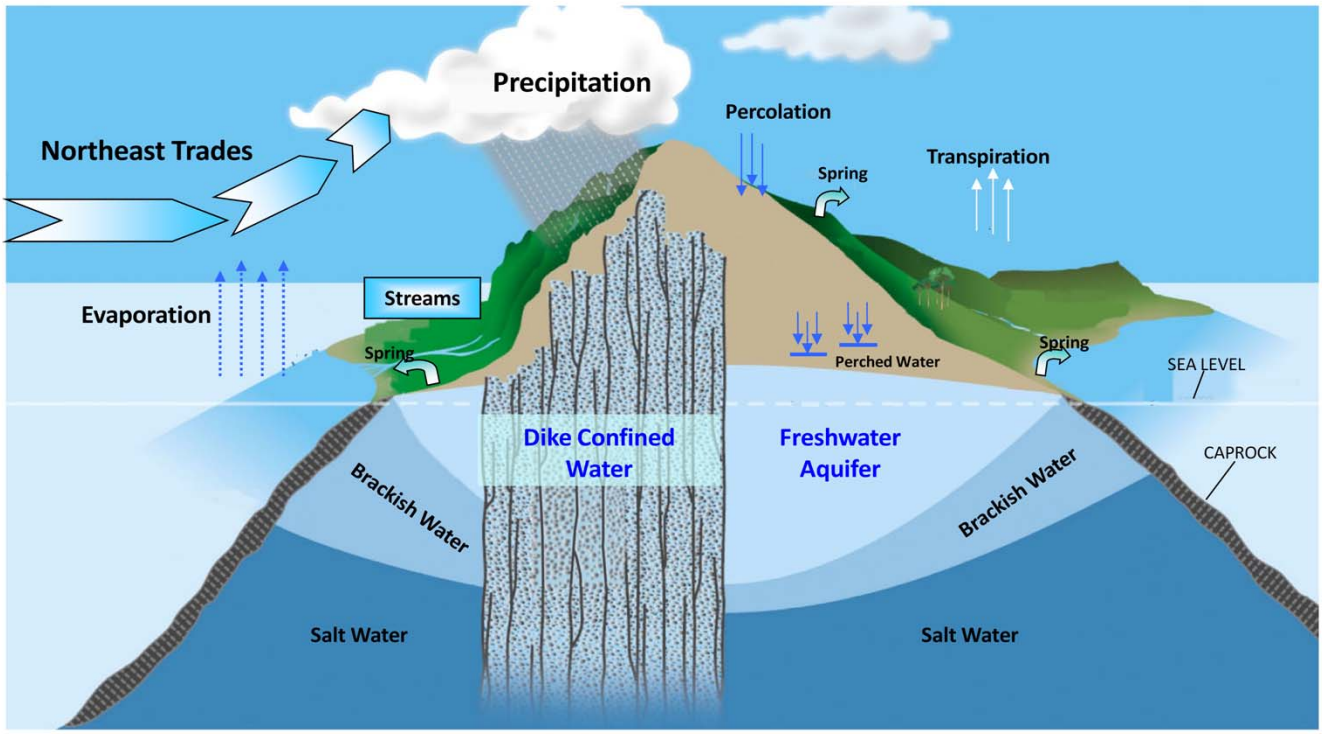
- Allows a direct tie to the City’s land use plans;
- Allows more detailed study within each district; and
- Is easier to plan and focus on water issues in each community.

Completed Plans: Waianae, Koolau Loa, Koolau Poko.

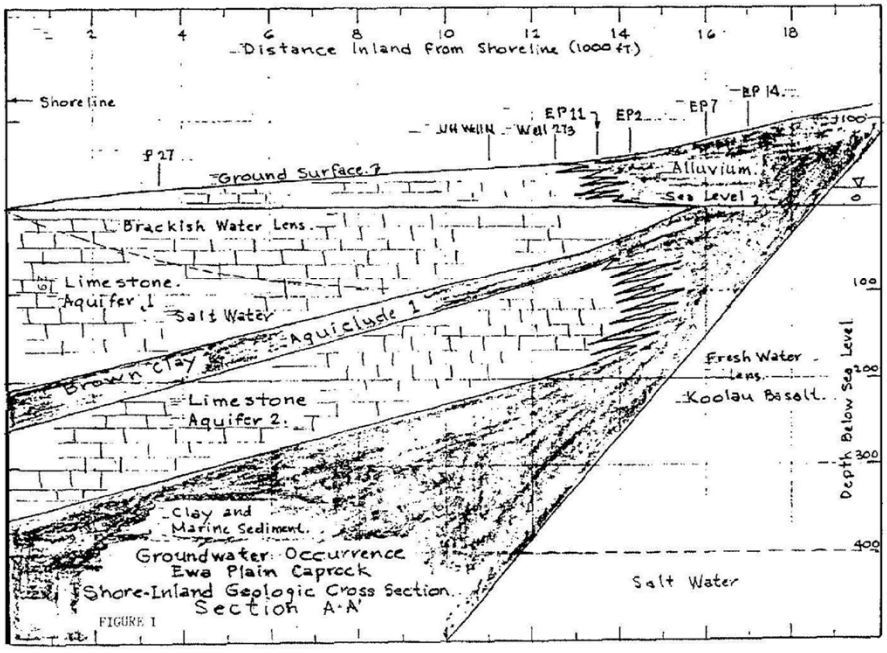
Plans in progress: North Shore, Ewa

Upcoming Plans: Central Oahu, PUC, East Honolulu

‘Ewa Planning District
Regional Hydrology



‘Ewa Planning District
Regional Hydro-Geology

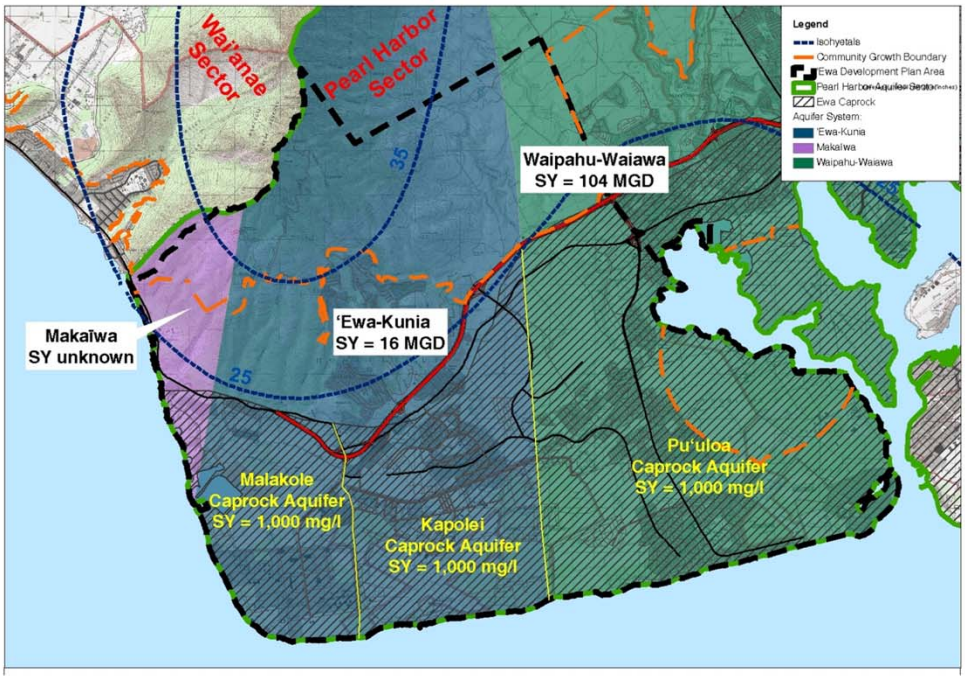


Mink, 1989

In Ewa, there is a special geologic formation called “caprock.”

