MINUTES

REGULAR MEETING
OF THE
BOARD OF WATER SUPPLY

December 19, 2011

At 2:03 PM on December 19, 2011 in the Board Room of the Public Service Building at 630 South Beretania Street, Honolulu, Hawaii, Board Chairman Chung called to order the Regular Meeting of the Board.

Present:	Randall Y. S. Chung, Board Chair Denise M. C. De Costa, Vice Chair Theresia C. McMurdo Duane R. Miyashiro Westley K. C. Chun Glenn M. Okimoto
Absent:	Adam C. Wong
Also Present:	Dean Nakano, Acting Manager Marc Chun Bryan Gallagher Daryl Hiromoto Erwin Kawata Paul Kikuchi Jan Kemp Tracy Kitaoka Michael Matsuo Keoni Mattos Jonathan Suzuki Jason Takaki Kurt Tsue Barry Usagawa Susan Uyesugi Ron Wada Wayne Yoshimura
Others Present:	Krishna Jayaram, Deputy Corporation Counsel Dan Lawrence, Deputy Corporation Counsel Sherri Hiraoka, Townscape, Inc.

APPROVAL OF MINUTES	Approval of the Minutes of the Regular Meeting held on November 28, 2011
MOTION TO APPROVE	Theresia McMurdo and Denise De Costa motioned and seconded, respectively, to approve the Minutes of the Regular Session Meeting of November 28, 2011. The motion was unanimously carried.

"December 19, 2011

ADOPTION
OF RESOLUTION
818, 2011

Chairman and Members
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96843

Chairman and Members:

Subject: Adoption of Resolution No. 818, 2011, Acceptance of Gifts to the Board of Water Supply from City Mill Company, Ltd., for Detect-A-Leak Week Program

We recommend acceptance of the proposed gift to the Board of Water Supply (BWS), City and County of Honolulu, from City Mill Company, Ltd. (City Mill), of 7,500 toilet leak detection dye tablets valued at $750.00. The dye tablets will be used as part of our annual Detect-A-Leak Week program, which helps educate the public about the importance of regular leak detection as an effective means to prevent unnecessary water loss.

According to the United States Environmental Protection Agency, the average American home can waste more than 10,000 gallons of water every year from running toilets, dripping faucets, and other household leaks. The most common household leaks are in toilets, so during Detect-A-Leak Week, the public can pick up toilet leak detection dye tablets at any City Mill, Satellite City Hall, or in the lobby of the BWS Public Service Building at 630 South Beretania Street.

Detect-A-Leak Week will be observed statewide from March 11-17, 2012 with each county water department coordinating its own public outreach program. In addition to the support of City Mill, the Chamber of Commerce of Hawaii and the Oahu Group of the Sierra Club have supported the program for more than 10 years.

We greatly appreciate the continued support and commitment of our community partners and our customers who support this very worthwhile program, which encourages everyone to embrace their role as responsible stewards of our precious water resource.

Respectfully submitted,

/s/ Dean A. Nakano
DEAN A. NAKANO
Acting Manager

Attachment"

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

RESOLUTION NO. 818, 2011

ACCEPTANCE OF GIFTS FROM CITY MILL COMPANY, LTD.,
IN SUPPORT OF ANNUAL DETECT-A-LEAK WEEK PROGRAM

WHEREAS, the Board of Water Supply's (BWS) annual Detect-A-Leak Week program will be observed from March 11-17, 2012, and focuses consumer attention on property leak detection and timely repair as an effective means to prevent unnecessary water loss; and

WHEREAS, City Mill Company, Ltd., is offering 7,500 toilet leak detection dye tablets valued at $750.00 in support of the BWS's water conservation program and the 2012 Detect-A-Leak Week; and

WHEREAS, according to the U.S. Environmental Protection Agency, the average American home can waste more than 10,000 gallons of water every year from running toilets, dripping faucets, and other household leaks; and

WHEREAS, the participation and commitment of our community partners helps to educate the public about the importance of regular leak detection and their role as responsible stewards of our precious water resources; now, therefore,

BE IT RESOLVED that the BWS hereby accept the gift valued at $750.00 and directs the Acting Manager, or his delegate, to accept and thank the City Mill Company, Ltd., for this gift.

ADOPTED:

/s/ Randall Y. S. Chung
RANDALL Y. S. CHUNG
Chairman

Honolulu, Hawaii
December 19, 2011

DISCUSSION: In response to Board Chairman Chung's questions, Acting Manager Dean Nakano stated City Mill Company, Ltd. has been a sponsor for many years.

MOTION TO ADOPT: Theresia McMurdo motioned to adopt Resolution No. 818, 2011, Acceptance of Gifts to the Board of Water Supply from City Mill Company, Ltd., for Detect-A-Leak Week Program. The motion was second by Denise De Costa and unanimously approved.

RESOLUTION NO. 818,2011, ADOPTED ON DECEMBER 19, 2011			
	AYE	NO	COMMENT
RANDALL Y. S. CHUNG	X		
DENISE M. C. DE COSTA	X		
DUANE R. MIYASHIRO	X		
THERESIA C. MCMURDO	X		
ADAM C. WONG			ABSENT
WESTLEY K. C. CHUN	X		
GLENN M. OKIMOTO	X		

ITEM FOR INFORMATION NO. 1 "December 19, 2011

KOOLAU POKO WATERSHED MANAGEMENT PLAN

Chairman and Members
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96843

Chairman and Members:

Subject: Koolau Poko Watershed Management Plan

Water Resources staff will provide a summary presentation of the pre-final Koolau Poko Watershed Management Plan. The long-range strategic water resources plan will guide future water use and development and watershed management actions in the district.

In accordance with Chapter 30, Revised Ordinances of Honolulu, the Board of Water Supply (BWS) will submit the pre-final watershed management plan to the City Department of Planning and Permitting for their review and submittal to the City Council for adoption by ordinance. The plan will then be submitted to the State Commission on Water Resource Management for their adoption as a component of the Hawaii Water Plan, in accordance with Chapter 174-C, the State Water Code.

Respectfully submitted,

/s/ Dean A. Nakano
DEAN A. NAKANO
Acting Manager"

The foregoing was for information only.

DISCUSSION

Water Resource Program Administrator Barry Usagawa briefed the Board on the Koolau Poko Watershed Management Plan which is one of eight plans that makes up the Oahu Watershed Management Plan (OWMP). He provided handouts of the presentation, a copy of the Koolau Poko Watershed Management Plan (KPWMP) Executive Summary and the Islandwide water supply overview.

In response to Chairman Chung's inquiry as to why the outlying areas were done first, Mr. Usagawa explained that they wanted to engage existing watershed partnerships to help design a holistic watershed-based plan that the community would support that balanced water use, development and watershed protection.

ES EXECUTIVE SUMMARY

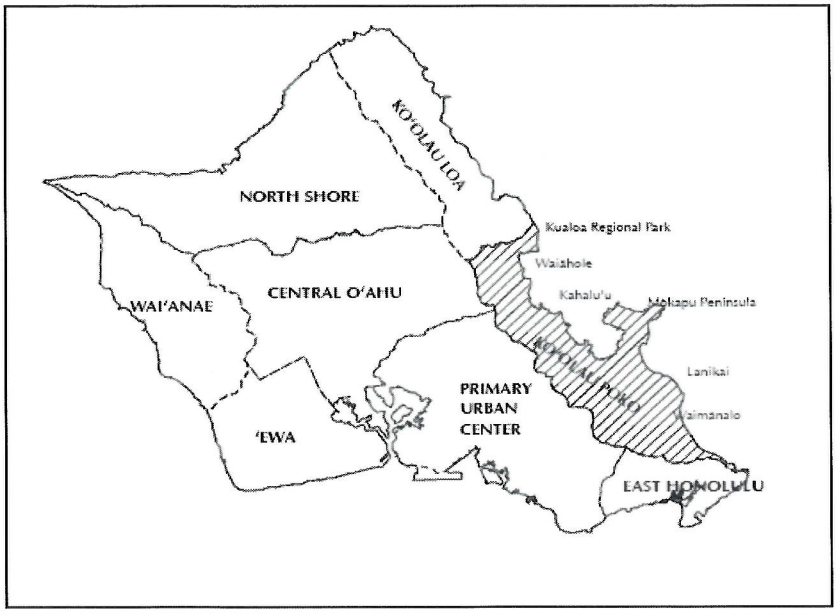
ES.1 PURPOSE OF THE KO'OLAU POKO WATERSHED MANAGEMENT PLAN (KPWMP)
ES.2 THE KPWMP AND THE KO'OLAU POKO SUSTAINABLE COMMUNITIES PLAN
ES.3 THE PLANNING PROCESS
ES.4 GOALS AND OBJECTIVES OF THE KPWMP
ES.5 SUMMARY PROFILE OF THE DISTRICT
ES.6 WATER USE AND PROJECTED DEMAND
ES.7 PROJECTS AND STRATEGIES
ES.8 IMPLEMENTATION OF THE KPWMP

ES.1 PURPOSE OF THE KO'OLAU POKO WATERSHED MANAGEMENT PLAN

The KO'OLAU POKO WATERSHED MANAGEMENT PLAN (KPWMP) is a long-range, 20-year plan to the year 2030 for the preservation, restoration, and balanced management of ground water, surface water, and related watershed resources in the Ko'olau Poko District, island of O'ahu. The City and County of Honolulu Department of Planning and Permitting (DPP) and the Honolulu Board of Water Supply (BWS) have jointly prepared the KPWMP, in accordance with the State Water Code, the Hawai'i Water Plan, and the City's Ordinance 90-62 that established the O'ahu Water Management Plan. The KPWMP is one of eight district-specific plans that together will form the updated O'ahu Water Management Plan.

The PUBLIC REVIEW DRAFT of the KPWMP was posted on the BWS website at www.hbws.org in December 2010. After a 90-day public review period, DPP and BWS finalized the KPWMP and will present the plan to the Honolulu City Council and to the State Commission on Water Resource Management (CWRM) for adoption.

Figure ES.1 The 8 Districts of the O'ahu Water Management Plan



This EXECUTIVE SUMMARY provides a brief synopsis of the planning process, major findings, and recommendations of the KPWMP.

The plan is presented in five chapters and a number of appendices:

Chapter 1. O'ahu Water Management Plan Overview

Chapter 2. Ko'olau Poko Watershed Profile

Chapter 3. Existing Water Use and Forecasts of Future Water Use and Demand

Chapter 4. Plan Objectives, Water Supply and Watershed Management Projects and Strategies

Chapter 5. Implementation of the KPWMP

ES.2 THE KPWMP AND THE KO'OLAU POKO SUSTAINABLE COMMUNITIES PLAN

The State Water Code requires that the County water use and development plans be consistent with the County land use plans and policies. Thus, throughout the planning process for the KPWMP, BWS and DPP have been mindful of the policies and guidelines of the Ko'olau Poko Sustainable Communities Plan (KPSCP), which was first enacted in August 2000. DPP began the KPSCP update process in mid-2009, and thus this Public

Review Draft of the KPWMP reflects some of the policy changes that are included in the draft revised KPSCP.

The KPSCP provides a vision for the preservation, conservation, and enhancement of the region's natural and scenic resources, cultural and historical resources, agricultural lands, and residential neighborhoods. This overarching vision for the district is the overall policy guide for the KPWMP as well.

ES.3 THE PLANNING PROCESS

At the outset of the planning process, BWS and DPP established several key guiding principles for the KPWMP. They directed that the Plan be:

- Community-based
- Environmentally holistic
- Reflective of ahupua'a management principles
- Action-oriented
- In alignment with State and City water and land use policies

In accordance with these overall guiding principles, the planning process for the KPWMP emphasized the importance of two complementary sets of studies and actions:

1. **Technical research work**, including data collection and analysis, review of relevant plans and programs, creation of maps, charts and graphs, and statistical projections of future demands for potable and non-potable water;

2. **Stakeholder outreach and consultation:** individual interviews and small group meetings with community leaders, community groups and organizations, land owners, developers, public agencies, and elected officials, and general community meetings to provide a forum for the discussion of watershed issues and needed actions. More than 50 stakeholder meetings of various kinds were held.

Thus, the planning process was both technical and community-based in nature, and the conclusions and recommendations that emerged from the planning process were based both on technical analysis and on the values and ideas of the many stakeholders.

It is also important to note that much of the research and community outreach work was organized by "Neighborhood Board Area" in order to reflect and respect the diversity of resources and community issues in Kahalu'u, Kāne'ohe, Kailua, and Waimānalo.

ES.4 GOALS AND OBJECTIVES OF THE KPWMP

BWS and DPP established an overall GOAL and five major OBJECTIVES for all of the watershed management plans:

GOAL: ***To formulate an environmentally holistic, community-based, and economically viable watershed management plan that will provide a balance between: (1) the preservation and restoration of Oahu's watersheds, and (2) sustainable ground water and surface water use and development to serve present and future generations.***

The five major OBJECTIVES which are common to all of the watershed management plans for O'ahu are:

OBJECTIVE #1: PROMOTE SUSTAINABLE WATERSHEDS

OBJECTIVE #2: PROTECT AND ENHANCE WATER QUALITY AND QUANTITY

OBJECTIVE #3: PROTECT NATIVE HAWAIIAN RIGHTS AND TRADITIONAL CUSTOMARY PRACTICES

OBJECTIVE #4: FACILITATE PUBLIC PARTICIPATION AND EDUCATION, AND PROJECT IMPLEMENTATION

OBJECTIVE #5: MEET FUTURE WATER DEMANDS AT REASONABLE COST

Each of the Watershed Management Plans developed **district-specific SUB-OBJECTIVES** under each of the major OBJECTIVES. These Sub-Objectives were articulated based on the issues and values that emerged for the district from both the technical research work and the stakeholder consultation process.

Water Supply and Watershed Management Projects and Strategies that would respond to and implement these Sub-Objectives were then researched and documented.

ES.5 SUMMARY PROFILE OF THE DISTRICT

Ko'olau Poko is one of the eight districts of O'ahu. This district is located on the windward side of the island, and stretches from Kualoa in the north to Makapu'u Point in the south, a distance of about 20 miles. Ko'olau Poko is 41,512 acres in size, and had a Census Year 2000 population of approximately 118,000 people.

The largest urbanized areas in the district are Kāne'ohe and Kailua. More rural settlement areas include Waiāhole, Kahalu'u, Maunawili, and Waimānalo. Four Neighborhood

Boards provide opportunities for community dialogue on various local issues: Kahaluʻu, Kāneʻohe, Kailua, and Waimānalo Neighborhood Boards. It should be noted that the traditional eastern boundary of the *moku* of Koʻolau Poko was Kuliʻouʻou Ridge in Hawaiʻi Kai.

Major arterial roadways serving these communities are Kalanianaʻole Highway, Kamehameha Highway, Pali Highway, Likelike Highway, and H-3 Freeway.

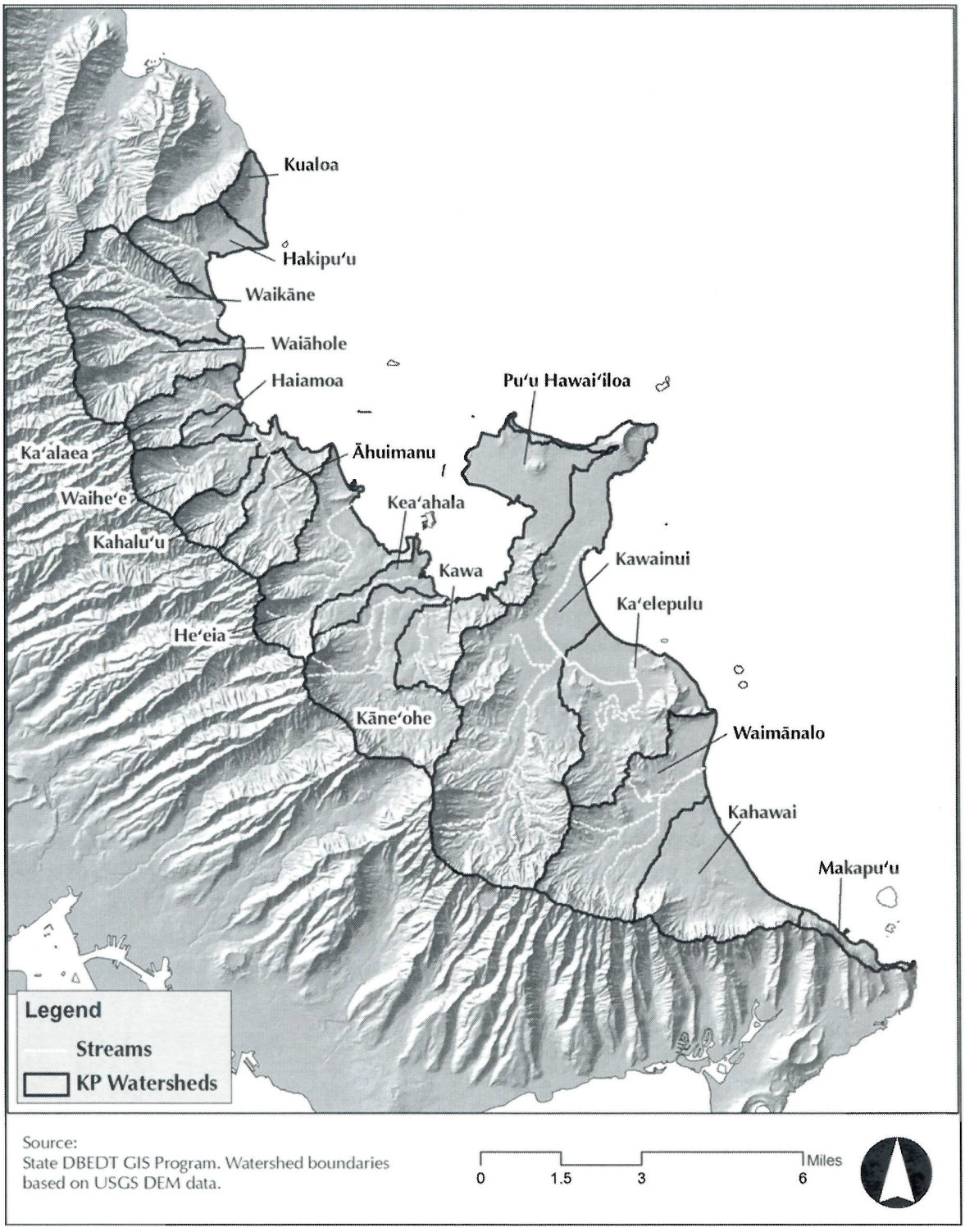
There are a total of 19 watersheds in the district: Kualoa, Hakipuʻu, Waikāne, Waiāhole, Kaʻalaea, Haiamoa, Waiheʻe, Kahaluʻu, ʻĀhuimanu, Heʻeia, Keaʻahala, Kāneʻohe, Kawa, Puʻu Hawaiʻi Loa, Kawai Nui, Kaʻelepulu, Waimānalo, Kahawai, and Makapuʻu.

There are 13 perennial streams in Koʻolau Poko. The median flows of these streams range from about 0.5 cubic feet per second (cfs) for Ioleka'a Stream to 11 cfs for Kamoʻoaliʻi Stream. These streams are important habitats for native fresh water species as well as important sources of water for local farmers.

A watershed is defined as a drainage basin that catches, collects, and stores water that travels toward the ocean via rivers, streams, or through subterranean springs or seepages.[i] While watersheds and *ahupuaʻa* often have similar boundaries, in Koʻolau Poko, watershed boundaries do not exactly line up with the *ahupuaʻa* boundaries as the *ahupuaʻa* in Koʻolau Poko sometimes have a larger land area than a watershed.

There are two Aquifer System Areas (ASYA) in Koʻolau Poko: the Koʻolau Poko ASYA with a Sustainable Yield of 30 million gallons per day (mgd), and the Waimānalo ASYA with a sustainable yield of 10 mgd. In 2009, the Board of Water Supply provided approximately 16 mgd of potable water to meet this district's needs, of which approximately 6 mgd was imported from Koʻolau Loa. In addition, several millions of gallons of water per day were provided by state and private water systems to farmers from both surface and ground water sources.

Figure ES.2 Koʻolau Poko Watersheds



ES.6 WATER USE AND PROJECTED DEMAND

Ko'olau Poko utilizes a combination of ground, surface, and recycled sources to meet its water demands. In 2000, most of the district's water demand was met by ground water, which provided for both potable and non-potable uses. The Honolulu Board of Water Supply (BWS) provides most (68%) of the water used in Ko'olau Poko, with private sources also providing a significant (28%) quantity of water.

TABLE ES.1 IN-DISTRICT WATER USE BY SOURCE TYPE (CY 2005)

Water Source	Potable/Non-Potable	Estimated Amount (mgd)
Surface Water	Non-Potable	5.864
Ground Water	Potable & Non-Potable	22.388
Recycled Water	Non-Potable	0.550
TOTAL		**28.802**

Future water demands were projected in low-, mid-, and high-growth scenarios through the year 2030. The low-growth demand scenario was selected as the base case scenario, as it was based on City growth policies as reflected in its land use plans. The overall municipal water demand was tied to population, which in the low-demand scenario, was projected to decrease by about 4%. The greatest increase in demand is from a projected increase in agricultural acreage which, in the low-demand scenario, was equal to a 1% increase in agricultural acreage per year.

TABLE ES.2 DISTRICT WATER DEMAND BY WATER USE SECTOR

Ko'olau Poko	2000 (mgd)	2030 (mgd)		
		Low	Mid	High
Municipal	**18.060**	**17.534**	**17.867**	**18.200**
BWS*	18.008	17.471	17.804	18.137
State	0.052	0.063	0.063	0.063
Agriculture	**9.700**	**12.185**	**16.990**	**22.622**
Diversified Agriculture	4.217	5.482	6.013	7.609
Kalo	4.882	6.103	10.377	14.412
Aquaculture - Private	0.600	0.600	0.600	0.600
Landscape Irrigation	**1.734**	**1.942**	**1.964**	**1.986**
BWS	0.847	1.055	1.077	1.099
State	0.042	0.042	0.042	0.042
Federal	0.550	0.550	0.550	0.550
Private	0.295	0.295	0.295	0.295
Total NB Area	**29.494**	**31.660**	**36.821**	**42.807**

*Potable demand does not include 0.5 mgd exported to East Honolulu

ES.7 PROJECTS AND STRATEGIES

The KPWMP provides information on specific Water Supply and Watershed Management **"Projects with Champions,"** and more general information on **"Watershed Management Strategies."** The "strategies" are defined as important concepts that do not yet have "champion" entities that would organize and implement these concepts.

The Projects with Champions are for the most part **specific projects that are being planned and/or that are being implemented by a particular public agency or agencies or by a particular community group or non-profit entity.** Many land use and resource management plans present "projects" that are more or less generic ideas. For Ko`olau Poko, however, there are many place-specific watershed management projects that are already ongoing. The KPWMP thus focuses on these real projects.

