Final Report

Hawaii Water Conservation Plan

Prepared for:

State of Hawaii

Department of Land and Natural Resources

Commission on Water Resource Management

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Contents

Section Page

Executive Summary **ES-1**

Acronyms and Abbreviations ..... **v**

1 Introduction **1-1**

2 Background **2-1**
2.1 Commission on Water Resource Management 2-1
2.2 Current State of Water Management and Conservation Planning, Regulation, and Implementation in Hawaii 2-2
2.2.1 Water Management and Conservation Planning 2-2
2.2.2 Regulation and Implementation 2-5

3 Water Conservation Plan Development **3-1**
3.1 Planning Process 3-1
3.2 Water Conservation Advisory Group 3-2

4 Water Use Analysis **4-1**
4.1 Data Sources and Gaps 4-1
4.2 Water Use Statewide and by Island 4-2
4.3 Water Use Summary by Sector 4-3
4.3.1 Groundwater Well Data 4-3
4.3.2 Municipal 4-3
4.3.3 Military 4-5
4.3.4 Agriculture 4-6
4.3.5 Golf Course 4-10

5 Water Conservation Strategies and Goals **5-1**
5.1 Strategy and Goal Setting 5-1
5.2 Selected Strategies and Goals 5-2
5.2.1 Purpose 5-2
5.2.2 Goal 1 5-2
5.2.3 Goal 2 5-2
5.2.4 Goal 3 5-3
5.2.5 Goal 4 5-3

6 Water Conservation Best Management Practices **6-1**
6.1 Best Management Practice Development and Screening Process 6-1
6.2 Best Management Practice Descriptions 6-2
6.3 Best Management Practice Summaries by Sector 6-2
6.3.1 Landscape 6-2
6.3.2 Municipal—Residential, Commercial, Retail, and Industrial 6-4
6.3.3 Military 6-6
6.3.4 Agriculture 6-9
6.3.5 Golf Courses 6-13

7 Statewide Water Conservation Program **7-1**
7.1 Development of Program Elements 7-1
7.1.1 Best Management Practices Evaluation and Prioritization 7-1
7.1.2 Water Conservation Program Elements for Implementation 7-5
7.1.3 Other Policy Actions 7-14

Section Page

7.2 Implementation, Staffing, and Funding 7-14
7.2.1 Implementation Plan 7-15
7.2.2 Staffing Plan 7-15
7.2.3 Funding 7-16
7.3 Near Term Actions to Launch the Water Conservation Program 7-20
7.4 Future of Water Conservation Advisory Group 7-21
7.5 Water Conservation Plan Review and Update 7-21

8 References 8-1

Tables

4-1 Municipal Water Use Estimates 4-2
6-1 Municipal BMPs 6-4
6-2 Military BMPs 6-7
6-3 Agriculture BMPs 6-9
6-4 Golf Course BMPs 6-14
7-1 Municipal BMP Prioritization 7-1
7-2 Military BMP Prioritization 7-2
7-3 Agriculture BMP Prioritization 7-3
7-4 Golf Course BMP Prioritization 7-4
7-5 Water Conservation Program Implementation Plan 7-17

Figures

3-1 Water Conservation Planning Process Diagram 3-1
4-1 Statewide Reported Water Usage 4-2
4-2 Statewide Groundwater Wells by Island 4-3
4-3 Statewide (Excluding Hawaii Island) Municipal Average Water Use 2006–2009 4-4
4-4 Maui Monthly Water Use 4-4
4-5 State of Hawaii Projected Municipal Water Demand 4-5
4-6 Military Housing Irrigation Use 4-6
4-7 Map of Irrigation Systems Providing Water Use Data 4-7
4-8 Average Reported Water Use for Agricultural Irrigation Systems 4-8
4-9 Average Irrigated Area for Reporting Agricultural Irrigation Systems 4-9
4-10 Annual Trends in Cropping for Hawaii (1992–2010) 4-10
4-11 Map of Golf Courses Providing Water Use Data 4-11
5-1 SWOT Matrix 5-5

Appendices

A Meeting Agendas, Notes, Materials/Handouts, and Presentations
B BMP Templates

Acronyms and Abbreviations

AMA	Agricultural Management Assistance
AWEP	United States Department of Agriculture Natural Resources Conservation Service Agricultural Water Enhancement Program
AWUDP	Agricultural Water Use and Development Plan
BMP	Best Management Practice
BWS	City and County of Honolulu's Board of Water Supply
CWRM	State of Hawaii Department of Land and Natural Resources Commission on Water Resource Management
DLNR	State of Hawaii Department of Land and Natural Resources
DOE	U.S. Department of Energy
DOW	Kauai Department of Water
DWS	Department of Water Supply
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
FEMP	Federal Energy Management Program
FTE	full-time employee
HDOA	State of Hawaii Department of Agriculture
HECT	High Efficiency Commercial Equipment
HET	High Efficiency Toilet
HGCSA	Hawaii Golf Course Superintendants Association
IA	Irrigation Association
IWA/AWWA	International Water Association/American Water Works Association
IWMP	Irrigation Water Management Plan
JBPHH	Joint Base Pearl Harbor-Hickam
LEED	Leadership in Energy and Environmental Design
LICH	Landscape Irrigation Council of Hawaii
mgd	Million Gallons per Day
NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
O&M	Operation and Maintenance
RC&D	Resource Conservation and Development Council
SCADA	Supervisory Control and Data Acquisition
SMART	Specific, Measurable, Attainable, Relevant, and Timely
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UH	University of Hawaii

USACE	United States Army Corps of Engineers
USAF	U.S. Air Force
USDA	U.S. Department of Agriculture
USGBC	U.S. Green Building Council
WCAG	Water Conservation Advisory Group
WUDPs	Water Use and Development Plans

Executive Summary

Need for a Water Conservation Plan

As an island state, Hawaii has limited access to natural fresh water supplies. Competition for fresh water, increasing population and development pressures, the rising awareness of environmental water needs, and the impacts of global climate change require that Hawaii become as efficient as possible in its uses of limited fresh water supplies. In some areas of the state, demand for water is approaching the sustainable limits of supply, and these demands are expected to increase in the future. In order to sustain and protect our water for future generations, we must strive to be as efficient as possible in all of our water uses.

The Commission on Water Resource Management (CWRM) is the primary steward of the water resources public trust and has broad powers and responsibilities to protect and manage Hawaii's water resources. This includes the authority and duty to develop plans and programs to conserve water across the State of Hawaii. While various state agencies and municipalities have developed and implemented individual programs to conserve water, there has been a lack of coordination and communication to collaborate those efforts toward a common goal.

Hawaii Water Conservation Plan Purpose

The purpose of the Hawaii Water Conservation Plan is to identify and implement water use and delivery efficiency measures to conserve the fresh water resources of the state. The plan is intended to be a guiding document for the CWRM as they develop and implement water efficiency measures that can be implemented across the state by various water user groups. In "owning" the Hawaii Water Conservation Plan, the CWRM serves as a coordinator, funding source, clearing house and offers technical assistance. Because the CWRM is not a water purveyor, it can lead by example, but otherwise cannot directly implement water efficiency programs. The CWRM depends on water users in Hawaii to participate and implement the measures outlined in this plan.

It is important to note that this Hawaii Water Conservation Plan focuses mainly on "demand side" measures of water use and delivery efficiency measures and programs to implement them. Although other types of "supply side" measures are commonly mentioned when discussing water conservation, such as reuse of recycled water or stormwater capture for groundwater recharge, these practices are not the emphasis of this plan. For the purposes of the Hawaii Water Conservation Plan, water conservation is defined as the reduction in fresh water use by improving the efficiency of water delivery and end water uses.

Principles and Planning Process

The CWRM began this process to develop a water conservation program with three overarching objectives:

1. Develop a coordinated statewide water conservation planning strategy and policy framework.
2. Develop a statewide water conservation program to implement the planning and policy framework.
3. Work collaboratively with water conservation stakeholders to achieve CWRM objectives.

The planning process for developing this water conservation plan involved forming an advisory group, defining a water use baseline, setting water conservation goals and strategies, developing recommended best management practices (BMP), defining and evaluating implementation approaches, and establishing an implementation and funding plan.

Water Conservation Advisory Group

There are numerous categories or sectors of water uses across the State of Hawaii. The uses range from municipal water supply to military to golf course and agriculture. Within the municipal and military sectors, there are also commercial, industrial, institutional, and other uses that are served. Realizing the need for collaboration and cooperation to succeed in a water conservation program, the CWRM sought to establish an advisory group of

stakeholders that would represent such a diverse water use spectrum. The Water Conservation Advisory Group (WCAG) is composed of water industry professionals and experts from across the state with knowledge or interest in water efficiency and conservation. Members represent all major water use sectors in the private industry as well as all levels of government.

During the development of this water conservation plan, the volunteer WCAG met six times over a period of 18 months to help create the statewide water conservation plan and program. During the six facilitated meetings, the WCAG contributed water use data, water conservation program information, participated in the development of sector-based BMPs, and established an initial prioritization of water conservation program elements. The CWRM believes that there should be a continuation of the WCAG or some derivative group of core members to support the implementation of water conservation programs in the state and to provide expert advice during the evolution of the State Water Conservation Program.

Water Use Characterization

The largest water use sectors by volume in Hawaii are the municipal and the agricultural sectors. The municipal (including military) water demand is approximately 205 million gallons per day. Water use data show that the residential sector is the largest municipal water use category, accounting for nearly two-thirds of all municipal water use. After that, the largest municipal water use categories are commercial, institutional, and hotel. Therefore, the categories in which municipal water conservation BMPs should be targeted include residential, commercial, institutional, and hotel use. The data also illustrate that there is a strong seasonal outdoor water use, and that outdoor water conservation BMPs should be considered.

Agricultural use is estimated at well over 350[1] million gallons per day (which represents both the reported and unreported uses), irrigating approximately 50,700 acres statewide. However, water use data are measured at different points within each irrigation system. Most data sets represented metered deliveries from main ditches and pipelines to water use at farm/field level diversion points, so do not represent total water diversions. Almost all of Hawaii's remaining large agricultural irrigation systems are legacy sugar plantation delivery systems. Many of these systems have fallen into disrepair, but some are undergoing rehabilitation through State-funded efforts. Rehabilitation, modernization, and improved maintenance of this system have the potential to improve water delivery efficiency while also improving the reliability of agricultural water supplies. It is important to note that some agricultural operations also have non-irrigation water uses for pest control and to meet regulatory requirements.

There are 104 golf courses in Hawaii with an estimated average water use of 53 million gallons per day in total across the golf course sector. The data indicate that the average 18-hole golf course in Hawaii covers 124 irrigated acres, has a peak month water use of 0.65 million gallons per day, and an average annual water use rate of 0.37 million gallons per day. Based on the data provided by water users and purveyors and on a per unit area basis, the average golf course irrigation water use was about half the average agricultural irrigation water use. However, the range in reported water use for individual agricultural and golf course sector sites was wide enough that a general comparison of water use across these two sectors is not possible.

[1] Agricultural water use based on the best available data at the time of printing which includes surface water and some brackish groundwater. This value does not include water supplied by municipal water utilities. Agriculture irrigation terminology have specific definitions described below:

Agricultural Water Use: Actual surface and ground water (fresh and brackish) used to grow crops and raise livestock. Where agricultural water systems are not available, farmers and ranchers obtain their water from municipal systems and is not included here.

Agricultural Water Demand: Replacement evapotranspiration for fields that are in production utilizing age crop coefficients. During droughts or system problems water use falls short of demand.

Deficit: The difference between agricultural water demand and use.

Water Conservation Measures and Prioritization

During the plan development process, the WCAG formulated a list of BMPs for the municipal, military, agricultural, and golf course sectors. The idea of establishing a landscape water use sector was considered, but since landscape use is common in all these sectors, the WCAG acknowledged the Landscape Industry Council of Hawaii (LICH), Landscape Irrigation Conservation Best Management Practices manual. Practices in the LICH manual can be applied within appropriate sector program elements.

A comprehensive list of sector-based BMPs was developed and the WCAG was led through a prioritization exercise to initially rank the BMPs based on specific criteria. The CWRM and the project team devised implementation approaches for each of the BMPs. These implementation approaches were then prioritized based on the following factors consistent with the CWRM's internal strengths and weaknesses as well as external threats and opportunities: ease of implementation, cost to CWRM, cost to "implementer," and whether the proposed BMP builds upon existing programs. The BMPs/implementation approaches were grouped into sector-based water conservation programs, and recommendations were made for program implementation and scheduling.

Implementation Plan

The Hawaii Water Conservation Plan implementation section describes prioritization, scheduling, and resources needed to implement recommended water conservation programs. There must be a balance of incentives and policy to elicit changes across the water use spectrum. The cost of implementation (both staffing and financial) is a major factor on whether a program can be implemented or not. Benefit-cost analysis is one factor to consider when choosing a project for implementation. Because staff and funding are both limited, implementation of the plan will occur over time and can be advanced as more staff and funding are available. This phased approach to implementation will require wise use of State funds and may necessitate new approaches to working together to implement the BMPs.

The CWRM's approach is to initially provide technical assistance and incentives where possible and to later establish or implement regulations and policies aimed at conserving and protecting our water resources. In this plan, there are a limited number of measures that are policy and/or regulation oriented and require certain actions by permitted water users over time. In most cases, however, the CWRM intends to establish a conservation framework and invite voluntary participation by different user groups for purposes of awareness, demonstration, documentation, or to receive dedicated funding for water conservation. The underlying premise of the plan is to build upon existing water conservation efforts where they exist and ones that have high stakeholder interests and opportunities for cost-sharing, establish partnerships to encourage voluntary participation in CWRM-sponsored water conservation programs, and to foster understanding and support for water efficiency. Any regulatory enforcement should give the affected parties reasonable time to comply without severe economic hardship. Over time, as data collection on water use and water savings evolves, additional programs may become viable and funding may be dedicated to support additional water conservation programs.

The implementation plan describes a 10 year planning horizon. As described in Section 7.1.2, two key implementation programs recommended for the first 2 years are: (1) procedure for conducting and requiring annual water loss audit for municipal, military, and other public water systems, and (2) irrigation metering demonstration projects for agriculture irrigation systems. Providing technical assistance and guidance will help affected stakeholders prepare for and begin to comply with policy and regulatory measures over some reasonable period of time. If funding is available, the CWRM will consider incentives to encourage the use of WaterSense/high efficiency plumbing fixtures and equipment as well as water efficient commercial equipment.

In addition to the recommended water conservation programs, the CWRM will continue to expand its role in coordinating new and existing water conservation programs, improving our water use data collection capacity, exploring policy actions, and pursuing funding opportunities to increase program effectiveness.

Commission Role and Vision

This Hawaii Water Conservation Plan establishes the Water Conservation Program in the CWRM. The CWRM anticipates taking a lead coordination role for water conservation across the State while partnering and collaborating with the WCAG and interested stakeholders. Water conservation programs should complement existing water conservation programs or measures within stakeholder agencies and organizations. Water conservation policies should be developed and enforced giving affected parties reasonable time to comply with rules and regulations. Program success will depend on coordinating water conservation program implementation, sharing resources, and building upon small achievements. The CWRM will pursue a sustainable funding strategy to implement the Hawaii Water Conservation Plan.

Regular water conservation plan updates or sectional revisions are necessary to evaluate program effectiveness, reflect changes happening in the community or in governmental regulations, and other factors such as new technologies. A 5-year update or revision to this plan is recommended.

The term “water conservation” means different things to different people. In Hawaii, a wide range of activities have been associated with the concept of water conservation, from watershed management to protect sensitive recharge areas to over-irrigation to promote aquifer storage and recovery to resource substitution which aims to use non-potable alternatives to preserve natural supplies. For the purposes of the Hawaii Water Conservation Plan, water conservation is defined as the reduction in fresh water use by improving the efficiency of water delivery and end uses.

SECTION 1

Introduction

1.1 Need for a Water Conservation Plan

As an island state, Hawaii has limited access to natural fresh water supplies. Competition for fresh water, increasing population and development pressures, the rising awareness of environmental water needs, and the impacts of global climate change require that Hawaii become as efficient as possible in its uses of limited fresh water supplies. Over 90 percent of the state's drinking water comes from groundwater sources, while much of the water used for agricultural irrigation comes from surface water sources. It is estimated that public water systems supply approximately 205 million gallons per day (mgd) of potable water across the state. Water used for agricultural irrigation is estimated to be well over 350[1] million gallons per day. In some areas of the state, demand for water is approaching the sustainable limits of supply, and these demands are expected to increase in the future. In order to sustain and protect our water for future generations, we must strive to be as efficient as possible in all of our water uses.

As the primary steward of the water resources public trust, the Commission on Water Resource Management (CWRM) has broad powers and responsibilities to protect and manage Hawaii's water resources, including the authority and duty to develop plans and programs to conserve water across the State of Hawaii. While various state agencies and municipalities have developed and implemented individual programs to conserve water, there has been a lack of coordination and communication to collaborate those efforts toward a common goal. In 2010, CWRM discovered an opportunity to cooperate with the U.S. Army Corps of Engineers (Planning Assistance to States Program) to develop a state water conservation plan and program to improve water use efficiencies in all water use sectors in the state.

1.2 Hawaii Water Conservation Plan Purpose

The purpose of the Hawaii Water Conservation Plan is to identify and implement water use and delivery efficiency measures to conserve the fresh[2] water resources of the state. While the plan is primarily intended to be a guidance document for the CWRM to direct agency activities and resources to promote water conservation, this plan also serves as an information resource that may be used by various water user groups to further their own water conservation efforts.

In "owning" the Hawaii Water Conservation Plan, the CWRM serves as a coordinator, funding source, clearing house, and resource for technical assistance and support. Because the CWRM is not a water purveyor, the CWRM can lead by example but otherwise cannot directly implement water efficiency programs. The CWRM will be dependent upon the participation of the water users in Hawaii to implement the measures outlined in this plan.

In this plan, some of the measures are policy- and/or regulation-oriented and require certain actions by water users over time. In most cases, however, the CWRM intends to establish a conservation framework and invite voluntary participation by different user groups for purposes of awareness, demonstration, documentation, or to receive dedicated funding for water conservation.

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[1] Agricultural water use based on the best available data at the time of printing which includes surface water and some brackish groundwater. This value does not include water supplied by municipal water utilities. Agriculture irrigation terminology have specific definitions described below:

Agricultural Water Use: Actual surface and ground water (fresh and brackish) used to grow crops and raise livestock. Where agricultural water systems are not available, farmers and ranchers obtain their water from municipal systems and is not included here.

Agricultural Water Demand: Replacement evapotranspiration for fields that are in production utilizing age crop coefficients. During droughts or system problems water use falls short of demand.

Deficit: The difference between agricultural water demand and use.

[2] Includes some brackish ground water for agricultural operations.

The underlying premise of the plan is to build upon existing water conservation efforts where they exist and to establish partnerships to encourage voluntary participation by public water suppliers, agricultural and other water users in CWRM-sponsored water conservation programs to foster understanding and support for water efficiency. Over time, as data collection on water use and water savings evolves, additional programs may become viable and funding dedicated to support additional water conservation programs.

Recognizing that some water users and sector groups are ahead of others in the implementation of water conservation measures, and in view of the current staffing and funding limitations of CWRM, this plan may also serve as a technical resource for water users to independently implement the prioritized BMPs identified in this plan. For each of the recommended BMPs, a brief description, qualitative estimates of water savings and costs, and possible implementation mechanisms are provided.

BMPs may also be considered and incorporated into long-range water use and development plans as a strategy for meeting future demands and promote sustainable water management. CWRM intends to fold the Hawaii Water Conservation Plan along with the recommended BMPs into the Water Resource Protection Plan component of the Hawaii Water Plan. The various other State and County agencies responsible for developing and updating other water use and development components of the Hawaii Water Plan will be encouraged to incorporate appropriate water conservation BMPs as part of their long-range plans.

1.3 Hawaii Water Conservation Plan Scope

This Hawaii Water Conservation Plan focuses mainly on water use and delivery efficiency measures and programs to implement them within four major water use sectors in Hawaii: municipal, military, agriculture, and golf course. Best available information was used to characterize sector water use and identify current and potential best management practices for industry implementation and to direct CWRM program development. While other types of practices are commonly mentioned when discussing water conservation, such as watershed protection or stormwater capture for groundwater recharge, these practices are not the emphasis of this plan. However, where appropriate, the Water Conservation Advisory Group identifies a limited number of best management practices that are not directly related to efficiency of water delivery and use but will serve to protect and conserve Hawaii's natural fresh water supplies.

The term "water conservation" means different things to different people. In Hawaii, a wide range of activities have been associated with the concept of water conservation, from watershed management to protect sensitive recharge areas to over-irrigation to promote aquifer storage and recovery to resource substitution which aims to use non-potable alternatives to preserve natural supplies. For the purposes of the Hawaii Water Conservation Plan, water conservation is defined as the reduction in fresh water use by improving the efficiency of water delivery and end uses.

Section 2

Background

2.1 Commission on Water Resources Management

The State of Hawaii Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) was created as the acting entity to fulfill the State of Hawaii's responsibility as the trustee of water resources to set policies, protect resources, define uses, and establish regulatory procedures. CWRM was established in 1987 through the adoption of the State Water Code (Chapter 174C, Hawaii Revised Statutes) and is governed by Chapters 13-167 to 13–171 of the Hawaii Administrative Rules.

CWRM consists of seven voluntary Commission members that have exclusive jurisdiction and final authority in all matters relating to implementation and administration of the State Water Code. Five of those members are appointed by the governor and confirmed by the State Senate; the remaining two are the Chairperson of the State Board of Land and Natural Resources, who serves as Chairperson of the Water Commission, and the Director of the State Department of Health.

CWRM is organized into three program areas: the Groundwater Regulation, Stream Protection and Management, and Planning Branches. Planning Branch personnel are responsible for coordination of all components of the Hawaii Water Plan and the development and implementation of a statewide water conservation plan and program, among other things. There are 22 employees of the CWRM, aligned to program areas outlined above. These staff members are responsible for carrying out the day to day responsibilities of the CWRM. Funding for the CWRM is through a variety of sources. These sources include appropriations by the legislature, fees/charges/fines/penalties, money from public and private sources to benefit water resource protection and management, and the sale of retail items by the DLNR related to water resources.

Several of the key powers and duties of CWRM are listed below.

- Designate water management areas for regulation.
- Establish an instream use protection program designed to protect, enhance, and reestablish beneficial instream uses of water.
- Cooperate and assist federal, state, county, or other local government agencies/organizations, and all other public and private agencies created for the purpose of utilizing and conserving State of Hawaii waters, in coordinating the use of their facilities, and participating in the exchange of ideas, knowledge, and data.
- Plan and coordinate programs for the development, conservation, protection, control, and regulation of water resources based upon the best available information in coordination with federal, state, county, or other local government agencies/organizations, and all other public and private agencies created for the purpose of utilizing and conserving State of Hawaii waters.
- Catalog and maintain an inventory of all water uses and water resources.
- Enforce its rules and orders.

Water resource management funding is established through the DLNR and can be used for the following activities.

- Monitoring programs and activities concerning water resource quality, protection, and management.
- Research programs and activities concerning water conservation and investigation of alternative sources of water.
- Data collection, development, and updating of long-range planning documents.
- Protection, management, operational, or maintenance functions including funding permanent or temporary staff positions.

2.2 Current State of Water Management and Conservation Planning, Regulation, and Implementation in Hawaii

2.2.1 Water Management and Conservation Planning

Conservation of water in the State of Hawaii is not a new idea. The three areas of water conservation (resource, water system, and consumer) have led to ongoing educational and outreach events spearheaded by the counties and industry groups for a number of years. Although each entity and water use sector has a mission to conserve water resources individually, there has been a lack of coordination and communication to collaborate those efforts toward a common goal. The current efforts from each sector are described below to allow for opportunities to build and combine measures helping to decrease inefficiencies and increase savings, as well as implement a successful statewide water conservation program.

Documents that have been written to explain current water usage, forecasts, and provide water conservation practices for specific events include: the *Hawaii Drought Plan* (Wilson Okamoto Corporation, 2005), county water use and development plans (Carl Freedman, Haiku Design and Analysis, 2007; Fukunaga & Associates, Inc., 2010; Group70 International, 2009; Townscape, 2009, RW Beck et al., 2001), *Agricultural Water Use and Development Plan* (Water Resource Associates, 2004), *Hawaii Water Resource Protection Plan* (Wilson Okamoto Corporation, 2008), and various Department of Defense mandates (e.g., U.S. Department of the Navy, 2010). Other than this document, there are none that link all counties and sectors together to support common water conservation goals.

In February 2000, CWRM published the Statewide Framework for Updating the Hawaii Water Plan (Framework), which included methods to integrate and update the Water Resource Protection Plan, Water Quality Plan, State Water Projects Plan, Agricultural Water Use and Development Plan, and county water use and development plans. This framework document discussed guidelines to update the plan, methods to integrate land use and water plans from the various entities, the roles and responsibilities of the different agencies, and potential critical resource areas that need more monitoring and data gathering. Importantly, the Framework recommends the specific consideration of water conservation as a resource option for meeting future demands.

Recent water management and conservation planning efforts are summarized by sector below.

2.2.1.1 State Departments

A number of documents have been published to encourage the adoption of water conservation measures at the state level. In response to Governor Lingle's Administrative Directive No. 06-01 (requiring all state agencies and programs to increase their commitment towards implementing innovative and resource efficient operation and management), the *Water Conservation Manual for State of Hawaii Facilities* (CWRM, 2007) provides detailed information on how to implement water efficient practices at state buildings and facilities.

Efforts to lead by example by the State of Hawaii on water conservation included the *Prototype Water Conservation Plan for the Department of Land and Natural Resources* (Fukunaga & Associates, 2005) which was a pilot project that examined five DLNR facilities to develop water conservation plans for other government facilities. The study concluded that to achieve the agency conservation goal of 10 percent and to save 3.1 million gallons per month, they needed to pursue additional follow-on studies/assessments of each facility. This would lead to the development of facility-specific water conservation plans aimed at achieving, or surpassing, their goal.

Another good example of government leading by example is the State of Hawaii Department of Accounting and General Services (DAGS) energy savings performance contracting (ESPC). Act 155, Session Laws of Hawaii 2009, authorized energy savings performance contracting in State-owned public buildings. During 2010 and 2011, DAGS entered into ESPC for 10 public buildings in the Capital District. These buildings covered over 1.3 million square feet. The purpose of the ESPC was to increase energy efficiency and building performance with the goal of reducing energy usage and demand. As part of the ESCP, the contractor also retrofitted building plumbing fixtures with better-than-code water efficient fixtures, installed weather-based irrigation systems, and made water efficiency improvements to air-conditioning cooling towers. These water efficient measures are expected to reduce potable water use by a total of 20 million gallons per year.

The Alliance for Water Efficiency completed a draft inventory in April 2012 of laws and policies on water conservation in place at all 50 states. In this document, the Alliance for Water Efficiency also assigned a grade to each state to reflect its level of water efficiency based on state-level laws and practices. Hawaii received a grade of "D" in this report, along with 18 other states receiving the lowest score. Two states received an "A;" there were ten "B's;" and 19 "C's." In order for Hawaii to move up in this scorecard grade, additional state-level policies, laws, and practices should be put into place and implemented.

2.2.1.2 Municipal

The municipal water providers for each county (City and County of Honolulu Board of Water Supply, Maui Department of Water Supply, Kauai Department of Water, and Hawaii Department of Water Supply) currently have their own programs for water management planning. The information below describes their efforts to support water conservation.

Honolulu Board of Water Supply

The Honolulu Board of Water Supply (BWS) has implemented a number of water conservation measures, becoming a role model for the rest of the state.

Stated in the Water Resource Protection Plan (Wilson Okamoto Corporation, 2008), BWS adopted a water conservation program using the following elements:

- Education and outreach (public, school, watershed, and community)
- Leak detection
- Repair and maintenance
- Large water user programs
- Regulation
- Alternative source development
- Recycling
- Conservation alternatives

In May 2011, BWS completed the Draft Water Conservation Program (WCP) Plan, which is the result of a multi-phased project spanning three years related to planning a comprehensive conservation program for the BWS service area. The WCP Plan includes results from a 2009 Market Penetration Study performed on Oahu to evaluate water conservation habits and saturation. The WCP Plan also includes results related to an evaluation of 15 water conservation programs/measures. BWS staff currently implements several of these conservation programs and are looking to phase in the launch of new conservation measures over the next several years.

Maui Department of Water Supply

The Maui Department of Water Supply (DWS) has implemented a water conservation program that includes a significant public outreach component (consumer conservation measures, waste prevention, general conservation information, free low-flow shower heads, faucet aerators, and leak detection dye tablets). The Maui DWS developed and expanded its conservation program to include both supply-side (leak detection, preventive and predictive maintenance, use of reclaimed water, use of alternate system backups, and resource protective measures) and demand-side measures (fixture distribution, audits/retrofits, landscaping, tiered rate structure, educational programs, regulations, and resource protection) (Wilson Okamoto Corp, 2008).

Kauai Department of Water

In the Kauai DOW *Water Plan 2020* (RW Beck et al., 2001), water conservation programs include:

- 100 percent customer metering
- Meter repair/replacement program
- Non-metered water analysis/report
- Leak detection
- Tank overflow controls/alarms
- Plumbing code water efficient fixture and pressure reducing valve requirement

- Voluntary water restriction notice
- Public outreach/education programs

The Kauai DOW also has a water conservation plan to meet the long-range water conservation goals of the BWS that include:

- Public outreach and education (community events, public presentations, display exhibits, publications/brochures, and school program)
- Demonstration conservation garden
- Pressure management
- Audits (system, residential, landscape)
- Ultra low flow toilet retrofit rebate
- Fixture distribution (low flow shower head and residential retrofit kit)
- Leak detection

Hawaii Department of Water Supply

The County of Hawaii Department of Water Supply (DWS) encourages conservation through the following (Wilson Okamoto Corporation, 2008):

- Inverted-block rate structure (charging higher unit costs for larger water users)
- Public outreach (brochures and handouts available to the public)
- During periods of drought or low rainfall, the department may issue notices asking for a 10 percent voluntary reduction in domestic use and restricting agricultural irrigation to the hours between 8 p.m. and 6 a.m.

Water conservation measures mentioned in the County of Hawaii DWS 20-year water master plan (Fukunaga & Associates, Inc., 2010) are separated into supply and demand-side. The supply-side measures include meter replacement and repair, non-revenue water analysis, leak detection program, and storage tank automatic level controls. The demand-side measures include meter replacement and repair, plumbing code regulation, voluntary water reduction, public outreach/education program, and xeriscape and efficient landscaping.

2.2.1.3 Military

The U.S. Department of Defense does not have a department-wide water conservation program, but each division follows the respective governmental requirements (Fukunaga & Associates, Inc., 2003). Military installations throughout Hawaii have been required to conserve water through various mandates including recent Executive Orders. Some examples are the installation of electric water meters and reductions of water usage by a specific amount each year. There currently is not a document adopted by all military branches that describes a water conservation plan.

Federal agencies must also improve their water efficiency and management by the following (U.S. Department of Energy, 2012):

- Reducing potable water consumption intensity 2 percent annually through fiscal year 2020, or 26 percent by the end of fiscal year 2020, relative to a fiscal year 2007 baseline.
- Reducing agency industrial, landscaping, and agricultural water consumption 2 percent annually, or 20 percent by the end of fiscal year 2020, relative to a fiscal year 2010 baseline.
- Identifying, promoting, and implementing water reuse strategies consistent with state law that reduce potable water consumption.

2.2.1.4 Agriculture

The sugar plantation industry's desire to increase water use efficiency in Hawaii spurred industry producers to become pioneers in the field of subsurface drip irrigation. Weather based irrigation scheduling using automated weather networks with radio telemetry is commonplace in plantation settings and large-scale agricultural operations. Farmers and ranchers regularly facing water deficits due to drought conditions are forced to quickly adopt water conservation measures. Additionally, establishment of instream flow standards and new regulatory conditions create additional challenges to water conservation efforts. The State of Hawaii Department of Agriculture (HDOA) created an *Agricultural Water Use and Development Plan* (AWUDP) published in 2004 (Water Resource Associates, 2004). Its purpose was to establish a rehabilitation program to maintain and repair various public and private systems and plan for a transition from mono-crops to diversified farming. The plan includes water conservation practices such as metering and monitoring individual farm connections and billings. HDOA plans to update the AWUDP within five years.

2.2.1.5 Golf Courses

Many golf courses are using advanced technology such as climate based irrigation scheduling and centralized control systems to efficiently manage their irrigation and conserve water. Several golf courses are also using recycled water, which reduces the demands on other freshwater supplies. The Hawaii golf course superintendents association provides a forum for connecting the golf course industry across Hawaii. However, there is no comprehensive guidance for water conservation on golf courses in Hawaii.

2.2.1.6 Landscape Industry

Landscape irrigation management is an important part of water conservation practices within both the municipal and military sectors. The Landscape Irrigation Council of Hawaii (LICH) has taken an active role in recent years to provide uniform guidance on irrigation water conservation practices that should be promoted within landscapes in Hawaii. The LICH recently took a water conservation survey of the industry and has published a handbook of recommended best management practices (BMPs) based on their feedback (LICH, 2011).

2.2.2 Regulation and Implementation

As authorized under the State Water Code, CWRM uses regulatory controls to implement its policies and relies on a permit system to apply and implement regulations concerning the diversion of surface waters and the development of ground water sources. This permit system helps to protect water resources and existing legal uses, ensure reasonable-beneficial uses, implement the counties' long-range plans, as well as promote hydrologic data gathering.

CWRM also has the authority to designate an area as a water management area if it is determined to be threatened by existing or proposed withdrawals and limit the amount of water withdrawn. This is done through a water use permitting process that is evaluated based on a number of criteria. The State Water Code does require that permitted uses be reasonable and reflect efficient water use as determined through actual metered use data in conjunction with established guidelines and standards. Adequacy of water conservation measures are analyzed as part of the reasonable-beneficial use test. Permit holders are required to submit water shortage plans, and other special conditions may be applied to these permits.

To protect instream uses, CWRM is authorized to establish instream flow standards (sometimes referred to as minimum flows) where necessary to protect the public interest in waters of the State. The setting of instream flow standards may affect the offstream water availability in affected stream systems.

In addition, the State Water Code requires the CWRM to catalog and maintain an inventory of all water uses. Hawaii Revised Statutes §174C-5(14). Hawaii Administrative Rules Title 13, Chapter 168, Section 7 (HAR 13-168-7) further requires the owners of well and stream diversion works to provide and maintain an approved meter or other appropriate device for measuring and reporting total water usage on a monthly basis to CWRM. In order to improve compliance with this rule, CWRM is in the process of setting up a database for well owners to input their monthly usages, thereby facilitating the reporting requirement for source owners while also allowing CWRM to more easily identify users who become delinquent by providing an automatic electronic notification to owners of their need to file the report.

As noted earlier, CWRM has limited authority to actually implement water conservation measures. Rather, its role is more of a coordinator and resource for technical support and funding. CWRM can use its regulatory tools to encourage water conservation in designated water management areas.

Each county is responsible for regulating water usage and implementing water conservation practices within its jurisdiction. As an example, a number of counties have executed water use restrictions during periods of drought. Counties have also provided high efficiency toilet rebates and free low-flow fixtures to promote water conservation.

Implementation of water conservation projects typically falls under the responsibility of county municipalities, military installations, private water purveyors, the HDOA in the case of state-run irrigation systems, and other water users with support from CWRM.

The State Water Code establishes the Hawaii Water Plan as the principal water resources planning guide for the State of Hawaii. The Hawaii Water Plan is comprised of the following five component parts (responsible agency in parentheses) : *Water Resource Protection Plan* (CWRM), *Water Quality Plan* (Hawaii Department of Health), *Agricultural Water Use and Development Plan* (Hawaii Department of Agriculture), *State Water Projects Plan* (DLNR Engineering Division), and *County Water Use and Development Plans* (one for each respective County). While it is NOT a component of the Hawaii Water Plan, the Hawaii Water Conservation Plan should be used as a guidance document and its principles incorporated into the Hawaii Water Plan component parts as appropriate. The next update of the *Water Resources Protection Plan* will incorporate elements of the Hawaii Water Conservation Plan. Future updates of the *Statewide Framework for Updating the Hawaii Water Plan* will include recommendations to integrate and incorporate the ideas and principles of the Hawaii Water Conservation Plan into the Hawaii Water Plan documents to the extent reasonable and appropriate.

SECTION 3

Water Conservation Plan Development

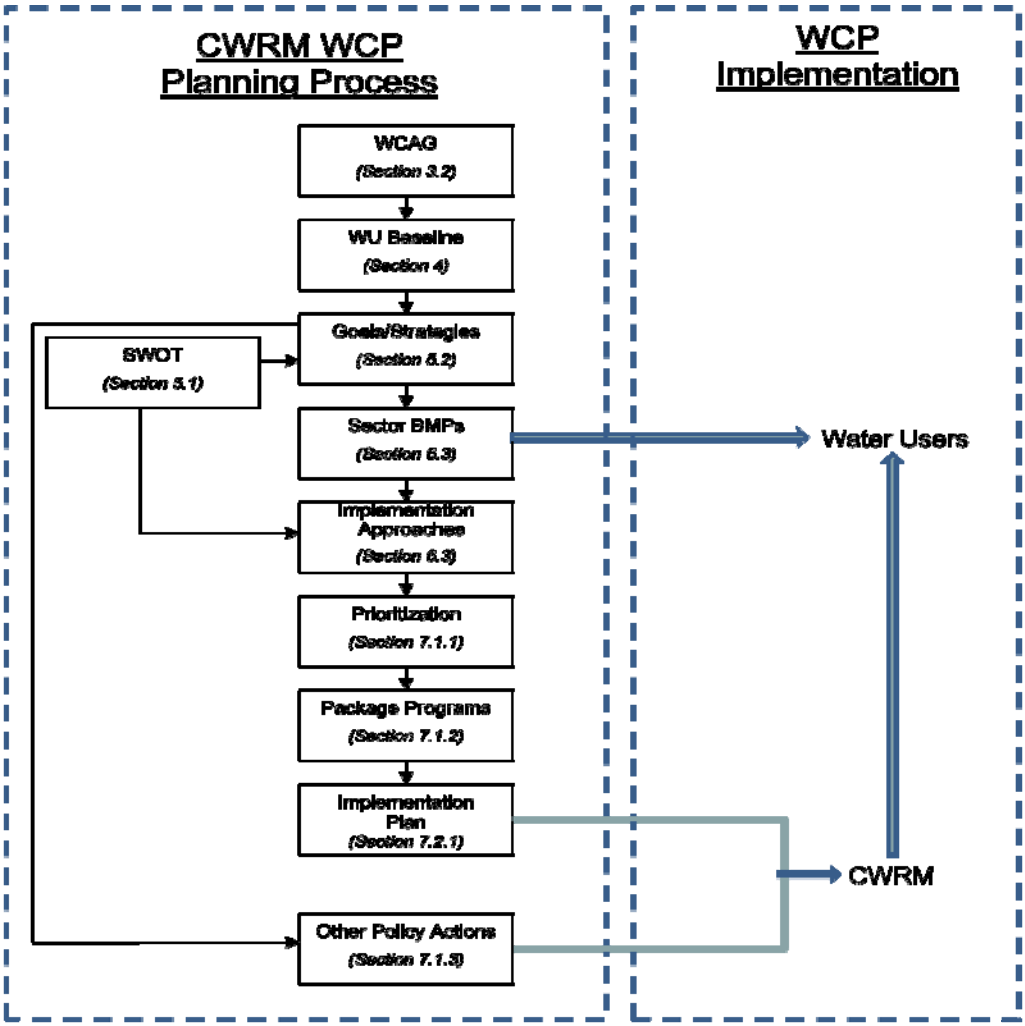
This section outlines in brief the planning process that was used to develop this plan and describes the stakeholder participation provided by the water conservation advisory group.

3.1 Planning Process

The Commission on Water Resource Management (CWRM) began this process to develop a water conservation program with three overarching objectives:

1. Develop a coordinated statewide water conservation planning strategy and policy framework.
2. Develop a statewide water conservation program to implement the planning and policy framework.
3. Work collaboratively with water conservation stakeholders to achieve CWRM objectives.

The planning process for developing this water conservation plan involved forming an advisory group, defining a water use baseline[1], conducting a SWOT analysis (strengths, weaknesses, opportunities, and threats), setting water conservation goals and strategies, identifying and prioritizing recommended BMPs, defining and evaluating implementation approaches, packaging programs, and establishing an implementation and funding plan. Figure 3-1 illustrates the steps in the planning process and where various elements of the plan may be implemented by water users and/or CWRM.



[1] See Section 4.3.4 for further discussion on agricultural water baseline estimates.

FIGURE 3-1
Water Conservation Planning Process Diagram

3.2 Water Conservation Advisory Group

The Water Conservation Advisory Group was instituted by CWRM and is comprised of representatives from the various water use sectors in the State of Hawaii. The group's involvement in the process of developing the water conservation plan was to provide realistic and factual information in the particular water use sector they represented. The WCAG was composed of a cross section of water users and other interested organizations from across the state. The WCAG met six times to gain information and viewpoints on the accuracy of existing water use data, water conservation BMPs, and implementation strategies, as well as to comment on the water conservation goals and objectives defined in this statewide water conservation plan.

Organizations involved with the WCAG include:

- Castle & Cooke Homes, Inc.
- City and County of Honolulu Board of Water Supply
- City and County of Honolulu Sustainable Building Task Force
- County of Hawaii Department of Water Supply
- County of Kauai Department of Water
- County of Maui Department of Water Supply
- Hawaii Association of Conservation Districts
- Hawaii Community Foundation
- Hawaii Farm Bureau Federation
- Hawaii Golf Course Superintendents Association
- Hawaii Hotel and Lodging Association
- Hawaii Prince Hotel and Golf course
- Hawaiian Commercial & Sugar Company
- ITC Water Management, Inc.
- Landscape Industry Council of Hawaii
- Marine Corps Base Hawaii
- Mililani Homeowners Association
- NAVFAC Hawaii
- Navy Region Hawaii Energy Team
- Office of Hawaiian Affairs
- Sierra Club Hawaii Chapter
- State of Hawaii Department of Accounting and General Services
- State of Hawaii Department of Agriculture
- State of Hawaii Department of Business and Economic Development
- State of Hawaii Department of Education
- State of Hawaii Department of Hawaiian Home Lands
- State of Hawaii Department of Transportation
- United States Army Garrison Hawaii
- United States Department of Agriculture Natural Resources Conservation Service
- United States Geological Survey
- University of Hawaii College of Tropical Agriculture and Human Resources
- University of Hawaii Office of Physical, Environmental, and Long Range Planning

Note that while representatives from the four county water utilities and military water utilities are included in the WCAG, there are no representatives from smaller public water systems. In order to keep the size of the WCAG at a manageable level, it was decided not to include representatives from these smaller public water systems. In

moving forward with implementation, CWRM will collaborate with these public water systems to ensure that programs would not impose an unreasonable hardship if implemented.

Water conservation goals and strategies, as well as recommended lists of BMPs and implementation strategies, were established collaboratively with input from CWRM, USACE, and the Water Conservation Advisory Group (WCAG). The WCAG meetings and separate water use sector stakeholder meetings were used to solicit input on each aspect of the plan. Once the initial goals, strategies, and recommended BMPs had been compiled, CWRM, USACE, and the WCAG reviewed the plan to verify that each aspect was realistic to accomplish.

The topics presented and discussed within each WCAG meeting are summarized as follows:

Meeting 1: *WCAG kick-off* (discussion of preliminary water use profiles/analysis; general water conservation goals)

Meeting 2: *Agricultural/Golf Course/Landscape Irrigation Data Analysis* (discussion of water use data/analysis per sector; brainstorming of water conservation BMPs per sector; brainstorming of general implementation strategies)

Meeting 3: *Municipal/Military Data Analysis* (discussion of water use data/analysis per sector; brainstorming of BMPs per sector; brainstorming of implementation and responsibility matrices per sector)

Meeting 4: *Goals and Implementation Strategies* (discussion of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis performed by CWRM and USACE; discussion and ranking of specific, measurable, attainable, relevant, and time-based (SMART) objectives, strategies, goals, and BMPs; review and discussion of recommended BMPs per sector)

Meeting 5: *Draft Plan Review* (comments and suggestions provided on the draft plan by the WCAG)

Meeting 6: *Final Plan Presentation/Implementation Process and Schedule Discussion* (the final plan was presented; CWRM and USACE discussed the next steps for implementation)

Meeting agendas, notes, materials/handouts, and presentations can be found in Appendix A. It should be noted that the data analysis shown in each of these presentations is a work in progress and does not reflect the findings or conclusions determined in this plan.

SECTION 4

Water Use Analysis

Before establishing water conservation goals and strategies and evaluating recommended BMPs for the State of Hawaii, a baseline was needed to evaluate existing water use patterns. This was created by gathering data from the municipal, military, agriculture, and golf course water use sectors and updating estimates presented in previous plans. Since limited information was available within some water use sectors, generalizations were made as needed to determine a path forward.

Establishing a water use baseline provides an understanding of major water use categories and helps to recognize areas within the categories having the most potential for water savings. Water use data were collected from a number of sources across the State of Hawaii in an attempt to characterize the magnitude and patterns of water use across multiple water use sectors. Although the uses for each sector vary seasonally, an average water use rate in million gallons per day (mgd) averaged over the entire year was used as the common metric to allow comparisons across water use sectors.

4.1 Data Sources and Gaps

A large number of agencies from various sectors provided historical water use data for this analysis. While there were some data gaps in water use categories, enough data were collected to generate a good picture of the water use in Hawaii. Below is a summary of the agencies providing data and the gaps identified as part of the process.

Some of the data received were from the following sources:

- CWRM
- County of Hawaii Department of Water Supply
- County of Kauai Department of Water
- County of Maui Department of Water Supply
- Joint Base Pearl Harbor-Hickam
- Army Garrison
- Marine Corp Base Hawaii
- City and County of Honolulu Board of Water Supply
- Landscape Industry of Hawaii
- State of Hawaii Department of Health
- Hawaii Department of Agriculture
- Agribusiness Development Corporation
- Various public and private golf courses
- East Maui Irrigation Company
- Maui Land and Pineapple
- Kamehameha Schools
- Hawaii Hotel and Lodging Association

The following areas need improvement in water use data gathering:

- Golf courses (statewide)
- County of Hawaii potable water distribution
- Military housing, landscape irrigation, and industrial use
- Groundwater well usage in non-water management areas
- Residential landscape irrigation usage
- Agricultural irrigation water usage for private systems and systems not under Department of Agriculture management

4.2 Water Use Statewide and by Island

Using information collected, water use was analyzed both statewide and by island for each sector. In particular, Figure 4-1 shows the reported water use statewide by water use sector. This analysis shows that reported agricultural use is the largest water user in Hawaii at 282 mgd, with municipal coming in second at 206 mgd. Some portion of the total military use is included in the municipal sector. Likewise, a portion of the 18 mgd of reported golf course use is also supplied by the municipal sector.

Note: Data represents only the users who supplied water usage data. The total agricultural use is estimated at more than 350 mgd and the total golf course demand is estimated at 53 mgd.

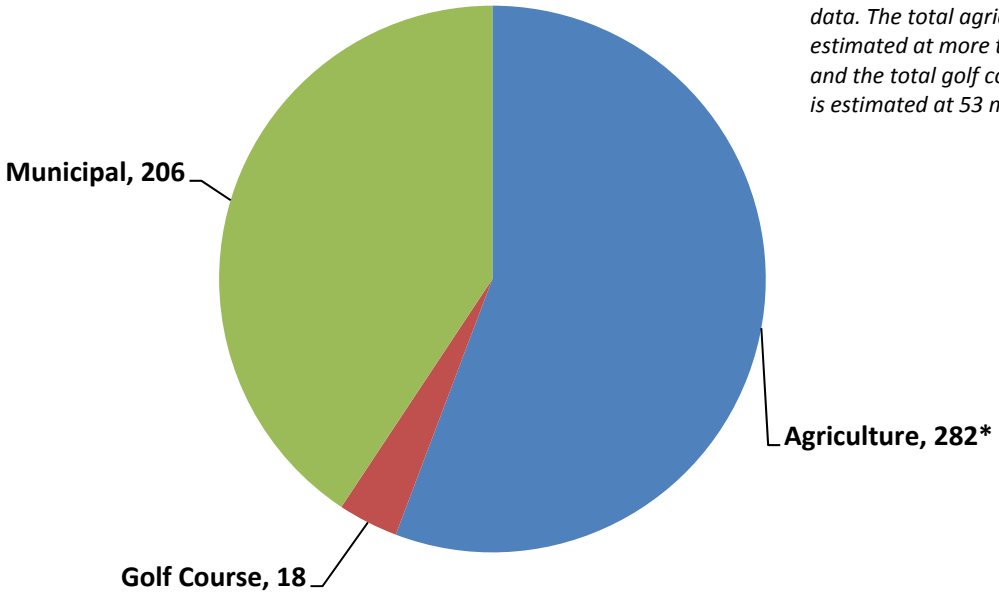


FIGURE 4-1
Statewide Reported Water Usage In million gallons per day
**Agricultural uses includes surface water and some brackish ground water*

The four municipal county water systems provided water use data, but only Kauai, Oahu, and Maui have water user classifications that allow further analysis by island. As shown in Table 4-1, the municipal use was analyzed and estimated using gallons/account/day and gallons/person/day (also called per capita). However, the water use rates shown in Table 4-1 do not reflect a measure of efficiency; rather they represent the unique mixtures of types of residential, commercial, industrial, and agricultural uses in each county water system. Municipal water systems supply water for agriculture uses (both irrigation and processing), which are not counted in the Agriculture category in Figure 4-1 above.

TABLE 4-1
Municipal Water Use Estimates

Area	Gallons/Account/Day	Gallons/Person/Day
Kauai	642	228
Oahu	822	159
Maui	1,037	246
Hawaii	596	160
Statewide (Weighted Average)	801	172

Note: Affected by non-residential uses such as tourism, transient population, commercial, etc. Average of 2006–2009; includes all municipal sectors.

4.3 Water Use Summary by Sector

It can be more valuable to consider individual sector uses within categories, and analyze the amount and seasonality of each to understand patterns. For example, the municipal water use category contains many different water use types.

4.3.1 Groundwater Well Data

A large amount of groundwater well information was collected and analyzed. This includes well owner, capacity, and usage. However, the information is not consistently updated, and many of the wells listed in the database may no longer be in use. The information does provide a snapshot of the total potential groundwater use on each island. Statewide, there are 4,663 wells listed in the database, and 1,721, or 37 percent of them, have pump capacity data listed. Figure 4-2 shows the number of wells listed with pump capacity in the database by island. Further analysis could not be performed on these data. It is recommended to update the database to remove inactive wells and to begin collecting usage data on a regular basis.

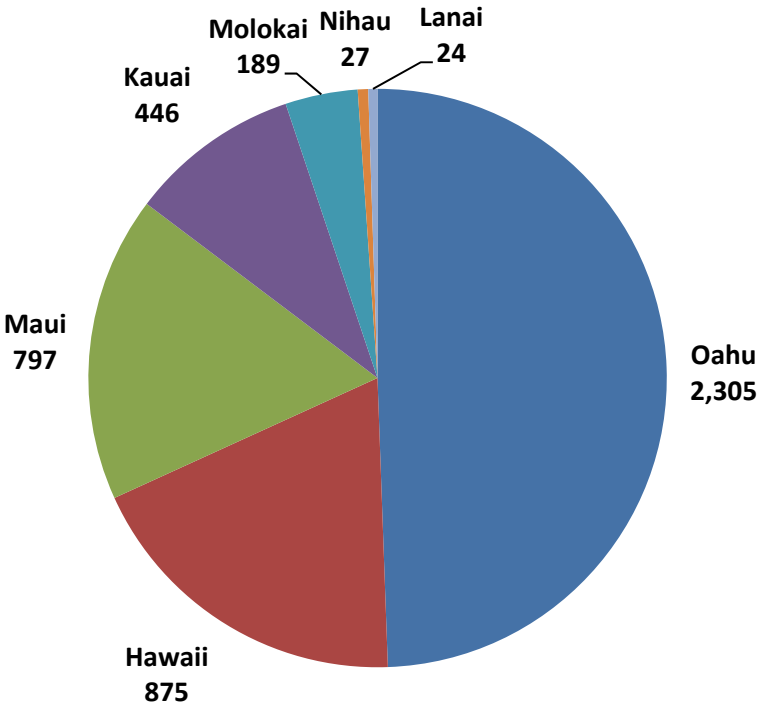


FIGURE 4-2
Statewide Groundwater Wells by Island
Number of wells

4.3.2 Municipal

In order to evaluate municipal water use in Hawaii, the three systems that provided account breakdowns were combined to create a statewide analysis. This allowed for the determination of the largest user categories, and individual sector capacity for water conservation. Statewide municipal water usage is summarized in Figure 4-3. The residential sector is the largest municipal water use category, accounting for nearly two-thirds of all municipal water use. After that the largest water use categories are commercial, institutional, and hotel. Therefore, the categories in which water conservation BMPs should be targeted include residential, commercial, institutional, and hotel use.

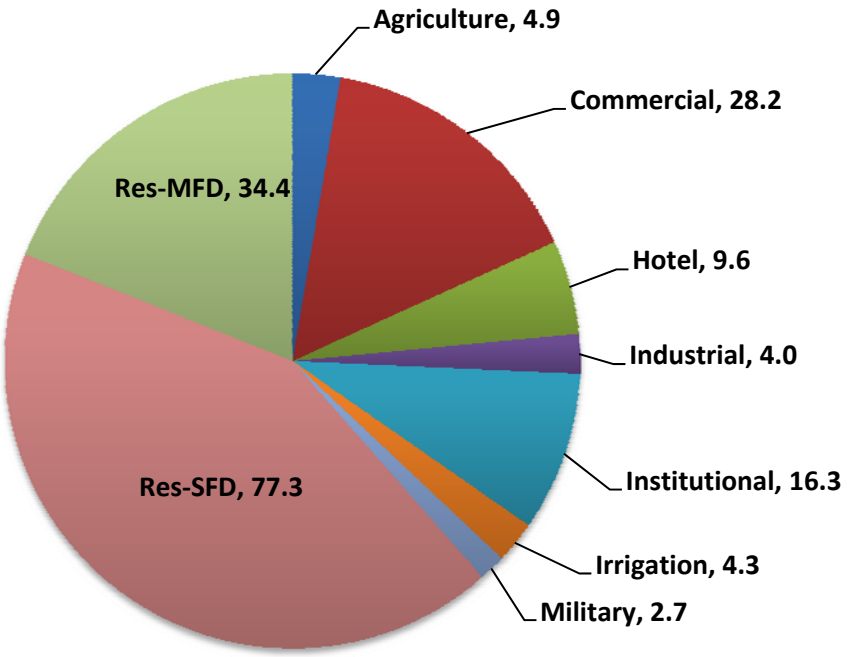


FIGURE 4-3
Statewide (Excluding Hawaii Island) Municipal Average Water Use 2006–2009
In million gallons per day

Next, the seasonality of water use can be evaluated to determine indoor/outdoor use patterns. See Figure 4-4 for an example of a seasonal water use pattern from Maui. This illustrates that there is a strong seasonal outdoor water use, and that outdoor water conservation BMPs should be considered.

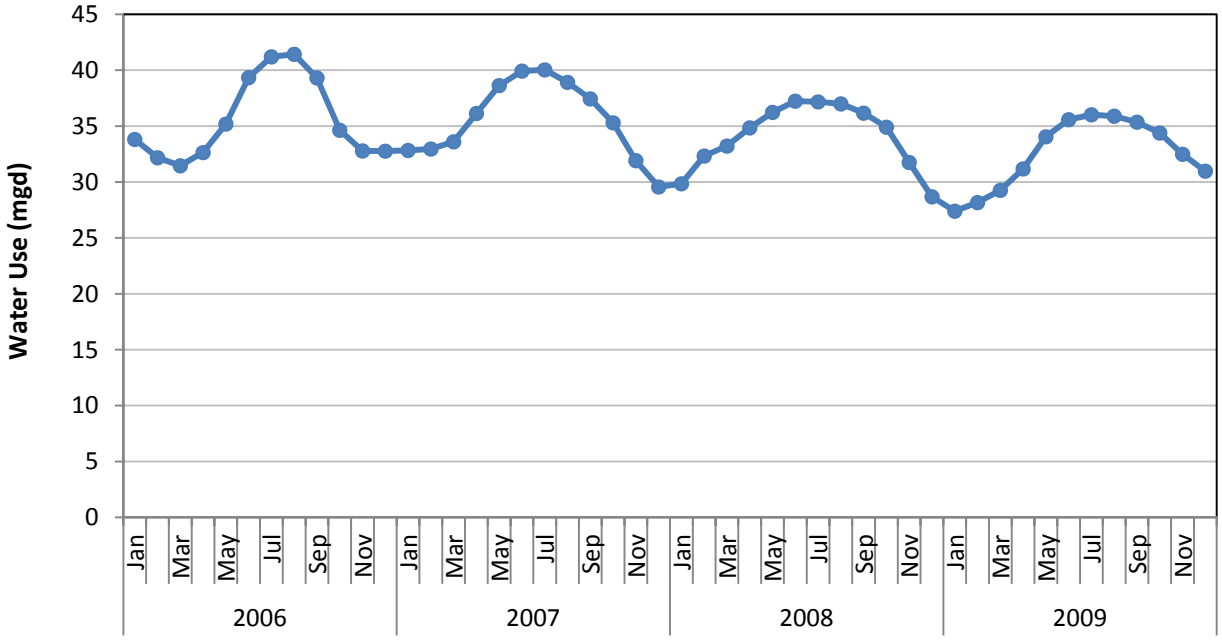


FIGURE 4-4
Maui Municipal Water Use
In million gallons per day

4.3.2.1 Municipal Water Demand Projections

Typically, municipal water demand is the fastest growing sector of water use. According to the projections made in the Water Resource Protection Plan, the statewide municipal water demand is expected to increase from just over 300 mgd in 2010 to over 400 mgd by 2030, as shown in Figure 4-5 below (Wilson Okamoto Corporation, 2008). Note that although the reported measured municipal water use in 2010 may be somewhat less than the baseline projected water demand, the expected trends in water demand remains unchanged. If realized, this increased usage will likely put a strain on the water resources in Hawaii, and further highlights the need for municipal water conservation.

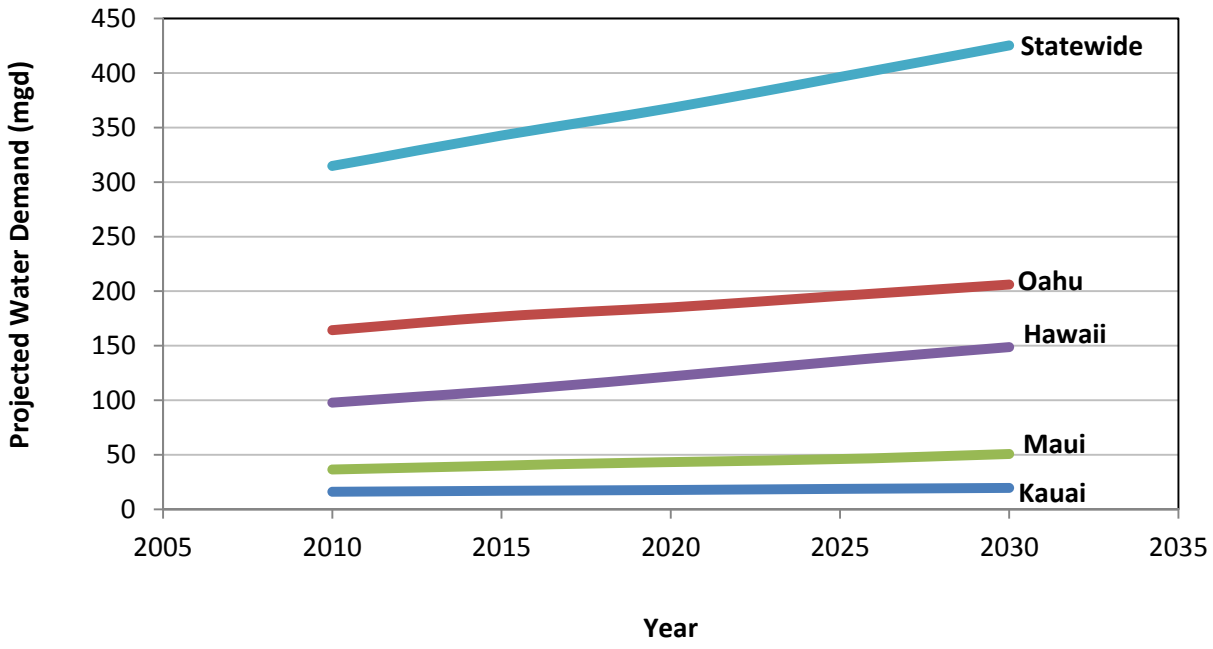


Figure 4-5
State of Hawaii Projected Municipal Water Demand
In million gallons per day

4.3.3 Military

Very limited data about military-specific water use were received. Mostly, military housing water use was collected for some facilities, but overall military installation usage was not provided for use in this analysis. However, with the data that were provided, it can be concluded that outdoor use in the military housing sector is significant. See Figure 4-6 for an example of irrigation water use at three selected housing groups (Ford Island North, Moanalua Terrace, and Pearl City Peninsula) at the Joint Base Pearl Harbor-Hickam (JBPHH).

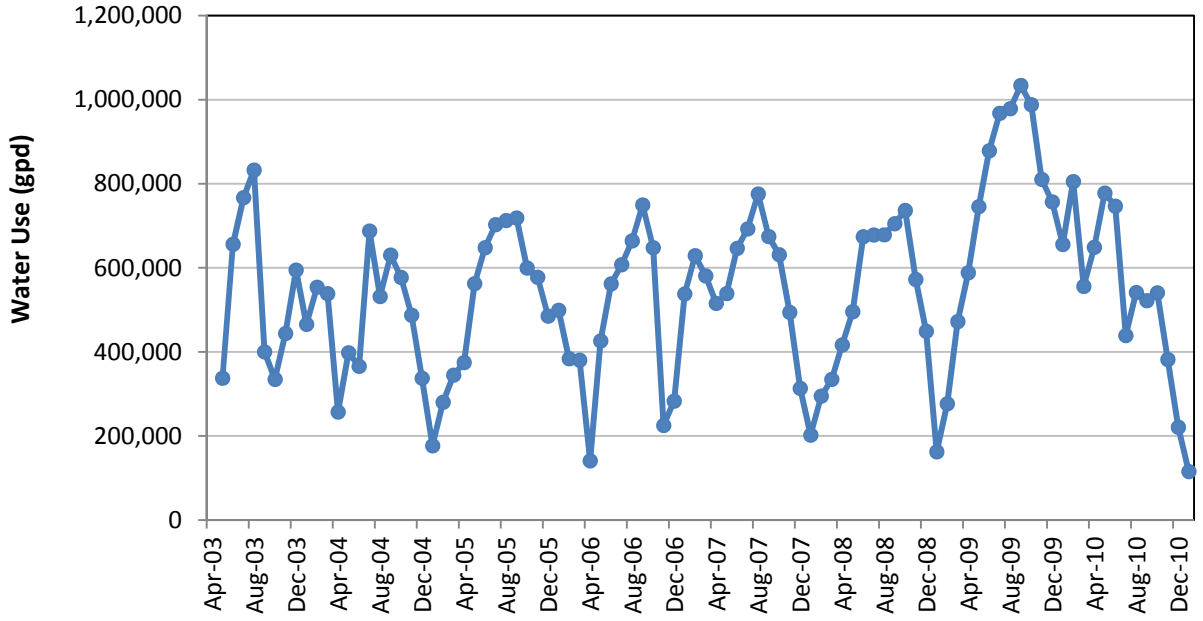


Figure 4-6
Military Housing Irrigation Water Use (at Ford Island North, Moanalua Terrace, and Pearl City Peninsula Housing Groups)
In gallons per day

4.3.4 Agriculture

The agricultural industry in Hawaii produced $690 million of farm gate revenues in 2010 (USDA-NASS, 2010) and is important to the overall economy and food security of the state (Water Resource Associates, 2004). In the future, this industry may also be a significant contributor to energy security in Hawaii with the development of a biofuel industry (UH-CTAHR, 2009).

Historically, Hawaii's agricultural economy was dominated by large commodity plantations producing products such as sugar cane and pineapple, predominantly for export. During the period between the 1970s and 1990s, most of these plantations were abandoned and previously cultivated lands and irrigation systems were idled. Since that time, there have been concerted efforts by the state to develop a more diversified agricultural economy that would utilize this agricultural land base and the irrigation infrastructure that remain, while improving the overall food security of Hawaii. In support of these goals, the state has invested in the HDOA and Agribusiness Development Corporation efforts to manage and maintain water deliveries from large irrigation systems in service to the diversified agricultural interests benefiting from these water supplies.

The HDOA published an AWUDP in 2004 (Water Resource Associates, 2004) and is currently in the process of updating that plan. The purpose of the AWUDP was to develop a plan for preserving existing large irrigation systems to support continued agricultural use. This was accomplished by inventorying existing agricultural water uses and infrastructure of large irrigation systems, developing a list of infrastructure improvements needed within these aging systems, and projecting potential irrigation water demands for a basis of future project planning.

Within the 2004 AWUDP, irrigation diversions from three HDOA run irrigation systems (Molokai, Waimanalo, and Waimea) with measured water deliveries were reported from 1995 through 2002. The systems with reported water use data represented three of the total thirteen irrigation systems that were studied. Since the time of the 2004 AWUDP, additional metered water use data have become available due to efforts by the HDOA and other agricultural water purveyors. As part of this plan, managers from all thirteen of the systems presented in the 2004 AWUDP and managers of other systems identified through WCAG members were contacted to request current water use data. In total, water use data from ten irrigation systems were obtained over varying periods of record. A map of the irrigation systems from which water use data were obtained is presented in Figure 4-7.

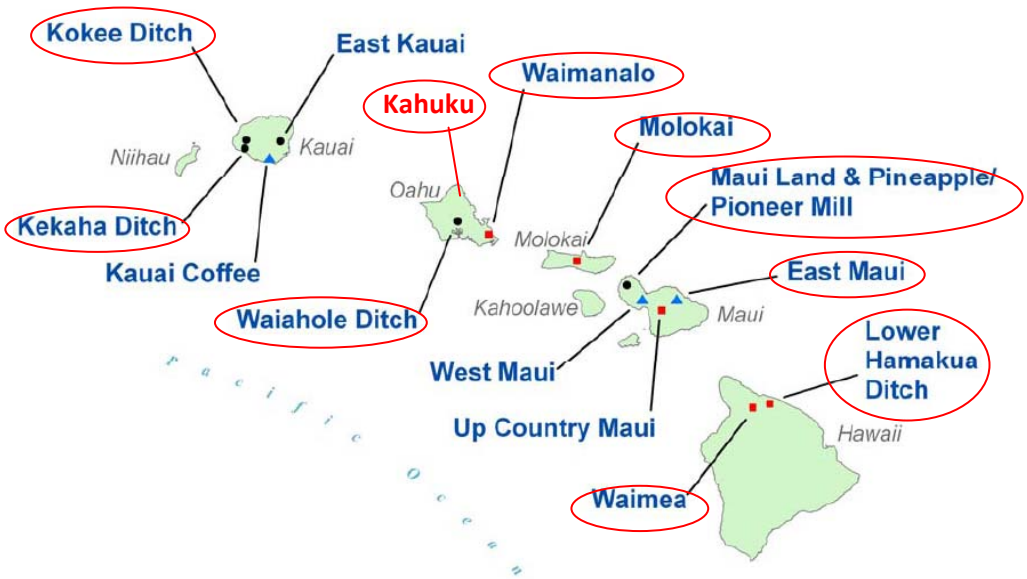


FIGURE 4-7
Map of Irrigation Systems Providing Water Use Data
Map of studied irrigation systems in the 2004 AWUDP courtesy of Hawaii Department of Agriculture. Circled systems provided water use data for this planning effort. Blue text indicates systems included within the 2004 AWUDP. Red text indicates systems that provided water use data but were not included within the 2004 AWUDP.