- The coastal plain is made up of sediments that form a relatively impermeable sedimentary material, or “caprock.”
- The caprock restricts the seaward flow of fresh ground water.
- Caprock also holds water within its limestone layers. This water is fed by rainfall and leakage from the basal aquifer.
- Irrigation from sugar plantations used to enhance the caprock aquifer, but since the closing of Oahu Sugar Company (OSCo), the brackish caprock lens shrank.

‘Ewa Planning District
Ground Water



‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

31

- The Ewa Planning District overlays the Pearl Harbor Aquifer Sector Area.
- Aquifer Sector Areas are broken up into smaller units called Aquifer System Areas (ASYA). Ewa overlays Makaiwa and a portion of the Ewa-Kunia and Waipahu-Waiawa ASYAs.
- Additionally, there is an Ewa Caprock Aquifer with three ASYAs: Kapolei, Malakole, and Puuloa.
- SY for the Caprock aquifers is set by a chloride limit of 1,000 mg/l and is specific to irrigation wells because it is the chloride level that is considered acceptable or irrigation.

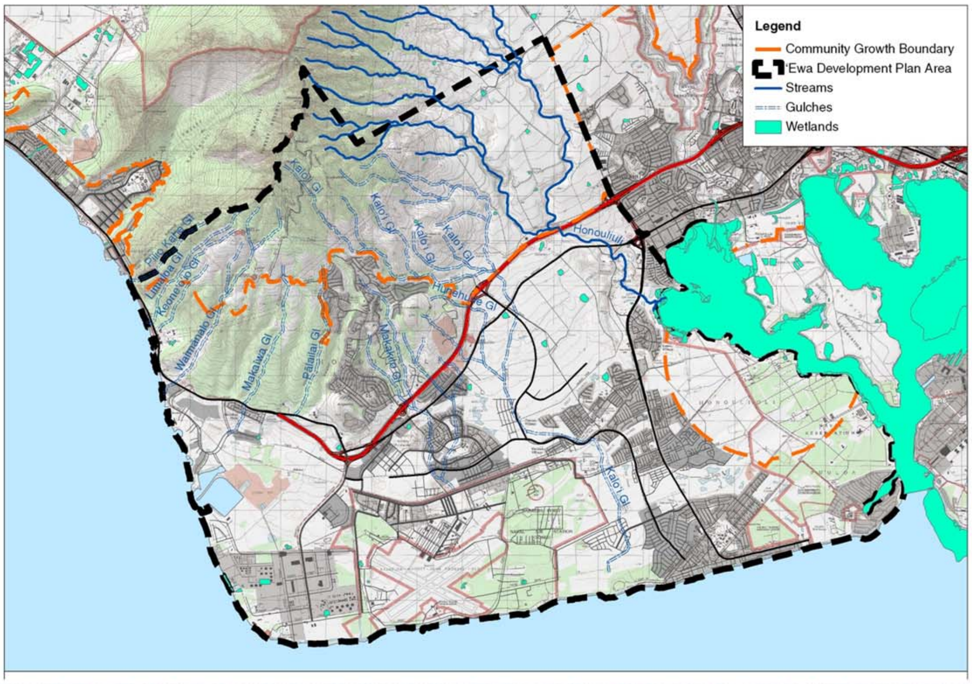
‘Ewa Planning District

Ground Water Quality

- BWS regularly tests its water to ensure that Safe Drinking Water Act requirements are met.
- BWS tests for over 100 different kinds of chemical contaminants and bacteria.
- The Waipahu-Ewa-Waianae System has not exceeded the legal limit for contaminants since at least 2004.

http://www.ewg.org/tap-water/whatsinyourwater2/HI/waipahu-ewa-waianae/0000335/

‘Ewa Planning District
Surface Water



‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013
33

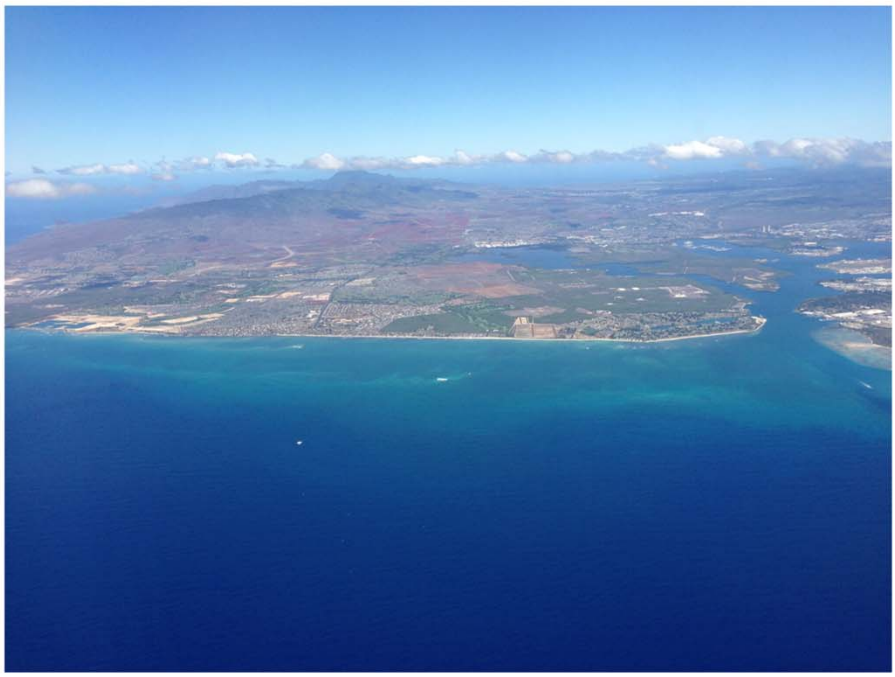
- Honouliuli is the only perennial stream in Ewa.
- There are many dry gulches that transport water from the mountains to the coast during heavy rains.
- There are several small wetlands in Ewa, some of which were possibly associated with agricultural irrigation features.
- The Pearl Harbor National Wildlife Refuge was created in 1976 to mitigate wetland loss and protect Hawaiian waterfowl. There are two units: Honouliuli and Kalaeloa
- The Kalaeloa NWR Unit also protects Karst formations, underground drainage networks that connect to the surface through sinkholes and provide habitat for opae ula.

‘Ewa Planning District
Drainage and Flooding

http://archives.starbulletin.com/96/11/06/news/story2.html

- Low-lying areas of the Ewa plain are prone to flooding.
- Flat topography slows water coming off of the Waianae mountains.
- Detention is being used as a major flood control tool.
- The Ewa Development Plan recommends preserving natural gulches for drainage purposes.