The KPWMP presents information on a total of 34 projects with champions, which are organized as follows:

DISTRICT-WIDE PROJECTS AND PROGRAMS

01 BWS Capital Program
02 BWS Water Conservation Program
03 BWS Pumpage Optimization
04 *Ahupua'a* Boundary Marker Project
05 Establish Measurable Instream Flow Standards
06 Hawai'i Ocean Resources Management Plan and Climate Change Adaptation Framework
07 Hawai'i Coral Reef Assessment and Monitoring Program (CRAMP)

PROJECTS AND PROGRAMS IN TWO OR THREE NEIGHBORHOOD BOARD AREAS

08 MCBH Integrated Natural Resources Management Plan
09 Implement Requirements of the TMDLs that have been approved or are in progress for Ko'olau Poko Streams
10 Expansion of the Waimānalo Forest Reserve
11 Waimānalo Irrigation System Improvements & Conservation
12 Aloha 'Āina Programs (Luluku and Maunawili)

KAHALU'U PROJECTS AND PROGRAMS

13 Waihe'e Ahupua'a Initiative
14 Hakipu'u Learning Center

KĀNE'OHE PROJECTS AND PROGRAMS

15 He'eia Stream Restoration Project
16 Papahana Kuaola
17 Māhuahua 'Ai o Hoi (He'eia Wetland Restoration)
18 Management and Stewardship of He'eia Fishpond
19 Hydro-Modification Storm Drain Installation Project
20 Halawa-Luluku Interpretive Development
21 Management and Stewardship of Waikalua Loko Fishpond
22 Kokokahi Cultural Learning Center

KAILUA PROJECTS AND PROGRAMS

23 MCBH Water Conservation Program
24 Management and Stewardship of Kawainui Marsh
25 Hāmākua Marsh Ecosystem Restoration Program
26 Purchase of Pu'u o Ehu Hillside
27 Kailua Beach Management Plan
28 Management and Stewardship of Ka'elepulu Watershed
29 Ka'elepulu Storm Water Capture

WAIMĀNALO PROJECTS AND PROGRAMS

30 Waimānalo Watershed Project
31 Waimānalo Watershed Analysis Risk Management Framework Study
32 God's Country Waimānalo Programs
33 Bellows Air Force Station Integrated Natural Resource Management Plan
34 Waimānalo Waste Water Treatment Plant Recycled Water Reuse

The KPWMP also presents some basic information on a total of 39 Watershed Management STRATEGIES. "Strategies" are defined here as potential actions that would serve to implement the overall goal, objectives, and sub-objectives of the KPWMP, but that do not currently have a project champion. Many of these strategies could become "Projects" if/when an agency or organization decides to be the champion for that strategy.

DISTRICT-WIDE STRATEGIES

DISTRICT-WIDE SURFACE WATER MANAGEMENT STRATEGIES

01 Establish "Customized" Stream Buffers for Specific Streams
02 Concrete Flood Channel Redesign Projects

DISTRICT-WIDE LAND MANAGEMENT STRATEGIES

03 Comprehensive Ko'olau Poko Litter and Illegal Dumping Mitigation Program
04 Native Plant Propagation Program
05 Establish Alien Plant Control Programs
06 Establish Fencing Exclosures in High Priority Areas for Feral Pig Control
07 Coordinate Pig Hunting Programs
08 Minimize the Impacts of Feral Mammals on Watershed Resources
09 Restrict Off-Road Recreational Vehicles in *Mauka* Areas
10 Convert Cesspools to Septic Tanks to Protect Estuaries and Aquifers
11 Preserve and Restore the Forested Areas Above Groundwater Sources

DISTRICT-WIDE COMMUNITY STRATEGIES

12 Develop an Efficient Alternative Process that Assists the KBRC with Implementation of the Kāne'ohe Bay Master Plan
13 Create and Maintain a "Directory" of Ko'olau Poko Community Organizations and Groups
14 Establish a Stream Signage Program to Educate the Public About Stream Processes and Characteristics

DISTRICT-WIDE CULTURAL RESOURCES / TRADITIONAL PRACTICES STRATEGIES

15 Conduct Ko'olau Poko Oral History Studies
16 Promote *Kalo* Restoration Projects
17 Conduct Periodic Surveys of Active *Lo'i* to Use as Future Baseline Data for Monitoring and Evaluation

DISTRICT-WIDE WATER SUPPLY STRATEGIES

18 Utilize More Surface Water for Agricultural Irrigation
19 Develop Groundwater Wells to Provide Additional Water for Diversified Agriculture
20 Agriculture Water Conservation Program
21 Implement the Recommendations of the Hawai'i Drought Plan
22 Encourage Gray Water Reuse to Reduce the Amount of Ground Disposal of Wastewater
23 Encourage Water Efficient Fixtures in Current and Future Development
24 Encourage Low Impact Development Design Concepts in Future Development
25 Storm Water Reclamation Projects

KAHALU'U STRATEGIES

26 Management and Stewardship of Mōli'i Fishpond
27 Kahalu'u Neighborhood Board Area Long Range Agriculture Expansion Plan
28 Dredge the Kahalu'u Flood Lagoon
29 Create a Hakipu'u *Ahupua'a* Land Trust
30 HHFDC Repair and Upgrade of the Waiāhole Valley Water System
31 Restoration of *Heiau* in 'Āhuimanu

KĀNE'OHE STRATEGIES

32 Restore the Estuary Area near Waikalua Loko Fishpond (presently Bay View Golf Course)

33 Utilize Water from Ho'omaluhia Reservoir for Irrigation

KAILUA STRATEGIES

34 Increase MCBH WWTP Capacity to Recycle Wastewater to R-1 Water Quality Standards

35 Maintain "Green Spaces" in Kailua

WAIMĀNALO STRATEGIES

36 Waimānalo Long Range Agriculture Expansion Plan

37 Implement the NRCS "Alternatives for Restoration of Waimānalo Stream" Report

38 Establish a Waimānalo Community Composting Facility to Dispose of Animal Wastes

39 Convert the DOA Kailua Reservoir to a Sediment Retention Basin

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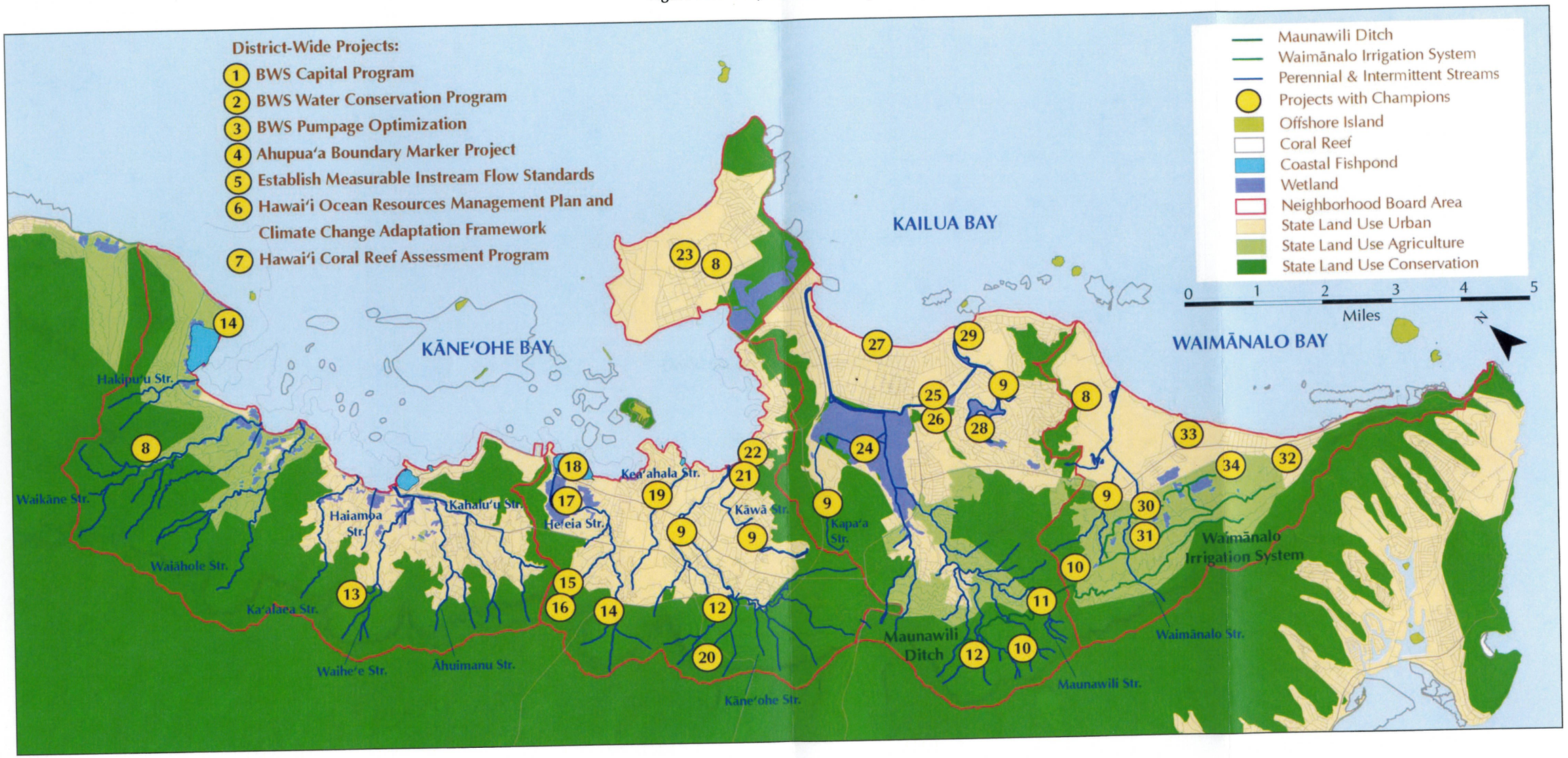
Figure ES.3 Projects with Champions



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ES.8 IMPLEMENTATION OF THE KPWMP

IMPLEMENTATION of the Ko'olau Poko Watershed Management Plan will be a long term, ongoing process involving many project "champions" from public agencies, non-profit entities, community groups, and private land owners and businesses. Chapter 5 of the KPWMP presents the details of the plan implementation agenda.

The Water Use and Development section of the plan is summarized as follows:

- The future growth "scenario" for Ko'olau Poko is the "SCP Policy Scenario," based on population projections developed by DPP. The DPP population projections show a slight decline in the district's population from 2000 to 2030, from-117,999 to 113,243 – a decline of about 4%.

- BWS potable water supplied to Ko'olau Poko District in CY 2000 was 19.84 mgd. BWS potable water demand for the district projected to 2030 is 18.846 mgd. BWS existing potable water sources and systems for the district are adequate to meet the current and future projected potable water demand.

- Non-potable water demand for Ko'olau Poko in CY 2000, primarily for agriculture, was 11.434 mgd. Non-potable water demand for the district projected to 2030 is 14.126 mgd. Most of the increased demand is for possible future *kalo* production.

- Future non-potable water demand could be met by an increase in the use of both stream water and ground water for agricultural irrigation. However, regulatory and cost constraints will make it challenging to increase the supply of agricultural water in Ko'olau Poko.

The principal water demand and supply numbers are summarized in the following graph:

Figure ES.4 Ko'olau Poko Projected Water Supply and Demand Policy Scenario

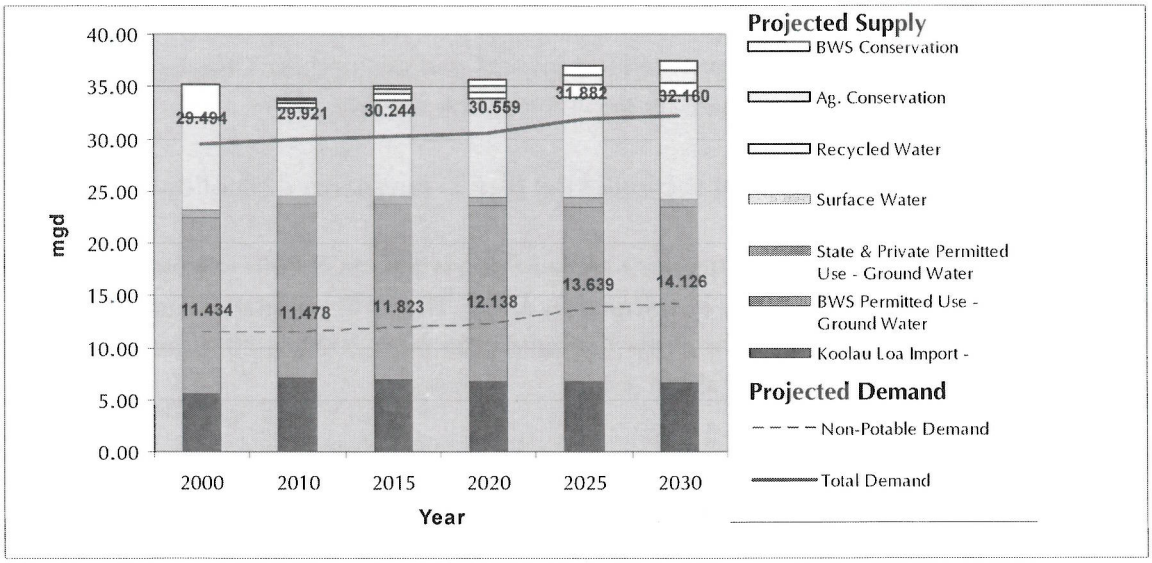


Table ES.3 Ko'olau Poko Projected Water Supply and Demand Policy Scenario

	2000	2010	2015	2020	2025	2030
SUPPLY	**35.135**	**36.889**	**38.185**	**38.816**	**40.152**	**40.791**
Ko'olau Loa Import – Ground Water	5.616	7.000	6.900	6.800	6.700	6.600
BWS Permitted Use – Ground Water	16.795	16.795	16.795	16.795	16.795	16.795
State and Private Permitted Use – Ground Water	0.743	3.753	3.888	3.958	4.032	4.111
Surface Water	8.810	8.370	9.210	9.451	9.691	9.932
Recycled Water	3.171	0.550	0.550	0.550	1.250	1.250
Agricultural Conservation	0.000	0.215	0.431	0.646	0.862	1.077
Conservation	0.000	0.421	0.842	1.263	1.683	2.104
DEMAND	**29.494**	**29.421**	**29.244**	**29.559**	**30.882**	**31.660**
Potable Demand*	18.060	17.942	17.920	17.920	17.743	17.534
Non-Potable Demand	11.434	11.478	11.823	12.138	13.639	14.126

*Potable demand does not include 0.5 mgd exported to East Honolulu

Domestic and agricultural demand for ground water can be met with available ground water supplies, as indicated in the following table.

Table ES.4 Ko'olau Poko Existing and Future Ground Water Use – Policy Scenario

Aquifer System Area	Sustainable Yield (mgd)	Use in 2005 (mgd)	Projected Use 2030 (mgd)
Kahana (import from Ko'olau Loa)	15	5.616	6.600
Ko'olau Poko & Waimānalo	40	17.388	20.984
TOTAL	**55**	**23.004**	**27.584**

Phasing and Funding of the 34 "Projects with Champions" is presented in the IMPLEMENTATION chapter in tabular form. The projects are noted as being either "short term" – to be implemented within the next 5 years – or "long term" – requiring more than 5 years to implement. Funding for these projects will potentially be provided by various federal, state, and city programs and agencies, and by private foundations and businesses.

The IMPLEMENTATION chapter also provides a presentation and discussion of CRITICAL WATERSHEDS and CATALYST PROJECTS.

A **"critical watershed"** is defined as a watershed that: (1) provides various opportunities to promote sustainable watersheds, or (2) needs protection or enhancement of water quality and quantity, or (3) provides many opportunities to protect Native Hawaiian rights and traditional customary practices, or (4) presents special opportunities for organizing and implementing important watershed management actions, or (5) provides significant ground water or surface water supplies to meet current and future demand.

A **"catalyst project"** is defined as a high priority project within a critical watershed that, when implemented, will provide energy, connectivity, information, and inspiration for other projects and programs within the watershed.

The critical watersheds and catalyst projects were defined as follows:

- **Kahaluʻu Neighborhood Board Area**
  Critical Watershed: Waiheʻe Stream Watershed – selected because this watershed is the largest single source of potable water for the Koʻolau Poko District (about 5 mgd), and because of the many opportunities for pro-active management projects within the watershed.
  Catalyst Project: Waiheʻe Ahupuaʻa Initiative (WAI) Strategic Plan – Fund and develop a succinct Strategic Plan for the WAI Project that presents the Vision and Mission for WAI, and a 5-Year Action Plan for priority projects and programs.

- **Kāneʻohe Neighborhood Board Area**
  Critical Watershed: Heʻeia Stream Watershed – selected because of its complex of natural resources and opportunities for cultural and resource management programs, from *mauka* forest lands to streams, the Heʻeia wetlands, the great Heʻeia fish pond, and the marine resources of Kāneʻohe Bay.
  Catalyst Project: Māhuahua ʻAi O Hoi (Heʻeia Wetlands Restoration Project) – Provide technical assistance, funding, regulatory approvals, and resource management programs for this major wetlands restoration/food security project.

- **Kailua Neighborhood Board Area**
  Critical Watershed: Kawai Nui Marsh Watershed – selected both for its importance to the Waimānalo Ditch System and the historical, cultural, and ecological importance of Kawai Nui marsh.
  Catalyst Project: Management and Stewardship of Kawai Nui Marsh – Provide technical assistance, funding, regulatory approvals, and resource management programs for this major wetlands/ecosystem restoration program.

- **Waimānalo Neighborhood Board Area**
  Critical Watershed: Waimānalo and Kahawai Stream Watersheds – selected because the important farm lands of Waimānalo are located within these two stream watersheds.
  Catalyst Project: Increase Water Supplies for Waimānalo Farmers – Provide funding for diverse sources of additional water for diversified agriculture in Waimānalo, including modernization of the Waimānalo water diversion and ditch system, small to moderate yield ground water wells, and reclaimed water from the Waimānalo Waste Water Treatment Plant.

The KPWMP identifies a large number of "Projects with Champions" and "Watershed Management Strategies" that are important for water use and watershed health in Ko'olau Poko. These projects and strategies require various levels of manpower and funding, and can only be implemented to the extent that resources are available from the private and public sectors of the community.

The IMPLEMENTATION chapter concludes with some thoughts on the need for a dedicated funding source that could provide ongoing financial resources for the implementation of important water supply and watershed management projects.

The proposed strategies and projects within this plan are the result of a comprehensive watershed analysis and stakeholder consultation process. The projects may involve various governmental agencies and non-governmental organizations. The implementation and funding of these projects are not the sole responsibility of the Board of Water Supply, City and County of Honolulu, or State of Hawai'i. This Plan is intended to guide agencies and organizations in implementing the most important initiatives for Ko'olau Poko watersheds and water resources; however, implementation will depend on budgetary priorities, the availability of grants, and partnering efforts over the long term.

ENDNOTES

[i] Board of Water Supply Water for Life: The History and Future of Water on O'ahu.

1.3 O'AHU WATER USE AND DEVELOPMENT PLAN UPDATE

The OWMP consists of islandwide water management policies and strategies and regional watershed management plans, which guide the activities of the City and County of Honolulu and advises the state CWRM in the areas of planning, management, water development and use and allocation of O'ahu's limited water resources. The islandwide policies and strategies listed in Article 2, Chapter 30 ROH, and restated below, apply to all City agencies "in the performance of their powers, duties and functions as related to both public and private development." The implementation of the strategies will carry out the policies.

Policy 1.	Facilities for the provision of water shall be based on the general plan population projections and the land use policies contained in the development plans and depicted on the development plan land use maps.
Policy 2.	System flexibility shall be maintained to facilitate the provision of an adequate supply of water consistent with planned land uses. The municipal water system shall be developed and operated substantially as an integrated islandwide water system.
Policy 3.	Close coordination shall be maintained between federal, state and county agencies which are involved in the provision or management of water to ensure optimal distribution of the available water supply.
Policy 4.	The quality and integrity of the water supply shall be maintained by providing for the monitoring and protection of the water supply in accordance with the requirements of the state water code.
Policy 5.	The development and use of nonpotable water sources shall be maximized in a manner consistent with the protection of the groundwater quality.
Policy 6.	Water conservation shall be strongly encouraged.
Policy 7.	Alternative water sources shall be developed wherever feasible to ensure an adequate supply of water for planned uses on O'ahu.

Strategy 1.	Develop water resources in consonance with the general plan population projections and the land use policies contained in the development plans and depicted on the development plan land use maps. Priority shall be given to affordable housing projects shown on the development plan land use maps or processed under HRS Chapter 201E.
Strategy 2.	Continue to safely develop the remaining available groundwater in accordance with the requirements of the state water code.
Strategy 3.	Use surface water more effectively and efficiently.
Strategy 4.	Continue to refine the near and long-term projections of agriculture on the island to more accurately project the future net release of water currently committed to agricultural use.
Strategy 5.	Maintain an ongoing water conservation program through the board, using such approaches as pricing, public information, educational programs, water-saving devices, and use restrictions and allocations.
Strategy 6.	Develop and use nonpotable water sources, wherever feasible, for the irrigation of agricultural crops, parks and golf courses, landscaping and for certain industrial uses.
Strategy 7.	Continue efforts to develop economical methods of demineralizing brackish water and desalting seawater.

Article 2 further states that "based on the findings and projections in the OWMP, provisions for an adequate supply of water to meet islandwide needs for at least twenty years shall be addressed. This shall be determined after evaluating the anticipated demand for water use from municipal, agricultural, military and private users; the available remaining groundwater which can be safely developed; the planned and proposed water source development projects; and alternative water development projects under way." The following update provides this basis.

Water use and development on O'ahu is guided by the City's General Plan and the Development Plans and Sustainable Community Plans for the eight land use districts. These community-based land use plans describe each community's vision of their future and provide land use and infrastructure policies and guidelines. An important aspect of the City's land use plans is the establishment of urban growth and sustainable community boundaries that separate urban, agricultural and conservation lands. These boundaries provide adequate area for urban and rural development, protect important agricultural and conservation lands and facilitate infrastructure master planning.

An essential component of the WMP is the development of region specific watershed management projects and strategies that enhance ground water and surface water supplies, improve land management with respect to water, protect traditional and cultural practices and facilitate plan implementation. Each regional WMP will consist of about 30 to 40 watershed management projects and strategies derived from stakeholder consultation and the strategic plans and capital improvement programs of various Federal, State and City agencies, organizations, communities and watershed partnerships. These projects meet the five WMP objectives of balancing the protection of natural resources and the sustainable use of O'ahu's water supplies.

The following summary of O'ahu's water use and development provides the island-wide context to review and understand the eight regional WMPs. Together, the proposed regional watershed management plans update the OWMP as designed in the OWMP Framework.

As part of the process of initiating the update of the OWMP, and consistent with the guidelines set forth in the Statewide Framework for Updating the Hawai'i Water Plan, BWS has compiled information on existing and projected water demands and sources of supply for the municipal system; State, federal, and private water systems; and prime agricultural lands. In summary, BWS has evaluated the adequacy of the supply to meet future potable and non-potable water needs and through a combination of conservation, diversified water supply development and watershed protection strategies, the City can meet water demands through the 2030 planning period.

1.3.1 City and County of Honolulu Land Use Plans

The General Plan for the City and County of Honolulu is a comprehensive statement of objectives and policies, which sets forth the long-range aspirations of O'ahu's residents and the strategies of actions to achieve them. It is the overarching policy document of a comprehensive planning system that addresses physical, social, economic and environmental concerns affecting O'ahu. This planning system serves as the coordinating structure by which the City provides for the future growth on the island of O'ahu. The General Plan establishes a distribution of residential population among the eight land use districts that directs development to the primary and secondary urban centers and the Ewa and Central O'ahu urban fringe areas to relieve developmental pressures in the remaining urban fringe and rural areas and to meet housing needs. The General Plan can be viewed at the following link:
http://www.honoluludpp.org/Planning/OahuGenPlan.asp

The City established regional Development Plans (DP) and Sustainable Community Plans (SCP) for each of the eight land use planning regions of O'ahu. Each community oriented land use plan is intended to help guide public policy, investment, and decision making over the next 20 years. Each plan responds to specific conditions and community values of each region. 'Ewa and the Primary Urban Center are "development plan" areas where growth and supporting facilities will be directed and be the policy guide for development decisions and actions needed to support that growth. The remaining six districts are "sustainable communities" plans, which are envisioned as relatively stable regions in which public programs will focus on supporting existing populations. Each land use district establishes a boundary to contain urban and rural development to protect agriculture and preservation zoned areas. The following table lists the eight land use plans and their website links.