The "water use" data provided and discussed in this section represents water diversions at various points in the water delivery systems and does not imply consumptive use. Consequently, a significant portion of this reported "water use" is returned to the hydrologic basins through irrigation return flows to surface water and groundwater. The distinction between water conservation by diverted water reduction and by consumptive use reduction is discussed further in Section 6.

The average annual water usage from the ten irrigation systems is presented in Figure 4-8. The approximate irrigated acres for each system were also provided by these water purveyors and are summarized in Figure 4-9. Based on this assessment, the average agricultural water use across all of the islands is at least 282 mgd and serves approximately 50,700 irrigated acres. Based on the total water use over the irrigated area, the annual water use is 5,560 gallons per day per acre (gpd/ac) or 6.23 acre feet per acre per year (af/a/yr). The range on these estimates was quite large, however, with average annual rates ranging from 10 gpd/ac to 8,204 gpd/ac and 0.01 af/a/yr to 9.19 af/a/yr. These values may be limited by irrigation system water availability. An alternative estimate of demand based on crop water requirements can be computed by multiplying the crop's replacement evapotranspiration rate by the irrigated acreage.

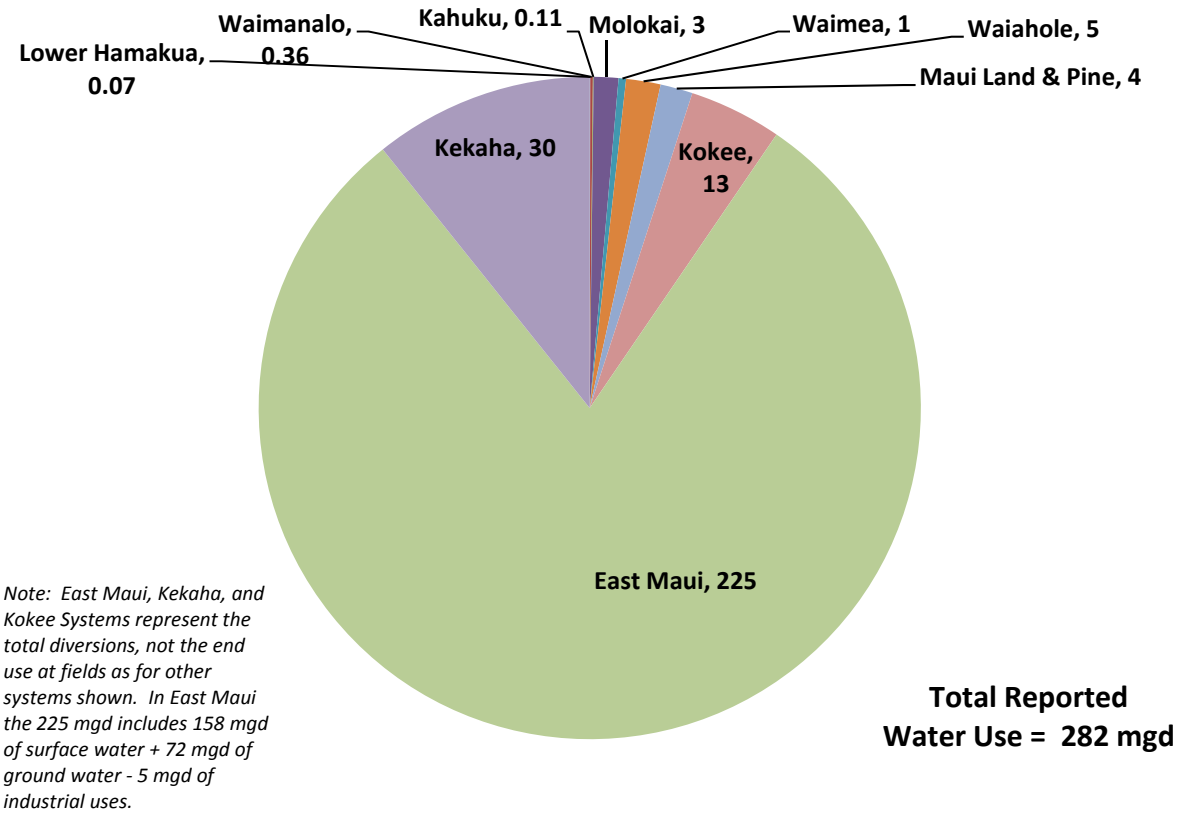
The resulting total water use estimate forms the first statewide estimate of total agricultural water use based on actual measured flows from the largest irrigation systems operated in Hawaii. However, there are several limitations of the raw water use and irrigated acreage data that need to be recognized:

- This water use summary does not capture agricultural water uses supplied by municipal systems, individual wells or smaller irrigation systems not included in the 2004 AWUDP.
- Of the known systems studied in the 2004 AWUDP that did not provide water use data, there is at least an additional 72 mgd of demand between the West Maui and Kauai Coffee systems (Water Resource Associates, 2004), provided there continues to be agricultural operations sustained at these 2004 levels.
- Periods of record in the water use data supplied ranged from 1 to 16 years, so year to year variability and trends over time could not be assessed for all systems.
- Water use data are measured at different points within each irrigation system. Most data sets represented metered deliveries from main ditches and pipelines to water use at farm/field level diversion points, so do not

represent total water diversions. Only data from the East Maui, Kokee, and Kekaha systems represent total diversions.

- Within the reported 50,700 irrigated acres, not all of the lands are in production or irrigated within any given month due to fallowing and rotations. Consequently, the average water use on the basis of actively irrigated acreage is likely underestimated.
- Due to changing weather patterns including persistent drought and severe storm events the average reported water use does not necessarily represent quantities of water available on a daily basis since the variability of flows in surface water irrigation systems have increased.

In summary, based on currently available data, there is strong evidence that the reported agricultural water use significantly underestimates the total agricultural water diversions.



Note: East Maui, Kekaha, and Kokee Systems represent the total diversions, not the end use at fields as for other systems shown. In East Maui the 225 mgd includes 158 mgd of surface water + 72 mgd of ground water - 5 mgd of industrial uses.

FIGURE 4-8
Average Reported Water Use from Agricultural Irrigation Systems Illustrated in Figure 4-7
In million gallons per day
Source: Agricultural Water Use and Development Plan, 2004; Compilation of Data Submissions, Part II, PR-2010-01, 2010

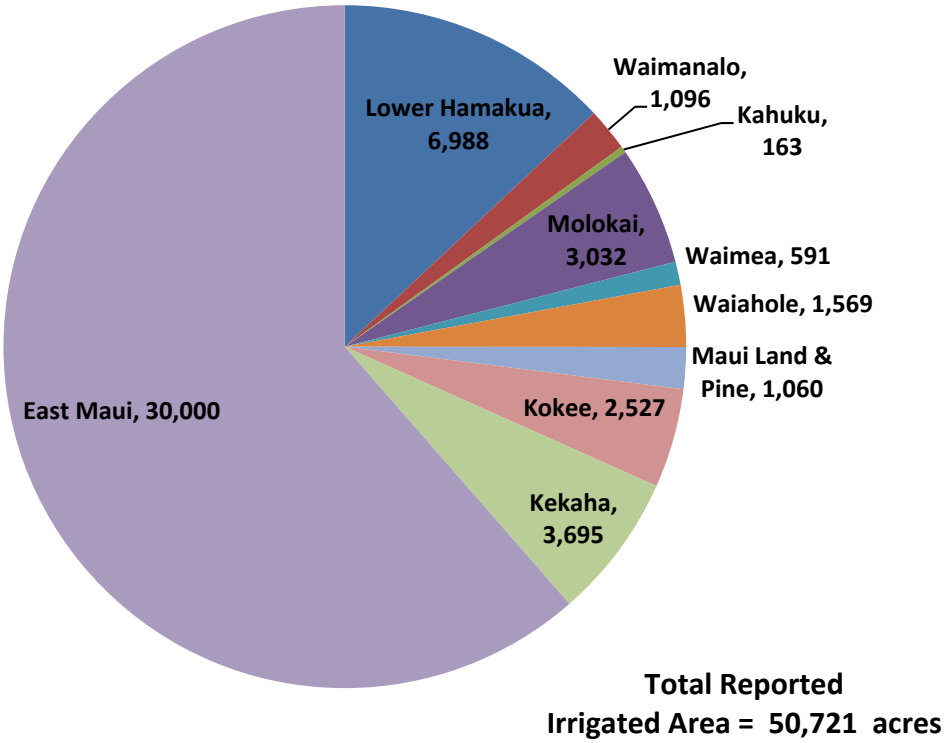


FIGURE 4-9
Average Irrigated Area from Reporting Agricultural Irrigation Systems Illustrated in Figure 4-7
In acres
Source: Agricultural Water Use and Development Plan, 2004; Compilation of Data Submissions, Part II, PR-2010-01, 2010

In the 2004 AWUDP, future agricultural water uses were projected as increases above 2004 baseline water use given projected population growth and trends in diversified agriculture development. Updated agricultural statistics for Hawaii through 2010 (USDA-NASS, 2010) show that the trends in the agricultural economy transition from traditional sugar cane and pineapple mono-crops to diversified agriculture have continued (Figure 4-10). Associated with this trend has also been an increase in the number of smaller farming operations. While the total farm-gate values in Hawaii have increased over this time, the total farmland under production as reported in the U.S. Department of Agriculture (USDA) census of agriculture decreased from 1.439 million acres in 1997 to 1.121 million acres in 2007. The trends in total land under irrigation and net irrigation water demands, however, are uncertain. Although future agricultural water use demand estimates are not available at this time, the changes in the number and size of agricultural operations and the changes in the level of diversification in cropping systems is important to understand in developing plans for managing agricultural irrigation water supplies and water use into the future.

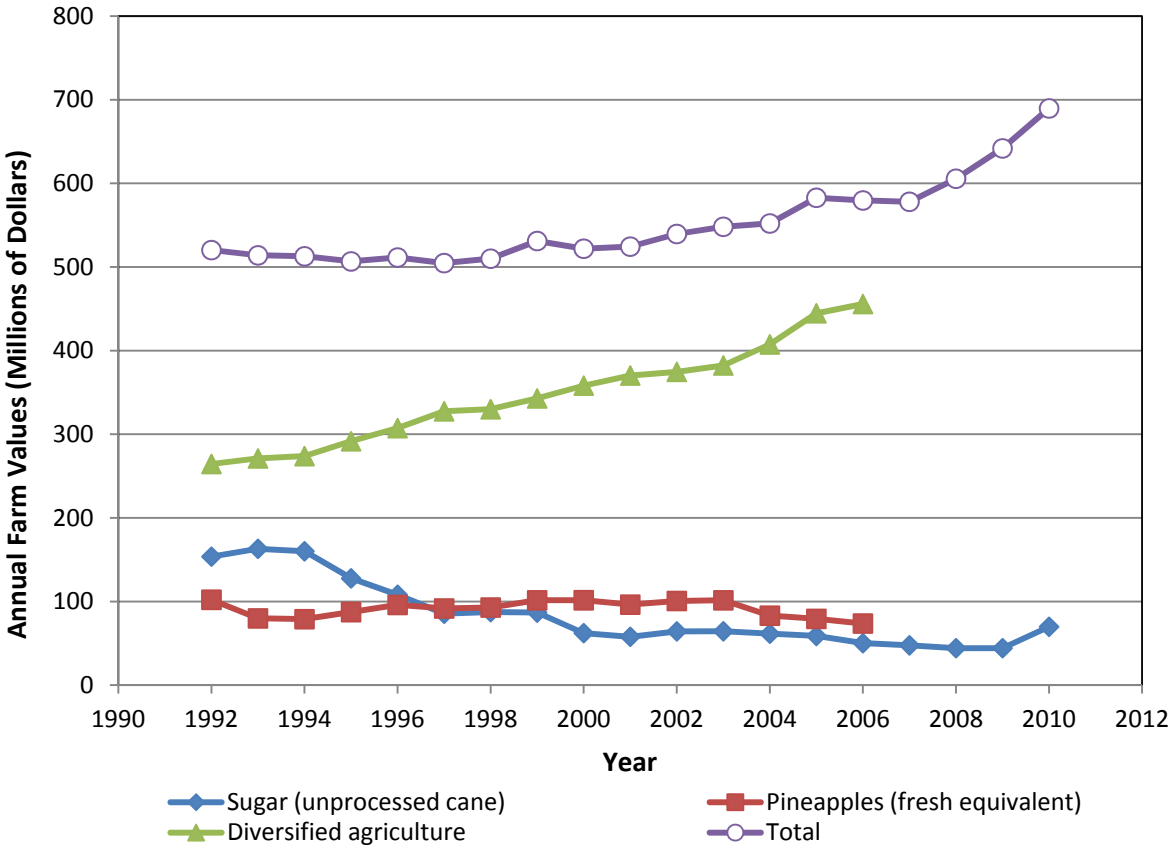


FIGURE 4-10
Annual Trends in Cropping for Hawaii (1992–2010)
Detailed data was not available for 2007 to 2010 for diversified agriculture and pineapples.

4.3.5 Golf Course

Golf courses are popular recreational and tourist attractions in Hawaii, and, as a result, they are well distributed across the islands. The water supplies are varied, with some courses receiving water from municipal water purveyors, some utilizing reclaimed wastewater or desalinated water, and others drawing water from private groundwater wells.

Golf courses were contacted through the Hawaii Golf Course Superintendants Association and the municipal water providers on the WCAG to collect water use data for this analysis. In total, water use data were supplied by 35 golf courses (both public and private) throughout the state and limited data (number of holes and acreage) were supplied by 55 golf courses. A map of the courses providing water use data is shown in Figure 4-11 to display the geographic coverage of the water use data set.

FIGURE 4-11
Map of Golf Courses Providing Water Use Data

Over the 35 golf courses that provided water use data, there was a total of 18 mgd of average annual reported water use for an average annual water use per golf course of 0.51 mgd. These courses ranged in size from 18 to 36 holes. According to Golf Link (www.golflink.com), there are 104 golf courses in Hawaii in total. Assuming a similar average water use rate for the remaining golf courses that did not supply data, the total water use by golf courses in Hawaii is roughly estimated at 53 mgd.

Twelve golf courses provided detailed data on average annual water use, peak month water use, irrigated acreage, and number of holes. From these data, it was determined that the average 18-hole golf course in Hawaii covers 124 irrigated acres, has a peak month water use of 0.65 mgd, and an average annual water use rate of 0.37 mgd (2,948 gpd/ac or 3.30 af/a/yr). The range on these estimates was quite large, however, with average annual rates ranging from 201 gpd/ac to 7,192 gpd/ac and 0.23 af/a/yr to 8.05 af/a/yr.

Based on the data provided by water users and purveyors and on a per unit area basis, the average golf course irrigation water use was about half the average agricultural irrigation water use. However, the range in reported water use for individual agricultural and golf course sector sites was wide enough that a general comparison of water use across these two sectors is not possible.

SECTION 5

Water Conservation Strategies and Goals

There are many different approaches and pathways an organization can take to encourage water conservation. However, recognizing the constraints of limited resources, an effective program needs to be built around clearly defined goals and around strategies that can be used to accomplish those goals. As an early step in the planning process, CWRM initiated a strategy and goal setting process that involved an inward and outward looking assessment of the organizational strengths, weaknesses, opportunities and threats within the context of promoting water conservation in the state of Hawaii. The results of this process were ultimately used to narrow the focus of the water conservation program around four primary goals.

5.1 Strategy and Goal Setting

In order to develop a statewide water conservation plan that has achievable results, it is important that proposed strategies and goals (expected outcomes) are realistic and appropriate for the "environment" in which the plan will be implemented. Water conservation goals can be very broad and policy based, whereas others can be very specific. The level of detail contained in the goal is driven by the circumstances of the entity developing and implementing the water conservation program. In some instances, where there are well documented water supply shortfalls and considerable information regarding water resources, demands, hydrologic information, growth, and other data, the conservation goals tend to be very specific. In that case, an example goal may be: "reduce average daily water use by 12 percent across all user categories by 2020." Yet, in other cases the water conservation goal may be much more general based on the "conservation drivers," data availability, culture, and economic circumstances. There is no right or wrong approach; however, the direction that is chosen must be governed by the realities of the planning environment and the potential to achieve realistic implementation of conservation activities and anticipated savings. For purposes of developing the Hawaii Water Conservation Plan, a more generalized approach was applied.

As the water conservation planning activities were underway, it became apparent that a clear understanding of the internal (to CWRM) and external (across water user groups and the state) factors was needed to guide the development of a realistic and implementable water conservation plan. An analysis of the strengths, weaknesses, opportunities and threats (SWOT) was conducted. A SWOT is a tool that is often used to set objectives for planning, a basis for assessing core competencies of an organization and to bring clearer purpose and understanding of the elements essential for success.

Participants included in the SWOT analysis were: Lenore Ohye, Neal Fujii, Jeremy Kimura (all from CWRM), Debbie Solis (USACE), Ross Kaneko, Jason Smesrud, and Brian Skeens (all from CH2M HILL), representing Hawaii and agricultural and municipal conservation areas of technical expertise.

Figure 5-1 contains a simple listing of each of the identified strengths and weaknesses (internal to CWRM) and opportunities and threats (external to CWRM). As part of the analysis, team members were asked to evaluate how important a given strength or weakness was relative to a given opportunity or threat. The results of this analysis indicate the following strengths are important to take into account in developing the water conservation plan: (1) using a collaborative approach with stakeholders and (2) having a culture of efficiency. Weaknesses that had to be considered in the plan development included limited existing budget and staff resources, as well as lack of data collection and reporting system to measure water use.

Opportunities that exist include a growing awareness of water resources and interest in "being green" as well as showing the potential cost savings from conservation as operational, chemical, and power costs are increasing. Potential threats to be overcome with the plan include misperceptions about conservation, the economy, lack of support for fees to fund conservation, and perceived inequality in water use and allocation.

The results are helpful in guiding the planning process, but should not be considered "prescriptive". In this case, the results of the SWOT were used to define "goal areas," to focus the plan on what can be realistically

accomplished. Within each goal area are strategies, which define types of actions that can be taken to leverage the goal to achieve water savings. The water conservation plan purpose, goals, and strategies are listed below.

In some cases, the goals and strategies listed below can be used to guide thinking about how different BMPs can be implemented in Hawaii to best achieve water savings or participation in water conservation programs. Goals represent a "general approach" to implementation of a BMP, regardless of water use sector. Whereas, the strategies define somewhat more specific tactics that align with the goal, which then can be used as a means of fostering BMP implementation. It is important to remember that a BMP is an action or practice. A BMP linked with a strategy can be considered a water conservation measure or "approach" that defines the implementation. Water conservation measures (or approaches) are described in Section 7 of this report. In other cases, the goals and strategies represent a higher level of thinking that can be used to guide planning within the CWRM, aid in setting policy direction, or otherwise inform the function, structure, and needs of CWRM.

5.2 Selected Strategies and Goals

5.2.1 Purpose

The overall purpose of this water conservation plan is to set the framework for a statewide water conservation program that will help state, municipal, military, golf course, and agricultural water users in Hawaii to become as efficient as possible in the uses of freshwater resources. Four primary goals were selected to help achieve this mission. Under each goal, strategies are presented that define the types of actions that can be taken to leverage the goal to achieve water savings.

5.2.2 Goal 1

Build upon the established collaborative approach with stakeholders to develop an implementation framework for a statewide conservation program in Hawaii.

Strategies:

- Develop model ordinances (e.g., landscape code), developed collaboratively with industry groups, with support from and enactment at local/county level.
- Building on the WCAG, establish a statewide water conservation advisory council, to continue collaboration and guide statewide implementation of water conservation programs.
- Establish partnerships with entities implementing water conservation programs aimed at demonstrating costs, savings, and effectiveness (e.g., Honolulu BWS, military, golf courses, hotels, etc.).
- Develop technology transfer programs (e.g., "green hotel," seminars, demonstration projects, etc.).
- Foster voluntary reporting of water conservation measure implementation and data/monitoring and reporting for water uses that are outside of designated water management areas.

5.2.3 Goal 2

Secure consistent and reliable funding sources for statewide conservation program by leveraging strong organizational and CWRM support for water conservation.

Strategies:

- Include conservation program activities and measures that have the greatest potential savings or effectiveness, at the least cost, to ensure implementation of prioritized "best practices."
- Secure needed funding (or re-allocate existing budgets) to establish financial or other incentive programs to motivate implementation of BMPs across targeted user groups.
- Collaborate with other state agencies to allocate funding for water use efficiency improvements and ensure data collection and monitoring for each investment in conservation measures.

- Re-evaluate existing CWRM water management strategy outlined in the Hawaii Water Plan to ensure that water conservation policies and approaches are clearly defined and that recommendations from this statewide water conservation plan are included in the strategy.
- Identify and secure additional, external funding sources for the implementation of water conservation programs (e.g., public-private partnerships, existing federal programs, etc.).
- Seek partnerships with entities with common or shared objectives to leverage funding for research and achieve greater implementation of water conservation measure (e.g., related state agencies).

5.2.4 Goal 3

Evaluate the existing statewide water resource availability, permitting, monitoring, and allocation programs and identify potential enhancements to ensure program effectiveness.

Strategies:

- Enhance the existing Hawaii Water Plan, by including a water conservation target that can be established in the context of known, available, or anticipated future water resources.
- Continue development of water use data collection, analysis, and reporting system to enable accurate assessment of water use.
- Explore policy changes to make improvements in water use efficiency and related reporting (e.g., State Water Code, building codes, county ordinances, etc.).
- Explore policy changes to proactively plan for the expanded use of reclaimed water for agriculture, landscaping, irrigation, recharge, and industrial uses.
- Require development and submittal of water conservation plan and annual reporting on implementation of water conservation plan measures as a condition of receiving a water use permit.

5.2.5 Goal 4

Leverage the existing “culture of efficiency” to increase water resource awareness and create a strong “conservation ethic” among the all water users.

Strategies:

- Tie communications efforts (stand-alone or in support of specific water conservation effort) and the need for water conservation to culture, values, and potential financial savings.
- Establish a water resource management public awareness campaign that incorporates climate change, energy/water nexus, food scarcity, viable agriculture, watershed management, and source protection and augmentation.
- Create a water conservation recognition program to celebrate success and reward those (entities, organizations, individuals) that improved their water use efficiency.
- Develop (or make available) a water resource and conservation education curricula (e.g., “Project WET”) aimed at school children, with implementation at the local/county level.

Figure 5-1

SWOT Matrix

3/1/2012

		Opportunities								Threats									
		Leverage/cost-share with existing programs (federal, county, large users, LICH)	Growing awareness of water resources and interest in sustainability, being "green", efficiency (cultural, perceptual connection)	Growing public concern about energy/water nexus, climate change and food security (analytical connection)	Few users consume significant percentage of water	Recent legislative support for funding Ag water conservation	Rising power, chemical and operational cost to water users	Tie conservation program funding to water supply dependent users	Existing platform for outreach	Misperceptions about conservation (entices growth, stops development)	Loss of water revenue	Perceived inequity in water use and allocation	Economic downturn (impact on state budgets & stakeholder investments)	No recurring funding mechanism for CWRM	Lack of support for fees to fund water conservation	Price of water is too low	Resistance to mandates and limits on "personal freedom"	Growing "entitlement attitude" to "use what I pay for"	Total
Strengths	Organizational Support (admin, leadership & staff) for water conservation	16	10	6	5	19	2	16	8	10	8	11	15	11	13	13	11	6	180
	Dedicated water conservation coordinator position	16	10	11	9	9	9	5	21	13	11	9	7	5	11	4	6	5	161
	Broad legal authority to make and enforce rules	0	7	8	11	4	1	14	1	0	4	8	0	14	8	4	11	9	104
	Collaborative approach with stakeholders	15	12	8	13	21	18	15	17	26	19.5	18	11	10	11	15	10	4	243.5
	Culture of efficiency	4	25	12	5	8	27	5	3	9	10.5	2	5	3	4	20	21	21	184.5
Weaknesses	Lack of data collection and reporting system to measure water use	8	2	9	19	11	9	11	3	15	9	23	8	2	8	5	5	14	161
	No clearly defined limits on water resource availability	7	10	11	13	6	9	4	3	8	11	14	6	0	6	12	4	15	139
	Limited staff for state-wide implementation	14	6	6	5	14	6	6	17	6	4	2	19	18	9	1	2	0	135
	Limited existing budget	14	14	5	2	5	12	8	20	4	3	0	25	14	27	7	2	4	166
	No existing strategic, guiding document for program priorities	10	6	19	10	8	10	6	12	12	11	8	1	6	5	11	11	10	156
	Administrative rulemaking process is onerous	1	0	0	1	0	0	2	0	0	2	0	0	3	0	1	2	1	13
	CWRM has no experience navigating the rulemaking process	0	0	2	3	0	0	4	0	0	4	0	0	6	0	1	3	2	25
	Lack of willingness to enact and enforce rules	0	3	8	9	0	2	9	0	2	8	10	8	13	3	11	17	14	117
Total		105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	1785

SECTION 6

Water Conservation Best Management Practices

An activity that is implemented to address a specific type of use and method for water conservation is referred to as a Best Management Practice or BMP. The range of BMP options for water conservation in general is very wide. However, the selection of BMPs for a water conservation program should be customized to the specific targeted water uses and should consider local factors that may influence the probability for effective adoption of the BMP.

This Plan concentrates on ways to increase the efficiency of the use and delivery of water in multiple sectors. There are other ways to approach water conservation and management to achieve a reduction in water use in a particular sector or for a specific quality of water. In taking a holistic approach, one could consider other alternatives such as reuse of recycled wastewater for irrigation or groundwater recharge; stormwater capture for nonpotable uses or groundwater recharge; rainwater catchment to supplement irrigation uses; and desalination of seawater for high quality uses. Implementing these alternatives would achieve a reduction in water demands by substitution of some ground or surface water source, nonetheless, a comprehensive examination of these alternatives is beyond the scope of this document. As mentioned earlier, this Plan will focus mainly on ways to increase the efficiency of the delivery and uses of water in various use sectors as defined in this Plan.

6.1 Best Management Practice Development and Screening Process

The process of identifying and screening water conservation BMPs in Hawaii was a collaborative effort involving the WCAG. A long list of practices in place throughout the industry as well as in Hawaii was screened down to ten practices per water user sector. These final BMPs were then considered for implementation in Section 7 of this plan. The BMPs presented in this section identify possible implementation strategies, responsibilities, definitions, and descriptions of how each BMP might be implemented in Hawaii.

Water use sectors in this report were chosen to represent broad categories of water use while considering the real-world implications of implementing a water conservation program. The four main categories—municipal, military, agriculture, and golf courses—have key agencies, organizations, or corporations that could take ownership of a water conservation program while collaborating with CWRM. For example, the municipal sector includes all municipal water utilities as well as privately owned public water systems in the state. Likewise, branches of the military own and operate their own public water systems with their own unique challenges and circumstances. Agriculture has publicly and privately owned irrigation systems, and state (HDOA) and federal (Natural Resources Conservation Service) agencies established to support this industry. Landscape was initially assigned its own water use sector, but it was soon realized that there were substantial elements of landscape water use in the municipal, military, and golf course sectors. In order to preserve landscape BMPs, the project team included specific landscape BMPs in these respective sectors. A comprehensive list of landscape BMPs is provided in the following subsection.

Following the WCAG input of BMPs, further screening was provided by CWRM. The methodology used to screen the top ten BMPs for each water user sector implicitly followed the process outlined in the AWWA M52 Manual, *Water Conservation Programs—A Planning Manual* (2006). This process includes considerations of the following criteria when evaluating and ranking BMPs:

- **Cost-effectiveness**. Qualitative cost rankings were considered in selecting the most appropriate BMPs.
- **Technology/market maturity.** Only BMPs that have been proven to be effective were selected.
- **Service area match.** Considerations were given to climate and compatibility with local systems and practices.
- **Customer acceptance/equity**. Customers must be willing to implement BMPs and the burden of responsibility must be equitable.
- **Better measure available**. When measures had the same targeted end uses or water losses, measures that ranked highest in the other criteria were selected.

Upon implementation, it is important that the BMPs are monitored for success. Success includes, for example, achieving expected water savings, implementing BMPs at costs close to the budgeted amounts, or attracting good attendance or participation in an educational or demonstration event. For each BMP that is implemented, a follow-up audit should be performed to measure success. The follow-up actions will be specific to the BMP.

6.2 Best Management Practice Descriptions

A standardized template was created to describe each BMP with a consistent set of evaluation factors. Each BMP template (see Appendix B) includes these elements:

- **Category**. Water use sector that the BMP is applicable within (municipal, military, agriculture, golf courses).
- **Description.** A general description of what the BMP entails and its value.
- **Water Savings.** A qualitative ranking of potential water savings (low, moderate, high) and notes on factors that influence the associated water savings.
- **Cost.** A qualitative ranking of potential implementation costs (low, moderate, high) and notes on factors that influence the associated cost of the BMP.
- **Implementation.** Proposed implementation methods that may be feasible in Hawaii.
- **Responsibility.** Designation of the entities with expected responsibility for implementing the BMP.
- **Schedule.** An estimation of the amount of time necessary to implement the BMP.

The BMP templates presented Appendix B are grouped according to water use sectors (MU for municipal; MI for military; AG for agriculture; and GC for golf courses) and are listed in order of the ranking provided by the WCAG.

6.3 Best Management Practice Summaries by Sector

6.3.1 Landscape

As shown in previous sections, the water user sectors selected for BMPs were municipal, military, agriculture, and golf courses. Landscape irrigation is a component of the municipal, military, and golf course water use sectors. Building upon the work developed by the LICH, the list of recommended BMPs developed in the LICH position statement on irrigation water conservation (LICH, 2011) were utilized in developing the initial lists of BMPs for the WCAG to consider in developing prioritized BMPs for each water use sector. Many of the LICH BMPs are built in as components of the prioritized water use sector specific BMPs. The BMPs that LICH supports and encourages are as follows:

For new installations and major renovations

- Design irrigation system with sprinklers spaced with head to head coverage or better.
- Irrigation system plans and specifications shall include post-construction documentation, including drawings of record (as-built drawings), maintenance recommendations, seasonal operational schedules, design precipitation rates, manufacturer’s operational guide, which shall remain onsite.
- Specifications shall require a coverage test prior to acceptance and LICH water conservation BMPs.
- Irrigate with a precipitation rate not exceeding soil infiltration rate.
- Design systems to irrigate similar hydrozones (similar site, slope, sun exposure, soil conditions, and plant materials with similar water use) on same circuit. Avoid irrigation overlap between high and low water demand hydrozones.
- Use a climate based irrigation controller (Smart Controller). Automatic irrigation controllers utilizing evapotranspiration, weather sensor, or soil moisture sensor.
- Encourage the use of drip irrigation for individual specimen plants.

- Use of flow sensors with malfunction valve shutoff system capability at irrigation controller.
- Use irrigation submeter that measures water use on large sites.
- Use water conservation irrigation components including but not limited to rotary nozzles, pressure regulated spray heads & valves, rain switches, and matched precipitation rate nozzles.
- Sprinklers in low-lying areas shall be equipped with check valves.
- Incorporate low impact development storm water design methods including rain gardens, infiltration beds, swales, and basins that allow water to collect and soak into the ground on site.
- Preserve existing native trees and non-invasive vegetation where feasible during development and do not install irrigation in these areas.
- Encourage the use of non-potable water sources when available.
- Encourage the use of xeriscaping practices to include drought tolerant plants or plants that are naturally occurring at the site and surroundings.
- Use a qualified irrigation designer and installation contractor such as those certified by the Irrigation Association and a maintenance contractor with water conservation expertise.

For maintenance

- At a minimum, adjust irrigation controller run times seasonally.
- Conduct a practical water audit annually. Review the system components to verify that the components meet the original design criteria for efficient operation and uniform distribution of water.
- At a minimum, conduct a monthly inspection to verify system operation and correct deficiencies.
- Water in 2 to 3 short run time cycles in areas where run off and ponding occurs.
- Program irrigation controllers to encourage deep watering to improve deep rooting and increase drought resistance. Avoid daily watering except for sandy soils.
- Mulch plantings and refresh as necessary to maintain a minimum of 2 inches.
- Encourage the incorporation of organic matter like compost into soils.
- Schedule night or early morning runtimes for established plantings (5:00 p.m. to 9:00 a.m.)
- Allow grass to grow taller to conserve water.
- Aerate lawns when compaction occurs.
- Encourage landscape professionals to attend water conservation seminars with continuing education units including American Water Works Association, Landscape Industry Council of Hawaii, American Society of Landscape Architects, U.S. Green Building Council, and the Irrigation Association.
- Use a maintenance contractor with water conservation expertise.

Note that these landscape BMPs are not summarized in a table as the remaining sector ones are. Some of these landscape BMPs are incorporated into the other sector BMP tables.

The following subsections summarize their respective BMPs in table form. The full descriptions of these BMPs can be found in Appendix B.

6.3.2 Municipal—Residential, Commercial, Retail, and Industrial

A wide variety of BMPs exist for water conservation in the municipal sector, both for indoor and outdoor use, as well as supply-side measures. In order to prioritize the top ten for Hawaii, a long list was collected from various sources, both internal to Hawaii and throughout the municipal industry in the United States. The WCAG assisted in prioritizing the BMPs to ensure applicability in Hawaii as well as cover the variety of water users in the municipal sector. In particular, the municipal sectors that were identified during the water use analysis were also given priority to include BMPs, such as residential, commercial, institutional, and hotel. In addition, the BMPs listed for the municipal sector also include BMPs that focus on outdoor water use efficiency, since during the water use analysis it was identified as a source of potential water savings. The top ten municipal BMPs are summarized in Table 6-1.

TABLE 6-1
Municipal BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsible Party	Possible Implementation Mechanisms
MU1	Water Loss Control	Water loss control is the calculation and reduction of water losses according to industry standard methodology.	- Municipal water systems (submit audits) - CWRM (collect and review audits)	a) Work with municipal providers to adopt, modify, or develop a procedure for conducting an annual water audit, submitting the results annually, and identifying corrective actions for implementation. b) Track and publicize annual increase in water audit validity and/or reduction in water losses.
MU2	Rain Barrel Programs	Rain barrels collect rainwater from roof gutters to be used at a later time for non-potable outdoor purposes.	- Municipal water providers	a) Provide links to municipal provider websites regarding rain barrel program information. b) Public or targeted giveaway programs or sale at a reduced or subsidized price to water users. c) Do it yourself workshops.
MU3	Irrigation Upgrade Programs	Irrigation upgrade programs are the assessment and replacement of automatic irrigation components with more water-efficient technologies.	- Municipal water providers	a) Establish an "Irrigation Upgrade Grant Program," and partner with local municipal suppliers to apply for irrigation upgrade grants. b) Targeted or public rebates. c) Water budgets to incentivize with financial penalties. d) Education/demonstration installations.
MU4	Water Reuse	Water reuse is the practice of using potable water for more than one end use before disposal. Typical implementations are distribution of highly treated wastewater for non-potable uses such as irrigation or industrial process water.	- Municipal water providers - CWRM (gray water policies)	a) Coordinate with the Hawaii Department of Health (and other appropriate agencies) to sponsor and support the adoption of a modified gray water reuse policy. b) Explore the possibility of modifying the building code to promote more rainwater reuse. c) Coordinate with various state agencies and county building/permitting entities to establish an incentive program to encourage installation of gray water reuse systems. Such incentives could include a streamlined building permitting process, reduced fees (permitting or connection fees, etc.), and a reward and recognition program for those entities that voluntarily install gray water systems. d) Work with municipal water users and/or universities to identify and establish

TABLE 6-1
Municipal BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsible Party	Possible Implementation Mechanisms
				demonstration and research projects to show the application of efficient irrigation technologies and document water savings.
MU5	Education and Outreach	Education and outreach is the development and dissemination of materials about ways to become more water efficient, and the value of water.	- CWRM (develop program) - Municipal providers (promote programs)	a) Work collaboratively with the WCAG (or its successor group) to develop key messages regarding the importance of water conservation. The key messages should include conservation themes that emphasize the importance of conservation to culture, values, potential financial savings, and the broader water resources concerns (save now for the future: energy, food production, climate change, etc.). b) Work collaboratively with the WCAG (or its successor group) to establish a water resource management public awareness campaign (using the key messages defined previously) that incorporates climate change, energy/water nexus, food security, agricultural viability, watershed management, and source protection and augmentation. c) Work with the Board of Education and the WCAG (or its successor group) to develop (or make available) a water resource and conservation education curricula (e.g., "Project WET") aimed at school children.
MU6	Efficient Commercial Equipment	Efficient commercial equipment is the identification and promotion of water using equipment for commercial users that are more water-efficient than those currently available or in use.	- Municipal water providers (education/incentives) - CWRM (policy/regulation)	a) Establish an "Efficient Commercial Equipment Rebate Program (WaterSense certified)," and partner with local municipal suppliers to apply for efficient commercial equipment rebate funds. b) Coordinate with various state agencies and county building/permitting entities to establish an incentive program to encourage installation of high efficiency commercial equipment (HECT), which exceeds state or national standards. Such incentives could include a streamlined building permitting process, reduced fees (permitting or connection fees, etc.), and a reward and recognition program for those entities that voluntarily install devices and technologies that go beyond current state or national standards.
MU7	Irrigation Technology	Irrigation technology is the promotion and installation of irrigation technology for automatic systems typically in residential or small landscape situations.	- Municipal water providers (promotion/outreach) - CWRM (develop requirements)	a) Work with LICH (and other professional associations, vendors, or selected entities with relevant expertise, etc.) to develop informational materials defining efficient irrigation practices (design, technologies, and maintenance), identifying additional informational resources, and showing documented savings and other information deemed important. b) Work with municipal water users, universities, and/or military installations to identify and establish demonstration and research projects to show the application of efficient irrigation technologies and document water savings. c) Work with LICH to develop a model ordinance for landscape and irrigation design, and encourage the requirement for the use of certified irrigation professionals. CWRM would collaborate with municipal providers in the development of the model ordinance. The model ordinance could then be adopted by county governments in Hawaii.

TABLE 6-1
Municipal BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsible Party	Possible Implementation Mechanisms
MU8	Green Business Program	Green business programs are the development of new or promotion of existing green business programs. The intent is to highlight individual businesses that have implemented green business practices.	- State Department of Business, Economic Development and Tourism has an established Green Business (recognition) Program Municipal water providers (identify/promote) - CWRM (program development)	a) Work with the WCAG (or its successor group) to create a water conservation recognition program to celebrate success and reward those (entities, organizations, individuals) that improved their water use efficiency. b) One-time or recurring rebates for certified businesses, or reduction in fees.
MU9	Water Use Surveys	Water use surveys include the development of water user assessment surveys to evaluate and benchmark opportunities for water efficiency improvements at individual customers.	- Municipal water providers - CWRM (create survey)	a) Work with municipal suppliers to develop a water use survey tool (or modify existing templates). b) One-time financial credit for participating in a survey or audit.
MU10	WaterSense Certified/Labeled Equipment	WaterSense certified/labeled equipment is the promotion of the U.S. Environmental Protection Agency (EPA) WaterSense program	- Municipal water providers/CWRM (as well as policy/regulation changes)	a) Work with the WCAG (or its successor group) to adopt a policy in support of the EPA WaterSense program (partnership, labeling and requirements). b) Code changes to adopt WaterSense equipment. c) Rebate programs established by water utilities with funding support from CWRM.

6.3.3 Military

For the military water use sector, the BMPs are similar to the municipal sectors such as residential and commercial. As a result, there are many similar BMPs focusing on those users. The WCAG provided input into the selection and prioritization of the military BMPs. One of the primary sources for military BMPs was the Department of Energy (DOE) Federal Energy Management Program (FEMP), Water Efficiency program area. The FEMP lists a set of BMPs for Federal agencies in response to Executive Order (E.O.) requirements, which required Federal agencies to reduce water use through cost-effective water efficiency improvements. The list of BMPs is updated periodically by the U.S. Environmental Protection Agency (EPA) WaterSense Office. The top ten

military BMPs are summarized in Table 6-2. Some of these BMPs may be in place already, such as the requirement to use a bucket and hose with spray nozzle when washing vehicles.

TABLE 6-2
Military BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
MI1	Install Meters at Users/Buildings	Install meters at users/buildings is a BMP to prioritize on-base military users and/or buildings to install water use meters to better track water usage.	- Military installations (submit reports to CWRM)	a) Work with military installations (whether self-supplied or on a municipal water supply) to adopt a metering policy that all retail (e.g., residences, restaurants, vehicle wash areas, recreational facilities) water uses on the installation be metered, to the maximum extent possible. DoD instructions and EISA also dictate and support the metering of buildings.
MI2	Information and Education Programs	Information and education programs are the preparation and dissemination of materials about water conservation and efficiency and reducing water waste and loss.	- Military installations - CWRM/USACE (coordinate materials)	a) Promote and make available water conservation messages and other water conservation educational materials to military installations.
MI3	Distribution System Audits, Leak Detection, and Repair	This BMP is the identification and reduction of leaks and other water losses and performing an audit according to industry standard methodology.	- Military installations (report to CWRM)	a) Work with military installations that are self-supplied to develop a policy requiring that the military water supplier complete an annual water loss program b) Requirement to report on progress annually c) Incentives could also be used to reward the reduction of leaks and other water losses
MI4	Water Efficient Fixtures	This BMP is the use of more water efficient fixtures in new buildings, and the retrofitting of equipment into existing buildings to reduce water use.	- Military installations (report to CWRM)	a) Work with military installations to develop a policy specifying the use of water efficient fixtures. b) Requirement to reduce water use intensity by 20% according to federal requirement c) Implement LEED for new buildings according to the SPiRiT to LEED program

TABLE 6-2
Military BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
MI5	Look for Opportunities to Reuse or Recycle Water; Alternate Water Sources	This BMP is the practice of identifying opportunities to reuse or recycle water, or use alternate water sources for the original purpose.	- Military installations (report to CWRM)	a) Assist military installations in identifying available alternative water supplies such as reclaimed water for non-potable uses such as landscape irrigation. b) Assist in determining feasibility and cost payback.
MI6	Water-Efficient Landscaping	Water-efficient landscaping is the use of landscaping practices that reduce irrigation water requirements.	- Military installations	a) Work with military installations to encourage the adoption of the model ordinance/policy for landscape and irrigation design, and encourage the requirement for the use of certified irrigation professionals.
MI7	Water-Efficient Irrigation	Water-efficient irrigation is the assessment and replacement of automatic irrigation components with more water-efficient technologies.	- Military installations - CWRM (assist in developing standard audit process)	a) Work with the military to identify and establish demonstration and research projects to show the application of efficient irrigation technologies and document water savings. b) Work with military leadership to revise performance maintenance contracts for landscape management to follow the irrigation and landscape guidelines developed by the LICH and eliminate the “keep it green” payment incentive.
MI8	Cooling Tower Management	Cooling tower management is the proactive maintenance and management of cooling towers to reduce leaks and water use.	- Military installations	a) Work with the military to evaluate water use and efficiency options that are available to reduce and/reuse/alternate sources to offset current cooling tower water use. b) Options may include: requirement to perform regular maintenance; submit reports to prevent/repair leaks and evaluate increasing the cycles of concentration; and require a minimum cycle of concentration be set for all cooling towers.
MI9	Use a Bucket and Hose with Spray Nozzle When Washing Vehicles	This BMP is intended to promote the use of spray nozzles on hoses when washing vehicles, to prevent wasted water when not initially wetting or rinsing the vehicle during the wash process.	- Military installations	a) Military installations will make it policy to require and provide spray nozzles to all vehicle washing locations. b) Distribution of educational materials describing the benefits of using spray nozzles when washing vehicles.

TABLE 6-2
Military BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
MI10	Maintenance Program to Repair Clogged Line/Valves/Meters and Check All Valves, Pressure-Reducing Valves, and Meters in the Water System	This BMP is to perform maintenance on the water system to prevent leaks and interruptions in operation.	- Military installations	a) Assist military installations with the development of a preventive maintenance program that can be used on all facilities in Hawaii.

6.3.4 Agriculture

The BMPs presented for agriculture were developed starting with a list of agricultural irrigation BMPs compiled from several different sources (other agricultural water conservation plans and other state water policies and codes related to agricultural water conservation). This list of BMPs was then reviewed by the WCAG and was narrowed down to a prioritized list of the top ten BMPs most applicable to irrigation water conservation in Hawaii. The top ten agriculture BMPs are summarized in Table 6-3.

TABLE 6-3
Agriculture BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
AG1	Volumetric Measurement of Irrigation Water Use	This BMP includes the volumetric flow measurement at main diversion points from surface or groundwater and volumetric flow measurement at field diversions from main irrigation delivery systems.	- Irrigation water users - CWRM (promotion/outreach) - HDOA/USGS/NRCS/UH (technical assistance)	a) Identify challenges/barriers to metering and water use reporting on permitted surface water and groundwater diversions. b) Develop outreach and education on compliance with current requirements for metering and water use reporting. c) Require metering and water use reporting on major surface water and groundwater diversions in accordance with existing law. d) Develop field demonstration projects for metering of selected major diversions. e) Provide financial incentives and technical assistance to water users for metering installations.

TABLE 6-3
Agriculture BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
AG2	Climate and Soil Moisture Based Irrigation Scheduling	Climate and soil moisture based scheduling is the use of real-time climate and soil moisture data to adjust irrigation schedules.	- Irrigation water users - CWRM (promotion/outreach) - HDOA/NRCS/UH (technical assistance)	a) Develop a plan to implement a state-wide network of climate stations to enable irrigation users to tie into the data network for support of climate-based irrigation. b) Develop educational materials and in-field demonstration projects and provide technical assistance to water users in the use of climate and soil moisture based irrigation scheduling. c) Use incentive funding programs to cover equipment costs and to encourage adoption.
AG3	On-Farm Irrigation Audits and Water Management Plans	Development and adherence to an irrigation water management plan (IWMP) that considers climate, cropping, water supply and labor limitations is probably the single best way to improve irrigation water use efficiency at the farm scale.	- Irrigation water users - CWRM (promotion/outreach) - HDOA/NRCS/UH (technical assistance)	a) Develop educational materials and provide technical assistance to water users for completing an Irrigation Water Management Plan (IWMP). b) Use incentive funding programs to encourage adoption.
AG4	Upgrade of On-Farm Systems to Higher Efficiency Systems	Installation and operation of high efficiency on-farm systems (sprinkler, micro-spray, and drip) can be effective in reducing irrigation water.	- Irrigation water users - CWRM (promotion/outreach) - HDOA/NRCS/UH (technical assistance)	a) Develop educational materials and in-field demonstration projects and provide technical assistance for upgrading on-farm irrigation systems. b) Collaborate with NRCS in identifying priorities for use of EQIP, Agricultural Management Assistance (AMA), and AWEP funds to provide financial incentives through cost-share on irrigation system conversion costs with qualifying participants.
AG5	Crop Residue Management, Conservation Tillage, and Terracing for Improved Rainfall Capture on Irrigated Lands	Conservation tillage, crop residue management, rotational grazing programs, and terracing of steep slopes can be used to maintain proper surface infiltration, reduce evaporation losses, and improve rainfall capture.	- Irrigation water users - CWRM (promotion/outreach) - HDOA/NRCS/UH (technical assistance)	a) Develop educational materials and in-field demonstration projects and provide technical assistance for crop residue management, conservation tillage, and terracing. b) Use of incentive funding programs to encourage BMP adoption.

TABLE 6-3
Agriculture BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
AG6	Lining and Piping of Irrigation Canals	Leakage from unlined irrigation canals can be significantly reduced through projects to install liners that reduce canal seepage or projects that replace canals with enclosed conduits.	- Water purveyors/HDOA - CWRM (promotion/outreach) - HDOA/NRCS (technical assistance)	a) Identify barriers/challenges to development of current water conservation plans by major irrigation system operators. b) Collaborate with HDOA, NRCS, irrigation system managers, and water users on developing practical water conservation plans. c) Develop and enact regulations to require all major irrigation systems over a certain size, regardless of ownership, to have current water conservation plans. d) Develop educational materials and in-field demonstration projects to encourage adoption of conveyance efficiency improvement projects. Simultaneously, support continued research on understanding the role of seepage on aquifer recharge. e) Assist agricultural sector in obtaining outside funding for water conservation projects. f) Simultaneously support assessments to determine impacts of lining on total water within the hydrologic unit.
AG7	Lining of Earthen Impoundment Embankments	Lining of earthen impoundment embankments can be used to reduce the amount of seepage and water loss through those embankments.	- Water purveyors/HDOA - CWRM (promotion/outreach) - HDOA/NRCS (technical assistance)	a) See possible implementation measures for AG6 above
AG8	Rehabilitation of Aging and Leaking Pipes, Flumes, Gates, Structures, Impoundments	Repair and/or replacement of aging and leaking pipes, flumes, gates, structures, and impoundments can significantly reduce water losses.	- Water purveyors/HDOA - CWRM (promotion/outreach) - HDOA/NRCS (technical assistance)	a) See possible implementation measures for AG6 above
AG9	Water Control Structure Automation	Installing automated water control structures that respond to upstream or downstream water levels or respond to operational inputs from remote controls can significantly reduce operational spills.	- Water purveyors/HDOA - CWRM (promotion/outreach) - HDOA/NRCS (technical assistance)	a) See possible implementation measures for AG6 above

TABLE 6-3
Agriculture BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
AG10	Centralized Canal Supervisory Control and Data Acquisition Systems	Use of centralized SCADA systems coordinated with remote communications can be a powerful tool in allowing an irrigation system manager to remotely monitor flows in various sections of the system and to adjust water control structures to match water deliveries to water demands.	- Water purveyors/HDOA - CWRM (promotion/outreach) - HDOA/NRCS (technical assistance)	a) See possible implementation measures for AG6 above

Understanding agricultural water use and the benefits of water conservation in Hawaii is complex because of the wide range of water users (small plot farmers to corporate operations) and water purveyors (State of Hawaii, loose collections of users forming ditch companies and corporate operators) and because of the large land base over which water use occurs. Important factors that must be considered when evaluating agricultural BMPs for water conservation are discussed further below.

6.3.4.1 Water Users versus Water Purveyors

Within the agricultural sector, the water conservation BMPs can be divided into those under responsibility of the water users versus those under the responsibility of the water purveyors. For the large irrigation systems, responsibility for water management typically shifts from the water purveyor to the water user at the point where the water user removes water from a main water delivery system canal or pipeline. Because of the difference in types of infrastructure and operations and the differences in financial and technical capacity between water purveyors and users, these considerations were addressed in addressing the possible implementation strategies and responsible parties for agricultural BMPs.

6.3.4.2 Measuring Water Conservation and Water Use Efficiency

There are two fundamentally different metrics for measuring conserved water and water use efficiency in irrigation applications across the landscape. The first (water conservation by diverted water reduction) is based on a reduction in water diversions from surface or groundwater sources to satisfy irrigation uses. The second (water conservation by consumptive use reduction) is based on a reduction in consumptive use of diverted water that represents water lost from the watershed through evaporation or plant transpiration. The focus of a particular irrigation water conservation program should clearly define which type of water conservation is desired and how irrigation efficiency is measured.

Water conservation by measure of reduced diversions is the most simplified metric of water conservation. It is also the easiest form of conservation to measure since a single point of water measurement can be used. A reduction in total water diversion can produce positive benefits in terms of maintaining minimum instream flows. However, if the reduction in diversion is achieved by reducing the losses of diverted water to groundwater recharge, there can be impacts to downstream groundwater users. One example is the use of canal lining or piping to reduce seepage losses. This type of water conservation needs to be evaluated on a case by case basis within each groundwater basin and should be balanced between the water supply limitations of the water source and potential impacts to the downstream water sources.

Water conservation through reduction in consumptive uses is more difficult to measure than diverted water conservation but is required in the analysis of closed basins where a holistic view of the water budget across a watershed is needed. Changes in land use patterns like fallowing or use of conservation tillage are examples of activities that can have a direct impact on reducing water losses to evaporation and plant transpiration. Canal piping and lining projects also have a consumptive use conservation component in reducing evaporative losses from the canal and from phreatophytic vegetation that grows in the canal or is supported by canal seeps. Typically, consumptive use conservation is only a small part of the overall diverted water conservation amount but represents the true “savings” of water that is not lost to the hydrologic basin. Measurement of consumptive use reduction can be complicated, requiring assessment of historical and post-conservation project consumptive use through aerial photos, satellite imagery, and site hydrologic studies.

For the purpose of the high level comparison of BMPs according to water conservation potential, diverted water conservation is the metric being used. However, when water conservation projects are being considered in the future for the purpose of water supply/demand balancing within water supply limited basins, a detailed understanding of both diverted water and consumptive use conservation is recommended.

6.3.5 Golf Courses

Water use on golf courses in Hawaii is influenced by the desire to produce presentable and resilient playing surfaces while controlling the operating costs of water deliveries. Consequently, most golf courses in Hawaii are trying to be as water conscious as possible and many are using advanced technology such as climate based irrigation scheduling and centralized control systems to efficiently manage their irrigation. Several golf courses are also using recycled water, which reduces the demands on other freshwater supplies.

The BMPs that are presented below were developed starting with a list of BMPs developed by the LICH for landscape irrigation in Hawaii (LICH, 2011) and from the report *Best Management Practices (BMPs) Water-Use Efficiency/Conservation Plan for Golf Courses* (Carrow et al., 2007). This list of BMPs was then reviewed by the WCAG and was narrowed down to a prioritized list of the top ten BMPs most applicable for golf course water

conservation in Hawaii. Many of the BMPs presented in the aforementioned sources are very detailed design and maintenance best practices. Instead of attempting to list all of these best practices, some generalized BMPs such as "Use of qualified irrigation designers and contractors" were developed to help capture the wide array of best practices applicable to irrigation water conservation. The top ten golf course BMPs are summarized in Table 6-4.

TABLE 6-4
Golf Course BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
GC1	Use of Qualified Irrigation Designers and Contractors	Use of qualified and experienced designers and contractors is the best way to ensure a water efficient irrigation system.	- Hawaii Golf Course Superintendants Association	a) Developing a registry of qualified irrigation design and construction contractors with proven experience and certification by the Irrigation Association
GC2	Onsite Weather Station and Climate Based Scheduling	Climate based scheduling is the use of real-time climate data to adjust irrigation schedules. Use of an onsite weather station is especially important in Hawaii where precipitation gradients can be extreme over short distances.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach)	a) Collaborate with GCSAA to develop an education program promoting the benefits of onsite weather station and climate-based scheduling. b) Establish an award and recognition program for golf courses that adopt this and other BMPs. c) Use of rebates.
GC3	Daily Inspection and Repairs	Maintaining good operating conditions of an irrigation system through daily inspection and repairs is an important part of conserving water.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach)	a) Explore water use permitting or other regulations to require golf course managers to perform daily inspections and repairs and immediately correct any major leaks.
GC4	Regularly Scheduled Irrigation System Audits	Regularly scheduled irrigation system audits are a good way to assess the performance of an irrigation system against industry benchmarks and design standards and to create a punch list of repairs or upgrades that may be needed to correct performance problems.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach and develop guidelines)	a) Explore water use permitting or other regulations to require golf course managers to perform regular system audits and develop a program for corrective actions, with a requirement to report on progress annually. b) Reward the reduction of leaks and other water losses.

TABLE 6-4
Golf Course BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
GC5	Aeration of High Traffic Areas for Improved Infiltration	Regular aeration programs can be used to alleviate surface compaction with the additional benefits of improving turf quality and playability.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach)	a) Explore water use permitting or other regulations to require golf course managers to develop a program for surface runoff control
GC6	Centralized Irrigation System Control	Centralized irrigation system control provides greater flexibility in changing schedules to match water demands and to coordinate the rotation of irrigation run times around the system.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach)	a) Collaborate with the GCSAA to develop and/or promote an education/demonstration project, showing the installation, water savings, O&M impacts, etc., of a centralized irrigation control system used on a golf course. b) Establish an award and recognition program for golf courses that adopt this and other BMPs. c) Use of rebates.
GC7	Multiple Flow Meters in Distribution System for Leak Detection	Installing flow meters on different zones or regions within an irrigation system can aid in the detection and repair of leaks.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach)	a) Collaborate with the GCSAA to develop and promote a rebate (or other financial incentive program) to incentivize the installation of more water meters distributed across the golf course water/irrigation delivery system to enable the detection of system leaks.
GC8	Drip Systems for Trees/Shrubs	In tree and shrub landscaping areas, sprinkler systems can be replaced with drip or micro irrigation systems to deliver the required amount of water directly to plant root systems without overwatering adjacent areas.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach)	a) Collaborate with the GCSAA to develop and/or promote an education/demonstration project, showing the installation, water savings, O&M impacts, etc., of a drip irrigation system for non-turf areas (specifically trees and shrubs) used on a golf course.
GC9	Replacing Non-Play Turf Areas with Xeriscaping	Water efficient landscape design and plant selection can significantly reduce irrigation water requirements in comparison to turf areas.	- Water purveyors/golf courses - CWRM/HGCSA (promotion/outreach)	a) Collaborate with the GCSAA to develop and/or promote an education/demonstration project, showing the installation, water savings, O&M impacts, etc., of replacing non-play turf areas on a golf course with xeriscaping (or native, non-water intensive landscaping) b) Develop a rebate (or other financial incentive program) to incentivize the replacement of non-play turf areas with xeriscaping (or native, non-water intensive

TABLE 6-4
Golf Course BMPs
(see Appendix B for more detail)

ID/Rank	BMP	Description	Responsibility	Possible Implementation Mechanisms
				landscaping).
GC10	Use of Non-Potable Water Sources	Use of non-potable water sources can help to reduce demand pressures on potable water supplies.	- Water purveyors - CWRM/HGCSA (promotion/outreach)	a) Develop educational materials pertaining to the availability of local/municipal wastewater, industrial wastewater, or other non-potable water sources that could be used to offset potable water that is currently used for golf course irrigation.

HGCSA = Hawaii Golf Course Superintendants Association.

Section 7

Statewide Water Conservation Program

The Hawaii Water Conservation Plan serves as an initial roadmap for CWRM to follow in implementing a water conservation program over the next ten years. The intent of this plan is to focus CWRM's limited resources on activities that will be most effective in achieving better quantification of water use patterns and activities that produce increased efficiency in water use. It is envisioned that the program will be led by two water conservation coordinators within CWRM that are focused on different water use sectors. In order for this program to be successful, CWRM will be relying strongly upon partnerships formed with other federal and state agencies, local municipalities, water purveyors, and water users across multiple water use sectors.

Elements of this program may be useful for water managers within other agencies. However, this program is specifically intended to guide CWRM's activities in promoting water conservation across the state of Hawaii.

7.1 Development of Program Elements

This section builds upon the definition of the BMPs that were presented in Section 6 by evaluating different implementation approaches, prioritizing the BMP options, and finally by packaging top ranked BMPs into proposed water conservation program elements. These proposed water conservation program elements form the building blocks of the state water conservation program.

7.1.1 Best Management Practices Evaluation and Prioritization

For each of the BMPs within a given use category, there are one or more implementation approaches that provide specific definitions for how the BMP could be managed by CWRM, with anticipated participation and implementation by water users within the classification outlined. This range of possible implementation approaches was presented within the Section 6 tables. And while the defined implementation approaches were developed based on the objectives and strategies outlined in Section 5, it became apparent that not all BMPs can or should be implemented as part of the CWRM's water conservation program. Annual budget constraints and staffing limitations are the primary reasons why not all BMPs can be implemented. Additionally, implementation of some of the BMPs would require legislative change and/or adoption of local ordinances that are not under the direct authority of the CWRM.

These factors, among others, were used to further prioritize the BMPs and related approaches that were considered. Specifically, the criteria that were used in this analysis included: ease of implementation, cost to CWRM, cost to "implementer," whether the proposed BMP builds upon existing programs, and the impact of the BMP on improving Hawaii's water conservation score, as defined by the Alliance for Water Efficiency.

The resulting prioritization is summarized for municipal, military, agriculture, and golf courses in Tables 7-1, 7-2, 7-3, and 7-4, respectively. Each BMP was given a unique identifier as presented in Section 6. Where there was more than one implementation approach, the BMP number remained constant, but each implementation approach was given a unique alphabetical identifier (e.g., a, b, or c, etc.).

TABLE 7-1
Municipal BMP Prioritization

BMP #/ Implementation Approach Indicator	BMP Name	Implementation Approach
MU8	Green Business Program	Water conservation recognition program
MU1	Water Loss Control	Procedure for conducting and requiring annual water audit
MU2	Rain Barrel Programs	Provide links to websites

TABLE 7-1
Municipal BMP Prioritization

BMP #/ Implementation Approach Indicator		BMP Name	Implementation Approach
MU7	a	Irrigation Technology	Informational materials
MU7	c	Irrigation Technology	Model ordinance for landscape and irrigation design
MU9		Water Use Surveys	Water use survey tool
MU10	a	WaterSense Certified/Labeled Equipment	Policy in support of the EPA WaterSense program
MU10	b	WaterSense Certified/Labeled Equipment	Rebate program
MU3		Irrigation Upgrade Programs	Irrigation upgrade grant program
MU6	a	Efficient Commercial Equipment	Rebate program
MU6	b	Efficient Commercial Equipment	Incentive program
MU5	a	Education & Outreach	Key messages
MU4	a	Water Reuse	Modified gray water reuse policy
MU4	b	Water Reuse	Incentive program
MU7	b	Irrigation Technology	Demonstration and research projects
MU5	b	Education & Outreach	Public awareness campaign
MU5	c	Education & Outreach	Conservation education curricula
MU4	c	Water Reuse	Demonstration and research projects

It is important to note that there are some public water systems (privately owned) that fall under the regulation of the Hawaii Public Utilities Commission (PUC). There may be some water conservation BMPs that could require PUC approval if a regulated public water system were to incorporate these BMPs into its rules and regulations, since in these cases water system rule changes need to be approved by the PUC.

TABLE 7-2
Military BMP Prioritization

BMP #/ Implementation Approach Indicator		BMP Name	Implementation Approach
MI6		Water Efficient Landscaping	Encourage adoption of the model ordinance/policy for landscape and irrigation design
MI3		Distribution System Audits, Leak Detection, and Repair	Annual water loss program
MI7	b	Water Efficient Irrigation	Revise performance maintenance contracts for landscape management
MI4		Water Efficient Fixtures	Policy specifying the use of water efficient fixtures

TABLE 7-2
Military BMP Prioritization

BMP #/ Implementation Approach Indicator	BMP Name	Implementation Approach
MI2	Information and Education Programs	Water Conservation messages/other educational materials
MI1	Install Meters at Users/Buildings	Metering policy
MI9	Bucket & Hose with Spray Nozzle When Washing Vehicles	Policy to require and provide spray nozzles
MI5	Look for Opportunities to Reuse/Recycle Water and Seek Alternate Water Sources	Identifying available alternative water supplies
MI8	Cooling Tower Management	Offset current cooling tower water use
MI7 a	Water Efficient Irrigation	Establish demonstration and research projects
MI10	Maintenance program to Repair Clogged Line/Valves/Meters & Check All Valves, Pressure Reducing Valves, and Meters in the Water System	Development of a preventative maintenance program

TABLE 7-3
Agriculture BMP Prioritization

BMP #/ Implementation Approach Indicator	BMP Name	Implementation Approach
AG1 b	Volumetric Measurement of Irrigation Water Use	Educational materials, field demonstration projects, leverage NRCS EQIP cost-share program for on-farm conservation, agriculture water conservation award program
AG3	On-Farm Irrigation Audits and Water Management Plans	Educational materials and field demonstration projects
AG5	Crop Residue Management, Conservation Tillage, and Terracing for Improved Rainfall Capture on Irrigated Lands	Educational materials and field demonstration projects
AG2 b	Climate and Soil Moisture Based Irrigation Scheduling	Educational materials and field demonstration projects
AG1 a	Volumetric Measurement of Irrigation Water Use	Require metering of all major surface water diversions and measuring water use at field turnouts on large systems
AG4	Upgrade of On-Farm Systems to Higher Efficiency Systems	Educational materials and field demonstration projects
AG6 a	Lining and Piping of Irrigation Canals	Regulatory options for requiring all major irrigation systems to have current water conservation plans and to conduct research on understanding the role of seepage in a hydrologic basin's water balance

TABLE 7-3
Agriculture BMP Prioritization

BMP #/ Implementation Approach Indicator		BMP Name	Implementation Approach
AG7	a	Lining of Earthen Impoundment Embankments	Regulatory options for requiring all major irrigation systems to have current water conservation plans and to conduct research on understanding the role of seepage in a hydrologic basin's water balance
AG8	a	Rehabilitation of Aging and Leaking Pipes, Flumes, Gates, Structures, Impoundments	Regulatory options for requiring all major irrigation systems to have current water conservation plans
AG9	a	Water Control Structure Automation	Regulatory options for requiring all major irrigation systems to have current water conservation plans
AG10	a	Centralized Canal Supervisory Control and Data Acquisition Systems	Regulatory options for requiring all major irrigation systems to have current water conservation plans
AG6	b	Lining and Piping of Irrigation Canals	Educational materials, field demonstration projects, leverage HDOA state funded installations, agriculture water conservation award program, research on understanding the role of seepage in a hydrologic basin's water balance
AG7	b	Lining of Earthen Impoundment Embankments	Educational materials, field demonstration projects, leverage HDOA state funded installations, agriculture water conservation award program, research on understanding the role of seepage in a hydrologic basin's water balance
AG8	b	Rehabilitation of Aging and Leaking Pipes, Flumes, Gates, Structures, Impoundments	Educational materials, field demonstration projects, leverage HDOA state funded installations, agriculture water conservation award program
AG9	b	Water Control Structure Automation	Educational materials, field demonstration projects, leverage HDOA state funded installations, agriculture water conservation award program
AG10	b	Centralized Canal Supervisory Control and Data Acquisition Systems	Educational materials, field demonstration projects, leverage HDOA state funded installations, agriculture water conservation award program
AG2	a	Climate and Soil Moisture Based Irrigation Scheduling	Develop plan for implementing a state-wide network of climate stations

TABLE 7-4
Golf Course BMP Prioritization

BMP #	BMP Name	Implementation Approach
GC1	Use of Qualified Irrigation Designers/Contractors	Work with HGCSAA to develop registry of qualified designers/contractors
GC2	Onsite Weather Station and Climate Based Scheduling	Develop education program, demonstration projects, and golf course water conservation award program
GC9	Replacing Non-Play Turf Areas with Xeriscaping	Develop education program, demonstration projects, and golf course water conservation award program

TABLE 7-4
Golf Course BMP Prioritization

BMP #	BMP Name	Implementation Approach
GC10	Use of Non-Potable Water Sources	Develop education program, demonstration projects, and golf course water conservation award program
GC3	Daily Inspection and Repairs	Requirement to perform regular inspections, corrective action program, report progress annually
GC4	Regularly Scheduled Irrigation System Audits	Requirement to perform regular system audits, corrective action program, report progress annually
GC6	Centralized Irrigation Control System	Develop education program, demonstration projects, and golf course water conservation award program
GC5	Aeration of High Traffic Areas for Improved Infiltration	Develop education program, demonstration projects, and golf course water conservation award program
GC7	Multiple Flow Meters in Distribution System for Leak Detection	Develop education program, demonstration projects, and golf course water conservation award program
GC8	Drip Systems for Trees/Shrubs	Develop education program, demonstration projects, and golf course water conservation award program

7.1.2 Water Conservation Program Elements for Implementation

After the BMPs were prioritized by water use sector and evaluated for possible implementation approaches, the top ranked BMPs were grouped into packaged water conservation program elements. Each water conservation program element is built around one or more BMPs that will be implemented by the same state staff, targeting related stakeholders to address a defined water conservation issue within a particular water use sector. Water conservation program elements that are recommended for implementation are presented below. Each program includes an issue statement, solution, implementation type, program summary, responsibility, funding source and partners, staff needs and program expenses. Implementation approaches are generally classified as education-based, regulatory or incentive (financial or other meaningful incentive). The staff needs and program expenses presented are for CWRM's budgeting only and do not represent costs provided by other participating partners in the program or full implementation costs. Examples of non-labor program costs include contracting outside entities for workshops and trainings and inter-island travel by water conservation coordinators. Estimates are based on project team experience and other water conservation programs in the U.S. This information was the basis for developing the actual implementation and funding plan (programs by year), as shown in Section 7.2 and represents only those costs to CWRM. Additional costs for implementation may be borne by participating entities and may range from in-kind services to capital investment, depending on the type of program.