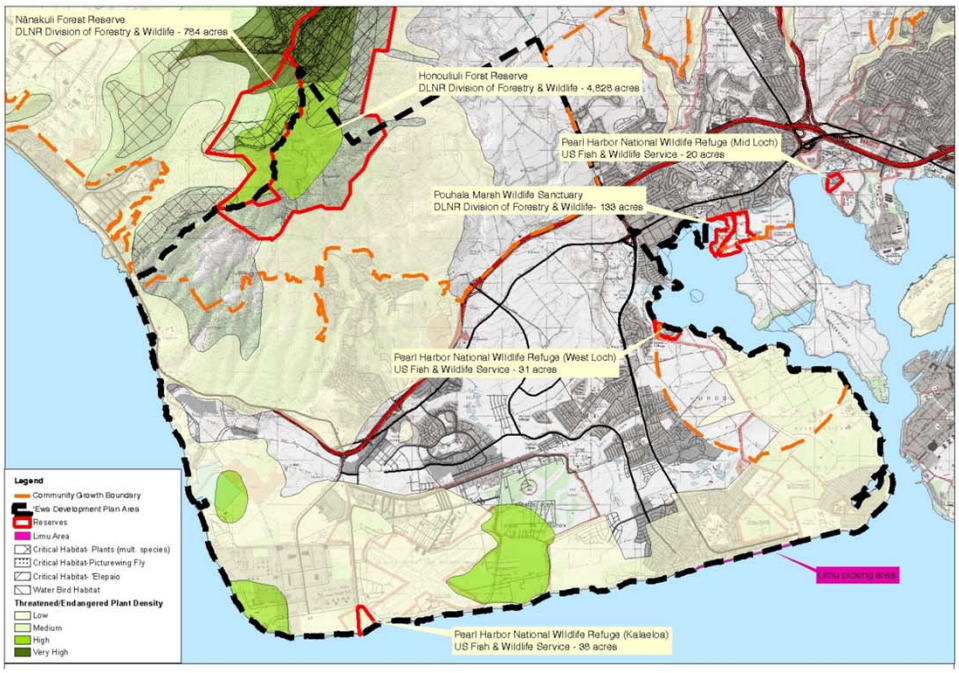
‘Ewa Planning District
Near Shore Waters



- There are three main coastline areas: Pearl Harbor, Ewa Beach, and Kahe.
- Pearl Harbor is the state’s largest estuary. The entire harbor is identified by the State Department of Health as a Water Quality Limited Segment due to high levels of nutrients, chlorophyll-a, and turbidity.
- Waters off of the Kahe and Ewa shorelines gradually increase in depth and while there are corals, there is very little true reef there.
- Seaweed was once plentiful off of the Ewa shoreline, but has since declined. There are several theories as to why this occurred, but the actual cause of this loss is not known. This area is now designated as the Ewa Limu Management Area, and harvesting is only allowed by permit.

‘Ewa Planning District

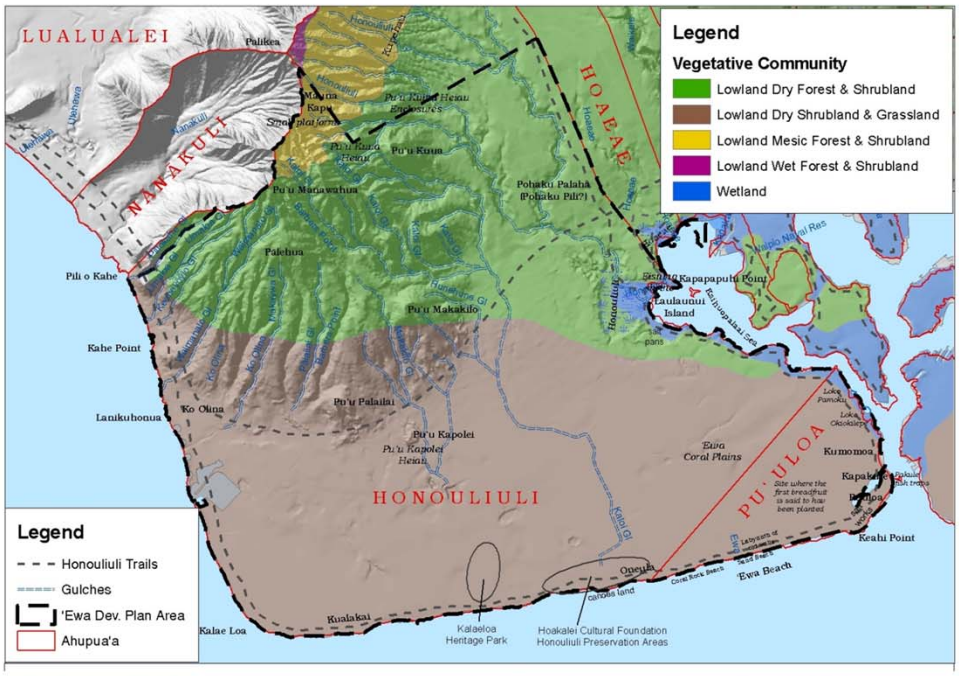
Terrestrial Ecosystems



There are few native vegetative communities left in Ewa however, some species of native and endangered plants and animals may still be found here:

- A small portion of the critical habitat for endangered elepaio falls within the Ewa District.
- USFWS manages two units of the Pearl Harbor National Wildlife Refuge in Ewa: Honouliuli, which was created to protect endangered waterfowl and Kalaeloa, which protects the last remaining ancient, coastal, dry land plant community that was once widespread along the Ewa plain.
- Most of the high value habitat is found in the mauka Honouliuli Forest Reserve in the Waianae Mountains, much of which falls outside of the District boundaries

‘Ewa Planning District
History and Culture



- Today’s Ewa District overlays a portion of the Honouliuli and Puuloa *ahupuaa*.
- Many well-known cultural features are associated with the forested areas (*puu*, *heiau*) and coastline (canoe landings, salt works, fishponds).
- Two main trails traversed the district: one coastal and the other along the base of the Waianae Mountains.
- Kalaeloa Heritage and Legacy Foundation is working to establish the Kalaeloa Heritage Park. Volunteers are restoring heiau, habitation sites, and other features that tell the story of the community that once lived here.
- Hoakalei Cultural Foundation has entered into a stewardship agreement with the State for three preservation areas at Honouliuli. The Foundation leads efforts to clean and restore habitation, ceremonial, and agricultural sites, and plant communities and wetland areas that provide habitat for wetlands birds, invertebrates, and plants.

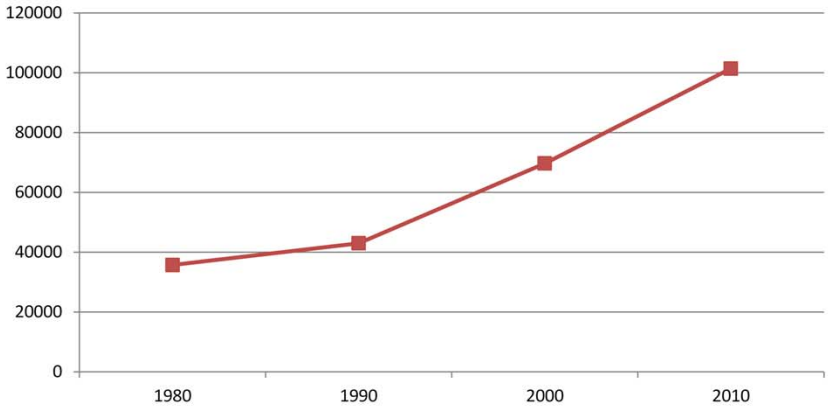
‘Ewa Planning District
Recent History

- 1796 Captain Henry Barber (Barber’s Point) ran aground on a coral shoal
- 1876 U.S. Navy gets exclusive rights to develop Pearl Harbor
- 1877 James Campbell purchases 41,000 acres of land in Honouliuli
- 1879 First successful well drilling in ‘Ewa allows for large-scale sugar plantations
- 1886 O‘ahu Railway and Land Company begins construction
- 1890 ‘Ewa Plantation Company opens, the first of three large sugar plantation in ‘Ewa