O'ahu's Land Use Planning Regions	Web Page Links to the DP/SCP Land Use Plans
Wai'anae	http://www.honoluludpp.org/Planning/DevSust_Waianae.asp
Ko'olau Loa	http://www.honoluludpp.org/Planning/DevSust_Koolauloa.asp
Ko'olau Poko	http://www.honoluludpp.org/Planning/DevSust_Koolaupoko.asp
North Shore	http://www.honoluludpp.org/Planning/DevSust_NorthShore.asp
'Ewa	http://www.honoluludpp.org/Planning/DevSust_Ewa.asp
Central O'ahu	http://www.honoluludpp.org/Planning/DevSust_CentralOahu.asp
East Honolulu	http://www.honoluludpp.org/Planning/DevSust_EastHonolulu.asp
Primary Urban Center	http://www.honoluludpp.org/Planning/DevSust_PrimaryUrbanCenter.asp

1.3.2 Population Forecasts and Municipal Water Demand

Table 1.1 shows the DPP population forecast from 2000 to 2030 by land use district accounting for residents, visitors, military and private water systems. Water use and census

population in 2000 defines a per capita demand by development plan area that is used to forecast 2030 water demand for the population served by BWS.

In 2004, DPP forecasted an increase in O'ahu's resident population from about 870,000 in 2000 to about 1.1 million residents in 2030. Subsequent DPP interim forecasts reduced the 2030 resident population by approximately 9%. Note that the next update of the water demand forecast is expected after the 2010 census data is incorporated into the City's population projections. Based on the City's 2004 growth projections evaluating population, visitors, housing and employment factors, BWS forecasts an increase in municipal potable water demand of approximately 52 mgd for O'ahu from 154.7 mgd in 2000 to 206 mgd in 2030 and represents the mid-growth scenario. Most of the forecasted growth will occur in 'Ewa, PUC, Central O'ahu, Wai'anae and East Honolulu. Military and private water use is expected to increase by 1.3 mgd in the same time period.

Conservation has reduced the per capita demand by 6% in 2000 from 1990 levels and recent data suggest per capita demand is decreasing further as water conservation programs continue to advance. Per capita demand ranges from a low of 142 gallons per capita per day (gpcd) in Ko'olau Loa to 224 gpcd in Wai'anae due to a drier climate and larger agriculture water use from the municipal system. Note that with all long-range forecasts, a range of variation will occur due to uncertainties such as economics, zoning, population distribution and conservation. The **mid growth scenario** of 52 mgd is within the range of historical linear projections of municipal water demand growth.

Table 1.1 O'ahu Population and Water Demand

2000, By Development/Sustainable Communities Plan Area

DP Area	Resident Population	Residents Absent	Visitors Present	Defacto Population	Private/ Military	Population Served	DP area Demand (mgd)	Per Capita Demand (gpcd)
Wai'anae	42,259	1,718	1,190	41,731	0	41,731	9.34	223.79
'Ewa	68,696	2,793	916	66,819	5,159	61,660	15.30	223.58 *
East Honolulu	46,735	1,900	867	45,702	0	45,702	10.11	221.3
PUC	419,422	17,053	79,882	482,251	35,137	447,114	76.45	170.98
Central O'ahu	148,208	6,026	484	142,667	18,213	124,455	19.41	155.96
Ko'olau Poko	117,910	4,794	140	113,256	0	113,256	19.84	175.14
Ko'olau Loa	14,546	591	1,391	15,346	4,936	10,409	1.48	142.47
North Shore	18,380	747	40	17,672	3,234	14,438	2.82	194.97
Total	876,156	35,623	84,911	925,444	66,680	858,766	154.75	

2030, By Development/Sustainable Communities Plan Area

DP Area	Resident Population	Residents Absent	Visitors Present	Defacto Population	Private/ Military	Population Served	DP Area Demand (mgd)	Per Capita Demand (GPCD)
Wai'anae	50,616	2,044	3,701	52,273	62	52,211	11.68	223.79
'Ewa	184,612	7,455	22,257	199,415	9316	190,099	42.50	223.58
East Honolulu	51,059	2,062	2,152	51,150	0	51,150	11.32	221.3
PUC	489,389	19,761	93,139	562,767	36188	526,579	90.04	170.98
Central O'ahu	189,599	7,656	1,756	183,699	18048	165,651	25.83	155.96
Ko'olau Poko	115,357	4,658	1,349	112,048	0	112,048	19.62	175.14
Ko'olau Loa	16,725	675	4,814	20,863	6494	14,369	2.05	142.47
North Shore	19,945	805	1,246	20,386	3212	17,174	3.35	194.97
Total	1,117,302	45,116	130,414	1,202,600	73,320	1,129,280	206.40	

* The 'Ewa District per capita demand reflects a 1.516 mgd adjustment to account for demineralized recycled water use for industrial process water, which reduced potable water use after 2000.

O'AHU POPULATION AND WATER DEMAND SUMMARY

Development Plan Area	2000 BWS Population Served	2030 BWS Population Served	Estimated Population Increase in 2030	Additional Water Demand in 2030 (mgd)
Wai'anae	41,731	52,211	10,480	2.34
'Ewa	61,660	190,099	128,439	27.20
East Honolulu	45,702	51,150	5,448	1.21
PUC	447,114	526,579	79,465	13.59
Central O'ahu	124,455	165,651	41,196	6.42
Ko'olau Poko	113,256	112,048	-1,208	-0.22
Ko'olau Loa	10,409	14,369	3,960	0.57
North Shore	14,438	17,174	2,736	0.53
Total	858,766	1,129,280	270,514	51.65

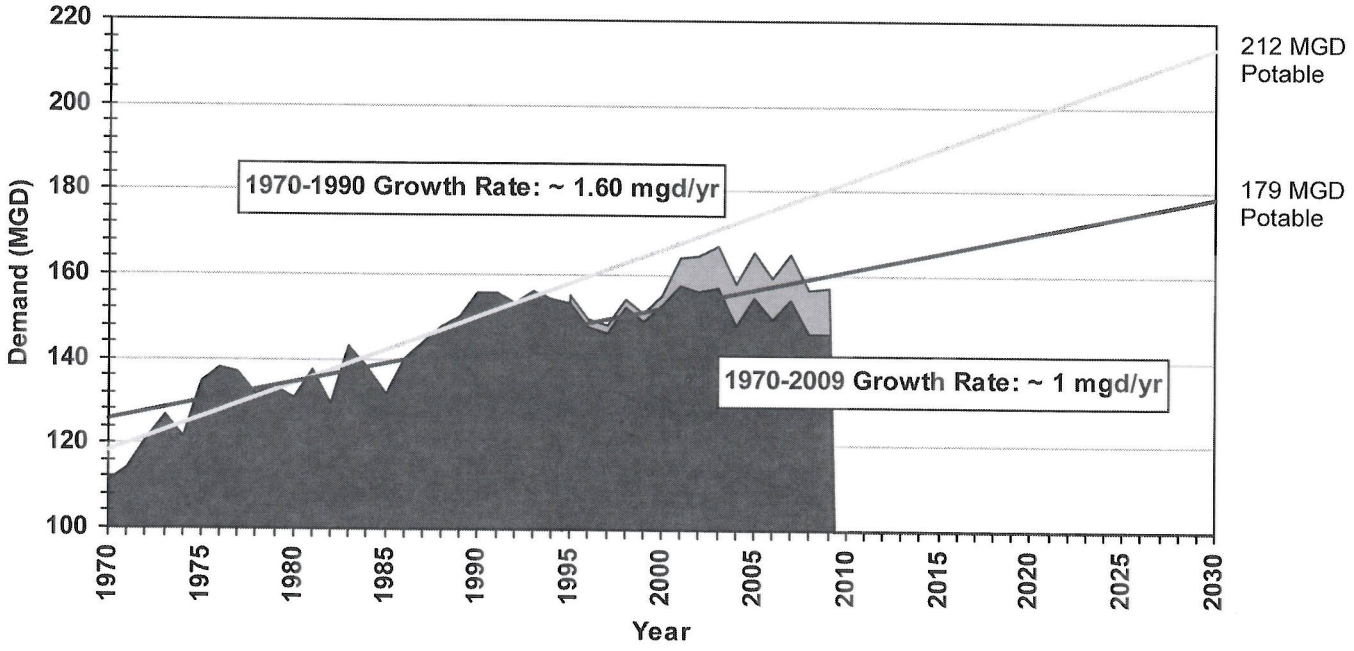


Figure 1.3 BWS Potable and Nonpotable Water Systems Demands: Actual 1970-2009 and Linear Projection to 2030

Conservation efforts and recycled water have had a significant role in keeping island-wide potable water use at 1990 levels through 2009 at approximately 155 mgd. Figure 1.3 shows BWS potable (blue) and nonpotable (purple) water systems historical water demand growth rates from 1970 to 2009. The potable growth rates are linearly projected to 2030 along two slopes ranging from 1.0 mgd/year to 1.60 mgd/year, with 2030 demands of 179 mgd as the **low growth scenario** to 212 mgd as the **high growth scenario**, respectively and represent the range in potable water demand growth expectations over time. The lower slope represents the benefit that conservation and economic factors have on leveling potable water demand growth.

Table 1.2 shows O'ahu's ground water use as of September 2009 totaling 196 mgd including the Waiāhole Ditch and the brackish 'Ewa Caprock aquifer. Municipal ground water use constitutes 76% of the total, with military, agriculture and irrigation and other uses taking up the remainder. Agriculture ground water use includes private wells and the Waiāhole Ditch but overall agriculture groundwater use has decreased post-plantation owing to the availability and use of surface water and the slow rate of diversified agriculture growth.

Table 1.2 O'ahu's Ground Water Use Sept 2009

Use Category	Water Used 12-Mo. MAV Sept 2009 (mgd)	Percentage of Total Water Use Sept 2009
Municipal	148	76%
Military	22	11%
Agriculture*	14	7%
Irrigation**	5	3%
Domestic	2	1%
Industrial**	4	2%
Total	196	100%

* Includes Waiahole Ditch
** Includes Ewa Caprock Brackish aquifer

Table 1.3 summarizes Appendix C by listing O'ahu's largest permitted uses of fresh groundwater by user including Waiāhole Ditch water uses but excluding saltwater and brackish caprock water uses in 2009.

Table 1.3 O'ahu's Top Ground Water Users by Permitted Use September 2009

Owner	Permitted Use (mgd)	Owner	Permitted Use (mgd)
1. Honolulu BWS	183.08	9. US Fish & Wildlife	2.91
2. Waialua Sugar	33.48	10. Monsanto	2.64
3. US Navy	28.77	11. Robinson Kunia	2.49
4. D.R. Horton	7.97	12. Dole/Castle & Cooke	2.13
5. US Army	7.29	13. Agribusiness Dev.	2.00
6. Del Monte	5.03	14. Galbraith Estate	2.00
7. Dillingham Ranch	4.10	15. Bishop Estate	1.86
8. HRI/Lā'ie Water Co	3.69	16. Serenity Park	1.54

1.3.3 Department of Hawaiian Home Lands Demands

The Department of Hawaiian Home Lands (DHHL) owns lands in Mākaha, Wai'anae, Lualualei, Nānākuli, Kalaeloa, Kapolei, Papakōlea, Mō'ili'ili, Waimānalo and Ha'ikū as shown in Figure 1.4. DHHL is currently compiling their O'ahu master plan and their findings will be incorporated in future WMP's. DHHL projected water demands of 1.7 mgd (State Water Projects Plan 2003) are incorporated into the BWS municipal water demand forecasts using the population based per capita demand method. DHHL holds water reservations in the Waimānalo aquifer of 0.124 mgd and in the Waipahu-Waiawa aquifer of 1.358 mgd for their projects. DHHL will request that CWRM assign their reservations toward new or existing sources as their lands are developed.

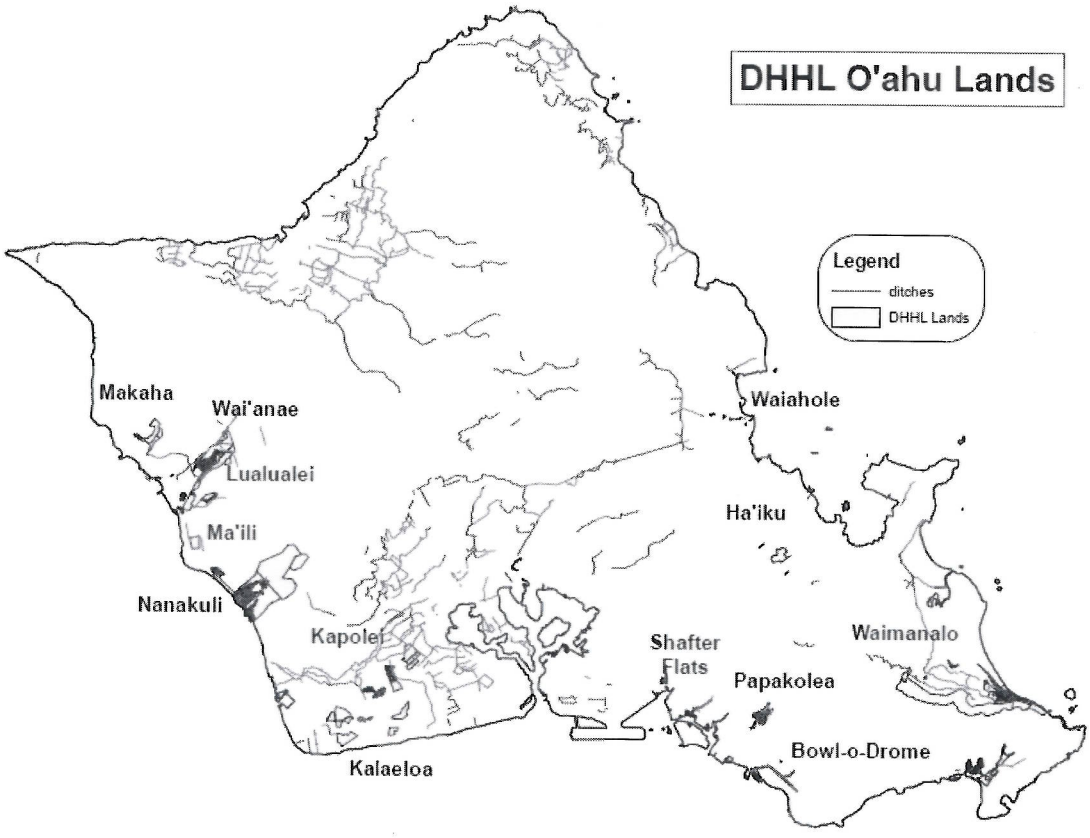


Figure 1.4 Department of Hawaiian Home Lands on O'ahu

1.3.4 STATE WATER PROJECTS PLAN WATER DEMANDS

The State Water Projects Plan (SWPP), 2003, identified a total of 24.5 mgd of housing, commercial, industrial, institutional and agricultural water demands for State agencies on O'ahu to the year 2020. Approximately 51% of O'ahu's SWPP demand or 12.5 mgd is nonpotable use. The Department of Agriculture's demand of 7.6 mgd, the Department of Business Economic Development and Tourism's demand of 7.2 mgd and the University of Hawaii's demand of 3.1 mgd are the largest water needs.

The SWPP identified several water development strategies to meet their projected water demands including the use of existing State water system capacity; developing new water systems based on development master plans such as East Kapolei and Kalaeloa; utilizing existing BWS water credits from previous source development and pursuing recycled and brackish water for nonpotable irrigation constitute approximately 17.9 mgd or 73% of O'ahu's SWPP total. The remaining 6.7 mgd or 27% of State water demand can be obtained from BWS through the payment of Water System Facilities Charges. The BWS municipal water demand forecasts using the population based per capita demand method of assessing State and County land use plans can be assumed to incorporate most of the SWPP's demands except for State owned water systems. An accounting tying specific source names to projected State agency demands would be helpful in the next SWPP update.

The SWPP update should add stronger water conservation and water loss reduction strategies, which were largely absent in the 2003 SWPP. Leak detection and repair projects in aging State water systems, such as agriculture, could reduce new source development, reduce operating and maintenance costs and provide more capacity for drought mitigation. The SWPP is currently being updated and their findings will be incorporated in future WMP's.

1.3.5 AGRICULTURAL WATER DEMAND

The State and City have adopted objectives and policies for the preservation of agricultural lands and for the long-term support of a viable agriculture industry on O'ahu. City land use plans have been adopted with growth boundaries in part to protect prime agricultural lands.

O'ahu's projected agricultural water demands have a wide variation and are uncertain yet important for water use planning because of the substantial quantities consumed for irrigation. Future water demand for agricultural crops depends on the type of crops cultivated, the climate and the number of acres in cultivation. The State Agricultural Water Use and Development Plan, (AWUDP) December 2004,[1] estimated a worst and best case

range of 7.6 mgd and 30.4 mgd, respectively, of additional water demand for O'ahu based on population projections, partial replacement of imported produce with locally grown produce and maintaining farm value growth in diversified agriculture. Approximately 13 mgd of the projected best case agricultural demand was assumed to be assigned to private irrigation systems, with the remaining 17 mgd accommodated by the State's Waiāhole Ditch and Waimanalo irrigation systems. The AWUDP focused on maintaining existing State diversified agriculture systems and on transforming plantation water systems to serve diversified agriculture. "With available farm lands and adequate irrigation water, a significant expansion of diversified agriculture is an attainable and economically worthwhile goal which can be achieved largely by: 1) replacing much of Hawai'i's imported produce with locally grown produce, 2) pursuing niche and off-season markets of fruits and vegetables for export, 3) growing new or Asian-based specialty crops for export, and 4) meeting increased demand from the tourism and cruise ship industries for fresh fruits and vegetables." The two irrigations systems studied on O'ahu are the Waiāhole Ditch and Waimānalo irrigation systems. The Kaukonahua ditch system in Central O'ahu and North Shore was not included in the State AWUDP. Based on water metered data from the Lālāmilo system (South Kohala, Hawai'i Island), dry and wet season water use per acre varied between 2,500 gpd/acre to 4,600 gpd/acre. According to the AWUDP, an average of 3,400 gpd/acre is considered the best available estimate and a reliable value for use in planning and forecasting irrigation water demand for Hawai'i's diversified agriculture industry. It should be noted, that 3,400 gpd/acre is considered to be a practical consumptive water use rate which does not include irrigation system water loss.

Figure 1.5 shows the agricultural zoned lands on O'ahu with the four major irrigation systems: Waiāhole Ditch, Kaukonahua, Waimānalo and Punalu'u. Existing stream diversions and distribution systems should be inventoried, leaks and evaporation losses reduced to a reasonable goal and water use verified. Diversion works should include control gates to maintain diverted flows at reasonable and beneficial use plus losses. The practice of diverting maximum stream flow and then releasing unused diverted water into downstream drainage systems or into different streams should be minimized. Improvements to existing ditch systems, such as lining or piping ditches, have the potential to reduce water loss and thereby provide water for the expansion of agriculture without adding new diversions. Cost and benefit considerations should be factored into the feasibility of these improvements and will affect implementation. Significant new surface water diversions require amendments to the IFS, but the studies and processes are cost prohibitive.

Kamehameha Schools has renovated their Punalu'u and Kawailoa irrigation systems with cultural and eco-friendly stream diversion modifications and piped ditch systems to conserve and enhance the availability of stream water, Figure 1.6. The diversions include fish ladders on both stream banks and grated intakes to prevent debris and fish from entering the system. The ditch system was piped to reduce water loss and ditch maintenance and provide a pressurized irrigation system for farmers. The improvements

keep unused water in the stream because as irrigation declines during the day or season, the pipe fills up to the intake and diverted flow reduces to zero.

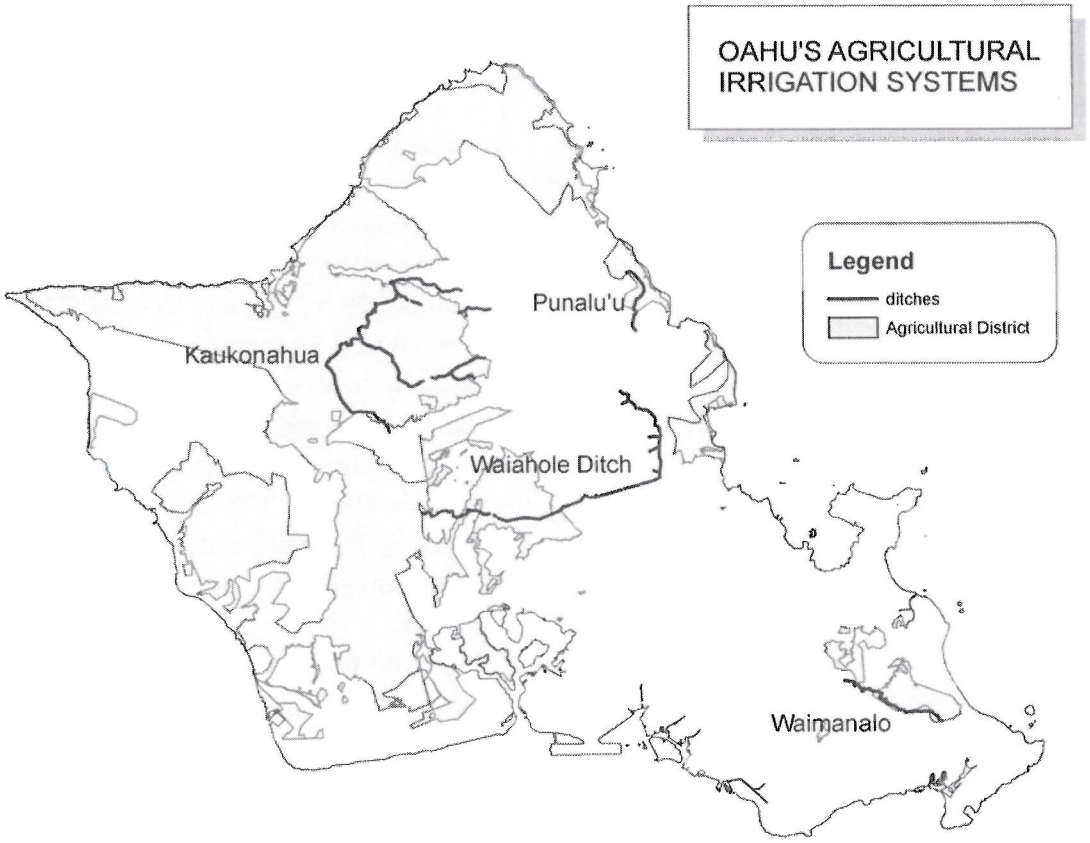


Figure 1.5
Agricultural Zoned Lands on O'ahu

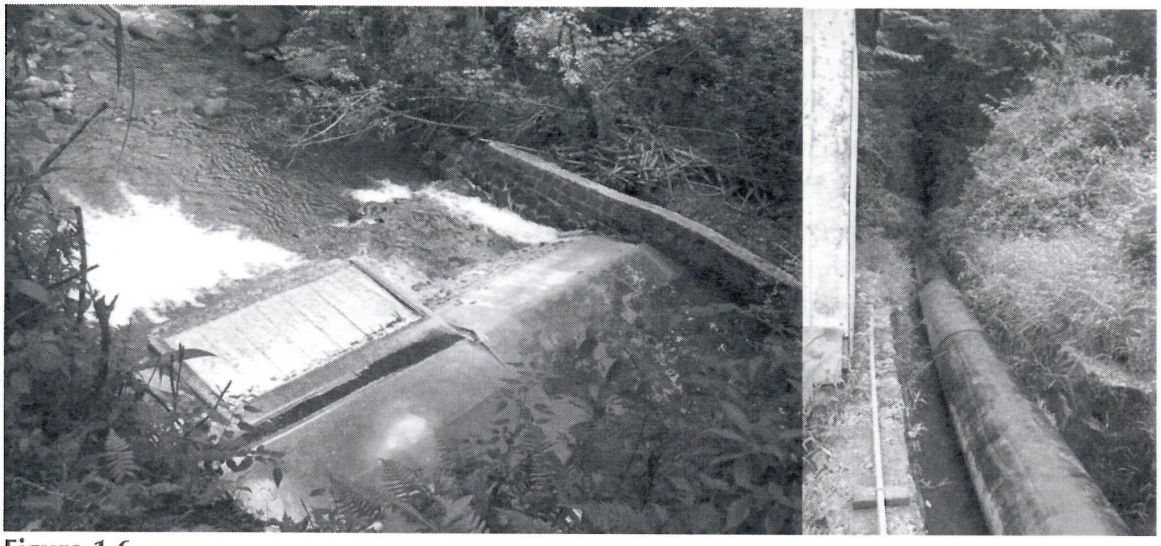


Figure 1.6
Punalu`u Stream Diversion and Piped Ditch

There are large tracts of agricultural lands in the 'Ewa, Central O'ahu, North Shore, Ko'olau Loa and Ko'olau Poko districts. The 2004 AWUDP estimated that of the 49,500 acres of prime agriculture lands on O'ahu, 11,000 acres are in monocrop cultivation. The remaining 38,500 acres are idle and available for cultivation. Table 1.4 lists prime agricultural lands as identified in the City's land use plans with an average water use per acre proposed in the State AWUDP and as adjusted for high rainfall.