7.1.2.1 General

1. Hawaii Water Conservation Recognition Program

Issue: Need to advertise successes and encourage wider adoption of advanced water conservation strategies

Solution (BMP): All BMPs and other water saving actions taken by municipal suppliers of customers served (e.g., hotels)

Implementation Type: Education

Implementation Program: A statewide water conservation award program will be established to recognize significant achievement in improving water use efficiency. All water users and their direct customers (e.g. in the case of a municipal supplier a hotel or other water user can be recognized) are

eligible for a Hawaii Water Conservation Award. Awards will be presented at other industry conferences or other appropriate public event, and will be advertised on the CWRM web site.

Responsibility for Implementing: CWRM will develop appropriate nomination and screening processes and determine venues for advertising award recipients.

Funding Source/Partners: CWRM/DEBEDT Green Business Program

Staff Needs: 0.1 full-time employee (FTE) for 10 years

Program Expenses: $5,000/year for 10 years (begin implementation in year 3)

7.1.2.2 Municipal

1. Procedure for Conducting and Requiring Annual Water Loss Audit

Issue: Need for standardization in water loss reporting by public water systems

Solution (BMP): Water Loss Control

Implementation Type: Education and Regulatory

Implementation Program: Education will take place on the AWWA/IWA Water Audit methodology and AWWA Free Water Audit Software© for public water systems in Hawaii. Following the training, public water systems will be required to conduct water loss audits using the methodology and software and submit to CWRM on an annual basis.

Responsibility for Implementing: CWRM will use existing educational materials available from AWWA and other states that have implemented similar programs. Municipal water system staff familiar with this methodology could participate and assist with education statewide. Requirement will phase in based on water system size, as appropriate.

Funding Source/Partners: USACE, CWRM, AWWA-Hawaii Section, municipal water systems. Hawaii Rural Water Association

Staff Needs: 0.3 FTE for 2 years

Program Expenses: $10,000 for year one, $5,000 for year 2

2. Model Ordinance for Landscape and Irrigation Design

Issue: Lack of consistent standards for landscape design, irrigation system performance and irrigation scheduling that focus on water use efficiency

Solution (BMP): Model Ordinance for Landscape and Irrigation Design

Implementation Type: Education

Implementation Program: Development of a statewide, model landscape and irrigation design code that emphasizes water use efficiency; and providing assistance to local governments to aid in adoption.

Responsibility for Implementing: CWRM will partner with County staff (water supply, code development, clerk, etc.) and LICH to develop a model ordinance that results in irrigation efficiency, is consistent with the BMPs developed by the LICH and is “adoptable” by County governments.

Funding Source/Partners: USACE, CWRM, LICH, appropriate County staff

Staff Needs: 0.3 FTE for 2 years

Program Expenses: $5,000/year for 2 years (years 9-10)

3. Policy in support of the EPA WaterSense Program

Issue: Need to promote new, more efficient plumbing fixtures and other devices certified by the EPA WaterSense program

Solution (BMP): WaterSense Certified/Labeled Equipment

Implementation Type: Education

Implementation Program: CWRM will encourage water systems to become promotional partners, if they have not already done so, and will coordinate educational material to promote WaterSense devices statewide.

Responsibility for Implementing: CWRM will use existing EPA WaterSense educational materials to promote the program statewide with partnership and cooperation from the water systems.

Funding Source/Partners: USACE, CWRM, municipal water systems

Staff Needs: 0.1 FTE for 2 years

Program Expenses: $2,000/year for 2 years (years 1-2)

4. Irrigation Upgrade Grant/Rebate Program (only implemented with additional funding scenarios)

Issue: Considerable water use for irrigation; opportunities for improved water use if efficient technologies and design standards can be implemented

Solution (BMP): Irrigation upgrade rebate program

Implementation Type: Incentive

Implementation Program: CWRM will develop a landscape and irrigation system rebate program to motivate early replacement of landscape materials and technologies to improve water use efficiency. CWRM will work with LICH, municipal water suppliers, the hotel/motel association (and others) to develop the rebate eligibility criteria, application process, reporting requirements, data collection and promotional needs. Actual rebates will be made on a 50-50 cost share basis with participating municipal suppliers.

Responsibility for Implementing: Municipal water suppliers will develop a rebate program based on the agreed-to structure and will be reimbursed by CWRM as the rebate program is implemented. Municipal cooperators and CWRM will enter into a Memorandum of Understanding (MOU) with providers granted participation in the rebate program.

Funding Source/Partners: CWRM, LICH, municipal water suppliers

Staff Needs: 0.4 FTE for 5 years

Program Expenses: $50,000/year for 5 years (years 6 – 10, or earlier if funds are made available)

5. Efficient Commercial Equipment Rebate Program

Issue: Need to increase water efficiency of water-using commercial equipment

Solution (BMP): Efficient Commercial Equipment

Implementation Type: Incentive

Implementation Program: CWRM will develop a list of water-using commercial equipment that will be eligible for rebates upon upgrade. Commercial water users such as hotel/motel/resort, institutional will be the target for this program. Existing lists of equipment from other programs in the United States will be used as the basis for the lists. The first year will be developing the program, including targeted water users and equipment lists; then the program will begin and run for 5 years.

Responsibility for Implementing: CWRM will implement with partnerships from the water systems. It is possible a third party may be used to administer the rebates. Funding could be supplemented by the water systems.

Funding Source/Partners: CWRM, municipal water systems

Staff Needs: 0.3 FTE for 5 years

Program Expenses: $5,000 for year 1, $50,000/year for 4 years (years 2-5)

6. WaterSense/High Efficiency Equipment Replacement Program

Issue: Numerous high water using fixtures and appliances still in use; little market penetration of high efficiency equipment and/or devices.

Solution (BMP): Rebate program for WaterSense certified technologies

Implementation Type: Education and Incentive

Implementation Program: CWRM will develop a rebate program to motivate the installation of WaterSense devices. CWRM will work with municipal water suppliers to develop the rebate eligibility criteria, application process, reporting requirements, data collection and promotional needs. Actual rebates will be made on a 50-50 cost share basis with participating municipal suppliers.

Responsibility for Implementing: Municipal water suppliers will develop a rebate program based on the agreed-to structure and will be reimbursed by CWRM as the rebate program is implemented. Municipal cooperators and CWRM will enter into a Memorandum of Understanding (MOU) with providers granted participation in the rebate program.

Funding Source/Partners: CWRM, municipal water suppliers

Staff Needs: 0.5 FTE for 5 years

Program Expenses: $50,000/year for 5 years (years 1-5)

7. Efficient Commercial Equipment Incentive Program

Issue: Need to increase water efficiency of water-using commercial equipment in new developments

Solution (BMP): Efficient Commercial Equipment

Implementation Type: Incentive

Implementation Program: CWRM will work with municipal water systems to develop incentives for new commercial developments to install and use efficient commercial water-using equipment. These incentives could come in the form of reduced fees such as facilities charge, meter fee, etc.

Responsibility for Implementing: CWRM will implement with partnerships from the water systems. The list of eligible equipment will be developed by CWRM with water system input. Municipal water systems will develop the appropriate incentives with approval by CWRM.

Funding Source/Partners: CWRM, municipal water systems

Staff Needs: 0.1 FTE for 5 years

Program Expenses: $2,000/year for 5 years (years 1-5)

8. Irrigation Technology Demonstration and Research Project

Issue: Considerable water used for landscape irrigation, with opportunities to save water if efficient technologies and design standards can be implemented

Solution (BMP): Irrigation Technology Demonstration and Research Project

Implementation Type: Education and Incentive

Implementation Program: Cost-sharing demonstration project with one or two (initially) water users, with high irrigation water uses. Ideally, demonstrations include residential and commercial properties. Demonstrations such as these establish a proof of concept that can be transferred to other landscapes and irrigation systems.

Responsibility for Implementing: CWRM, with their partners, will select target partners and facilitate cost-share/technical assistance; CWRM will partner with LICH, the building industry or contractors association and municipal suppliers to define demonstration parameters, data collection, monitoring and promotional/educational needs.

Funding Source/Partners: CWRM, LICH, municipal water suppliers, building industry or contractors association

Staff Needs: 0.3 FTE for 4 years

Program Expenses: $40,000/year for 4 years (years 7-10)

7.1.2.3 Military

1. **Model Ordinance/Standards for Landscape and Irrigation Design**

Issue: Lack of standards for landscape design, irrigation system performance and irrigation scheduling that focus on water use efficiency

Solution (BMP): Model Ordinance for Landscape and Irrigation Design

Implementation Type: Education

Implementation Program: CWRM will develop a statewide, model landscape and irrigation design code that emphasizes water use efficiency; and provide assistance to military installation to encourage adoption (as policy, contractual requirement, executive order or other) for use on military installations in Hawaii.

Responsibility for Implementing: CWRM will partner with USACE, facility operators/managers to secure adoption of the landscape standards.

Funding Source/Partners: CWRM, USACE, military facility managers, leadership

Staff Needs: 0.2 FTE for 2 years

Program Expenses: $5,000/year for 2 years (years 7-8)

2. **Annual Water Loss Program**

Issue: Need for standardization in water loss reporting at military installations

Solution (BMP): Distribution System Audits, Leak Detection, and Repair

Implementation Type: Education and Regulatory

Implementation Program: Education will take place on the AWWA/IWA Water Audit methodology and AWWA Free Water Audit Software © for military installations in Hawaii. Following the training, military installations should conduct water loss audits using the methodology and software and submit to CWRM on an annual basis.

Responsibility for Implementing: CWRM will use existing educational materials available from AWWA and other states that have implemented similar programs. Municipal water system staff familiar with this methodology could participate and assist with education statewide. Requirement will phase in based on water system size, as appropriate.

Funding Source/Partners: USACE, CWRM, municipal water systems, military installations, Hawaii Rural Water Association

Staff Needs: 0.1 FTE for 2 years

Program Expenses: $2,000/year for 2 years (years 1-2)

3. **Water Efficient Irrigation Performance Contracts**

Issue: Contract operations agreements that incentivize excess water use for landscape irrigation

Solution (BMP): Water Efficient Irrigation

Implementation Type: Education and Policy

Implementation Program: CWRM will develop sample contract to incentivize water use efficiency in landscape water use on military installations and housing. CWRM will work with facility managers and housing contractors to modify the sample to result in an implementable contract and set a target timetable for adoption.

Responsibility for Implementing: CWRM will select irrigation systems and facilitate cost-share/technical assistance; CWRM will partner with facility managers, housing contractors and State of Hawaii Department of Accounting and General Services (DAGS) to help develop performance contracts

Funding Source/Partners: USACE, CWRM, Military facility manager, housing contractor, DAGS

Staff Needs: 0.1 FTE for 2 years

Program Expenses: $10,000/year for 2 years (years 9-10)

4. **Policy to Install Meters at Users/Buildings**

Issue: Need for understanding of water use throughout military installations in Hawaii

Solution (BMP): Install Meters at Users/Buildings

Implementation Type: Education and Regulatory

Implementation Program: CWRM will work with military installation leadership to develop a policy to install and regularly read water meters at users and buildings. Military installations will develop a timeline for installation of these water meters.

Responsibility for Implementing: CWRM will model this program using existing military meter installation programs throughout the United States.

Funding Source/Partners: USACE, CWRM, military installations

Staff Needs: 0.2 FTE for 5 years

Program Expenses: $5,000/year for 5 years (years 6-10)

7.1.2.4 Agriculture

1. **Irrigation Metering Demonstration Project**

Issue: Lack of water use measurement

Solution (BMP): Volumetric measurement of irrigation water use

Implementation Type: Education and Incentive

Implementation Program: Cost-sharing demonstration project with one or two (initially) large water purveyor and small irrigator to install and operate water measurement devices on or near their diversions or wells. The devices should be inexpensive to install, maintain, and operate. Ideally, systems that are already metering all field deliveries would be selected to allow more comprehensive irrigation system wide water budgets. This will establish a proof of concept that can be transferred to other irrigation systems.

Responsibility for Implementing: CWRM will select irrigation systems and facilitate cost-share/technical assistance; CWRM will partner with NRCS to utilize EQIP or AWEP programs as applicable, with USGS to provide technical assistance. Irrigation water purveyors will contribute cost-share and in-kind services.

Funding Source/Partners: USACE, CWRM, HDOA, NRCS, USGS, Resource Conservation and Development Council (RC&D), UH Cooperative Extension Service, irrigation system partners

Staff Needs: 0.2 FTE for 2 years

Program Expenses: $10,000/year for 2 years (years 1-2)

2. Irrigation Metering and Reporting Enforcement

Issue: Lack of water use measurement and reporting

Solution (BMP): Volumetric measurement of irrigation water use

Implementation Type: Regulatory

Implementation Program: Require compliance with §174C-5(15), HRS and §13-168-7, HAR. CWRM will establish a staged compliance schedule to require installation of measurement devices and reporting of monthly water use to CWRM.

Responsibility for Implementing: CWRM

Funding Source/Partners: CWRM

Staff Needs: 0.2 FTE for 5 years

Program Expenses: $5,000/year for 5 years (years 6-10)

3. Irrigation Metering Incentives and Technical Assistance

Issue: Lack of water use measurement and reporting

Solution (BMP): Volumetric measurement of irrigation water use

Implementation Type: Incentive

Implementation Program: Provide technical assistance to water purveyors and water users that need to install water metering in order to comply with existing regulations. Additionally, assist water purveyors and water users in identifying cost-share funding opportunities through NRCS. State cost share funds will also be allocated and a program will be developed to distribute cost-share funds.

Responsibility for Implementing: CWRM will partner with NRCS to utilize EQIP or AWEP programs as applicable and with USGS to provide technical assistance.

Funding Source/Partners: USACE, CWRM, HDOA, NRCS, USGS, RC&D, UH Cooperative Extension Service, irrigation system partners

Staff Needs: 0.2 FTE for 5 years

Program Expenses: $50,000/year for 5 years (years 6-10)

4. Irrigation Water Purveyor Conveyance Efficiency Education and Demonstration

Issue: Low conveyance system efficiencies on open canal systems

Solution (BMP): Lining and Piping of Irrigation Canals; Lining of Earthen Impoundment Embankments; Rehabilitation of Aging and Leaking Pipes, Flumes, Gates, Structure, Impoundments; Water Control Structure Automation; and Centralized Canal Supervisory Control and Data Acquisition Systems

Implementation Type: Education

Implementation Program: Workshops will be held to share successes from demonstration projects where these BMPs have already been implemented. Water managers from state and private irrigation systems will be invited to attend.

Responsibility for Implementing: CWRM will work with HDOA to conduct education and demonstration workshops. CWRM will work with NRCS to identify opportunities for use of AWEP cost share funding.

Funding Source/Partners: USACE, CWRM, HDOA, NRCS, RC&D, UH Cooperative Extension Service, irrigation system partners

Staff Needs: 0.2 FTE for 5 years

Program Expenses: $10,000/year for 5 years (years 1-5)

5. Irrigation Water Purveyor Water Conservation Plan Requirement

Issue: Low conveyance system efficiencies on open canal systems

Solution (BMP): Lining and Piping of Irrigation Canals; Lining of Earthen Impoundment Embankments; Rehabilitation of Aging and Leaking Pipes, Flumes, Gates, Structure, Impoundments; Water Control Structure Automation; and Centralized Canal Supervisory Control and Data Acquisition Systems

Implementation Type: Regulatory

Implementation Program: Implement new regulations requiring that all large irrigation systems (over a set permitted flow rate) develop a water conservation plan (WCP) and update the plan at least once every 5 years. Minimum plan requirements will be set in regulation and a brief guidance document will be developed to provide more detail to water purveyors/users on how to develop a WCP. WCPs will at a minimum characterize the existing water uses and system water budget, identify potential water conservation projects, and estimate water savings and costs for those projects. Elements of the WCPs will aid the state in understanding current water use efficiencies and will aid water purveyors in developing the materials necessary to support future grant and cost-share assistance applications that could provide funding for capital projects.

Responsibility for Implementing: CWRM will work with HDOA and NRCS to develop the minimum WCP regulatory requirements and the guidance document for WCP preparation.

Funding Source/Partners: CWRM, HDOA, NRCS, irrigation system partners

Staff Needs: 0.1 FTE for 5 years

Program Expenses: $10,000/year for 5 years (years 6-10)

6. Irrigation Water User Workshops

Issue: Opportunity for reduced water use with improved on-farm irrigation water management

Solution (BMP): Crop Residue Management, Conservation Tillage, and Terracing for Improved Rainfall Capture on Irrigated Lands; On-Farm Irrigation Audits and Water Management Plans; Climate and Soil Moisture Based Irrigation Scheduling; Upgrade of On-Farm Systems to Higher Efficiency Systems

Implementation Type: Education and Incentive

Implementation Program: Workshops will be held to educate farmers and nurserymen on the application of on-farm irrigation water conservation BMPs. Workshops will build upon successes of demonstration projects that have already been implemented and will help users to identify NRCS programs that may be available to provide cost-share assistance.

Responsibility for Implementing: CWRM will contract with RC&D to conduct workshops

Funding Source/Partners: USACE, CWRM, RC&D, NRCS, UH Cooperative Extension Service

Staff Needs: 0.2 FTE for 5 years

Program Expenses: $50,000/year for 5 years (years 1-5)

7. **Agricultural Climate Station Network Development**

Issue: Lack of readily available real-time climate data to support advanced irrigation scheduling

Solution (BMP): Climate and Soil Moisture Based Irrigation Scheduling

Implementation Type: Technical Assistance

Implementation Program: Work with other state and federal agencies to develop a plan for a state-wide network of climate stations to provide real-time evapotranspiration and precipitation data for irrigation scheduling. This program will not include implementation but will develop a plan to a sufficient level of detail that resources, partners, and capital and O&M costs of such a program can be assessed.

Responsibility for Implementing: CWRM will convene a discussion with agencies that could be a partner in setting up or running the long-term program and agencies that have similar experience in other states such as NRCS, U.S. Bureau of Reclamation (BOR) in the western United States and California Department of Water Resources (DWR) in California.

Funding Source/Partners: CWRM, NRCS, NOAA, UH, BOR, DWR

Staff Needs: 0.2 FTE for 2 years

Program Expenses: $10,000/year for 2 years (years 6-7)

7.1.2.5 Golf Courses

Given the relatively small proportion of statewide water use on golf courses and the higher levels of water use efficiency already achieved by this water use sector, there are only two water conservation program elements that are being considered at this time. One program element is included below and the other is part of the general category in Section 7.1.2.1. This approach will allow the limited resources available for the water conservation program to be focused on sectors with higher potential for significant water use savings.

1. **Irrigation Design and Construction Contractor Registry**

Issue: Need to encourage education and certification of design and construction contractors to standardize application of irrigation BMPs

Solution (BMP): Use of Qualified Irrigation Designers and Contractors

Implementation Type: Education

Implementation Program: A registry of qualified irrigation design and construction contractors will be developed and made available through the CWRM and LICH web site. Certification by the Irrigation Association and other education, training, and experience will be considered in setting the standard for qualification. Process will be advertised through the HGCSA, LICH, and local contractor's organizations.

Responsibility for Implementing: CWRM will work with HGCSA and LICH to develop appropriate qualifications and to establish the process for registering designers and contractors.

Funding Source/Partners: CWRM, HGCSA, LICH, IA

Staff Needs: 0.1 FTE for 2 years

Program Expenses: $5,000/year for 2 years (years 7-8)

7.1.3 Other Policy Actions

In addition to the specific BMPs and implementation strategies outlined above, there are other regulatory, policy, and educational actions that warrant consideration by CWRM. These policy actions were not considered in the evaluation and prioritization of the BMPs and implementation approaches, nor were they taken into account when allocating staff time and funding in selecting water conservation actions for implementation. Rather, it was assumed that a portion of the remaining staff availability, or other staff within the CWRM that do not have direct responsibility for the water conservation plan defined herein would take responsibility for the other policy actions.

The policy actions, shown in priority order (high to low), are listed below.

- Continue to expand its role as the coordinating agency for water conservation activities between all levels of government, military, universities and the private sector. (P1)
- Continue development of water use data collection, analysis, and reporting system to enable accurate assessment of water. (P2)
- Explore policy changes to make improvements in water use efficiency and related reporting (e.g., State Water Code, green plumbing codes [IAMPO; ICC], county ordinances, etc) via the State Building Code Council, Hawaii Legislature, and County Councils. (P3)
- Require development and submittal of water conservation plan and annual reporting on implementation of water conservation plan measures as a condition of receiving a water use permit. (P4)
- Explore sources of supplemental funding that can be generated by CWRM to implement the Water Conservation Program. (P5)
- Review Part III of the State Water Code, the Water Resource Protection Plan and Statewide Framework for Updating the Hawaii Water Plan to ensure consistency with the appropriate water conservation policies, regulatory mechanisms and program measures outlined in the Statewide Water Conservation Plan. (P6)
- Establish baseline water use and develop water conservation targets for individual sectors or water systems that can be established in the context of known, available, or anticipated future water resources. (P7)
- Explore policy changes to proactively plan for the expanded use of recycled wastewater and storm-water for agriculture, landscaping, irrigation, recharge, and industrial uses. (P8)
- Establish a water resource management public awareness campaign that incorporates climate change, energy/water nexus, food scarcity, viable agriculture, watershed management, and source protection and augmentation. (P9)

Government should lead by example and CWRM should instill ways to encourage this through outreach, technical assistance, exploring public/private partnerships, explaining the link between energy and water efficiency, recommending amendments to existing legislation, prioritizing water efficiency actions in government agencies and organizations, and researching existing energy and water efficiency performance contracting in government (P10)

7.2 Implementation, Staffing, and Funding

The implementation and funding plan described in this section is generally based on a phased implementation approach: early (1-2 year), mid-term (3-5) and long term (6-10) timeframes. The phased approach was necessary due to CWRM staff limitations and budget constraints. Additionally, phasing the program to build partnerships, provide educational materials, demonstrate and document savings was considered important to building credibility for the program and broadening interest and support. This is especially true when financial incentives and/or regulatory programs are being implemented.

7.2.1 Implementation Plan

Building on the development of individual water conservation program elements as presented above, a recommended implementation plan for the overall water conservation program was developed. Three basic scenarios for staffing levels and funding levels were considered in establishing the recommended elements of the water conservation program. These scenarios were:

- Scenario 1: "Status Quo"—$150,000 per year; 1.5 FTE
- Scenario 2: Additional staff emphasis—$150,000 per year; 3.5 FTE
- Scenario 3: Additional funding emphasis—$350,000 per year; 1.5 FTE

For purposes of this plan, the most conservative scenario of maintaining "Status Quo" staffing and funding levels was assumed to remain constant over the 10 year planning time frame. Table 7-5 depicts the recommended water conservation programs, the years they are proposed for implementation, and the annual costs and FTE for each. Note that although the staffing and funding levels may vary above and below the assumed staffing and funding levels on an annual basis, the approximate FTE is 1.6 and the approximate annual costs are about $145,000 on average over the 10 years. It is expected that the actual program expenses and staffing times will be adjusted each year to fit within the available staffing and expense budgets.

If additional funding is available in the future, it is recommended that rebate programs and other "grant" programs be expanded to make a greater number of rebates be available to increase "market penetration" of a given technology or practice, as shown in gray on Table 7-5. If additional staff resources are made available, it is recommended that they be used to accelerate program implementation and/or expand demonstrations to more geographies/users. The only exception to this is in the municipal category. If additional funding is available, it is recommended that a landscape and irrigation technology rebate program be developed.

It is not recommended that additional programs beyond what is recommended here be implemented. Attempting to simultaneously implement a greater number of programs dilutes the effect of any given program, places additional stress on staff to manage a greater number of programs, and leads to a fractured, un-sustainable program. In the long-term, it will be more effective to develop fewer programs, with deeper penetration and focus that achieve greater water savings at less overhead (administrative) costs.

It is important to note that the schedule in Table 7-5 represents one scenario where Planning Branch personnel can be fully committed to the water conservation program elements and that funding is ensured. Implementation will be based on CWRM staffing and funding availability on a year-to-year basis and that Table 7-5 will be used as a menu of options to be taken. It is also important to recognize that the initiation dates and duration of these Water Conservation Programs could be extended or contracted depending on mitigating factors. Also the expenses may fluctuate annually based on the type and amount of implementation taking place.

7.2.2 Staffing Plan

Based on the water conservation program implementation plan, which relies upon 1.5 FTEs, the following current positions (and descriptions) are suggested.

7.2.2.1 Agricultural/Golf Course Water Conservation Coordinator

This position is responsible to develop and implement the water conservation programs identified in the agricultural and golf course water use sectors. They will be responsible for developing relationships with HDOA, NRCS, the Farm Bureau and the golf course industry association, and other agricultural users groups that can support the mission of water conservation in the agricultural and golf course water use sectors. The employee will become familiar with issues facing these water users and will address these challenges in customizing water conservation programs to increase participation and adoption. The employee will maintain working knowledge of pertinent regulations (local, state and national) that affect these water users. The employee will develop deep knowledge of external funding sources, understand the application, award or allocation process to maximize the amount of matching funds/grants/loans and other sources of outside revenue are dedicated to furthering water use efficiency and conservation among the agricultural and golf course water use sectors. This position will need to work effectively within the regulatory process in Hawaii to ensure adoption of identified regulations, aid in

tracking and reporting on adoption and implementation progress. The position will work closely with the Municipal/Educational Water Conservation Coordinator to develop targeted educational materials, promote success and recognize water savings achievements through the defined awards program.

7.2.2.2 Municipal/Educational Water Conservation Coordinator

This position is responsible to develop and implement the water conservation programs identified for the municipal and military water use sectors. The employee in this position will be responsible for developing relationships with municipal water suppliers, LICH, AWWA, Hotel/Motel association and military installation managers. The employee will become familiar with issues facing these water users and will address these challenges in customizing water conservation programs to increase participation and adoption. The employee will maintain working knowledge of pertinent regulations (local, state and national) that affect these water users. This position will need to work effectively within the regulatory process in Hawaii to ensure adoption of identified regulations, aid in tracking and reporting on adoption and implementation progress. Additionally, this position will be responsible for developing educational materials as defined in the implementation program and to promote participation in targeted programs (e.g. rebates, promote demonstration projects – data, site visits, etc.) across all water use classes.

In addition to the above position descriptions, capacity within the CWRM or other department should be planned to complete the following:

1. Tracking and/or implementing the “other policy actions”
2. Water conservation program tracking, analysis, evaluation and update
3. Educational support for graphic design, copy, website, social media and other support functions as needed support the water conservation program

7.2.3 Funding

The primary funding for implementing the water conservation program will come from CWRM to support the two water conservation coordinators and expenses for their program activities. However, many of the water conservation program elements will require additional outside funding to support implementation of water conservation measures.

In order to supplement state funding for the water conservation program, several existing funding sources and programs related to water conservation were identified. Outside (non-state) funding will be especially important for infrastructure related costs that are beyond the budget capacity of the water conservation program. Construction and operations of pilot projects is an example application where outside funding may be pursued. In addition, there may be some opportunities to explore performance contracting to fund projects, which use the savings achieved to fund the implementation, but these must be explored on a case-by-case basis.

The following sections briefly outline some possible outside funding sources. However, additional information regarding the application (or allocation) process, uses of, and/or limitations of funding sources will be needed to specifically define the role each of the funding sources in the implementation of the Statewide Water Conservation Plan.

TABLE 7-5

Water Conservation Program Implementation Plan

	Water Conservation Program Element Name	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6		Year 7		Year 8		Year 9		Year 10	
		FTE	Expenses	FTE	Expenses	FTE	Expenses	FTE	Expenses	FTE	Expenses	FTE	Expenses	FTE	Expenses	FTE	Expenses	FTE	Expenses	FTE	Expenses
General																					
1	Hawaii Water Conservation Recognition Program	0.1	$5,000	0.1	$5,000	0.1	$5,000	0.1	$5,000	0.1	$5,000	0.1	$5,000	0.1	$5,000	0.1	$5,000	0.1	$5,000	0.1	$5,000
Municipal																					
1	Procedure for Conducting and Requiring Annual Water Loss Audit	0.3	$10,000	0.3	$5,000																
2	Model Ordinance for Landscape and Irrigation Design																	0.3	$5,000	0.3	$5,000
3	Policy in support of the EPA WaterSense Program	0.1	$2,000	0.1	$2,000																
4	Irrigation Upgrade Grant/Rebate Program (if funding is available)											0.4	$50,000	0.4	$50,000	0.4	$50,000	0.4	$50,000	0.4	$50,000
5	Efficient Commercial Equipment Rebate Program	0.3	$5,000	0.3	$50,000	0.3	$50,000	0.3	$50,000	0.3	$50,000										
6	WaterSense/High Efficiency Equipment Replacement Program	0.5	$50,000	0.5	$50,000	0.5	$50,000	0.5	$50,000	0.5	$50,000										
7	Efficient Commercial Equipment Incentive Program	0.1	$2,000	0.1	$2,000	0.1	$2,000	0.1	$2,000	0.1	$2,000										
8	Irrigation Technology Demonstration and Research Project													0.3	$40,000	0.3	$40,000	0.3	$40,000	0.3	$40,000
Military																					
1	Model Ordinance/Standards for Landscape and Irrigation Design													0.2	$5,000	0.2	$5,000				
2	Annual Water Loss Program	0.1	$2,000	0.1	$2,000																
3	Water Efficient Irrigation Performance Contracts																	0.1	$10,000	0.1	$10,000
4	Policy to Install Meters at Users/Buildings											0.2	$5,000	0.2	$5,000	0.2	$5,000	0.2	$5,000	0.2	$5,000
Agriculture																					
1	Irrigation Metering Demonstration Project	0.2	$10,000	0.2	$10,000																
2	Irrigation Metering and Reporting Enforcement											0.2	$5,000	0.2	$5,000	0.2	$5,000	0.2	$5,000	0.2	$5,000
3	Irrigation Metering Incentives and Technical Assistance											0.2	$50,000	0.2	$50,000	0.2	$50,000	0.2	$50,000	0.2	$50,000
4	Irrigation Water Purveyor Conveyance Efficiency Education and Demonstration	0.2	$10,000	0.2	$10,000	0.2	$10,000	0.2	$10,000	0.2	$10,000										
5	Irrigation Water Purveyor Water Conservation Plan Requirement											0.1	$10,000	0.1	$10,000	0.1	$10,000	0.1	$10,000	0.1	$10,000
6	Irrigation Water User Workshops	0.2	$50,000	0.2	$50,000	0.2	$50,000	0.2	$50,000	0.2	$50,000										
7	Agricultural Climate Station Network Development											0.2	$10,000	0.2	$10,000						
Golf Courses																					
1	Irrigation Design and Construction Contractor Registry													0.1	$5,000	0.1	$5,000				
	Total	2.1	$146,000	2.1	$186,000	1.4	$167,000	1.4	$167,000	1.4	$167,000	1 (1.4)	$85,000 ($135,000)	1.6 (2)	$135,000 ($185,000)	1.4 (1.8)	$125,000 ($175,000)	1.6 (2)	$135,000 ($185,000)	1.6 (2)	$135,000 ($185,000)

7.2.3.1 Drinking Water State Revolving Funds (DWSRF) (EPA, 2012)

In 1996, the Safe Drinking Water Act established the Drinking Water State Revolving Fund to help finance drinking water infrastructure improvements by providing low-cost loans (0 percent to market rate and repayment terms of up to 20 years) and other types of assistance. These funds are available to both privately and publicly owned systems and favor small and disadvantaged communities, as well as those who emphasize prevention as a tool for ensuring safe drinking water.

States have the option of providing up to 30% of the grant to provide assistance to disadvantaged communities (i.e. lower interest rates, principal forgiveness, or negative interest rate loans). States also have the authority and flexibility to use up to 10% of its grant to any of the following:

- Support its State drinking water program
- Develop and implement capacity development, source water protection, and operator certification

They can use up to 2% of the grant to provide technical assistance to systems serving communities with populations fewer than 10,000.

7.2.3.2 U.S. Bureau of Reclamation

The United States Department of the Interior Bureau of Reclamation WaterSMART grants (USBR, 2012) provides the following cost-shared grants:

- Water and Energy Efficiency
- System Optimization Review
- Advanced Water Treatment and Pilot and Demonstration Project
- Develop Climate Analysis Tools

This program is not currently authorized for use in Hawaii. However, the WaterSMART program could also apply if federal rules were changed to authorize application of this program in Hawaii. WaterSMART has been used widely for agricultural projects in Reclamation states.

Other Reclamation programs like Title XVI have been authorized for use in Hawaii, so there is a precedent for a possible change in federal program rules to expand the geographic reach of Reclamation programs. This rule change would likely require congressional lobbying from the state of Hawaii.

The Title XVI Program (Water Reclamation and Reuse) was established in 1992 and allows the Secretary of the Interior to do the following (USBR, 2009):

- Investigate and identify opportunities for water reclamation and reuse of wastewater
- Design and construct demonstration and permanent facilities to reclaim and reuse wastewater
- Conduct research for the reclamation of wastewater and naturally impaired ground and surface waters

To apply for this program, projects need to conduct a feasibility study among other requirements. The Title XVI program has been used widely for municipal projects.

7.2.3.3 Non-profit Group Grants

The Turner Foundation, Inc., was founded in 1990 as a private family foundation committed to preventing damage to water, air, and land. It provides invitation-only grants to those protecting rivers, lakes, wetlands, aquifers, oceans and other water systems from contamination, degradation, and other abuses, as well as other areas (Turner Foundation, Inc., 2012).

Hawaii Community Foundation is a public, statewide, charitable services and grantmaking organization supported by donor contributions for the benefit of Hawaiʻi's people. There may be opportunities for water conservation implementation funding from this organization.

7.2.3.4 Military

There are a number of possible funding sources for water conservation projects on military installations, including the following:

- U.S. Army Corps of Engineers project funding – There may be funding available funding from the U.S. Army Corps of Engineers for the planning, and implementation of water conservation projects.
- Performance contracting – This is where a private contractor partners to capitalizes the investment of a water savings technology, and the savings are used to reimburse the initial capital investment plus profit.
- Federal Energy Management Program – There may be some funding available to implement the water savings goal of 20 percent water use intensity reduction, as identified in Executive Orders. In addition, various branches of the military have "Net Zero Water" installation goals, which may be eligible for funding.
- U.S. Department of Energy funding – Certain types of water savings will also save energy, especially end uses of hot water. These water savings technologies may be eligible for funding support through a partnership with the U.S. Department of Energy.

7.2.3.5 U.S. Department of Agriculture

The United States Department of Agriculture Natural Resources Conservation Service Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers to help plan and implement conservation practices. This program also helps agricultural producers to meet Federal, State, and local environmental regulations (NRCS, 2012a).

The United States Department of Agriculture Natural Resources Conservation Service Agricultural Water Enhancement Program (AWEP) provides financial and technical assistance to agricultural producers to enhance surface and ground water conservation, as well as improve the water quality. This program is considered a partnership, not a grant (NRCS, 2012b).

7.2.3.6 State of Hawaii

Capital Improvement Project funding may be available to a variety of capital intensive water conservation projects.

7.3 Near Term Actions to Launch the Water Conservation Program

Given its limited financial and personnel resources, CWRM's goal is to achieve early, small successes in water conservation. Once the Hawaii Water Conservation Program is established and early goals achieved, program expansion will be pursued. The near-term water conservation program would involve four main tasks.

Implementation of Priority Programs: CWRM will develop a detailed work plan for the prioritized near-term program elements and begin the implementation of these programs. Programs will involve members of the WCAG and may include work in all Counties.

Funding: CWRM will also seek out sources of funding to implement incentive-based program elements. Should funding become available, CWRM will work with water utilities to develop incentive programs – either rebates, give aways, or direct replacements of high water use fixtures or appliances. This would be targeted or competitive through a request for proposals. Once a program is developed and a partner selected, memoranda of agreement will be executed to ensure program procedures are followed and successful water savings is achieved.

WCAG Continuation: CWRM will continue to collaborate with the WCAG through proposed annual meetings (at a minimum) to evaluate water conservation program efficacy, share information, and to identify new opportunities for partnerships. One option is to develop a memorandum of understanding among willing WCAG organizations to demonstrate willingness and commitment to water conservation. A detailed description of options for continuation of the WCAG immediately follows this section.

Policy Research and Development: CWRM will monitor State of Hawaii Legislative initiatives and respective County Council proceedings promoting water conservation and make appropriate comments to support these efforts (e.g., Resolution to promote LICH BMPs). CWRM will also work on furthering Other Policy Actions as listed in Section 7.1.3.

7.4 Future of Water Conservation Advisory Group

The establishment of and workshop approach with the WCAG to develop the Statewide Water Conservation Plan was an effective process for gaining needed insights and guidance on the plan. It is envisioned that much of the collaboration that was established during the planning process will continue as BMPs are implemented, but could also continue indefinitely through the creation of a sustained WCAG that provides ongoing guidance and feedback as the water conservation program matures over time. In particular, the WCAG can be instrumental in building upon the momentum gained during the plan development process and immediately begin to provide CWRM input into the work plan that will be developed for priority programs.

For the WCAG to continue, the following considerations are offered to aid in the adoption of a formal, standing committee:

1. Maintain a cross-section of water users and stakeholders
2. Establish committees along functional areas to support CWRM program development needs
3. Define a process for how representatives are chosen
4. Establish a leadership structure and related roles (chair, vice chair, secretary, etc.)
5. Rotate leadership on a planned, recurring schedule (staggered 2-year terms)
6. Clearly define committee roles (advisory) and expectations for participation (attend some percentage of meetings, etc.)
7. Establish meeting calendar, location, and agenda topics well in advance

Advisory groups, such as the WCAG, are an excellent way to foster mutual understanding, share in the development and “ownership” of projects or programs as technologies change and markets mature, and engage stakeholders as future participants. However, managing a successful committee requires considerable staff investment, consistent leadership and communication, and steady effort to keep committee members engaged. It is not uncommon for standing committees to lose effectiveness over time unless a sustained investment, clear purpose, and the introduction of relevant topics remains at the forefront of the committee’s work.

One possible way for the group to demonstrate and maintain their commitment and participation is through the development of a Memorandum of Understanding (MOU), which would be signed by all members of the WCAG, including the State. An example of a successful conservation organization with an MOU (and dues paying members) is the California Urban Water Conservation Council (CUWCC). THE CUWCC MOU could be adapted for Hawaii with further input and modifications where necessary prior to implementation.

7.5 Water Conservation Plan Review and Update

As the Hawaii Water Conservation Plan is implemented and promulgated, its progress and applicability should be evaluated based on its effectiveness in increasing the efficiency of water use and the amount of resources needed or expended to achieve these goals. Many factors affecting water can alter the expected outcomes of this Plan. New technologies and regulatory frameworks can have great influence on how water is used in different sectors. Unforeseen local or statewide events, such as natural disasters, can also have impacts on water supply and demand. External factors such as abrupt climate change, world oil prices or international conflicts can also indirectly impact how the community thinks about water.

The Hawaii Water Conservation Plan should be reviewed every five years and CWRM should budget accordingly for these updates. The Plan should be evaluated based on the following criteria:

- Implemented program/policy efficacy and cost (post-audit)
- Applicability of and continuing need for recommended programs
- Level of collaboration and cooperation between program partners
- Overall water savings
- New technologies or regulations
- Goals and objectives met
- Validity of WCAG or substitute organization
- Other applicable factors

SECTION 8

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Appendix A
Meeting Agendas, Notes, Materials/Handouts, and Presentations

Water Conservation Advisory Group Meeting

May 23, 2011, 1:00 pm – 4:00 pm

Agenda

Time	Item	Lead
1:00 – 1:30	Welcome and Introductions • *Name and Affiliation* • *Overview of Water Conservation Advisory* Group	Neal Fujii
1:30 – 1:50	Project Overview • *Project Vision* • *Scope of Work* • *Schedule*	Neal Fujii and Ross Kaneko
1:50 – 2:20	Role of Water Conservation Advisory Group • *Role of the WCAG in completing the project* • *Expectations of the WCAG members*	Wendy Nero
2:20 - 2:30	Break	
2:30 – 3:00	Preliminary Water Use Data Review • *Water use by island* • *Water use by type* • *Data gaps*	Wendy Nero
3:00 – 3:45	Water Conservation Goals Discussion	Wendy Nero
3:45 – 4:00	Wrap up and Next Steps	Ross Kaneko

Location:

Dept. of Accounting and General Services

Kalanimoku Building, Room 322B

1151 Punchbowl Street

Honolulu, HI 96813

State Water Conservation Advisory Group (WCAG) Meeting #1

Date: **23 May 2011**

Time: **1:00-4:00 pm HST**

Location: **Kalanimoku Building, Room 322B**

Attendees: Neal Fujii, CWRM
Jeremy Kimura, CWRM
Lenore Ohye, CWRM
Bill Tam, CWRM
Debbie Solis, Army Corps of Engineers
Wendy Nero, CH2M HILL
Ross Kaneko, CH2M HILL
Alyssa Smith, CH2M HILL
See attached list of WCAG attendees

Due to competition for fresh water, increasing population and development pressures, the sustainable movement, and the impacts of global climate change requiring Hawaii to become as efficient as possible in its uses of fresh water, the Army Corps of Engineers in partnership with the State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) have determined that a water conservation plan for the State of Hawaii should be established. As part of this effort, a Water Conservation Advisory Group (WCAG) – made up of experts from each water use sector – was formed to assist in policy and program development. It is anticipated that the WCAG will meet a total of six (6) times throughout the duration of the project. The first meeting was convened on May 23, 2011, and the following summarizes and documents the activities of the meeting.

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List of Acronyms

Acronym	Organization
BWS	City and County of Honolulu Board of Water Supply
DAGS	Hawaii Department of Accounting and General Services Central Services Division
DBEDT	Hawaii Department of Business, Economic Development, and Tourism Energy Office
CWRM	Hawaii Department of Land and Natural Resources Commission on Water Resource Management
DOE	Hawaii Department of Education
HDOA	Hawaii Department of Agriculture
HDWS	County of Hawaii Department of Water Supply
HFB	Hawaii Farm Bureau
HGCSA	Hawaii Golf Course Superintendents Association
HHLA	Hawaii Hotel & Lodging Assoc
KDOW	Kauai County Department of Water
KS	Kamehameha Schools
LICH	Landscape Industry Council of Hawaii
MCBH	Marine Corps Base Hawaii, Kaneohe
MDWS	Maui County Department of Water Supply
MTA	Mililani Town Association
NAVFAC	Naval Facilities Engineering Command, Hawaii
OHA	Office of Hawaiian Affairs
UHM CTAHR	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources
USACE	United States Army Corp of Engineers
USAG HI	United States Army Garrison Hawaii
USDA NRCS	United States Department of Agriculture- Natural Resources Conservation Service
WCAG	Water Conservation Advisory Group

Meeting Summary

1. Welcome and Introductions (Neal Fujii/Debbie Solis)- Neal initiated introductions of the project team and asked WCAG members to provide a short background about their organization and their interest in this project.

- Introductions

  Neal Fujii- Explained the reasons for CWRM to initiate this project.

  Debbie Solis- Introduced the role of the Army Corp of Engineers (they have a mission to help with flood control, commercial navigation, and water resources).

  Ross Kaneko- project manager from CH2M HILL Honolulu; introduced Jason Smesrud and Brian Skeens (team members not present).

  Wendy Nero- From the CH2M HILL Tampa Bay and Orlando offices; has a background in environmental science and M.S. in water resource planning; spent 25 years in the water

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industry between a state regulatory agency, water utility, and a private consulting firm; participated in water conservation plans at all scales across the nation.

Alyssa Smith – project engineer from CH2M HILL Honolulu.

Darrel Yagodich (Hawaiian Homelands)- Hawaiian Homelands maintains 3 water systems that service homelands and commercial properties.

Bill Nutting (MCBH)- BWS supplies the MCBH Kaneohe and outlying areas rely on the Navy water systems; MCBH Kaneohe reuses treated wastewater effluent on their golf course (Klipper).

Kekoa Willing (HGCSA)- he is the current Treasurer of HGCSA.

Bob Lillie (HGCSA)- he is the past President of HGCSA.

Boyd Ready (LICH)- he is the past President of LICH with 25 years in the landscaping industry; LICH recently finished a public survey for recommended BMP's; the Governor proclaimed July as Landscape Industry Council Water Conservation month.

Warren Watanabe (Hawaii Farm Bureau)- he is representing farmers'/ranchers' interest statewide.

Howard Wiig (DBDET)- DBDET sees a direct correlation between energy efficiency and water efficiency.

Mike Hayama (USDA Natural Resources Conservation Service)- USDA NRCS provides technical and financial assistance to farmers and ranchers.

Russell Okita (NAVFAC)-NAVFAC maintains 5 water systems on Oahu.

Greg Hayashi (NAVFAC)- NAVFAC also maintains the PMRF system on Kauai.

Amy Brinker (Sierra Club)- she is representing the Sierra Club for Robert Harris; she is also a part of KYA Sustainability Studio.

Kevin Murphy (MTA)

Allen Wolfe (USAG HI- Housing)- Army Garrison Hawaii water is supplied by BWS, Navy systems, and Army-owned systems.

Carl Evensen (UH CTAHR)- he is currently the interim associate dean for cooperative extension and representing the interests of agricultural water use.

Lauren Roth Venu (Roth Ecological Designs)- she is currently serving as the committee chair for the CCH Water/Wastewater Sustainability Task Force; she is also representing Roth Ecological, which designs natural water and wastewater treatment systems.

Ross Lum (DOE)

Corey Shibata (DAGS Central Services)- DAGS CSD maintains state office buildings and has recently installed low-flow fixtures and pervious concrete.

Lenore Ohye (CWRM)

Bill Tam (CWRM)- Deputy Director of Commision on Water Resource Management

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Tina Yamaki (HHLA)- HHLA is a trade organization that represents hotels and lodging properties statewide.

Brian Kau (HDOA)- HDOA manages irrigation systems statewide, as well as agriculture lands.

Jocelyn Doane (OHA)- OHA is a state agency created in 1978 that is committed to improving the lives of native Hawaiians.

Faith Shiramizu (Kauai DOW)- she is representing Kauai DOW and is focusing on conservation initiatives.

Cat Sawai (BWS)

Tui Anderson (Maui DWS)- he is representing Maui DWS and is focusing on conservation initiatives.

Kanani Aton (Hawaii DWS)- she is representing Hawaii DWS and is focusing on conservation initiatives.

Elson Gushiken (ITC Water Management)- ITC is a 33 year old design-build firm focusing on agricultural water planning; he has been involved with water reuse for 27 years, has participated on WEF and AWWA committees for 17 years and participated on committees creating water use guidelines for the State of Hawaii, as well as gray water reuse guidelines.

- Overview of Water Conservation Advisory Group

  Neal noted that the WCAG includes 27 organizations, and while many more were considered, members were selected based on the following criteria:
  - Large water users
  - Water providers
  - Those with water conservation programs
  - Perceived potential for water savings
  - Ability to implement water conservation policies
  - Commitment to water conservation
  - Expertise in different areas
  - Diversity in use sectors

  Neal emphasized the CWRM is not going to dictate or mandate policies, rather they are looking to work collaboratively with all members.

2. Project Overview (Neal Fujii/Ross Kaneko)

   The project's vision, scope of work, and general schedule were presented to the WCAG. Details are provided in the attached pdf copy of the PowerPoint presentation used at the workshop.

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3. Role of Water Conservation Advisory Group (Wendy Nero) – CH2M HILL outlined the roles and responsibilities of the WCAG over the course of the project, and solicited from WCAG members their expectations for the project and the State Water Conservation Plan.

- Role of the WCAG in completing the project
    - Provide subject matter input
    - Assist with policy and program development
    - Review and comment on the State Water Conservation Plan
- Discussion by WCAG members:

Cat Sawai (BWS)- BWS recently completed a comprehensive water conservation plan, which will be available sometime in June.

Carl Evensen (UH CTAHR) – he noted that a USGS representative as a member on the WCAG was not present.

- Neal/Debbie: There should be a representative added to the group; USGS will be valuable since they've been collecting data for a 5-year estimated water use database in the US.

Lauren Roth Venu (Roth Ecological Designs) – She noted there are water/wastewater committee report recommendations going through City Council and will be available in a couple of months, which could provide useful information to the plan.

Howard Wiig (DBDET) – He noted some people involved with building and plumbing codes are discussing gray water policies and diversions of rain water on roofs; he would like to see those types of policies built into the building/plumbing codes.

Neal Fujii asked for input on the energy/water nexus

- Howard Wiig- He notes there's a significant reliance on energy/oil from abroad.

- Lauren Roth Venu- She's read a report where California did a study that discovered 20% of energy costs are attributed to water conveyance.

- Cat Sawai- She suggests looking at customer surveys and notes that HECO has done many, which might be useful information for the plan.

Bill Tam- He feels that there should be a focus on water quality, soil/water conservation, recharge issues, and a reduction of urban run-off and pollution.

Elson Gushiken- He notes the project team may want to look at water reuse, reclaimed water, and constituents of concern. Oahu has a "no pass zone" for which recycled water is not approved for use- he's wondering if this can be changed.

Kekoa Willing/Bob Lillie- From the standpoint of the HGCSA, they are looking to reduce the quantity of water used.

Darrell Yagodich- he provided some comments regarding the impact of agriculture:

- There's a decrease in water recharge with the demise of sugar.

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- Pumping costs are expensive (80% of electric costs are associated with pumping).

- There have been cases of extreme leakage in the system (reported losing 200,000 gal/day in pipes due to a leak).

He also noted they do not currently have a conservation plan.

Jocelyn Doane- she wasn't sure what is meant by a water conservation plan

- Wendy: Water conservation plans typically focus on the end use of water and work up from that. Beneficial reduction in water use differs by perspective, i.e. water utilities- cost; golf courses- business; homeowner/environmental- quality of life/preserve culture. This particular plan will not encompass source protection or be centralized around energy savings.

Boyd Ready- He had a few thoughts to share:

- Energy: Since it costs money to move water uphill, then maybe look at generating energy when moving water downhill (i.e. micro-turbines).

- He noticed the proportion of private vs. public entities is 15% to 85%, respectively; he's interested in who controls the majority of water use.

- He recently attended a conference in Phoenix that discussed retaining water on-site and percolating which involves re-landscaping all urban built spaces.

- Wendy: She noted to examine the existing population of users and future development. Some water conservation measures could include financial incentives/dis-incentives, regulatory requirements, and education (which will lead to behavior or technology/process changes).

Bill Tam- He mentioned the opportunity costs of not enforcing or promoting conservation measures might be good to research.

Carl Evensen- He mentioned there's concern regarding the watershed management on Lana'i to enhance supply. Apparently some wells have broken the lens and the County is looking to use reverse osmosis as a treatment possibility.

Bill Tam- He noted that restoring the watershed will help enhance the water supply. Opportunity costs frame which conservation measures you choose.

Tina Yamaki- She mentioned the hotel industry has realized the greening of hotels is a positive market appeal to guests. HHLA has been looking at their bottom-line to cut costs by working with BWS and HECO, has been researching other industry methods, and is looking at ways to incorporate conservation measures with the community. All properties have different water conservation standards, but there is a state hotel green program, as well as national programs.

Greg Hayashi/Russell Okita- They mentioned that they would like to invite a representative from the NAVFAC energy office. NAVFAC is also under the presidential mandate to reduce water and electric usage.

Bill Nutting-MCBH is under the federal mandate to reduce water use 2% per year per square foot of buildings, which includes outdoor use.

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Corey Shibata- DAGS has installed low-flow fixtures, is looking into more energy efficient air conditioning units as funding becomes available, and has installed water sensors for irrigation, as well as irrigation sub-meters with BWS.

Lauren Roth Venu- She suggested identifying barriers with each end user to obtain a net-zero water use end goal (making the most use of water that falls onto the property while still water supplied from the utility). She also mentioned that including gray water systems and catchment into the plan will help minimize potable water use.

Tui Anderson- The County of Maui has started a water conservation plan that follows their WUDP. Some challenges they've come across involve the locations of water supply vs. water demand.

Bill Tam- He suggested examining aggregate costs (costs are externalized to others, not individuals).

> *Example: Niu Valley- Ground water was diverted into the sewer system when the highway was built. This caused an increased stress on the CCH system, which was allocated to the public aggregate balance sheet, not individual owners in the area.*

Debbie Solis asked the WCAG for input on public education

> *- Boyd Ready- He feels that the educational pathways into the landscape industry are minimal. Certified landscapers are wasting their time cleaning up after non-certified landscapers because operators don't care about the system and need training/education. He thinks there is a need for certification programs and performance standards.*
>
> *- Tui Anderson- He also noted that there's a need for homeowner education on irrigation systems.*

4. Preliminary Water Use Data Review (Wendy Nero) – CH2M HILL summarized the preliminary analyses of data received to date, and facilitated a group discussion about inaccuracies/discrepancies/gaps in the analyses.

- Water use by island
- Water use by type

Municipal

County of Hawaii (Kanani Aton):

- *She may be able to provide a list of the top 10 water users (possibly all are industrial users)*
- *HDWS' water conservation measures target large water users with educational forums, and include early childhood education.*
- *HDWS assumed the downward trend in water use is a result of the economy.*

County of Kauai (Faith Shiramizu): no comments.

County of Maui (Tui Anderson):

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- *The county's total water use is different than the given municipal data.*
    - *The HC&S sugar plantation (EMI water system) uses a peak of 160 mgd.*
        - *Warren-He comments that this is an average flow. Lately there's been a drought, so the flow hasn't been close to 160 mgd.*
        - *Neal- He reviews the weekly reports and notes that the water use is close to 160 only when there's heavy rain. Otherwise, the flow is usually less than 80 mgd.*

CCH/BWS (Cat Sawai)

- *The BWS data analysis shows residential account usage at over 500 gal/day compared to the national average of 300-400 gal/day.*
- *Cat clarified that SFD is combined with MFD in the billing data provided. According to BWS' records, their SFD water usage is approximately 300 gal/day.*
- *There is a noticeable downward trend in residential water usage from 2004-2009. Cat notes this is probably due to the installation of low-flow fixtures.*
- *BWS residential customers typically don't have dual-meters (residential/irrigation) because it's not cost effective.*

Military

- *CH2M HILL needs water use by type behind each master water meter to prepare a more complete analysis of military water use.*
- *The housing information from NAVFAC is skewed since the number of "units" per building could be a 2-plex, 4-plex, or sfd.*
- *Russell Okita to check with NAVFAC housing for more detailed information regarding what type of units are connected to each master meter.*
- *Allen noted that the Army does not meter individual homes.*
- *Russell Okita- noted historic housing in Wahiawa has individual meters. Most of the remaining PPV housing is master metered wherever possible.*
- *Army/Navy- CH2M HILL requested the Army and Navy to provide data on their non-residential uses (i.e. commercial, medical, restaurants, vehicle wash down areas, and other operations to give insight to water uses).*
- *The military water use data displayed a slight upward trend.*
    - *Bill Nutting-He noted that he submits annual total water usage numbers for the mandate. He also mentioned to look into the Defense Utilities and Energy Recording System (DUERS).*
    - *NAVFAC mentioned that their private housing contractor is billed for water use.*
    - *In 2009-2010, NAVFAC housing was privatized and re-modeled, which explains the spike in water use.*

Golf Courses

- *HGCSA is willing to help provide information for golf courses in their association.*
    - *12-month avg water usage for all golf courses*
    - *Irrigated acres for each course*
    - *All islands*

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        - *Separate water source (RWF, municipal, brackish)*
        - *Statistics on golf courses in the HGCSA*
    - *The calculated usage shown on the presentation appears low. According to the members from HGCSA, historical usage averages 500,000-600,000 gal/day for 18 holes/130-150 acres.*

Landscape

- *Boyd Ready*
    - *Conservation measures for irrigation have become inexpensive compared to prices in decades prior.*
    - *It's not feasible for residential customers to use flow sensors, but could easily use weather sensors as a replacement.*
    - *The LICH survey categorized 75 suggested BMPs into 3 categories:*
        - *Easy and cheap*
        - *Harder but should be done*
        - *Harder to do and not worth the work*

Agriculture

- *Brian Kau- He mentioned that data should be available for the East Maui Irrigation Company.*
    - *Neal- He noted sugar companies kept good records of water usage, but most systems may not be used now or have been transferred to other users. Now, it's hard to record stream diversions. Neal mentioned that CWRM needs to keep on them/motivate them to measure and report usage on a regular basis. This has lead the CWRM to create an online database system for operators to report water use, but there's still the issue of measurement.*
    - *CH2M HILL to contact Agribusiness Development Corporation for information on the Kaua'i and Waiahole Ditch systems.*
    - *Elson- He brought up that Kamehameha Schools (KS) uses their own water system in Wahiawa, not the Dole water system.*
        - *KS also owns a Punalu'u water system, the ditch system in Kohala.*
- *Tui Anderson- He noticed the Wailuku Water Company (sugar) and Island of Lana'i (critical water situation) were missing from the list of water systems.*
- *It was suggested to check the DOH Safe Drinking Water Branch database on small water systems.*
- *Lenore Ohye- She wanted to clarify what is meant by "source of water".*
    - *Wendy stated that it pertains to state waters (ground and surface). Using reclaimed water would be a conservation option.*
    - *A suggestion was made to also look at those using reclaimed water. If they do use reclaimed, do they supplement with potable (amount?).*
- *Brian Kau- Some agriculture lots are supplied by potable AND non-potable sources. To check on this, cross-reference the TMKs with DOA and BWS records.*
- *Bill Tam*
    - *He mentioned CCH's consent decree, which will require the 2 largest WWTPs to be upgraded to secondary treatment in 2024 and 2035; this may allow for the effluent to be reused as a future source of water.*
    - *He also mentioned another aspect of conservation is the impact on surface water. Water conservation is more than examining the efficiency of the end use, but to focus on the overall utility of the resource.*

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- *Elson Gushiken- He wonders if the state is surveying or keeping an inventory of the dams and reservoirs statewide. If so, has someone determined the amount of water being used or their current capacities.*
  - *Bill Tam- There are 138 regulated dams and 183 unregulated dams based on the DLNR guidelines. Most reservoirs were used for old plantations, but are no longer maintained or monitored. There is currently a dams and reservoirs study in place with Oceanit. Private owners are required to submit water usage amounts but CWRM is backlogged for 2 years.*

- Data gaps

  Data collection needs to be completed by the end of June 2011.

5. Water Conservation Goals Discussion (Wendy Nero) – Goals the WCAG have for this plan or what they'd like to see in the end product.

Bill Nutting
- *Establish benchmarks to compare the existing water use to other standards from different industries.*

Kanani Aton
- *Establish efficiency standards for old systems (conveyance), distribution systems, and ag conveyance.*
- *Focus on the low hanging fruit (i.e. since the dry sides of islands use 3x more water, focus on preserving the water on the wet side of islands; focus on commercial users, not domestic; focus on biggest users, not the insignificant users).*
- *Focus on getting the biggest bang for your buck.*

Tui Anderson
- *Maui's biggest challenge is that their highest demand is in an area where they have the lowest supply (Upcountry and South-side).*
- *Focus on cost effectiveness by examining resource driven priority areas.*
  - *Wendy: With residential/ag uses on the dry side of the island and expensive source water, there's a possibility for onsite reuse.*

Tina Yamaki
- *She would like to share best practices between industries since the hotel industry has high standards and is one of the bigger users.*
  - *Wendy: Noted to focus on incentives and accomplishments of industries.*

Cat Sawai
- *BWS is focusing on larger users, not the largest demographic.*
  - *Wendy: Examine goals by customer class or type of use.*
- *Research supply-side conservation measures for municipalities with demand in mind.*

Kanani Aton
- *She mentions to include energy savings with water savings by user.*

Garrett Matsunami
- *He would like to identify partnership opportunities. Castle & Cooke is estimating a cost of $40 million to send wastewater from their development to Honouliuli WWTP for treatment and disposal. Looking instead for a partnership to build a WWRF near their development, and provide R-1 water to golf courses or public parks for irrigation (thereby displacing potable use).*
  - *Wendy: Willingness to partner helps facilitate conservation practices.*

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Bill Tam

- *He mentioned to examine discrete areas such as Kona vs. Hilo, versus the more general Hawaii Island. Try to judge the system and resources for each area accordingly.*

Carl Evensen

- *Focus on educating the operators, but will need resources to follow through.*

Boyd Ready

- *He wants to establish a baseline for systems with devices and those without. Then benchmarks can be created by either device type or number of devices used on that system.*
  - *Wendy:*
    - *Use benchmarks to establish the process of implementing goals.*
    - *Education as a measure is hard and expensive, but is important. Another water conservation measure option is to do irrigation audits on a regular basis.*

Warren Watanabe

- *He wonders if the state is committed to agriculture since they keep requesting water reductions.*
  - *Wendy: Focus on distinguishing between water conservation and water efficiency. We need to know the current/existing water usage to determine goals. If agriculture is expected to grow, how can you plan for conservation?*

Bill Nutting

- *He suggests examining incentives similar to those effective for energy. There's also a correlation with energy, water, and crops, which can provide more options for water conservation measures.*
- *Focus on reducing water use during peak demand period (5-9pm).*

Jocelyn Doane

- *She suggested including source augmentation to accommodate for a future increase in population and food security.*

Bill Tam

- *He discussed the restoration of irrigation reservoirs and that reservoirs are a key piece of water storage, recharge, and use. Since the average rainfall has decreased, reservoirs are important.*
  - *Wendy: Examine the comparison between population and ag source development.*

Tina Yamaki

- *She requested that an education link be added to the CWRM website for water conservation information.*

Tui Anderson

- *He suggested that legislation and regulation may be a necessary consideration.*

Amy Brinker

- *She suggested doing a cost benefit analysis (i.e. she did a university water audit on toilets). The savings become apparent when examining the return on investment.*
- *She also mentioned that public/private partnerships help make measures easier.*

Bill Nutting

- *The federal mandate requires that all DoD agencies annually conduct comprehensive energy/water audits of those facilities that represent 75% of the water consumption.*

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6. Wrap up and Next Steps (Wendy Nero)

7. Action Items

- Honolulu BWS: provide a copy of the Brown and Caldwell comprehensive study
- Lauren Roth Venu: provide copies of the CCH water and wastewater reports
- HHLA: provide a copy of the state green hotel program and any other national programs being used in Hawaii
- MCBH/NAVFAC/Army Garrison:
- *Provide copies of the DUERS or annual reports of water usage for the past 5 years*
- *Provide site plans (types of buildings per master meter) of major bases*
- *Provide types of housing units*

- HGCSA: Provide statistics and water usage information for golf courses within the association
- Hawaii Farm Bureau/HDOA: agricultural data/contacts on Maui
- CH2M HILL:
- *Collect information on the the building and plumbing codes for each county*
- *Revise the water use profiles for residential data (separate SFD and MFD water usage)*
- *Review 2010 census data*
- *Complete data acquisition by June 30*

If there are any necessary corrections or additions, please contact me via email at Ross.Kaneko@ch2m.com or you can reach me on my office line at 808-440-0225, or my cell phone at 808-554-3791.