‘Ewa Planning District
Recent History

- 1890s ‘Ewa Villages begin construction
- 1942 Barber’s Point Naval Air Station (BPNAS) established
- 1961 Kalaeloa Barber’s Point Harbor constructed
- 1977 City Council designates Kapolei as O‘ahu’s Secondary Urban Center
- 1986 Construction starts at Ko Olina
- 1994 OSCo, the last sugar plantation in ‘Ewa, closes
- 2002 State HCDA assumes responsibility for BPNAS
- 2012 UH West O‘ahu opens

‘Ewa Planning District
Population

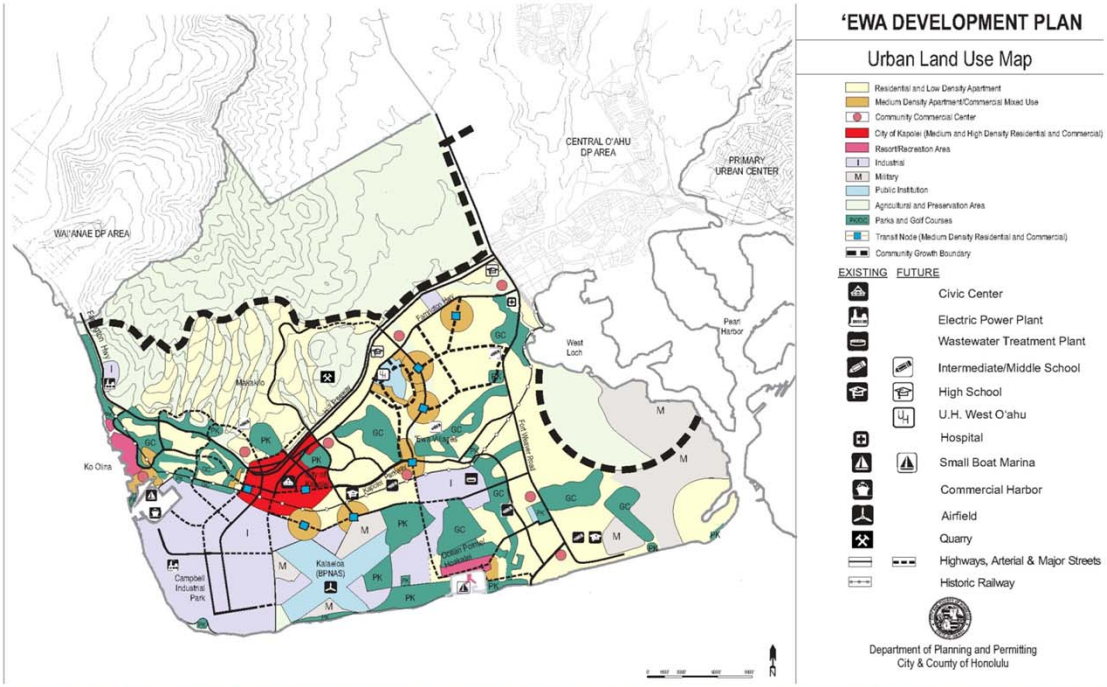


	1980	1990	2000	2010	Change (1980-2010)
‘Ewa DP Area	35,709	42,983	68,696	101,397	65,688
O‘ahu Total	762,564	836,231	876,156	953,207	193,211
% of O‘ahu	4.7%	5.1%	8.0%	10.6%	

- The population in Ewa has increased by 184% between 1980 and 2010 (30 years).
- As a Development Plan area and designated as Honolulu’s “Second City,” Ewa will continue to grow.
- In Honolulu’s General Plan, Ewa should account for 13% of Oahu’s population by 2025.

‘Ewa Planning District

‘Ewa Development Plan Land Use Map



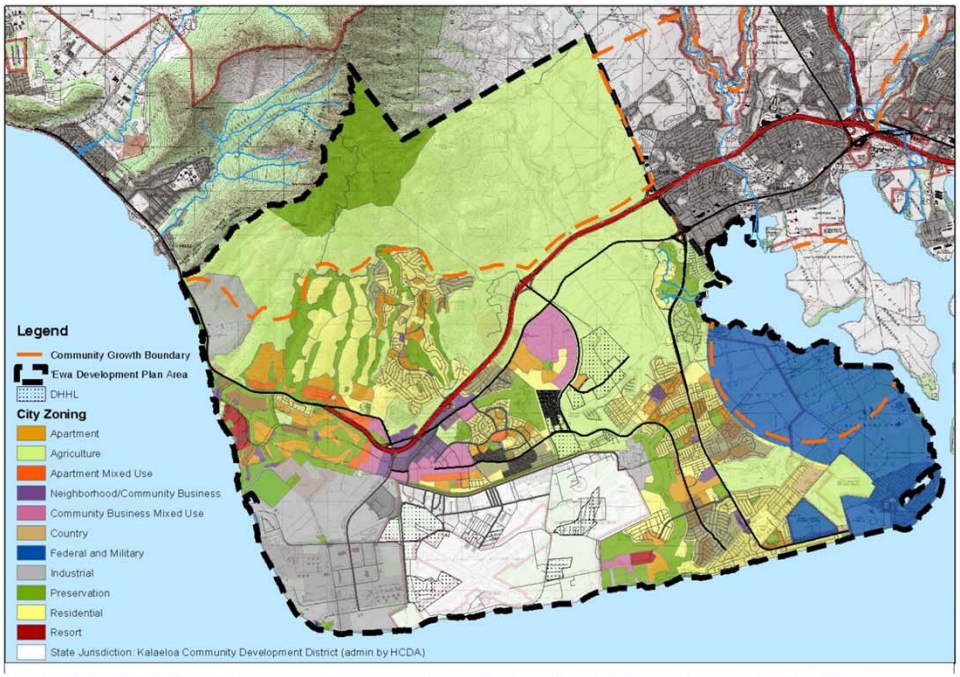
‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

41

The Ewa Development Plan Land Use map highlights the following:

- The Community Growth Boundary protects the Navy’s safety zone (“blast zone”) and land mauka of the H-1 Freeway, Makakilo, and Makaiwa.
- Residential uses makai of the community growth boundary
- Protection of gulches to ensure proper drainage
- Continued Industrial uses in the Campbell Industrial Park area
- Continued military use in Puuloa and portions of Kalaeloa
- Continued resort use at Ko Olina
- Dense urban center at Kapolei
- Future transit nodes and associated medium density residential mixed use.

‘Ewa Planning District
City Zoning



‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

42

City zoning generally shows:

- Preservation of the upper forests
- Agriculture in the much of the sloped areas
- Urban uses in the plain
- Military use of the area fronting Pearl Harbor
- Industrial use in the Campbell Industrial Park area
- The former Barber’s Point Naval Air Station is now the Kalaeloa Community Development District and under the jurisdiction of the Hawaii Community Development Corporation (HCDA). HCDA creates development rules for its development districts that supercede City zoning.
- Similarly, DHHL owns 652 acres of land in Ewa and is not subject to City zoning.