Table 1.4 Prime Agricultural Lands on O'ahu

City Land Use District	Prime Agricultural Land Area (acres)	Water Use per Acre (gal/acre-day) (State AWUDP)	Nonpotable Water Demand (mgd)
North Shore	20,000	3,400	68
Central O'ahu	10,350	3,400	35
'Ewa	3,000	3,400	10
Ko'olau Loa	3,000	3,400	10
Ko'olau Poko	1,300	3,400	4
	485	2,500*	1
Total	38,135		128

* Lower demand factor applied for high rainfall areas such as Kahalu'u & Kāne'ohe.

The total prime agricultural lands in these districts could have an average potential diversified agricultural water demand of 128 mgd which will vary between 2,500 gallons per acre day (gpad) during wet seasons and 4,600 gpad during dry seasons. Studies indicate that applied water demands for diversified agriculture in high rainfall areas such as Punalu'u, Waiāhole, Kahalu'u and Kāne'ohe, where rainfall exceeds 60 to 70 inches per year, will require less water, approximately 2,500 gpad.

CWRM in the Waiāhole Ditch contested case, has allocated an average of 2,500 gallons per acre for large-tract Kunia farms allowing for some continuous proportions of fallow and cultivated lands. Small farms do not have the area to fallow their fields and will therefore have higher water demands per acre. Existing systems like the Waiāhole Ditch, Kaukonahua Stream/Wahiawā Reservoir, Kawailoa, Punalu'u, Waimanalo and the 'Ewa Caprock aquifer system area already provide a portion of this total. Additional potable ground water supplies in these aquifer system areas could provide supplemental agricultural water supply especially during drought. Diversified agricultural water demands in Wai'anae, PUC and East Honolulu are largely incorporated into the municipal demand forecasts. Ground water development is more costly for agriculture than gravity and surface water sources and may compete with urban uses.

Traditional wetland *kalo* occur in almost all districts but according to various studies, the variability of water demands is large, and inflows can range from approximately 100,000 gpad to 300,000 gpad with temperature as one of the key factors to prevent rot. While net consumptive use (evapo-transpiration and infiltration) averages approximately 50,000 gpad (USGS 2005), the additional water flow, which is returned to the stream, is needed to manage temperature and account for ditch losses. This plan therefore assumes 100,000 gpad for wetland *kalo* water demand estimates. *Kalo's* high water use per acre and limited surface water supplies will limit the expansion and restoration of *lo'i kalo* but because it is important to preserve the remaining traditional *kalo* lands, the lower range of water demand will allow a greater amount of restoration. Water loss reduction strategies in *'auwai* and ditch systems (lining and piping) could provide additional water reducing the necessity of constructing additional stream diversions and potentially divert less stream water.

Recent discussion regarding biofuels and ethanol as renewable energy sources have become prominent with the law requiring 10% ethanol additives to gasoline and HECO's new Campbell power plant's ability to accept 100% biofuels. An evaluation of available agricultural lands and water supplies in the North Shore indicate that a biofuel or ethanol industry could be accommodated up to the sustainable limits of the Waialua, Mokulē'ia and Kawailoa aquifer system areas and from the Wahiawā reservoir. According to the State DOA, sugar cane using drip irrigation will require 5,600 gals/acre-day, depending on elevation and climate. Biodiesel crops range in water use, with the most oil efficient crop being oil palm using only 760 gals/acre-day yielding over 5,300 gals of oil/acre.[2] Other crops being studied by the Hawai'i Agriculture Research Center are kukui, avocado, coconut and jatropha. Algae are also being researched as a bio-fuel source and will require water to produce.

1.3.6 Ground Water Availability

The table of Sustainable Yield and Ground water Use by Aquifer System Area was provided by the CWRM and BWS for 2009 (Table 1.5). The table shows the seven aquifer sector areas and 26 aquifer system areas on O'ahu with their associated revised sustainable yields adopted in August 2008 by CWRM, water use permits, water use in 2009 and the unallocated sustainable yields. CWRM reduced O'ahu's sustainable yields by 39 mgd in 2008 from 446 mgd to 407 mgd. The table footnotes attempt to qualify the table and additional information on sustainable yields is included in *Appendix D, Overview of O'ahu's Hydrogeology*. A complete listing of the 2009 O'ahu Water Use Permit Index is provided in *Appendix C*.

Overall, there is available water on O'ahu, in comparing permitted use that has been allocated and/or actual withdrawal to sustainable yield. A significant portion of the remaining untapped supplies exist in remote areas of the island where growth is limited, infrastructure does not exist or pumping may affect stream flows and will be subject to future measurable IFS. 2005 was a high rainfall year, in which water use was below normal for both agriculture and urban sources, but in 2009, rainfall was about normal yet water use still decreased by 7 mgd from 2005 data. In general, the Honolulu sector is fully allocated to the adopted sustainable yields. The Pearl Harbor, Wahiawā and North Shore sectors have a significant amount of unallocated sustainable yield, unused or released by the sugar plantations. The Windward sector's unused sustainable yields (Waimānalo, Ko'olau Poko and Kahana) may interact with streams due to dike influences and therefore, availability may be subject to amendments of the interim IFS. Wai'anae's remaining water is small, in remote areas and also subject to interim IFS in dike areas. Due to these land, economic, operational and environmental reasons, BWS has identified the concept of recoverable yield for its own municipal planning purposes. Recoverable yield is an estimate of the amount of ground water that could feasibly be developed for an aquifer system area and is slightly less than the CWRM adopted sustainable yields. BWS has identified Waimānalo, Ko'olau Poko, Kahana, Kea'au, Lualualei and Nānākuli aquifer system areas where recoverable yields are less than or equal to sustainable yields. The concept of recoverable yield allows BWS to plan and respond to uncertainties.

Table 1.5 Sustainable Yield and Ground Water Use by Aquifer System Area (MGD)

Aquifer Sector	Aquifer System		Sustainable Yield (SY)	Water Use Permits Issued 2009	Unallocated Sustainable Yield	Existing Water Use 12 MAV Sept 2009	SY minus water use
Honolulu	Wai'alae-East		2	0.790	1.210	0.492	1.508
	Wai'alae-West		4	2.797	1.203	0.755	3.245
	Pālolo		5	5.646	-0.646	5.816	-0.816
	Nu'uanu	1	14	15.165	-1.165	13.123	0.877
	Kalihi		9	8.761	0.239	7.941	1.059
	Moanalua	1	16	19.960	-3.960	13.042	2.958
Total Honolulu			50	53.119	-3.119	41.169	8.831
Pearl Harbor	Waimalu		45	46.951	-1.951	32.265	12.735
	Waipahu-Waiawa		104	84.856	19.144	55.389	48.611
	'Ewa-Kunia		16	15.457	0.543	16.333	-0.333
	Makaīwa		0	0.000	0.000	0.000	0.000
Total Pearl Harbor			165	147.264	17.736	103.987	61.013
Central	Wahiawā		23	21.928	1.072	7.047	15.953
Total Central			23	21.928	1.072	7.047	15.953
Wai'anae	Nanakuli	1,2,4	2	0.000	2.000	0.000	2.000
	Lualualei	1,2,4	4	0.000	4.000	0.099	3.901
	Wai'anae	2	3	0.000	3.000	2.418	0.582
	Makaha	1,2	3	0.000	3.000	2.278	0.722
	Kea'au	2,4	4	0.000	4.000	0.000	4.000
Total Wai'anae			16	0.000	16.000	4.795	11.205
North	Mokulē'ia	1	8	8.025	-0.025	0.174	7.826
	Waialua	1	25	30.311	-5.311	2.974	22.026
	Kawailoa	1	29	1.614	27.386	0.385	28.615
Total North			62	39.950	22.050	3.533	58.467
Windward	Ko'olau Loa	1	36	18.589	17.411	10.373	25.627
	Kahana	1,4	15	1.101	13.899	0.000	15.000
	Ko'olau Poko	1,3,4	30	10.312	19.688	9.904	20.096
	Waimānalo	1,4	10	1.631	8.369	0.303	9.697
Total Windward			91	31.633	59.367	20.580	70.420
Total Aquifer Sector			**407**	**293.894**	**113.106**	**181.111**	**225.889**
'Ewa Caprock	Malakole	5	1,000 mg/l	0.603		4.414	
	Kapolei	5	1,000 mg/l	2.033		0.608	
	Pu'uloa	5	1,000 mg/l	13.261		1.426	
Total 'Ewa Caprock				15.897		6.448	
Waiahole Ditch			15	12.440	2.560	8.524	6.476
Total Waiahole Ditch			15	12.440	2.560	8.524	6.476
Grand Total Fresh and Brackish			422	322.231	115.666	196.083	232.365

2009 Recorded about normal rainfall but island-wide aquifer sector pumpage decreased by 7 mgd below 2005 data.

Permanent instream flow standards may reduce available sustainable yield. Withdrawals affecting streams require instream flow standards amendments.

1 2008 Water Resource Protection Plan updates on sustainable yield included.
2 Wai'anae is not a designated water management area, therefore, there is no permitted use.
3 Waihe'e Tunnel & Waihe'e Inclined Wells are not included under 2009 Permitted Uses, but are included under Existing Water Use.
4 BWS Recoverable Yield expected to be lower due to economics, land constraints, small yields, etc. & regulatory actions involving instream flow standards.
5 Brackish Water. Managed by chloride limit of 1,000 mg/l for irrigation wells.

Excludes salt water wells

Source: CWRM and BWS Data. BWS footnotes.

Query date 8/30/10. Based on reported pumpage to CWRM as of 9/09.

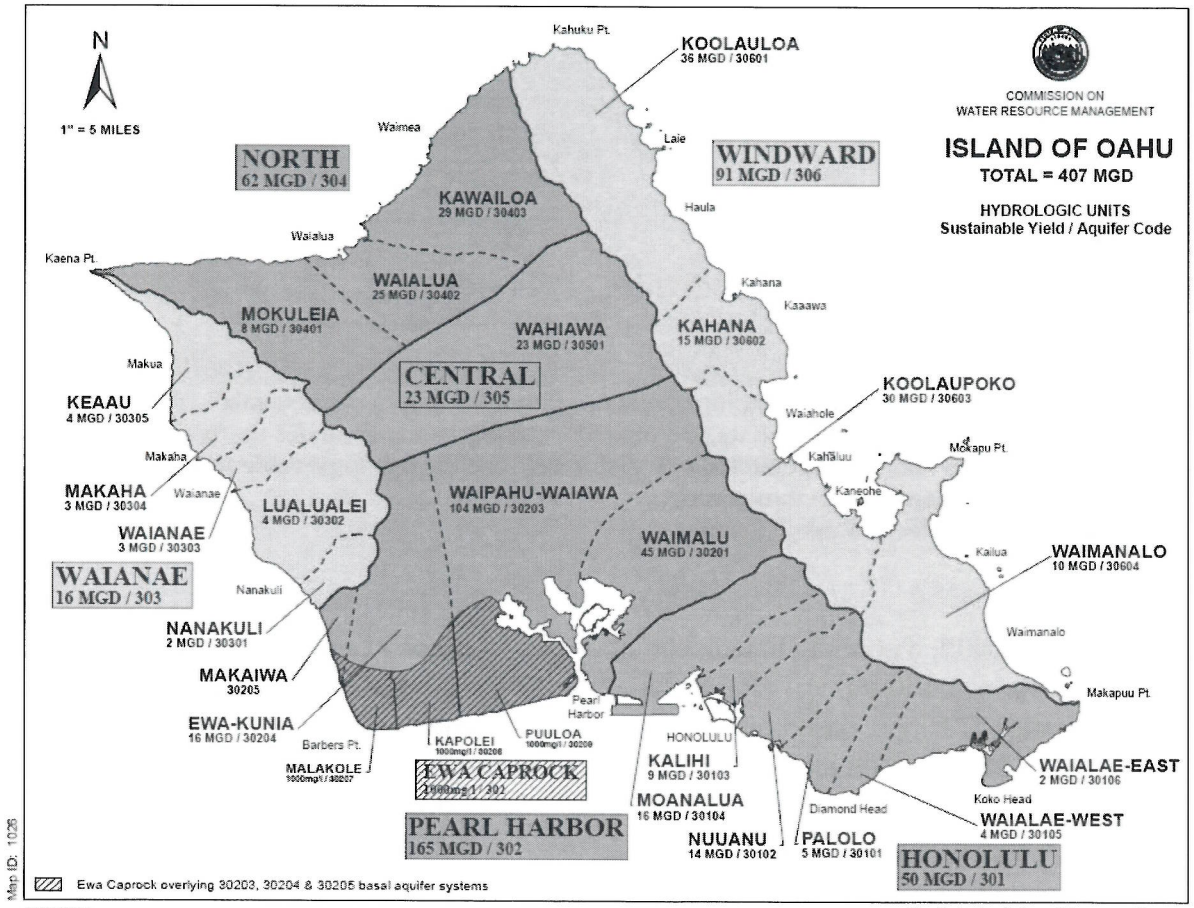


Figure 1.7
O'ahu Aquifer System Areas

CWRM has adopted sustainable yields to protect ground water resources and regulate water use by water use permits. The following Table 1.6 summarizes the available ground water by aquifer sector area accounting for the uncertainties of ground water-surface water interaction in dike formations in Windward and BWS operational experience in Wai'anae.

Table 1.6 Summary of Available Ground Water by Aquifer Sector Area

Aquifer Sector	Sustainable Yield	Water Use Permits Issued Sept 2009	Unallocated Sustainable Yield (mgd)	Water Use 2009	SY minus Water Use
Honolulu	50	53	-3	41	9
Pearl Harbor	165	147	18	104	61
Central	23	22	1	7	16
Wai'anae	16	---	16	5	1*
North	62	40	22	4	58
Windward	91	32	59	21	26**
Total	**407**	**294**	**113**	**181**	**171**

* Adjusted: Based on pumping operations and BWS assessed recoverable yields.

** Adjusted: Ko'olau Loa only, (36 mgd SY – 10 mgd use). Excludes the Waiāhole Ditch and the Kahana, Ko'olau Poko & Waimanalo sectors due to possible surface water interactions in dike formations.

***All footnotes in Table 1.5 apply.

On O'ahu in 2009, a normal rainfall year, about one-third or 113 mgd (294-181) of permitted use was unused. An estimate of available ground water on O'ahu is approximately 171 mgd, based on CWRM revised sustainable yields for O'ahu minus water use in 2009, excluding the Kea'au, Lualualei, Nānākuli, Kahana, Ko'olau Poko and Waimānalo aquifer systems and Waiāhole Ditch. Groundwater use on O'ahu decreased by about 7 mgd from 2005 to 2009.

1.3.7 Surface Water Availability

IFS are similar to sustainable yields for ground water, in that their establishment provides a management system that protects instream and cultural uses while allowing for possible non-instream water use. CWRM is tasked with setting IFS for Hawai'i's streams in accordance with the State Water Code. The code defines instream flow standards as "the quantity or flow of water or depth of water which is required to be present at a specific location in a stream system at certain specified times of the year to protect fishery, wildlife, recreational, aesthetic, scenic, and other beneficial instream uses."[3] These instream flow standards need to consider the best available information in assessing the range of present or potential instream and non-instream uses.

The current instream flow standards for O'ahu streams are called interim instream flow standards (IIFS) and are based on the "amount of water flowing in each stream on the effective date of the standard without further amounts of water being diverted off-stream through new or expanded diversions". The effective dates are December 10, 1988 for Leeward O'ahu and May 4, 1992 for Windward O'ahu.[4] In the Waiāhole Contested Case Hearing, the CWRM recognized that "retaining the status quo (through the adoption of the

previous interim standards) helped to prevent any future harm to streams while the scientific basis for determining appropriate instream flow standards is developed and an overall stream protection program put into place."[5] The stream flows and diversions were not quantified in the standard, however users of surface water and ground water were required to register their uses with CWRM.

The CWRM amended the interim instream flow standards for four windward streams - Waiāhole, Waianu, Waikāne and Kahana have been established via the Waiāhole Ditch Combined Contested Case on July 13, 2006.

Table 1.7 Amended O'ahu Interim Instream Flow Standards

Stream	1960s Streamflow	Amended Interim Instream Flow Standard	Percent Increase
Waiāhole	3.9 mgd	8.7 mgd	124%
Waianu	0.5 mgd	3.5 mgd	600%
Waikāne	1.4 mgd	3.5 mgd	150%
Kahana	11.2 mgd	13.3 mgd	19%

The State Water Resources Protection Plan (WRPP) established surface water hydrologic units and provided an inventory of basic stream data for O'ahu's streams. Table 3-22 of the WRPP lists 87 streams on O'ahu, including the watershed area, number of diversions and stream gages. Diverted stream flows and their uses are not measured or reported and could not be included. The stream diversion inventory process continues and new information will be added to future WMPs. Figure 1.8 shows O'ahu's surface water hydrologic units.

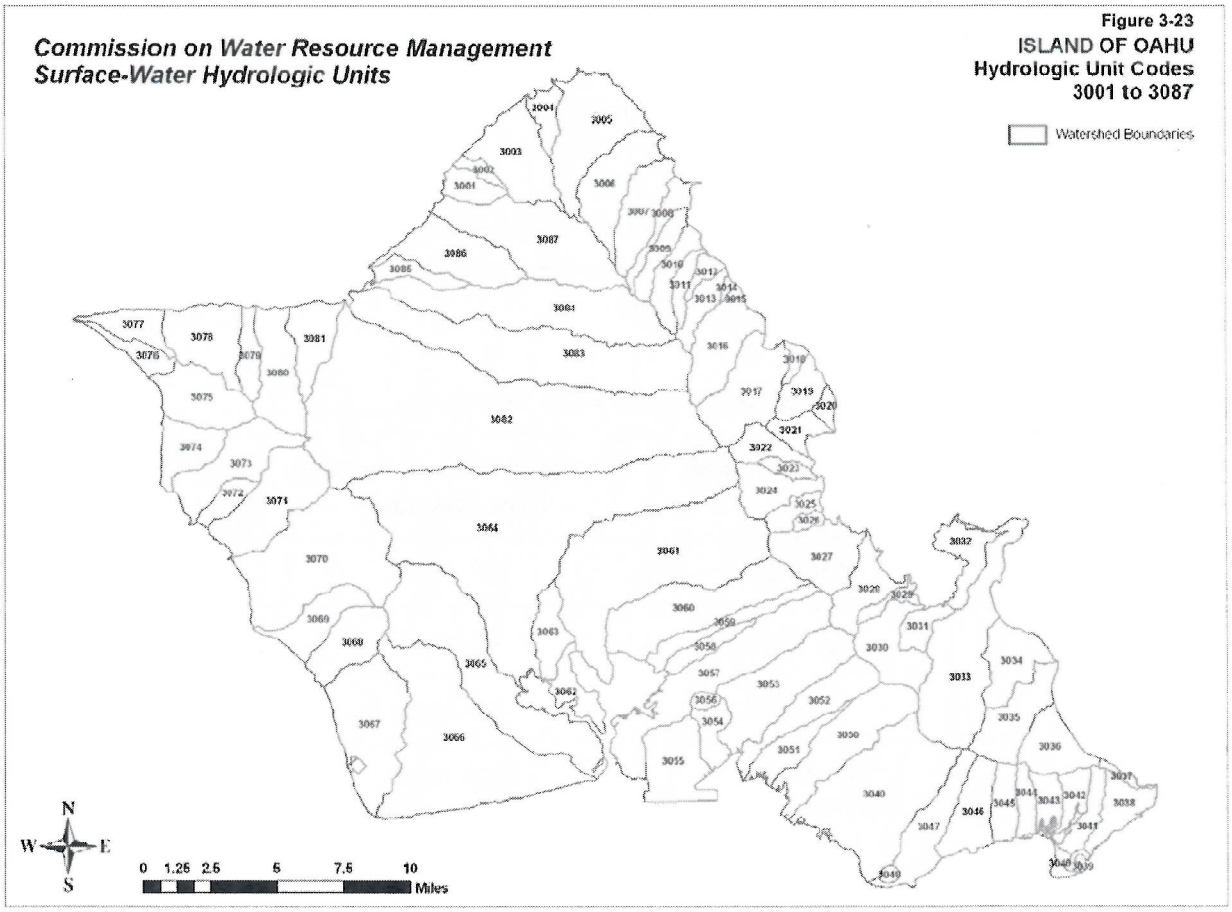


Figure 1.8
O'ahu Surface Water Hydrologic Units

The hydrogeology appendix describes the complexity of setting measurable IFS balancing hydrology with instream and non-instream uses. It is difficult to plan for additional non-instream uses of surface water without measurable IFS, because non-instream uses of surface water are an essential IFS component. Punalu'u Stream and irrigation system studies have cost over $500,000 and therefore, new diversions, while permit-able, are not cost effective unless a simpler methodology for setting measurable IFS is proposed. The planning approach to surface water availability then, is to plan within the diverted amounts existing when the status quo interim IFS were adopted, or as subsequently amended by CWRM. Additional surface water can be provided for non-instream uses through improvements in distribution system efficiency, leakage reduction, crop selection and through efficient irrigation techniques. Significant new stream diversions will require amendments to IFS. In general, a starting point for surface water availability assumes 50% of Q70, stream flowing 70% of the time. Table 1.8 lists some of O'ahu's largest perennial streams.

Table 1.8 O'ahu's Largest Streams and Mean Flows (2004 and 2010)

Stream Name	USGS Stream Gage No.	Mean Flow 2004 (CFS / MGD)	Mean Flow 2010 (CFS / MGD)
Kaluanui	16304200	7.5 / 4.8	3.9 / 2.5
Punalu'u (above ditch)	16301050		19.0 / 12.3
Kahana	16296500	53.5 / 34.6	28.1 / 18.1
Waikāne	16294900	19.1 / 12.3	7.9 / 5.1
Waiāhole (Kamehameha Hwy)	16294100	55.0 / 35.6	26.3 / 17.0
Waihe'e	16284200	9.2 / 6.0	5.3 / 3.4
Kahalu'u	16283200	5.1 / 3.2	1.6 / 1.1
Haiku	16275000	3.6 / 2.3	1.8 / 1.2
Kamo'oali'i - Kāne'ohe	16272200	17.5 / 11.3	-- / --
Makawao – Kailua	16254000	7.2 / 4.7	3.2 / 2.1
Mānoa (Kānewai)	16240500	5.9 / 3.8	8.2 / 5.3
Kalihi	16229000	9.2 / 6.0	4.0 / 2.6
North Hālawa	16226200	9.9 / 6.4	2.8 / 1.8
Waiawa	16216000	50.0 / 32.3	-- / --
Waikele	16213000	53.7 / 34.7	24.5 / 15.8
Mākaha	16211600	2.2 / 1.4	0.5 / 0.3
N. Kaukonahua	16200000	19.2 / 12.4	10.4 / 6.7
S. Kaukonahua	16208000	29.6 / 19.1	15.1 / 9.7
'Ōpae'ula	16345000	18.8 / 12.2	11.9 / 7.7
Kamananui - Waimea	16330000	24.7 / 16.0	12.9 / 8.3
Total		**400.9 / 259.2**	**187.4 / 120.9**

Source: USGS Data. Several USGS gages have been discontinued due to cost considerations.
Note: Q70 is less than mean stream flow.

1.3.8 Planned Source Development

New sources recently completed or in various stages of construction and potential potable sources that will provide for future water demands are listed in Table 1.9. Alternative potable and non-potable sources such as recycled water and desalination are listed in Table 1.10.