Respectfully submitted,

Ross A. Kaneko

Attachments:
- Attendance list
- Flip Chart Notes
- Project team contact list
- WCAG Meeting #1 Presentation

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Water Conservation Advisory Group Meeting #1 (5/23/2011)
List of Attendees

Last Name	First Name	Organization	Email Address
Anderson	Tui	Maui County Department of Water Supply (MDWS)	tui.anderson@mauicount.gov
Aton	Kanani	County of Hawaii Department of Water Supply (HDWS)	Katon@hawaiidws.org
Brinker	Amy	Sierra Club/KYA Sustainability Studio	abrinker@thekyastudio.com
Doane	Jocelyn	Office of Hawaiian Affairs (OHA)	jocelynd@oha.org
Evensen	Carl	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources (UHM CTAHR)	evensen@hawaii.edu
Gushiken	Elson	ITC Water Mgt, Inc	elson@itcwater.com
Hayama	Michael	United States Department of Agriculture- Natural Resources Conservation Service (USDA NRCS)	michael.hayama@hi.usda.gov
Hayashi	Greg	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	greg.hayashi@navy.mil
Kau	Brian	Hawaii Department of Agriculture (HDOA)	brian.k.kau@hawaii.gov
Lillie	Robert	Hawaii Golf Course Superintendents Association (HGCSA)	robert.lillie@us.army.mil
Lum	Ross	Hawaii Department of Education (DOE)	ross_lum@notes.k12.hi.us
Matsunami	Garret	Castle & Cooke	gmatsunami@castlecook.com
Murphy	Kevin	Mililani Town Association (MTA)	kmurphy@mililanitown.org
Nutting	Bill	Marine Corps Base Hawaii, Kaneohe (MCBH)	william.nutting@usmc.mil
Okita	Russell	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	russell.okita@navy.mil
Ready	Boyd	Landscape Industry Council of Hawaii (LICH)	boydready@akahisvc.com
Roth Venu	Lauren	Roth Ecological Design	lauren@rothecological.com
Sawai	Cat	City and County of Honolulu Board of Water Supply (BWS)	csawai@hbws.org
Shibata	Corey	Hawaii Department of Accounting and General Services Central Services Division (DAGS CSD)	corey.b.shibata@hawaii.gov
Shiramizu	Faith	Kauai County Department of Water (KDOW)	fshiramizu@kauaiwater.org
Solis	Debbie	United States Army Corp of Engineers (USACE)	deborah.a.solis@usace.army.mil
Tam	Bill	Hawaii Department of Land and Natural Resources Commission on Water Resource Management (DLNR CWRM)	william.tam@hawaii.gov
Watanabe	Warren	Hawaii Farm Bureau	warrenmcfb@hotmail.com
Wiig	Howard	Hawaii Department of Business, Economic Development, and Tourism Energy Office (DBEDT)	hwiig@dbedt.hawaii.org
Willing	J. Kekoa	Hawaii Golf Course Superintendents Association (HGCSA)	nmgckekoa@hawaii.rr.com
Wolfe	Allen	United States Army Garrison Hawaii (USAG HI)	allen.wolfe@us.army.mil
Yamaki	Tina	Hawaii Hotel/Lodging Assoc	tyamaki@hawaiihotels.org
Yagodich	Darrell	Hawaiian Homelands	darrell.c.yagodich@hawaii.gov

Flip Chart Notes

Expectations:

- BWS Conservation Plan
- USGS participation
- W/WW Report (CCH)
- Bldg Codes
    - Gray water
    - Catchment
- Energy-Water Nexus
    - Energy Audit- utilities
    - Biofuels
- Motivators for customers
- Water quality implications
- Reuse regulations- impacts on conservation
- Golf courses- good neighbors
- Loss of ag- impacts on recharge
    - Leakage
    - Pumping costs
- WCAG
    - 15% private
    - 85% public
- Opportunity cost of not doing this
    - Source water quality
- Watershed enhancement- increase supply
- State's "hotel green" program
- Presidential mandate: 2% water use reduction/yr/ building sf
- Net-zero water use
    - How to get there
    - Barriers
- Maui County- conservation plan to follow WUDP

    - Conservation = source
- Public costs
    - Niu valley- ENV example
- Training for landscape maintenance staff
    - Homeowners also
- Defense utilities energy reporting system
- Golf courses: differentiate between those above potable aquifer
- Kamehameha ag
    - Wahiawa
    - Punaluu
    - Kohala ditch
- Conservation impact on in-stream flows
- DOH-SDWB: small systems

<u>Goals:</u>

- Benchmarks
- Water distribution efficiency
- Focus on biggest users
    - Biggest bang for your buck
    - Cost effectiveness
    - Resource driven priority areas
- Sharing best-practices
- Incentives/recognition
- Goals by type of use
- Include energy savings
- Supply-side (municipal)
- Partnership opportunities
    - C&C Koa Ridge
- Education
    - Target groups and resources

    - Marketing
    - Electronic media-easy access
- Interface with general plan and community plan
- Peak demand period
- Resource protection
- Legislation/regulation
- Short-, mid-, long-term

Water Conservation Plan
Project Team Contact Information

Last Name	First Name	Organization/Company	Phone	Email
Fujii	Neal	CWRM	587-0264	neal.d.fujii@hawaii.gov
Kimura	Jeremy	CWRM	587-0269	jeremy.l.kimura@hawaii.gov
Ohye	Lenore	CWRM	587-0216	Lenore.N.Ohye@hawaii.gov
Solis	Debbie	USACE	438-0701	Deborah.A.Solis@usace.army.mil
Kaneko	Ross	CH2M HILL	440-0225	ross.kaneko@ch2m.com
Madison	Mark	CH2M HILL	(503)736-4453	mark.madison@ch2m.com
Nero	Wendy	CH2M HILL	(813)874-0777	wendy.nero@ch2m.com
Skeens	Brian	CH2M HILL	(678)530-4327	brian.skeens@ch2m.com
Smesrud	Jason	CH2M HILL	(503)736-4372	jason.smesrud@ch2m.com
Smith	Alyssa	CH2M HILL	440-0207	alyssa.smith@ch2m.com

Development of State Water Conservation Plan

Water Conservation Advisory Group Meeting

May 23, 2011

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US Army Corps of Engineers

Agenda

- Welcome and introductions
- Project overview
  - Background, vision, scope and schedule
- Role of Water Conservation Advisory Group
  - Composition, input and expectations
- Preliminary data review
  - Water use by island, data gaps
- Water conservation goals
- Next steps

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Project Overview- Background

Commission on Water Resource Management

- The Commission on Water Resource Management (CWRM) administers the State Water Code, which was created by the 1987 Hawaii State Legislature
- CWRM's general mission is to protect and enhance the water resources of the State of Hawaii through wise and responsible management

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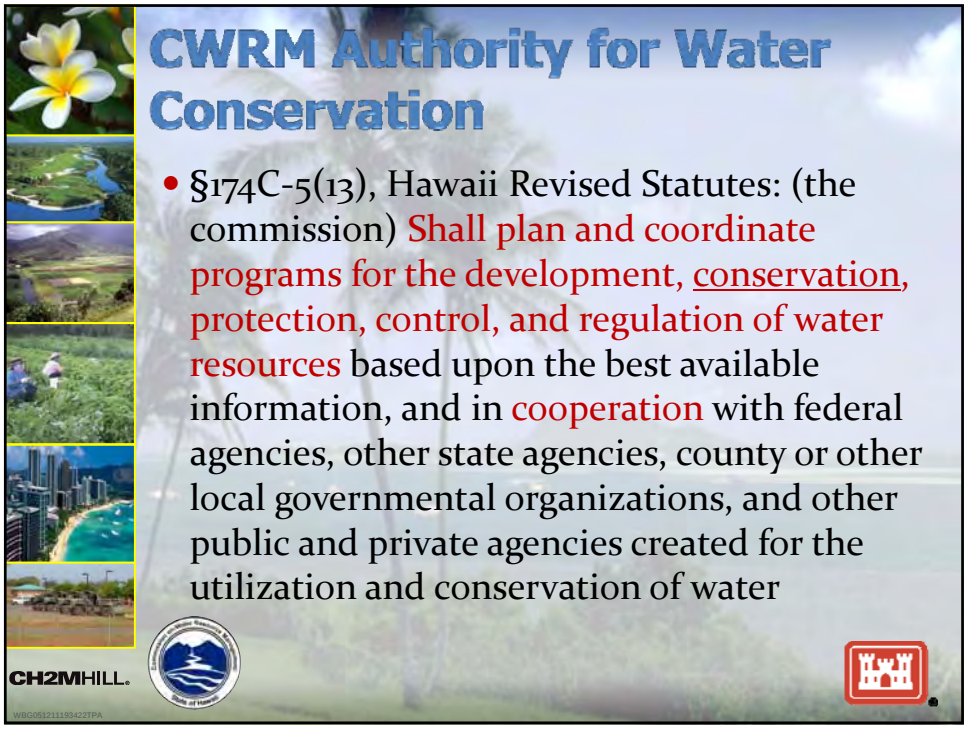
CWRM Authority for Water Conservation
• §174C-5(13), Hawaii Revised Statutes: (the commission) Shall plan and coordinate programs for the development, conservation, protection, control, and regulation of water resources based upon the best available information, and in cooperation with federal agencies, other state agencies, county or other local governmental organizations, and other public and private agencies created for the utilization and conservation of water
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Growing Competition for Water

Statewide Water Conservation Project Objectives

- Develop a coordinated statewide water conservation planning strategy and policy framework
- Develop a statewide water conservation program to implement the planning and policy framework
- Work collaboratively with stakeholders to achieve water conservation objectives

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Some Important Water Use Sectors

- County water departments
- Public water systems
- Agriculture
- State government
- Military
- Landscape industry
- Golf courses
- Industrial / commercial
- Traditional & customary
- Environmental

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Project Overview-Scope of Services

- Establish a Water Conservation Advisory Group (WCAG), host regular meetings
- Establish state-wide water conservation goals, with input from WCAG
- Analyze water use sectors to determine water conservation potential and identify cost-effective water conservation measures
- Identify, evaluate and compare the effectiveness of water conservation programs and measures

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Project Overview-Scope of Services cont.

- Statewide Water Conservation Plan will include:
  - Strategic plan (goals and objectives), including short and long term considerations
  - Implementation and funding plan
    - Staff needs, funding amounts and sources, cost estimates
  - Water conservation program description
  - Outreach plan
- Framework for continued operation of the WCAG

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Project Schedule

Task	2011									2012									
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Establish Water Conservation Advisory Group																			
Establish statewide water conservation goals/objectives; develop water use profile																			
Identify water conservation measures in each sector																			
Identify, evaluate, compare water conservation programs/measures																			
Identify and develop implementation mechanisms																			
Develop Statewide Water Conservation Plan																			
Submit Draft Statewide Water Conservation Plan																			
Review Draft Statewide Water Conservation Plan																			
2nd Draft Statewide Water Conservation Plan																			
Submit Final Statewide Water Conservation Plan																			
Final presentation to CWRM																			

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Water Conservation Advisory Group (WCAG)

Water Conservation Advisory Group (WCAG) Purpose

- Guide the study efforts
- Provide subject matter input
- Assist with policy and program development
- Review and comments on the goals and State Water Conservation Plan

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Water Conservation Advisory Group (WCAG) Composition

- State and federal agencies and departments
- Municipal water suppliers
- Agricultural water users
- Military installations
- Farm Bureau
- Landscape industry
- Homeowners/home builders
- Hotel/lodging association
- Environmental interests
- Office of Hawaiian Affairs

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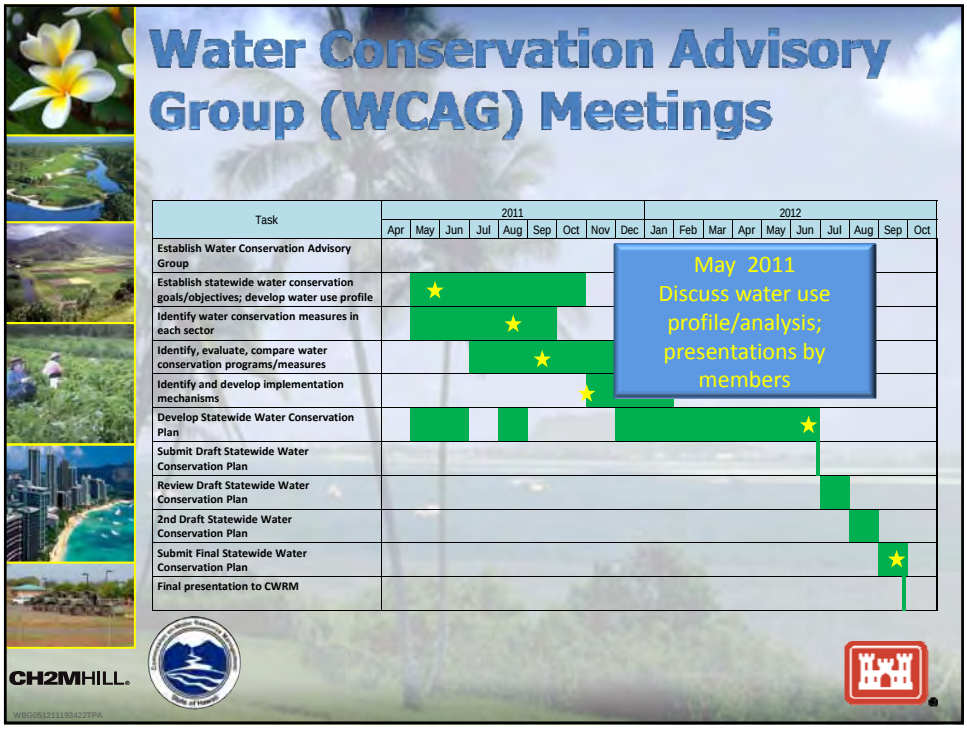
Water Conservation Advisory Group (WCAG) Meetings
Task
2011
2012
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
Establish Water Conservation Advisory Group
Establish statewide water conservation goals/objectives; develop water use profile
Identify water conservation measures in each sector
Identify, evaluate, compare water conservation programs/measures
Identify and develop implementation mechanisms
Develop Statewide Water Conservation Plan
Submit Draft Statewide Water Conservation Plan
Review Draft Statewide Water Conservation Plan
2nd Draft Statewide Water Conservation Plan
Submit Final Statewide Water Conservation Plan
Final presentation to CWRM
May 2011
Discuss water use profile/analysis; presentations by members
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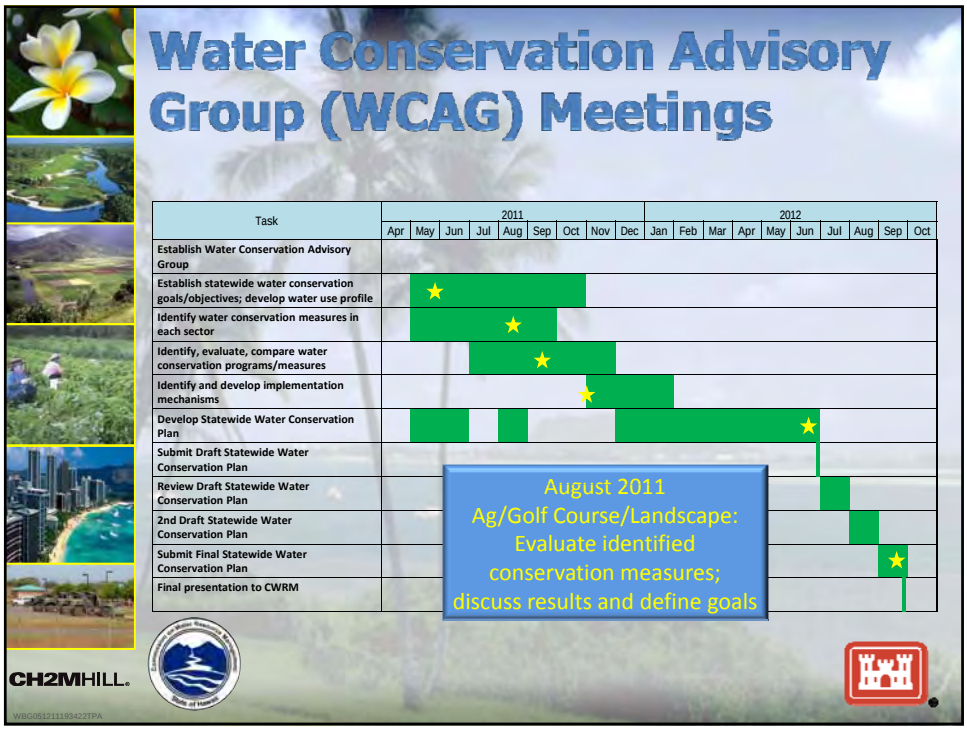
Water Conservation Advisory Group (WCAG) Meetings
Task
2011
2012
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
Establish Water Conservation Advisory Group
Establish statewide water conservation goals/objectives; develop water use profile
Identify water conservation measures in each sector
Identify, evaluate, compare water conservation programs/measures
Identify and develop implementation mechanisms
Develop Statewide Water Conservation Plan
Submit Draft Statewide Water Conservation Plan
Review Draft Statewide Water Conservation Plan
2nd Draft Statewide Water Conservation Plan
Submit Final Statewide Water Conservation Plan
Final presentation to CWRM
August 2011
Ag/Golf Course/Landscape: Evaluate identified conservation measures; discuss results and define goals
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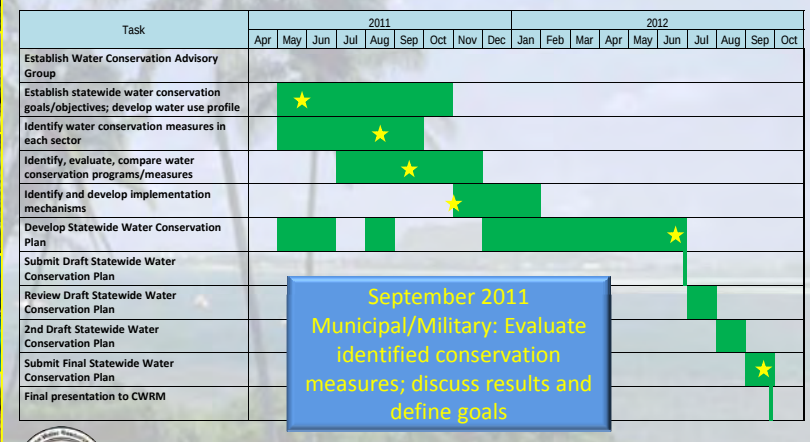
Water Conservation Advisory Group (WCAG) Meetings



September 2011
Municipal/Military: Evaluate identified conservation measures; discuss results and define goals

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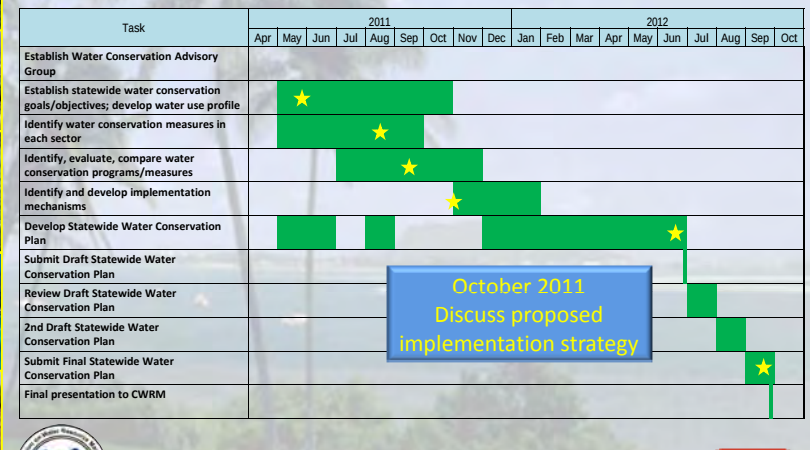
Water Conservation Advisory Group (WCAG) Meetings



October 2011
Discuss proposed implementation strategy

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Water Conservation Advisory Group (WCAG) Meetings

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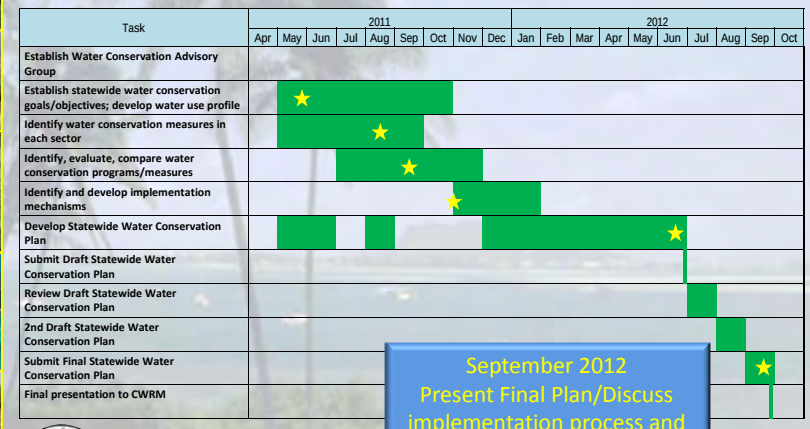
Water Conservation Advisory Group (WCAG) Meetings



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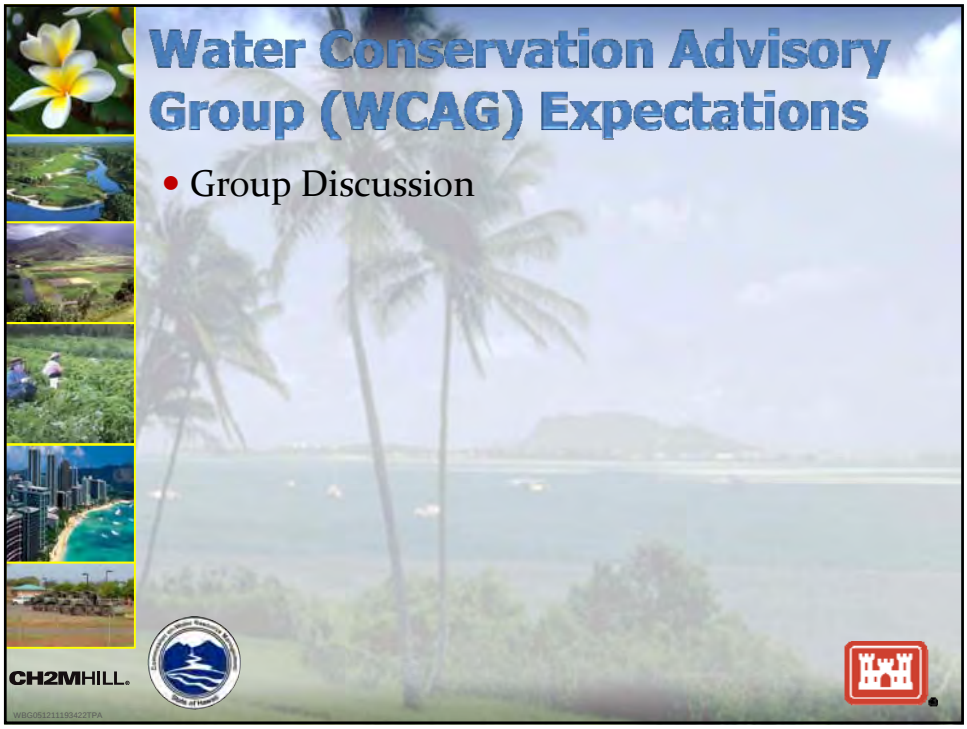
Water Conservation Advisory Group (WCAG) Expectations
• Group Discussion
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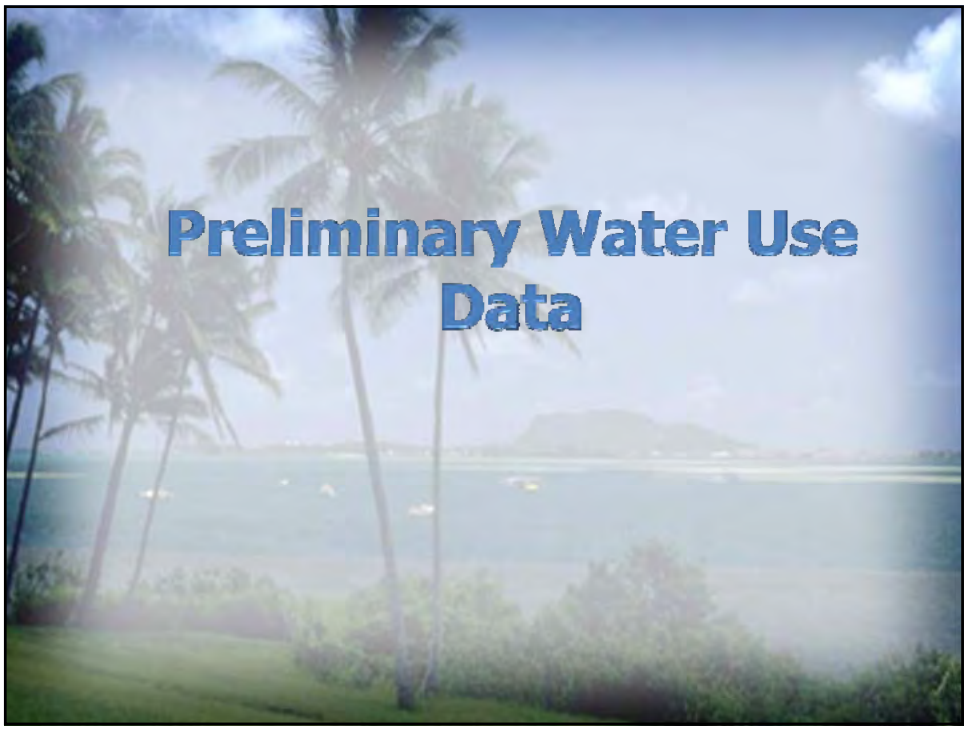
Preliminary Water Use Data

Preliminary Water Use Data

- Statewide Well Index Data
- Municipal Water Providers
- Military
- Irrigation Water Use
  - Golf courses
  - Landscape
  - Agriculture

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Statewide Well Index

- Comprehensive index of wells by Island
- Limited data available
- Provides a snapshot of "potential" water use
  - By type
  - By magnitude
  - By island

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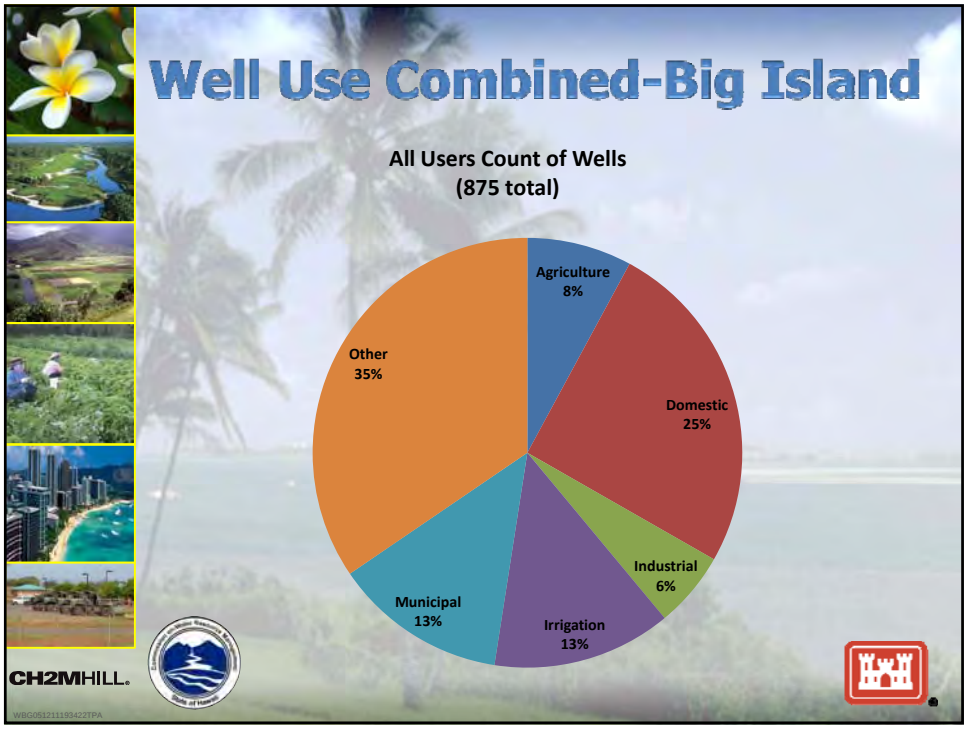
Well Use Combined-Big Island
All Users Count of Wells
(875 total)
Agriculture 8%
Domestic 25%
Industrial 6%
Irrigation 13%
Municipal 13%
Other 35%
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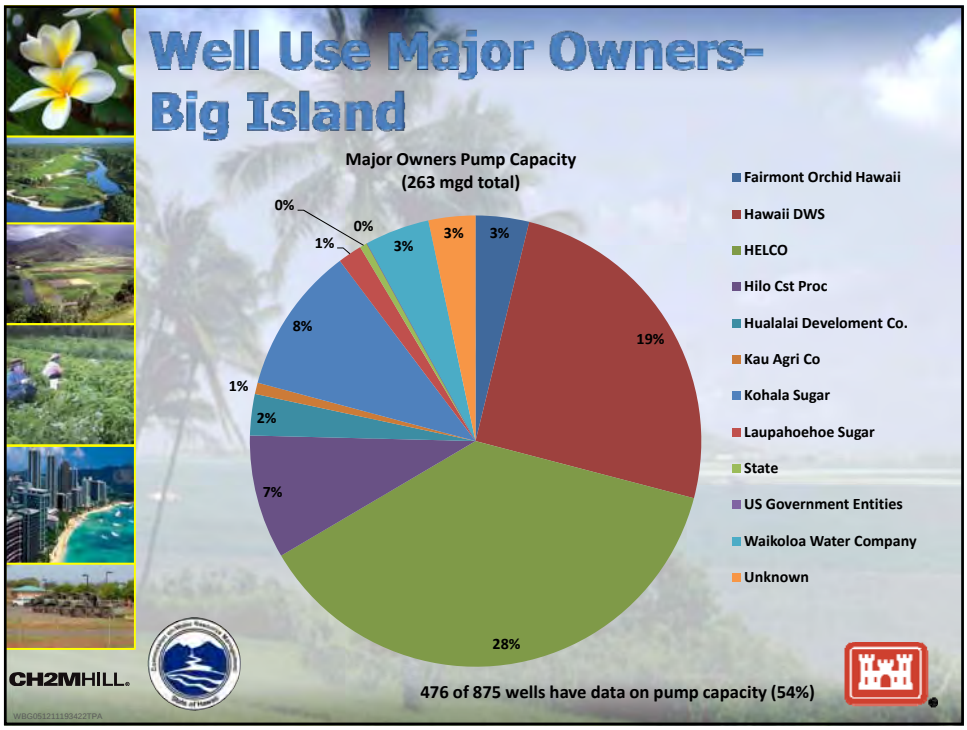
Well Use Major Owners-Big Island
Major Owners Pump Capacity
(263 mgd total)
3%
19%
28%
7%
2%
1%
8%
1%
0%
0%
3%
3%
Fairmont Orchid Hawaii
Hawaii DWS
HELCO
Hilo Cst Proc
Hualalai Develoment Co.
Kau Agri Co
Kohala Sugar
Laupahoehoe Sugar
State
US Government Entities
Waikoloa Water Company
Unknown
476 of 875 wells have data on pump capacity (54%)
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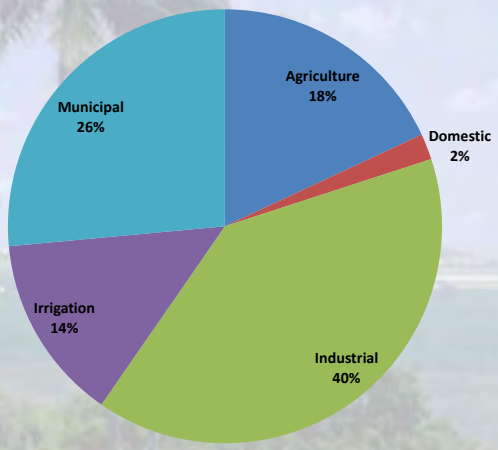
Well Uses-Big Island

Pump Capacity by User Type (385 mgd total)



476 of 875 wells have data on pump capacity (54%)

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Municipal Water Providers

- Hawaii – 2004-2009, annual by meter size
- Kauai – 2006-2009, monthly by category
- Maui – 2006-2009, monthly by category
- Oahu – 2006-2009, monthly by category

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Municipal Water Providers- Water Use Categories

- Agriculture
- Commercial:
  - Religious users
  - Hotels/Resorts
  - Mix-use
- Government:
  - Schools/Parks
  - State and County facilities
  - Military and non-military facilities
- Industrial
- Irrigation:
  - Golf courses
  - State/County/Private irrigation
- Residential:
  - State and City Housing
  - Multi-Family Dwellings
  - Single Family Dwellings

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Account Types by Water Provider

County	Hawaii	Kauai	Maui	Oahu
	accounts	accounts	accounts	accounts
Residential		18,399	31,421	153,396
Commercial		797	1,470	7,174
Industrial		31	211	631
Government		185	343	1,223
Agriculture		308	213	853

County of Hawaii provided by meter size only.

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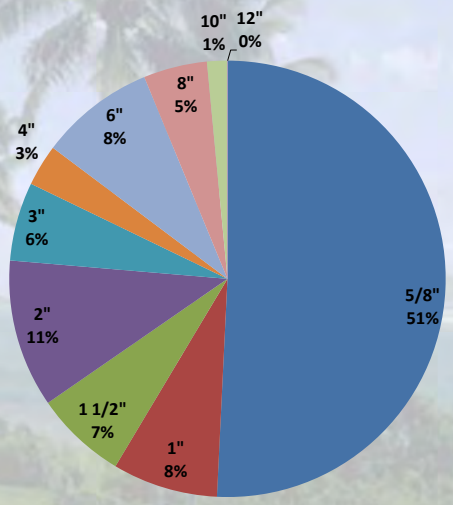
County of Hawaii Water Use 2006-2009



Meter Size	Consumption (mgd)
5/8"	12.2
1"	1.9
1 1/2"	1.6
2"	2.6
3"	1.4
4"	0.7
6"	2.0
8"	1.1
10"	0.4
12"	0.0

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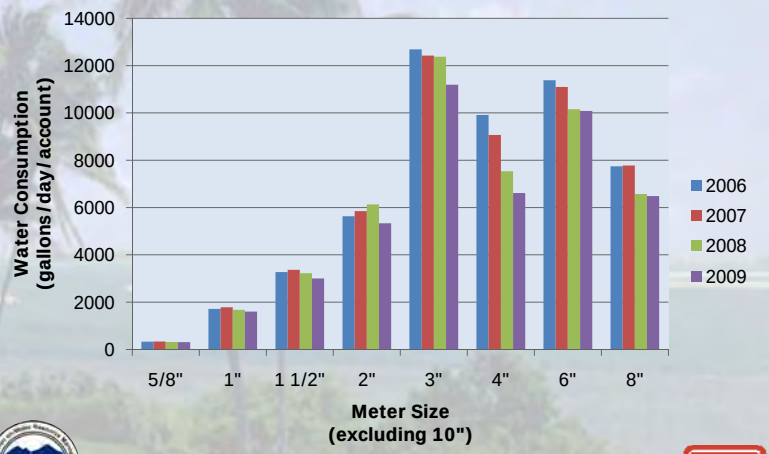
County of Hawaii Water Use 2006-2009



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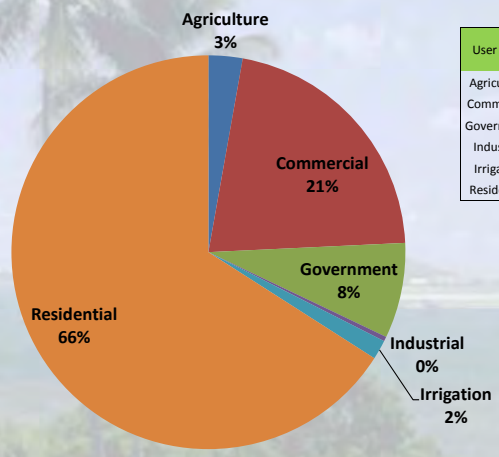
Kauai Water Use 2006-2009



User Type	Consumption (mgd)
Agriculture	0.4
Commercial	2.7
Government	1.0
Industrial	0.0
Irrigation	0.2
Residential	8.3

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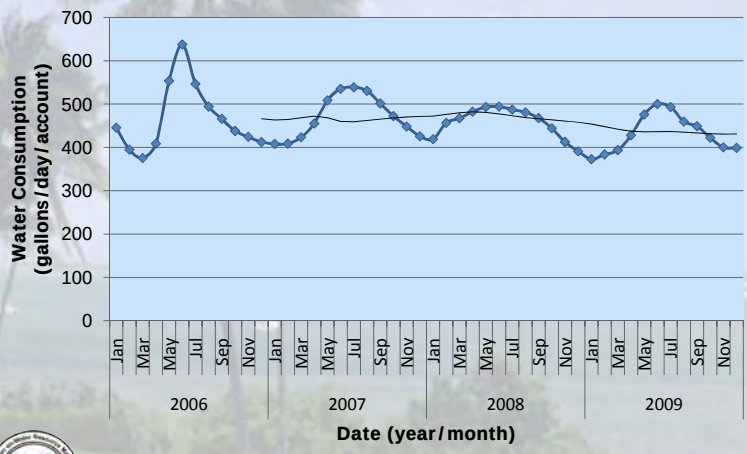
Kauai Water Use, Residential



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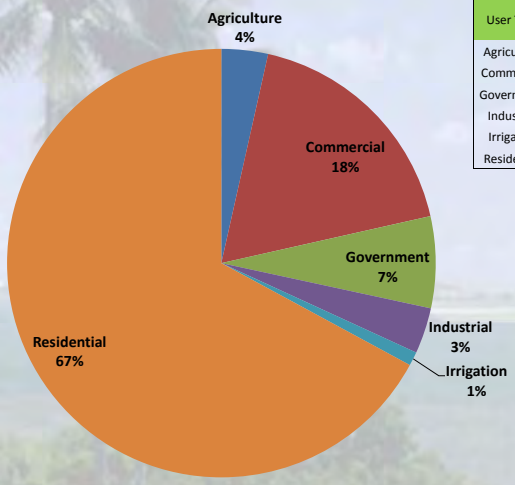
Maui Water Use 2006-2009



User Type	Consumption (mgd)
Agriculture	1.2
Commercial	6.2
Government	2.4
Industrial	1.2
Irrigation	0.4
Residential	23.1

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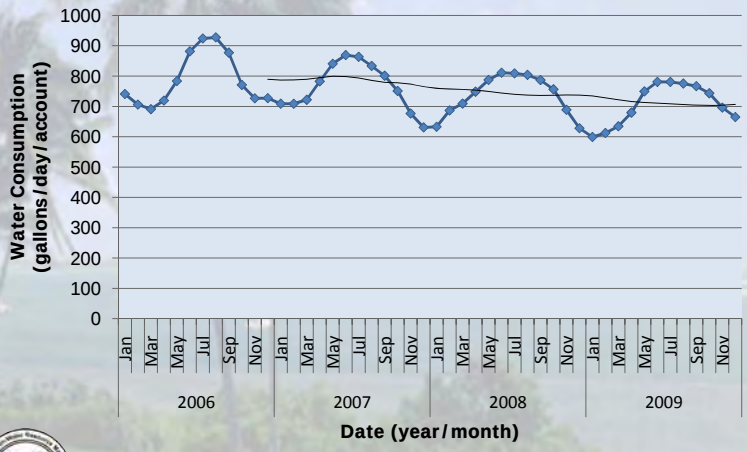
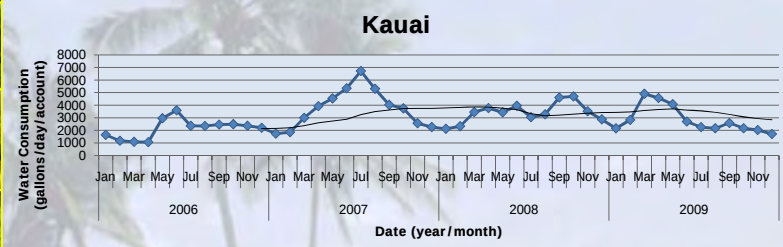
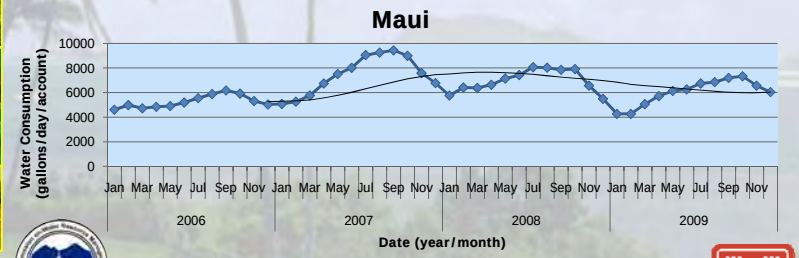
Maui Water Use, Residential



CH2MHILL.

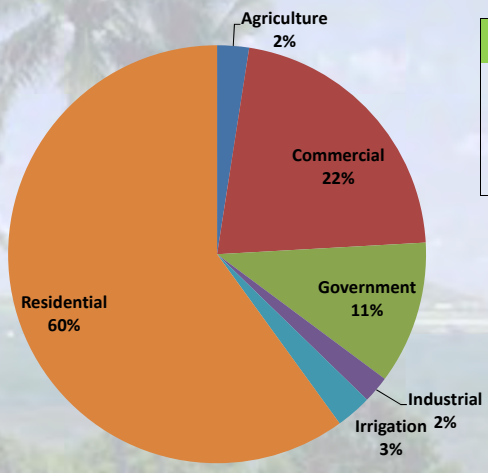
Kauai and Maui Irrigation





CH2MHILL.

Oahu Water Use 2006-2009



User Type	Consumption (mgd)
Agriculture	3.3
Commercial	29.2
Government	14.9
Industrial	2.8
Irrigation	3.7
Residential	80.8

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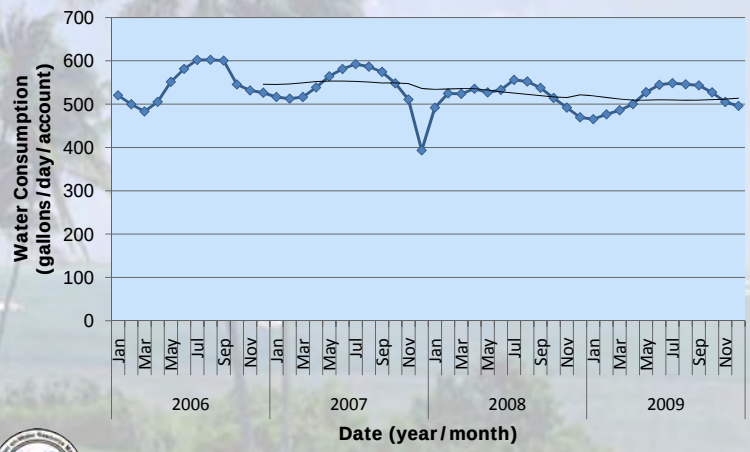
Oahu Water Use-Residential



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Usage by Water Provider

County	Hawaii	Kauai	Maui	Oahu
	gal/day/acct	gal/day/acct	gal/day/acct	gal/day/acct
Residential		431	706	514
Commercial		3,247	3,880	3,928
Industrial		1,280	4,891	4,494
Government		4,694	6,036	11,545
Agriculture		1,035	5,446	3,889

County of Hawaii provided by meter size only.

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Military Water Use

Received

- Navy
  - Pearl Harbor Housing water use
- Army
  - Aliamanu Water Infrastructure Study
  - Schofield water use study (coming soon)

Desired

- On-base water use information
  - Navy
  - Army (except Aliamanu and Schofield)
  - Air Force
  - Marine
  - Coast Guard

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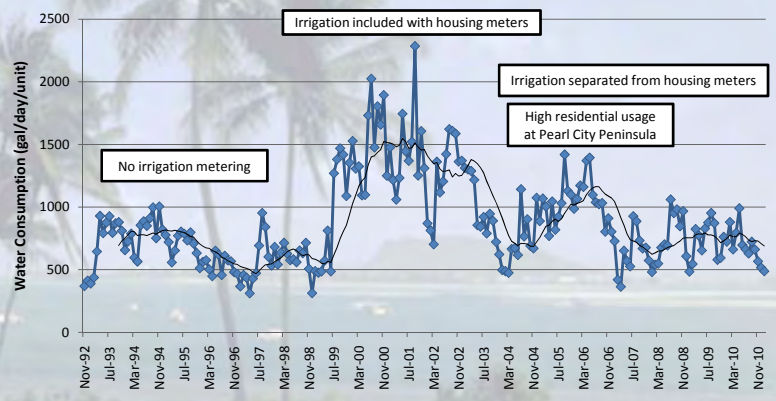
Joint Base Pearl Harbor Hickham (JBPHH)-Total Residential Water Consumption



Includes Ford Island North, Moanalua Terrace, and Pearl City Peninsula Housing Divisions

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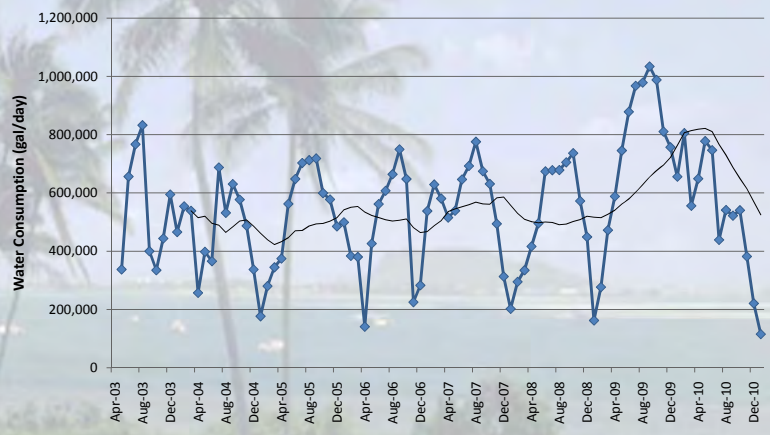
JBPHH-Total Irrigation Water Consumption



Includes Ford Island North, Moanalua Terrace, and Pearl City Peninsula Housing Divisions.
Does not include golf courses.

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Irrigation Water Use

- Three Primary Irrigation Uses
  - Golf Courses
  - Landscapes
  - Agriculture

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Golf Courses
• Most operate with:
– High efficiency application systems
– On-site weather station based scheduling
• Measured golf course water use per unit area will be evaluated
• In absence of a good baseline irrigation water requirements across climatic zones, these data will possibly be used as a baseline for all irrigation uses
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Golf Courses
• Data in Hand for 36 courses:
– Type of course, # of holes, water system, primary water source, type of water
– 12-month avg water use (mgd) for 15 courses
• Data Needs
– 12-month avg water use (mgd) for 21 remaining courses
– Irrigated acres for each course
– Similar data on any courses not already captured
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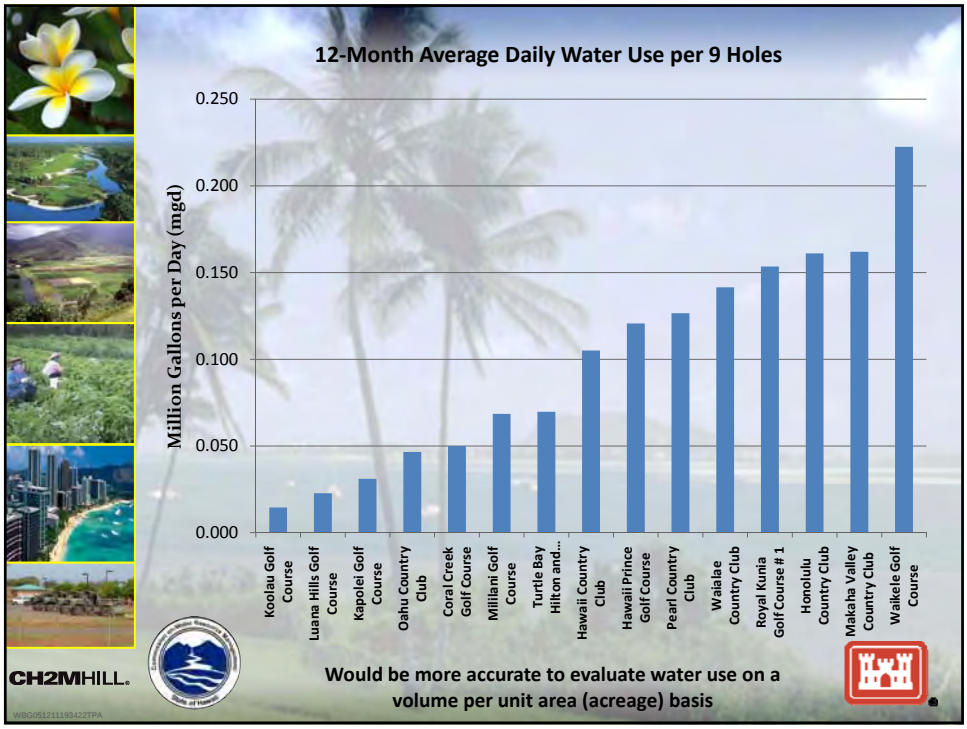
12-Month Average Daily Water Use per 9 Holes
Million Gallons per Day (mgd)
0.250
0.200
0.150
0.100
0.050
0.000
Koolau Golf Course
Luana Hills Golf Course
Kapolei Golf Course
Oahu Country Club
Coral Creek Golf Course
Mililani Golf Course
Turtle Bay Hilton and...
Hawaii Country Club
Hawaii Prince Golf Course
Pearl Country Club
Waialae Country Club
Royal Kunia Golf Course # 1
Honolulu Country Club
Makaha Valley Country Club
Waikele Golf Course
Would be more accurate to evaluate water use on a volume per unit area (acreage) basis
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Landscapes
• Wide variety of landscapes
– Residential
– Commercial
– Parks
– Schools
– Roadways
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Landscapes
• Landscape Industry Council of Hawaii (LICH)
– 2010 Survey of landscape irrigation water conservation best practices
– Policy/Position paper on best practices for landscape water conservation
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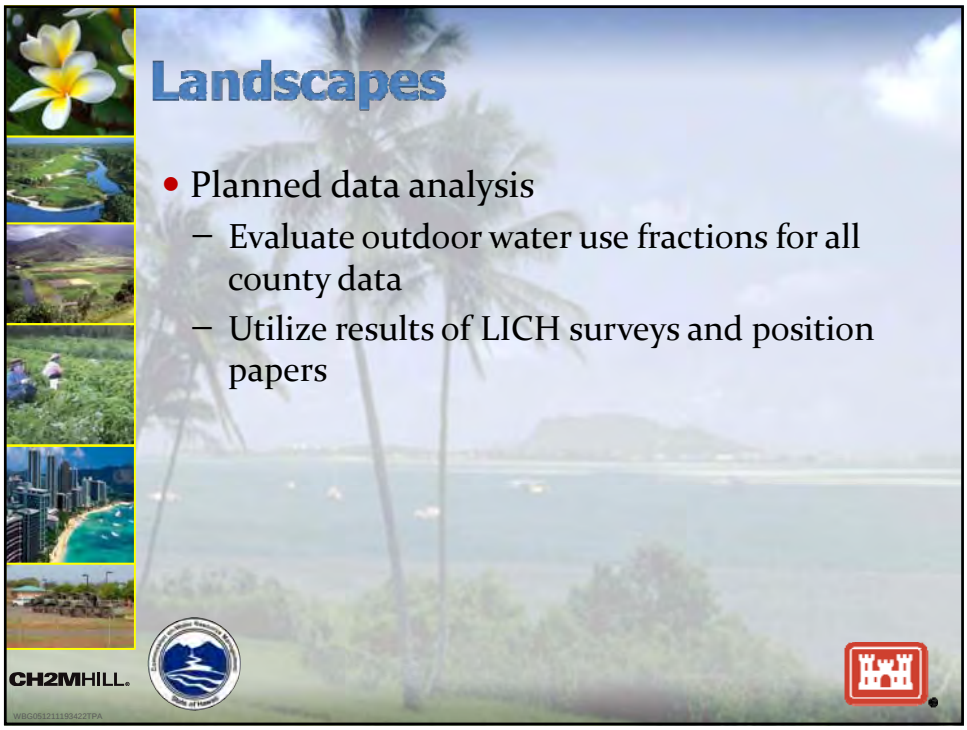
Landscapes
• Planned data analysis
– Evaluate outdoor water use fractions for all county data
– Utilize results of LICH surveys and position papers
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Agriculture

- Primary Data Sources:
  - 2004 Agricultural Water Use and Development Plan
  - Updated water use and construction contracts from Hawaii Dept of Agriculture

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WBG051211193422TPA

Systems Described in 2004 AWUDP	Water Use Data Provided by HDOA
Select Systems	
East Kauai Irrigation System	
Kekaha Ditch Irrigation System	two months only in 2000 & 2002
Kokee Ditch Irrigation System	
Maui Land and Pineapple/Pioneer Mill Irrigation System	
Waiahole Ditch irrigation System	
HDOA Systems	
Lower Hamakua Ditch Irrigation System	2000-2001, 2003-2010 (Honokaa-Paauilo: LHP) 2003-2010 (Honokaa-Paauilo: LHL)
Molokai Irrigation System*	1995-2010
Upcountry Maui Irrigation System	
Waimanalo Irrigation System*	1995-2010
Waimea Irrigation System*	1995-2010 (Lalamilo) 1995-2010 (Hawaiian Homes) 1995-2010 (Puukapu)
Private Systems	
East Maui Irrigation System	
Kauai Coffee Irrigation System	
West Maui Irrigation System	
Other Systems	
Kahuku Agricultural Park	2000-2010

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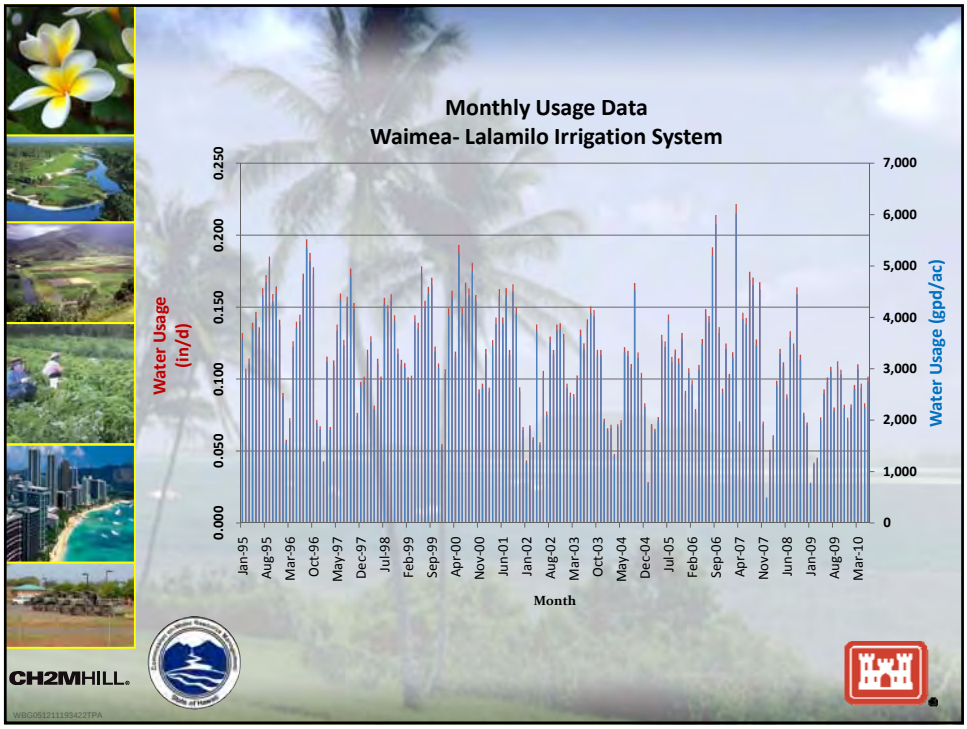
Monthly Usage Data
Waimea- Lalamilo Irrigation System
Water Usage (in/d)
0.000
0.050
0.100
0.150
0.200
0.250
Water Usage (gpd/ac)
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
Jan-95
Aug-95
Mar-96
Oct-96
May-97
Dec-97
Jul-98
Feb-99
Sep-99
Apr-00
Nov-00
Jun-01
Jan-02
Aug-02
Mar-03
Oct-03
May-04
Dec-04
Jul-05
Feb-06
Sep-06
Apr-07
Nov-07
Jun-08
Jan-09
Aug-09
Mar-10
Month
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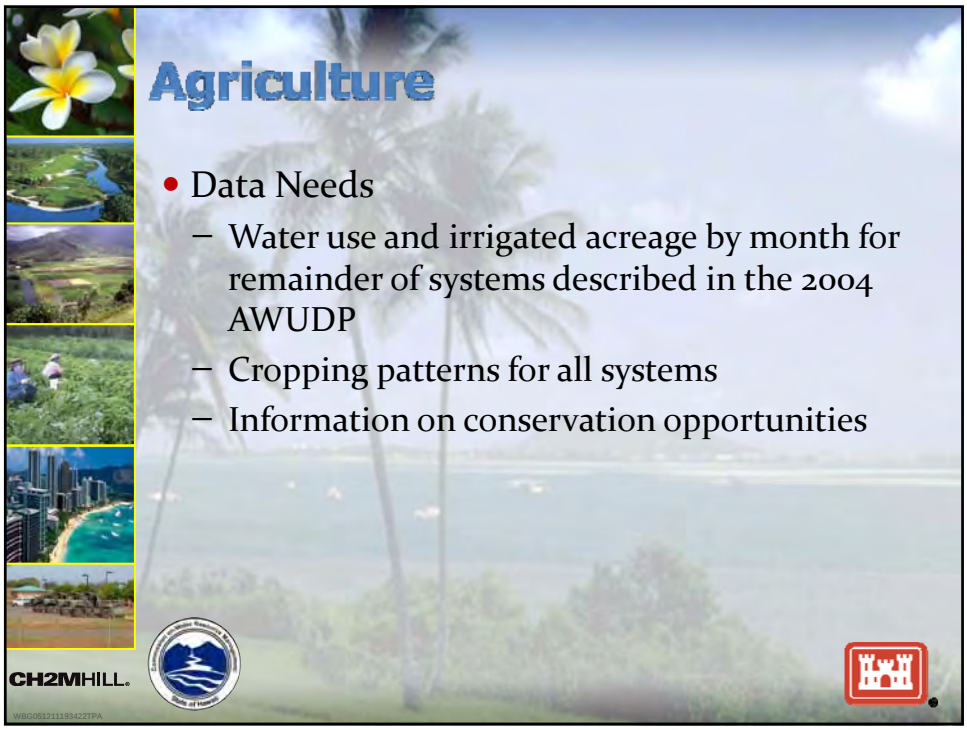
Agriculture
• Data Needs
– Water use and irrigated acreage by month for remainder of systems described in the 2004 AWUDP
– Cropping patterns for all systems
– Information on conservation opportunities
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Goal Setting Discussion

Goal Setting Considerations

- Must consider statewide vision, policy and strategy
- Be consistent with CWRM authority
- Align with potential opportunities based on water use analysis
- Be realistic and implementable
- Seek broader environmental benefits (e.g. creates energy savings)

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Types of Goals
Strategic
Cost-effectiveness
Customer class
Percentage reductions
Peak reductions
Highest users
Per capita
"Feel good"
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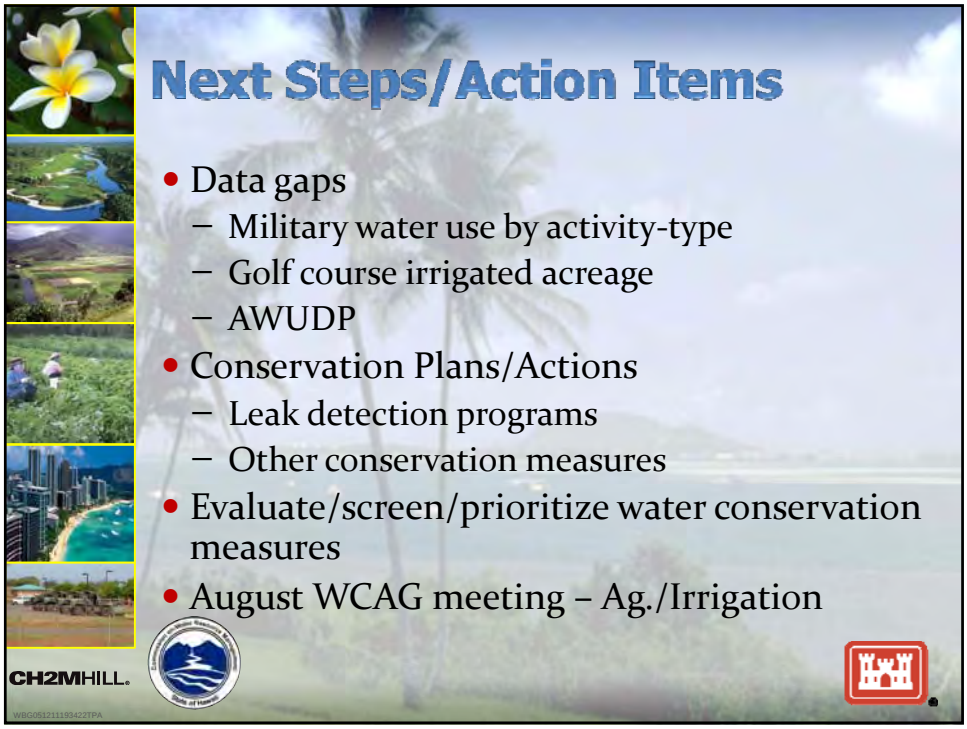
Next Steps and Action Items


Next Steps/Action Items
Data gaps
Military water use by activity-type
Golf course irrigated acreage
AWUDP
Conservation Plans/Actions
Leak detection programs
Other conservation measures
Evaluate/screen/prioritize water conservation measures
August WCAG meeting – Ag./Irrigation
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Water Conservation Advisory Group Meeting #2

August 25, 2011, 12:30 pm – 4:30 pm

Agenda

Time	Item	Lead
12:30 – 12:45	Welcome and "Re-introductions"	Neal Fujii
12:45 – 12:50	Agenda Review and Workshop Objectives	Wendy Nero
12:50 – 1:00	Scope "Refresher"	Wendy Nero
1:00 – 1:45	Water Use Data Review • *Agriculture* • *Golf Course* • *Landscape*	Jason Smesrud
1:45 – 2:45	Break-out Session: Water Conservation Best Practices • *Agriculture* • *Golf Course* • *Landscape*	Jason Smesrud/Wendy Nero
2:45 – 3:00	Break	
3:00 – 4:15	Break-out Session: Implementation Strategies	Wendy Nero/Jason Smesrud
4:15 – 4:30	Observations and Next Steps	Wendy Nero

Location:

Dept. of Land and Natural Resources – Board Room

Kalanimoku Building

1151 Punchbowl Street

Honolulu, HI 96813

State Water Conservation Advisory Group (WCAG) Meeting #2

Date: **25 August 2011**

Time: **12:30-4:30 pm HST**

Location: **Kalanimoku Building, Boardroom**

Attendees: Neal Fujii, CWRM
Jeremy Kimura, CWRM
Lenore Ohye, CWRM
Debbie Solis, Army Corps of Engineers
Ross Kaneko, CH2M HILL
Wendy Nero, CH2M HILL
Jason Smesrud, CH2M HILL
Alyssa Smith, CH2M HILL
See attached list of WCAG attendees

Due to competition for fresh water, increasing population and development pressures, the sustainable movement, and the impacts of global climate change requiring Hawaii to become as efficient as possible in its uses of fresh water, the Army Corps of Engineers in partnership with the State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) have determined that a water conservation plan for the State of Hawaii should be established. As part of this effort, a Water Conservation Advisory Group (WCAG) – made up of experts from each water use sector – was formed to assist in policy and program development. It is anticipated that the WCAG will meet a total of six (6) times throughout the duration of the project. The second meeting was convened on August 25, 2011, and the following summarizes and documents the activities of the meeting.

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List of Acronyms

Acronym	Organization
BWS	City and County of Honolulu Board of Water Supply
CWRM	Hawaii Department of Land and Natural Resources Commission on Water Resource Management
DHHL	Department of Hawaiian Home Lands
DPW	Directorate of Public Works (Army)
HDOA	Hawaii Department of Agriculture
HDWS	County of Hawaii Department of Water Supply
HDOT	Hawaii Department of Transportation
HFB	Hawaii Farm Bureau
HGCSA	Hawaii Golf Course Superintendents Association
HHLA	Hawaii Hotel & Lodging Assoc
KDOW	Kauai County Department of Water
LICH	Landscape Industry Council of Hawaii
MCBH	Marine Corps Base Hawaii, Kaneohe
MDWS	Maui County Department of Water Supply
MTA	Mililani Town Association
NAVFAC	Naval Facilities Engineering Command, Hawaii
UHM CTAHR	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources
USACE	United States Army Corp of Engineers
USAG HI	United States Army Garrison Hawaii
USDA NRCS	United States Department of Agriculture- Natural Resources Conservation Service
USGS	United States Geological Survey
WCAG	Water Conservation Advisory Group

Meeting Summary

1. Welcome and Re-introductions (Neal Fujii)- Neal initiated re-introductions of the project team and WCAG members.

- Introductions

  Neal Fujii (CWRM)

  Jeremy Kimura (CWRM)

  Lenore Ohye (CWRM)

  Debbie Solis (USACE)

  Ross Kaneko (CH2M HILL)

  Wendy Nero (CH2M HILL)

  Jason Smesrud (CH2M HILL)

  Alyssa Smith (CH2M HILL)

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Tui Anderson (Maui DWS)

Kanani Aton (Hawaii DWS)

Amy Brinker (Sierra Club)

Chris Dacus (HDOT/LICH)

Kristi Ellazar (MTA)

Carl Evensen (UH CTAHR)

Brian Kau (HDOA)

Garret Matsunami (Castle and Cooke)

Stephen Meder (UH)

Mae Nakahata (HC&S)

Jill Nishimura (USGS)

Russell Okita (NAVFAC)

Kathleen Ramirez (NAVFAC Energy)

Karl Santa (Army)

Cat Sawai (BWS)

Sharon Sawdey (NRCS)

Faith Shiramizu (Kauai DOW)

Rod Suzumoto (HHLA)

Warren Watanabe (Hawaii Farm Bureau)

2. Agenda Review, Workshop Objectives, Scope Refresher (Wendy Nero)

The agenda for the meeting, objectives of the workshops, and a brief scope refresher of work were presented to the WCAG. Details are provided in the attached pdf copy of the PowerPoint presentation used at the workshop.

3. Water Use Data Review- Agriculture, Golf Courses, and Landscape Irrigation (Jason Smesrud)

Water use data analysis was separated into three parts: agriculture, golf course, and landscape irrigation. Other sectors will be presented in a later WCAG meeting. Details are provided in the attached pdf copy of the PowerPoint presentation.

Neal Fujii- noted that some agricultural systems serve other types of users (i.e. residential, resorts).

- *Jason Smesrud- Agreed with Neal. More information is needed especially for the East Maui Irrigation system (EMI) water use reporting. Maui Land and Pineapple provided delivery amounts for different end users, which allowed for agricultural water use separation.*

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- *Brian Kau- Warned that some state systems report "possible" acreage, not actual acreage in use. More studies would need to be performed to determine the actual acreage.*
- *Jason Smesrud- Stated that there are inconsistencies in the type of data available to make decent comparisons.*

Roger Dunn- Asked why the Net Irrigation Water Requirements (NIWR) are significantly higher than 100% for three of the golf courses.

- *Jason Smesrud- One reason could be that the irrigated acreage is over-reported.*
- *Neal Fujii- Another reason may be that a weather station is not located on-site, so there's an uncertainty of the true microclimate and is mis-represented.*

Roger Dunn- Asked if other military water use data was collected.

- *Alyssa Smith- Stated that the data shown is specifically military housing data from JBPHH, but there is data from JBPHH for the NEX and one school.*
- *Roger Dunn- Stated that he will provide irrigation data from MCBH.*

Cat Sawai-

- *In reference to the NIWR bar graph, she asked if the goal is to make the NIWR and water use amounts even.*
    - *Jason Smesrud- Confirmed.*
- *Asked if CH2M HILL will try to acquire water use data from more golf courses since only 12 of 71 were shown.*
    - *Alyssa Smith- After reaching out to the contact list from the HGCSA, only a small number responded with water use data. There were a few that stated they did not have water use information recorded. Other than sending another request, not much else can be done to acquire that data.*
    - *Jason Smesrud- We need to reconcile the data.*
- *She stated that BWS didn't examine golf courses in their water analysis report because the water usage amount was insignificant to other users.*

Wendy Nero-

- *Some questions that need to be asked are if the acreage is represented accurately, is the irrigation truly representing irrigated acres, and does the rainfall correspond to the years we have data for and is it geographically relevant. For the sites we can correct that information, we will. Although, after that data is collected, there are still only a small number of sites represented.*
- *The initial vision of the project was to acquire a high level of data to pin point specific/detailed analysis for different areas. Since there is a lack of data, the current vision is to work toward general themes and observations by shifting from a measure-by-measure analysis to a best management practice application. This will lead to a generalized implementation plan.*

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- *Jason Smesrud- Since there is a lack of available metered water use and a large effort was made to collect current water use, one suggestion is to create a better system to collect/record data.*
- *Neal Fujii- Another recommendation is to have a backup system for data. CWRM is also looking to suggest better metering (i.e. sub-meter outdoor vs. indoor use).*
- *Debbie Solis- It is recognized that all water purveyors have issues to work though. An example is the Army trying to sub-meter as much as possible.*

Tui Anderson- Suggested using GIS to calculate accurate irrigated acreage of golf courses, and maybe even agricultural systems.

Barry Usagawa-

- *Surprised at the low response from golf courses, especially since it's their business to manage water use efficiently. He thinks their lack of response may be a result of the way they were asked. BWS will provide water use information for about 20 more golf courses.*
- *Agreed with the idea of using aerial photos to determine acreage. That's how BWS measures the taro cultivation areas.*
- *Suggested to take note of the quality and source of water being used to irrigate the golf course. Some courses use highly brackish water, which requires over-applying because it will crystallize, and others use CCH water, which will result in efficient systems because of the high water cost (i.e. Mid-Pac, Ala Wai, Hawaii Kai).*
  - *Tui Anderson-*
    - *Will provide water usage information for Waiehu Golf Course (the only county golf course on Maui).*
    - *Asked if CH2M HILL offered an incentive for golf courses to provide water usage data (if the golf courses provide water use data, then CH2M HILL would provide analysis of that data for them and suggest water conservation measures their specific course can adopt).*
  - *Rod Suzumoto- Hawaii Prince Hotel and Golf Club meters their well and observes their use diligently.*
- *Emphasize the project is going to help the golf course improve their irrigation efficiency, which will benefit them.*
- *Stated that if CH2M HILL is going to assume irrigation is seasonal for residential landscape irrigation, two things must be considered:*
  - *Rainfall in different areas*
  - *Seasonality of tourism*

Wendy Nero- The current analysis is focusing on general trends, not on wet months (which will be analyzed at a later time). The conclusion resulting from this data is whether or not the existing systems are generally efficient or not.

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Mae Nakahata- NOAA just updated their rainfall data using the PRISM mode, which is available.

- *Debbie Solis- Will provide this information to CH2M HILL.*

Chris Dacus- Asked how this data compares to other states in terms of amount/availability.

- *Jason Smesrud-*
  - *This seems average. States such as California are above average because of regulatory actions, while other states don't even have this amount of detail.*
  - *There are limitations with the agricultural data since the meters are off the ditch system instead of off the main diversion. It's more common to have main diversions report for compliance instead of at the end uses.*
  - *Golf courses are average, as well.*
- *Wendy Nero- Dry or long-term water-short states (i.e. California, Texas, etc), as well as areas having water wars (i.e. Tri-states and Canada) tend to have better, more comprehensive data.*
  - *Dual meters for irrigation increasing trend on the municipal side.*

4. Breakout Session: Water Conservation Best Management Practices (Wendy Nero)

See the attached handout sheets ("Breakout Session #1 Handout Sheets- Blank) used for this breakout session, as well as notes from each group ("Breakout Session #1 Notes).