‘Ewa Planning District

Water Supply System Operators and Well Owners

• BWS	Ground Water
	Recycled Water (R-1, RO)
• Other City	Ground Water
• State	Ground Water
	Waiāhole Ditch (private use)
• Federal	Ground Water
• Private	Ground Water

- Most of the water used in Ewa is supplied by ground water from both the basal and caprock aquifers.
- Waiahole Ditch provides some water to agricultural operations mauka of the H-1 Freeway
- Recycled water provides additional supply to industrial (RO) and irrigation (R-1) users.

‘Ewa Planning District
Water Supply – Basal Aquifer

Aquifer System Area (ASYA)		Sustainable Yield (SY)	Permitted Use in 2010 (mgd)	Difference [SY-Total Permitted Use] (mgd)	Average Reported Pumpage fin ‘Ewa for 2010 (mgd)[1]
‘Ewa-Kunia		16.0	15.46	0.54	11.04
Makaīwa		Undetermined	0.072	N/A	No reporting
Waipahu-Waiawa	Total	104.0	84.86	19.14	
	Within the ‘Ewa DP area		23.48		5.52
TOTAL		**120.0**	**100.26**	**19.68**	**16.56**

[1] Total pumpage only reflects what has been reported to CWRM. Many water use permit holders do not report their pumpage.

- The Ewa-Kunia and Waipahu-Waiawa Aquifer System Areas (ASYA) extend beyond the boundaries of the Ewa DP area.
- All of the permitted use in the Ewa-Kunia ASYA is within the Ewa DP area.
- A large portion of the permitted use in the Waipahu-Waiawa ASYA is outside of the Ewa DP area.

‘Ewa Planning District

Water Supply – ‘Ewa CaprockAquifer

Aquifer System Area (ASYA)	Sustainable Yield [SY] (mg/l)[1]	Permitted Use [PU] in 2010 (mgd)	Difference [SY-PU] (mgd)	Average Reported Pumpage for 2010 (mgd)[2]
Malakole	1,000	44.536	N/A	14.979[3]
Kapolei	1,000	2.333	N/A	0.762
Pu‘uloa	1,000	11.924	N/A	0.694
TOTAL	**N/A**	**58.793**	**N/A**	**16.435**

[1] SY for the Ewa caprock aquifer is set by a chloride limit of 1,000 milligrams per liter (mg/l). This is the generally accepted chloride limit for irrigation applications.
[2] Total pumpage only reflects what has been reported to CWRM. Many water use permit holders do not report their pumpage.
[3]Several wells in the Malakole ASYA pump salt water for industrial purposes. Salt water pumpage accounts for about 12.215 mgd of the total reported pumpage for Malakole.

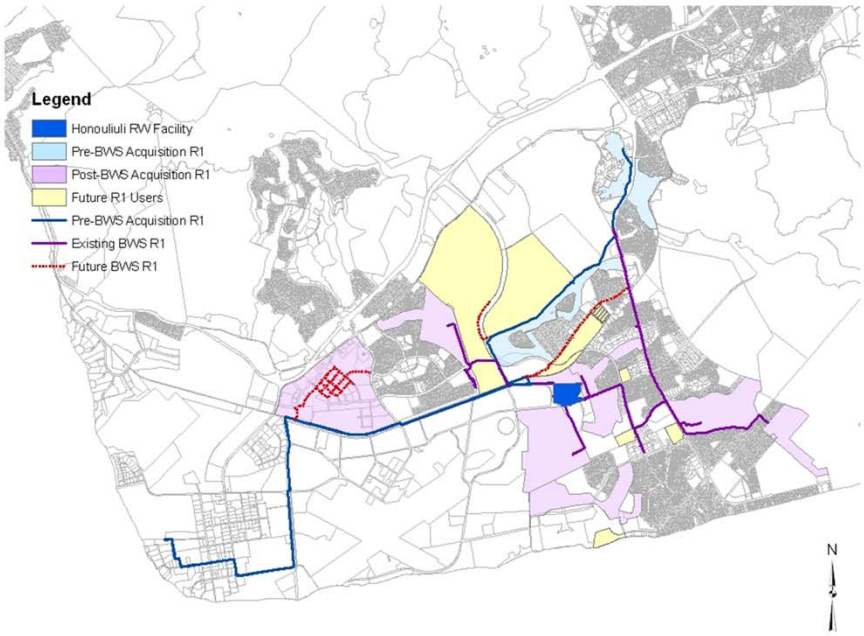
- Sustainable yield for the Ewa caprock aquifer is set by a chloride limit of 1,000 milligrams per liter (mg/L). This is the generally accepted chloride limit for irrigation applications.
- Several wells in the Malakole ASYA pump salt water for industrial purposes. Salt water pumpage accounts for about 12.215 mgd of the total reported pumpage for Malakole.

ʻEwa Planning District
Water Supply – Waiāhole Ditch

Permit-tees	Sustainable Yield [SY] (mg/l)	Permitted Use [PU] (mgd)		Difference [SY- Total PU] (mgd)	Average Reported Use for 2010 (mgd)	
		Total	ʻEwa DP		Total	ʻEwa DP
State	N/A	2.150	0.000	N/A	0.029	0.000
Private	N/A	10.751	4.120	N/A	6.681	2.217
TOTAL	**15.00**	**12.851**	**4.120**	**2.149**	**6.710**	**2.217**

- Waiahole Ditch is treated as its own water body and is assigned its own sustainable yield.
- Ewa use of Waiahole Ditch water accounts for 33% of the total water used in 2010 and 15% of the total Ditch sustainable yield.

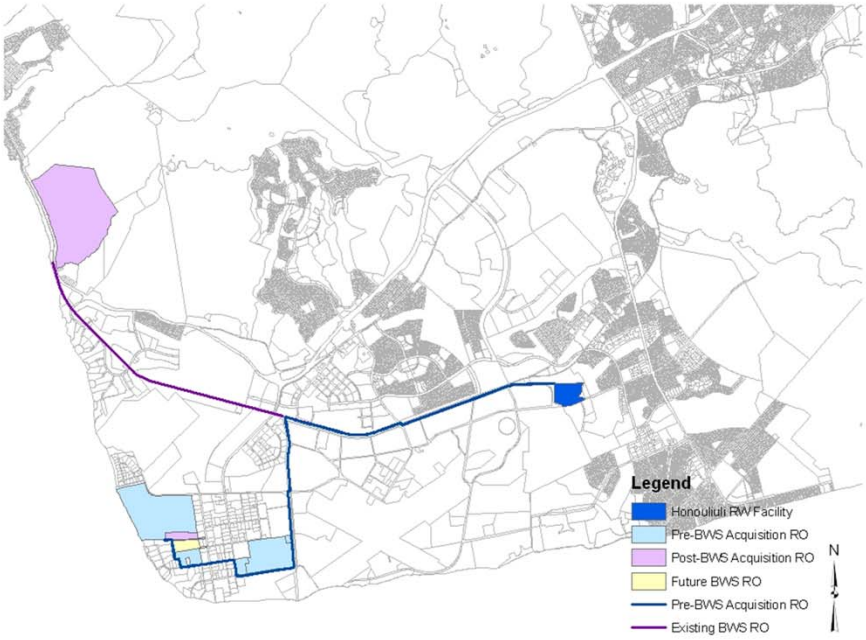
‘Ewa Planning District
R-1 Recycled Water System



‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013
47

- Blue area: users before the R-1 Recycled Water System was acquired by BWS. Only the City’s Ewa Villages and West Loch golf courses and Honouliuli Wastewater Treatment Plant were being served.
- Purple area: existing BWS R-1 customers. BWS purchased the system for $48 million and added about $12 million pipelines (purple lines) to connect more customers.
- Red lines show the future R-1 pipelines serving the City of Kapolei, Ewa Mahiko Park, UH West Oahu Campus, and DHHL East Kapolei lands.
- Today, there are 8 golf courses on-line, with some roadway landscaping and construction dust control uses. Demand is spread out over a 24 hour period via delivery scheduling where feasible.
- Many of the golf courses have back-up sources of supply like brackish caprock wells and the Navy’s Barbers’ Point water system, etc.