Table 1.9 Existing and Potential Ground Water Resources of Potable Water

	New Ground water Sources	Estimated Yield (mgd)	Additional Permitted Use Required (mgd)	CWRM Water Management Area	Potential Development Plan Area(s) Served
1.	Kahuku Wells Pump 3	1.0	1.0	Ko'olauloa	Ko'olauloa
2.	'Ōpana Wells	1.0	1.0	Ko'olauloa	Ko'olauloa
3.	Kaipapa'u or Wailele Well (1)	1.0		Ko'olauloa	Ko'olaupoko
4.	Kaluanui Wells * (1)	1.5		Ko'olauloa	Ko'olaupoko
5.	Ma'akua Wells * (1)	1.0		Ko'olauloa	Ko'olaupoko
6.	Kū'ou Well III *	0.5		Ko'olaupoko	Ko'olaupoko
7.	Waimānalo Well III *##	0.5	0.3	Waimānalo	Ko'olaupoko
8.	'Āina Koa Well II *	0.7		Waialae-West	East Honolulu
9.	Wai'alae Nui Well *	0.7		Waialae-West	East Honolulu
10.	Wahiawā Well III	3.0	3.0	Wahiawā	Central
11.	Waipi'o Heights Wells II and III	2.5	0.65	Waipahu-Waiawa	Central/PUC
12	Mililani Wells IV *	3.0	1.0	Waipahu-Waiawa	Central
13.	Waiawa Wells I-I (2)	6.0	6.0	Waipahu-Waiawa	Central
14	Manana Well *	1.0	0.9	Waipahu-Waiawa	PUC
15	Kunia Wells III *	3.0		Waipahu-Waiawa	'Ewa, Wai'anae
16	Waipahu Wells II *	3.0	1.0	Waipahu-Waiawa	Central
17	Waipahu Wells III *#	3.0		Waipahu-Waiawa	PUC
18	Waipahu Wells IV *	3.0		Waipahu-Waiawa	'Ewa, Wai'anae
19.	'Ewa Shaft *	10.0	3.0	Waipahu-Waiawa	'Ewa
20.	Koa Ridge Makai Wells	2.0	2.0	Waipahu-Waiawa	Central
	Total Potable Resources	**47.4**	**19.85 ****		

Notes:

1) Potential transfer of existing permitted use from Punalu'u Wells to optimize pumpage
2) Waiawa Water Master Plan, Revised Dec 14, 2004.

* Source already has an existing permitted use equal to or a portion of the estimated yield.

** Total does not include transfers of existing permitted use.

\# Includes 0.5 mgd water reservation for Department of Hawaiian Home Lands (DHHL)

0.124 mgd water reservation exists for DHHL in the Waimānalo WMA

Table 1.10 Existing and Potential Alternative Potable and Non-Potable Water Sources

	Resource	Minimum Estimate	Maximum Estimate	Development Plan Area(s) Served
Desalination (potable)				
1	Kapolei Brackish Desalination Plant	0.2	0.5	'Ewa, Wai'anae
2	Kalaeloa Seawater Desalination Plant	5.0	15.0	'Ewa, Wai'anae
Recycled Water				
4	Wahiawā Recycled Water (1)	2.0	4.0	Central
5	Honouliuli Recycled Water	12.0	20.0	'Ewa
6	Wai'anae Recycled Water (2)	2.0	3.0	Wai'anae
7	Kahuku, Turtle Bay, Lā'ie Recycled Water	0.8	2.6	Ko'olau Loa
8	Waimānalo Recycled Water	0.7	1.0	Ko'olau Poko
Nonpotable Water				
9	Waiāhole Ditch (3)	12.44	15.0	'Ewa, Central
10	Wahiawā Reservoir (4)	8.5	16.0	North Shore, Central
11	Kalauao Spring	0.5	3.3	PUC
12	'Ewa Brackish Basal Wells (5)	4.0	5.0	'Ewa
13	Ko'olau Loa Agricultural Wells (6)	6.3	12.6	Ko'olau Loa
14	Punalu'u Stream Irrigation System (7)	2.0	7.0	Ko'olau Loa
15	Maunawili Ditch/Waimanalo I	0.4	1.4	Ko'olau Poko
16	Kawailoa Irrigation System (8)	8	8	North Shore
	Total Alternative Resources	**64.84**	**114.4**	

Notes:

1) Wahiawā WWTP avg flow = 2 mgd, Schofield (Army) Avg flow = 2 mgd.
2) Wai'anae WWTP effluent chlorides at 800-900 mg/l may constrain full expansion.
3) Waiāhole Ditch Min = 2009 CWRM permitted use. 2.43 mgd remains unpermitted.
4) Kaukonahua Streams minimum average month = 8.5 mgd, 2004 mean flow = 31 mgd, 2010 mean flow = 16 mgd. Wahiawā Reservoir storage capacity = 9,200 ac-ft or 3,066 mg.
5) Revised 'Ewa Development Plan. EP2 (1 mgd), EP5&6 (2 mgd), EP10 (1-2 mgd).
6) Sustainable yield exists, but well sites have not been identified.
7) Effects of Surface Water Diversion and Groundwater Withdrawal on Streamflow and Habitat, USGS Report 2006-5153.
8) Approximately 80% is surface water and 20% is groundwater sources

The following table summarizes Tables 1.9 and 1.10 of planned potable ground water sources and alternative potable and nonpotable sources.

Resource	Quantity (mgd)
Ground water – Potable	47
Desalination – Potable (minimum estimate)	5
Recycled Water (minimum estimate)	18
Ground water – Nonpotable	28
Surface water – Nonpotable	38
Total	**134**

Increases in potable and nonpotable demand are offset by water conservation, released agricultural ground water from the close of the sugar plantations, seawater desalination and the development of brackish and recycled irrigation water systems. Surface water is not planned for municipal use until measurable IFS are set and water availability is determined.

Ground water will be developed utilizing available sustainable yield including released agricultural water for agricultural lands rezoned to urban use. Ground water supply evaluations will be conducted to refine available ground water estimates especially as permitted use approaches sustainable yields. New sources of supply will be developed in locations that do not impact streams or other sources.

Recycled water facilities in 'Ewa and Central O'ahu are planned for expansion to continue to off-set additional ground water development.

- In 2000, BWS acquired and now operates the 12 mgd Honouliuli Water Recycling Facility supplying irrigation and industrial process water for 'Ewa. The recycled water distribution system is supplemented with brackish water.
- The Army's Schofield WWTP produces about 2.0 mgd of R-1 recycled water and a distribution system is planned. The City's Wahiawa WWTP is being upgraded to produce 2.0 mgd of R-1 recycled water. A distribution system to Central O'ahu is possible, but is not being pursued at this time due to funding constraints.

In the mid term, seawater and brackish water desalination plants will be constructed to provide for future demand and off-set additional ground water development and provide a cost competitive alternative to increasing inter-district transfers.

- The Kalaeloa Seawater Desalination Plant is currently planned for construction in the 2020 timeframe and will bring an additional 5.0 mgd of potable water supply to the 'Ewa and Wai'anae districts. The plant will be capable of further expansion as needed.
- BWS acquired the State's demonstration brackish water desalination plant facilities in Kapolei Business Park, which could be renovated at relatively low cost, to produce approximately 0.5 mgd of potable water supply for Kapolei.

Research to develop more economical methods of cold seawater development for municipal purposes using a multiple product approach of distillation, energy production using ocean thermal energy conversion, district cooling and aquaculture has been completed, however, funding constraints limit its development.

1.3.9 Adequacy of Supply and Future Demand and Population Distribution

The 171 mgd of unused ground water available on O'ahu in 2009 (Table 1.6), adjusted for recoverability, and the existing large irrigation systems [Kaukonahua/Wahiawā Reservoir (16 mgd), Maunawili Ditch (1.4 mgd), Punalu'u Stream (7.0 mgd), Kawailoa (8 mgd) and the Waiāhole Ditch (15 mgd)] totaling 47 mgd are available to meet the projected high demand scenario for 2030 municipal water demand of 57 mgd (212 mgd – 155 mgd) and the AWUDPs best case of additional agricultural water demand of 30 mgd.

Existing stream diversions will continue to provide for agricultural uses including *kalo*, reducing the need for potable ground water, although supplemental wells are recommended as a drought mitigation strategy. No new stream diversions are planned for non-instream uses until interim IFS are amended to protect and support appurtenant rights, traditional and customary rights in the stream, estuary and nearshore water environments. However, water efficiency improvements in the stream diversion and ditch systems should provide additional surface water for additional agricultural irrigation.

Recycled water is planned to supply a minimum of 18 mgd for urban irrigation. Future seawater desalination could supply 5 to 15 mgd of potable water for 'Ewa and Wai'anae.

The City's General Plan directs the majority of future growth to 'Ewa and the Primary Urban Center, the two development plan areas where plans and infrastructure investment will support growth. The sustainable communities of Central O'ahu, Wai'anae and East Honolulu are relatively stable regions and will realize a lesser amount of expansion. In these five districts, natural and alternative water supplies, such as ground water, recycled water and seawater desalination will be fully integrated. The sustainable communities of North Shore, Ko'olau Loa and Ko'olau Poko will have little change in water demand throughout the planning period. The existing sources and infrastructure in these areas are adequate to provide potable water service through the planning horizon and therefore, additional integration of water supplies between these regions will be limited.

A summary graphic of O'ahu's estimated population distribution based on the 2000 census, BWS potable water demand in calendar year 2000 and water distribution is provided for the eight land use districts (Figure 1.5). This is essentially the base case of existing water demand and distribution in the BWS system that will be referenced in establishing future regional watershed management plan scenarios.

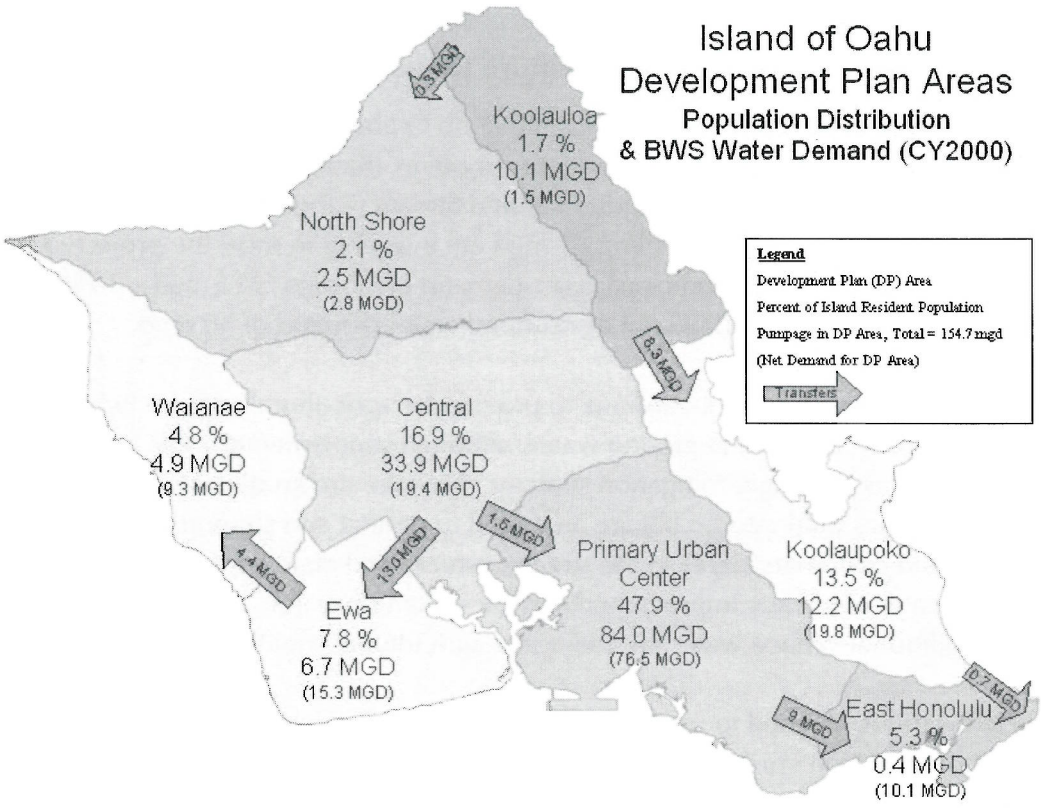


Figure 1.9
Population and Potable Water Demand Distribution 2000

A second summary graphic (Figure 1.9) of O'ahu's estimated population distribution based on DPP's 2030 forecast, BWS high demand scenario for potable water demand and water distribution in 2030 is also provided for the eight land use regions. Desalination is included in the 'Ewa district. This graphic represents a conservative future scenario.

The following findings summarize Figures 1.9 and 1.10 Population Distribution and Potable Water Demand 2000 and 2030.

- The O'ahu General Plan directs growth to the PUC and Ewa development plan areas allowing Wai'anae, Central O'ahu, North Shore, Windward and East Honolulu to be rural areas with limited growth.
- Projected increase in water demand in 'Ewa, Central O'ahu, PUC and East Honolulu of about 48.4 mgd can be met through a diversified combination of conservation, ground water, existing stream diversions, recycled water and desalination. New potable ground water sources will be developed utilizing released agricultural ground water in the Pearl Harbor aquifer. Brackish 'Ewa Plantation wells will continue to be converted for urban irrigation in 'Ewa to supplement potable ground water. New recycled water system expansions are planned.

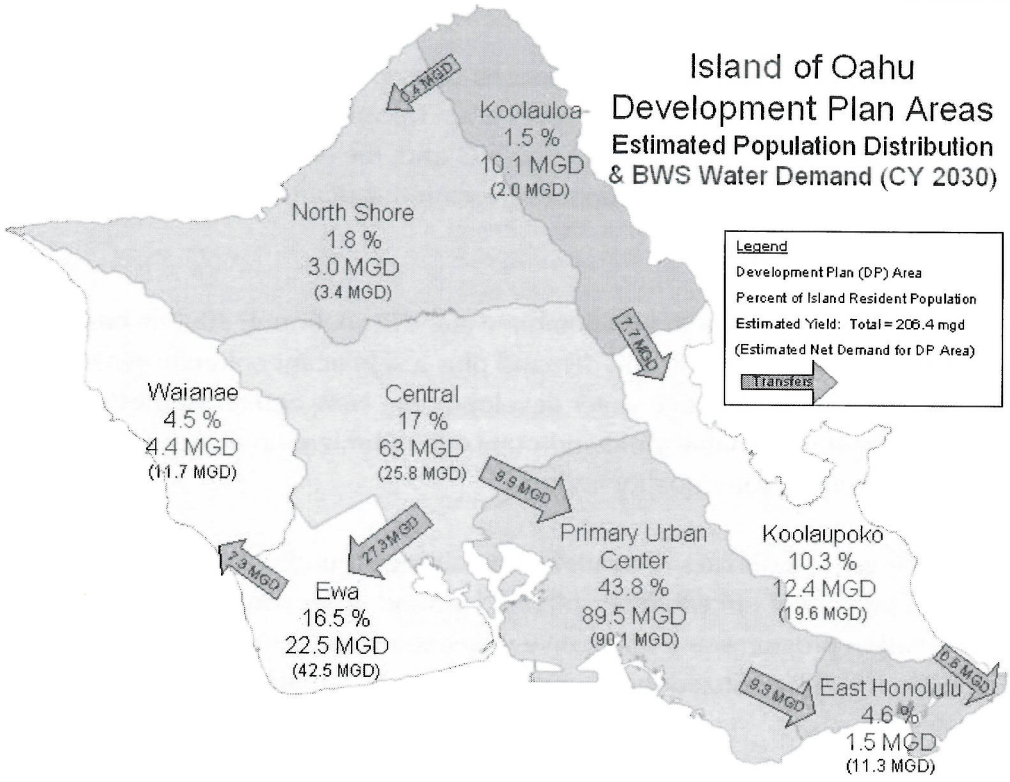


Figure 1.10
Estimated Population and Potable Water Demand Distribution 2030

- Projected water demand in Wai'anae of about 2.4 mgd will be met with transfers from the Pearl Harbor aquifer. To sustain the existing watersheds and streams in Makaha and Wai'anae valleys, source production will be kept at sustainable levels based on long-term operational experience and stream gaging. Over the long term, advanced conservation and recycled water in Wai'anae may reduce Pearl Harbor transfers, increasing the availability of ground water in 'Ewa
- Projected water demand in Ko'olau Loa of 0.5 mgd can be met with conservation, existing and planned ground water sources and recycled water within the district.
  - Ground water transfers from Ko'olau Loa to Ko'olau Poko are expected to reduce slightly over time due to the forecasted reduction in Ko'olau Poko's population by approximately 1,200 people.
  - Ground water transfers from Ko'olau Poko to East Honolulu, because of geology and drought susceptibility, are expected to remain between 0.5 and 0.7 mgd over time as 0.3 mgd of additional Pearl Harbor aquifer water is directed to East Honolulu.

- The North Shore currently has the largest unused supplies of ground water and existing surface water diversions on O'ahu. Because South O'ahu's water demands will be met with resources within South O'ahu, the North Shore's large water supplies will be available to support diversified agriculture including the potential bio-fuels industry.

This likely scenario of population and potable water distribution in 2030 is based on the best available estimates of supply and demand plus a significant commitment to advanced water conservation and alternative water development. New aquifer studies will continue to refine estimates of sustainable yield and pumpage optimization plans will be adapted to avoid salinity and other water quality impacts.

The most conservative estimates of available remaining ground water sustainable yields, a reasonable accounting of uncertainties, planned ground water source projects, advanced water conservation programs and alternative water source projects, such as recycled water and desalination, will be utilized to accommodate future demands.

1.3.10 Uncertainties and Contingencies

Planning efforts have uncertainties due to assumptions made about existing conditions and future scenarios. Identifying these uncertainties provides an opportunity to plan for a practical range of contingencies. This section highlights the major uncertainties and contingencies of this watershed management plan. Many of the watershed protection projects and water supply options discussed in *Chapter 4: Watershed Management Objectives, Projects and Strategies* and *Chapter 5: Implementation* incorporate contingencies designed to plan for uncertainties in supply and demand.

1.3.10.1 *Ground Water Supply Uncertainties*

Estimating Sustainable Yield

Sustainable yields for all aquifer system areas have been adopted as part of the State Water Code's Water Resources Protection Plan and are used for resource management, protection and development. The current sustainable yields are based on the best available information of hydrologic factors but have acknowledged limitations in estimating rainfall distribution, vegetative transpiration, overland runoff, aquifer leakage to the ocean and to the brackish transition zone and recharge to the various dike, basal, perched and caprock aquifers.

Recoverability of Sustainable Yield

Recoverability is the ability to feasibly extract ground water through wells or tunnels, up to the adopted sustainable yield. Recoverability is a major uncertainty due to surface and

ground water interactions, presence of separate hydro-geological formations within an aquifer system area, extended drought, and well location and spacing constraints. There are also regulatory, political, financial and public acceptance uncertainties surrounding additional ground water development and regional transport of water with respect to environmental impacts, local water needs and available supply.

Climate Change

Climate change is expected to cause more severe droughts and floods and as global temperatures increase, sea water levels are expected to rise affecting coastal environments, aquifers and streams. The uncertainties introduced by climate change emphasize the importance of incorporating flexibility, conservation and alternative supplies in the range of planning options. "Although most scientists worldwide agree that our planet's climate is warming, they recognize the uncertainty inherent in assessing climate change impacts. Uncertainties in projected greenhouse gas emissions, limitations of climate models, information loss when climate projections are downscaled to watershed resolution, and imperfections in hydrological models all contribute to the uncertainty."[6]

Ground Water Contamination

Contaminants infiltrating into ground water and spreading through the aquifers places uncertainty in the amount of available water supply. Contamination from agricultural and urban activities has previously occurred in Central O'ahu, Waialua and Honolulu. Contamination could also result from purposeful human activities. The contamination can be mitigated, but treatment is very expensive and time consuming. If treatment is too costly, the well will be shut down and pump capacity will be permanently reduced. Replacement wells are also expensive. Therefore, prevention is the most cost effective measure against ground water contamination.

1.3.10.2 *Recommended Contingency Plans for Ground water Supply Uncertainties*

Ground water sustainable yield estimates provide for resource management and protection but contain uncertainties in water budget, recoverability, climate change and impacts from contamination. The following planning strategies will mitigate the effect of ground water supply uncertainties:

Contingency for Estimating Sustainable Yield

- Periodically update information on rainfall, evapo-transpiration, runoff, leakage and recharge to reflect current hydrologic trends due to climate change.
- Evaluate and account for aquifer boundary conditions recognizing separate geological formations such as dike, basal, alluvial and caprock aquifers within each aquifer system area.

- Construct deep monitor wells in important basal aquifers to provide the ability to monitor water levels, freshwater lens and transition zone thickness and trends in response to pumping.
- Develop advanced numerical ground water models to improve sustainable yield estimates. CWRM with BWS, USGS and the Navy participating, has created the Pearl Harbor Ground water Monitoring Working Group to monitor key indicators such as head, salinity, and transition zone trends, and also to reaffirm the adopted sustainable yields through a milestone framework and optimize pumpage in the Pearl Harbor aquifer sector area. The group is working toward a 3-dimensional solute transport ground water model calibrated to the new deep monitor wells. The work of this group could be a viable model applied to other aquifer sector areas statewide.

Contingency for Recoverability of Sustainable Yield

- Until interim IFS are amended, seek new ground water wells that do not impact surface waters. Develop long-term monitoring plans of stream and watershed indicators.
- Optimize well spacing and pump sizing on an aquifer system area basis to increase recoverability and avoid lens shrinkage, upconing and seawater intrusion. Align water system infrastructure capital plans to more readily accommodate smaller wells spaced throughout the water system when practical.
- During severe, long-term droughts usually greater than 3 years, the full sustainable yield may not be recoverable. Dike source yields will likely drop below permitted use. BWS operational experience accounts for source yields in normal rainfall and drought years. The difference, approximately 14 mgd, is supplemented by the following drought mitigation strategies that will improve the water system's resilience to climate variability:
    - In non-drought years, ensure pumping does not exceed normal rainfall level estimates to preserve sufficient aquifer storage to meet maximum day demands during drought.
    - During drought years, reduce pumping to drought level estimates to protect the freshwater lens. Reducing pumping is difficult, as water demands will increase during drought, therefore:
        - Implement the BWS low ground water plan and other progressively increasing conservation measures to reduce water demands.
        - Develop additional ground water wells to supplement reductions in source yields due to severe drought.
        - Develop alternative, drought-proof water supplies such as recycled water, brackish and seawater desalination facilities.
        - Mandate dual water systems for new large developments to maximize nonpotable water use to conserve the potable water supply.

  - Ensure sufficient aquifer recovery during post-drought periods by reducing pumpage and implementing the applicable watershed protection projects for the most important and/or impacted watersheds.
- Regulatory, political, financial and public acceptance uncertainties can be addressed by environmental disclosure, cost benefit analysis, public outreach, education, alternative source analyses, and holistic watershed management and integrated resource planning.

Contingency for Rising Sea Levels due to Climate Change

Rising sea levels is a global issue, which may have long-term impacts for Hawai'i. A precautionary approach to mitigating impacts of rising sea levels is to identify the water system's most critical vulnerabilities, then suggest how climate variability and extremes might aggravate those vulnerabilities, and finally to design a range of solutions covering the climate uncertainty.[3] The following contingencies could be evaluated:

- Partially backfilling deep wells to account for rising sea levels. Well capacity may decrease and may have to be supplemented with other wells.
- In areas of thin caprock above mean sea leve, such as in Pearl Harbor, constructed hydraulic barriers could prevent rising sea levels from intruding over the caprock into the freshwater aquifers. This solution is similar to Orange County California's Water Factory 21, recycled water hydraulic barrier injection system.
- Private brackish caprock wells near the coast may become more brackish or unusable and may need to be replaced with alternative supplies, such as recycled water
- Recycled water and seawater desalination could replace capacities lost to rising sea levels.