Observations:

- *Overlap of BMPs between the three sectors*
- *Opportunities for collaboration (i.e. public data share-site)*

5. Breakout Session: Implementation Strategies (Wendy Nero)

Sharon Sawdey- USDA NRCS Programs

- *Mission: Working with agricultural producers to help conserve and protect resources*
- *Started in the 1930's- known as the Soil Conservation Service*
- *Farm Bill program*
  - *EQIP (Environmental Quality Incentives Program)*
    - *Nationwide- $1 billion is granted each year*
    - *Assists agricultural producers with technical assistance, develop conservation plans, and financial assistance*
    - *Cost-share program*
      - *Typical producers: 50-75% incentives provided to install facilities*
      - *Beginning/Dis-advantaged farmers: Up to 90% costs provided*

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- *Eligibility:*
  - *Have control of land for the life of program (about 10 years)*
    - *Majority of Hawaii producers are on leased-land with no long-term leases*
    - *NRCS is trying to work around this*
  - *Adjusted gross income limitation*
    - *Taxing entities (i.e. large landowners) are not eligible*
    - *Currently limited to individual producers in Hawaii*
- *$6 million provided for technical/financial assistance to Hawaii farmers in 2010 (100 different contracts to about 15,000 acres of land)*
- *Most common water conservation practices implemented: irrigation water management*
  - *Help producers understand how the volume of water, soil conditions, and consumption of crop are inter-related.*
- *Another common practice: micro-irrigation/sprinkler system for small scale systems.*

- *Field office locations: 1- Kauai; 1- Oahu; 1- Maui; 1- Molokai; 3- Big Island*
- *Website: www.pia.nrcs.usda.gov (Farm Bill link located on the left-hand side)*
- *Chris Dacus- Will the new Farm Bill include more conservation practices?*
  - *Sharon- Yes, it will include energy efficiency, organic production, improved energy use, and energy audits.*
- *Agricultural Management Assistance (AMA) Program*
  - *Concerned with water conservation*
  - *If you don't have an existing water irrigation system, AMA looks to reduce risk of agricultural operations.*
  - *Will help start an irrigation system with conservation in mind*
- *Agricultural Water Enhancement Program (AWEP)*
  - *Geared toward partnering efforts*
  - *Not done in Hawaii yet, but NRCS is looking for the opportunity*
  - *Taxing entities are not eligible*
  - *This is a nationwide competition to acquire additional funds*
  - *Looking for opportunities where groups of producers/interested parties submit a proposal of what can be done to conserve water.*

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Examples of other types of implementation strategies are provided in the attached pdf copy of the PowerPoint presentation. See the attached notes from each group ("Breakout Session #2 Notes).

6. Observations and Next Steps (Wendy Nero)

Other Thoughts/Observations:

- *Irrigation conservation professional certification*
- *GIS application/tool*
  - *Compile overall water use/acreage for all uses*
  - *Create a tool that is web-based to combine water use data with good weather data to determine site specific irrigation needs*
- *Education programs*
  - *Children- water conservation*
  - *Adults- operators*
  - *Tourists and military families*
- *Leak detection and repair (i.e. irrigation ditches, conveyance systems, etc)*
- *Link education and incentives*
- *Partnerships*
  - *Incentivize greater investment by private sector*
  - *Public sector- improved processes and permitting*
- *Funding- for construction*
  - *Need operation and maintenance funding*
    - *New technology/need info and funding*
- *Incentivize efficiency by publishing water use data (very sensitive info; how to compare to benchmarks)*

Next Steps:

- *Next WCAG meeting tentatively November 14* ***UPDATE: November 17***

7. Action Items

- *Roger Dunn- To provide MCBH water use information.*
- *Barry Usagawa- To provide water use information for golf courses supplied by BWS.*
- *Tui Anderson- To provide water use information for Waiehu Golf Course.*
- *Debbie Solis- To provide NOAA rainfall information.*
  - *Will email the WCAG the website for the rainfall atlas update (available early September).*

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If there are any necessary corrections or additions, please contact me via email at Ross.Kaneko@ch2m.com or you can reach me on my office line at 808-440-0225, or my cell phone at 808-554-3791.

Respectfully submitted,

Ross A. Kaneko

Attachments:

- Attendance list
- Project team contact list
- Breakout Session #1 Worksheets- Blank
- Breakout Session #1 Notes
- Breakout Session #2 Notes
- WCAG Meeting #2 Presentation

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Water Conservation Advisory Group Meeting #2 (8/25/2011)
List of Attendees

Last Name	First Name	Organization	Email Address
Anderson	Tui	Maui County Department of Water Supply (MDWS)	tui.anderson@mauicounty.gov
Aton*	Kanani	County of Hawaii Department of Water Supply (HDWS)	Katon@hawaiidws.org
Brinker	Amy	Sierra Club/KYA Sustainability Studio	abrinker@thekyastudio.com
Dacus	Chris	Hawaii Department of Transportation (HDOT)/ Landscape Industry Council of Hawaii (LICH)	christopher.a.dacus@hawaii.gov
Dunn	Roger	Marine Corps Base Hawaii, Kaneohe (MCBH)	rogerdunn@gmail.com
Ellazar	Kristi	Mililani Town Association (MTA)	kellazar@mililanitown.org
Evensen	Carl	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources (UHM CTAHR)	evensen@hawaii.edu
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Manuel	Kaleo	Hawaiian Homelands (DHHL)	kaleo.l.manuel@hawaii.gov
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Meder	Steve	University of Hawaii- Manoa	smeder@hawaii.edu
Nishimura	Jill	United States Geological Surveys (USGS)	
Okita	Russell	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	russell.okita@navy.mil
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Santa	Karl	Army- Directorate of Public Works (DPW)	karl.santa@us.army.mil
Sawai	Cat	City and County of Honolulu Board of Water Supply (BWS)	csawai@hbws.org
Sawdey	Sharon	United States Department of Agriculture- Natural Resources Conservation Service (USDA NRCS)	sharon.sawdey@hi.usda.gov
Shiramizu*	Faith	Kauai County Department of Water (KDOW)	fshiramizu@kauaiwater.org
Solis	Debbie	United States Army Corp of Engineers (USACE)	deborah.a.solis@usace.army.mil
Suzumoto	Rod	Hawaii Prince Hotel and Golf Course	rsuzumoto@hiprince.com
Usagawa	Barry	City and County of Honolulu Board of Water Supply (BWS)	busagawa@hbws.org
Watanabe	Warren	Hawaii Farm Bureau	warrenmcfb@hotmail.com
Wolfe	Allen	United States Army Garrison Hawaii (USAG HI)	allen.wolfe@us.army.mil
Yamaki	Tina	Hawaii Hotel/Lodging Assoc	tyamaki@hawaiihotels.org

TEXT*	Called in

Water Conservation Plan
Project Team Contact Information

Last Name	First Name	Organization/Company	Phone	Email
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Hawaii Statewide Water Conservation Plan

WCAG Meeting #2: Agriculture, Golf Courses and Landscape Irrigation

BMP Discussion - Breakout Group Exercise # 1 (60 min.)

1) Materials/Set-up
    a. Groups divided by water use category (Agriculture, Golf Courses and Landscape Irrigation), work as team on their specific category
    b. Excel file of BMP's for each category copied to hand out. Need: BMP name, description, comments, priority (1-x), extra rows to add new BMP's
    c. Create "score sheet" for each category to tally recommendations
    d. Individuals will report rankings, which will be tallied in an excel file, and averaged across all participants in the sub-group.
2) Instructions
    a. Present overview slides/instructions (10 min).
    b. Work as a group to discuss the different BMP's. Discussion for each BMP should include
        i. How do the BMP's apply to the circumstances in Hawaii?
        ii. Do they apply equally to publicly owned and privately owned systems? If no, why not?
        iii. How would you change or modify them to be more applicable to different systems? Public? Private? (write changes/issues/thoughts in the comments section)
        iv. What additional BMP's should be included for consideration in the statewide water conservation plan?
        v. What else should the CWRM be thinking about for effective water resource management now and in the future?
    c. Agree on a final list of BMP's for ranking (within 25 min).
    d. Work as a group to rank the final list of BMP's, with 1 being the highest ranked BMP and X being the lowest ranked BMP (10 min).
    e. Each group reports results:
        i. Top 3 issues or considerations
        ii. Top 5 ranked BMP's (15 min).

Agriculture			
BMP Category	**Specific BMPS**	**Comments**	**Priority**
Use of Alternative Irrigation Water Sources			
	Reclaimed Water Use		
	Brackish Water Use		
Irrigation Water Use Management			
	Climate Based Irrigation Scheduling		
	Soil Moisture Based Irrigation Scheduling		
	On Farm Irrigation Audits		
On-Farm Systems			
	Volumetric Measurement of Irrigation Water Use		
	Conversion of Supplemental Irrigated Farmland to Dry-Land Farmland		
	Brush Control/Management		
	Crop Residue Management and Conservation Tillage		
	Lining of On-Farm Irrigation Ditches		
	Replacement of On-Farm Irrigation Ditches with Pipelines		
	Conversion to Higher Efficiency Flood Irrigation Systems		
	Conversion to Drip/Micro-Irrigation System		
	Conversion to Center Pivot, Linear Move, and Sprinkler Irrigation Systems		
	Tailwater Recovery and Reuse Systems		
	Drainwater Recovery and Reuse Systems		
	Energy Audits Provided by Local Electric Utilities		
Water District Delivery Systems			
	Adoption of rate structures that promote conservation		
	Volumetric Measurement of All Irrigation Diversions		
	Lining of Earthen Canals		
	Replacement of Canals with Pipelines		
	Construction of reregulation reservoirs		
	Water control structure automation		
	Centralized control systems (SCADA) for gates and diversions and leak detection		
Additional Measures to Consider			

Golf Courses

BMP Category	Specific BMPS	Comments	Priority
Use of Alternative Irrigation Water Sources			
	Reclaimed Water Use		
	Brackish Water Use		
Landscape and Golf Course Design			
	Drought Resistant and Low Water Use Turf Grass		
	Minimizing Close-Cut, Highly Maintained Turf Area		
	Lining of storage ponds and all water features		
	Stormwater and drainage capture and reuse		
Irrigation Systems Design and Devices			
	Use a qualified irrigation designer and installation contractor such as those certified by the Irrigation Association		
	Centralized irrigation control systems		
	Flow meter on main water sources		
	Multiple flow meters in distribution system for leak detection		
	Automatic rain shut-off devices		
	Automatic wind shut-off devices		
	Automatic drain valves to limit head drainage in low areas		
	Pressure regulators to ensure proper operating pressure		
	Drip systems for landscape plants		
Irrigation System and Golf Course Maintenance			
	Daily inspection and repairs		
	Regularly scheduled irrigation system audits		
	Aeration of high traffic areas for improved infiltration		
Irrigation Scheduling/Operation			
	On-site weather station for climate based irrigation scheduling		
	Soil moisture based irrigation scheduling		

Landscape			
BMP Category	**Specific BMPS**	**Comments**	**Priority**
LICH Position Statement Measures			
Support and encourage the following best management practices for new installations or major renovations			
	Design irrigation system with sprinklers spaced with head to head coverage or better.		
	Irrigation system plans and specifications shall include post-construction documentation, including drawings or record (as-built drawings), maintenance recommendations, seasonal operational schedules, design precipitation rates, manufacturer's operational guide which shall remain on site. Specifications shall require a coverage test prior to acceptance and LICH water conservation best practices.		
	Irrigate with a precipitation rate not exceeding soil infiltration rate.		
	Design systems to irrigate similar hydrozones (similar site, slope, sun exposure, soil conditions, and plant materials with similar water use) on same circuit. Avoid irrigation overlap between high and low water demand hydrozones.		
	Use a Climate Based Irrigation Controller (Smart Controller). Automatic irrigation controllers utilizing either evapotranspiration, weather sensor or soil moisture sensor.		
	Encourage the use of drip irrigation for individual specimen plants.		
	Use of flow sensors with malfunction valve shutoff system capability at irrigation controller.		
	Use irrigation submeter that measures water use on large sites.		
	Use water conservation irrigation components including but not limited to rotary nozzles, pressure regulated spray heads & valves, rain switches and matched precipitation rate nozzles.		
	Sprinklers in low-lying areas shall be equipped with check valves.		
	Incorporate Low Impact Development storm water design methods including rain gardens, infiltration beds, swales, and basins that allow water to collect and soak into the ground on site.		
	Preserve existing native trees and non-invasive vegetation where feasible during development and do not install irrigation in these areas.		
	Encourage the use of non-potable water sources when available.		
	Encourage the use of xeriscaping practices to include drought tolerant plants or plants that are naturally occurring at the site and surroundings.		
	Use a qualified irrigation designer and installation contractor such as those certified by the Irrigation Association and a maintenance contractor with water conservation expertise.		
Supports the following best management practices for maintenance			
	At a minimum, adjust irrigation controller run times seasonally.		
	Conduct a practical water audit annually. Review the system components to verify that the components meet the original design criteria for efficient operation and uniform distribution of water.		
	At a minimum, conduct a monthly inspection to verify system operation and correct deficiencies.		
	Water in 2-3 short run time cycles in areas where run off and ponding occurs.		
	Program irrigation controllers to encourage deep watering to improve deep rooting and increase drought resistance. Avoid daily watering except for sandy soils.		
	Mulch plantings and refresh as necessary to maintain a minimum of 2 inches.		
	Encourage the incorporation of organic matter like compost into soils.		
	Schedule night or early morning runtimes for established plantings (5:00 pm to 9:00 am).		
	Allow grass to grow taller to conserve water.		
	Aerate lawns when compaction occurs.		
	Encourage landscape professionals to attend water conservation seminars with continuing education units including American Water Works Association, Landscape Industry Council of Hawaii, American Society of Landscape Architects, U.S. Green Building Council, and the Irrigation Association.		
	Use maintenance contractor with water conservation expertise.		
Strongly opposes			
	Requiring utilization of drip irrigation for entire sites due to short lifespan, high maintenance and exaggerated water savings		
	Requiring extensive and expensive water audits according to the Irrigation Association's Certified Landscape Irrigation Auditor Training Manual (2004).		
	Prohibiting permanent irrigation systems.		
	Requiring use of synthetic grass.		
Additional Measures to Consider			

Breakout Session #1 Notes- BMPs

Landscape Irrigation (Chris Dacus)

Issues/Themes/Considerations:

- Cost of implementation
- Don't design a "water thirsty" landscape (preventative vs. reactive)
- "Acceptance" of the landscape

Suggestion:

- Address temporary irrigation installations

Top 5 BMPs:

1. Encourage the use of xeriscaping practices to include drought tolerant plants or plants that are naturally occurring at the site and surroundings.
2. Conduct a practical water audit annually. Review the system components to verify that the components meet the original design criteria for efficient operation and uniform distribution of water.
3. Schedule night or early morning runtimes for established plantings (5:00 pm to 9:00 am).
4. At a minimum, conduct a monthly inspection to verify system operation and correct deficiencies.
5. At a minimum, adjust irrigation controller run times seasonally.

Agriculture (Mae Nakahata)

Issues/Themes/Considerations:

- Enable crop production and manage/raise livestock
- Manage waste vs. reducing use
- Recognize and account for groundwater/surface water inter-relationships (short-term gains vs. long-term losses)

Top 4 BMPs:

1. Climate based irrigation scheduling; soil moisture based irrigation scheduling; on farm irrigation audits; volumetric measurement of irrigation water use.
2. Replacement of Canals with Pipelines.
3. Crop Residue Management and Conservation Tillage.
    - Better use of rainfall event. (i.e. Many pastures are un-irrigated, but if they can be tilled or a shallow basin is designed, it will pull the water in and force deep infiltration during rainfall events. This will reduce irrigation water requirements but will produce more forage crops.)
4. Water control structure automation.

Golf Course (Tui Anderson)

Issues/Themes/Considerations:

- Already efficient due to cost, so they need to focus on managing that resource
- Maintain aesthetics

- Most practices will be cost-driven
- Other sectors could learn from GC irrigation practices

BMPs- Overall Top 5:

1. All Irrigation Systems Design and Devices BMPs
    a. Use a qualified irrigation designer and installation contractor such as those certified by the Irrigation Association
    b. Centralized irrigation control systems
    c. Flow meter on main water sources
    d. Multiple flow meters in distribution system for leak detection
    e. Automatic rain shut-off devices
    f. Automatic wind shut-off devices
    g. Automatic drain valves to limit head drainage in low areas
    h. Pressure regulators to ensure proper operating pressure
    i. Drip systems for landscape plants
2. On-site weather station for climate based irrigation scheduling
3. Daily inspection and repairs
4. Regularly scheduled irrigation system audits
5. Aeration of high traffic areas for improved infiltration

BMPs for New Golf Courses:

1. Non-potable water source
2. Design
3. Irrigation control system (ICS)

BMPs for Existing Golf Courses:

1. ICS (weather based control)
2. Technical assistance audit
3. Inspections
4. Maintenance

Implementation Strategies Discussion - Breakout Group Exercise # 2 (60 min).

1) Materials/Set-up
    a. Groups that were created for the BMP discussion will remain together for the Implementation Strategies discussion (Agriculture, Golf Courses and Landscape Irrigation) and will work as team on their specific category
    b. Example strategies will be presented; copies of slides will be provided to each team for reference
    c. Each table will have 5x7 sticky pads, magic markers, "dots"
2) Instructions
    a. Present overview slides/instructions (5 min).
    b. Work as an individual to explore implementation strategies.
    c. Questions to consider for each Implementation Strategy (Policy and Regulations, Incentives (Penalties) and Financial Assistance, Education and Outreach and Partnerships) should include:
        i. What is already working well that could be enhanced or expanded?
        ii. What policies are needed to enhance and encourage the implementation of water conservation practices?
        iii. How effective can regulations (and enforcement) be in improving water use efficiency in Hawaii? (consider culture, economics, history, land use, enforcement capacity, organizational structure, etc.)
        iv. What should water managers in Hawaii be thinking about to increase efficiency in 10 years? 20 years?
        v. How important are financial incentives (or penalties) in "motivating" investments in water conservation?
        vi. Where should financial support for conservation come from? Why?
        vii. When and what about water conservation implementation should be regulated?
        viii. How big a role do education and outreach play in water use efficiency? Who do you envision as "the educators"?
        ix. What role should the State of Hawaii play in ensuring long term water use efficiency? How can they fulfill that role?
        x. What barriers exist that prevent successful implementation of water conservation? How would you remove them?
        xi. If you were solely responsible for water management in Hawaii, what would you do?
    d. As an individual, prepare 8-10 "ideas" using the 5x7 sticky notes. These ideas should be simple and singular, and be limited to 3-5 words; one idea per sticky note. They are concepts to be further explored, not the complete solution (20 min).
    e. As a group, quickly read all the concepts and group by "like theme".
    f. Give each grouping a "name" that captures the theme and write that one a sticky note for the group (20 min).
        i. Each group reports results by theme, specific concepts within each "theme" (15 min).

Breakout Session #2 Notes- Implementation Strategies

Agriculture Group

- Funding
    - Consolidate like funding programs
    - State funding for planning (water resources) *(2)
    - Tax credits and incentives
    - Get more access to BOR programs
    - Assistance in application for grants
    - Legislative lobby for federal funding into Hawaii
    - Better financial support for conservation planning and districts
    - Partnerships to promote increased funding for Ag irrigation system efficiency enhancements
    - Incentivize private investment
    - Integrated water system (park/museum)
    - Add a tax to water to support conservation
    - % of property tax to water conservation (i.e. county uses .05% for conservation mostly focused on land)
    - Encourage water conservation by providing rebates/credits to residential customers who implement low flow fixtures
    - Graduated rate structure for user type
    - Dual/hybrid water systems
- Water Conservation Studies
    - Water conservation project feasibility study funding/grant program *(3)
    - Combined surface/groundwater studies (use and supply)
    - Study for efficiencies in open ditch irrigation
    - One stop shop for water studies/stakeholders/technologies
    - Clearinghouse of latest water efficient technologies
- Climate Data Network
    - State to fund the establishment of weather stations network for climate-based irrigation scheduling
    - Public met system
    - Statewide irrigation climate data network *(5)
- Regulatory
    - Xeriscaping on all new state projects
    - Water catchment on new state projects
    - Enforcement of ag water meters (true ag production/use)
    - Require metering of all major stream diversions
    - State as WMA (Water Management Area) *(2)
- BMPs
    - Tags on produce and other local food with gallons of water used to grow or raise
    - Automation device
    - Homestead (DHHL) awareness program
    - Increase reclaimed water use where appropriate
    - Decentralized waste system
    - Prioritize water uses in water code
    - Reuse of stormwater

    - Stormwater recapture
    - Safe use of reclaimed water for crop production
    - Understand short term gain vs. long term
    - New developments required to use "living building" standards if not LEED platinum
- Partnerships
    - Incentivize public-private partnerships *(1)
    - Develop partnerships for multiple use water resource/conservation/groundwater recharge flood protection measures *(3)
    - State (county) interagency working committees
- Education
    - Water video on plane into Hawaii *(1)
    - Irrigation technology field days (UH, DOA, CWRM)
    - Demonstration projects for irrigation field days
    - Develop and deliver farmer education program on water conservation BMPs and incentives *(1)
    - Public education- amount of water that goes to watering grass and landscaping
    - School kids audit water use at school (and surrounding neighborhoods)
    - Educate school kids about water conservation (suggest grades 3-7)
    - Involve master gardeners program (UHM/CTAHR) in delivering information to home owners
    - Encourage more enrollment in NRCS Farm Bill programs like EQIP

<u>Landscape Irrigation Group</u>

- Incentives
    - Anything that increases water project "payback"
    - Water budgets with incentives (partners) *(2)
    - Irrigation conserving component incentives *(2)
        - Ast. for water audits
        - BMP rebates
        - Grants = implementation
    - Credit on water bills for completed conservation projects
    - Rebates for water conservation equipment
    - Tiered water rates
- Education and Outreach
    - Leak detection workshop for large water users (i.e. military)
    - Award program for "innovative irrigation design implementation"
    - Conservation education for homeowner, business, landscape, and ag users
    - Encourage use of LEED points in water conservation
    - Free training and free use of leak detection equipment (i.e. borrow/loan) *(1)
    - Contest/competition with various industries with recognition
    - Hold annual workshops to expand existing practices to others *(1)
    - Sector based irrigation BMP workshops
    - Water conservation awards/recognition
    - "How to" book of irrigation conservation BMPs and LEED points *(1)
- Legislation and Design Standards
    - Establish landscape water use index (i.e. max GpAc or GPD for various uses- resort, golf, inst, res, etc)

    - Standardize required water use data collection *(4)
    - Mandate use of "water sense" rated items/services
- Industry
    - Irrigation conservation professional certification
- Partnership
    - Water audits with multiple entities
    - BETA programs on measuring conservation water and dollar savings
    - Smart meters that can track usage 24/7
    - Utilize smart meters to detect leaks, waste, largest water use (when/how)
    - Create comprehensive statewide network of weather stations for irrigation controller use
    - Research funding for testing efficacy of conservation measures as applied in Hawaii *(1)

<u>Golf Course Group</u>

- Education
    - Education assistance (i.e. web, in-person)
    - A place where best practices are shared (website) statewide/nationwide
    - Public announcements regarding water conservation practices
    - Joint military PR program to educate military families
    - Mandatory water/energy conservation education for schools
- New Technology
    - Bio-filter treat water to grow food
    - Audit tool that is web-based
    - Statewide weather stations (microclimate data)
    - Chat room/bulletin board to share BMPs/conservation ideas
    - Use website to provide BMPs for water conservation based on use
    - Grow food
- Audit
    - State should provide technical assistance for water audits
    - Water use study for hotels, condos, commercial buildings (assisted funding) *(1)
    - Audit programs (budgets) *(1)
    - Free water audits; net zero savings = costs
    - Leak detection for on-site plumbing systems
- Partnerships
    - Form groups of water conservation champions signing an MOU committing to BMPs *(2)
    - Partnerships between public and private sectors
- Alternative Water Sources
    - Stormwater capture (i.e. reuse, groundwater infiltration)
    - Rainwater collection for landscape irrigation
    - Reclaimed water system expansion *(2)
    - Treat sewage to R2/R1 levels; equal to drinking water standards (i.e. Singapore)
    - Collect stormwater in storage tanks and pump for landscape irrigation
- Regulation
    - Create "water police" and fine users who waste; create a hotline (i.e. 911) to report abuse *(1)

    - Install more water fountains and repair those that are broken to reduce bottled water
    - Underground water supply pipe leak detection; repair; assisted funding
    - Require more detailed water use reporting (i.e. well data)
    - Enforce required water use reporting
    - Install flow sensors to detect leak location
    - Mandate it
    - Don't penalize businesses for implementing conservation practices with mandates
    - Meter every water user; submeter as much as possible; compare users by metrics and allow that information to be public (i.e. newspaper, internet, t.v.)
    - Report water usage to state by various groups of users
    - Focus on larger users (i.e. 80/20 rule)
    - Allow irrigation only to go on in the day so you know if it's' working
    - No irrigation system should be on when it's raining
- Money/Funding/Incentives/Dis-incentives
    - Create a watershed fee tied to pump size to fund conservation measures that protects the watershed *(3)
    - Establish water conservation fund legislatively for planning/implementation *(1)
    - Efficient irrigation rebates
    - Apply the HECO IRP fee model to water bills to fund conservation programs (i.e. rebates, audits, new technology, alternative water sources) *(2)
    - Rebates for water conservation devices and systems
    - Tax credits and rebates *(3)
    - Financial dis-incentive for over consumption of water (i.e. tiered system)
    - Raise water rates comparable to mainland

*(_) – A dot sticker (along with the number of stickers) was placed on the idea

Development of State Water Conservation Plan

Water Conservation Advisory Group Meeting #2

August 25, 2011

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US Army Corps of Engineers

Agenda

- 12:30-12:45 Welcome and Re-introductions
- 12:45-12:50 Agenda Review and Workshop Objectives
- 12:50-1:00 Scope "Refresher"
- 1:00-1:45 Water Use Data Review
- 1:45-2:45 Break-out Session: Water Conservation Best Practices
- 2:45-3:00 Break
- 3:00-4:15 Break-out Session: Implementation Strategies
- 4:15-4:30 Observations and Next Steps

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Scope Refresher

Project Overview-Scope of Services

- Establish a Water Conservation Advisory Group (WCAG), host regular meetings
- Establish state-wide water conservation goals, with input from WCAG
- Analyze water use sectors to determine water conservation potential and identify cost-effective water conservation measures
  - Water purveyors, golf courses, agriculture, military, ICI, landscape and residential

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Project Overview-Scope of Services cont.

- Identify, evaluate and compare the effectiveness of water conservation programs and measures
- Identify and develop the elements of and recommendations for a statewide water conservation program. Elements include:
  - Staff training, policy development, public education and outreach, incentive programs, technical assistance, MOU's with stakeholders and web page development

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Project Overview-Scope of Services cont.

- Statewide Water Conservation Plan will include:
  - Short and long term considerations
  - Strategic plan (goals and objectives)
  - Implementation and funding plan
    - Staff needs, funding amounts and sources, cost estimates
  - Water conservation program description
  - Outreach plan
- Framework for continued operation of the WCAG

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Water Use Data Review

Agriculture

Golf Courses

Landscapes

Goals of the Water Use Profile

- Characterize total water use for comparison across islands and sectors
- Estimate current water use efficiency
- Identify opportunities for conservation

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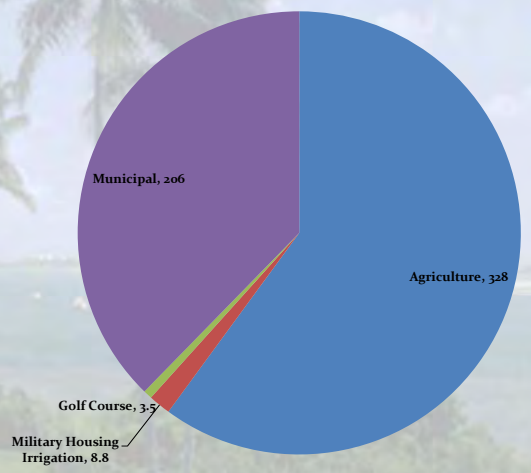
Water Use Profile - Overall



*Data represents only the users who supplied water usage data.

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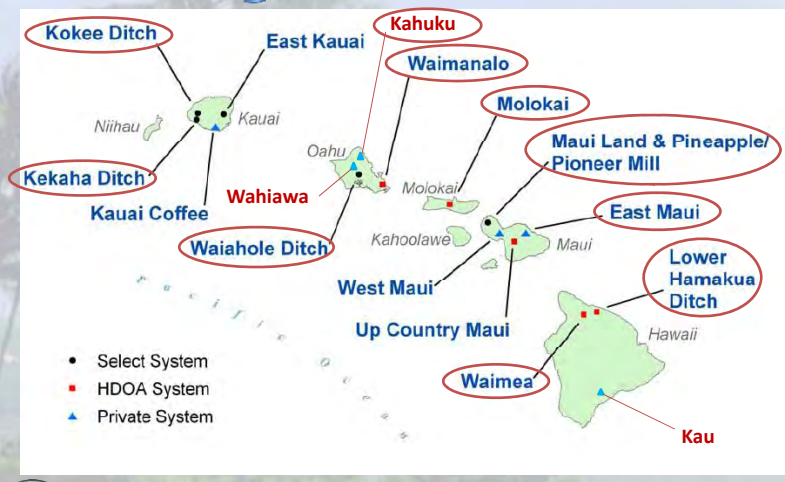
Systems Included in Water Use Profile - Agriculture



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Systems Described in 2004 AWUDP	Water Use Data Provided Obtained
Select Systems	
East Kauai Irrigation System	
Kekaha Ditch Irrigation System	Two months only in 2000 & 2002 (HDOA); Monthly Flow Data (1988-1999) (ADC)
Kokee Ditch Irrigation System	Monthly Flow Data (1988-1999) from ADC
Maui Land and Pineapple/Pioneer Mill Irrigation System	Monthly Flow Data (2010-2011)
Waiahole Ditch irrigation System	Monthly Data (July 1999-June 2010) and reports from ADC
HDOA Systems	
Lower Hamakua Ditch Irrigation System	2000-2001, 2003-2010 (Honokaa-Paauilo: LHP)
	2003-2010 (Honokaa-Paauilo: LHL)
Molokai Irrigation System*	1995-2010
Upcountry Maui Irrigation System	Construction not complete
Waimanalo Irrigation System*	1995-2010
Waimea Irrigation System*	1995-2010 (Lalamilo)
	1995-2010 (Hawaiian Homes)
	1995-2010 (Puukapu)
Private Systems	
East Maui Irrigation System	Daily supply and demand data (June 2010-August 2011)
Kauai Coffee Irrigation System	
West Maui Irrigation System	
Other Systems	
Kahuku Agricultural Park	2000-2010

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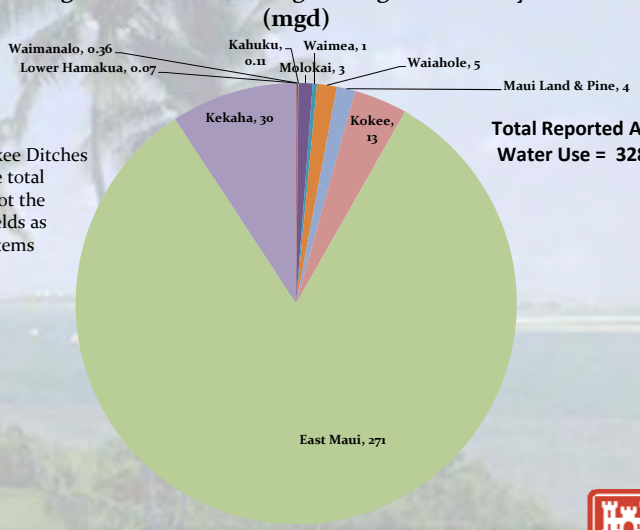
Water Use Profile - Agriculture

Average Annual Water Usage for Agricultural Systems (mgd)



*Kekaha/Kokee Ditches represent the total diversions, not the end use at fields as for other systems shown.

Total Reported Annual Water Use = 328 mgd

This pie chart represents data received for a combination of various years (1995-2010).

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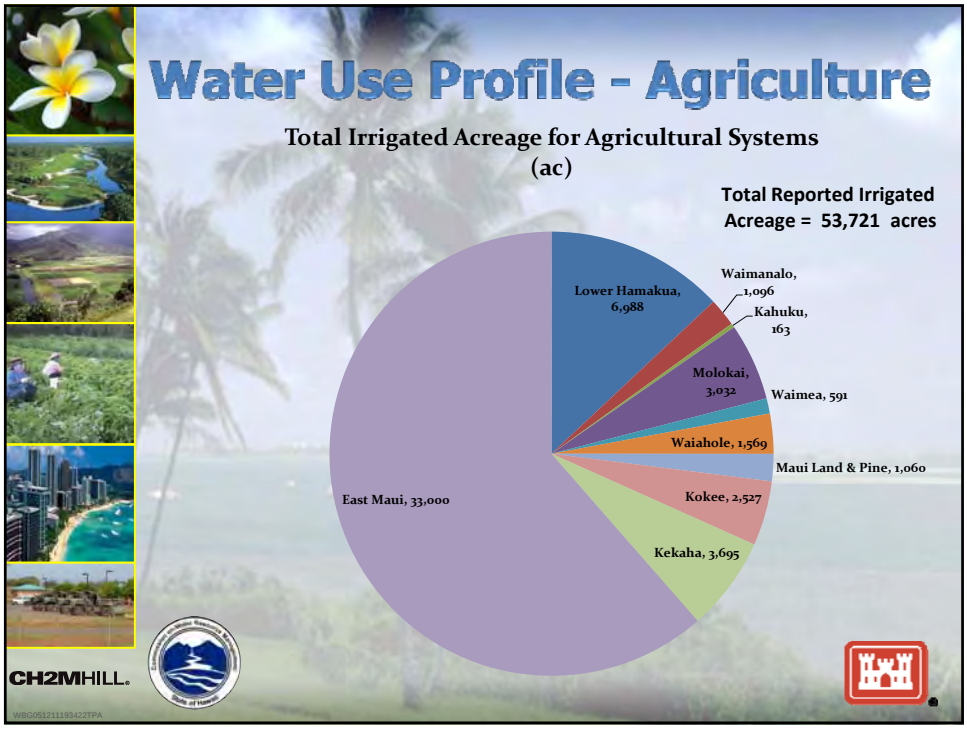
Water Use Profile - Agriculture
Total Irrigated Acreage for Agricultural Systems
(ac)
Total Reported Irrigated Acreage = 53,721 acres
Lower Hamakua, 6,988
Waimanalo, 1,096
Kahuku, 163
Molokai, 3,032
Waimea, 591
Waiahole, 1,569
Maui Land & Pine, 1,060
Kokee, 2,527
Kekaha, 3,695
East Maui, 33,000
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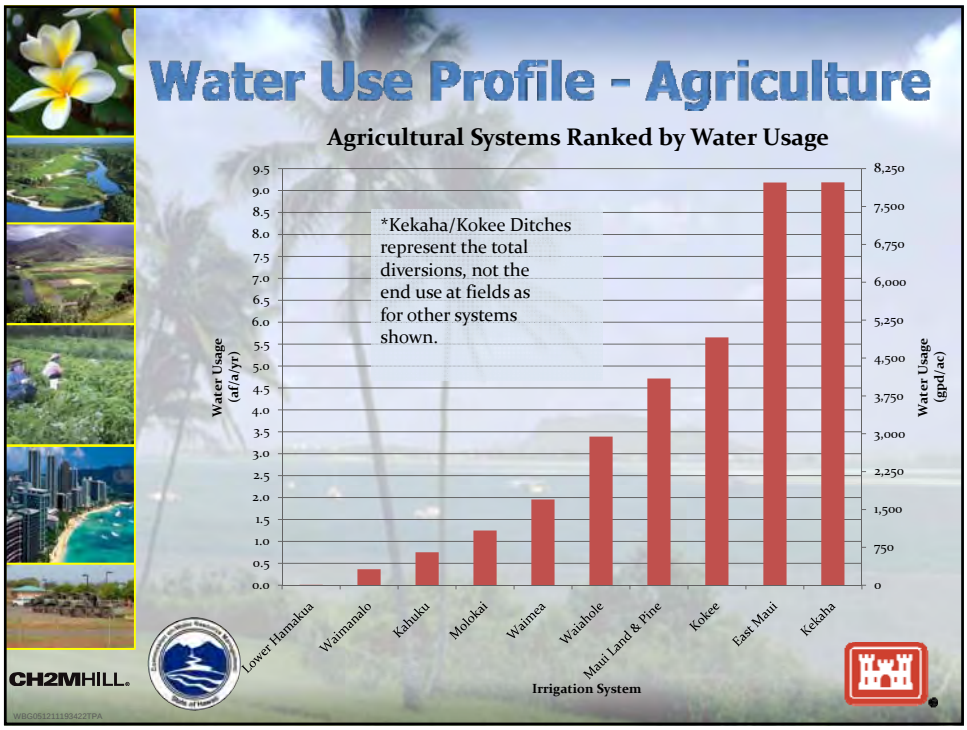
Water Use Profile - Agriculture
Agricultural Systems Ranked by Water Usage
*Kekaha/Kokee Ditches represent the total diversions, not the end use at fields as for other systems shown.
Water Usage (af/a/yr)
Water Usage (gpd/ac)
Lower Hamakua
Waimanalo
Kahuku
Molokai
Waimea
Waiahole
Maui Land & Pine
Kokee
East Maui
Kekaha
Irrigation System
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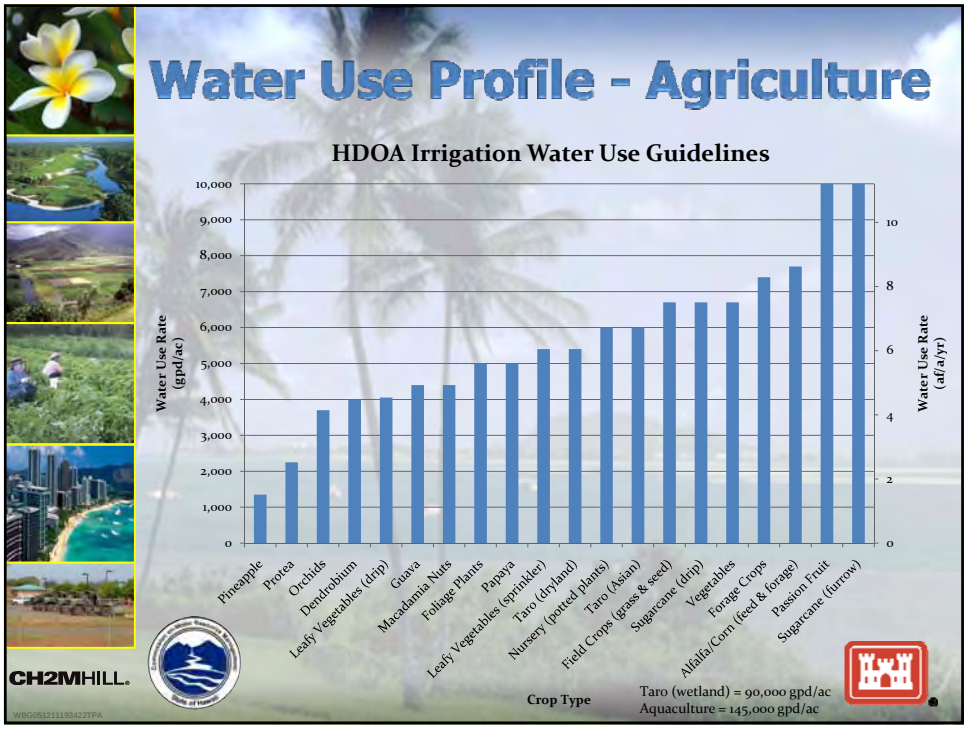
Water Use Profile - Agriculture
HDOA Irrigation Water Use Guidelines
Water Use Rate (gpd/ac)
Water Use Rate (af/a/yr)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
10
8
6
4
2
0
Pineapple
Protea
Orchids
Dendrobium
Leafy Vegetables (drip)
Guava
Macadamia Nuts
Foliage Plants
Papaya
Leafy Vegetables (sprinkler)
Taro (dryland)
Nursery (potted plants)
Taro (Asian)
Field Crops (grass & seed)
Sugarcane (drip)
Vegetables
Forage Crops
Alfalfa/Corn (feed & forage)
Passion Fruit
Sugarcane (furrow)
Crop Type
Taro (wetland) = 90,000 gpd/ac
Aquaculture = 145,000 gpd/ac
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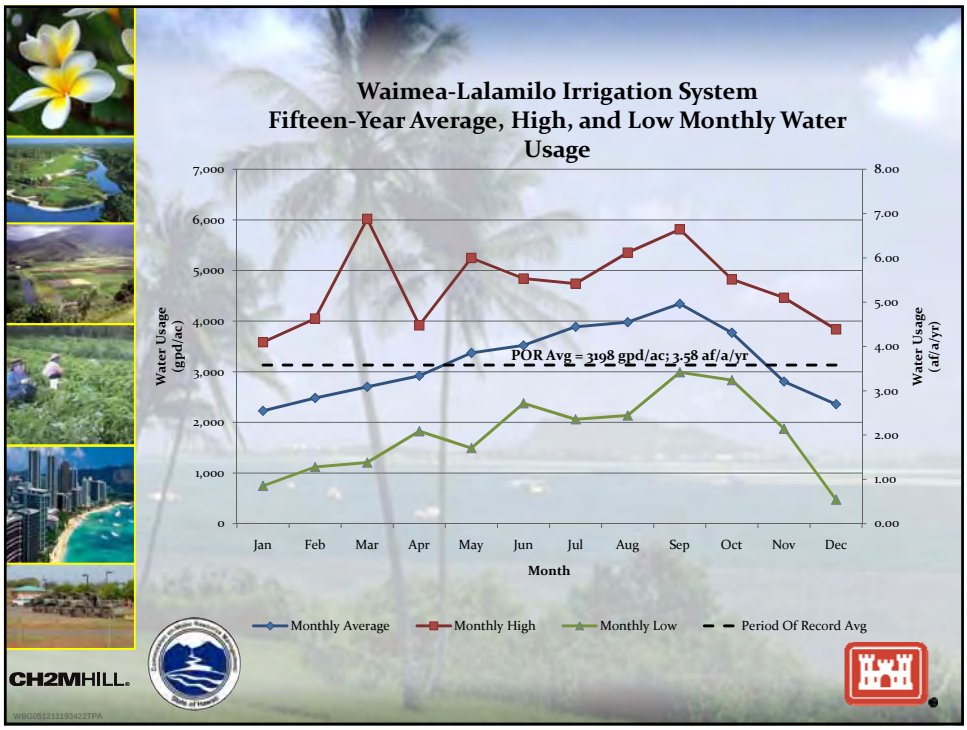
Waimea-Lalamilo Irrigation System
Fifteen-Year Average, High, and Low Monthly Water Usage
Water Usage (gpd/ac)
Water Usage (af/a/yr)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
POR Avg = 3198 gpd/ac; 3.58 af/a/yr
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Monthly Average
Monthly High
Monthly Low
Period Of Record Avg
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Data Observations - Agriculture

- Some large ag water uses are not metered
- In metered systems, water use is generally metered at diversions from ditches or at the end user property line
- Stream diversions are not metered so the following losses are not captured:
  - Canal and reservoir leakage and evaporation
  - Operational canal spills

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Systems Included in Water Use Profile – Golf Courses

- Data from 12 courses on 4 islands

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Water Use Profile - Golf Courses

Type	# of Golf Courses	Total Acreage	# of Holes
Limited Data* (# Holes; Acreage)	55	8245	1026
Provided Water Use Data**	12	2204	289
No Data Received	4		
Total:	71	10449	1315

*Acreages for 9 of the 55 courses were estimated using Google Earth.
** 7 of the 12 courses provided monthly water use data (see the table below for the periods received).

Golf Course Name	Period of Data
Moanalua	Nov 1992-Jun 2010
Pearl	Jan 2005-Jun 2011
Kaanapali	Jul 2010-Jun 2011
Kahili-King Kam	May 2006-Dec 2010
Navy-Marine	Nov 1992-Jan 2011
Hualalai/Keolu	Jan 2006-May 2011
Kukio	Jan 2006-Dec 2010

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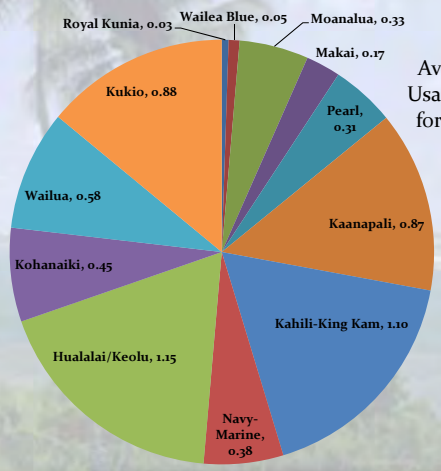
Water Use Profile - Golf Courses



Average Annual Water Usage (mgd) normalized for 18 holes = 0.37 mgd

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Water Use Profile - Golf Courses
Peak Month Water Use per 18 Holes (mgd)
0.82 mgd high
Average Peak Month Normalized for 18 Holes = 0.65 mgd
Royal Kunia, 0.60
Wailea Blue, 0.80
Moanalua, 0.54
Makai, 0.28
Pearl, 0.55
Kaanapali, 0.65
Kahili-King Kam, 0.80
Navy-Marine, 0.57
Hualalai/Keolu, 0.80
Kohanaiki, 0.82
0.28 mgd low
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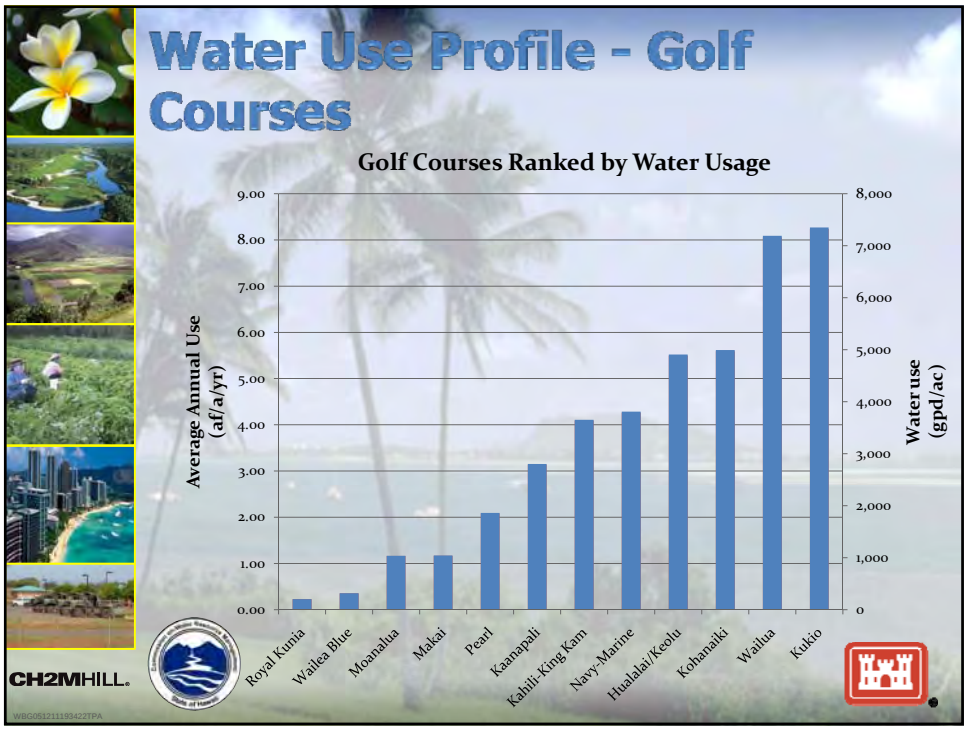
Water Use Profile - Golf Courses
Golf Courses Ranked by Water Usage
Average Annual Use (af/a/yr)
Water use (gpd/ac)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Royal Kunia
Wailea Blue
Moanalua
Makai
Pearl
Kaanapali
Kahili-King Kam
Navy-Marine
Hualalai/Keolu
Kohanaiki
Wailua
Kukio
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Water Use Profile - Golf Courses

- Procedures for Estimating Water Use Efficiency of 12 Golf Courses with Measured Water Use
  - Average annual net irrigation water requirements (NIWR)
    - Pan evaporation Atlas for Hawaii (DLNR)
    - Local climate stations for precipitation
    - Corrections for crop ET and effective precipitation
  - Overall Water Use Efficiency = NIWR / AW

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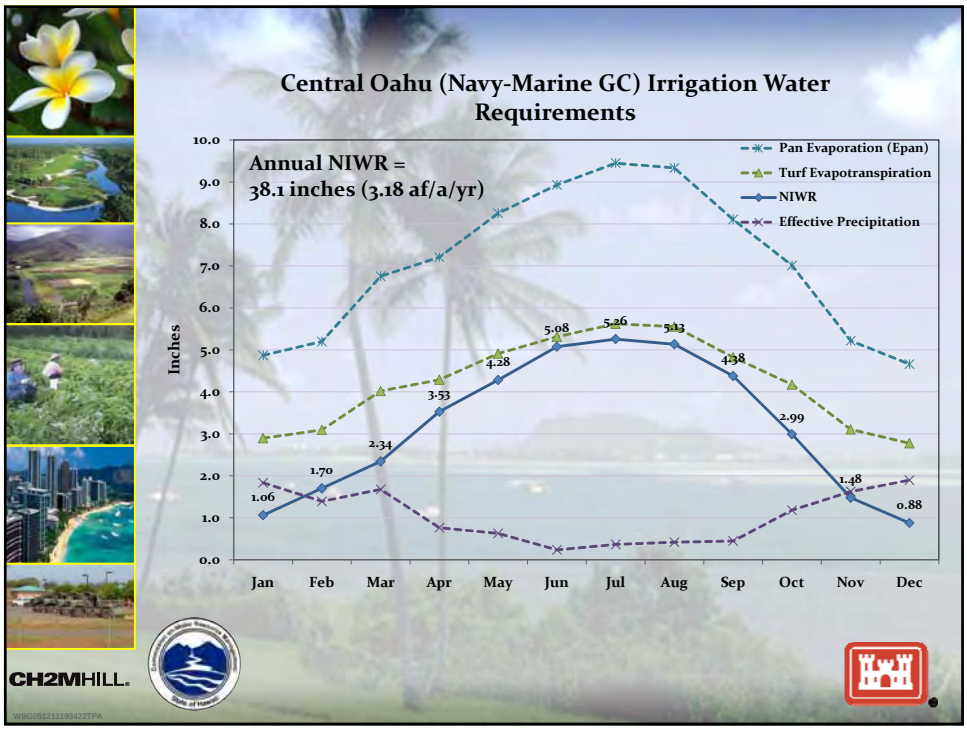

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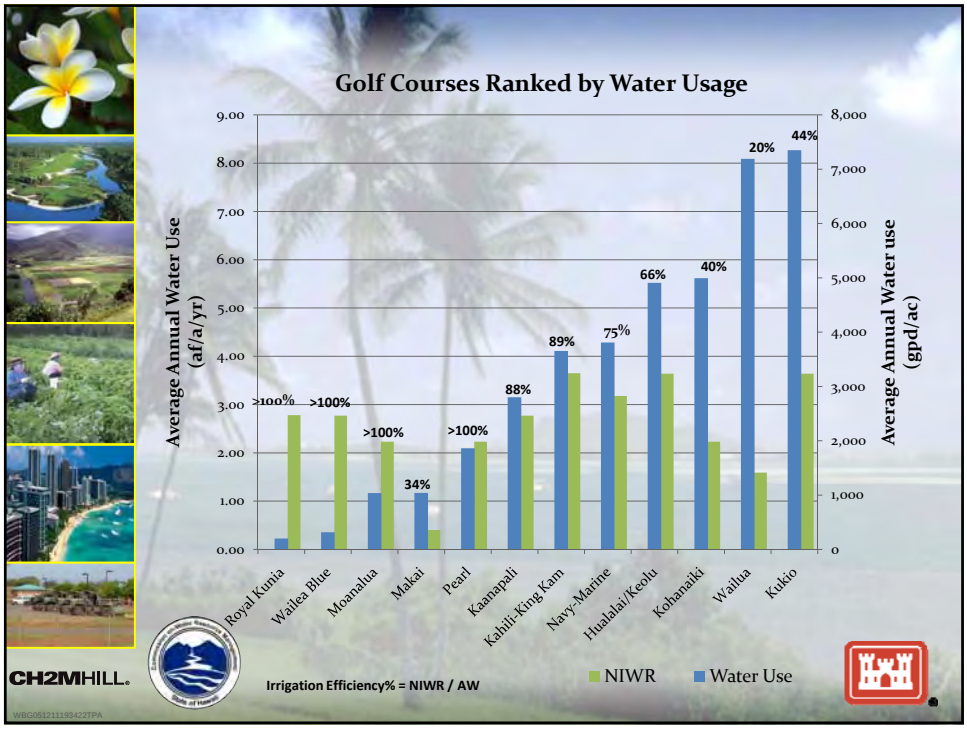
Golf Courses Ranked by Water Usage
Average Annual Water Use (af/a/yr)
Average Annual Water use (gpd/ac)
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
>100%
>100%
>100%
34%
>100%
88%
89%
75%
66%
40%
20%
44%
Royal Kunia
Wailea Blue
Moanalua
Makai
Pearl
Kaanapali
Kahili-King Kam
Navy-Marine
Hualalai/Keolu
Kohanaiki
Wailua
Kukio
Irrigation Efficiency% = NIWR / AW
NIWR
Water Use
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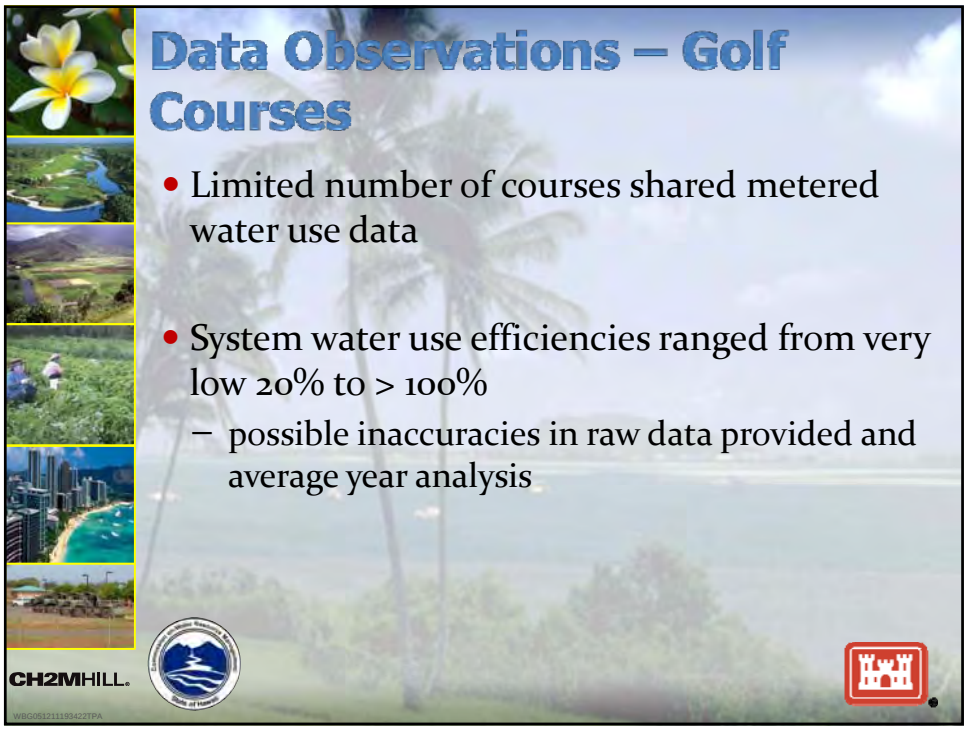
Data Observations – Golf Courses
• Limited number of courses shared metered water use data
• System water use efficiencies ranged from very low 20% to > 100%
– possible inaccuracies in raw data provided and average year analysis
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Systems Included in Water Use Profile – Landscape Irrigation

- Municipalities
  - Kauai DOW
  - CCH BWS
  - Maui DWS
- Military
  - Housing irrigation

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Municipal Water Providers – Landscape Irrigation

- Hawaii – 2004-2009, annual by meter size (no categories)
- Maui – 2006-2009, monthly by category (Agriculture and Irrigation Categories)
- Oahu – 2006-2009, monthly by category (Agriculture and Irrigation Categories)
- Kauai – 2006-2009, monthly by category (Agriculture and Irrigation Categories)

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Military – Landscape Irrigation

- Pearl City
- Moanalua Terrace
- Manana
- Ford Island North

Other housing divisions did not separate out irrigation water use.

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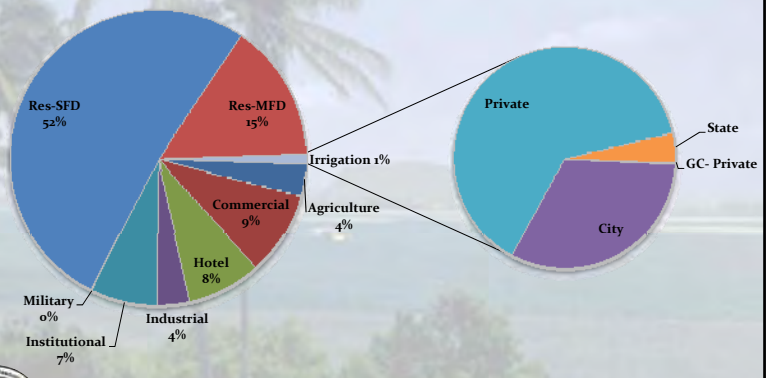
Water Use Profile - Landscape Irrigation

Maui DWS Water Use by Sector (2006-2009)



Total Average Annual Use: 34.5 MGD

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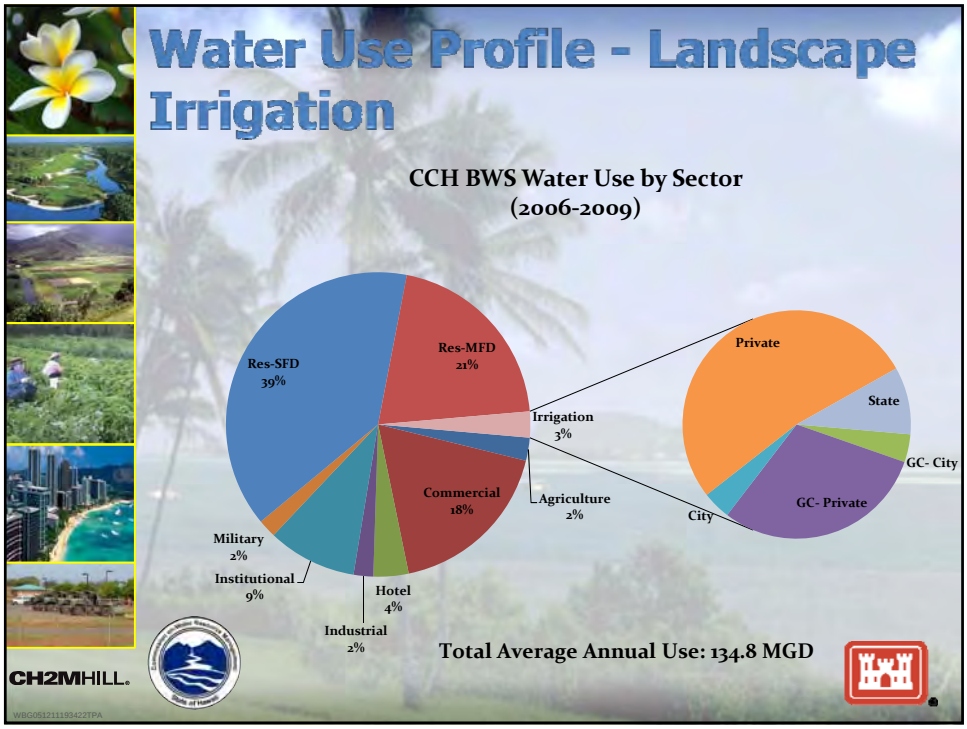
Water Use Profile - Landscape Irrigation
CCH BWS Water Use by Sector
(2006-2009)
Res-SFD 39%
Res-MFD 21%
Irrigation 3%
Commercial 18%
Agriculture 2%
Military 2%
Institutional 9%
Hotel 4%
Industrial 2%
Private
State
GC- City
GC- Private
City
Total Average Annual Use: 134.8 MGD
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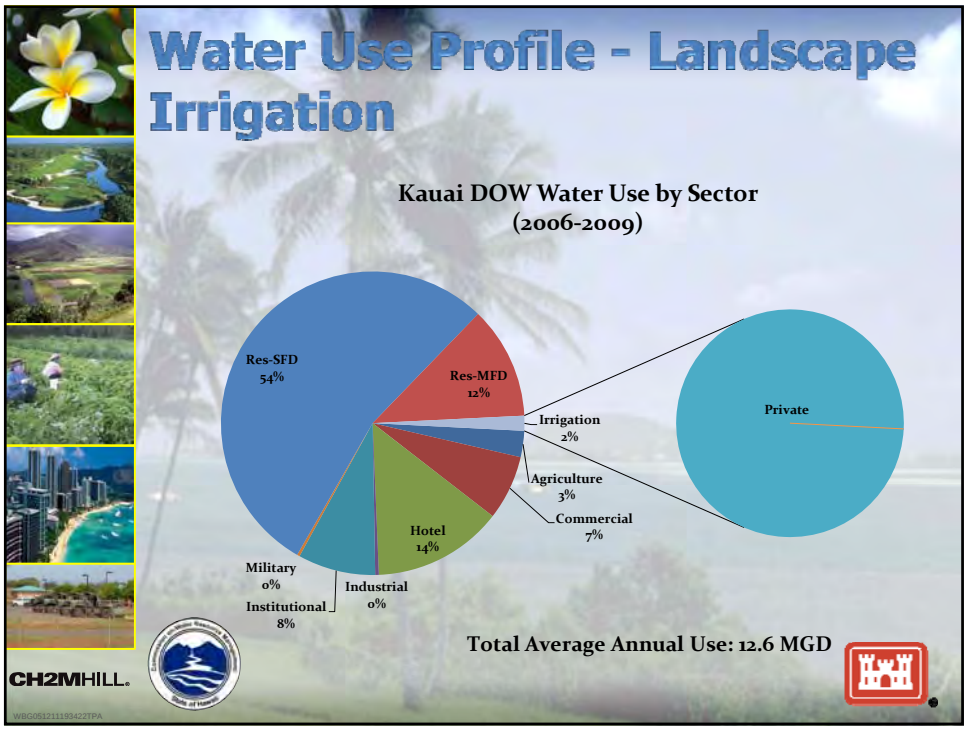
Water Use Profile - Landscape Irrigation
Kauai DOW Water Use by Sector
(2006-2009)
Res-SFD 54%
Res-MFD 12%
Irrigation 2%
Agriculture 3%
Commercial 7%
Hotel 14%
Industrial 0%
Military 0%
Institutional 8%
Private
Total Average Annual Use: 12.6 MGD
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Water Use Profile - Landscape Irrigation

- Maui DWS

2008-2009 (MGD)	Average Month	Maximum Month	Minimum Month
Total	33	37	25
Single Family	18	20	13

Maximum Month is 50% higher than Minimum Month and 12% higher than Average Month (Total)

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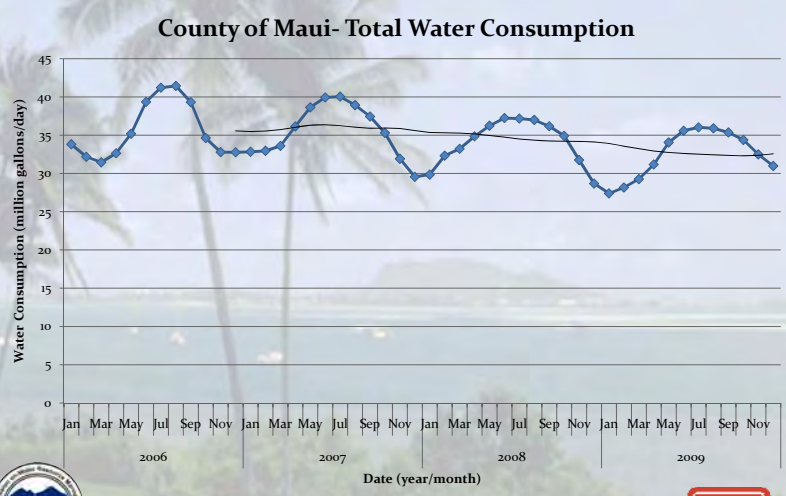
Water Use Profile - Landscape Irrigation



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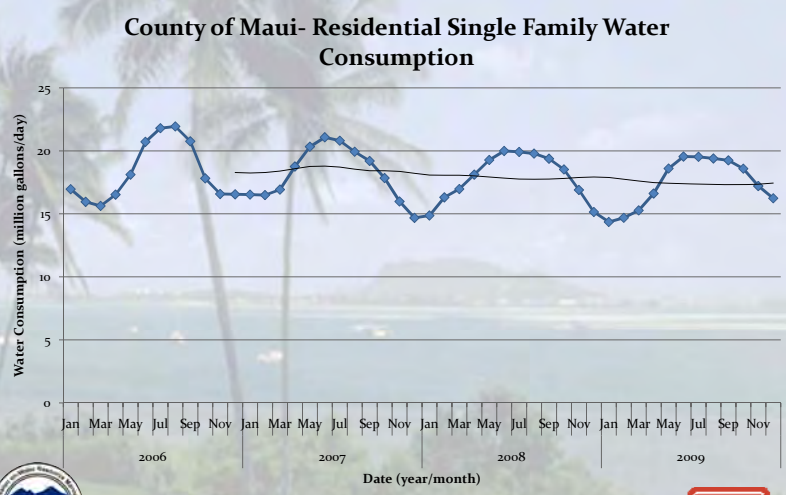
Water Use Profile - Landscape Irrigation



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Water Use Profile - Landscape Irrigation

- Kauai DOW

2008-2009 (MGD)	Average Month	Maximum Month	Minimum Month
Total	12	14	10
Single Family	7	8	6

Maximum Month is 40% higher than Minimum Month and 17% higher than Average Month (Total)

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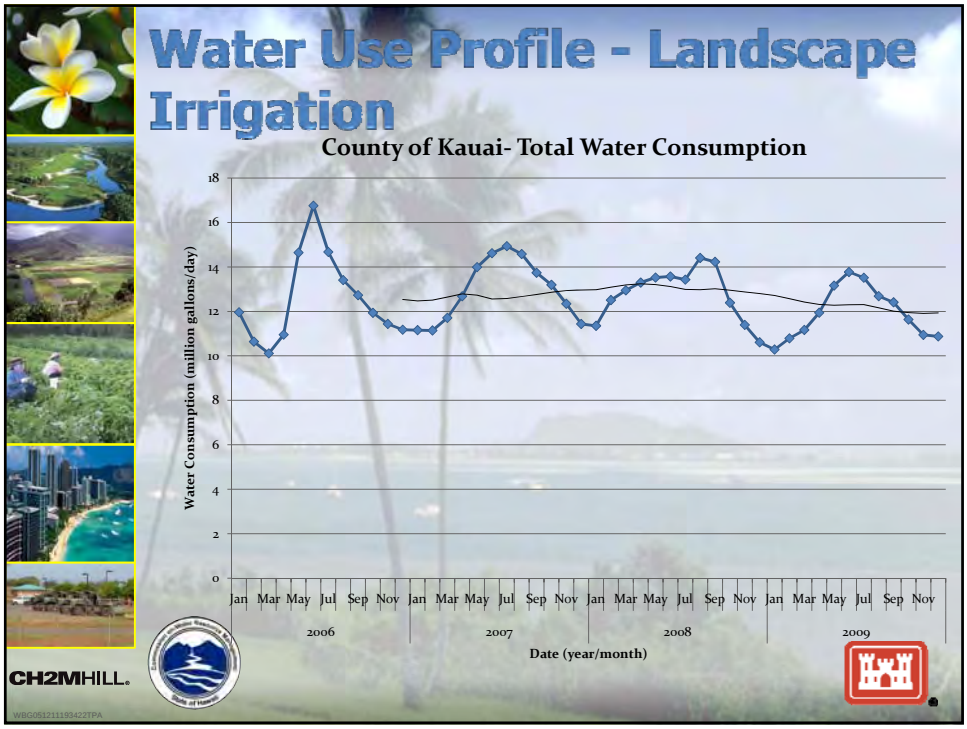
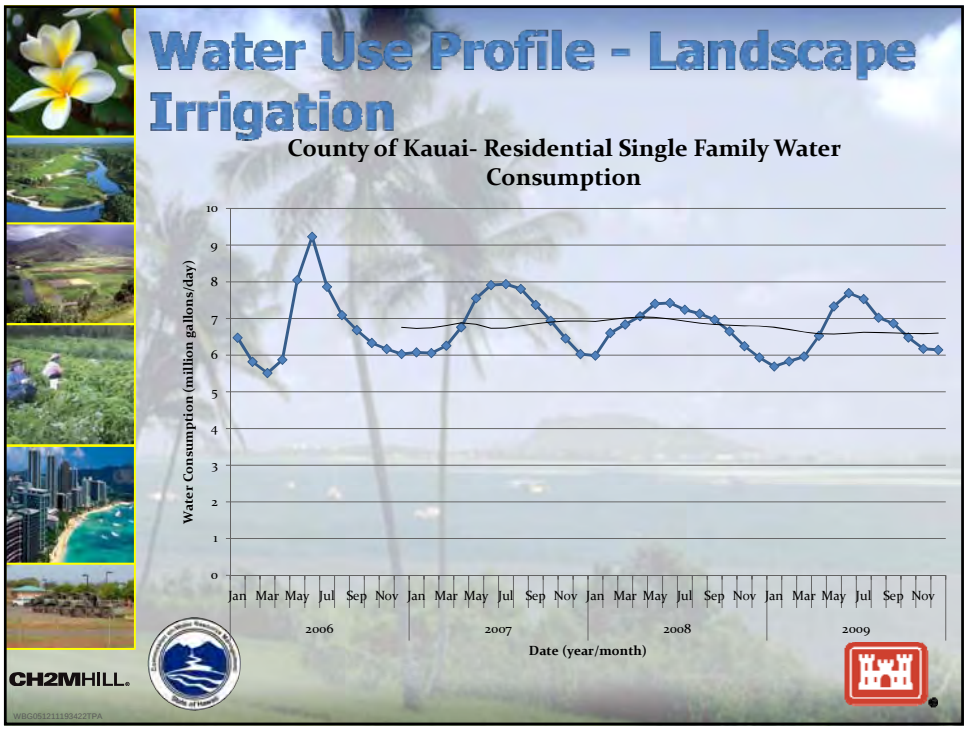

Water Use Profile - Landscape Irrigation
County of Kauai- Total Water Consumption
Water Consumption (million gallons/day)
0
2
4
6
8
10
12
14
16
18
Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov
2006
2007
2008
2009
Date (year/month)
CH2MHILL.