‘Ewa Planning District
RO Recycled Water System

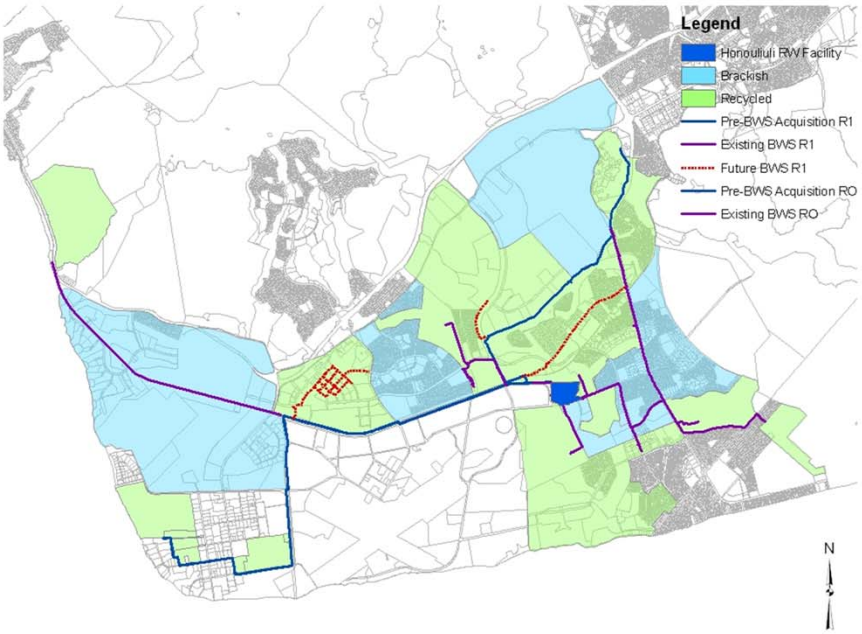


‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013
48

- Blue parcels and lines show the RO customers and pipelines to Campbell Industrial Park prior to BWS acquiring the system.
- Purple parcel and line shows a new RO pipeline constructed by HECO in 2010 to connect the Kahe power plant to the system.
- The yellow area is the City’s H-Power garbage to energy power plant scheduled to use RO when the 3rd boiler is built in 2012.
- There are seven RO users on-line with the addition of HECO Kahe and Campbell peaking power plants.

‘Ewa Planning District

Recycled and Brackish Water Service Zones



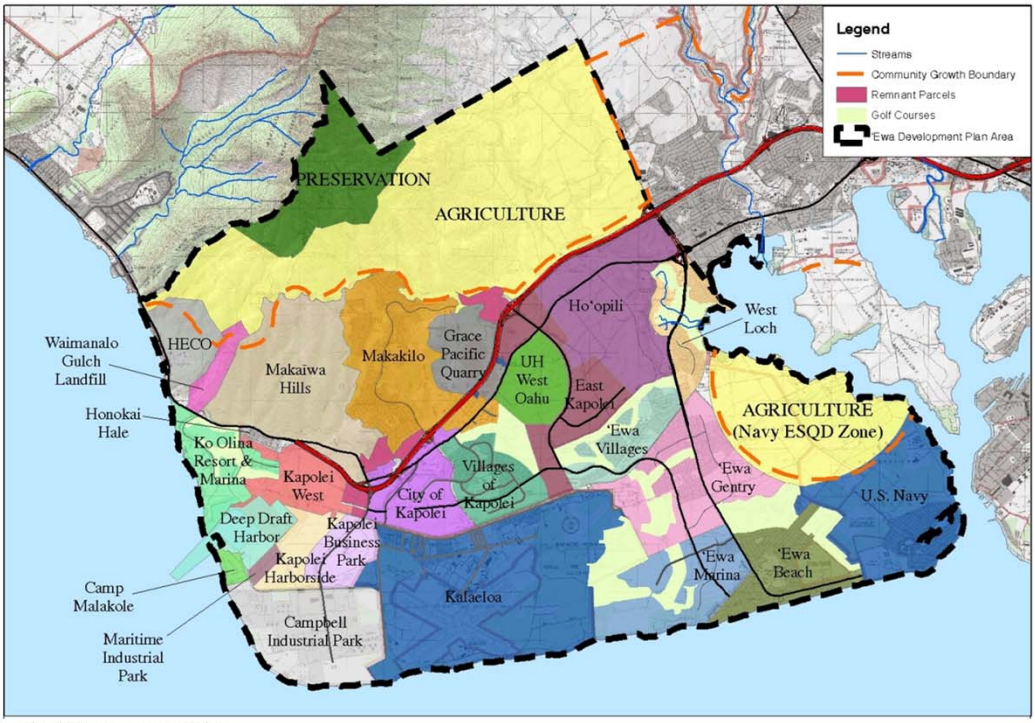
‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

49

- In the meantime, small users adjacent to the recycled water distribution system will be required to connect. BWS rules and regulations require use of nonpotable water, if available.
- When developing their water master plans, large developers will be required to install dual water systems and brackish systems designed to one day convert to recycled water.
- Old sugar plantation sources can be renovated, such as EP-5&6 for Hoopili and EP-10 for West Kapolei & Harborside.
- Blue areas represent brackish water users
- Green areas show recycled water service zones

‘Ewa Planning District

Current and Future Proposed Development



‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

50

- The WMP will develop water demand projections that will take into account projected population growth under low-, moderate-, and high-growth scenarios.
- We will also be developing an “Ultimate” water demand scenario that attempts to identify a development scenario that could potentially be limited by water supply if implemented at some point in the future.
- This “Ultimate” water demand scenario has been defined as: “All of the residential units that are currently planned have been built.”
- This map shows existing development and all developments that are currently proposed.
- Kapolei and Kalaeloa have grown as job centers and development is “maxed out” and all agricultural lands within the community growth boundary has been converted to urban uses.
- All feasibly cultivated lands in the Navy ESQD (“blast”) zone and mauka of the H-1 Freeway are in cultivation.
- There is one additional golf course, for a total of ten.