Contingency for Impacts from Ground water Contamination

- EPA and DOH provide extensive regulatory guidelines to address contamination of drinking water. EPA has developed a list of Best Available Technologies (BAT) to remove various contaminants in drinking water and restore the drinking water source for public consumption.
- Conduct regular water quality samples and track trends of contaminants. If trends are rising toward the maximum contaminant level (MCL), initiate planning and engineering of the recommended BAT so that the treatment system is in place before the MCL is reached.
- Apply DOH Source Water Protection program guidelines to water systems such as conducting sanitary surveys, protecting source water delineation/capture zones above wells and best management practices for potential contaminating activities. Conditions for source water protection should be placed on land use plan approvals.

- Implement the water system vulnerability assessment recommendations and other security measures for well stations and other facilities.
- Seal old, unused wells with cement grout to prevent direct contamination to the aquifer and leakage from the aquifer. Well sealing could be regulated through the building permit application process.

1.3.10.3 *Surface Water Supply Uncertainties*

Amending Interim Instream Flow Standards

The most significant uncertainty related to the availability of surface water is the lack of measurable IFS for the majority of streams on O'ahu. Other uncertainties relate to the complexity of stream studies (scientific, cultural, economic and environmental) and their potential cost. These uncertainties realistically mean that additional surface water is not available now or for the foreseeable future. The following is a range of possible outcomes:

- If there is additional water available after instream uses are met, water will be available for agricultural use.
- If no additional water is available, status quo instream and non-instream uses will be maintained.
- If there is insufficient water in the stream to meet the measurable IFS, water from existing non-instream uses will need to be returned to the stream, and alternative water sources for agriculture and urban uses may be needed.

Quantifying Stream Flows, Diversions and Use

There is a level of uncertainty in the amount of surface water flowing in O'ahu's streams and stream segments (low, mean, median and peak variations of flows), the number of diversions and the diverted flows and their associated use and non-use. On O'ahu there are 87 surface water hydrologic units containing approximately 232 stream diversions. In order to adequately protect streams and manage surface water use, streams need to be gaged, diversions structures must be inventoried and surface water use reported on a regular basis. As with ground water use, non-instream water use must be reasonable and beneficial, conserved or returned to the stream.

Drought Impacts on Surface Water

Drought impacts instream uses and the availability of surface water, and is another uncertainty. Surface water is supplied by rainfall and ground water leakage as base flow, and is impacted more readily during drought than ground water. Extended drought can have dire implications, especially for agriculture, much of which relies solely on surface water for irrigation.

1.3.10.4 *Recommended Contingency Plans for Surface Water Supply Uncertainties*

Surface water measurable IFS provide for resource management and protection but contain uncertainties because of the complexity in setting measurable IFS, the need for updating inventories of flows, diversions and use, and impacts from drought. The following planning strategies account for surface water supply uncertainties:

Contingency for amending interim IFS

- CWRM has established a prioritized listing of high natural quality streams to amend interim IFS using best available information.
- CWRM will be acting on the pending petitions for amending interim IFS and has developed a standardized measurable IFS methodology emphasizing practicality and consistency.
- Until measurable IFS are established, new stream diversions are not recommended in this plan, other than for traditional and cultural practices, such as kalo cultivation. Other surface water users should work within the existing diverted flows, applying conservation and water loss prevention strategies to increase system efficiencies.

Contingency for inventories of stream flow, diversion and use

- Cooperative partnerships such as with USGS, will be expanded to jointly fund the gaging of important perennial streams.
- The 2006 Legislature appropriated $650,000 to conduct statewide field investigations to verify and inventory surface water uses and stream diversions and update existing surface water information. BWS hydro-geologists are conducting field surveys using CWRM survey protocols of stream diversions to supplement CWRM efforts.
- The stream permitting process is being revised to improve the acquisition of pertinent information, and a surface water use reporting system will be established.

Contingency for Drought Impacts on Surface Water

- Alternative sources such as ground water and recycled water should be developed to mitigate drought impacts on agriculture. Barriers to recycled water especially for edible vegetable crops will need to be addressed.
- Water loss strategies will extend existing diverted flows. Agricultural crops could also be modified to use less water, markets permitting.
- Watershed forestation and protection projects will focus on critical watersheds to increase base flows and natural storage supplying streams.

A significant limitation to using surface water is its variability and lack of reliability especially during dry periods and drought. By increasing water storage, or by supplementing surface water with ground water, which is called conjunctive use, additional agricultural lands may be irrigated year-round cost effectively with minimal impact. Figure 1.7 (Seasonal Agricultural Water Use Supplementing Surface Water with Ground water) shows the seasonal relationship between surface water in conjunction with ground water for agricultural irrigation. During dry seasons and drought, when demand increases and limited stream water is available, ground water can supplement surface water, protecting instream uses. Surface water, which is more abundant during the wet season, can be economically used, allowing time for the ground water source to be replenished.

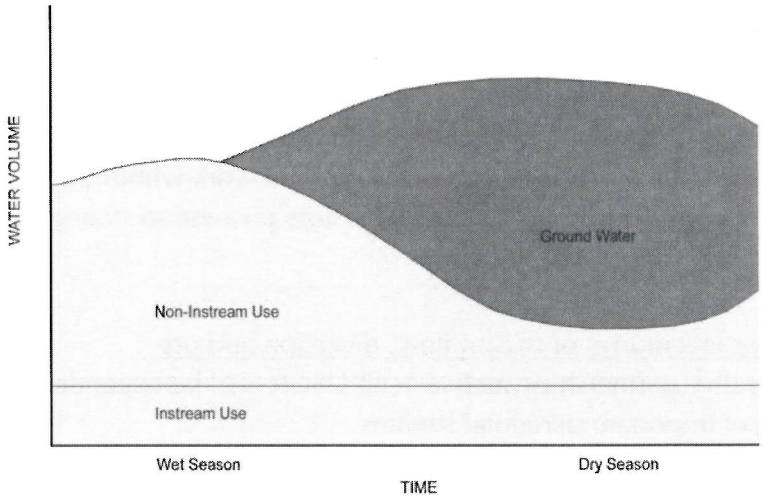


Figure 1.11 Seasonal Agricultural Water Use Supplementing Surface Water with Ground Water

1.3.10.5 *Demand Projection Uncertainties*

Agricultural Water Demands

Predicting agricultural water demands is challenging because of two categories of information – the agricultural products market and regional crop water demand numbers. While Hawai'i's diversified agricultural production has increased in recent years, the amount of agricultural activity has not yet come close to the former sugar plantation days. Much of the land with agricultural zoning is not in agricultural production. Potential bio-fuel production could put more acreage into active cultivation and increase crop water demands.

Regional crop water demand uncertainties are related to crop types, operational variables for each crop type such as fallow periods and frequency of harvest, and local climatic conditions. Crop water demands are challenging because of the diversity of crops and of the relatively few crop numbers that are geographically specific or agreed upon.

Urban Water Demands

Predicting population growth depends on public policies in the Development and Sustainable Communities Plans, the enforcement of community-based plans and the overall economy. While the urban growth and rural community boundaries are established, within the boundaries there is much area for future residential growth. With a strong economy, the growth within it could happen at a faster than predicted pace – but with a slow economy, growth could occur at a slower than predicted pace. Also, the amount of water that may be conserved and maintained over time is difficult to predict.

1.3.10.6 *Recommended Contingency Plans for Demand Projection Uncertainties*

The following strategies can mitigate the uncertainties in demand forecasting:

- Demand forecasts provide a range of possible future demands (low, mid and high) with associated water supplies. Adjusting the timing of water supply projects will accommodate changes in the rate of demand growth. If growth is slower or faster than predicted, projects can be deferred until needed or developed in a shorter timeframe. Regular updates of this plan will allow course corrections.
- Improved conservation measures and economic forces have slowed both urban and agricultural water demand growth extending existing supplies.
- With the diversified water supply approach of advanced conservation, sustainable ground water and surface water supplies, and new technologies in recycled water and desalination, there should be sufficient water supply to accommodate variability in domestic and agricultural water demand growth.

ITEM FOR INFORMATION NO. 2

BWS COMMUNICATION PROTOCOL

DISCUSSION

Board Member Westley Chun requested the Department inform the Board Members when news releases are issued to the public. Mr. Chun noted when a board member initiates an item be placed on the agenda, such as the off-site fire protection policy at the October 2011 board meeting, and the public is invited to testify on the issue, he felt it would have been proper for the Department to inform the Board members first of any changes instead of it being reported in the newspapers.

Acting Manager Nakano explained in this situation, the Department did not issue a news release, but the article was a result of Mrs. Krasniewski being interviewed by a reporter as a result of her coming to the board to testify.

Since that meeting, the Department has been in further consultation with the Honolulu Fire Department and the interpretation of the Water System Standards was clarified and there were no changes to the standards themselves. The majority of the pending permit applications have been processed with just a handful that still need to be addressed.

The Department will update its press release email list to ensure the BWS Board Members are included.

ITEM FOR INFORMATION NO. 3

"December 19, 2011

FINANCIAL UPDATE

Chairman and Members
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96843

Chairman and Members:

Subject: Financial Update for the Period Ended November 30, 2011

The following Board of Water Supply's financial reports are attached:

- Budget vs Actual Revenue and Expense Totals
- Statement of Revenues, Expenses and Change in Net Assets
- Balance Sheet
- Budget vs Actual Appropriate Budget – Total BWS Summary

Respectfully submitted,

/s/ Dean A. Nakano
DEAN A. NAKANO
Acting Manager

Attachments"

The foregoing was for information only.

DISCUSSION:

Chief Financial Officer Paul Kikuchi reported financial savings for the month in various categories and that revenues are down.

In response to Board Chairman Chung's questions, Mr. Kikuchi stated the Department plans to request the Board's authorization of a proposal to restructure its current debt service. Presently, Merrill Lynch is the Board's bond underwriter who was competitively selected in conjunction with the City and County of Honolulu.

Board Member Glenn Okimoto commented that he doesn't consider the savings in personnel, equipment, projects etc. as a financial savings or a positive factor because you need to spend the money that the Board approved by hiring people to get the projects done.

Mr. Kikuchi stated the Department cautiously tracks its expenditures and doesn't spend all the money right away and only purchases what is needed.

Budget vs. Actual
Revenue and Expense Totals
As of November 30, 2011

	YTD Actuals	YTD Budget	Favorable/ (Unfavorable) Variance
Revenues	65,924,000	66,241,000	(317,000)
Operating Expenses	(48,361,000)	(65,424,000)	17,063,000
Net Revenues (expenditures)	17,563,000	817,000	16,746,000

Board Of Water Supply
Statement of Revenues, Expenses And Change In Net Assets
For the Five Months Ending November 30, 2011

Current Month Actual	% Revenue	Last Year Actual	% Revenue	Description	Year to Date Actual	% Revenue	Last Year to Date Actual	% Revenue	% Change
				REVENUE					
13,089,967.36	100.00	13,251,324.27	100.00	OPERATING REVENUE	65,066,401.26	100.00	68,777,272.44	100.00	5.40-
13,089,967.36	100.00	13,251,324.27	100.00	REVENUE	65,066,401.26	100.00	68,777,272.44	100.00	5.40-
				OPERATING EXPENSES					
2,321,172.83-	17.73	2,320,648.17-	17.51	LABOR COSTS	11,690,423.07-	17.97	11,949,076.55-	17.37	2.16-
957,414.85-	7.31	794,357.41-	5.99	SERVICES	3,008,278.75-	4.62	3,941,268.96-	5.73	23.67-
250,351.62-	1.91	1,988.18	.02	SUPPLIES	941,767.32-	1.45	689,135.05-	1.00	36.66
3,941.34-	.03	2,599.06-	.02	EDUCATION & TRAINING	74,565.33-	.11	26,203.79-	.04	184.56
2,161,179.79-	16.51	544,603.17-	4.11	UTILITIES	10,779,039.94-	16.57	6,439,606.81-	9.36	67.39
50,781.09-	.39	145,070.00-	1.09	REPAIR AND MAINTENANCE	688,397.25-	1.06	961,020.30-	1.40	28.37-
1,038,729.80-	7.94	1,505,298.91-	11.36	MISC	6,579,941.40-	10.11	5,994,178.44-	8.72	9.77
5,179,585.16-	39.57	1,175,980.89-	8.87	RETIREMENT SYSTEM CONTRIBUTIO	8,922,129.51-	13.71	4,861,018.42-	7.07	83.54
1,764.32-	.01	19,142.04	.14	MISC EMPLOYEES' BENEFITS	444,707.19	.68	135,071.23-	.20	429.24-
11,964,920.80-	91.41	6,467,427.39-	48.81	OPERATING EXPENSES	42,239,835.38-	64.92	34,996,579.55-	50.88	20.70
730,922.88-	5.58	808,907.80-	6.10	NON OPERATING REVENUE AND EXPE	2,667,760.19-	4.10	1,325,811.90-	1.93	101.22
1,055,331.56	8.06	380,891.97	2.87	CONTRIBUTION IN AID	5,050,600.54	7.76	3,919,578.79	5.70	28.86
4,377,475.28-	33.44	3,734,703.68-	28.18	OTHER EXPENSES	21,542,950.12-	33.11	17,978,655.33-	26.14	19.83
2,928,020.04-	22.37	2,621,177.37	19.78	Change In Net Assets	3,666,456.11	5.63	18,395,804.45	26.75	80.07-

Board Of Water Supply
Balance Sheet
As of November 30, 2011

Description	Amounts Current	Last Month End	Last Year End	Change This Month	This Year
ASSETS					
CURRENT ASSETS	30,696,071.27	29,589,414.02	26,721,776.49	1,106,657.25	3,974,294.78
RESTRICTED ASSETS	1,859,907.43	1,783,039.84	16,977,096.61	76,867.59	-15,117,189.18
INVESTMENTS	180,578,320.81	178,818,431.85	170,566,345.23	1,759,888.96	10,011,975.58
OTHER ASSETS	2,969,832.91	3,300,746.91	4,069,356.13	-330,914.00	-1,099,523.22
PROPERTY / PLANT	1,150,982,494.41	1,152,903,049.22	1,157,677,224.29	-1,920,554.81	-6,694,729.88
TOTAL ASSETS	1,367,086,626.83	1,366,394,681.84	1,376,011,798.75	691,944.99	-8,925,171.92
LIABILITIES					
CURRENT LIABILITIES	17,219,646.36	13,267,749.48	25,051,498.39	3,951,896.88	-7,831,852.03
OTHER LIABILITIES	20,979,144.82	20,572,172.90	21,725,332.64	406,971.92	-746,187.82
BONDS PAYABLE, NONCURRENT	316,101,508.42	316,840,412.19	319,700,620.59	-738,903.77	-3,599,112.17
LIABILITIES	354,300,299.60	350,680,334.57	366,477,451.62	3,619,965.03	-12,177,152.02
NET ASSETS					
RETAINED EARNINGS	342,031,850.56	342,653,312.50	332,340,706.53	-621,461.94	9,691,144.03
FUND BALANCE	594,633,831.66	594,633,831.66	594,633,831.66		
RESERVE FOR ENCUMBRANCES	72,868,664.91	72,247,202.97	82,559,808.94	621,461.94	-9,691,144.03
CURRENT YEAR CHANGES TO FU	3,251,980.10	6,180,000.14		-2,928,020.04	3,251,980.10
NET ASSETS	1,012,786,327.23	1,015,714,347.27	1,009,534,347.13	-2,928,020.04	3,251,980.10
TOTAL LIABILITIES AND NET ASSETS	1,367,086,626.83	1,366,394,681.84	1,376,011,798.75	691,944.99	-8,925,171.92

($000's)

OPER UNIT ALL
BUSINESS UNIT ALL

CIFIS 12820-3021
AS OF 11/30/2011

YTD-TO-DATE					FOR THE FISCAL YEAR				
YTD Actuals	YTD Budget	Avail/ (Over)	%	Object Description	Revenues/ Expend	Open Encumb	Annual Budget	Avail/ (Over)	%
65,924	66,241	317	.48	REVENUE	65,924		159,411	93,487	58.65
				OPERATING EXPENSES:					
12,653	18,050	5,397	29.90	Personnel Services	12,653		43,732	31,079	71.07
				MATERIALS AND SUPPLIES					
3,118	5,837	2,719	46.58	Services	1,548	1,570	13,297	10,179	76.55
2,357	2,964	607	20.48	Supplies	1,346	1,011	7,269	4,912	67.57
22	178	156	87.64	Education & Training	19	3	463	441	95.25
	4	4	100.00	Utilities			10	10	100.00
804	2,700	1,896	70.22	Repairs & Maint	445	359	6,854	6,050	88.27
3,500	3,749	249	6.64	Misc	3,357	143	10,028	6,528	65.10
17	997	980	98.29	Equipment	17		2,920	2,903	99.42
8,725	9,407	682	7.25	Debt Service	8,725		22,577	13,852	61.35
				FIXED CHARGES:					
9,894	11,685	1,791	15.33	Utilities	9,894		28,043	18,149	64.72
1,375	1,375			Case Fees	1,375		3,300	1,925	58.33
2,672	2,939	267	9.08	Retirement System Contribution	2,672		7,055	4,383	62.13
3,224	5,539	2,315	41.79	Misc Employees' Benefits	3,224		13,293	10,069	75.75
48,361	65,424	17,063	26.08	TOTAL OPERATING EXPENDITURES	45,275	3,086	158,841	110,480	69.55
17,563	817	(16,746)		NET REVENUES (EXPENDITURES)	20,649	(3,086)	570	(16,993)	

BOARD OF WATER SUPPLY

City and County of Honolulu

RECRUITMENT AND SEPARATION STATUS

For Period Ended December 9, 2011

Total Filled Positions	522
Total Vacant Positions	152
Total Positions Under Recruitment (Phase 1)	25
Total Positions Under Recruitment (Phase 2)	17

Status of Positions Under Recruitment

	Phase I as of		Phase II as of	
	11/18/2011	12/9/2011	11/18/2011	12/9/2011
Pending DHR Classification Action	2	2	1	1
Pending DHR Open List	7	6	2	2
Pending Updated PD	2	2	0	0
Pending IDCE	1	0	4	0
Pending Interview Questions	6	5	9	8
Pending Interviews	8	5	0	5
Anticipated Starts	1	5	0	1

Month	Separated
Nov-11	2
Dec-11	1

Phase I

Month	Filled
Nov-11	14
Dec-11	2

Phase II

Month	Filled
Nov-11	0
Dec-11	0

Legend:

DHR = Department of Human Resources City and County of Honolulu

IDCE = Intra-Departmental Competitive Examination

PD = Position Description

DISCUSSION: Acting Manager Nakano reported he has been instructed by the incoming Manager and Chief Engineer to suspend filling management and supervisory positions until such time he comes on board. Mr. Nakano asked for direction from the Board if he could continue filling certain supervisory positions.

In response to Board Chairman Chung's questions, Mr. Nakano stated the hiring process can be suspended, however, in certain positions many good candidates might not wait the 45-60 days until the new manager is on board and may find a position somewhere else.

It was recommended by the Board that Mr. Nakano continue filling supervisory positions from section heads and below until the new manager is in place.

ITEM FOR INFORMATION NO. 5 "December 19, 2011

GROUNDWATER LEVELS

Chairman and Members
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96843

Chairman and Members:

Subject: Status Update of Groundwater Levels at All Index Stations

Two aquifer index wells are within a low groundwater status level for the production week that ended on December 3, 2011. Kaimuki and Punaluu remain under a caution condition. The weekly production average for the period was 134.54 million gallons per day.

The Board of Water Supply rainfall index for the month of November was 69 percent of normal with a 5-month moving average of 69 percent. As of December 6, 2011, the U.S. Drought Monitor indicated D2 (severe drought) conditions on the eastern side of the island of Oahu with D0 (abnormally dry) and D1 (moderate drought) conditions for the rest of the island. The National Weather Service outlook projects above normal rainfall for December through June of 2012. Aquifer head levels are on a stable level trend due to the relatively low production rates for the year.

Respectfully submitted,

/s/ Dean A. Nakano
DEAN A. NAKANO
Acting Manager

Attachments"

The foregoing was for information only.

PUMPAGE, HEAD, AND RAINFALL REPORT

Week of 11/27/11 to 12/03/11

STATION	MGD	HEAD	STATION	MGD	HEAD	STATION	MGD	HEAD		MGD	HEAD
METRO			WINDWARD			EWA-WAIANAE (CONT)			PH (CONT)		
KULIOUOU	0.00		WAIMANALO I	0.00		MAKAHA IV	0.00		PEARL CITY II	1.06	
WAILUPE	0.00		WAIMANALO II	0.05		MAKAHA V	0.17		PEARL CITY III	0.38	
WAIALAE-IKI	0.00		KUOU I	0.23		MAKAHA VI	0.00		WAIAU	1.71	
AINA KOA	0.02		KUOU II	0.08		MAKAHA SHAFT	0.00	13.83	NEWTOWN	1.05	
AINA KOA II	0.54		KUOU III	0.11		KAMAILE	0.00		KAONOHI I	0.83	
WAIALAE SHAFT	0.00		LULUKU I	0.98		WAIANAE I	0.17		WAIMALU I	0.00	
MANOA II	0.00		HAIKU	0.30		WAIANAE II	0.65		AIEA	0.77	
PALOLO	0.91		IOLEKAA	0.02		WAIANAE III	0.00		AIEA GULCH 497	0.44	
KAIMUKI HIGH	3.48	23.20	KAHALUU	0.64		MAKAKILO	1.19		AIEA GULCH 550	0.23	
KAIMUKI LOW	0.39		WAIHEE	0.00		HONOULIULI I	1.18		HALAWA 277	1.56	
WILDER	7.62		KAHANA	0.59		HONOULIULI II	7.02		HALAWA 550	0.00	
BERETANIA HIGH	4.60	23.91	PUNALUU I	0.00	16.16	SUBTOTAL:	11.48		KAAHUMANU MTR(-)	0.00	
BERETANIA LOW	0.48		PUNALUU II	3.73		IMPORT FROM PH			KAAMILO FLO MTR (-)	0.00	
KALIHI HIGH	1.95	22.95	PUNALUU III	0.96		KAPOLEI LINE BSTR	0.98		KUNIA I	4.88	19.33
KALIHI LOW	0.91		KALUANUI	0.00		HONOULIULI LB FLOW	12.54		KUNIA II	1.89	
KAPALAMA	0.95		MAAKUA	0.00		EWA BEACH FLOW	3.26		KUNIA III	2.86	
KALIHI SHAFT	8.27		HAUULA	0.16		HONOULIULI I (-)	-1.18		HOAEAE	4.61	
MOANALUA	0.95	19.41				HONOULIULI II (-)	-7.02		EWA SHAFT	0.00	
SUBTOTAL:	31.08		KAHUKU	0.35		SUBTOTAL:	8.59		WAIPAHU INTCON. (-)	-1.13	
			OPANA						EWA-WAIANAE (-)	-8.59	
IMPORT FROM PH			WAIALEE I	0.00		PEARL HARBOR			PH LOCAL USE:	28.32	
HALAWA SHAFT	9.20	17.10	WAIALEE II	0.04		WAHIAWA	2.98		TOTAL SUBURBAN:	59.22	
KAAMILO	1.15		SUNSET BEACH	0.00		WAHIAWA II	0.00				
KALAUAO	9.33	17.40	SUBTOTAL:	8.24		MILILANI I	2.49		KALAUAO SPRINGS	0.90	
PUNANANI	10.93					MILILANI II	0.00		BARBERS POINT (NP)	0.99	
KAONOHI II	0.00		WIND. EXPORT	0.50		MILILANI III	0.75		GLOVER TUNNEL (NP)	0.59	
WAIMALU II	0.00	15.83				MILILANI IV	1.57				
KAAHUMANU	1.03	.	HALEIWA-WAIALUA			WAIPIO HTS.	0.41		HEAD CONDITION		
HECO WAIAU	0.71		HALEIWA	0.04		WAIPIO HTS. I	0.15		CAUTION / ALERT / CRITICAL		
MANANA	0.85		WAIALUA	3.05		WAIPIO HTS. II	0.20		Kaimuki		
KAAHUMANU FLOW MT	0.00		SUBTOTAL:	3.09		WAIPIO HTS. III	0.49		Punaluu		
KAAMILO FLOW MTR	0.00					WAIPAHU	1.13	19.35			
TOTAL IMP/EXP WAIP. INT:	1.13		EWA-WAIANAE			WAIPAHU II	0.34				
IMPORT FRM WIND:	0.50		MAKAHA I	0.34		WAIPAHU III	1.87				
SUBTOTAL:	34.81		MAKAHA II	0.10		WAIPAHU IV	1.94				
			MAKAHA III	0.66		PEARL CITY SHAFT	0.93	15.30			
TOTAL METRO:	65.89					PEARL CITY I	0.52				