Water Use Profile - Landscape Irrigation
County of Kauai- Residential Single Family Water Consumption
Water Consumption (million gallons/day)
0
1
2
3
4
5
6
7
8
9
10
Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov
2006
2007
2008
2009
Date (year/month)
CH2MHILL.

Water Use Profile - Landscape Irrigation

- CCH BWS

2008-2009 (MGD)	Average Month	Maximum Month	Minimum Month
Total	132	143	115
Single Family	52	56	46

Maximum Month is 24% higher than Minimum Month and 8% higher than Average Month (Total)

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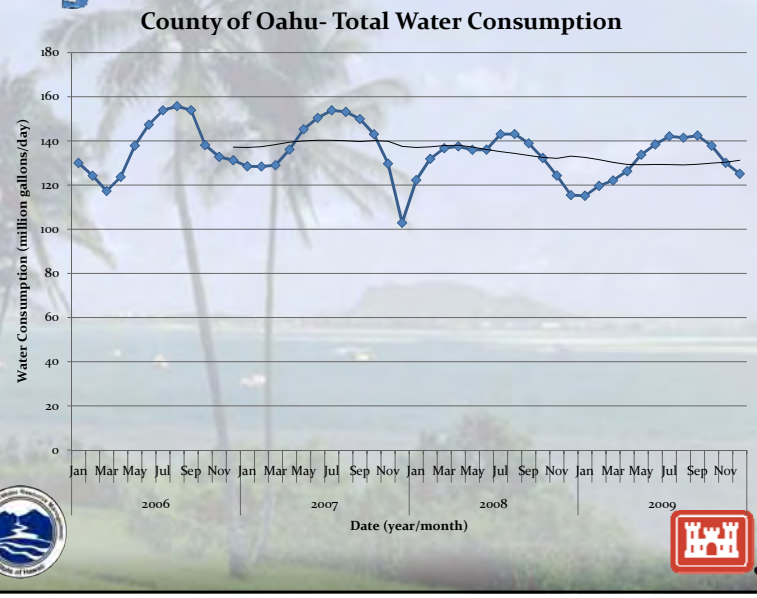
Water Use Profile - Landscape Irrigation



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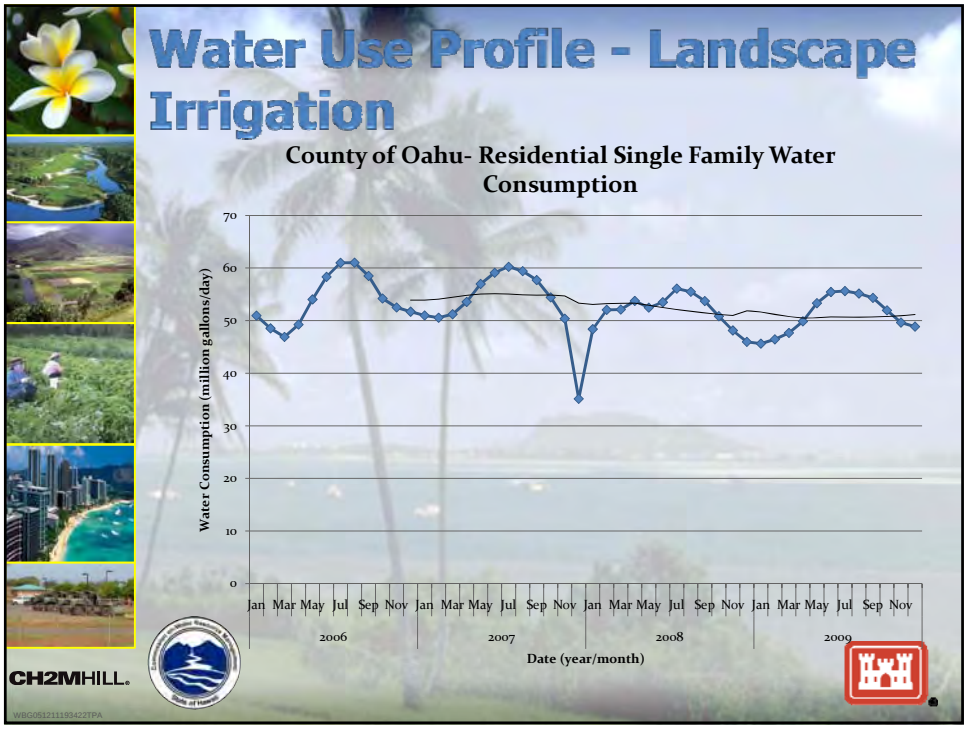
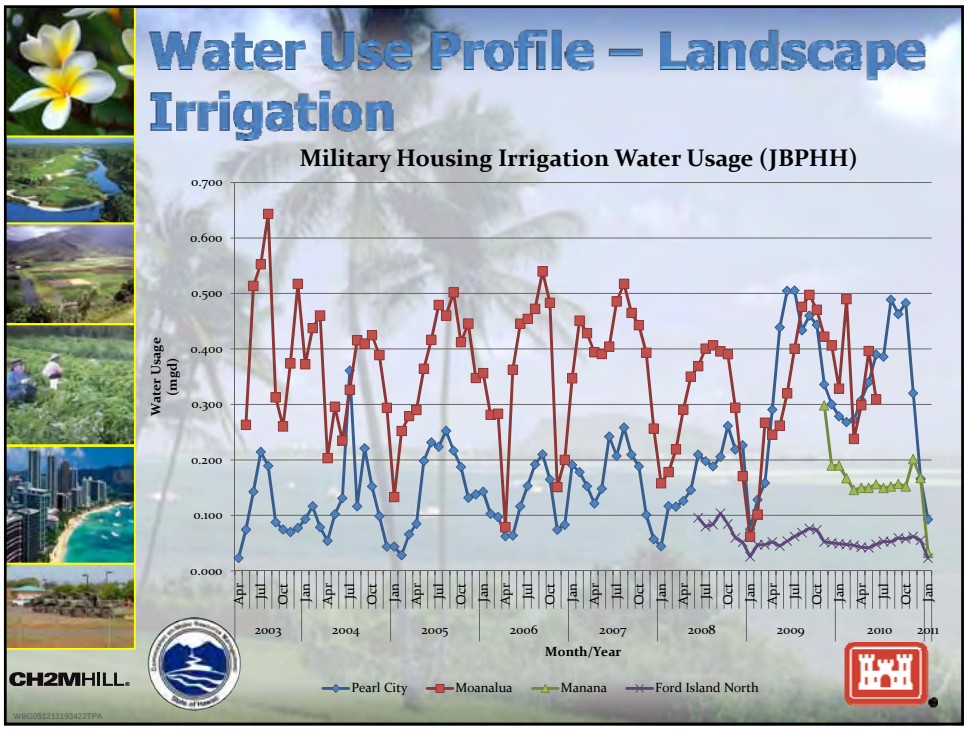

Water Use Profile - Landscape Irrigation
County of Oahu- Residential Single Family Water Consumption
Water Consumption (million gallons/day)
70
60
50
40
30
20
10
0
Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov Jan Mar May Jul Sep Nov
2006
2007
2008
2009
Date (year/month)
CH2MHILL.


Water Use Profile – Landscape Irrigation
Military Housing Irrigation Water Usage (JBPHH)
Water Usage (mgd)
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2003
2004
2005
2006
2007
2008
2009
2010
2011
Month/Year
Pearl City
Moanalua
Manana
Ford Island North
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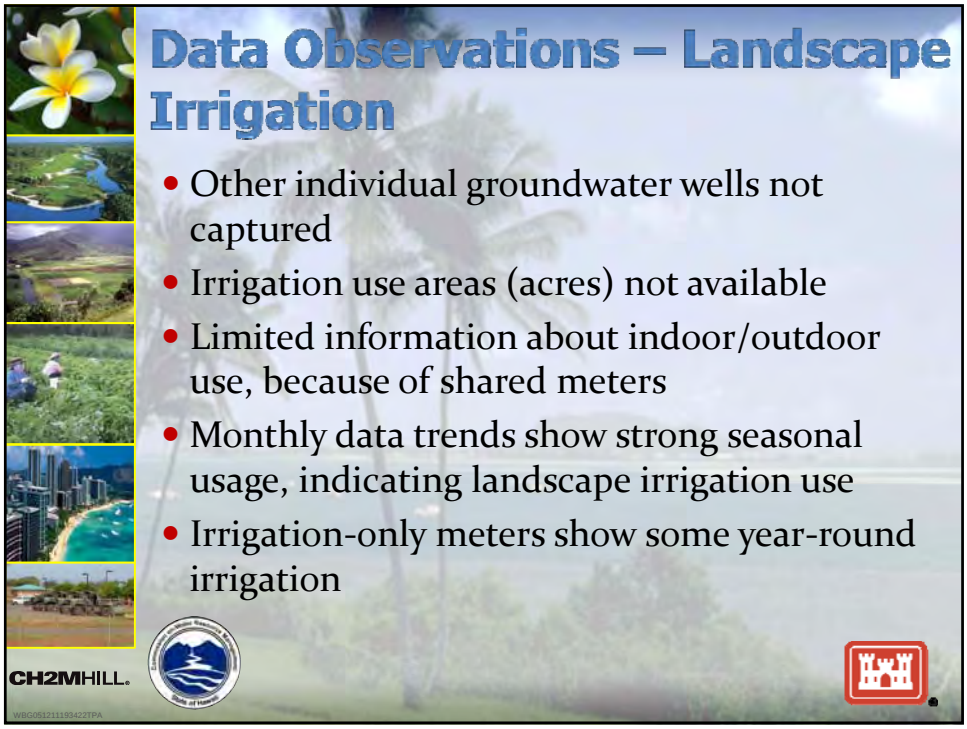
Data Observations – Landscape Irrigation
• Other individual groundwater wells not captured
• Irrigation use areas (acres) not available
• Limited information about indoor/outdoor use, because of shared meters
• Monthly data trends show strong seasonal usage, indicating landscape irrigation use
• Irrigation-only meters show some year-round irrigation
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Advisory Group Input ?
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Water Conservation Best Practices

Agriculture

Golf Courses

Landscape Irrigation

Primary Sources of Initial Best Practice Lists

- Agriculture
  - Water Conservation Best Management Practices Guide (Texas Water Development Board)
  - Administrative Rules on Water Management and Conservation Plans (Oregon Water Resources Department)
- Golf Courses
  - Best Management Practices (BMPs) Water-Use Efficiency/Conservation Plan for Golf Courses (University of Georgia)
- Landscape Irrigation
  - Position Statement on Irrigation Water Conservation (Landscape Industry Council of Hawaii)

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Agriculture

Agriculture			
BMP Category	Specific BMPS	Comments	Priority
Use of Alternative Irrigation Water Sources			
	Reclaimed Water Use		
	Brackish Water Use		
Irrigation Water Use Management			
	Climate Based Irrigation Scheduling		
	Soil Moisture Based Irrigation Scheduling		
	On Farm Irrigation Audits		
On-Farm Systems			
	Volumetric Measurement of Irrigation Water Use		
	Conversion of Supplemental Irrigated Farmland to Dry-Land Farmland		
	Brush Control/Management		
	Crop Residue Management and Conservation Tillage		
	Lining of On-Farm Irrigation Ditches		
	Replacement of On-Farm Irrigation Ditches with Pipelines		
	Conversion to Higher Efficiency Flood Irrigation Systems		
	Conversion to Drip/Micro-Irrigation System		
	Conversion to Center Pivot, Linear Move, and Sprinkler Irrigation Systems		
	Tailwater Recovery and Reuse Systems		
	Drainwater Recovery and Reuse Systems		

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Golf Courses

Golf Courses			
BMP Category	Specific BMPS	Comments	Priority
Use of Alternative Irrigation Water Sources			
	Reclaimed Water Use		
	Brackish Water Use		
Landscape and Golf Course Design			
	Drought Resistant and Low Water Use Turf Grass		
	Minimizing Close-Cut, Highly Maintained Turf Area		
	Lining of storage ponds and all water features		
	Stormwater and drainage capture and reuse		
Irrigation Systems Design and Devices			
	Use a qualified irrigation designer and installation contractor such as those certified by the Irrigation Association		
	Centralized irrigation control systems		
	Flow meter on main water sources		
	Multiple flow meters in distribution system for leak detection		
	Automatic rain shut-off devices		
	Automatic wind shut-off devices		
	Automatic drain valves to limit head drainage in low areas		
	Pressure regulators to ensure proper operating pressure		
	Drip systems for landscape plants		

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Landscape Irrigation

Landscape			
BMP Category	Specific BMPS	Comments	Priority
LICH Position Statement Measures			
Support and encourage the following best management practices for new installations or major renovations			
	Design irrigation system with sprinklers spaced with head to head coverage or better.		
	Irrigation system plans and specifications shall include post-construction documentation, including drawings or record (as-built drawings), maintenance recommendations, seasonal operational schedules, design precipitation rates, manufacturer's operational guide which shall remain on site. Specifications shall require a coverage test prior to acceptance and LICH water conservation best practices.		
	Irrigate with a precipitation rate not exceeding soil infiltration rate.		
	Design systems to irrigate similar hydrozones (similar site, slope, sun exposure, soil conditions, and plant materials with similar water use) on same circuit. Avoid irrigation overlap between high and low water demand hydrozones.		
	Use a Climate Based Irrigation Controller (Smart Controller). Automatic irrigation controllers utilizing either evapotranspiration, weather sensor or soil moisture sensor.		
	Encourage the use of drip irrigation for individual specimen plants.		
	Use of flow sensors with malfunction valve shutoff system capability at irrigation controller.		
	Use irrigation submeter that measures water use on large sites.		

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Breakout Group Questions

- How do the BMP's apply to the circumstances in Hawaii?
- Do they apply equally to publicly owned and privately owned systems? If no, why not?
- How would you change or modify them to be more applicable to different systems? Public? Private? (write changes/issues/thoughts in the comments section)
- What additional BMP's should be included for consideration in the statewide water conservation plan?
- What else should the CWRM be thinking about for effective water resource management now and in the future?

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Break-out Groups
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BREAK

Implementation Strategies

Potential Implementation Strategies

- Policies and Regulation
- Financial Assistance and Incentives
- Education and Outreach
- Partnerships

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Policies and Regulations - Existing

- Water Use Permits required in designated Water Management Areas (ground, surface)
- Common Law on water rights and uses applies in non-designated areas
- Well Construction and Pump Installation permits required for any new or modified ground water use
- Stream Diversion and Stream Alteration permits required for any new or modified surface water diversion (plus petition to amend Interim Instream Flow Standard, as appropriate)
- Traditional and customary rights of ahupua'a tenants
- Appurtenant rights of kuleana and taro lands

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Policies and Regulations - Existing

- CWRM Water Use Permit holders are required to be water efficient and to develop a water shortage plan
- State Energy Policy and Hawaii Clean Energy Initiative has water efficiency implications
- Governor Lingle's Administrative Directive requiring LEED certification for new/renovat.
- HBWS proposed rate increase (public comment period)
- Hawaii 2050 Sustainability Plan

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Incentives and Financial Assistance - Existing

- Federal Sources
  - EPA (State DOH administered)
    - DWSRF Loans
    - CWSRF Loans
  - Bureau of Reclamation
    - Title 16 Grants
    - WaterSMART
  - NRCS
    - EQIP
    - AWEP
- Local/State Examples
- Other State Examples

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EPA – Drinking Water State Revolving Fund

- Low interest loans available for potable water system projects
- Project rating criteria includes 10 incentive points for having a water conservation program
- Green Project Reserve
  - up to 20% of available funds annually (up to ~$20M in 2011)
  - eligible projects include water efficiency projects and receive bonus rating points
- Additional Subsidization
  - Targeted to Green Project Reserve
  - zero interest loans with principal forgiveness
  - FY2011 includes ~$2.8M

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EPA – Clean Water State Revolving Fund

- Low interest loans for capital projects that improve water quality (Point and non-point source projects)
- $60.8 Million planned for FY2012 in Hawaii
- Interest rates 1-2% below muni bond rate with 20 year payback
- Green project reserve applies to CWSRF also (20% set-side for green projects inc. water/energy efficiency)
- Most often used for wastewater projects
- Examples exist for application to irrigation canal piping projects that reduce irrigation return flows to sensitive surface waters

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USBR - Title 16 Grants

- Water reclamation and reuse projects
- Focus on stretching water supplies and water supply sustainability
- Up to 25% funding of total project costs for water recycling projects
- Opportunities are wide-ranging including irrigation, environmental restoration, groundwater recharge and others

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USBR - WaterSMART Grants

- Has not been used in Hawaii and is generally restricted to projects involving Reclamation water
- 50/50 cost-shared funding
- Sustainable water supply emphasis
- Water and Energy grants
  - save water, improve energy efficiency, address environmental issues
- System Optimization Review Grants
  - Broad look at system-wide efficiency
- Include method for quantifying benefits

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Natural Resources Conservation Service Programs

- Presentation by Sharon Sawdey/NRCS on NRCS incentive programs (EQIP and AWEP)

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Local/State Examples

- DBEDT Green Business Program
- Legislation introduced to incentivize sustainable development (includes water conservation)
- Discontinued
  - MDWS replacement plumbing fixtures project (limited)
  - HBWS toilet rebate program
  - Special legislation for drought mitigation

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Examples from Other States

- Florida
  - Cooperative funding program; annual competitive grant process w/ 50/50 cost share; state share from property taxes
- California
  - Competitive grants programs with local cost share; state share from General Obligation bonds
  - Recent emphasis on Integrated Regional Water Management (IRWM) grants
    - Proposals include multiple projects: water supply, water conservation, water quality, environmental restoration, flood control
    - Local agencies must cooperate to submit an integrated regional proposal

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Outreach and Education - Existing

- CWRM water conservation publications
- HHLA hotel room cards (linen/towels)
- Project WET (Kauai)
- BWS
  - Annual Leak Detection workshop (county water departments)
  - TV media buys
  - Halawa xeriscape garden/unthirsty plant events
  - Rain barrel event
  - Annual poster contest
  - School presentation/guest speakers

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Outreach and Education - Existing

- County water department media buys (TV, print)
- NRCS/Oahu RC&D irrigation workshop
- CWRM miscellaneous public events (i.e., Earth Day)

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Partnerships

- PPP examples
  - Technology demonstration/transfer (SMART irrigation system installed at public building)
  - Shared cost for development of alternative water sources to offset potable use (reclaimed)
- Public/Public examples
  - JPA's for products and/or services (toilet rebate services, bulk purchase)
  - Media relations
- Professional societies
  - Legislation

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Breakout Group Questions - 1

- What is already working well that could be enhanced or expanded?
- What policies are needed to enhance and encourage the implementation of water conservation practices?
- How effective can regulations (and enforcement) be in improving water use efficiency in Hawaii? (consider culture, economics, history, land use, enforcement capacity, organizational structure, etc.)
- What should water managers in Hawaii be thinking about to increase efficiency in 10 years? 20 years?
- How important are financial incentives (or penalties) in "motivating" investments in water conservation?

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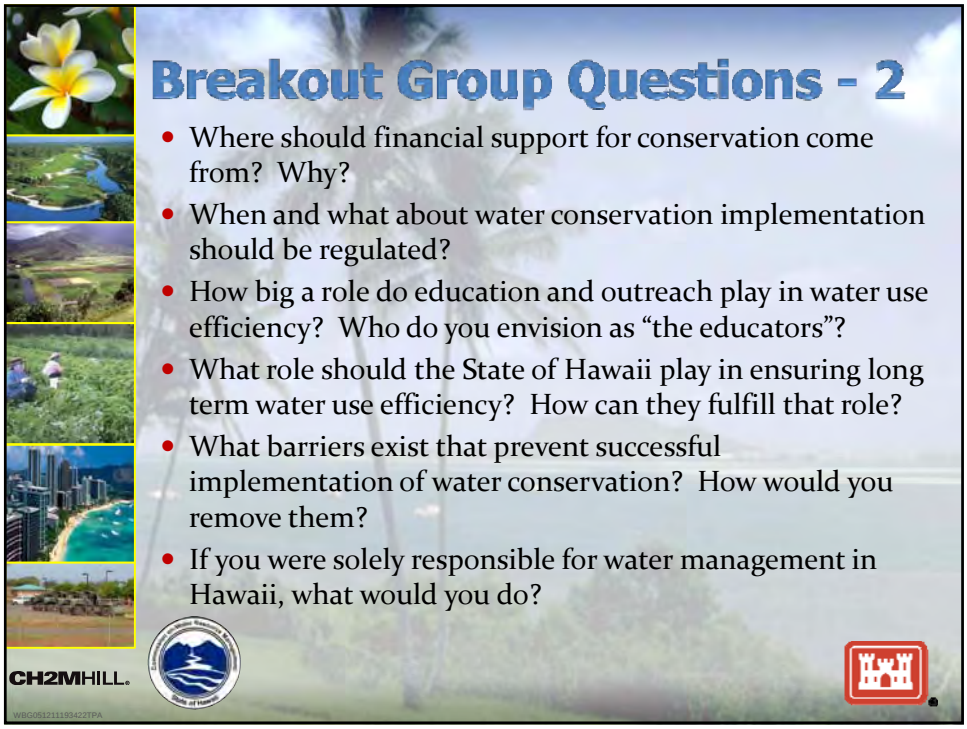
Breakout Group Questions - 2
Where should financial support for conservation come from? Why?
When and what about water conservation implementation should be regulated?
How big a role do education and outreach play in water use efficiency? Who do you envision as "the educators"?
What role should the State of Hawaii play in ensuring long term water use efficiency? How can they fulfill that role?
What barriers exist that prevent successful implementation of water conservation? How would you remove them?
If you were solely responsible for water management in Hawaii, what would you do?
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Break-out Groups
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Observations and
Next Steps

Hawaii Water Conservation Plan

WCAG Meeting #3

November 17, 2011

Draft Agenda

8:30-8:40 **Welcome and Re-introductions**

8:40-8:45 **Agenda Review and Workshop Objectives**

8:45-9:15 **Review of WCAG Meeting 2 and Next Steps**

9:15-9:45 **Water Use Data Review**

Discuss shift from island analysis to statewide

Overall water usage pie chart and Municipal breakdown pie chart

Update on residential per capitas and show potential for efficiency

9:45-10:00 **Break**

10:00-10:30 **BMP Review**

Discuss methodology for statewide analysis (vs. island)

Review Military recommendations –

Introduce AWE tool

Identify Potential BMPs for Domestic (RICI – Residential, Industrial, Commercial, Institutional)

10:30-11:15 **Break-out Session: Water Conservation Best Practices**

Identify potential best practices for RICI

Solicit feedback on Military recommendations

11:15-11:30 **Break**

11:30-12:15 **Break-out Session: Implementation Strategies**

Similar activity to WCAG#2, but focusing on domestic (RICI) and military

12:15-12:30 **Observations and Next Steps**

State Water Conservation Advisory Group (WCAG) Meeting #3

Date: **17 November 2011**

Time: **8:30 am-12:30 pm HST**

Location: **CH2M HILL HNL Office, Makai Conference Room**

Attendees: Neal Fujii, CWRM
Jeremy Kimura, CWRM
Debbie Solis, Army Corps of Engineers
Brian Skeens, CH2M HILL
Ross Kaneko, CH2M HILL
Alyssa Smith, CH2M HILL
See attached list of WCAG attendees

Due to competition for fresh water, increasing population and development pressures, the sustainable movement, and the impacts of global climate change requiring Hawaii to become as efficient as possible in its uses of fresh water, the Army Corps of Engineers in partnership with the State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) have determined that a water conservation plan for the State of Hawaii should be established. As part of this effort, a Water Conservation Advisory Group (WCAG) – made up of experts from each water use sector – was formed to assist in policy and program development. It is anticipated that the WCAG will meet a total of six (6) times throughout the duration of the project. The third meeting was convened on November 17, 2011, and the following summarizes and documents the activities of the meeting.

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List of Acronyms

Acronym	Organization
BWS	City and County of Honolulu Board of Water Supply
CWRM	Hawaii Department of Land and Natural Resources Commission on Water Resource Management
DBEDT	Hawaii Department of Business, Economic Development, and Tourism Energy Office
DHHL	Department of Hawaiian Home Lands
DOE	Hawaii Department of Education
HDOA	Hawaii Department of Agriculture
HDWS	County of Hawaii Department of Water Supply
HFB	Hawaii Farm Bureau
HHLA	Hawaii Hotel & Lodging Assoc
KDOW	Kauai County Department of Water
MDWS	Maui County Department of Water Supply
MTA	Mililani Town Association
NAVFAC	Naval Facilities Engineering Command, Hawaii
USACE	United States Army Corp of Engineers
USAG HI	United States Army Garrison Hawaii
USDA NRCS	United States Department of Agriculture- Natural Resources Conservation Service
WCAG	Water Conservation Advisory Group

Meeting Summary

1. Welcome and Re-introductions (Neal Fujii/Ross Kaneko)- Ross initiated re-introductions of the project team and WCAG members.

- Introductions

  Neal Fujii (CWRM)

  Ross Kaneko (CH2M HILL)

  Brian Skeens (CH2M HILL)

  Debbie Solis (USACE)

  Alyssa Smith (CH2M HILL)

  Sharon Sawdey (USDA NRCS)

  Cat Sawai (BWS)

  Lisa Maddaus (Maddaus Water Managemernt on behalf of BWS)

  Garret Matsunami (Castle and Cooke)

  Ross Lum (DOE)

  Russell Okita (NAVFAC)

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Greg Hayashi (NAVFAC)

Pam Pogue (MDWS)

Kathie Ramirez (NAVFAC Energy)

Kristi Ellazar (MTA)

Faith Shiramizu (KDOW)

Kanani Aton (HDWS)

Jocelyn Doane (OHA)

Rod Suzumoto (HHLA)

Lauren Roth Venu (Roth Ecological Designs)

Kaleo Manuel (DHHL)

Elson Gushiken (ITC Water Management)

Brian Kau (HDOA)

Warren Watanabe (HFB)

Howard Wiig (DBDET)

Jeremy Kimura (CWRM)

Barry Usagawa (BWS)

2. Agenda Review, Workshop Objectives, Scope Refresher, Re-cap of WCAG #2 (Brian Skeens)

The agenda for the meeting, objectives of the workshops, and a brief scope refresher were presented to the WCAG, along with a recap of WCAG #2. Details are provided in the attached pdf copy of the PowerPoint presentation used at the workshop.

3. Water Use Data Review- Municipal Sectors and Military (Brian Skeens)

Water use data analysis was separated into two distinct parts: municipal and military. Details are provided in the attached pdf copy of the PowerPoint presentation.

Neal Fujii- asked if Brian knows the cost of water in the Northwest and South of the US.

- *Brian Skeens- Not sure, but major providers have a tiered rate structure. There are rate studies in those areas, but it depends on the types of uses.*

Howard Wiig- something to note is the high percentage of people living in multi-family housing.

- *Brian Skeens- Great point, although this data only represents single family housing.*

Lauren Roth Venu- comment that on the sewer bill, 18% is deducted to assume for irrigation usage.

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- *Brian Skeens- So this is assuming indoor use is even higher than the percentage assumed on the slides. Have there been studies conducted to determine the actual amount of water being used for indoor/outdoor residential usage?*
- *Lauren- In general, Hawaii has smaller properties compared to the homes on the mainland, so there's less to irrigate.*
- *Brian- This supports the idea that indoor usage is much higher than the national average.*
- *Barry- This deduction from the sewer bill has been around for decades. Knows this number is conservative. City and County of Honolulu Department of Environmental Services (ENV) determines this percentage.*
- *Brian- there are a number of studies that can be done, such as matching up the sewer flows with the water flows, especially during dry periods, to determine the actual amount of water used on irrigation.*

Elson Gushiken- asked if there was any discussion during the WCAG #2 meeting if there is a benefit for residents to install a dual meter for indoor/outdoor use. If you put in a meter to get a credit, you'll have to go through ENV.

- *No, there was discussion about the dual meters in general, but not on the benefit for installation.*
- *Barry- BWS would charge for another lateral, which is about $1,000. Some customers may use more than 18% on outdoor use, which would save them money. An audit may need to be done beforehand to determine if the irrigation use is more or less than the 18%.*
- *Lauren- Something to note if the City updates the plumbing code and allows for graywater systems, this becomes a factor to calculate the amount of water used for irrigation.*

Barry Usagawa- noted that the demand projection data shown is higher than the actual trend.

Howard Wiig- most of the newly constructed single family housing on the Ewa side of Oahu has a large building footprint and leaves very little room for irrigation. Also, the developers are required to use brackish water for irrigation.

Cat Sawai- will be a "living plan" where something like every 5 years, the plan and projections can be re-assessed and changes accordingly?

- *Brian- the projections shouldn't be driving the conservation plan. Goal is to come up with conservation practices to help increase efficiency. Not doing supply and demand comparisons. Updates are necessary.*
- *Neal- Wants the WCAG to continue after the plan is written, which includes updating the plan. More important to keep the WCAG together in the future.*
- *Debbie- before the contract was written, it was discussed to create a WCAG to help validate the goals, BMPs, and implementation strategies. After the plan is done, the relationships will continue to help implementation.*

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- *Elson- this is important because there will be unforeseen changes, which will require for the plan to be adjusted. Such as changes in technology.*
- *Neal- Is there a water conservation committee in the AWWA-HI Section?*
- *Elson- not currently. Committees thrive and exist because a need becomes apparent.*
- *Lauren- Creating goals might be important to figure out for water conservation. There is a Hawaii Clean Energy initiative, 70% clean energy by 2030. Create a similar goal for water conservation to have something like by 2030 70% of water reuse.*
- *Elson- may achieve milestones quickly which will require adjustments to the plan.*
- *Brian- the next meeting, we'll discuss goals in detail, as well as benchmarks for measuring success.*
- *Barry- BWS is concerned about the fact that customers will potentially be using less water, which means a reduction in revenues for them. Since BWS seeks stable revenues, they may have to raise rates to compensate for declining usage.*
- *Brian- it's not a good message to tell customers that water conservation will allow them to pay less for water. It's important to encourage efficiency and establish sustainable rates.*
- *Debbie- there needs to be a balance between the cost of water and the actual resource. We need to bring the customer focus back to the supply of the resource.*
- *Elson- we understand that the population of the state will increase and need to look at the water resource on a global level.*
- *Howard- on the next generation of the plumbing code, graywater will be included.*
- *Lisa Maddaus- In California, it's a strange concept to customers that they are paying either the same amount or more for water that's reused. They think it should be cheaper. Need to remind customers that water won't necessarily be cheaper because it's coming from a different source.*

Lauren- in regards to reclaimed water, it makes more sense to have a system localized next to the customers who will use it. Having dual pipes running from distribution plants may not be very cost effective.

- *Neal- CWRM does have the option to require the use of recycled water for non-potable uses if the new development is in vicinity of the distribution source. This is in the Water Code, but hasn't been enforced yet.*
- *Neal- CWRM report was done in either 2004/2005 that did a survey on treatment plants producing recycled water.*
- *Lisa- there's a trend for dual systems on the mainland (in extreme water-limited areas only).*
- *Barry- if there is another available source of water, they will require the use of it. Do you see the trend of dual plumbing on the mainland.*

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- *Lisa- it depends on the resource. More dual plumbing on commercial buildings and new developments.*
- *Elson- there are conflicts with the codes and different State departments (i.e. the color of pipes for reused water).*

Elson- it's almost a disincentive to install graywater because of the hurdles you need to cross to have it approved.

- *Kanani- almost everyone on Hawaii-island, except for Hilo and Kona, is using a septic system. It's not discussed to use graywater or reuse. About 40% of Hawaii-island residents use rain water catchments systems.*
- *Lauren- ENV does try to block the progress of graywater because there wouldn't be enough water in their pipes to move solids to the treatment plant. Maybe implement graywater systems in stages to minimize the impact on ENV.*
- *Debbie- Department of Health should be invited to these meetings to have input on this and help coordinate.*

Lisa- graywater doesn't seem to be as popular as rain water because it seems more risky. Usually this option comes up during droughts.

Elson- appliances are becoming more water efficient, which will produce less water to use for graywater.

4. Breakout Session: Water Conservation Best Management Practices (Brian Skeens)

See the attached handout sheets ("Breakout Session #1 Handout Sheets- Blank) used for this breakout session, as well as notes from each group ("Breakout Session #1 Notes).

5. Breakout Session: Implementation Strategies (Brian Skeens)

See the attached handout sheets ("Breakout Session #2 Handout Sheets- Blank) used for this breakout session, as well as notes from each group ("Breakout Session #2 Notes).

6. Observations and Next Steps (Brian Skeens)

Next Steps:

- *Next WCAG meeting tentatively March 2012*
- *A document to be sent out in late February 2012 to be reviewed before the next meeting.*

7. Action Items

- *WCAG free to send any comments or questions to anyone on the project team.*

If there are any necessary corrections or additions, please contact me via email at Ross.Kaneko@ch2m.com or you can reach me on my office line at 808-440-0225, or my cell phone at 808-554-3791.

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Respectfully submitted,

Ross A. Kaneko

Attachments:

- Attendance list
- Project team contact list
- Breakout Session #1 Instructions/Worksheets- Blank
- Breakout Session #1 Notes
- Breakout Session #2 Instructions/Worksheets- Blank
- Breakout Session #2 Notes
- WCAG Meeting #2 Presentation

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Water Conservation Advisory Group Meeting #3 (11/17/2011)
List of Attendees

Last Name	First Name	Organization	Email Address
Aton	Kanani	County of Hawaii Department of Water Supply (HDWS)	Katon@hawaiidws.org
Doane	Jocelyn	Office of Hawaiian Affairs (OHA)	jocelynd@oha.org
Ellazar	Kristi	Mililani Town Association (MTA)	kellazar@mililanitown.org
Gushiken	Elson	ITC Water Mgt, Inc	elson@itcwater.com
Hayashi	Greg	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	greg.hayashi@navy.mil
Kau	Brian	Hawaii Department of Agriculture (HDOA)	brian.k.kau@hawaii.gov
Lum	Ross	Hawaii Department of Education (DOE)	ross_lum@notes.k12.hi.us
Maddaus	Lisa	Maddaus Water Management	lisa@maddauswater.com
Manuel	Kaleo	Hawaiian Homelands (DHHL)	kaleo.l.manuel@hawaii.gov
Matsunami	Garret	Castle & Cooke	gmatsunami@castlecooke.com
Okita	Russell	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	russell.okita@navy.mil
Pogue	Pam	Maui County Department of Water Supply (MDWS)	pam.pogue@co.maui.hi.us
Ramirez	Kathleen	NAVFAC HI Energy Management	kathleen.j.ramirez1@navy.mil
Roth Venu	Lauren	Roth Ecological Design	lauren@rothecological.com
Sawai	Cat	City and County of Honolulu Board of Water Supply (BWS)	csawai@hbws.org
Sawdey	Sharon	United States Department of Agriculture- Natural Resources Conservation Service (USDA NRCS)	sharon.sawdey@hi.usda.gov
Shiramizu	Faith	Kauai County Department of Water (KDOW)	fshiramizu@kauaiwater.org
Solis	Debbie	United States Army Corp of Engineers (USACE)	deborah.a.solis@usace.army.mil
Suzumoto	Rod	Hawaii Prince Hotel and Golf Course	rsuzumoto@hiprince.com
Usagawa	Barry	City and County of Honolulu Board of Water Supply (BWS)	busagawa@hbws.org
Watanabe	Warren	Hawaii Farm Bureau	warrenmcfb@hotmail.com
Wiig	Howard	Hawaii Department of Business, Economic Development, and Tourism Energy Office (DBEDT)	hwiig@dbedt.hawaii.org

Water Conservation Plan
Project Team Contact Information

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Solis	Debbie	USACE	438-0701	Deborah.A.Solis@usace.army.mil
Kaneko	Ross	CH2M HILL	440-0225	ross.kaneko@ch2m.com
Madison	Mark	CH2M HILL	(503)736-4453	mark.madison@ch2m.com
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Skeens	Brian	CH2M HILL	(678)530-4327	brian.skeens@ch2m.com
Smesrud	Jason	CH2M HILL	(503)736-4372	jason.smesrud@ch2m.com
Smith	Alyssa	CH2M HILL	440-0207	alyssa.smith@ch2m.com

BMP Discussion – Breakout Exercise (45 min)

Instructions

1. Work as a group to discuss the different BMPs on the slides:
    a. How do the BMP's apply to the circumstances in Hawaii
    b. What additional BMPs should be included for consideration in the statewide water conservation plan?
    c. Which should be deleted?
    d. What else should the CWRM be thinking about for effective water resource management now and in the future?
2. On the flip chart list of BMPs, for each listed BMP:
    a. Are there edits or changes to this BMP? Make changes on flip chart.
    b. Should this remain on the list for additional consideration? If no, delete from flip chart.
    c. Are there others that should be added? Add to the flip chart.
    d. For this final list of BMPs, strive for consensus
3. Prioritize final list of BMPs
    a. Each person gets 3 dots to spread between BMPs.
    b. Count dots to identify top 10 BMPs to consider during implementation breakout.
4. Rewrite final list of 10 prioritized BMPs on new flip chart during break.

Municipal BMPs

- Rain Shutoff Switches for Irrigation Systems
- Low-Flow Kitchen Spray Rinse Valves
- Efficient Commercial Equipment
- High Efficiency Urinals in Commercial
- Submetering on Commercial and Multi-Family
- Water Loss Control
- Public Education and Outreach
- Water Use Surveys (Commercial, Government, Hotel/Motel/Resorts, Multi-Family, Large Landscape)
- Water Budgets
- Efficient Multi-Family and Coin-Op Clothes Washers
- Tiered Water Rates
- High Efficiency Toilets
- Rain Barrel Programs (Residential, Large Properties)
- Irrigation Upgrade Programs
- Efficient Cooling Towers
- Weather-Based Irrigation Controllers
- Water System Loss Reduction
- Reuse Water
- Gray Water Reuse

Military BMPs

- Water Management Planning
- Information and Education Programs
- Distribution System Audits, Leak Detection, and Repair
- Water-Efficient Landscaping
- Water-Efficient Irrigation
- Toilets and Urinals
- Faucets and Showerheads
- Boiler/Steam Systems
- Single-Pass Cooling Equipment
- Cooling Tower Management
- Commercial Kitchen Equipment
- Laboratory/Medical Equipment
- Other Water Intensive Processes
- Alternate Water Sources
- Install meters at users/buildings
- Maintenance program to repair clogged line/valves/meters and check all valves, PRVs, and meters in the water system
- Limit lawn and plant irrigation to 3 days per week (Tuesday, Thursday, Sunday)
- Irrigate between 0400 and 1000
- Irrigation systems secured on rainy days
- Adjust irrigation devices to deliver water to lawn and plants only (do not runoff)

Military BMPs

- Use mulch for top dressing
- Use a bucket and hose with spray nozzle when washing vehicles
- Use dry methods to clear sidewalks, pavement
- Cover exterior hose bibs with removable key hose bib covers
- SPiRiT to LEED Transition Program – includes water efficient fixtures (such as 1-pint urinals)
- Inspect all plumbing fixtures on a weekly basis to ensure no leaks
- Inspect all swimming pools and jacuzzis/hot tubs for leaks and cover jacuzzis/hot tubs during non-operating hours
- Green building requirements set forth in NAVFAC guidance
- Use Federal Energy Management Program energy and water best practices
- Monitor irrigation use around buildings to include amount, direction, and time of watering
- Look for opportunities to reuse or recycle water

Breakout Session #1 Notes- Top 10 BMPs

Military (Blue Group)

1. Install meters at users/buildings
2. Information and Education Programs
3. Distribution System Audits, Leak Detection, and Repair
4. SPiRiT to LEED Transition Program – includes water efficient fixtures (such as 1-pint urinals)
    a. Toilets and Urinals
    b. Faucets and Showerheads
    c. Use Federal Energy Management Program energy and water best practices
5. Look for opportunities to reuse or recycle water; Alternate Water Sources
6. Water-Efficient Landscaping
7. Water-Efficient Irrigation
8. Cooling Tower Management
9. Use a bucket and hose with spray nozzle when washing vehicles
10. Maintenance program to repair clogged line/valves/meters and check all valves, PRVs, and meters in the water system

Municipal (Green Group)

1. Reuse Water
2. Water Loss Control/Budgets/Surveys
3. Rain Barrel Programs (Residential, Large Properties)
4. Irrigation Upgrade Programs
5. Public Education and Outreach
6. Rain Shutoff Switches for Irrigation Systems
7. Water System Loss Reduction
8. Low-Flow Kitchen Spray Rinse Valves
9. Efficient Cooling Towers
10. High Efficiency Urinals in Commercial

Municipal (Yellow Group)

1. Water System Loss Reduction (Leak Detection); Water Loss Control (Water Audit)
2. Rain Barrel Programs (Residential, Large Properties)
3. Efficient Commercial Equipment

3. Irrigation Upgrade Programs
3. Green Business Program
6. Water Use Surveys (Commercial, Government, Hotel/Motel/Resorts, Multi-Family, Large Landscape) – Audit?
7. Education and Outreach (Training- new equipment/practices)
7. Weather-Based Irrigation Controllers
7. Gray Water Reuse
10. Water Sense Certified/Labeled Equipment

Implementation Discussion – Breakout Exercise (60 min)

Instructions

1. Develop "Implementation Matrix" for top 10 BMPs
    a. Work as a group to explore and discuss implementation strategies specific to EACH BMP
    b. Identify a scribe and spokesperson.
    c. Using the Implementation Matrix, for each BMP, rank the recommended implementation approach, 1, 2, or 3, for education, incentives or regulations/policy for each BMP (1 is highest, 3 is lowest)
    d. Present results
2. Develop "Responsibility Matrix" for top 10 BMPs
    a. Review instructions and example
    b. Identify a scribe and spokesperson.
    c. Using the Responsibility Matrix, for each BMP, identify the recommended roles (RASI) related to implementation of each BMP. Write the corresponding letter in the box on the matrix.
        i. **R** – responsible, is held accountable for the implementation and completion of a given BMP.
        ii. **A** – authorizes, approves or signs off on the method or results of a given BMP.
        iii. **S** – supports, provides assistance, information, promotion, partnership in the implementation of a given BMP, if requested.
        iv. **I** – informed, NEEDS (not wants or desires or should) to be kept informed of the progress or results of a given BMP.
    d. There can only be one R for each BMP, not all others are required to be used.
    e. If there are other entities to be included, based on the group discussion, they can be written into the matrix.
    f. Present results

Breakout Session #2 Notes- Implementation and Responsibility Matrices

Military (Blue Group)

BMP		Implementation Matrix				Responsibility Matrix				
		Education and Awareness	Financial Incentives	Policy and Regulations	Comments and Considerations	CWRM	Municipal Provider	Military Installation	Federal Agency	Other-Resident
1	Install meters at users/buildings	2	3	1		I	I	R	I	I
2	Information and Education Programs	1				I	I	R	I	S
3	Distribution System Audits, Leak Detection, and Repair			1		I	I	R	I	S
4	SPiRiT to LEED Transition Program – includes water efficient fixtures (such as 1-pint urinals) (Toilets and Urinals; Faucets and Showerheads; Use Federal Energy Management Program energy and water best practices)			1		I	I	A	R	
5	Look for opportunities to reuse or recycle water; Alternate Water Sources			1		S	I	R	I	I
6	Water-Efficient Landscaping	1		2		I	I	R		S/I
7	Water-Efficient Irrigation			1		I	I	R		S/I
8	Cooling Tower Management			1		I	I	A	R	
9	Use a bucket and hose with spray nozzle when washing vehicles	1				I	I	R		S/I
10	Maintenance program to repair clogged line/valves/meters and check all valves, PRVs, and meters in the water system	1				I	I	R		

Municipal (Green Group)

BMP		Implementation Matrix				Responsibility Matrix					
		Education and Awareness	Financial Incentives	Policy and Regulations	Comments and Considerations	CWRM	Municipal Provider	Military Installation	Federal Agency	Other	Other
1	Reuse Water	1	2	B	Gray water main block.	S	S/I	S	S	(DOH) S/R/I	(DPP) S/A/I
2	Water Loss Control/Budgets/Surveys	1	2	3	Government should lead by example.	S	S/I	S	S	(Users) I/R/A/S	
3	Rain Barrel Programs (Residential, Large Properties)	2	1	B	Possible revised code for internal use.	S	S	S	S	(Users) I/R/A/S	(DPP) S/A
4	Irrigation Upgrade Programs	2	1			S	S	S	S	(Users) R/A/S	(DPP) S/A
5	Public Education and Outreach	1	2			S	S	S	S		(Government) R/S
6	Rain Shutoff Switches for Irrigation Systems	1		2		S	S	S	S	(Users) R/A/S	
7	Water System Loss Reduction	3	2	1		S	R/A	S	S		
8	Low-Flow Kitchen Spray Rinse Valves	1	2			S	S	S	S	(Users) R/A/S	(DPP) S/A
9	Efficient Cooling Towers	3	2	1		S	S	S	S	(Users) R/A/S	(DPP) S/A
10	High Efficiency Urinals in Commercial	2	1	3		S	S	S	S	(Users) R/A/S	(DPP) S/A

Municipal (Yellow Group)

	BMP	Implementation Matrix				Responsibility Matrix						
		Education and Awareness	Financial Incentives	Policy and Regulations	Comments and Considerations	CWRM	Municipal Provider	Military Installation	Federal Agency	Other	Other	Other
1	Water System Loss Reduction (Leak Detection); Water Loss Control (Water Audit)	1	3	2		S	R/A	A/S/I		(Private Institutions) I		
2	Rain Barrel Programs (Residential, Large Properties)	1	2	3	Service incentives (T.A.)	R	A	A				
3	Efficient Commercial Equipment	1	3	2	Financial rebates; support; industry participation; free landscape audits	S		A		(LICH) R	(DOE/DAGS) I/S	(UH/Parks) I/S
4	Irrigation Upgrade Programs	1	2	3	"green hotels"; municipality funding support	S	S/A	A		(DBEDT) R/A	(Commercial) I	
5	Green Business Program	1	2	3	low flow kitchen spray rinse valves; high efficiency urinals; efficient cooling towers	S	R/A	A		(Commercial) I/S		
6	Water Use Surveys (Commercial, Government, Hotel/Motel/Resorts, Multi-Family, Large Landscape) – Audit?	1	3	2		S	R/A	A				
7	Education and Outreach (Training- new equipment/practices)	1	3	2	training on new equipment and practices; cultural shift; everyone!	R		A				
8	Weather-Based Irrigation Controllers	1	2	3		S		A		(LICH) R		
9	Gray Water Reuse	1	3	2		S		A		(DOH) R		
10	Water Sense Certified/Labeled Equipment	2	3	1		R		A				

Development of Statewide Water Conservation Plan

Water Conservation Advisory Group Meeting #3

November 17, 2011

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US Army Corps of Engineers

Agenda

- 8:30-8:40 Welcome and Re-introductions
- 8:40-8:45 Agenda Review and Workshop Objectives
- 8:45-9:00 Review of WCAG Meeting #2
- 9:00-9:30 Water Use Data and Efficiency
- 9:30-9:45 Break
- 9:45-10:15 BMP Review
- 10:15-11:00 Break-out Session: Municipal and Military Water Conservation Best Practices
- 11:00-11:15 Break
- 11:15-12:15 Break-out Session: Implementation Strategies
- 12:15-12:30 Observations and Next Steps

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Review of WCAG Meeting #2 and Next Steps

Project Schedule and Next Steps

Task	2011									2012										
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Establish Water Conservation Advisory Group																				
Establish statewide water conservation goals/objectives; develop water use profile																				
Identify water conservation measures in each sector																				
Identify, evaluate, compare water conservation programs/measures																				
Identify and develop implementation mechanisms																				
Develop Statewide Water Conservation Plan																				
Submit Draft Statewide Water Conservation Plan																				
Review Draft Statewide Water Conservation Plan																				
2nd Draft Statewide Water Conservation Plan																				
Submit Final Statewide Water Conservation Plan																				
Final presentation to CWRM																				

February 2012
Receive draft implementation strategies for review

March 2012
Discuss proposed implementation strategy and goa

define goals; discuss implementation

May 2012
Receive Draft Plan for Review

June 2012
Review Draft Plan

implementation process and schedule

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WCAG Meeting #2
Agriculture, Golf Courses, Landscape Irrigation
BMP breakout groups
Implementation breakout groups
Major outcomes
Recommended and endorsed BMPs
Input on Implementation
Next steps
Evaluate and summarize recommendations
Goals and plans for Agriculture, Golf Courses, and Landscape Irrigation
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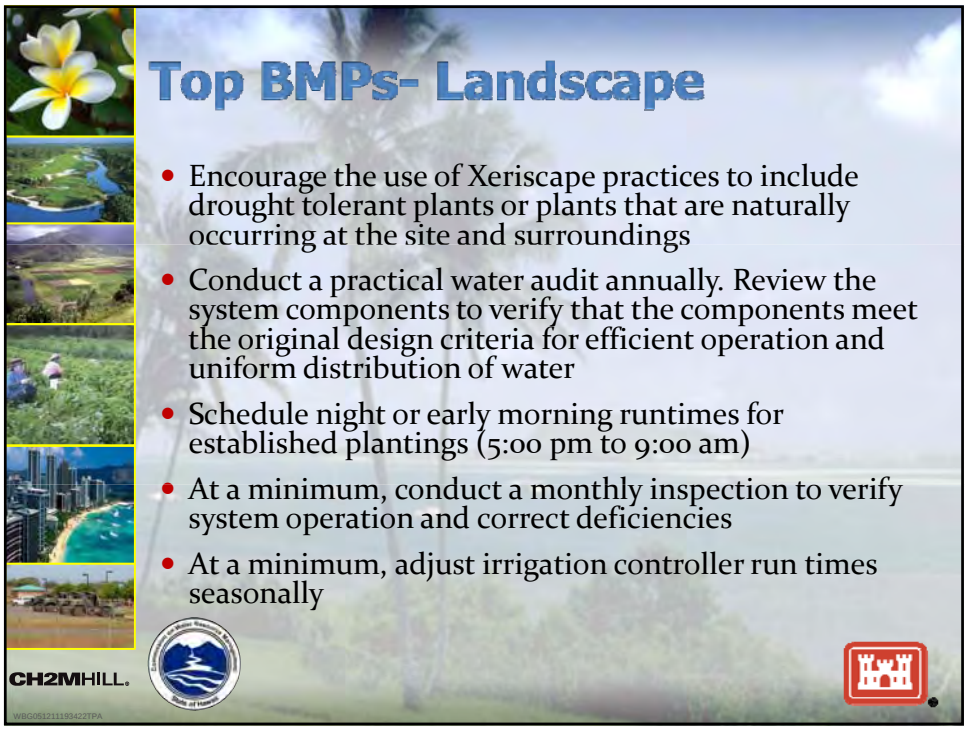
Top BMPs- Landscape
Encourage the use of Xeriscape practices to include drought tolerant plants or plants that are naturally occurring at the site and surroundings
Conduct a practical water audit annually. Review the system components to verify that the components meet the original design criteria for efficient operation and uniform distribution of water
Schedule night or early morning runtimes for established plantings (5:00 pm to 9:00 am)
At a minimum, conduct a monthly inspection to verify system operation and correct deficiencies
At a minimum, adjust irrigation controller run times seasonally
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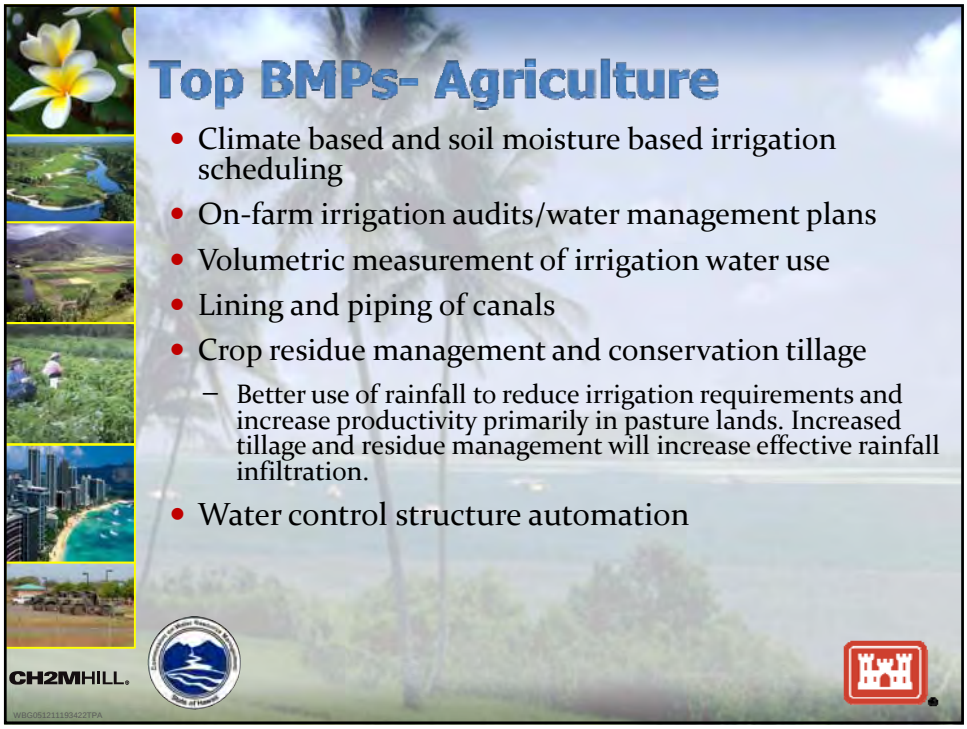
Top BMPs- Agriculture
Climate based and soil moisture based irrigation scheduling
On-farm irrigation audits/water management plans
Volumetric measurement of irrigation water use
Lining and piping of canals
Crop residue management and conservation tillage
Better use of rainfall to reduce irrigation requirements and increase productivity primarily in pasture lands. Increased tillage and residue management will increase effective rainfall infiltration.
Water control structure automation
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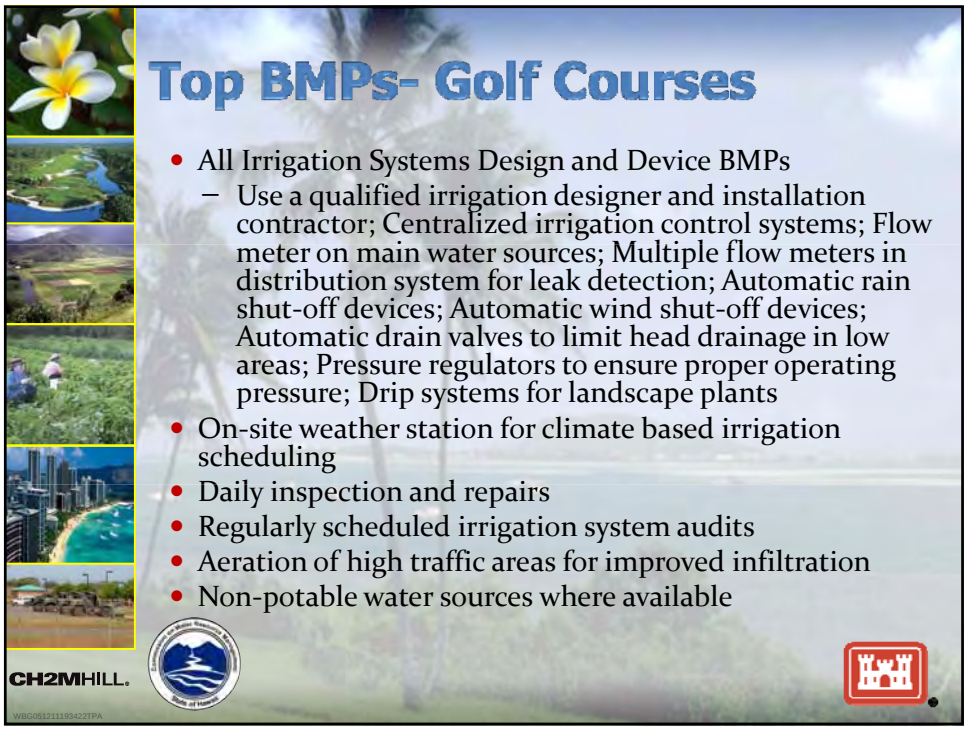
Top BMPs- Golf Courses
All Irrigation Systems Design and Device BMPs
Use a qualified irrigation designer and installation contractor; Centralized irrigation control systems; Flow meter on main water sources; Multiple flow meters in distribution system for leak detection; Automatic rain shut-off devices; Automatic wind shut-off devices; Automatic drain valves to limit head drainage in low areas; Pressure regulators to ensure proper operating pressure; Drip systems for landscape plants
On-site weather station for climate based irrigation scheduling
Daily inspection and repairs
Regularly scheduled irrigation system audits
Aeration of high traffic areas for improved infiltration
Non-potable water sources where available
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Implementation Strategies

- Funding/Incentives/Dis-Incentives
  - State funding for water resources planning
  - Water conservation project feasibility study funding/grant program
  - Water budgets with incentives (partners)
  - Irrigation conserving component incentives
    - Assistance for water audits/management plans
    - BMP rebates
    - Grants = implementation
  - Create a watershed fee tied to pump size to fund conservation measures that protects the watershed
  - Establish water conservation fund legislatively for planning/implementation
  - Apply the HECO IRP fee model to water bills to fund conservation programs (i.e. rebates, audits, new technology, alternative water sources)
  - Tax credits and rebates
- Regulation
  - State as WMA (Water Management Area)
  - Standardize required water use data collection
  - Create "water police" and fine users who waste; create a hotline (i.e. 911) to report abuse

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Implementation Strategies-cont…

- Partnerships
  - Incentivize public-private partnerships
  - Develop partnerships for multiple use water resource/conservation/groundwater recharge flood protection measures
  - Research funding for testing efficacy of conservation measures as applied in Hawaii
  - Form groups of water conservation champions signing an MOU committing to BMPs
- Education/Outreach
  - Water video on plane into Hawaii
  - Develop and deliver farmer education program on water conservation BMPs and incentives
  - Free training and free use of leak detection equipment (i.e. borrow/loan)
  - Hold annual workshops to expand existing practices to others
  - "How to" book of irrigation conservation BMPs and LEED points
- Audits
  - Water use study for hotels, condos, commercial buildings (assisted funding)
  - Audit programs (budgets)
- Technology
  - Statewide irrigation climate data network
  - Reclaimed water system expansion

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Water Use Data and Efficiency

Municipal

Military

Goals of the Water Use Profile

- Characterize the extent of water use by each category
- Evaluate potential for efficiency improvements
- Discuss and review applicable water conservation best management practices (BMPs)

Shift from Island-Specific Analysis to Statewide

- Collected great Island-specific data from County providers
- Roll up to Statewide (to the extent possible)
- Recommend best practices that have greater applicability
- Screen and prioritize best practices based on Statewide potential
- Local evaluation of cost and savings still necessary

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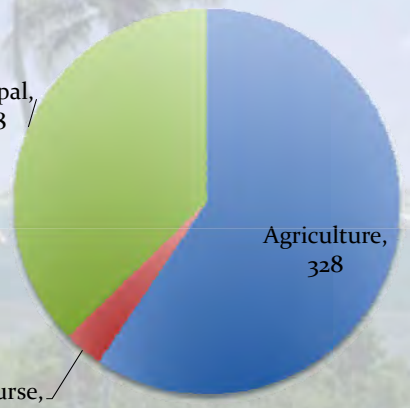
Statewide Water Use

Statewide Water Usage*
(mgd)



Total = 552 MGD

*Data represents only the users who supplied water usage data.

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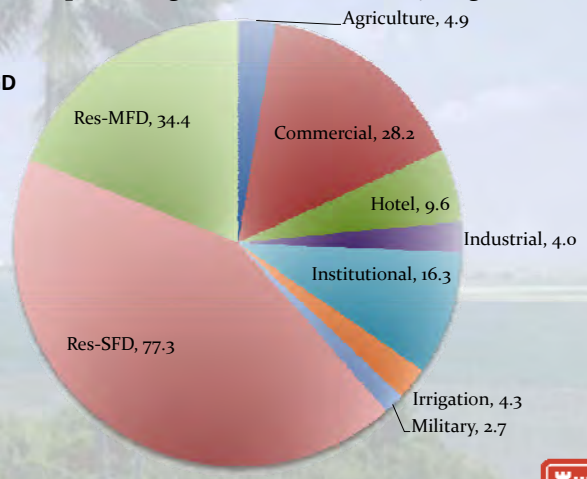
Water Use Profile - Municipal

Statewide (excluding Hawaii-island)
Municipal Average Water Use 2006-2009 (mgd)

Total = 182 MGD



Calculation of Water Use Rates

- Per account and per capita (person) use
- Averaged over 2006-2009

- Total water use
- Overall number of accounts
- Divided by the population served

- Single Family Residential water use
- Number of single family residential accounts
- Divided by the people per household, from 2010 Census

Island	People per household (pph)
Kauai	2.84
Oahu	2.95
Maui	2.82

Overall Municipal Use

	Gallons/account/ day	Gallons/person/ day
Kauai	642	228
Oahu	822	159
Maui	1,037	246
Statewide (weighted average)	839	174

Affected by non-residential use such as tourism, transient population, commercial, etc.