‘Ewa Planning District
Future BWS “Ultimate Water Demand”

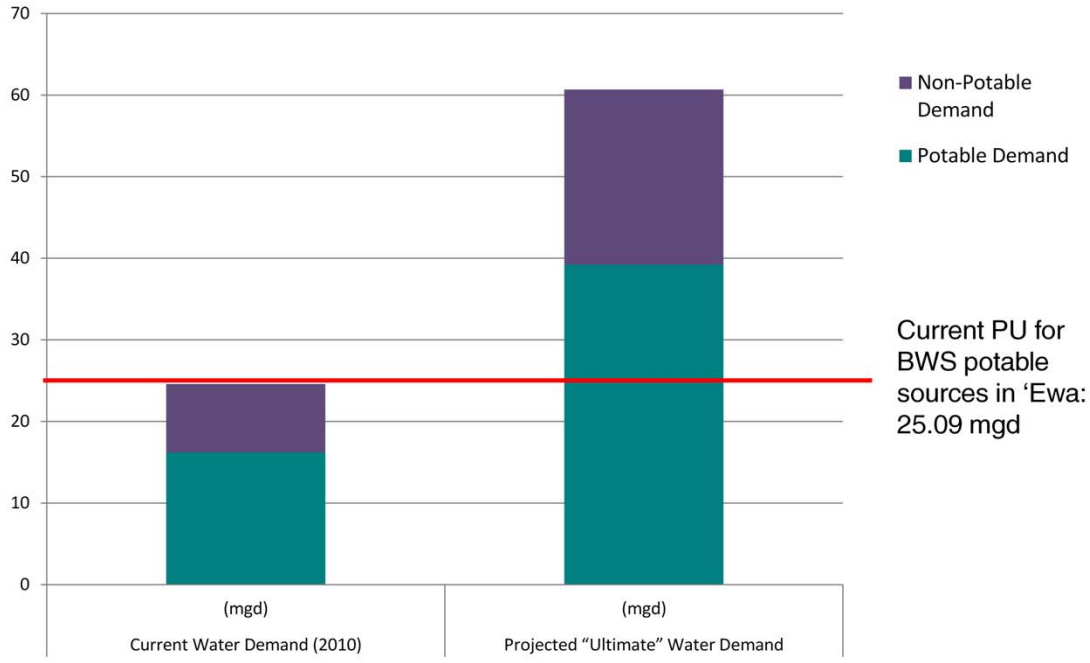
	Current ‘Ewa Water Demand (2010) (mgd)	Projected ‘Ewa “Ultimate” Water Demand (mgd)	Current Island-wide Demand (2010) (mgd)
Potable Demand	16.207	39.22	144.180
Recycled Water Demand	8.398	21.47	8.398
Other Non-Potable Demand	1.14[1]	1.14	2.076
TOTAL	25.745	64.83	154.654

[1] Other Non-Potable Demand in ‘Ewa = Barbers Point Non-Potable System

- The Ultimate demand scenario used each development’s water master plan to come up with the projected water demand.
- This method is conservative, as the water demand factors used in the water master plans are based on high usage in order to design infrastructure, rather than on actual use.

‘Ewa Planning District

Future BWS “Ultimate Water Demand”



‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

52

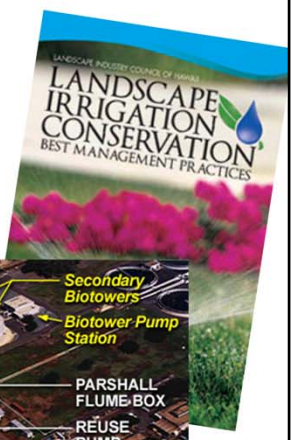
- Ultimate potable water demand would be close to BWS’s current permitted use (PU) for ground water sources in Ewa.
- Ewa already imports much of its potable water from Central Oahu.

‘Ewa Planning District

Potential Water Source Options

- Ground Water
- Recycled Water
- Desalination
- Stormwater Capture and Reuse
- Conservation

(Source: http://socalwater.org/pump-up-the-volume)



‘Ewa Watershed Management Plan
Community Meeting #1 – May 21, 2013

53

The Watershed Management Plans will consider many options for meeting projected future water demand.

‘Ewa Watershed Management Plan
Watershed Issues

- Sustainable Watersheds
  - We need to restore and manage our natural resources. Restoration will take generations; long-term efforts and commitment are needed!
  - Flooding will continue to increase as the amount of impervious surfaces increases.
  - Climate change and sea level rise will result in higher salinity of brackish ground water in the ‘Ewa caprock aquifer

To help understand what is important to the Ewa community regarding water resources, the planning team reviewed various plans and reports and interviewed community representatives to identify issues. These issues are summarized by Watershed Management Plan objective.

Objective: Sustainable Watersheds. What else does the Plan need to consider?

‘Ewa Watershed Management Plan

Watershed Issues

- Water Quality
  - Are former sugar lands adding chemicals to the water supply?
  - The caprock aquifer is getting saltier. Can injection of reclaimed water into the caprock stabilize salinity?
- Water Quantity
  - Water conservation programs are very important to reduce the need to pump water from the ground.
  - We should use grey water at the household level.

Objective: Water Quality and Quantity. What else does the Plan need to consider?

‘Ewa Watershed Management Plan
Watershed Issues

- Native Hawaiian Rights and Traditional and Customary Practices
  - There are important cultural sites and resources in ‘Ewa that we need to preserve and protect.
  - The sinkholes not only provide habitat for ‘ōpae ‘ula, they provided fresh water for drinking and places to grow food.
  - Limu was once plentiful off of ‘Ewa Beach but now there is hardly any.

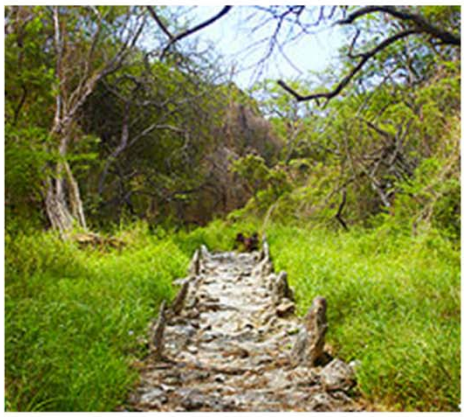


Photo: http://www.koolina.com/storytellers/unearthing-the-past

Objective: Native Hawaiian Rights and Traditional and Customary Practices. What else does the Plan need to consider?

‘Ewa Watershed Management Plan
Watershed Issues

- Public Participation, Education, and Project Implementation
  - Cultural and natural resources education for our children must be a high priority.
  - The new UH West O‘ahu campus can provide opportunities for education programs relating to natural resources management.