CWRM PERMITTED USE FOR BWS POTABLE SOURCES						PUMPAGE	2011	2010	GRAVITY	2011	2010
	A	B	C	D	E	SUBURB.	59.22	59.69	SUBURB.	9.06	7.70
WATER DISTRICTS	PERMITTED USE	2011	DIFF. B-A	YEAR/ DATE	DIFF. D-A	METRO	65.89	69.29	METRO	0.37	0.37
						TOTAL:	125.12	128.98	TOTAL:	9.43	8.07
HONOLULU	45.27	31.45	-13.82						Manoa	0.17	
WINDWARD	25.21	15.19	-10.02			NUUANU #5			Palolo	0.20	
NORTH SHORE	4.08	3.48	-0.60			(rainfall)	0.95"	1.66"	Waim. I&II	0.21	
WAHIAWA	4.27	2.98	-1.29						Waim. III&IV	0.19	
WAIANAE	4.34	3.81	-0.53						Waihee incl.	1.00	
EWA-KUNIA	15.88	9.39	-6.49						Waihee tun.	3.73	
PEARL HARBOR	92.66	68.25	-24.41						Luluku	0.25	
TOTAL:	191.71	134.54	-57.17						Haiku	0.00	
									Kahaluu	1.95	
									Waia. C&C	1.40	
									Waia plant.	0.32	

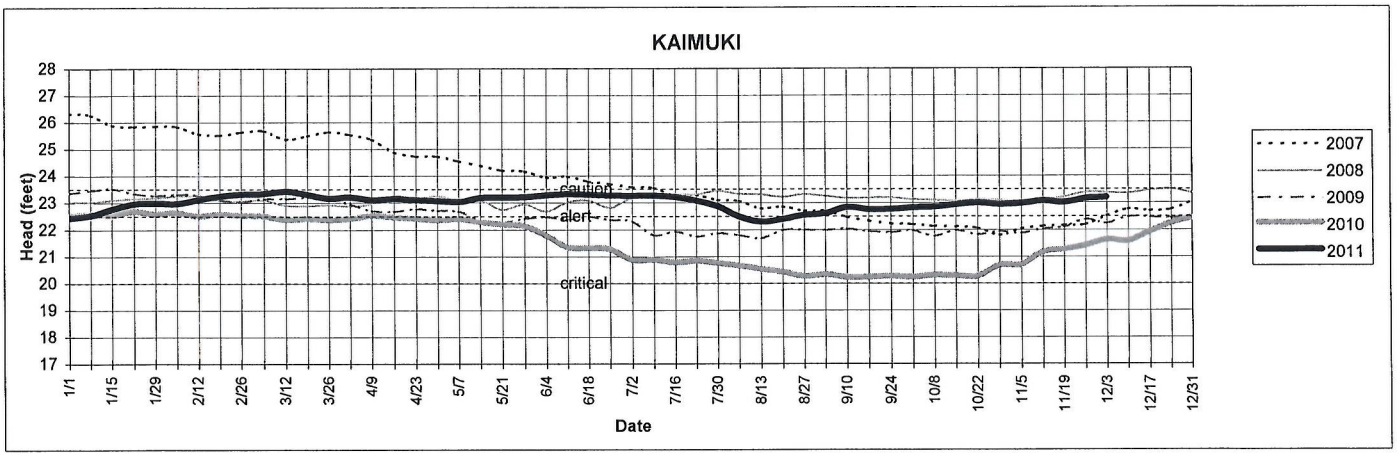
DROUGHT STATUS REPORT
DRAFT IN MGD

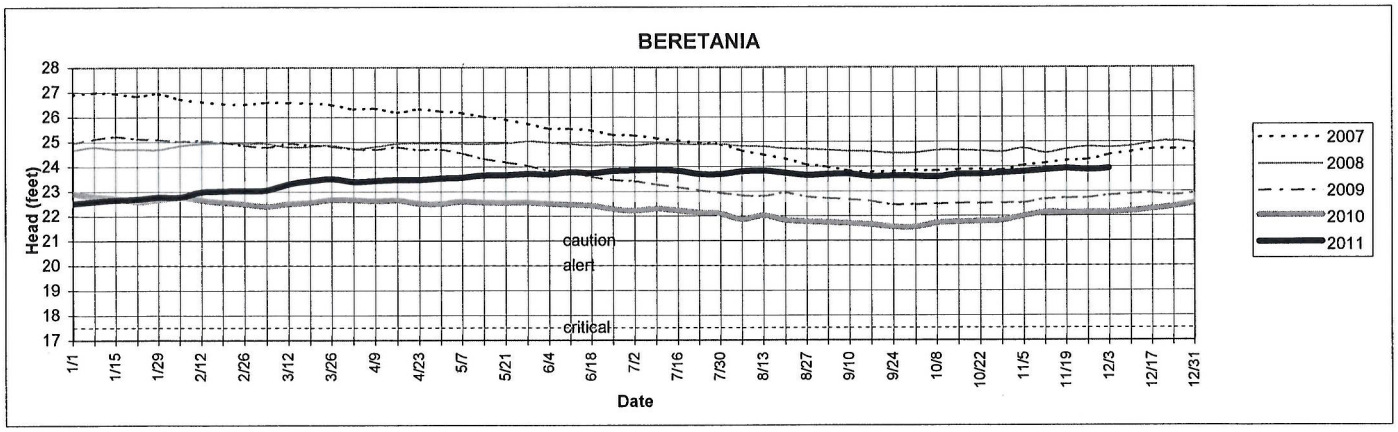
WATER USE DISTRICT	AUTHORIZED USE	2010	11/06-11/12 2011	2010	11/13-11/19 2011	2010	11/20-11/26 2011	2010	11/27-12/03 2011
HONOLULU	45.27	35.29	31.30	36.34	32.88	35.53	31.42	34.79	31.95
WINDWARD	25.21	15.56	14.22	15.39	14.95	16.28	15.99	15.09	14.69
NORTH SHORE	4.08	3.98	3.35	3.82	3.50	3.85	3.52	3.52	3.48
WAHIAWA	4.27	3.09	3.07	3.23	3.12	3.11	3.05	3.00	2.98
EWA-WAIANAE	20.22	21.79	21.43	20.27	23.00	20.21	21.88	20.94	21.79
PEARL HARBOR	92.66	60.79	57.86	59.60	58.30	60.21	61.24	59.70	59.66
TOTAL	191.71	140.51	131.23	138.65	135.75	139.18	137.10	137.05	134.54

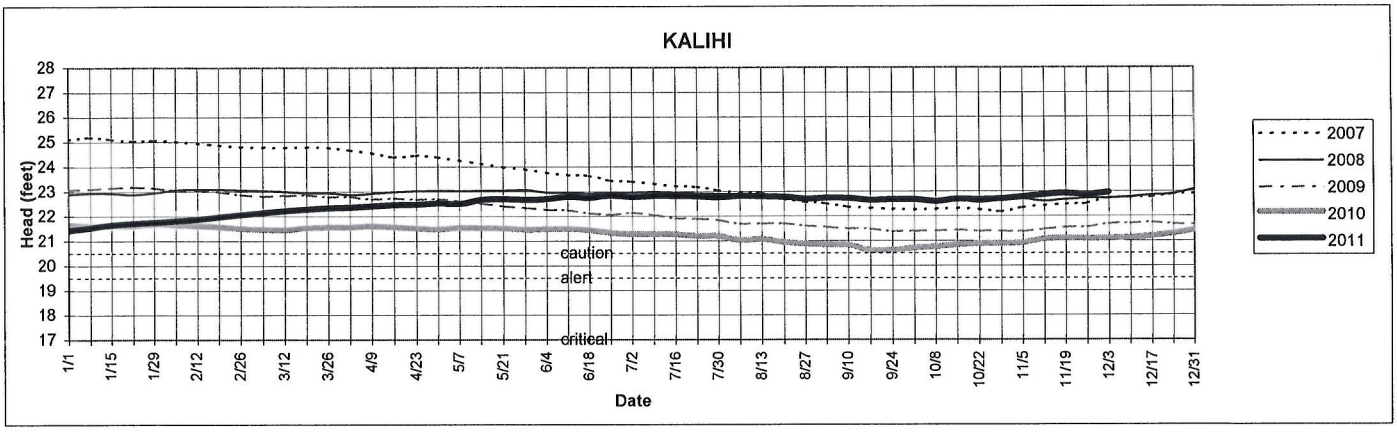
Accounts for in-district pumpage and transfers

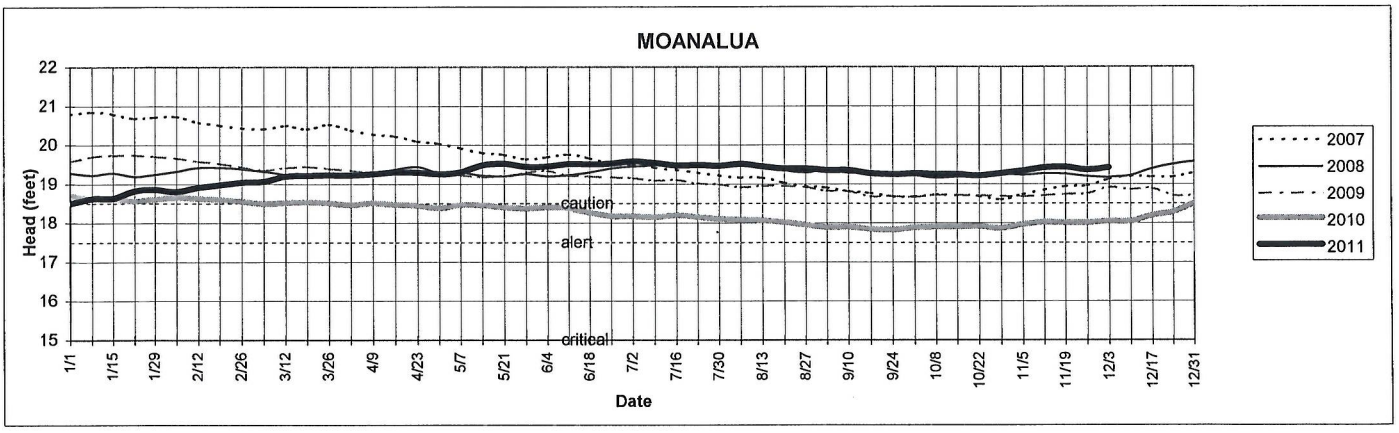
HEAD IN FEET

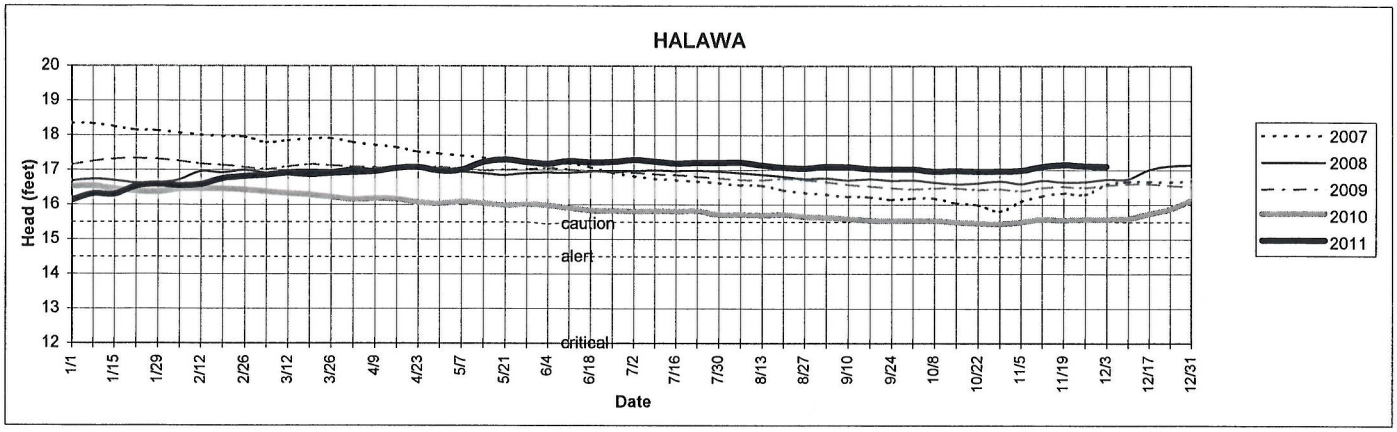
		2010	11/06-11/12 2011	2010	11/13-11/19 2011	2010	11/20-11/26 2011	2010	11/27-12/03 2011
HONOLULU									
KAIMUKI		21.18	23.07	21.26	23.01	21.41	23.15	21.62	23.20
BERETANIA		22.13	23.84	22.12	23.91	22.14	23.85	22.14	23.91
KALIHI		21.07	22.85	21.09	22.90	21.08	22.86	21.09	22.95
MOANALUA		18.02	19.41	18.00	19.43	18.00	19.36	18.04	19.41
PEARL HARBOR									
HALAWA		15.57	17.09	15.55	17.15	15.57	17.11	15.57	17.10
KALAUAO		15.58	17.42	15.56	17.42	15.60	17.42	15.57	17.40
PEARL CITY		13.54	15.30	13.57	15.29	13.61	15.30	13.63	15.30
WAIPAHU		17.38	19.38	17.39	19.38	17.43	19.32	17.45	19.35
KUNIA		17.36	19.37	17.36	19.38	17.42	19.32	17.43	19.33
EWA-WAIANAE									
MAKAHA		11.97	13.83	12.20	13.63	12.21	13.67	11.94	13.83
WINDWARD									
PUNALUU		15.09	16.58	14.81	16.51	14.77	16.16	14.77	16.16
KALUANUI		15.49	17.05	15.41	17.03	15.41	16.76	15.31	16.73
NORTH SHORE									
WAIALUA		11.23	11.27	11.16	11.21	11.14	11.17	11.16	11.16