- **Average of 2006-2009**
- **Includes all Municipal sectors**

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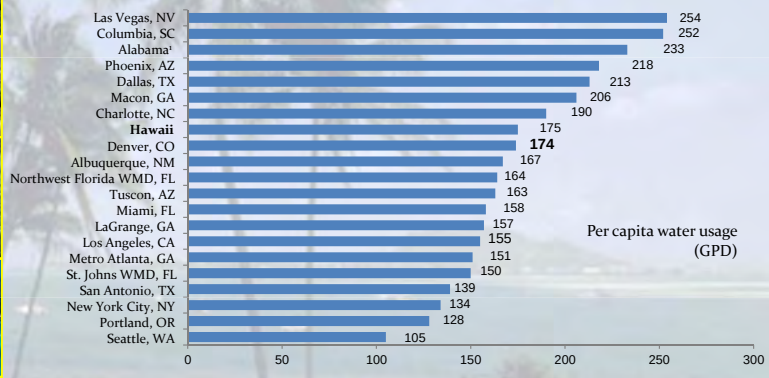
Water Use across the US



1. State average; data not available for individual cities in AL
Note: Overall per capita is calculated by dividing total gallons of water produced by water provider by the population served
Source: Georgia EPD analysis

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Residential Single Family Use

	Gallons/account/ day	Gallons/person/ day
Kauai	379	133
Oahu	359	122
Maui	597	212
Statewide (weighted average)	405	139

* Average of 2006-2009

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Residential Water Use Efficiency

- Single Family Residential = 139 gal/person/day
- If outdoor is 30-40%, indoor is 97-83 gal/person/day
- Theoretical minimum indoor use is 45 gal/person/day [1]
- Research from late 1990's calculated indoor use at 69 gal/person/day [2]

1 – Handbook of Water Use and Conservation, Amy Vickers (2001)
2 – AWWARF Residential End Uses of Water (1999)

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Potential for Efficiency

- Residential Use – Indoor and Outdoor
- Commercial – Hotel/Motel/Resorts
- Institutional – Schools, Government, University

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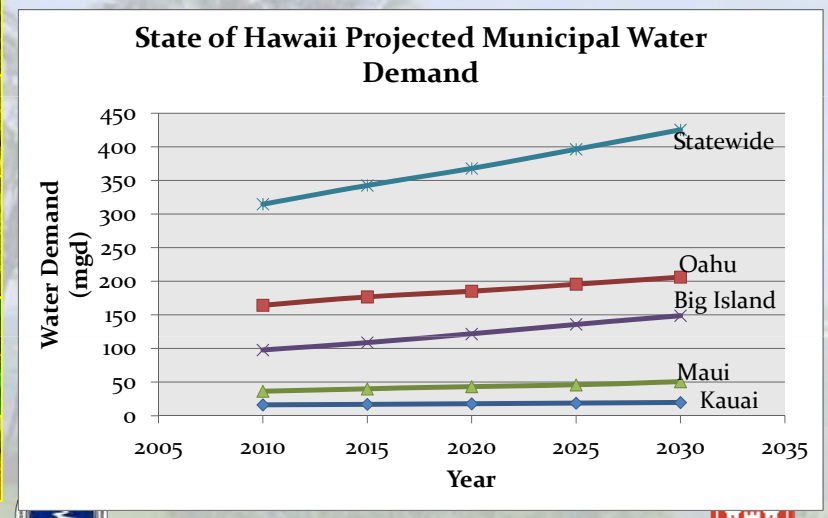
Update on Projections



Source: Water Resource Protection Plan - Hawaii Water Plan; June 2008

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Advisory Group Input ?
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BREAK

Water Conservation Best Practices

Municipal

Military

Primary Sources of Initial Best Practice Lists

- Municipal
  - AWWA M52: Water Conservation Programs Planning
  - Honolulu BWS: Water Conservation Planning
  - Research and Trends
- Military
  - FY07 Army Utilities Infrastructure Studies- Army Water Infrastructure Study for Schofield Barracks (East Range) Volume 1
  - NAVACTS Hawaii Water Conservation Message
  - Navy Region Hawaii Energy Management Program (July 21, 2010)
  - Executive Orders 13423 and 13514 and EPA WaterSense BMPs

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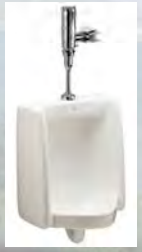
Municipal Water Conservation BMPs

- Rain Shutoff Switches for Irrigation Systems
- Low-Flow Kitchen Spray Rinse Valves
- Efficient Commercial Equipment
- High Efficiency Urinals in Commercial
- Submetering on Commercial and Multi-Family



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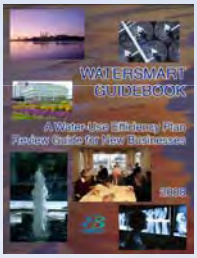
Municipal Water Conservation BMPs

- Water Loss Control
- Public Education and Outreach
- Water Use Surveys (Commercial, Government, Hotel/Motel/Resorts, Multi-Family, Large Landscape)
- Water Budgets
- Efficient Multi-Family and Coin-Op Clothes Washers
- Tiered Water Rates



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Municipal Water Conservation BMPs

- High Efficiency Toilets
- Rain Barrel Programs (Residential, Large Properties)
- Irrigation Upgrade Programs
- Efficient Cooling Towers
- Weather-Based Irrigation Controllers

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Water System Loss Reduction

- Water loss reduction is now considered a demand management practice
- Production Losses – source to distribution
- Distribution Losses:
  - Non Revenue Water Reduction
  - Water Auditing using IWA/AWWA Audit
  - Recently Updated AWWA Manual M36

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Perform a Water System Audit First

- Best if a holistic approach is taken and first problems with greatest consequences are identified
- This can best be achieved by a water audit which is a cost-effective means to identify the low hanging fruit.
- The water audit will allow for prioritizing of how and where to realize quick returns on investment

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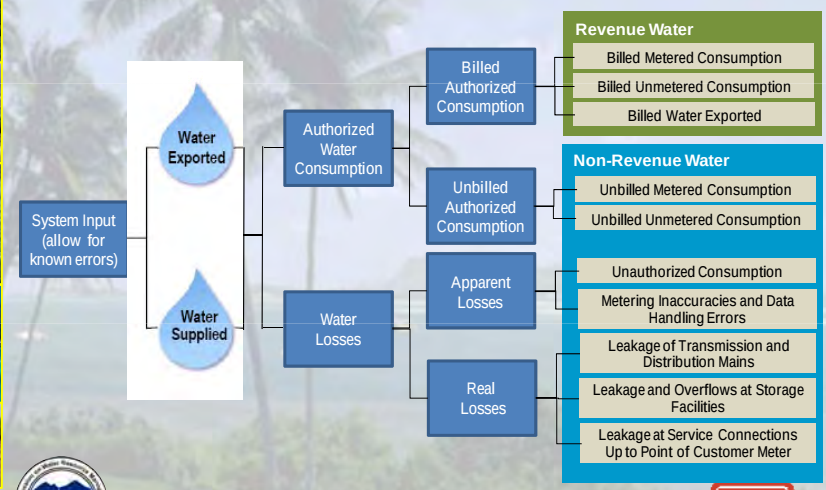
IWA/AWWA Standard Water Balance



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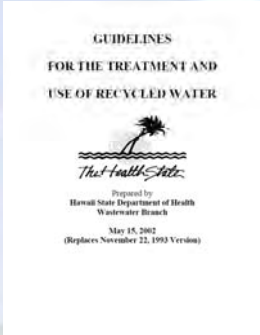
Use of Reclaimed Water

- Benefits
  - Offset potable water use
  - Reduces wastewater discharges
- Easier and more cost effective with new construction than retrofits
- Safety guidelines are important


GUIDELINES
FOR THE TREATMENT AND
USE OF RECYCLED WATER

Prepared by
Hawaii State Department of Health
Wastewater Branch

May 15, 2002
(Replaces November 22, 1993 Version)

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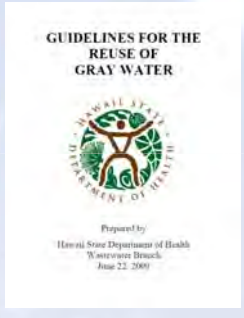
Reuse of Gray Water and Rainwater

- Guidance from Department of Health for outdoor use
- Captured rainwater and gray water for indoor purposes is not currently allowed, due to state plumbing codes


GUIDELINES FOR THE
REUSE OF
GRAY WATER

Prepared by
Hawaii State Department of Health
Wastewater Branch
June 22, 2009

Don't be a Gray Water Guerrilla!

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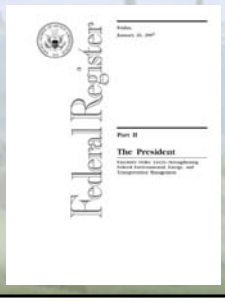
34

Military Water Conservation BMPs

- Executive Orders 13423 and 13514
- Require reduction in water consumption 2% annually through FY 2020
- EPA's WaterSense identified BMPs



1. Water Management Planning
2. Information and Education Programs
3. Distribution System Audits, Leak Detection, and Repair
4. Water-Efficient Landscaping
5. Water-Efficient Irrigation
6. Toilets and Urinals
7. Faucets and Showerheads
8. Boiler/Steam Systems
9. Single-Pass Cooling Equipment
10. Cooling Tower Management
11. Commercial Kitchen Equipment
12. Laboratory/Medical Equipment
13. Other Water Intensive Processes
14. Alternate Water Sources

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Military Water Conservation BMPs

- Install meters at users/buildings
- Maintenance program to repair clogged line/valves/meters and check all valves, PRVs, and meters in the water system
- Limit lawn and plant irrigation to 3 days per week (Tuesday, Thursday, Sunday)
- Irrigate between 0400 and 1000
- Irrigation systems secured on rainy days
- Adjust irrigation devices to deliver water to lawn and plants only (do not runoff)
- Use mulch for top dressing
- Use a bucket and hose with spray nozzle when washing vehicles
- Use dry methods to clear sidewalks, pavement
- Cover exterior hose bibs with removable key hose bib covers

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Military Water Conservation BMPs

- SPiRiT to LEED Transition Program – includes water efficient fixtures (such as 1-pint urinals)
- Inspect all plumbing fixtures on a weekly basis to ensure no leaks
- Inspect all swimming pools and jacuzzis/hot tubs for leaks and cover jacuzzis/hot tubs during non-operating hours
- Green building requirements set forth in NAVFAC guidance
- Use Federal Energy Management Program energy and water best practices
- Monitor irrigation use around buildings to include amount, direction, and time of watering
- Look for opportunities to reuse or recycle water

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Water Conservation Measure Evaluation

- Use representative Hawaii-statewide information to evaluate relative costs and benefits
- Prioritize and recommend BMPs to be implemented
- Local evaluation still required prior to implementation
- Alliance for Water Efficiency (AWE) Tracking Tool used to determine costs and benefits

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AWE Conservation Tracking Tool

- Analyze potential water savings, costs, and benefits of conservation measures
- Rank conservation measures
- Track implementation, water savings, and costs
- Growth by sector
- Predict revenue impact
- Track and graph the benefits of conservation activities over time
- Microsoft Excel with simple user interface
- Dynamic Tables, Charts, and Forms
- Scenario Management
- Detailed User Guide
- Further development is ongoing
- Greenhouse Gas reduction module
- Free for use by members

Alliance for Water Efficiency

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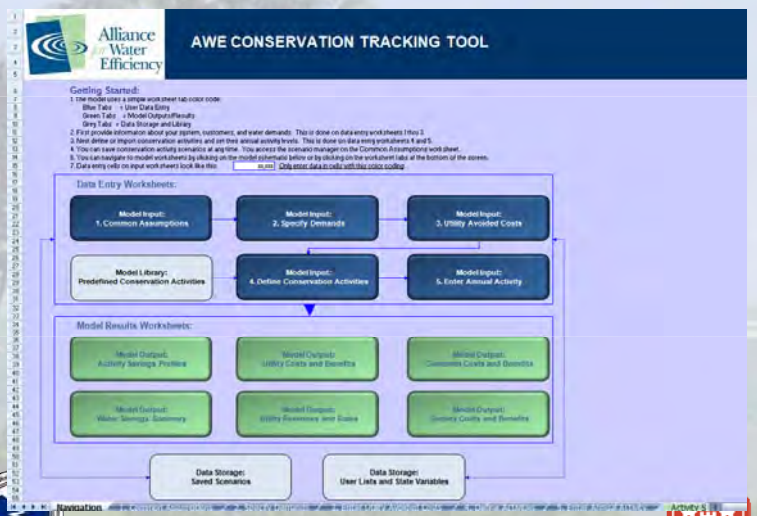
Model Navigation Worksheet



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Benefit-Cost Analysis Tabular Output

AWE CONSERVATION TRACKING TOOL: UTILITY COSTS & BENEFITS WORKSHEET

Return to Navigation Shee

Show Budget Table

Conservation Program Cost Analysis (2010 Dollars) — Amort. Years: 30

Class	Activity Name	Unit Cost ($/AF)	PV Cost	Amortized Cost
Single Family	Residential Surveys, SF	$ 848	$ 396,957	$ 20,024
Single Family	Residential HE Toilets, SF	$ 403	$ 1,694,499	$ 85,479
CII	CII HE Toilet	$ 787	$ 4,220,334	$ 212,893
Single Family	Residential Irrigation Controller, SF	$ 784	$ 3,087,580	$ 155,752
Irrigation	Large Land, Irrigation Controller	$ 195	$ 454,065	$ 22,905
Subtotal Conservation Activities		**$ 605**	**$ 9,853,435**	**$ 497,054**
Total With Overhead & Public Information		**$ 605**	**$ 9,853,435**	**$ 497,054**

Conservation Benefit Analysis (2010 Dollars)

Class	Activity Name	Unit Benefit ($/AF)	PV Benefit	Avoided Supply	Avoided Wastewater	Capacity Benefit
Single Family	Residential Surveys, SF	$ 634	$ 296,806	$ 271,696	$ 10,323	$ 14,787
Single Family	Residential HE Toilets, SF	$ 678	$ 2,850,081	$ 2,450,038	$ 240,463	$ 149,581
CII	CII HE Toilet	$ 678	$ 3,635,636	$ 3,138,087	$ 206,741	$ 190,808
Single Family	Residential Irrigation Controller, SF	$ 621	$ 2,443,620	$ 2,290,005	$ -	$ 153,615
Irrigation	Large Land, Irrigation Controller	$ 617	$ 1,437,826	$ 1,354,182	$ -	$ 83,643
Total		**$ 654**	**$ 10,663,969**	**$ 9,514,008**	**$ 557,527**	**$ 592,434**

Utility Conservation Program NPV and B/C Ratio (2010 Dollars)

Class	Activity Name	NPV ($)	B/C Ratio
Single Family	Residential Surveys, SF	$ (100,151)	0.75
Single Family	Residential HE Toilets, SF	$ 1,155,582	1.68
CII	CII HE Toilet	$ (584,698)	0.86
Single Family	Residential Irrigation Controller, SF	$ (643,961)	0.79
Irrigation	Large Land, Irrigation Controller	$ 983,760	3.17
Subtotal Conservation Activities		**$ 810,533**	**1.08**
Total With Overhead & Public Information		**$ 810,533**	**1.08**

Select Chart to View: Unit Costs Sorted — Chart Explanations

Utility Costs and Benefits

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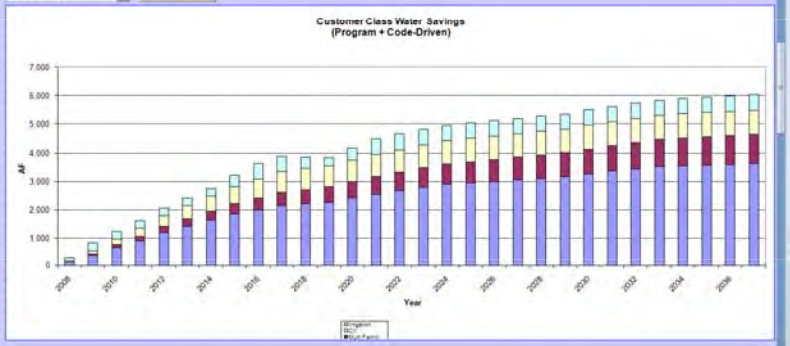
Graphical Display of Savings Results

Select Chart to View: Total Class Savings — Chart Explanations



Activity Savings Profiles | Water Savings Summary | Utility Costs and B

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Breakout Group Questions

- How do the BMP's apply to the circumstances in Hawaii
- What additional BMPs should be included for consideration in the statewide water conservation plan?
- Which should be deleted?
- What else should the CWRM be thinking about for effective water resource management now and in the future?

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Break-out Groups

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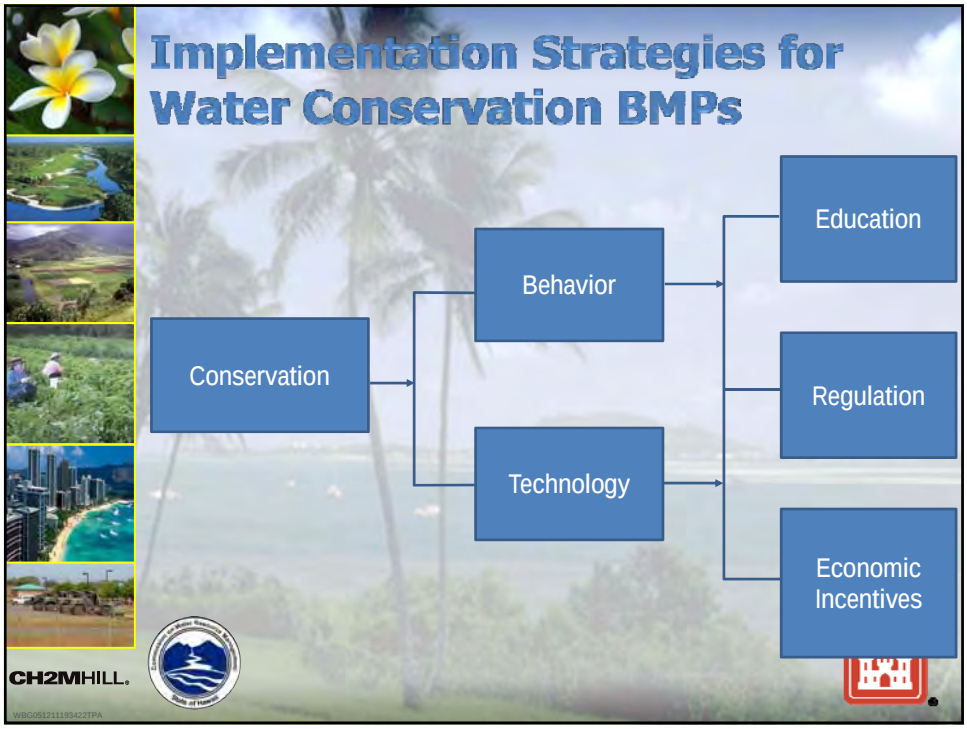
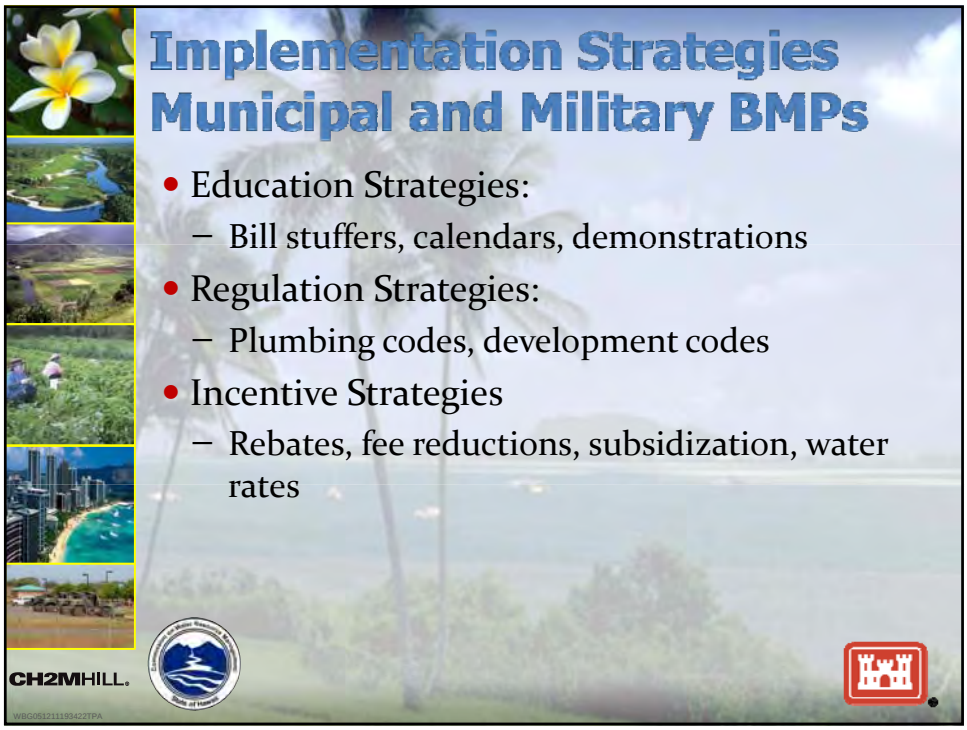
BREAK

Implementation
Strategies


Implementation Strategies for Water Conservation BMPs
Conservation
Behavior
Technology
Education
Regulation
Economic Incentives
CH2MHILL.


Implementation Strategies Municipal and Military BMPs
• Education Strategies:
– Bill stuffers, calendars, demonstrations
• Regulation Strategies:
– Plumbing codes, development codes
• Incentive Strategies
– Rebates, fee reductions, subsidization, water rates
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Breakout Group Questions

- Considering the 10 selected Municipal and Military BMPs, what would be the best implementation strategies for them in Hawaii?
- Discuss and identify implementation roles and responsibilities for the 10 selected BMPs.
- Other ideas on implementation of Municipal and Military BMPs?

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Break-out Groups

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Observations and Next Steps

Project Schedule and Next Steps

February 2012
Receive draft implementation strategies for review

March 2012
Discuss proposed implementation strategy and goa

define goals; discuss implementation

May 2012
Receive Draft Plan for Review

June 2012
Review Draft Plan

implementation process and schedule

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Water Conservation Advisory Group Meeting #4

Thursday, March 22, 2012
8:30 am – 12:30 pm.

Agenda

March 22, 2012		
8:30 – 8:45	Welcome and Meeting Objectives	Neal F.
	Goal Discussion	
8:45 – 8:50	• SMART Goals Defined	Wendy N.
8:50 – 9:15	• SWOT Analysis Review and Discussion of "Goal Areas"	Wendy N.
9:15 – 10:30	• Development of SMART Goals within Goal Areas	Wendy N.
10:30 – 10:45	Break	
10:45 – 11:15	Review BMPs, Agree on Definitions	Brian S.
11:15 – 12:15	Select, Refine and Scale BMPs Based on Goals	Brian S.
12:15 – 12:30	Wrap up and Next Steps	Ross K.

Location:

CH2MHILL Honolulu Area Office
1132 Bishop Street, Suite 1100
Honolulu, HI 96813

Valet parking in basement

State Water Conservation Advisory Group (WCAG) Meeting #4

Date: **22 March 2012**

Time: **8:30 am-12:30 pm HST**

Location: **CH2M HILL HNL Office, Makai Conference Room**

Attendees: Neal Fujii, CWRM
Jeremy Kimura, CWRM
Lenore Ohye, CWRM
Debbie Solis, Army Corps of Engineers
Wendy Nero, CH2M HILL
Brian Skeens, CH2M HILL
Ross Kaneko, CH2M HILL
Alyssa Smith, CH2M HILL
See attached list of WCAG attendees

Due to competition for fresh water, increasing population and development pressures, the sustainable movement, and the impacts of global climate change requiring Hawaii to become as efficient as possible in its uses of fresh water, the Army Corps of Engineers in partnership with the State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) have determined that a water conservation plan for the State of Hawaii should be established. As part of this effort, a Water Conservation Advisory Group (WCAG) – made up of experts from each water use sector – was formed to assist in policy and program development. It is anticipated that the WCAG will meet a total of six (6) times throughout the duration of the project. The fourth meeting was convened on March 22, 2012 and the following summarizes and documents the activities of the meeting.

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List of Acronyms

Acronym	Organization
BWS	City and County of Honolulu Board of Water Supply
CWRM	Hawaii Department of Land and Natural Resources Commission on Water Resource Management
DHHL	Department of Hawaiian Home Lands
HC&S	Hawaii Cane & Sugar
HDOA	Hawaii Department of Agriculture
HDWS	County of Hawaii Department of Water Supply
HDOT	Hawaii Department of Transportation
HFB	Hawaii Farm Bureau
HGCSA	Hawaii Golf Course Superintendents Association
HHLA	Hawaii Hotel & Lodging Assoc
KDOW	Kauai County Department of Water
LICH	Landscape Industry Council of Hawaii
MCBH	Marine Corps Base Hawaii, Kaneohe
MDWS	Maui County Department of Water Supply
MTA	Mililani Town Association
NAVFAC	Naval Facilities Engineering Command, Hawaii
UHM	University of Hawaii-Manoa
UHM CTAHR	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources
USACE	United States Army Corp of Engineers
USAG HI	United States Army Garrison Hawaii
USDA NRCS	United States Department of Agriculture- Natural Resources Conservation Service
WCAG	Water Conservation Advisory Group

Meeting Summary

1. Welcome and Re-introductions (Neal Fujii)- Neal initiated re-introductions of the project team and WCAG members.

- Introductions

  Neal Fujii (CWRM)

  Brian Skeens (CH2M HILL)

  Wendy Nero (CH2M HILL)

  Ross Kaneko (CH2M HILL)

  Jeremy Kimura (CWRM)

  Brian Kau (HDOA)

  Lenore Ohye (CWRM)

  Mae Nakahata (HC&S)

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Elson Gushiken (ITC Water Mgt)

Warren Watanabe (Hawaii Farm Bureau)

Greg Hayashi (NAVFAC)

Dragos Oprescu (MCBH)

Allen Wolfe (USAG HI)

Joy Buccat (KDOW)

Kanani Aton (Hawaii DWS)

Ryan Quitoriano (Hawaii DWS)

Debbie Solis (USACE)

Katie Ramirez (NAVFAC Energy)

Kristi Ellazar (MTA)

Howard Wiig (State Energy Office)

Sharon Sawdey (NRCS)

Carl Evensen (UHM CTAHR)

Kaleo Manuel (DHHL)

Sharon Williams (UHM)

Rod Suzumoto (HHLA)

2. Meeting Objectives (Neal Fujii)

Objectives of the meeting: 1) Review CWRM's internal goals for this water conservation plan; 2) review BMPs created by WCAG in previous meetings and agree upon implementation strategies.

3. Scope Refresher and Agenda Review (Wendy Nero)

A brief scope refresher of work, the agenda for the meeting, and objectives of the meeting were presented to the WCAG. Details are provided in the attached pdf copy of the PowerPoint presentation used at the meeting.

4. SWOT Analysis, Strategy Overview, SMART Objectives, Goals Discussion and Prioritization (Wendy Nero)

See the attached handouts and PowerPoint presentation for details.

- *Barry- (in regards to the goals and strategies) the most favorable BMPs will be those that are the least costly and easiest to implement. How do those fit into the water conservation plan?*

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- *Brian- in the past meetings, BMPs that are the most implementable and have the most potential were discussed. Some initial evaluation of those have been done, which makes up the implementation strategies that will be discussed later in the meeting. The evaluation of the cost and savings will vary across the state. We don't want a plan that dictates, but to come up with the right collection of BMPs. Individual sectors can further analyze those BMPs to determine which gives the best savings at the right cost. Recommended implementation strategies are based on the BMPs.*
- *Wendy- the implementers will not be CWRM, but the users. CWRM will need to work with users to implement the BMPs.*
- *Carl Evensen- another thought is who receives the benefits and who bares the cost? An example is irrigation/agriculture measures- credits/incentives are given to the agriculture producer, but savings will be seen by the public.*
  - *Wendy- This plan will not be that detailed. Some of the high value/high potential savings will need to be incentivized, but we don't necessarily have the funds to do this. We need to prioritize investments to gain the highest return.*
  - *Elson Gushiken- he's doing an analysis at a resort in Kona that's running 6 pumps continuously in salt water lagoons. The resort is reviewing their capital improvements and a system-wide analysis to develop 5 year plan to upgrade. Since the resort is private, they are taking into account that they'll have to bare all the costs.*

- *Mae Nakahata- (in regards to Strategy A) studies from the university lean toward the importance of climate change. Conservation cannot exist on its own. If the water source is decreasing, but the plan is pushing for conservation, how will you achieve the ultimate goal? As you develop your conservation program, there has to be a section to implement it. A connection between the two sections.*
  - *Wendy- Strategy C, 4th goal addresses this.*
- *Mae- (in regards to Strategy B) When you say food scarcity, food doesn't exist by itself. If you keep focusing on food, you may not get there because you created other problems. From an agriculture standpoint, you may want to say "viable agriculture".*

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- *Sharon Williams- (in regards to Strategy B, the last goal) it's not just water conservation, but also climate change.*
    - *Wendy- combine the second and last goal.*
- *Carl- relative to the culture of efficiency, we should also be looking for economic savings. This should be overt because it's an important incentive. It goes beyond culture and social values. The economic driver needs to be identified which will be a key aspect whether users improve efficiency of water use.*
    - *Wendy- Edit the first goal.*
- *Pam- (in regards to Strategy B Goal 2) could we say "watershed management"? It's important to make that link between watershed management and source availability of water in terms of long-range thinking.*
    - *Mae- source protection is important, but recognize that there are a lot of streams that are non-perennial. Also, forecasts predict bigger storms and longer droughts. It's not just protection, but source management, protection, and augmentation.*
        - *Watershed management (removal of invasive species) vs. source protection (non-perennial streams to force infiltration)*
        - *Efficiency may not be measured as the least amount of water used per unit area. It can have many meanings. How can we make sure the definition is appropriate for specific circumstances?*
    - *Debbie- the strategies and goals are meant to be general. The objectives will define the details to a point that clarifies the type of efficiency (agriculture vs. municipal vs. residential).*
    - *Elson- it may be more efficient to yield more water by balancing conservation and maximizing the efficiency of return. It basically comes down to economic value.*
    - *Neal- there is a distinction between delivery, practices, and crop types, but this distinction can't be made at the BMP level.*
    - *Wendy- context can be given in plan to explain this.*
    - *Howard Wiig- emphasis on monetary savings won't get anywhere in the public or private sectors without the mention of monetary savings.*

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        - *Sharon W.- what about water enhancement (i.e. to grow trees to increase rainfall)?*
            - *Pam- that's part of watershed management.*
                - *Wendy- this can be integrated into the water plan.*
- *Carl- (in regards to watershed management) part of the incentive to improve infiltration and reduce water loss, is to reduce negative environmental impacts. This might be mentioned as an additional source of funding (i.e. reduce polluted run-off to ocean) as a potential for partnerships to accomplish larger issues to benefit water conservation and other environmental impacts.*
    - *Wendy- this is mentioned in Strategy D*
- *Howard- the new plumbing code will permit the use of graywater in some shape or form, whether used inside for toilets or for landscaping. The energy International Residential Code (IRC) could have provisions for using roof-top rainwater for landscaping. There are no provisions for blackwater since it's too controversial.*
- *Brian K.- How is this different than the existing CWRM framework?*
    - *Brian S.- we recognize the existing framework. This framework is trying to bring it all together and take the next steps to examine the target to enhance the conservation measures and BMPs.*
    - *Wendy- reword to "enhance the existing framework".*
- *Mae- (in regards to Strategy D Goal 2) sounds like conservation needs to be the number one priority.*
    - *Wendy- the intent was to raise level of awareness and make sure conservation is a priority or it will be forgotten.*
    - *Neal- currently there's nothing in the CWRM budget for conservation measures. Funding for the plan is not a recurring source and is made possible by the partnership with the Army Corp of Engineers. There should be more attention given to conservation programs.*
    - *Sharon S.- maybe it should be listed as a line item instead of prioritized.*
- *Sharon S.- (Strategy D goal 4) starts to move away from a goal and seems more like a tactic.*
    - *Wendy- the intent is to capture the greatest return for the least investment.*

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- *Mae- incentives are not always necessarily financial (i.e. getting permits approved quicker)*
    - *Wendy- we still want to specify financial, but will include "other".*
- *Sharon S.- do you mean to focus on spending funds or analyze the use of funding?*
    - *Brian S.- when asking for funding, it's a good idea to know how the money will be used.*
    - *Wendy- this will allow a way to budget for programs.*
- *Carl- add a bit to encourage partnerships to increase funding sources.*
    - *Elson- Strategy D implies both whether collaborative partnerships are seeking internal funding or external funding. Funding sources can be external or internal and some degree of involvement of partners will be in a supportive role.*
    - *Debbie- CWRM should serve as the point of contact to let people know about different funding sources/partnerships available.*

The WCAG ranked the revised list of strategies and goals (see attached handouts).

5. BMP Discussion (Brian Skeens)

See the attached handouts and PowerPoint presentation for details. The BMPs listed on the handout are recommendations per sector that can be incorporated with the implementation strategies and goals mentioned in the first half of the meeting. The Agriculture BMP discussion will continue on the side between CWRM, USACE, CH2M HILL, HDOA, Hawaii Farm Bureau, NRCS, HC&S, NAVFAC, and ITC Water Management.

- *Barry- is this plan a guide or will it be enforced/required?*
    - *Brain S.- each BMP has its own implementation strategy.*
    - *Wendy- there will be a specific objective statement under the BMP. CWRM will adopt the action items.*
    - *Howard- the approval process for codes goes from Department of Health (DOH) to each county (who implement it) then becomes a requirement by municipalities.*
    - *Neal- CWRM has restricted authority to enforce codes and will need to work with each county.*
    - *Elson- According to the State Water Reuse Guidelines, if you don't follow them, you won't get DOH approval, but there's caveat stating the director can override.*

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- *Howard- Hawaii Energy (an electrical efficiency rebate program) takes $1.50 per electricity bill and decides how to use it.*
    - *Allen Wolfe- the Army has an incentive program for homes that examines the monthly moving average. For those who use the most, they pay a fee. For the customers who conserve the most, they receive a refund. Since implementing this, there has been a 10% drop in usage.*
    - *Barry- what about incentives, policies, and education?*
        - *Brian S.- Yes, you can do other things. These BMPs are our recommendations. Education on benefits of water conservation is important. CWRM will work with providers or end users to establish a funding source for rebates.*
        - *Mae- there are non-financial incentives (i.e. while waiting for a water connection, show you'll implement water conservation BMPs to get permits quicker).*
- *Howard- (in regards to green programs) the "green" hotel program in Hawaii has been successful.*
    - *Pam- government buildings should be included in this plan, not just businesses.*
    - *Wendy- an objective could be "CWRM will work with other state agencies to ensure participation in green business programs that address water/energy efficiency and retrofit by 2015".*
- *Cat- it's challenging to understand CWRM's plan. At what point do the stakeholders take the plan and implement it?*
    - *Brian- the plan will be broken down into long- and short-term goals with recommendations on how to get it done.*
    - *Lenore- This is where we can refer back to the responsibility matrix done in WCAG meeting #3.*
    - *Wendy- as a state level plan with a broader approach, these BMPs will be created into numerous objectives that will turn into partnerships. When the internal team did the SWOT analysis, it was clear that a heavy-handed approach is not desired. There are very few places that list something as required, but this could change before the plan is finalized. There will be a separate interactive process with CWRM to determine requirements that work for each provider/user.*

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    - *Barry- has concerns about specific mandates being listed in the plan.*
- *Howard- (in regards to Water Sense fixtures) all windows sold in America must pass a specific certification, as well as light bulbs will soon need to have a light sense label.*
- *Dragos Oprescu- (in regards to military BMPs) the government has a requirement to install electrical water meters by 2020 on all buildings.*
- *Dragos- (in regards to audits of the distribution system) there might be challenges with the maintenance staff on the repair side.*
    - *Allen- also, the privatization of the water system may be a problem.*
- *Dragos- (in regards to water efficiency) for the military, there is a mandate to have a 2% water reduction per year based on 2010 use.*
- *Barry- (in regards to cooling tower management) similar to a demonstration of softening of water and may want to consider losses of water from evaporation.*
    - *Lenore- when customers move toward renewable energies, it will become less water dependent/intensive.*
    - *Katie Ramirez- one of the challenges of a cooling tower management demonstration project is that the cooling towers on military bases are maintained under a service contract. The service contract would need to be modified to do the demonstration.*
- *Mae- (in regards to agriculture BMPs) there are conditions to these BMPs and there needs to be an understanding of the definitions.*
- *Brian K.- (in regards to agriculture audits) will these audits be required, and if so, who will be conducting them? Will every farm be required to do these audits? There are concerns about the smaller farms (i.e. under 1 acre). DOA does require a conservation district use area permit, but doesn't ask for anything more than that.*
    - *Brian S.- these are educational audits to help understand the potential benefits. Policy requirements will stem from the water management plans.*
    - *Wendy- the audits can be scaled (i.e. some water use per acreage), but the bigger users should have to do a water management plan.*
    - *Sharon S.- when NRCS offers assistance for irrigation, they require an irrigation water management practice (i.e. record water use).*
    - *Neal- water use permits are issued based on justification of need.*

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    - *Mae- water has numerous uses other than irrigation (i.e. use timed sprinklers on watercress fields to control insect mating). Also, there's a legislative bill that will help develop general accepted management practices (GAMP) (includes irrigation).*
- *Brian K.- (in regards to measuring flow) would all purveyors be required to retrofit their systems? How does this impact a system where it's owned/operated by one person (DOA doesn't control distribution)? How can you measure these diversions without a SCADA system? Some of these diversions take a day to hike to. What is considered timely data?*
    - *Neal- under the current code, they should have updated systems. It just hasn't been enforced, yet.*
    - *Elson- it's typically difficult to read diversions because some of these systems are far. Maybe do this on a weekly basis and take an average. You need to measure the ditch over time to understand if there is inefficiency in the structure.*
    - *Mae- streams are flashy (i.e. can go from 60 MG to 20 MG in a couple of hours)*
- *Mae- (in regards to "increased regulation to ") make sure the technology is there given the types of systems currently in place.*
- *Brian K.- (in regards to lining) this will be difficult due to the high cost, unless there is some kind of incentive.*
- *Mae- (in regards to increasing costs) if the cost of water increases for farmers, they can't pass that cost increase on to their customers because of the competition from the mainland who can provide the same products for a cheaper price. The system is not reliable enough, so farmers don't plant during the summer due to the risk. This goes against the state plan of increasing sustainability. The smaller farmers just won't pay for it.*
- *Brian K.- (in regards to incentives to rehabilitate systems) there are incentives for private systems (i.e. tax credits/breaks, money back), but the state faces a liability while trying to keep their systems running. The state is spending millions of dollars on their systems. What's the expectation?*
    - *Brian S.- the expectation is to come up with a plan, prioritize, budget, and target BMPs that can be agreed upon at these meetings.*
- *Neal- a general statement on behalf of CWRM: CWRM has a responsibility to make sure water is used in the most beneficial way. CWRM does recognize the importance of*

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agriculture, that surface water systems are inefficient by nature, and that CIP repairs and upgrades are expensive. That being said, we can't just do nothing. CWRM is not trying to mandate this plan, but to raise the awareness to a higher level to approach it with the existing limited resources.

- *Brian K.- Worried about systems who are trying to get established and don't have the backing/support of tax-payers.*
- *Lenore- looking at the BMPs, the requirement is to have a water conservation plan, not to implement. The goal is to write a plan and then implement it as you go. Maybe add a BMP to have technical expertise from CWRM available to users to facilitate a plan.*
- *Brian K.- does or will CWRM have the ability to support the smaller farmers to create a plan?*
- *Debbie- CWRM could do a collaborative workshop with DOA to educate small farmers about BMPs.*
- *Elson- the plan will be a good resource to look at options of BMPs.*

- *Mae- (in regards to agriculture BMPs) the most practical BMP listed is the last one, but should be reworded.*
- *Katie- (in regards to the side agriculture conference call) you may want to explore the affects of this plan on the development of biofuel crops (especially water intensive crops like algae). The military is interested in expanding biofuel crops in Hawaii.*
  - *Elson- agriculture includes aquaculture.*
  - *Kanani- users on the west side of Hawaii-island use 3 times more water than those on the east side. In Kona, there is an aquaculture venture that infuses salt water with potable water that is one of the largest water customers. The evaporation of the salt water is blended with the potable water to irrigate/produce spirulina.*
  - *Mae- there was a project that was using condensation to irrigate which could be considered conservation because it uses water in another way.*
  - *Brian S.- there will be a separate call to further discuss agriculture BMPs.*
- *Wendy- discussion of the WCAG scoring on the strategies/goals (see attachment).*
  - *The lower scores are the higher ranks.*

6. Topics for later discussion

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- *Lenore- (in regards to municipal)*
    - *Code/jurisdiction for source water protection/infiltration*
    - *Encourage low impact designs (Sharon W.)*
- *Brian Kau/Mae Nakahata/Sharon Sawdey- (in regards to agriculture)*
    - *Water audits and management plans*
    - *Volumetric measurement*
        - *Public/private*
        - *Large/small*
        - *Cost (local vs. mainland)*
    - *Technical expertise on water management plans*

7. Observations and Next Steps (Brian Skeens)

Next Steps:

- *Next WCAG meeting tentatively June 2012*
- *Draft plan will be sent in advance to be reviewed before the meeting.*

8. Action Items

- *WCAG to send any comments or questions to anyone on the project team.*

If there are any necessary corrections or additions, please contact me via email at Ross.Kaneko@ch2m.com or you can reach me on my office line at 808-440-0225, or my cell phone at 808-554-3791.

Respectfully submitted,

Ross A. Kaneko

Attachments:

- Attendance list
- Project team contact list
- Revised Meeting Handouts
- WCAG Votes on Strategies and Goals
- WCAG Meeting #4 Presentation

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Water Conservation Advisory Group Meeting #4 (03/22/2012)
List of Attendees

Last Name	First Name	Organization	Email Address
Aton	Kanani	County of Hawaii Department of Water Supply (HDWS)	Katon@hawaiidws.org
Brinker	Amy	Sierra Club/KYA Sustainability Studio	abrinker@thekyastudio.com
Buccat	Joy	Kauai County Department of Water (KDOW)	jbuccat@kauaiwater.org
Dacus	Chris	Hawaii Department of Transportation (HDOT)/ Landscape Industry Council of Hawaii (LICH)	christopher.a.dacus@hawaii.gov
Ellazar	Kristi	Mililani Town Association (MTA)	kellazar@mililanitown.org
Evensen	Carl	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources (UHM CTAHR)	evensen@hawaii.edu
Gushiken	Elson	ITC Water Mgt, Inc	elson@itcwater.com
Hayashi	Greg	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	greg.hayashi@navy.mil
Kau	Brian	Hawaii Department of Agriculture (HDOA)	brian.k.kau@hawaii.gov
Manuel	Kaleo	Hawaiian Homelands (DHHL)	kaleo.l.manuel@hawaii.gov
Nakahata	Mae	HC&S Co.	mnakahata@hcsugar.com
Oprescu	Dragos	Marine Corp Base Hawaii	dragos.oprescu.ctr@usmc.mil
Pogue	Pam	Maui County Department of Water Supply (MDWS)	pam.pogue@co.maui.hi.us
Quitoriano	Ryan	County of Hawaii Department of Water Supply (HDWS)	rquitoriano@hawaiidws.org
Ramirez	Kathleen	NAVFAC HI Energy Management	kathleen.j.ramirez1@navy.mil
Sawai	Cat	City and County of Honolulu Board of Water Supply (BWS)	csawai@hbws.org
Sawdey	Sharon	United States Department of Agriculture- Natural Resources Conservation Service (USDA NRCS)	sharon.sawdey@hi.usda.gov
Suzumoto	Rod	Hawaii Prince Hotel and Golf Course	rsuzumoto@hiprince.com
Usagawa	Barry	City and County of Honolulu Board of Water Supply (BWS)	busagawa@hbws.org
Watanabe	Warren	Hawaii Farm Bureau	warrenmcfb@hotmail.com
Wiig	Howard	Hawaii Department of Business, Economic Development, and Tourism Energy Office (DBEDT)	hwiig@dbedt.hawaii.org
Williams	Sharon	University of Hawaii-Manoa	sharonwi@hawaii.edu
Wolfe	Allen	United States Army Garrison Hawaii (USAG HI)	allen.wolfe@us.army.mil

Water Conservation Plan
Project Team Contact Information

Last Name	First Name	Organization/Company	Phone	Email
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Kimura	Jeremy	CWRM	587-0269	jeremy.l.kimura@hawaii.gov
Ohye	Lenore	CWRM	587-0216	Lenore.N.Ohye@hawaii.gov
Solis	Debbie	USACE	438-0701	Deborah.A.Solis@usace.army.mil
Kaneko	Ross	CH2M HILL	440-0225	ross.kaneko@ch2m.com
Madison	Mark	CH2M HILL	(503)736-4453	mark.madison@ch2m.com
Nero	Wendy	CH2M HILL	(813)874-0777	wendy.nero@ch2m.com
Skeens	Brian	CH2M HILL	(678)530-4327	brian.skeens@ch2m.com
Smesrud	Jason	CH2M HILL	(503)736-4372	jason.smesrud@ch2m.com
Smith	Alyssa	CH2M HILL	440-0207	alyssa.smith@ch2m.com

SWOT Matrix

		Opportunities								Threats									
		Leverage/cost-share with existing programs (federal, county, large users, LICH)	Growing awareness of water resources and interest in sustainability, being "green", efficiency (cultural, perceptual connection)	Growing public concern about energy/water nexus, climate change and food security (analytical connection)	Few users consume significant percentage of water	Recent legislative support for funding Ag water conservation	Rising power, chemical and operational cost to water users	Tie conservation program funding to water supply dependent users	Existing platform for outreach	Misperceptions about conservation (entices growth, stops development)	Loss of water revenue	Perceived inequity in water use and allocation	Economic downturn (impact on state budgets & stakeholder investments)	No recurring funding mechanism for CWRM	Lack of support for fees to fund water conservation	Price of water is too low	Resistance to mandates and limits on "personal freedom"	Growing "entitlement attitude" to "use what I pay for"	Total
Strengths	Organizational Support (admin, leadership & staff) for water conservation	16	10	6	5	19	2	16	8	10	8	11	15	11	13	13	11	6	180
	Dedicated water conservation coordinator position	16	10	11	9	9	9	5	21	13	11	9	7	5	11	4	6	5	161
	Broad legal authority to make and enforce rules	0	7	8	11	4	1	14	1	0	4	8	0	14	8	4	11	9	104
	Collaborative approach with stakeholders	15	12	8	13	21	18	15	17	26	19.5	18	11	10	11	15	10	4	243.5
	Culture of efficiency	4	25	12	5	8	27	5	3	9	10.5	2	5	3	4	20	21	21	184.5
Weaknesses	Lack of data collection and reporting system to measure water use	8	2	9	19	11	9	11	3	15	9	23	8	2	8	5	5	14	161
	No clearly defined limits on water resource availability	7	10	11	13	6	9	4	3	8	11	14	6	0	6	12	4	15	139
	Limited staff for state-wide implementation	14	6	6	5	14	6	6	17	6	4	2	19	18	9	1	2	0	135
	Limited existing budget	14	14	5	2	5	12	8	20	4	3	0	25	14	27	7	2	4	166
	No existing strategic, guiding document for program priorities	10	6	19	10	8	10	6	12	12	11	8	1	6	5	11	11	10	156
	Administrative rulemaking process is onerous	1	0	0	1	0	0	2	0	0	2	0	0	3	0	1	2	1	13
	CWRM has no experience navigating the rulemaking process	0	0	2	3	0	0	4	0	0	4	0	0	6	0	1	3	2	25
	Lack of willingness to enact and enforce rules	0	3	8	9	0	2	9	0	2	8	10	8	13	3	11	17	14	117
Total		105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	105	1785

A. Strategy: Develop an implementation framework that relies upon a collaborative approach with stakeholders

- Goal: Develop model ordinances (e.g. landscape code), developed collaboratively with industry groups, with support from and enactment at local/county level
- Goal: Develop technology transfer programs (e.g. "green hotel", seminars, demonstration projects, etc.)
- Goal: Establish partnerships with entities implementing water conservation programs aimed at demonstrating costs, savings and effectiveness (e.g. Honolulu BWS, military, golf courses, hotels, etc.)
- Goal: Foster voluntary reporting of water conservation measure implementation and data/monitoring and reporting for water users that are not directly permitted by the Commission on Water Resource Management (Commission or CWRM)
- Goal: Building on the Water Conservation Advisory Group, establish a statewide water conservation advisory council, to continue collaboration and guide statewide implementation of water conservation programs

B. Strategy: Leverage culture of efficiency to establish water resource awareness and garner water savings results

- Goal: Tie communications efforts (stand alone or in support of specific water conservation effort) and the need for water conservation to culture, values and financial savings
- Goal: Establish a water resource management public awareness campaign that incorporates climate change, energy/water nexus, food scarcity, viable agriculture, watershed management and source protection and augmentation
- Goal: Create water conservation recognition program to celebrate success and reward those (entities, organizations, individuals) that improved their water use efficiency
- Goal: Develop (or make available) a water resource and conservation education curricula (e.g. "Project WET") aimed at school children, with implementation at the local/county level

C. Strategy: Evaluate effectiveness and identify potential enhancements to the existing statewide water resource availability, permitting, monitoring and allocation program(s)

- Goal: Continue development of water use data collection, analysis and reporting system to enable accurate assessment of water use
- Goal: Explore policy changes to make improvements in water use efficiency and related reporting (e.g., State Water Code, building codes, county ordinances, etc).
- Goal: Explore policy changes to proactively plan for the expanded use of reclaimed water for agriculture, landscaping, irrigation, recharge and industrial uses
- Goal: Enhance the existing integrated statewide water management plan, by including a water conservation target, that can be established in the context of known available or anticipated future water resources.
- Goal: Require development and submittal of water conservation plan and annual reporting on implementation of water conservation plan measures as a condition of receiving a water use permit

D. Strategy: Leverage strong organizational and Commission support for water conservation to establish funding source(s)

- Goal: Re-evaluate existing CWRM strategy to prioritize water conservation elements and recommendations from the Statewide Water Conservation Plan
- Goal: Include conservation program implementation as a priority in the annual budgeting process that identifies the measures with the greatest potential savings at the least cost.
- Goal: Secure needed funding (or re-allocate existing budgets) to establish financial or other incentive program to encourage implementation of BMP's)
- Goal: Collaborate with other state agencies to allocate funding for water use efficiency improvements and ensure data collection and monitoring for each investment
- Goal: Identify and secure additional, external funding sources for the implementation of water conservation programs (e.g., public-private partnerships, existing federal programs, etc.)
- Goal: Seek partnerships with entities with common or shared objectives to leverage funding for research and achieve greater implementation of water conservation measure (e.g., related state agencies)

BMP Definitions

Municipal

Water Loss Control

Water Loss Control is the calculation and reduction of water losses according to industry standard methodology. The industry standard is the IWA/AWWA Water Audit Methodology as outlined in the AWWA M36 Manual, Water Audits and Loss Control Programs.

Implementation mechanisms include requirement of water systems to perform annual water audits and submit to CWRM, and showing increase annually in the water audit data validity and/or reduction in water losses.

Rain Barrel Programs

Rain barrels, when installed at residential or large properties, collect rainwater from roof gutters to be used at a later time for non-potable outdoor purposes, such as hand watering or car washing.

Implementation mechanisms include public or targeted giveaway programs, do it yourself workshops, and sale at a reduced or subsidized price to water users.

Irrigation Upgrade Programs

Irrigation upgrade programs are the assessment and replacement of automatic irrigation components with more water-efficient technologies, such as controller systems that use real-time weather or soil moisture input or efficient applications such as rotary heads or drip irrigation. These are typically targeted to large irrigation systems (non-residential).

Implementation mechanisms include targeted or public rebates, water budgets to incentivize with financial penalties, or education/demonstration installations.

Gray Water Reuse

Water Reuse is the practice of using potable water for more than one end use before disposal and return to natural waters. Gray water reuse is from certain indoor end uses (shower, lavatory, washing machine) that can be reused with minimal treatment for non-potable uses such as irrigation or toilet flushing.

Individual gray water systems for buildings and residential uses can be rebated, required, or publicized.

Education and Outreach

Education and outreach is the development and dissemination of materials about ways to become more water efficient, and the value of water. This can also include highlighting new equipment and/or practices that increase water efficiency, as well as training and demonstrations.

Implementation mechanisms include requirement of water systems to develop education and outreach programs or coordination of regional education programs that individual water systems can participate in.

Efficient Commercial Equipment

Efficient commercial equipment is the identification and promotion of water using equipment for commercial users that are more water-efficient than those currently available or in use. These equipment can include toilet flush valves, urinals, kitchen pre-rinse spray valves, ice machines, and

cooling towers. Typically the water savings is very definable and payback can be calculated for these devices, based on their use.

Implementation mechanisms include education of the payback to promote retrofits, rebates for the installation to increase the payback for retrofits, and requirement of the use of efficient equipment in new commercial facilities.

Irrigation Technology

Irrigation technology is the promotion and installation of irrigation technology for automatic systems typically in residential or small landscape situations. These technologies can include inexpensive rain shutoffs switches that can be added to irrigation controllers and weather-based irrigation system controllers that are becoming more affordable for residential and small landscape uses.

Implementation mechanisms include education and rebates for the installation of rain shutoff switches on existing systems or replacement with weather-based irrigation controllers, and requirements for installation of rain shutoff switches on new irrigation systems.

Green Business Program

Green business programs are the development of new or promotion of existing green business programs. The intent is to highlight individual business that have implemented green business practices, such as energy and water efficiency above and beyond existing requirements, such as the USGBC LEED programs, and others.

Implementation mechanisms include education and promotion of selected promotions to targeted or public businesses. For those businesses that participate, there should be education to the public and other businesses about their resulting water and energy savings. Other implementation considerations include one-time or recurring rebates for certified businesses, or reduction in fees.

Water Use Surveys

Water use surveys include the development of water user assessment surveys to evaluate and benchmark opportunities for water efficiency improvements at individual customers. General surveys and materials can be developed for standardized users, while more customer specific audits must be performed for some commercial, Hotel/Motel/Resorts, and large landscape users.

Implementation mechanisms include free targeted or public surveys or audits, as well as a one-time financial credit for participating in a survey or audit.

WaterSense Certified/Labeled Equipment

WaterSense certified/labeled equipment is the promotion of the US EPA WaterSense program, which includes the certification and labeling of water using fixtures and appliances that use 20% less water than existing requirements, and are performance tested to receive certification.

Implementation mechanisms include joining the WaterSense Partner program to promote the availability and adoption of WaterSense labeled devices, or code changes to adopt WaterSense equipment such as toilets, urinals and faucets.

Military

Install meters at users/buildings

Install meters at users/buildings is the prioritization of on-base military users and/or buildings to install water use meters to better track water usage. There should also be a monthly meter reading program, and if applicable, a reporting mechanism to the users/building tenants.

Implementation mechanisms include requirements to meter a percent of buildings annually until completion.

Information and Education Programs

Information and education programs are the preparation and dissemination of materials about water conservation and efficiency and reducing water waste and loss. These materials could include existing material being used at other military installations.

Implementation mechanisms include signs, flyers, and education programs.

Distribution System Audits, Leak Detection, and Repair

Distribution system audits, leak detection and repair is the identification and reduction of leaks and other water losses and performing an audit according to industry standard methodology. The industry standard is the IWA/AWWA Water Audit Methodology as outlined in the AWWA M36 Manual, Water Audits and Loss Control Programs.

Implementation mechanisms include requirements for distribution system managers to perform system audits and develop a program for leak detection and repair. Also included could be the requirement to report on progress annually. Incentives could also be used to reward the reduction of leaks and other water losses, such as awards and recognition.

Water Efficient Fixtures

This BMP is the use of more water efficient fixtures in new buildings, and the retrofitting of equipment into existing buildings to reduce water use. These fixtures may include 1-pint urinals, WaterSense toilets, faucets, showerheads, efficient commercial toilet flush valves, and others. Another source of infromatio for this is the Federal Energy Management Program and SPiRiT to LEED transition program

Implementation mechanisms include the requirement to reduce water use intensity by 20% according to federal requirement, and implement LEED for new buildings according to the SPiRiT to LEED program. Annual reporting towards these requirements should be performed and publicized.

Look for opportunities to reuse or recycle water; Alternate Water Sources

This BMP is the practice of identifying opportunities to reuse or recycle water, or use alternate water sources for the original purpose. This could be identifying water uses that could be either substituted with reuse or alternate supplies, or where the water could be captured and reused for another water use.

Implementation mechanisms include the preparation of typical applications, and things to look for, as well as water use audits for installations. Then, an incentive to implement this could be developed, such as a reward and recognition program.

Water-Efficient Landscaping

Water-efficient landscaping is the use of landscaping practices that reduce irrigation water requirements. This includes the selection of plants and layout of the landscaping to reduce water requirements.

Implementation mechanisms include the requirement to perform an audit of existing landscapes to identify potential retrofit opportunities, and the development of landscape standards for new installations that minimize water use requirements.

Water-Efficient Irrigation

Water-efficient irrigation is the assessment and replacement of automatic irrigation components with more water-efficient technologies, such as controller systems that use real-time weather or soil moisture input or efficient applications such as rotary heads or drip irrigation.

Implementation mechanisms include the requirement to perform audits of currently irrigated areas to identify potential retrofits and calculate potential water savings, and the development of water-efficient irrigation standards for new installations.

Cooling Tower Management

Cooling tower management is the proactive maintenance and management of cooling towers to reduce leaks and water use. The water consumption of a cooling tower can be reduced by increasing the cycles of concentration, or amount of time the water is cycled through before being replaced with fresh water.

Implementation mechanisms include the requirement to perform regular maintenance and submit reports to prevent and repair leaks, as well as evaluate increasing the cycles of concentration. Another implementation mechanism could be to require a minimum cycles of concentration be set for all cooling towers.

Use a bucket and hose with spray nozzle when washing vehicles

This BMP is intended to promote the use of spray nozzles on hoses when washing vehicles, to prevent wasted water when not initially wetting or rinsing the vehicle during the wash process.

Implementation mechanisms include distribution of buckets and spray nozzles to all vehicle wash locations and educational materials describing the benefits of using spray nozzles, when washing vehicles.

Maintenance program to repair clogged line/valves/meters and check all valves, PRVs, and meters in the water system

This BMP is to perform maintenance on the water system to prevent leaks and interruptions in operation. The intent is to be proactive rather than reactive, and develop a maintenance program to systematically check the components of the water system.

Implementation mechanisms include a requirement to develop a maintenance plan, and submit regular reports on inspection and repairs.

Golf Courses

Use of qualified irrigation designers and contractors

Water efficient irrigation systems start with a proper design and installation. Use of qualified and experienced designers and contractors is the best way to ensure a water efficient irrigation system.

Implementation mechanisms involve developing a registry of qualified irrigation design and construction contractors with proven experience and certification by the Irrigation Association.

On-site weather station and climate based scheduling

Climate based scheduling is the use of real-time climate data to adjust irrigation schedules. Data from on-site weather stations that measure precipitation and evapotranspiration calculation variables (solar radiation, wind speed, air temperature, and relative humidity) are coupled with irrigation scheduling procedures to adjusting schedules in response to climatic demands. Use of an on-site weather station is especially important in Hawaii where precipitation gradients can be extreme over short distances.

Implementation mechanisms include the use of rebates or education/demonstration installations to encourage adoption and to educate potential users. Incentives, such as an awards and recognition program, could also be used to reward progressive golf courses for the adoption of advanced technology.

Daily inspection and repairs

Maintaining good operating conditions of an irrigation system through daily inspection and repairs is an important part of conserving water. This involves inspecting and repairing broken, malfunctioning, or leaking pipes, valves, fittings, and sprinklers. It also involves inspection and correction of over-irrigation in areas of poor drainage.

Implementation mechanisms include requirements for golf course managers to perform daily inspections and repairs to immediately correct any major leaks.

Regularly scheduled irrigation system audits

Irrigation systems often degrade in performance over time as equipment wears out, repairs are made with mismatched replacement components, and as landscape areas are changed. Regularly scheduled irrigation system audits are a good way to assess the performance of an irrigation system against industry benchmarks and design standards and to create a punch list of repairs or upgrades that may be needed to correct performance problems. Guidelines for performing irrigation audits on golf courses are available through the Irrigation Association. Certification for golf irrigation auditors is also available through the Irrigation Association.

Implementation mechanisms include requirements for golf course managers to perform regular system audits and develop a program for corrective actions. Also included could be the requirement to report on progress annually. Incentives could also be used to reward the reduction of leaks and other water losses, such as awards and recognition.

Aeration of high traffic areas for improved infiltration

In heavily trafficked areas of golf courses, surface soil compaction can reduce infiltration rates and can result in increased surface runoff and lower irrigation efficiency. Regular aeration programs can be used to improve alleviate surface compaction with the additional benefits of improving turf quality and playability.

Implementation mechanisms include requirements for golf course managers to develop a program for surface runoff control.

Centralized irrigation control system

Centralized irrigation system control provides greater flexibility in changing schedules to match demands and coordinating the rotation of irrigation run times around the system. With this control comes increased opportunity to conserve water.

Implementation mechanisms include the use of rebates or education/demonstration installations to encourage adoption and to educate potential users. Incentives, such as an awards and recognition program, could also be used to reward progressive golf course for the adoption of advanced technology.

Multiple flow meters in distribution system for leak detection

In addition to a main water source flow meter, installing flow meters on different zones or regions within an irrigation system can aid in the detection and repair of leaks. A methodology to estimate the scheduled and expected delivery volumes is also needed for comparison to metered flow records. These procedures can also be automated when coupled with a centralized irrigation control system.

Implementation mechanisms include the use of rebates to encourage more distributed metering and advanced leak detection.

Drip systems for trees/shrubs

In trees and shrub landscaping areas, sprinkler systems can be replaced with drip or micro irrigation systems to deliver the required amount of water directly to plant root systems without overwatering adjacent areas.

Implementation mechanisms include the use of rebates or education/demonstration installations to encourage adoption and to educate potential users.

Replacing non-play turf areas with xeriscaping

Water efficient landscape design and plant selection can significantly reduce irrigation water requirements in comparison to turf areas. Turf areas outside of normal play are good candidates for conversion to xeriscaping. Redesign and independent scheduling of irrigation systems serving these areas is also needed.

Implementation mechanisms include the use of rebates or education/demonstration installations to encourage adoption and to educate potential users.

Use of non-potable water sources

Use of non-potable water sources can help to reduce demand pressures on potable water supplies. However, efficient use of all water sources including non-potable water is still important for wise stewardship of Hawaii's water resources. In Hawaii, non-potable water sources might include reclaimed municipal or industrial wastewater or brackish groundwater. Specific requirements for use and public contact may depend upon the level of treatment provided. A salinity management plan is also advised for the use of brackish water sources.

Implementation mechanisms include master planning of treatment volumes and distribution locations for reclaimed municipal or industrial wastewater with targeted end users.

Agriculture

Climate and soil moisture based irrigation scheduling

Climate and soil moisture based scheduling is the use of real-time climate and soil moisture data to adjust irrigation schedules. Data from weather stations that measure precipitation and evapotranspiration calculation variables (solar radiation, wind speed, air temperature, and relative humidity) can be coupled with irrigation scheduling procedures to adjust schedules in response to climatic demands. Use of direct soil moisture monitoring, coupled with climate input for irrigation scheduling and forecasting is the most effective method for optimizing irrigation applications to satisfy crop water requirements without excess water delivery.

Implementation mechanisms include the use of incentive funding programs, outside technical assistance, and education/demonstration installations to encourage BMP adoption.

On-farm irrigation audits and water management plans

Irrigation systems often degrade in performance over time as equipment wears out, repairs are made with mismatched replacement components, and as crops or irrigation areas are changed. Irrigation operations that do not follow a plan for adjusting water applications to meet varying water demands also presents an opportunity for water conservation. Regularly scheduled irrigation system audits are a good way to assess the performance of an irrigation system against industry benchmarks and design standards and to create a punch list of repairs or upgrades that may be needed to correct performance problems. Development and adherence to an irrigation water management plan that considers climate, cropping, water supply and labor limitations is probably the single best way to improve irrigation water use efficiency at the farm scale.

Implementation mechanisms include the use of incentive funding programs, outside technical assistance, and education/demonstration installations to encourage BMP adoption.

Volumetric measurement of irrigation water use

Volumetric measurement of irrigation water use is the first step in providing data that can be used to assess water use efficiency. Volumetric measurement at main diversion and delivery points can provide the data needed to assess irrigation distribution efficiency and to identify potential irrigation water conservation projects. Volumetric measurement at all field diversions from the main delivery systems can be used further to assess water use efficiency at the field scale.

Implementation mechanisms include the use of incentive funding for installation of metering systems and increased regulation to require metering of all surface water diversions.

Lining and piping of irrigation canals

Leakage from unlined irrigation canals can be significantly reduced through projects to install liners that reduce canal seepage or projects that replace canals with enclosed conduits (piping). Piping of canals can have the added benefit of capturing energy that can be harnessed for hydro-electric projects or to reduce irrigation pumping energy requirements.

Implementation mechanisms include the requirement that all major irrigation systems to have current water conservation plans, the use of incentive funding programs, and education/demonstration installations to encourage BMP adoption.

Lining of earthen impoundment embankments

Lining of earthen impoundment embankments can be used to reduce the amount of seepage and water loss through those embankments. This measure can have the added benefit of increased safety and risk/liability reduction for water impoundments.

Implementation mechanisms include the requirement that all major irrigation systems to have current water conservation plans, the use of incentive funding programs, and education/demonstration installations to encourage BMP adoption.

Rehabilitation of aging and leaking pipes, flumes, gates, structures, impoundments

Many of the major irrigation systems in Hawaii were originally constructed more than 50 years ago. Repair and/or replacement of aging and leaking pipes, flumes, gates, structures, and impoundments can significantly reduce water losses. These measures can have the added benefit of increased safety and risk/liability reduction for irrigation distribution systems.

Implementation mechanisms include the requirement that all major irrigation systems to have current water conservation plans, the use of incentive funding programs, and education/demonstration installations to encourage BMP adoption.

Water control structure automation

Controlling and matching water deliveries to water demands through open channel conveyance systems is a difficult task. Reductions in water demands or increases in water levels at main diversions often results in operational spills from canal systems. Installing automated water control structures that respond to upstream or downstream water levels or respond to operational inputs from remote controls can significantly reduce operational spills.

Implementation mechanisms include the requirement that all major irrigation systems to have current water conservation plans, the use of incentive funding programs, and education/demonstration installations to encourage BMP adoption.

Centralized canal SCADA (supervisory control and data acquisition) systems

Many large irrigation systems in Hawaii span wide areas from main diversion points out to farm turnouts at the ends of the delivery system. Main water control points in the systems are also often in remote locations that can be time consuming to access. Use of centralized SCADA systems coordinated with remote communications (radio or satellite) can be a powerful tool in allowing an irrigation system manager to remotely monitor flows in various sections of the system and to adjust water control structures to match water deliveries to water demands. These systems provide the added benefit of increased safety and risk/liability reduction for irrigation distribution systems.

Implementation mechanisms include the requirement that all major irrigation systems to have current water conservation plans, the use of incentive funding programs, and education/demonstration installations to encourage BMP adoption.

Upgrade of on-farm systems to higher efficiency systems

Installation and operation of high efficiency on-farm systems (sprinkler, micro-spray, drip) can be effective in reducing irrigation water use in comparison to flood and older or low-technology sprinkler systems.

Implementation mechanisms include the use of incentive funding programs, outside technical assistance, and education/demonstration installations to encourage BMP adoption.

Crop residue management and conservation tillage for improved rainfall capture on irrigated lands

Surface soil compaction of grazing and crop lands can result in increase rainfall runoff and reduced effectiveness of rainfall in satisfying crop water demands. This results in the need for additional supplemental irrigation and/or reduced crop or rangeland production. Conservation tillage, crop residue management, and/or rotational grazing programs can be used to maintain proper surface infiltration and improve rainfall capture.

Implementation mechanisms include the use of incentive funding programs, outside technical assistance, and education/demonstration installations to encourage BMP adoption.