Photo: Star Bulletin, April 28, 2008

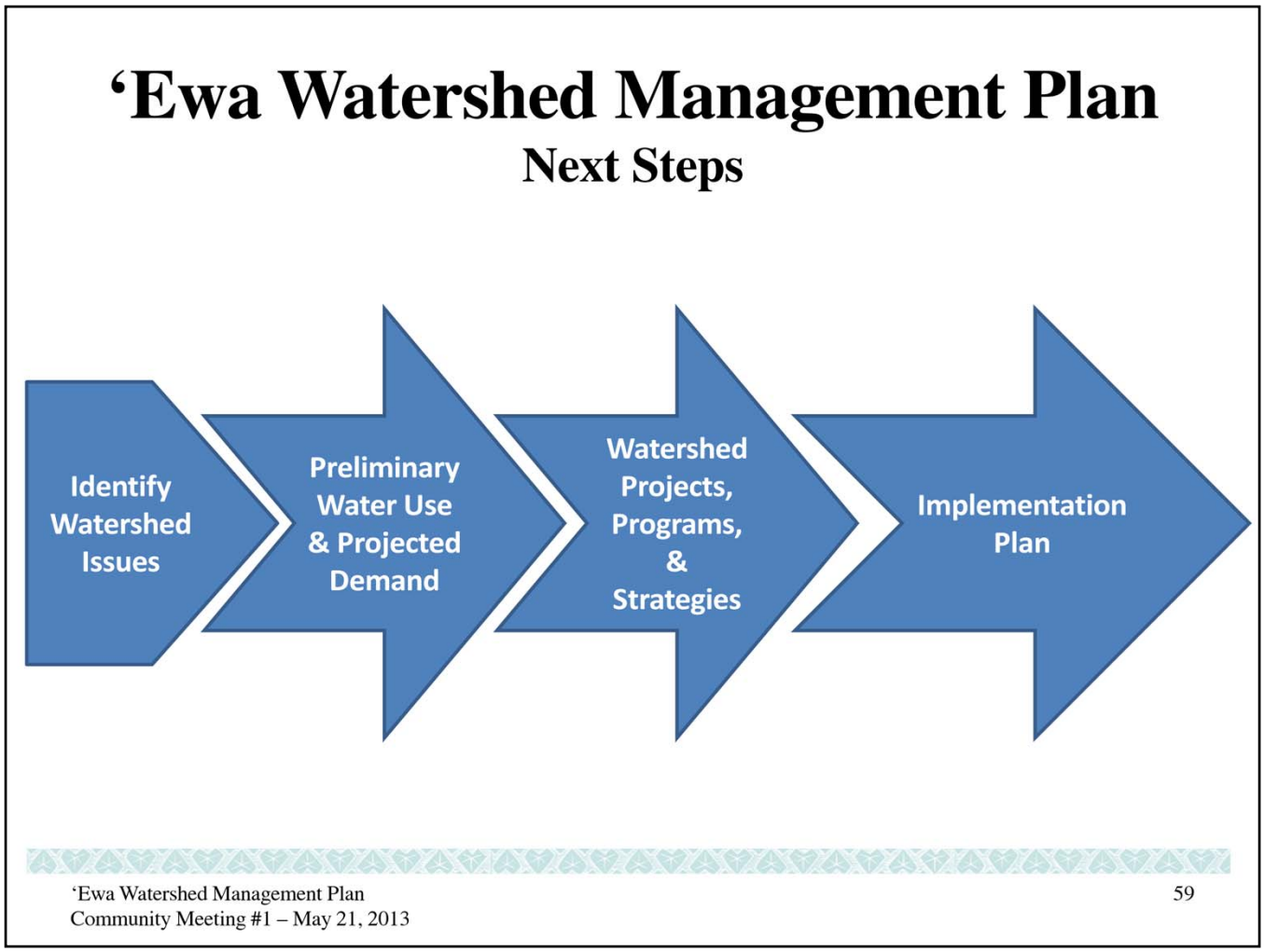
Objective: Public Participation, Education, and Project Implementation. What else does the Plan need to consider?

‘Ewa Watershed Management Plan
Watershed Issues

- Meeting Future Water Demands at Reasonable Costs
  - With all of this growth and development, will there be enough water for ‘Ewa in the future?
  - There are opportunities for capture, storage, transmission and use of stormwater runoff for irrigation of agricultural lands.

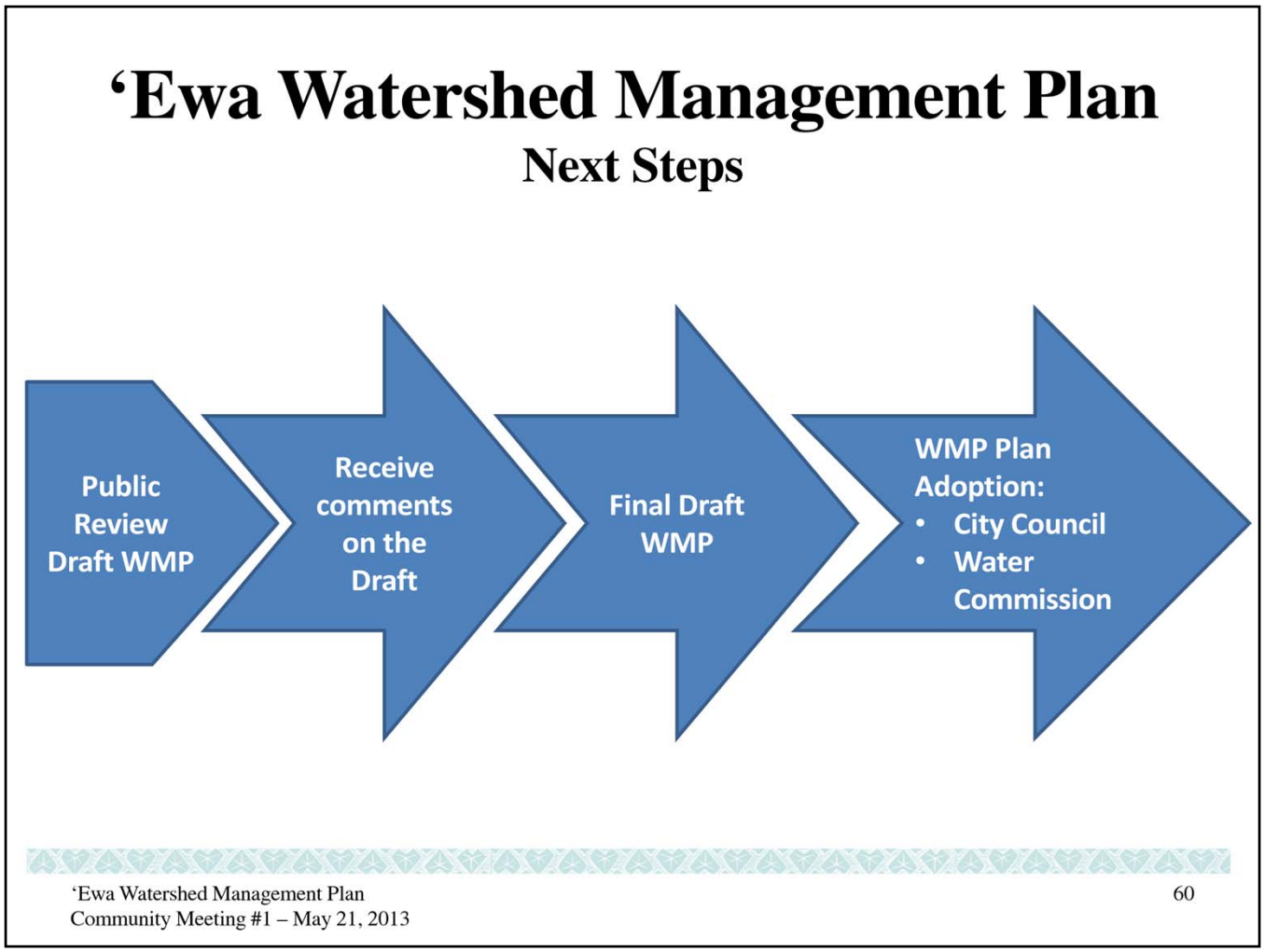
Photo: Honolulu BWS

Objective: Meet Future Water Demands at Reasonable Costs. What else does the Plan need to consider?



So far, we have done some research and interviews and have preliminarily identified watershed issues. We will continue to work on projected water demands and will share that in another community meeting.

We will then develop projects, programs, and strategies to address the watershed issues and meet future water demands.



The public review draft will include the background information on the Ewa district; the identified issues; the projected water demands; the proposed projects, programs, and strategies; and an implementation plan. This draft will be presented for public comment, revised, then submitted to the City Council and the State Water Commission for adoption and approval.

‘Ewa Watershed Management Plan

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Please feel free to contact us if you have any questions or comments!