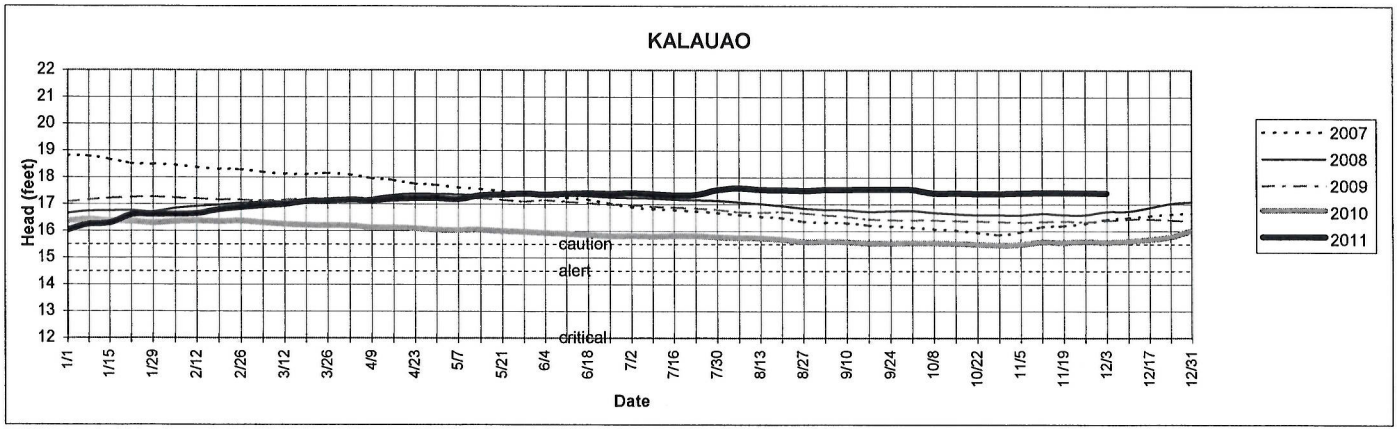

KAIMUKI
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

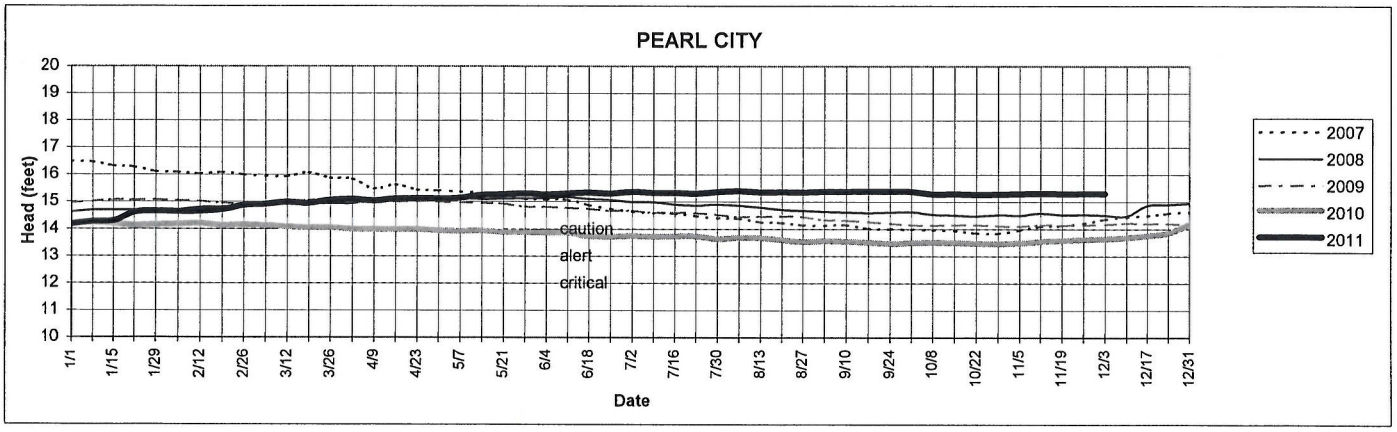

BERETANIA
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

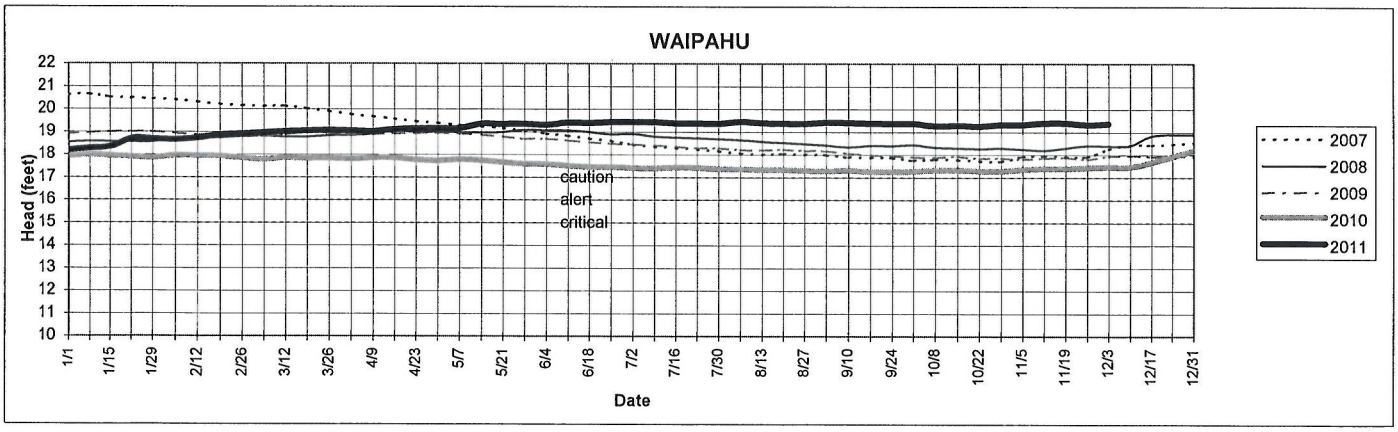

KALIHI
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

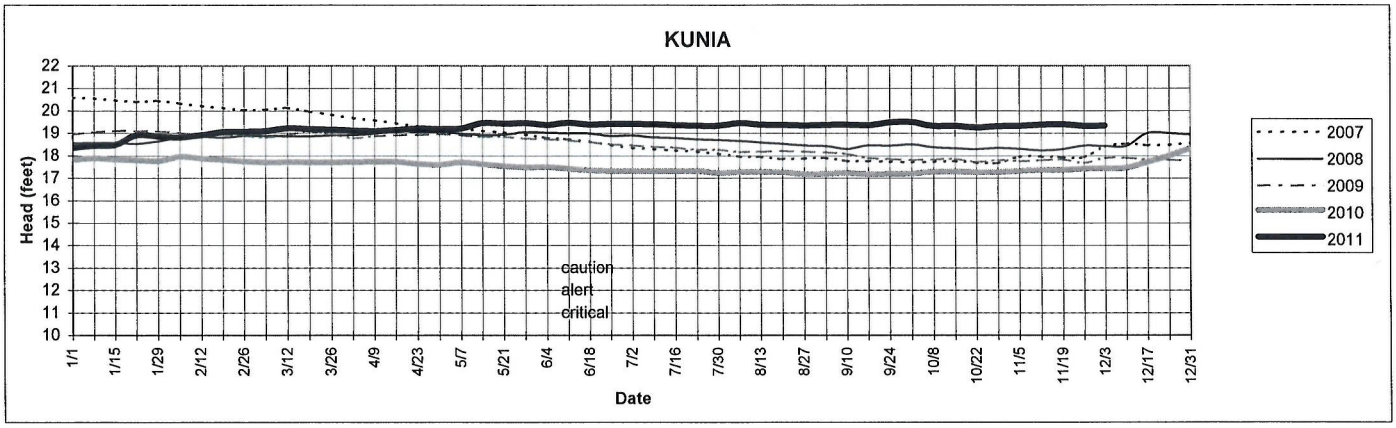

MOANALUA
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

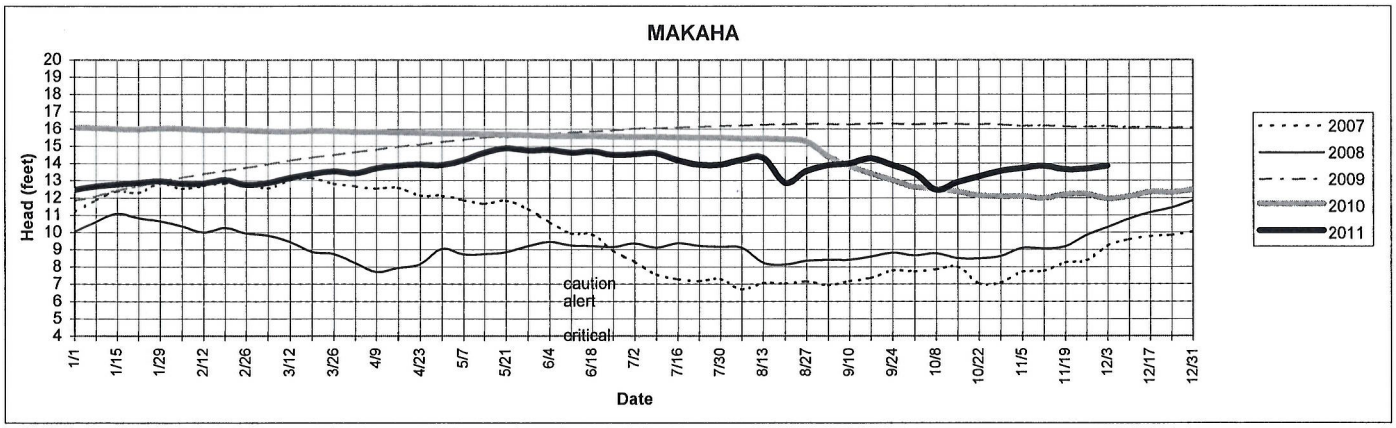

HALAWA
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

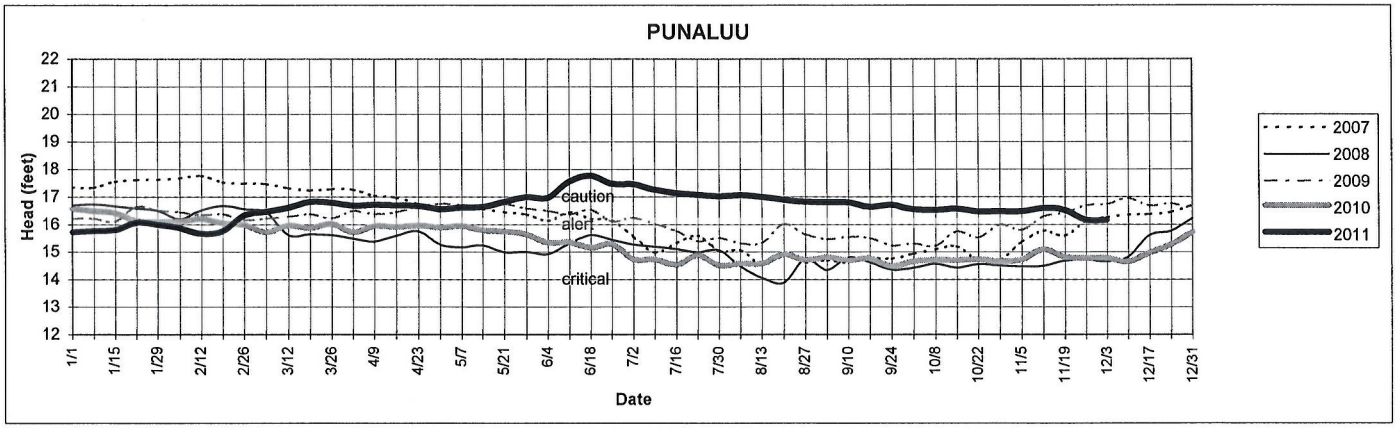

KALAUAO
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

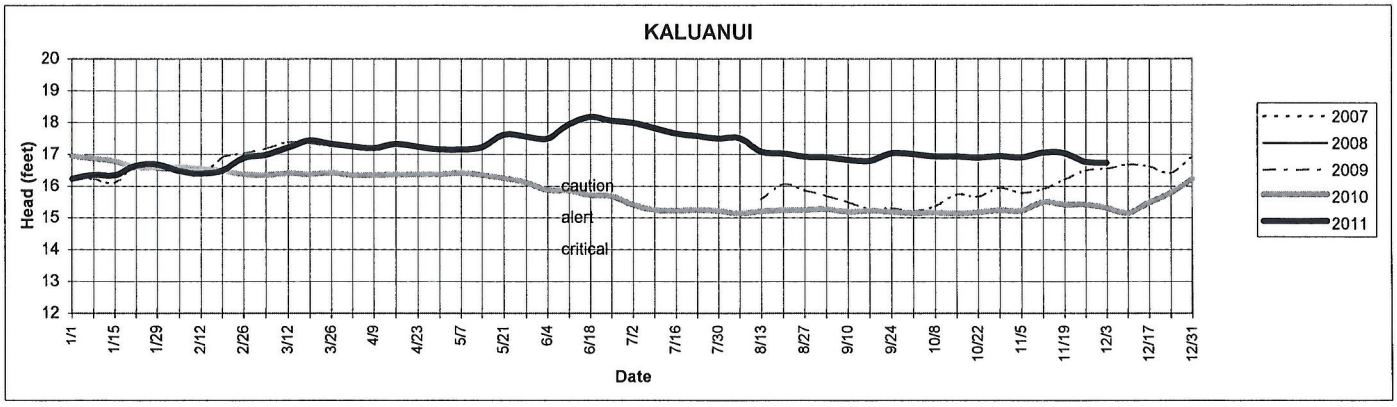

PEARL CITY
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

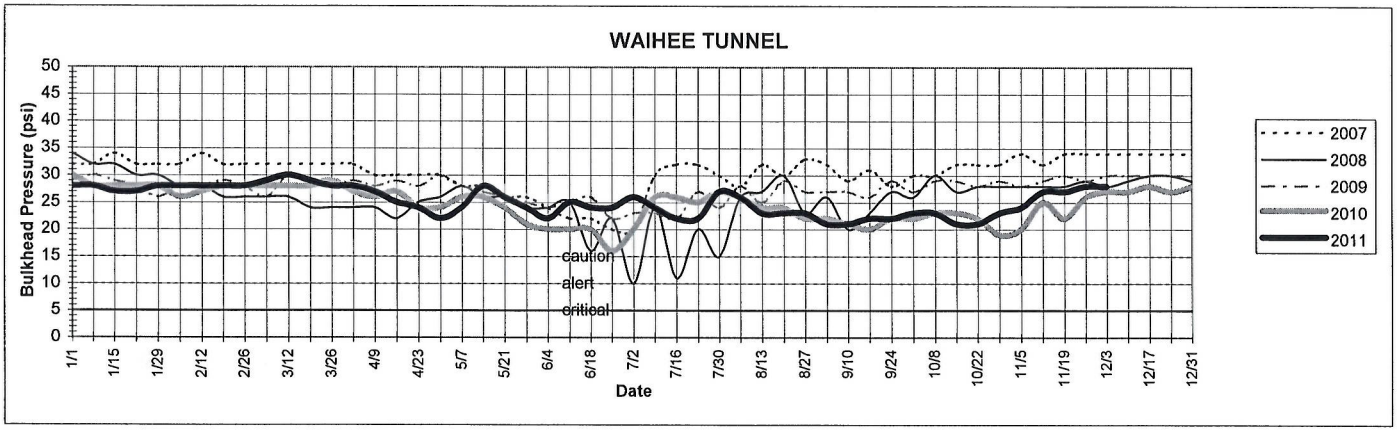

WAIPAHU
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

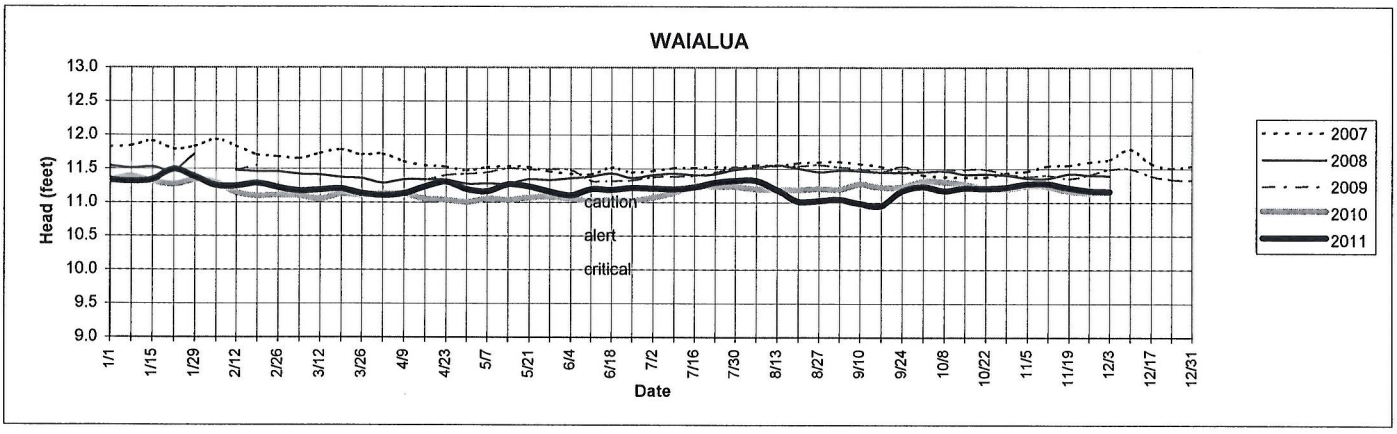

KUNIA
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

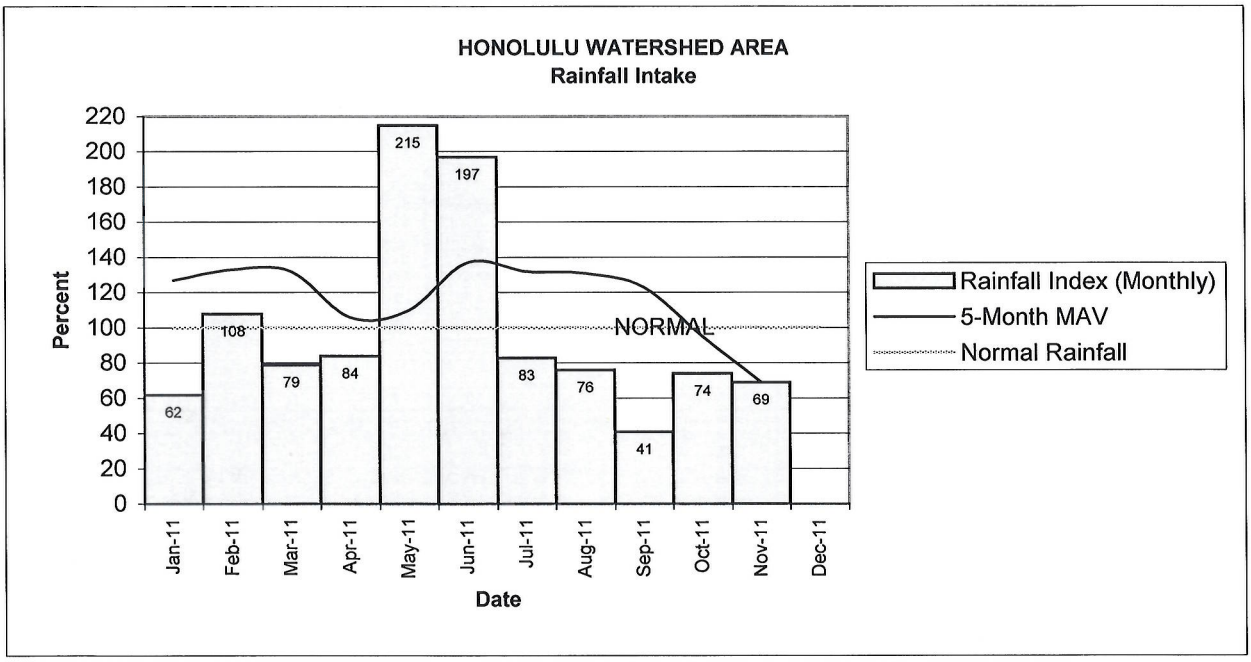

MAKAHA
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011

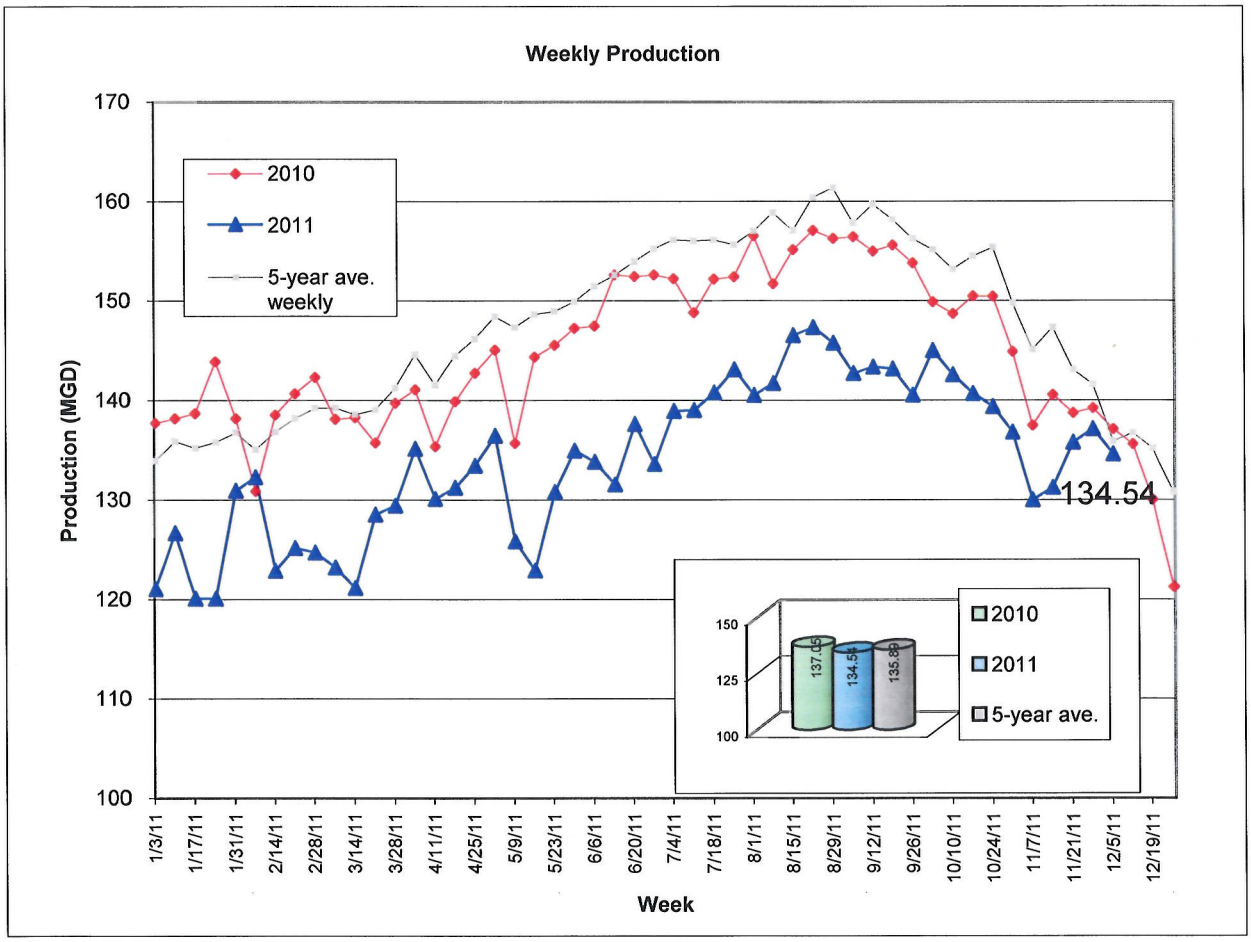

PUNALUU
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011


KALUANUI
Head (feet)
Date
caution
alert
critical
2007
2008
2009
2010
2011


WAIHEE TUNNEL
Bulkhead Pressure (psi)
50
45
40
35
30
25
20
15
10
5
0
caution
alert
critical
1/1
1/15
1/29
2/12
2/26
3/12
3/26
4/9
4/23
5/7
5/21
6/4
6/18
7/2
7/16
7/30
8/13
8/27
9/10
9/24
10/8
10/22
11/5
11/19
12/3
12/17
12/31
Date
2007
2008
2009
2010
2011


WAIALUA
Head (feet)
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
caution
alert
critical
1/1
1/15
1/29
2/12
2/26
3/12
3/26
4/9
4/23
5/7
5/21
6/4
6/18
7/2
7/16
7/30
8/13
8/27
9/10
9/24
10/8
10/22
11/5
11/19
12/3
12/17
12/31
Date
2007
2008
2009
2010
2011


HONOLULU WATERSHED AREA
Rainfall Intake
Percent
220
200
180
160
140
120
100
80
60
40
20
0
62
108
79
84
215
197
83
76
41
74
69
NORMAL
Jan-11
Feb-11
Mar-11
Apr-11
May-11
Jun-11
Jul-11
Aug-11
Sep-11
Oct-11
Nov-11
Dec-11
Date
Rainfall Index (Monthly)
5-Month MAV
Normal Rainfall

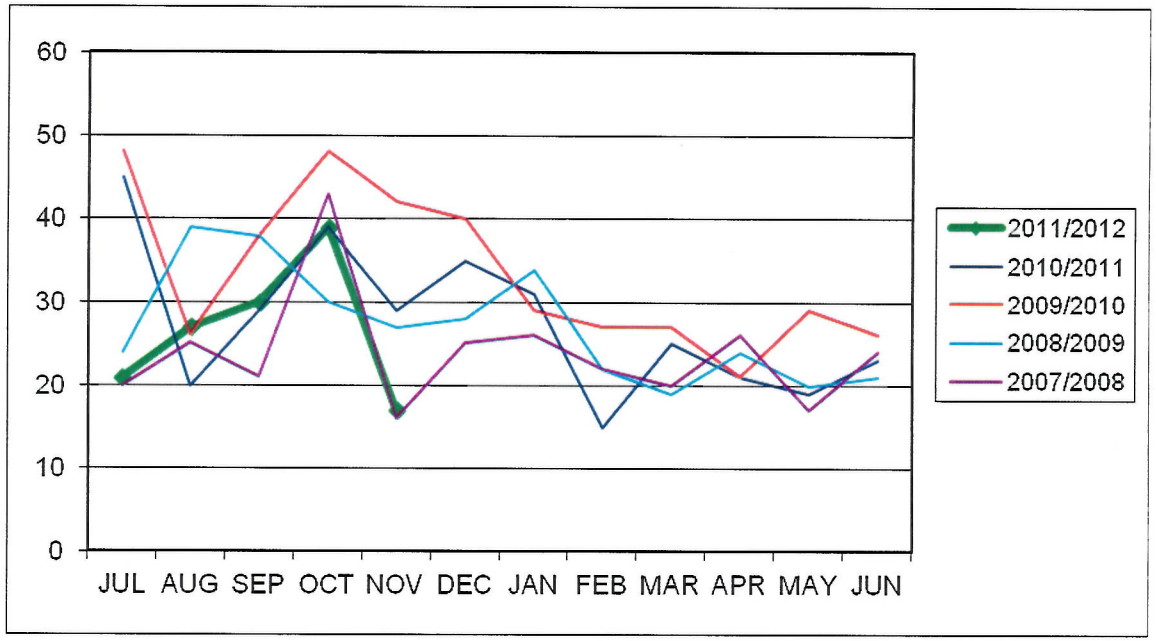

Weekly Production
Production (MGD)
170
160
150
140
130
120
110
100
2010
2011
5-year ave.
weekly
134.54
150
125
100
137.05
134.54
135.89
2010
2011
5-year ave.
1/3/11
1/17/11
1/31/11
2/14/11
2/28/11
3/14/11
3/28/11
4/11/11
4/25/11
5/9/11
5/23/11
6/6/11
6/20/11
7/4/11
7/18/11
8/1/11
8/15/11
8/29/11
9/12/11
9/26/11
10/10/11
10/24/11
11/7/11
11/21/11
12/5/11
12/19/11
Week

WATER MAIN REPAIR REPORT

November 2011

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
2011/2012	21	27	30	39	17								**134**
2010/2011	45	20	29	39	29	35	31	15	25	21	19	23	**331**
2009/2010	48	26	38	48	42	40	29	27	27	21	29	26	**401**
2008/2009	24	39	38	30	27	28	34	22	19	24	20	21	**326**
2007/2008	20	25	21	43	16	25	26	22	20	26	17	24	**285**

Date	Address	Size
11/1	836 11th Ave.	6" C.I.
11/2	1396 Queen Emma St.	6" C.I.
11/8	98-380 Koauka Lp.	8" C.I.
11/13	615 Kaulani Wy.	6" C.I.
11/14	44-015 Aina Moi Pl.	6" C.I.
11/16	742 Auahi St.	8" D.I.
11/16	754 Mokapu Rd.	6" C.I.
11/21	Meheula Pkwy. & Kuahelani Av.	16" C.C.
11/21	6505 Kalanianaole Hy.	24" P.V.C.
11/22	Kuliouou Rd. & Wakine Pl.	12" D.I.
11/23	85-1652 Haleahi Rd.	12" C.I.
11/24	25 Kailuana Pl.	8" C.I.
11/25	465 Wanaao Rd.	8" C.I.
11/27	Komo Mai Dr. near Aaniu Lp.	6" C.I.
11/27	455 Wanaao Rd.	8" C.I.
11/30	92-878 Kohupono St.	8" C.I.
11/30	98-413 Kaonohi st.	4" C.I.



Bold * - Pro-active Leak Repair

*There were no leak detection main repairs for the month of November

DISCUSSION: Board Member Westley Chun remarked during the interview of the Honolulu Marathon staff, it was mentioned that part of their planning for the event is to plan around a possible water main break. Mr. Chun hopes in the future the mindset of the public will change so they would not have to worry about breaks. This is something that the Department could strive for.

ANNOUNCEMENTS NO. 1 " December 19, 2011

2012 POETRY AND POSTER CONTEST

Chairman and Members
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96843

Chairman and Members:

SUBJECT: 2012 WATER CONSERVATION WEEK POSTER AND POETRY CONTEST

We are pleased to announce the launch of our 34th Annual Water Conservation Week Poster Contest and 4th Annual Water Conservation Week Poetry Contest open to Oahu school students. Students in grades K-6 are eligible to enter the poster contest, and students in grades 7-12 are eligible to entry the poetry contest.

The 2012 Water Conservation Week theme is *"The Wonder of Water."* Students are encouraged to use this year's theme to demonstrate the value of drinking water as an amazing, finite resource that needs to be conserved to sustain life for future generations.

There are four poster contest categories – kindergarten, grades 1 and 2, grades 3 and 4, and grades 5 and 6. There are three poetry contest categories – grades 7 and 8, grades 9 and 10, and grades 11 and 12. Winning and honorable mention entries will be featured in our 2013 Water Conservation Calendar, which will be available to the public at the end of 2012. This year's contest deadline is March 7, 2012. Posters and poems may be submitted to our Communications Office or any Satellite City Hall on Oahu. The winners of both contests will be announced on May 9, 2012 at an Awards Ceremony at Mission Memorial Auditorium.

Contest information and entry forms are included in the 2012 Water Conservation Calendars, which have been delivered to teachers at Oahu's public, private, and charter schools. The information is also posted on the Board of Water Supply's website. The 2012 Water Conservation Calendar provided for you earlier includes the winning poster and poetry entries from last year's contest.

A portion of the calendar and contests costs are being defrayed through sponsorships. The BWS would like to thank this year's sponsors: The

Friends of the Halawa Xeriscape Garden, Times Supermarkets, Aloha Pacific Federal Credit Union, and the BWS Federal Credit Union for their generous support. We are continuing our efforts to secure additional sponsors.

We look forward to receiving the upcoming contests entries to see how Oahu students creatively express their thoughts on water waste prevention. We hope they will reflect the success of the Department's efforts to educate our island youth and encourage them to continue to conserve our precious water for years to come.

Respectfully submitted,

/s/ Dean A. Nakano
DEAN A. NAKANO
Acting Manager"

MOTION TO RECESS INTO EXECUTIVE SESSION

Upon unanimously approved motion, the Board Recessed into Executive Session Pursuant to HRS § 92-5 at 2:58 PM to Consult with the Board's Attorney on Questions and Issues Pertaining to the Matters Posted for Discussion at an Executive Session.

OPEN SESSION

The Board reconvened in open session at 3:07 PM.

The Board of Directors confirmed the approval of the new Manager and Chief Engineer. A formal announcement is scheduled for the January, 23, 2012 Board Meeting.

MOTION TO ADJOURN

There being no further business, Chairman Chung at 3:07 PM called for a motion to adjourn the Open Session. Theresia McMurdo so moved; seconded by Westley Chun and unanimously carried.

THE MINUTES OF THE DECEMBER 19, 2011 REGULAR SESSION WERE APPROVED ON 01/23/2012			
	AYE	NO	COMMENT
RANDALL Y. S. CHUNG	X		
DENISE M. C. DE COSTA	X		
THERESIA C. MCMURDO	X		
DUANE R. MIYASHIRO			ABSENT
ADAM C. WONG	X		
WESTLEY K. C. CHUN	X		
GLENN M. OKIMOTO			ABSENT

Respectfully submitted,

NANCY TANO

APPROVED:

RANDALL Y. S. CHUNG
Chairman of the Board

JAN 23 2012
Date