		SCORE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A.	**Strategy: Develop an implementation framework that relies upon a collaborative approach with stakeholders**	**43**	3	2	1	1	2	1	1	2	2	1	3	1	2	1	4	1	2	3	1	2	4	1	1	1
Goals	Develop model ordinances (e.g. landscape code), developed collaboratively with industry groups, with support from and enactment at local/county level	**57**	3	2	4	1	1	5	3	5	5	3	1	1	1	3	3	1	1	2	3	2	1	1	3	2
	Develop technology transfer programs (e.g. "green hotel", seminars, demonstration projects, etc.)	**87**	5	4	3	4	2	4	4	3	2	4	2	5	2	4	4	3	5	4	4	4	2	4	4	5
	Establish partnerships with entities implementing water conservation programs aimed at demonstrating costs, savings and effectiveness (e.g. Honolulu BWS, military, golf courses, hotels, etc.)	**64**	2	3	2	3	4	3	5	2	1	1	4	3	3	1	2	2	3	3	2	3	5	2	2	3
	Foster voluntary reporting of water conservation measure implementation and data/monitoring and reporting for water users that are not directly permitted by the Commission on Water Resource Management	**92**	4	5	5	2	5	2	2	4	4	5	5	4	5	5	1	4	4	1	5	5	3	3	5	4
	Building on the Water Conservation Advisory Group, establish a statewide water conservation advisory council, to continue collaboration and guide statewide implementation of water conservation programs	**60**	1	1	1	5	3	1	1	1	3	2	3	2	4	2	5	5	2	5	1	1	4	5	1	1
B.	**Strategy: Leverage culture of efficiency to establish water resource awareness and garner water savings results**	**77**	4	3	2	2	4	4	4	3	4	4	4	3	3	3	2	4	4	4	4	1	1	2	4	4
Goals	Tie communications efforts (stand alone or in support of specific water conservation effort) and the need for water conservation to culture, values and financial savings	**47**	3	3	2	3	4	1	1	1	4	1	1	1	1	2	2	1	3	2	2	3	2	1	2	1
	Establish a water resource management public awareness campaign that incorporates climate change, energy/water nexus, food scarcity, viable agriculture, watershed management and source protection and augmentation	**53**	1	1	1	1	2	2	4	2	2	2	2	3	4	1	4	3	4	1	1	2	3	3	1	3
	Create water conservationrecognition program to celebrate success and reward those (entities, organizations, individuals) that improved their water use efficiency	**70**	4	4	3	4	3	4	2	3	3	3	4	2	2	3	1	4	2	3	3	1	1	4	3	4
	Develop (or make available) a water resource and conservation education curricula (e.g. "Project WET") aimed at school children, with implementation at the local/county level	**70**	2	2	4	2	1	3	3	4	1	4	3	4	3	4	3	2	1	4	4	4	4	2	4	2
C.	**Strategy: Evaluate effectiveness and identify potential enhancements to the existing statewide water resource availability, permitting, monitoring and allocation program(s)**	**68**	1	4	4	4	3	3	3	4	3	3	1	2	4	4	1	3	1	2	3	3	3	4	2	3
Goals	Continue development of water use data collection, analysis and reporting system to enable accurate assessment of water use	**67**	3	4	5	4	4	1	2	1	2	1	5	1	4	5	2	1	1	5	1	5	1	3	5	1
	Explore policy changes to make improvements in water use efficiency and related reporting (e.g., State Water Code, building codes, county ordinances, etc).	**69**	4	2	2	2	5	4	3	4	4	3	1	3	3	3	4	2	2	3	2	2	4	1	1	5
	Explore policy changes to proactively plan for the expanded use of reclaimed water for agriculture, landscaping, irrigation, recharge and industrial uses	**79**	2	3	3	3	2	3	5	5	5	4	2	4	1	4	5	4	4	4	5	1	2	2	2	4
	Enhance the existing integrated statewide water management plan, by including a water conservation target, that can be established in the context of known, available or anticipated future water resources.	**60**	1	1	1	1	1	2	1	3	3	2	3	2	5	1	1	3	5	2	4	4	5	4	3	2
	Require development and submittal of water conservation plan and annual reporting on implementation of water conservation plan measures as a condition of receiving a water use permit	**85**	5	5	4	5	3	5	4	2	1	5	4	5	2	2	3	5	3	1	3	3	3	5	4	3
D.	**Strategy: Leverage strong organizational and Commission support for water conservation to establish funding source(s)**	**52**	2	1	3	3	1	2	2	1	1	2	2	4	1	2	3	2	3	1	2	4	2	3	3	2
Goals	Re-evaluate existing CWRM strategy to prioritize water conservation elements and recommendations from the Statewide Water Conservation Plan	**91**	3	6	5	6	3	4	1	6	2	1	3	6	6	6	4	2	6	1	1	6	1	5	1	6
	Include conservation program implementation as a priority in the annual budgeting process, that identifies the measures with the greatest potential savings at the least cost.	**52**	1	2	6	1	1	6	2	1	1	5	1	5	1	1	1	1	3	2	2	1	2	1	2	3
	Secure needed funding (or re-allocate existing budgets) to establish financial or other incentive program to encourage implementation of BMP's)	**80**	5	3	3	2	4	5	3	2	3	2	2	2	4	3	2	3	5	4	4	2	6	6	4	1
	Collaborate with other state agencies to allocate funding for water use efficiency improvements and ensure data collection and monitoring for each investment	**86**	2	1	4	3	5	2	4	3	4	3	6	3	2	5	3	4	4	6	6	5	4	2	3	2
	Identify and secure additional, external funding sources for the implementation of water conservation programs (e.g., public-private partnerships, existing federal programs, etc.)	**91**	4	4	2	5	2	3	5	4	5	6	4	1	3	4	6	6	1	3	3	4	3	3	6	4
	Seek partnerships with entities with common or shared objectives to leverage funding for research and achieve greater implementation of water conservation measure (e.g., related state agencies)	**104**	6	5	1	4	6	1	6	5	6	4	5	4	5	2	5	5	2	5	5	3	5	4	5	5

** Lower scores are better**

Development of Statewide Water Conservation Plan

Water Conservation Advisory Group Meeting #4

March 22, 2012

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US Army Corps of Engineers

Agenda

- 8:30-8:45 Welcome and Meeting Objectives
- 8:45 -9:15 SWOT Analysis and Strategy Overview
- 9:15 – 9:30 SMART Objectives
  - SMART Objectives Defined
  - Strategy, Goals and BMP (objective) Example
- 9:00-10:30 Goals Discussion and Prioritization
- 10:30-10:45 Break
- 10:45-12:15 BMP Discussion
  - Review and Finalize Definitions
  - Identify Recommended Implementation Approach
  - Define Scale
- 12:15-12:30 Wrap up and Next Steps

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Meeting Objectives

Objectives

- Prioritize Goals
- Define BMP Implementation Approach

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SWOT Analysis and Strategy Overview

SWOT Analysis

- SWOT = Strengths, Weaknesses, Opportunities and Threats
- Purpose: Assess where an organization is (currently) relative to where it wants to go
- Internal (Strengths and Weaknesses)
- External (Opportunities and Threats)
- Shift strategy toward the strengths and opportunities and away from weaknesses or threats

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Example – Miracles Restaurant

Strengths	Weaknesses	Opportunities	Threats
Great food Cachet Good Ambience Loyal Employees	No valet parking Leased space Small kitchen	High-end catering Packaged products Special Events	Inexpensive competition Run out of money

- Each team member developed a list of each
- Compiled into master list
- Grouped by "like idea" to create the SWOT matrix

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Scoring the SWOT

- Each participant allocated limited points (15)
- Points distributed vertically based on the IMPACT or LEVERAGE that each STRENGTH or WEAKNESS has relative to each OPPORTUNITY or THREAT.
- The higher the impact, the higher the number given to that item.
- Each strength and weakness assessed one at a time

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Example SWOT Matrix

		Opportunities			Threats		Total
		High-end catering	Packaged Products	Special Events	Inexpensive Competition	Run out of Money	
Strengths	Great Food	4	4	2	2		12
	Cachet	2	2	2	3	4	13
	Good Ambience			2			2
	Loyal Employees					1	1
Weaknesses	No Valet Parking			2		1	3
	Leased Space					3	3
	Small Kitchen	3	3	1	4		11
	Total	9	9	9	9	9	45

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SWOT Matrix

Interest in sustainability

Misperceptions about conservation

Rising costs

Collaborative approach with stakeholders

Culture of efficiency

Lack of data collection/reporting

Limited existing budget

Lack of support for fees

Perceived inequity in water use

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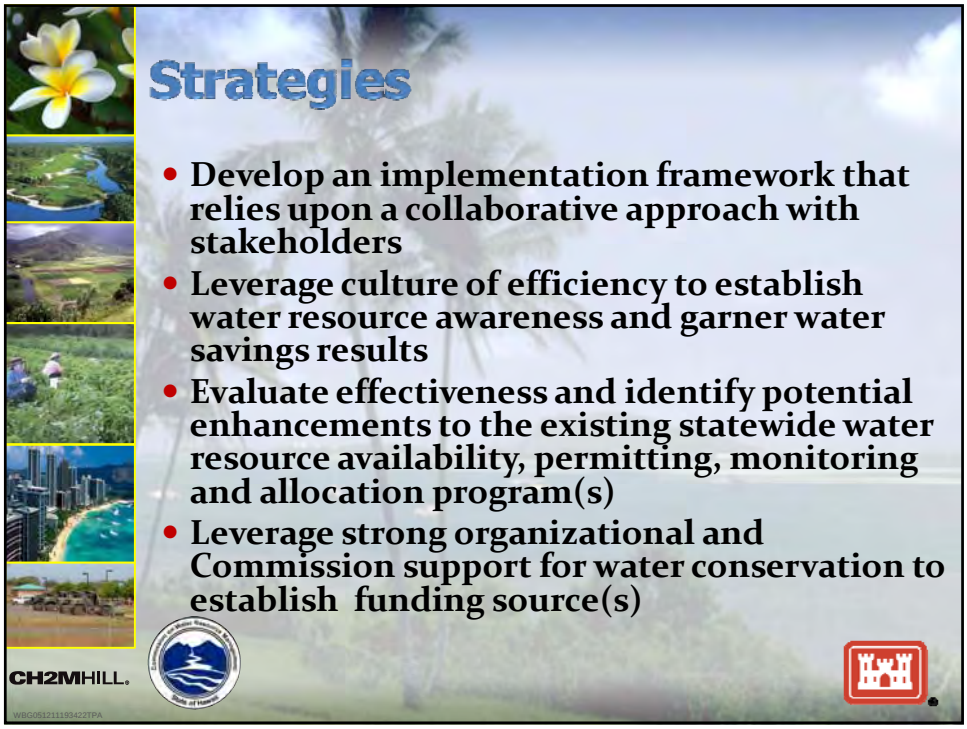
Strategies
• Develop an implementation framework that relies upon a collaborative approach with stakeholders
• Leverage culture of efficiency to establish water resource awareness and garner water savings results
• Evaluate effectiveness and identify potential enhancements to the existing statewide water resource availability, permitting, monitoring and allocation program(s)
• Leverage strong organizational and Commission support for water conservation to establish funding source(s)
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Example Strategy and Goal
• Strategy: Develop an implementation framework that relies upon a collaborative approach with stakeholders
– Goal: Develop model ordinances (e.g. landscape code), developed collaboratively with industry groups, with support from and enactment at local/county level
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Example Strategy, Goal and Objective

- Strategy: Develop an implementation framework that relies upon a collaborative approach with stakeholders
  - Goal: Develop model ordinances (e.g. landscape code), developed collaboratively with industry groups, with support from and enactment at local/county level
    - Objective: Work with LICH and municipal water suppliers to develop a model landscape code (including rain shutoffs and irrigation schedules) that is adopted by all Counties in Hawaii by July 2013.

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SMART Objectives

- Used to define measurable targets
- They define what is to be accomplished or achieved
- Must be "the reason the action is taken"

- S – Specific
- M – Measurable
- A – Achievable
- R – Realistic
- T – Time-based

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Goals Discussion and Prioritization

Goals Discussion

- Fatal flaw review
- Rank the Strategies
- Rank the goals within each Strategy

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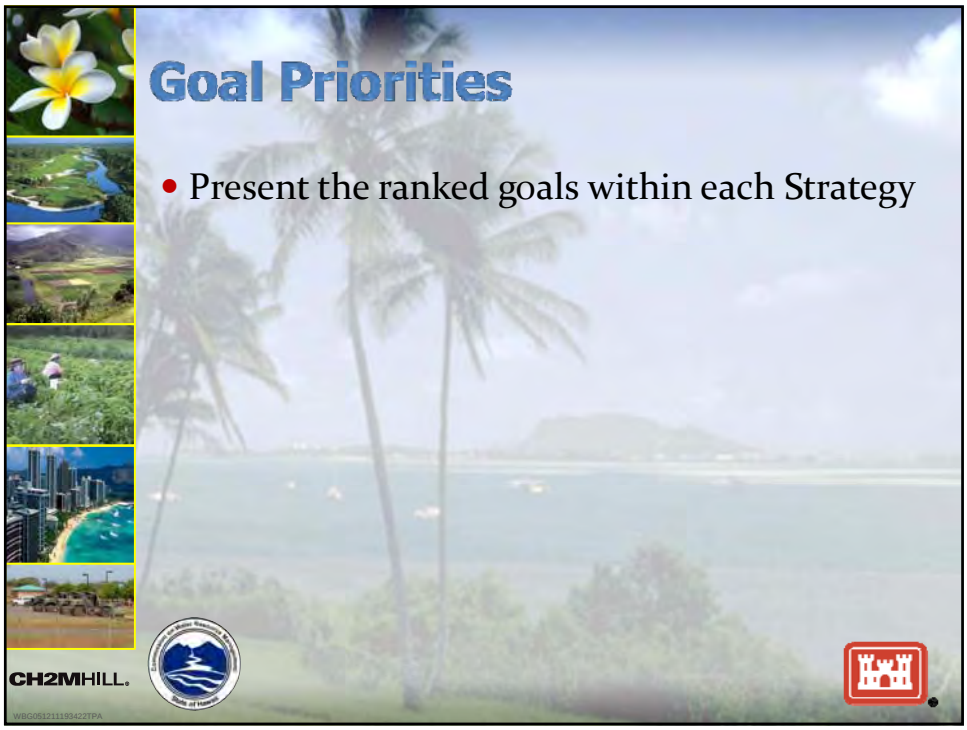
Break


Goal Priorities
• Present the ranked goals within each Strategy
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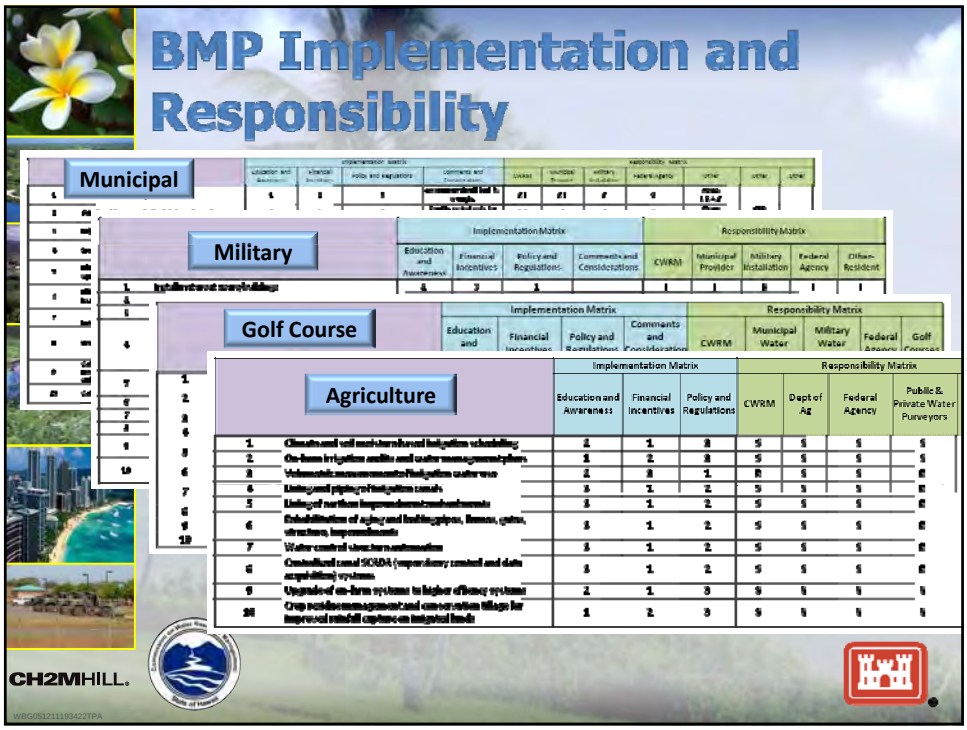
BMP Discussion


BMP Implementation and Responsibility
Municipal
Military
Golf Course
Agriculture
Implementation Matrix
Responsibility Matrix
Education and Awareness
Financial Incentives
Policy and Regulations
CWRM
Dept of Ag
Federal Agency
Public & Private Water Purveyors
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Top BMPs - Municipal
Water Loss Control
Require annual audit
Rain Barrel Programs
Education/promotion
Irrigation Upgrade Programs
Education/demonstration
Gray Water Reuse
Policy/education
Education and Outreach
Coordination
Efficient Commercial Equipment
Rebates/education/non-financial incentives
Irrigation Technology
Policy/education/demonstration
Green Business Program
Education
Water Use Surveys
Incentive/policy
WaterSense Certified/Labeled Equipment
Policy
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Top BMPs - Military
Install meters at users/buildings
Policy
Information and Education Programs
Coordination
Distribution System Audits, Leak Detection, and Repair
Policy
Water efficient fixtures
Policy
Look for opportunities to reuse or recycle water; Alternate Water Sources
Education
Water-Efficient Landscaping
Education
Water-Efficient Irrigation
Policy
Cooling Tower Management
Education/demonstration
Use a bucket and hose with spray nozzle when washing vehicles
Education
Maintenance program to repair clogged line/valves/meters and check all valves, PRVs, and meters in the water system
Policy
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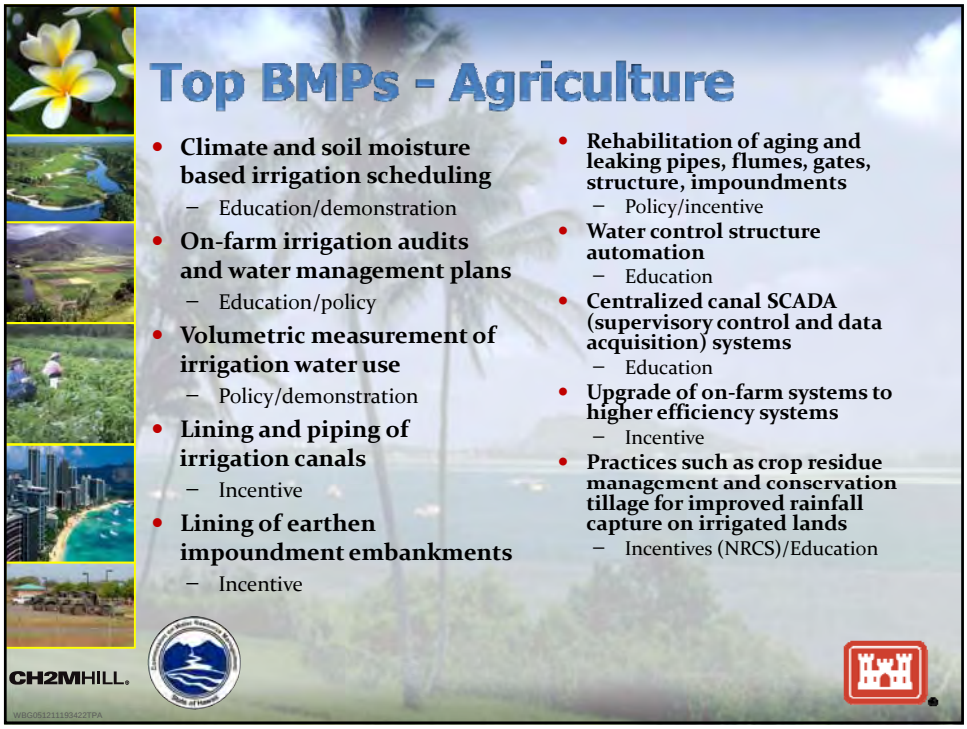
Top BMPs - Agriculture
Climate and soil moisture based irrigation scheduling
Education/demonstration
On-farm irrigation audits and water management plans
Education/policy
Volumetric measurement of irrigation water use
Policy/demonstration
Lining and piping of irrigation canals
Incentive
Lining of earthen impoundment embankments
Incentive
Rehabilitation of aging and leaking pipes, flumes, gates, structure, impoundments
Policy/incentive
Water control structure automation
Education
Centralized canal SCADA (supervisory control and data acquisition) systems
Education
Upgrade of on-farm systems to higher efficiency systems
Incentive
Practices such as crop residue management and conservation tillage for improved rainfall capture on irrigated lands
Incentives (NRCS)/Education
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Top BMPs – Golf Courses
Use of qualified irrigation designers and contractors
Policy
On-site weather station and climate based scheduling
Demonstration
Daily inspection and repairs
Promotion
Regularly scheduled irrigation system audits
Promotion
Aeration of high traffic areas for improved infiltration
Promotion
Centralized irrigation control system
Promotion/demonstration
Multiple flow meters in distribution system for leak detection
Promotion
Drip systems for trees/shrubs
Promotion
Replacing non-play turf areas with xeriscaping
Promotion
Use of non-potable water sources
Policy
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Next Steps and Schedule

Next Steps

- Apply appropriate scale to BMPs
- Develop objectives under high priority goals using BMPs and recommended implementation approach
- Prepare draft plan document

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Project Schedule

Task	2011									2012										
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Establish Water Conservation Advisory Group																				
Establish statewide water conservation goals/objectives; develop water use profile																				
Identify water conservation measures in each sector																				
Identify, evaluate, compare water conservation programs/measures																				
Identify and develop implementation mechanisms																				
Develop Statewide Water Conservation Plan																				
Submit Draft Statewide Water Conservation Plan																				
Review Draft Statewide Water Conservation Plan																				
2nd Draft Statewide Water Conservation Plan																				
Submit Final Statewide Water Conservation Plan																				
Final presentation to CWRM																				

June 2012
Receive Draft Plan for Review

March 2012
Discuss proposed implementation strategy and goals

June 2012
Review Draft Plan

September 2012
Present Final Plan

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State Water Conservation Advisory Group (WCAG) Meeting #5

Date: **23 August 2012**

Time: **8:30 am-12:30 pm HST**

Location: **DLNR Boardroom**

Attendees: Neal Fujii, CWRM
Jeremy Kimura, CWRM
Lenore Ohye, CWRM
Debbie Solis, Army Corps of Engineers
Ross Kaneko, CH2M HILL
Alyssa Smith, CH2M HILL
See attached list of WCAG attendees

Due to competition for fresh water, increasing population and development pressures, the sustainable movement, and the impacts of global climate change requiring Hawaii to become as efficient as possible in its uses of fresh water, the Army Corps of Engineers in partnership with the State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) have determined that a water conservation plan for the State of Hawaii should be established. As part of this effort, a Water Conservation Advisory Group (WCAG) – made up of experts from each water use sector – was formed to assist in policy and program development. It is anticipated that the WCAG will meet a total of six (6) times throughout the duration of the project. The fifth meeting was convened on August 23, 2012 and the following summarizes and documents the activities of the meeting.

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List of Acronyms

Acronym	Organization
BWS	City and County of Honolulu Board of Water Supply
CWRM	Hawaii Department of Land and Natural Resources Commission on Water Resource Management
DHHL	Department of Hawaiian Home Lands
HC&S	Hawaiian Commercial & Sugar Company
HCF	Hawaii Community Foundation
HDOA	Hawaii Department of Agriculture
HDWS	County of Hawaii Department of Water Supply
HDOT	Hawaii Department of Transportation
HFB	Hawaii Farm Bureau
HGCSA	Hawaii Golf Course Superintendents Association
HHLA	Hawaii Hotel & Lodging Assoc
KDOW	Kauai County Department of Water
LICH	Landscape Industry Council of Hawaii
MCBH	Marine Corps Base Hawaii, Kaneohe
MDWS	Maui County Department of Water Supply
MTA	Mililani Town Association
NAVFAC	Naval Facilities Engineering Command, Hawaii
UHM	University of Hawaii-Manoa
UHM CTAHR	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources
USACE	United States Army Corp of Engineers
USAG HI	United States Army Garrison Hawaii
USDA NRCS	United States Department of Agriculture- Natural Resources Conservation Service
WCAG	Water Conservation Advisory Group

Meeting Summary

1. Welcome and Re-introductions (Neal Fujii) - Neal initiated re-introductions of the project team and WCAG members.

- Introductions

  Neal Fujii (CWRM)

  Chris Dacus (HDOT/LICH)

  Warren Watanabe (Hawaii Farm Bureau)

  Mae Nakahata (HC&S)

  Yvonne Izu (Hawaii Farm Bureau)

  Lauren Roth Venu (Roth Ecological Design)

  Cat Sawai (BWS)

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Sharon Williams (UHM)

Debbie Solis (USACE)

Garret Matsunami (Castle & Cooke)

Joy Buccat (KDOW)

Kanani Aton (Hawaii DWS)

Ryan Quitoriano (Hawaii DWS)

Greg Hayashi (NAVFAC)

Russell Okita (NAVFAC)

Sherman White (NRCS)

Michael Hayama (NRCS)

Kristi Ellazar (MTA)

Kaleo Manuel (DHHL)

Jocelyn Doane (OHA)

Lenore Ohye (CWRM)

Brian Kau (HDOA)

Rod Suzumoto (HHLA)

Josh Stanbro (HCF)

Howard Wiig (State Energy Office)

Bill Denham (DOE)

Barry Usagawa (BWS)

Pam Pogue (MDWS)

2. Agenda Review and Meeting Objectives (Neal Fujii)

   Objectives of the meeting: 1) Review the draft Water Conservation Plan highlights; 2) Discuss and comment on Section 6; 3) Identify fatal flaws in the plan.

3. Hawaii Water Conservation Plan Review – Sections 1-5 (Neal Fujii)

   A brief overview of the contents in Sections 1-5. Details are provided in the attached pdf copy of the PowerPoint presentation used at the meeting.

   - *Lauren – In reference to Section 6, seems like some of the programs mentioned in the plan are already happening, but don't strive to go above and beyond to save water; and counties prioritize programs, so there's not a lot of flexibility to support more programs.*

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    - *Neal – Section 6 reflects what CWRM would like to do, but recognizes the disconnect. CWRM wants to support programs going on in other organizations (counties, military).*

- *Cat – the role of CWRM needs to be clarified (not necessarily a "hammer") with respect to the different sectors; what do the sectors think are applicable programs to them and how can CWRM assist that (i.e. provide training); clarify the use of the report, as well.*

- *Mae – what's the context in which Section 6 should be viewed? Ag is currently in extreme drought status and the industry doesn't have enough water; waste is defined in a different way; look closer at source development and maybe take advantage of storm water; how is this section relative to the bigger hydrologic cycle?*

    - *Neal – water conservation is being defined as a reduction of use for an application (i.e. 5 gallon toilet use a 1.5 gallon); be more efficient by reducing unnecessary use.*

        - *Mae – conservation is not necessarily reducing usage but conserving rainfall; she wants to make sure everyone understands what's meant by conservation.*

    - *Wendy – this report is specifically focused on water use efficiency and water conservation to reduce what is used to accomplish the task of what the water is being used for; for example, a rain barrel is not only to catch water, it off-sets other sources of water that could've been used; the effort is off-setting use, not capturing the resource. The plan is focused on this small piece of the water resource picture: water use efficiency at the end use.*

    - *Neal – there are opportunities to explore alternate uses in documents like the Hawaii Water Plan.*

    - *Yvonne – there needs to be a clear statement in the document that this is what the plan is for; how does CWRM plan to utilize this document; this document only addresses water efficiency, but there are other things that need to be addressed that aren't covered; then readers will understand this doesn't cover the whole picture.*

    - *Lauren – add a section that separates the big picture into categories: reduce (end users), replace (catchment), reuse (wastewater), recharge (aquifers with BMPs); this will give it a holistic approach; if the report is going to target one component, CWRM should recognize the bigger picture.*

        - *Neal – some BMPs do address stormwater capture; LICH came out with BMPs for landscape irrigation; some of these concerns are already covered in some of the BMPs, but the focus is on the location/use of water.*

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- *Barry – this needs to be linked to supply-side, not just demand-side; who will provide guidance to the counties/state to integrate this plan with the WUDPs and WRPP? How will CWRM ensure the updates capture the BMPs listed in this plan? How will this integrate with the rest of the state- and county-wide plans?*

- *Neal – Regarding CWRM's role in the plan, the biggest concept is the collaboration with all sectors/organizations; principals of implementation- be collaborative and work with existing programs; CWRM does not want to be regulatory; philosophy is technical assistance and education before regulatory action which is a reflection of comments from WCAG.*

4. Section 6 Discussion (Neal Fujii)

See the attached PowerPoint presentation for details.

- *Neal - This will be a living document, so it'll change as necessary.*
- *Howard – when looking at the costs, you also need to look at the benefits*
  - *Debbie – a cost-benefit analysis has not been done in this report. For anyone of the BMPs, you might need to do an analysis before implementing something.*
  - *Neal – the cost savings are somewhat reflected in the report; an official cost-benefit analysis wasn't done due to the lack of water use data.*
- *Cat – there's going to be a workshop at the HWWA conference in October to teach people about water audits; BWS recognizes they have gaps and need help; an expert from the mainland is flying in to teach counties about water auditing so they can see if it works for them.*
- *Barry – costs shown are the costs to CWRM to get program started?*
- *Mae – if CWRM doesn't want to enforce regulations, why does the term keep showing up?*
  - *Neal- we don't want to start off as enforcing regulations, but there are regulatory realities that are CWRM's responsibility. Some of these regulations are necessary.*
  - *Cat- CWRM isn't introducing new regulations.*

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- *Mae- ag is faced with rules/regulations that enable a number of citizen suits each year; if things are handled at the higher level and one part is moving quicker than others, you are opening the industry up to unintended consequences through regulation; the ultimate goal of the program may get lost; people use the plan for unintended needs (ex: EPA lost in law suit at Supreme Court level regarding spraying pesticide with a permit; it became a citizen suits since the state couldn't keep up with regulation); farmers are wasting their time fighting law suits instead of farming.*
- *Lenore – the goal is to get CWRM educated before regulating; demonstration projects will allow CWRM to be more understanding about the hardships before making it a regulation so they can tailor the regulation to fit the bigger picture.*
- *Barry – a certain amount of regulation does work; the BWS water use dropped 9% as a result of the regulation on HET; although, the regulation still needs to be reviewed thoroughly because there can be downsides.*

o *Lauren – maybe there should be a creation of an overarching goal for CWRM to meet some target of water conservation by some year (ex: 50% savings by 2030) to provide a framework to prioritize the low hanging fruits.*

- *Neal – when the project started, CWRM wanted to have a target, but the biggest challenge to do that was the lack of good data; there would be no way to measure the savings.*
- *Lauren – if you start with some end use fixture, then it can be quantifiable.*
- *Debbie- the challenge is that there are so many water use sectors; the bigger picture is that each sector has water use measures they can implement; CWRM's goal is to work with all sectors at the same time to implement these plan goals and to collect data to then establish a goal/target.*

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- *Sharon- we don't need to limit ourselves to one tool; use different ways to accomplish this.*
- *Yvonne – it's difficult to set a goal since there are a number of organizations/users that are involved (enables arguments about responsibility); CWRM could have some sort of goal at their level.*

- *Bill – The "carrot vs. stick" approach doesn't really work for the government because government employees don't get an incentive to save and it's easier to do the status quo; we should be thinking about the cost to society; regulation ("stick") is the way for government (with enforcement); this plan won't get attention until the existing law that has provisions for energy savings is adjusted to include water savings for State agencies.*
  - *Mae - the smaller ag producers will quit if pushed too hard; there's a balance that needs to be recognized; these producers face different issues compared to other sectors.*
    - *Neal – CWRM does recognize the cost of ag in Hawaii is higher than other places and will be considered when thinking about regulations.*
- *Barry – what is the plan goal? In terms of numbers, if you set a 10% savings, then people will keep challenging you (depends on how you display the data); the plan includes both water use efficiency and resource augmentation (i.e. stormwater reuse and gray water reuse); is the goal of the plan water use efficiency or to reduce potable per capita demand? This wouldn't work for ag, but will work for others to reduce demand of high quality water by supplementing with lower quality water or through use efficiency. If it's just use efficiency, then why are other pieces included in the plan? It should be included in the plan to attack the problem from both sides.*
  - *Neal – the plan doesn't necessarily have a goal statement; CWRM's goal is to protect the resource (use less water, augmenting); a goal might be efficiency of application and reduction in potable water via some other water source; this needs to be stated at the beginning of the plan.*

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    - *Kaleo – the goal of the plan needs have a focus and needs to connect with other plans; if not, as a user, when a department looks at this, it doesn't have application to other plans, so it probably won't be used.*

- *Lenore – there's no clear statement in the plan to define water conservation; looking at the BMPs and implementation plan, it's clear that it's a matter of supply-side efficiency and conservation of natural water supplies; we need to look at resource augmentation and water replacement (efficiency and conservation of natural supplies). Regarding the question of how this plan integrates with other plans: CWRM wants to do demonstration projects and technical assistance; this will lay the groundwork to catch sectors who haven't started programs; the BMPs provide a menu for other sectors who have started their programs; CWRM plans to put this in the WRPP, so it's not going to be a separate plan that sits by itself; this plan is CWRMs work effort to catch people up to a common place so everyone can be moved up at the same time. Incorporating this into the Hawaii Water Plan will give guidance to everybody.*

- *Kaleo –Explain the methodology in Section 6.2 behind grouping the BMPs into each program; the connection is unclear based on the outcomes; how are the BMPs in Table 6-1 picked for the programs? How are they ranked? Why isn't there a consistent number of programs for each sector (i.e. agriculture has 6 but golf courses have 2)? Include a statement like "primary focus is on municipal users because they're the highest user and want to cut back on loads."*

    - *Neal- many of the golf courses (especially private) are already sophisticated and efficient in terms of water conservation; municipal golf courses need help; the listed BMPs are opportunities for the municipal golf courses. An explanation will be provided.*

    - *Brian Skeens –there is a part in Section 5 on water use analysis where we identify the prioritization of selection and identify categories on usage/users where the most opportunities for savings were determined; we used the pie charts to create recommendations on the priorities shown in Section 6.*

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- *Yvonne – there are no private potable water suppliers present in the group; the amount of water usage is smaller than county but they do have different issues- primarily they are regulated by the Public Utility Commission (PUC); some of the programs in the plan will need to be approved by the PUC before it can be implemented; CWRM should at least inform them of these changes, as well as make a note in the introduction that they weren't involved.*
    - *Neal- CWRM recognizes there are areas where they can become more efficient.*
    - *Yvonne- PUC makes sure they are viable; PUC has gone through this with energy and have determined ways to make sure they won't lose money.*
    - *Debbie – this could be a great target area for education efforts in the future; use this as a starting point.*
    - *Jeremy- These private groups should be invited to the water conference to get training and to participate.*
- *Chris – what's being done to address the lack of data? The goals can be qualitative, but in the end you need to have a baseline. Goals don't need to be to reduce the water usage, but can be a combination of reducing water per acre; is there a BMP?*
    - *Neal- In Section 6, page 6-9 paragraph 2; in the implementation section there's something that talks about enforcing existing regulation for the collection of water use data.*
    - *Lenore- CWRM will need to perform demonstration projects for ag meter installations; for example, since we didn't have enough water use data on ag, one of the first things is to do a demonstration project to see how to meter the ag systems and determine what the difficulties are (such as difficulty in measuring the diversions); then we can encourage other ag users to provide the same data to create a baseline.*
    - *Neal- for the wells, CWRMs goal is to have an online reporting system.*

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- *Mae- Regarding Section 6.1.3.1, Lenore said it better than what's written.*
    - *Lenore- the actual regulatory requirement is a BMP, but not the implementation plan; CWRM wants to start with outreach and technical assistance to understand more before regulating it.*
    - *Yvonne- the wording probably scares people; reword this section to talk more about identifying the challenges of volumetric measuring, and then talk about implementation; the "bold" font scares people.*
    - *Cat- it's hard to get decent data without water auditing; the HWWA workshop should help with this.*
    - *Neal – Section 6.2.4 talks about demonstration project.*
- *Chris- it would be great to see government lead by example and be the first adopter of the BMPs; the private side/public sector might be more enthusiastic about adopting if the government did this first. The BMPs should be packaged in a way that government can adopt first and then allow for other sectors to follow after.*
    - *Sharon- agrees and thinks UH should be a leader.*
    - *Neal- new buildings need to be LEED silver; water conservation has a limited contribution to LEED.*
    - *Lauren- the State Building Code Council has been meeting and discussing plumbing codes; within the next year or so, they're looking at adopting the 2012 UPC (a dramatic jump in codes); there are concerns about how to get there and what training is appropriate; this is something that's starting but that group may be disintegrating and may turn to CWRM for support; this would be a great opportunity to take the initiative to being more progressive.*
    - *Neal- what's the instrument to implement having the government lead by example?*

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- *Cat- this is a good time to review the responsibility matrices that were done in WCAG meeting #3 to see what the group thought State and County would be responsible for.*
- *Chris- since everything is metered for government buildings, we should set a goal of a percent reduction and let the solutions fall from that.*
    - *Neal- like an executive order? (Yes)*
- *Bill- performance contracting is also an option where you meter and document the savings; water performance contracting is currently being done in mainland schools; they're able to document the savings without impacting operations; rolling-out a project for government agency or private sector performance contracting can encompass integration of the water into the energy savings performance contracting: low hanging fruit with the high hanging fruit to increase savings and net benefit for society.*
- *Lenore- we can encourage the State to have something similar to the energy initiative for water in State buildings and to use performance contracting to reduce water use.*
- *Debbie- there is no implementation plan for each sector in this document; there's a big step with a lot of details that needs to be done; maybe CWRM should include a paragraph that recommends for a State group to get together to set-up an implementation plan for this; CWRM will need to figure out how to start getting things done including how to do it, who will do it, who will fund it, etc.*
    - *Bill- Performance contracting allows for visible savings; it can be done in terms of policy with lobbying; there is currently no directive for water performance contracting.*
- *Pam- Maui is wrapping up the Maui Island Plan and hopes to adopt by the end of the year; Maui County also recently kicked off their WUDP; the agencies and organizations involved in that process have been asking about a water conservation code; the water resource committee recently*

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passed an updated plumbing code (to update all fixtures in county buildings); they're actively looking for other ways to conserve water.

- *Neal- how should this be incorporated into the plan?*
    - *Chris- first determine the total government water usage.*
    - *Jeremy- The engineering division in DLNR is responsible for preparing State Water Projects Plan to account for all current State facility water use; they are currently updating the DHHL demands and projections; this is a vehicle to get state water use numbers.*
    - *Chris- DOT has its own compliance agency; a lot of agencies are probably complying with some sort of law; if this was more of a compliance issue, we would be on board really quick and be able to tell the story better so the public/private would be more enthusiastic to do their part.*
    - *Debbie- an implementation plan will help prioritize the process in which it happens; we need a focused effort and funding; add a suggestion in the plan that CWRM is going to lead the effort to get it started; it will take time to get it set-up.*
    - *Neal- CWRM will take a stab at incorporating it.*
    - *Cat- this WCAG is a first step; each county can personalize their own water conservation plan and then educate other sectors after.*
    - *Debbie- if each state agency sets up their own plan, then they'll be competing for the funding; there needs to be a coordinated effort so all agencies win; look at new and collaborative ways to use resources wisely.*

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- *Lauren- CWRM should require all state buildings to do a water audit; then the low hanging fruits for each building can be identified; BMPs can be selected per building to be most effective.*

- *Neal- to get this in the plan, where should this be added?*

  - *Lenore- In Section 6.1.6: add a statement to the effect of "government should lead by example and CWRM should instill ways to encourage that whether it be through outreach, technical assistance, or public/private partnership"; then the group can determine the best ways to implement.*

5. Wrap-up and Next Steps (Neal Fujii)

Next Steps:

- *WCAG to submit comments by September 14*
- *WCAG Meeting #6 tentatively set for the middle of October*

8. Action Items

- *WCAG to send comments on the draft Water Conservation Plan to Alyssa Smith (alyssa.smith@ch2m.com) by COB September 14.*

If there are any necessary corrections or additions, please contact me via email at Ross.Kaneko@ch2m.com or you can reach me on my office line at 808-440-0225, or my cell phone at 808-554-3791.

Respectfully submitted,

Ross A. Kaneko

Attachments:
- Attendance list
- Project team contact list
- Flip Chart Notes
- WCAG Meeting #5 Presentation

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Water Conservation Advisory Group Meeting #4 (03/22/2012)
List of Attendees

Last Name	First Name	Organization	Email Address
Aton	Kanani	County of Hawaii Department of Water Supply (HDWS)	Katon@hawaiidws.org
Buccat	Joy	Kauai County Department of Water (KDOW)	jbuccat@kauaiwater.org
Dacus	Chris	Hawaii Department of Transportation (HDOT)/ Landscape Industry Council of Hawaii (LICH)	christopher.a.dacus@hawaii.gov
Denham	Bill	Department of Education (DOE)	bill_denham@notes.k12.hi.us
Doane	Jocelyn	Office of Hawaiian Affairs (OHA)	jocelynd@oha.org
Ellazar	Kristi	Mililani Town Association (MTA)	kellazar@mililanitown.org
Hayama	Michael	US Department of Agriculture- Natural Resources Conservation Service (USDA NRCS)	michael.hayama@hi.usda.gov
Hayashi	Greg	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	greg.hayashi@navy.mil
Izu	Yvonne	MLF - Farm Bureau	YIzu@moriharagroup.com
Kau	Brian	Hawaii Department of Agriculture (HDOA)	brian.k.kau@hawaii.gov
Manuel	Kaleo	Hawaiian Homelands (DHHL)	kaleo.l.manuel@hawaii.gov
Matsunami	Garret	Castle & Cooke	gmatsunami@castlecooke.com
Nakahata	Mae	HC&S Co.	mnakahata@hcsugar.com
Okita	Russell	Naval Facilities Engineering Command, Hawaii (NAVFAC Hawaii)	russell.okita@navy.mil
Pogue	Pam	Maui County Department of Water Supply (MDWS)	pam.pogue@co.maui.hi.us
Quitoriano	Ryan	County of Hawaii Department of Water Supply (HDWS)	rquitoriano@hawaiidws.org
Roth Venu	Lauren	Roth Ecological Design	lauren@rothecological.com
Sawai	Cat	City and County of Honolulu Board of Water Supply (BWS)	csawai@hbws.org
Stanbro	Josh	Hawaii Community Foundation	jstanbro@hcf-hawaii.org
Suzumoto	Rod	Hawaii Prince Hotel and Golf Course	rsuzumoto@hiprince.com
Usagawa	Barry	City and County of Honolulu Board of Water Supply (BWS)	busagawa@hbws.org
Watanabe	Warren	Hawaii Farm Bureau	warrenmcfb@hotmail.com
White	Sherman	US Department of Agriculture- Natural Resources Conservation Service (USDA NRCS)	sherman.white@hi.usda.gov
Wiig	Howard	Department of Business, Economic Development, and Tourism Energy Office	hwiig@dbedt.hawaii.org
Williams	Sharon	University of Hawaii-Manoa	sharonwi@hawaii.edu

Water Conservation Plan
Project Team Contact Information

Last Name	First Name	Organization/Company	Phone	Email
Fujii	Neal	CWRM	587-0264	neal.d.fujii@hawaii.gov
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Ohye	Lenore	CWRM	587-0216	Lenore.N.Ohye@hawaii.gov
Solis	Debbie	USACE	438-0701	Deborah.A.Solis@usace.army.mil
Kaneko	Ross	CH2M HILL	440-0225	ross.kaneko@ch2m.com
Madison	Mark	CH2M HILL	(503)736-4453	mark.madison@ch2m.com
Nero	Wendy	CH2M HILL	(813)874-0777	wendy.nero@ch2m.com
Skeens	Brian	CH2M HILL	(678)530-4327	brian.skeens@ch2m.com
Smesrud	Jason	CH2M HILL	(503)736-4372	jason.smesrud@ch2m.com
Smith	Alyssa	CH2M HILL	440-0207	alyssa.smith@ch2m.com

Flip Chart Notes

- Outside WC programs
    - Role of WRM
    - Use of report?
- Context for Chapter 6?
    - Drought – ag water shortage
    - Definition of "waste"
- Relation to larger hydro cycle?
    - Eg use of stormwater
- Conservation = reduction of use = increase in efficiency = decrease in waste
- Analogy of rainbarrels to conserve and capture
- Report focused on efficiency
    - Eg rainbarells offset use of another source, not capturing
- End use efficiency
    - (vs resource augmentation)
- Need clear statement of what report addresses (i.e. efficiency)
    - Vs. reduce, replace, reuse, recharge is more holistic
- How do components of HWP integrate WUDP revisions – need guidance on how conservation plan fold into
- Unintended consequences of "regulations"
- Set statewide conservation target (limited data)
- Unique ag considerations
- Small water systems
- ESPC- water
    - benchmarking

Other Notes

Kaleo –

- Section 6.2: expand on the methodology- how were the BMPs grouped into each program (identify BMPs in each program)?

Yvonne –

- Input from private water providers may be needed (regulations from PUC)
- Different issues than public
    - Opportunity for education (Debbie)

Chris –

- What's being done to address the lack of data?

Mae –

- Section 6.1.3.1: reword the BMP (as seen in Section 6.2.4)

Chris –

- "Government lead by example"
    - Have the government adopt these BMPs first
    - Tell the story
- Add to Section 6.1.6 (ranking high on the priority order) (Lenore)

Development of Statewide Water Conservation Plan

Water Conservation Advisory Group Meeting #5

August 23, 2012

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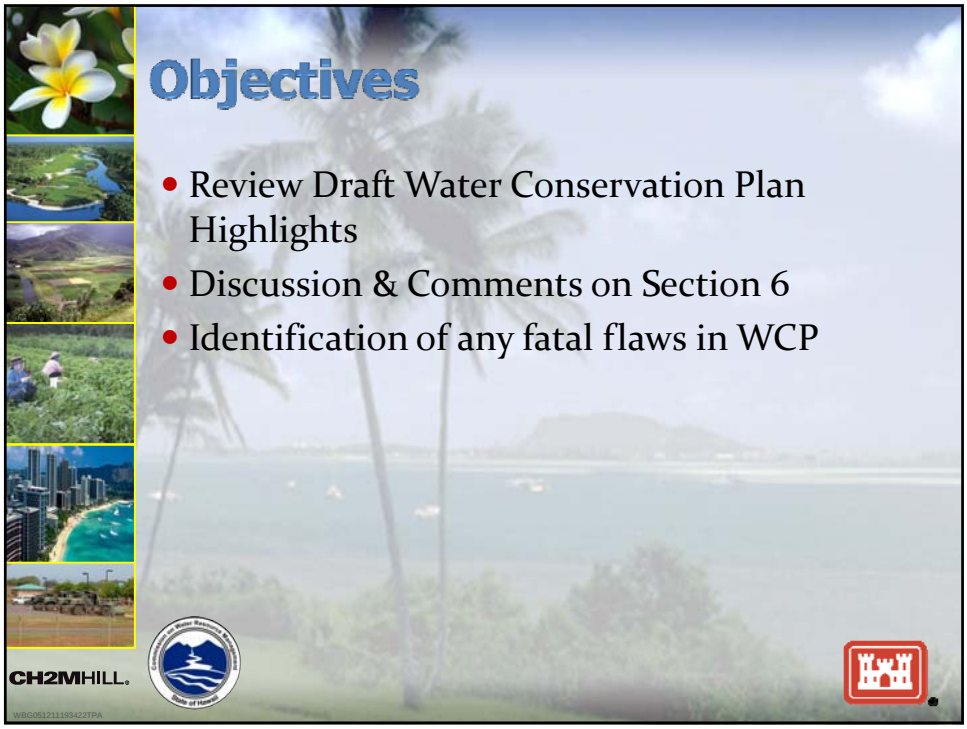
US Army Corps of Engineers

Agenda

- 8:30-8:45 Welcome and Re-Introductions
- 8:45-9:00 Agenda Review and Meeting Objectives
- 9:00-10:15 Hawaii Water Conservation Plan Sectional Review (Sections 1-5)
- 10:15-10:30 BREAK
- 10:30-12:15 Discussion Section 6
- 12:15-12:30 Wrap-up and Next Steps


Objectives
• Review Draft Water Conservation Plan Highlights
• Discussion & Comments on Section 6
• Identification of any fatal flaws in WCP
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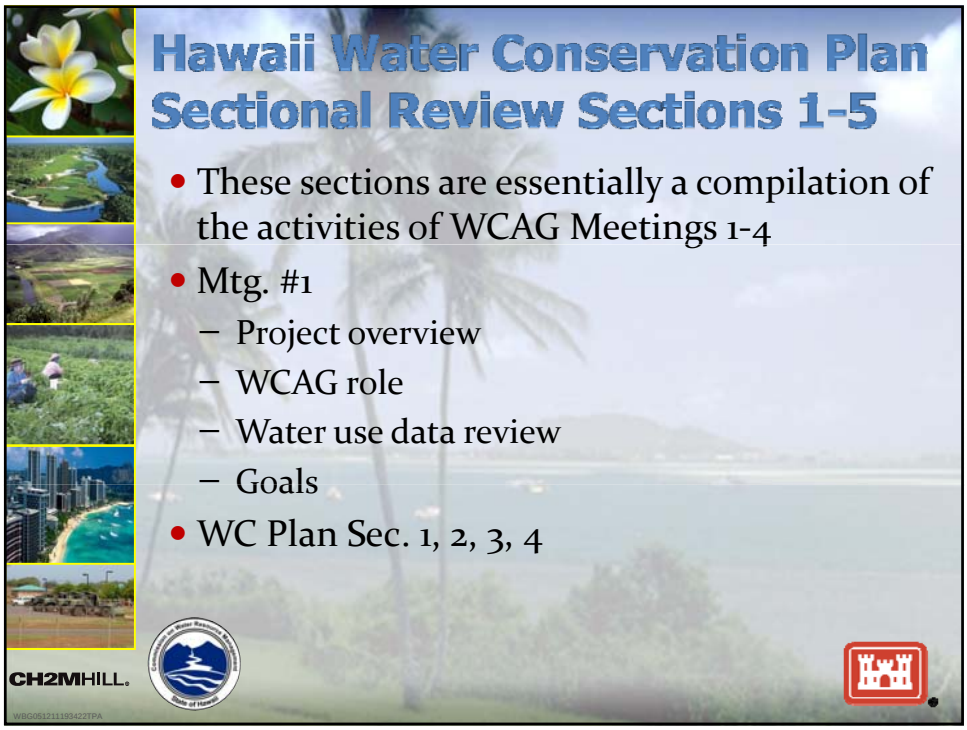
Hawaii Water Conservation Plan Sectional Review Sections 1-5
• These sections are essentially a compilation of the activities of WCAG Meetings 1-4
• Mtg. #1
– Project overview
– WCAG role
– Water use data review
– Goals
• WC Plan Sec. 1, 2, 3, 4
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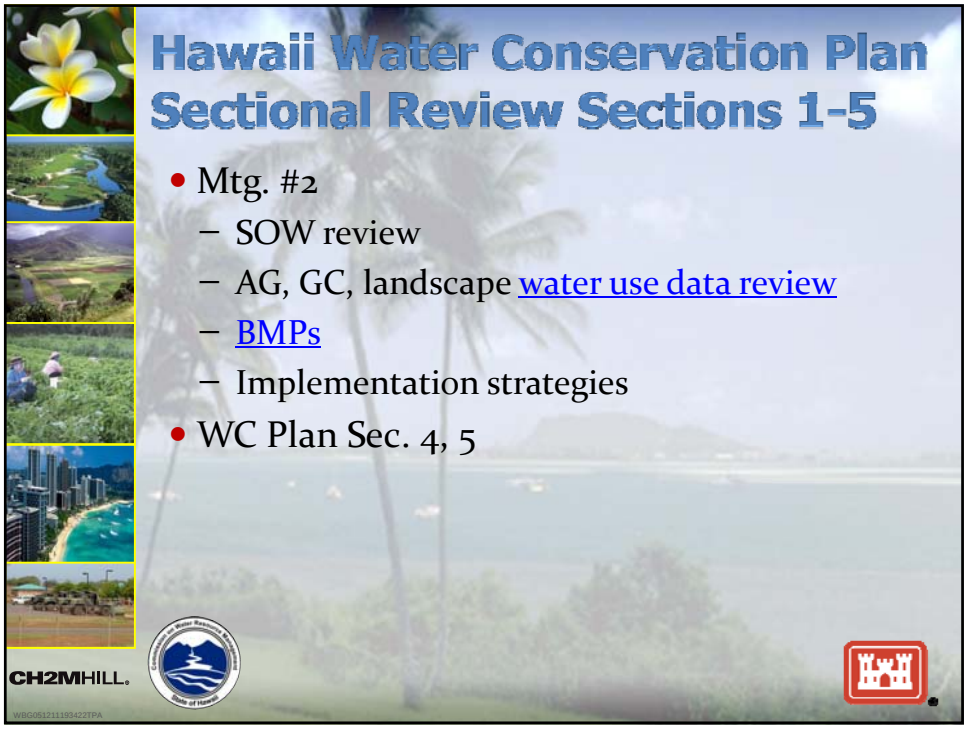
Hawaii Water Conservation Plan
Sectional Review Sections 1-5
• Mtg. #2
– SOW review
– AG, GC, landscape water use data review
– BMPs
– Implementation strategies
• WC Plan Sec. 4, 5
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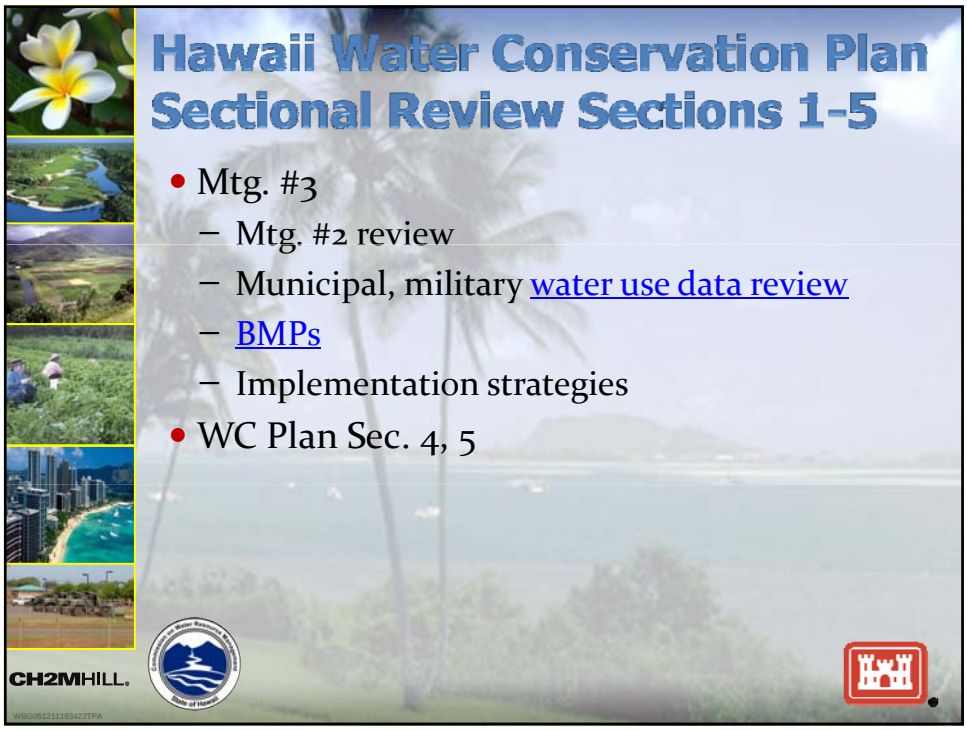
Hawaii Water Conservation Plan
Sectional Review Sections 1-5
• Mtg. #3
– Mtg. #2 review
– Municipal, military water use data review
– BMPs
– Implementation strategies
• WC Plan Sec. 4, 5
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Hawaii Water Conservation Plan
Sectional Review Sections 1-5
• Mtg. #4
– SWOT analysis & strategy
– SMART goals
– Goal prioritization
– Review BMP implementation mechanisms
• WC Plan Sec. 3, 5, 6
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Break
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Discussion Section 6

- Other Policy Actions
- Process for selecting program elements
- Implementation table
- How will CWRM implement programs?
- Technical assistance & demonstration programs before regulatory mandates
- Questions & Comments

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Discussion Section 6 – Other Policy Actions

- Developed during SWOT analysis
- Helps CWRM achieve its goals
- Assume that CWRM would implement with existing staff resources
- Would consider implementation timetable in the future
- Ease of implementation varies between policy actions
- Some are being explored (P1, P3)

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Discussion Section 6 – Process for Selecting Program Elements

- Project Team conducted additional prioritization of sector BMPs based on
  - Ease of implementation
  - Cost to CWRM (staffing & funding)
  - Cost to "implementer"
  - Builds on existing programs
  - Improves Hawaii's AWE water conservation score (policies)

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Discussion Section 6 – Implementation Table

- BMP prioritization used as a evaluation/screening tool to narrow BMPs down from 40+ to short-list
- Should be reasonable to implement
- BMPs packaged into sector programs
- WC Program details outlined
- Incentives before regulation
- Final evaluation based on CWRM staffing and funding scenario

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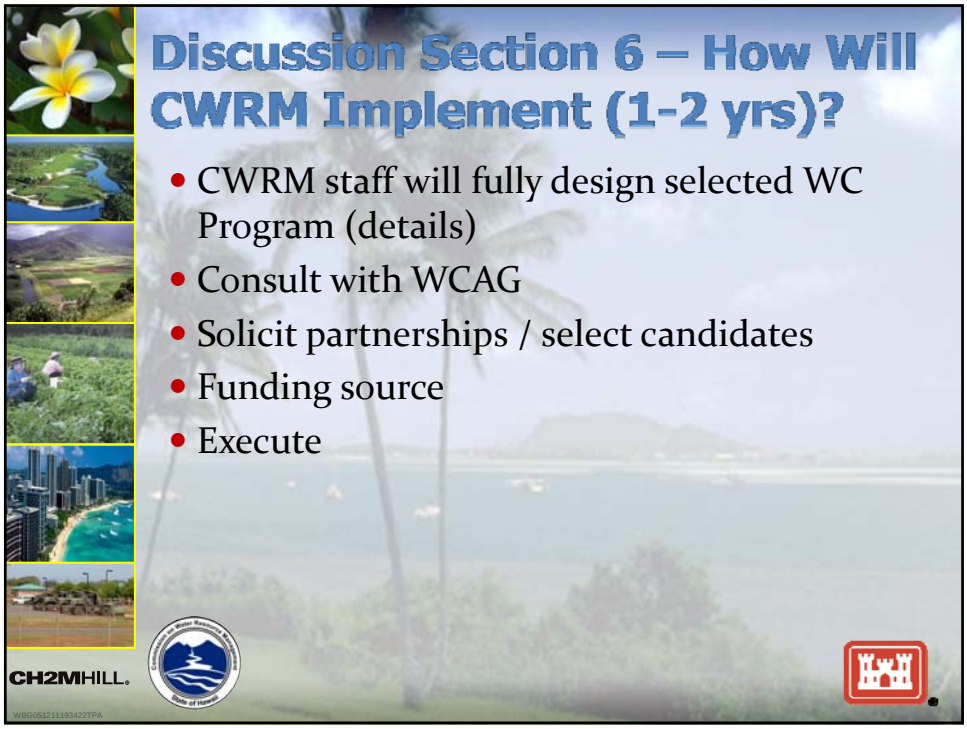
Discussion Section 6 – How Will CWRM Implement (1-2 yrs)?
• CWRM staff will fully design selected WC Program (details)
• Consult with WCAG
• Solicit partnerships / select candidates
• Funding source
• Execute
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Questions & Comments
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Discussion Section 6 – Mid to Long-Term Implementation
• Technical assistance & demonstration programs before regulatory mandates
• Start with small programs
• Build success and momentum
• Develop timetable for Policy implementation
• Establish sustainable funding
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Next Steps
• Written comments to CH2MHILL by September 14
• A comment form will be e-mailed to all
• Next meeting mid-October
• WCAG continued involvement
– Implementation and commitment
– Expectations and roles
• Implementation
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State Water Conservation Advisory Group (WCAG) Meeting #6

Date: **10 January 2013**

Time: **8:30-11:30 am HST**

Location: **DLNR Boardroom**

Attendees: Neal Fujii, CWRM
Jeremy Kimura, CWRM
Lenore Ohye, CWRM (phone)
Debbie Solis, Army Corps of Engineers
Ross Kaneko, CH2M HILL
Alyssa Smith, CH2M HILL
See attached list of WCAG attendees

Due to competition for fresh water, increasing population and development pressures, the sustainable movement, and the impacts of global climate change requiring Hawaii to become as efficient as possible in its uses of fresh water, the Army Corps of Engineers in partnership with the State Department of Land and Natural Resources (DLNR) Commission on Water Resource Management (CWRM) have determined that a water conservation plan for the State of Hawaii should be established. As part of this effort, a Water Conservation Advisory Group (WCAG) – made up of experts from each water use sector – was formed to assist in policy and program development. It is anticipated that the WCAG will meet a total of six (6) times throughout the duration of the project. The fifth meeting was convened on August 23, 2012 and the following summarizes and documents the activities of the meeting.

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List of Acronyms

Acronym	Organization
BWS	City and County of Honolulu Board of Water Supply
CWRM	Hawaii Department of Land and Natural Resources Commission on Water Resource Management
DHHL	Department of Hawaiian Home Lands
HC&S	Hawaiian Commercial & Sugar Company
HCF	Hawaii Community Foundation
HDOA	Hawaii Department of Agriculture
HDWS	County of Hawaii Department of Water Supply
HDOT	Hawaii Department of Transportation
HFB	Hawaii Farm Bureau
HGCSA	Hawaii Golf Course Superintendents Association
HHLA	Hawaii Hotel & Lodging Assoc
KDOW	Kauai County Department of Water
LICH	Landscape Industry Council of Hawaii
MCBH	Marine Corps Base Hawaii, Kaneohe
MDWS	Maui County Department of Water Supply
MTA	Mililani Town Association
NAVFAC	Naval Facilities Engineering Command, Hawaii
UHM	University of Hawaii-Manoa
UHM CTAHR	University of Hawaii-Manoa College of Tropical Agriculture and Human Resources
USACE	United States Army Corp of Engineers
USAG HI	United States Army Garrison Hawaii
USDA NRCS	United States Department of Agriculture- Natural Resources Conservation Service
WCAG	Water Conservation Advisory Group

Meeting Summary

1. Welcome and Re-introductions (Neal Fujii) - Neal initiated re-introductions of the project team and WCAG members.

- Introductions

  Neal Fujii (CWRM)

  Debbie Solis (USACE)

  Joy Buccat (KDOW)

  Sharon Williams (UHM)

  Mae Nakahata (HC&S)

  Warren Watanabe (Hawaii Farm Bureau)

  Howard Wiig (State Energy Office)

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Lauren Roth Venu (Roth Ecological Design)

Garret Matsunami (Castle & Cooke)

Elson Gushiken (ITC Water Management)

Barry Usagawa (BWS)

Jeremy Kimura (CWRM)

Chris Dacus (HDOT/LICH)

Lenore Ohye (CWRM) - phone

Ross Kaneko (CH2M HILL)

Alyssa Smith (CH2M HILL)

Brian Kau (HDOA)

Kaleo Manuel (DHHL)

Amy Brinker (Sierra Club)

Kristi Ellazar (MTA)

Pam Pogue (MDWS)

Cat Sawai (BWS)

2. Agenda Review and Meeting Objectives (Neal Fujii)

   Objectives of the meeting: 1) Final Plan – summarize key findings; 2) Feedback on near-term implementation actions; 3) Determine the future of the WCAG and continuing partnerships.

3. Final Report – Summary and Findings (Neal Fujii)

   A brief overview of the contents in Sections 1-5. Details are provided in the attached pdf copy of the PowerPoint presentation used at the meeting.

   - *Sharon – Would like to see something more specific on climate change and sea level rise.*
     - *Debbie – Maybe inform people of other initiatives happening around the State.*
     - *Neal – Counties are examining this for their watershed management plans to look at future demands and the effects of climate change.*
     - *Sharon – UH is preparing an overall master plan to determine if retaining water on site is more beneficial to the state.*
     - *Debbie – From the Federal perspective, budgeting is a big issue. It might be worthwhile for the WCAG to discuss initiatives when meeting in the future. Implementation usually comes down to money which is where partnerships come into play.*
   - *Lauren – what's the State doing about climate change?*

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- *Neal – Some things the State has been doing are:*
  - *Updated the rainfall atlas based on the last 30 years.*
  - *Evapotranspiration maps for the State to be completed by the end of Summer 2013.*
  - *Climate change assessment for Pacific and Hawaiian Islands (www.pacificrisa.org)*
    - *Barry – Ocean Resources Management Plan (ORMP) is available through the City and County of Honolulu Office of Planning Coastal Zone Management Program*
  - *Updating Water Resources Protection Plan – examining how climate change affects Hawaii's environment*
    - *Jeremy – projected to be a 2 year process*
- *Lauren – include a summary of the county WUDPs in the updated report*
  - *Debbie - Future meetings to discuss upcominig updates (information exchange)*
- *Barry – are there any agriculture BMPs for water reuse?*
  - *Brian – the issues with this are perception and availability*
  - *Mae – a statement regarding source development is missing from the report*
    - *Lenore – there was a text box added to the beginning of the plan, which can include source development*

4. Implementation and Partnerships (Neal Fujii)

Neal handed out documents on the *Water Loss Audit Training Plan* and *Irrigation Metering Project Plan* for review. See the attached PowerPoint presentation and Flip Chart Notes for details.

- Water Loss Audit Training Plan (see Flip Chart Notes)
  - *Pam – possibly do a demo/workshop at the upcoming conferences (HWWA or AWWA)*
    - *Neal – already spoke to AWWA*
  - *Elson – Workshops for neighbor islands?*
    - *Neal – CWRM will be paying for the coordination of workshops*
    - *Elson – National AWWA may have water loss audit trainings available (check with the Hawaii Section for details)*
  - *Neal – Need volunteers to form a Water Loss Audit Committee*
    - *Volunteers: Pam, Barry, Amy, Joy, and Elson (to help recruit)*
    - *Sharon – UH is also willing to participate*

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- *Elson – good to keep in mind there may be water loss audit equipment needs*
- *Barry – Which side of the meter is this targeting?*
    - *Debbie – the first phase will target the supply side and then phase 2 will target the customers*
- *Neal – Will create a schedule soon and coordinate planning with the Water Loss Audit Committee*

- Irrigation Metering Demonstration Project/Workshop (see Flip Chart Notes)
    - *Elson – Look into partnering with an existing measurement system (such as Kaanapali Land Management Company)*
    - *Brian – Be careful of how information/conclusions from the workshop/project are published*
    - *Mae – What's the original intention? Thought this was measuring at the diversion.*
        - *Neal – We're looking to measure at the diversion or some point downstream; the method can be applied to other points on the system and should be cost effective; if you get readings at different points on the system, then you'll have a better idea of water availability*
        - *Brian – there is some hesitation because system have numerous diversions*
        - *Neal – We need to understand what's being diverted; the goal is to demonstrate to an operator that the process isn't too intensive and cost effective; then it will become a benefit for everyone*
        - *Mae – there are new/different techniques to evaluate a system that don't necessarily require the measurement of water, but demonstrate the systems' integrity; if you measure water at first practical point, then you can determine how the water is being used vs how much*
            - *Neal – Our focus is what is coming into the system*
        - *Mae –each system is completely different from each other*
            - *Barry – the outcome is getting information; this will help mitigate drought by understanding the efficiency of use*
    - *Lauren – Maybe inform farmers about whats happening and types of things they should be thinking of; workshops will address the different variables to help solve some issues*
    - *Lenore – one of the reasons this was chosen as part of the implementation plan is for 2 objectives: 1) Ag total water use is huge in Hawaii and in order to support it, CWRM needs to know how much water they use 2) we need to find out where more efficiency can happen; this is why CWRM is starting with these demonstration projects, as well as tofigure out how to overcome the difficulties*

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that may arise for farmers; these discussions are good for the committee (volunteers are listed on Flip Chart Notes)

- *Neal - Need volunteers to form an Irrigation Metering Demo Project/Workshop Committee*
    - *Volunteers: Brian, Mae, Warren, Elson*
- *Elson – what point of diversion do you recommend using? Because loss is not necessarily considered waste*
    - *Brian – the ongoing argument of the definition of waste is very subjective*
        - *Lenore –water uses become contingent on water loss; sometimes it may not be in the best interest of the system to implement measures*
- *Neal – will schedule a committee meeting soon*

5. Future of WCAG (Neal Fujii)

- *Neal – meeting to be held 4 times a year (once a quarter)*
    - *Debbie – combine with conferences (AWWA)*
    - *Recommended to meet after the legislative session*

6. Current WC Initiatives to Watch

- *Chris (LICH water conservation initiative) – 26 BMPs for landscape irrigation; the document is available online; mentioned in the last meeting that government should lead by example – so there was a resolution for the government to adopt the BMPs, but the state wanted to make it a bill; support letters are needed; this bill will require adoption of maintenance measures and reporting flow; still working out the pilot project; it's been a slow/long process not because there's opposition, but due to the organization learning about the process*
- *Cat (BWS water conservation program) – highlight is the water auditing portion; focus is on the metering side (source and calibration)*
- *Sharon (UH Manoa stormwater management) – the master plan covers the entire campus; the problem is that the drainage plan is currently designed for only a 10-year storm; looking for input from others*
- *Howard (Green Business Program) – did energy audits on 10 state buildings this year (including water audits); after the audit, they installed low-flow and automatic shut-off fixtures; savings are noticable*

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If there are any necessary corrections or additions, please contact me via email at Ross.Kaneko@ch2m.com or you can reach me on my office line at 808-440-0225, or my cell phone at 808-554-3791.

Respectfully submitted,

Ross A. Kaneko

Attachments:

- Attendance list
- Project team contact list
- Flip Chart Notes
- WCAG Meeting #6 Presentation

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Water Conservation Advisory Group Meeting #6 (01/10/2013)
List of Attendees

Last Name	First Name	Organization	Email Address
Brinker	Amy	Sierra Club/KYA Sustainability Studio	abrinker@thekyastudio.com
Buccat	Joy	Kauai County Department of Water (KDOW)	jbuccat@kauaiwater.org
Dacus	Chris	Hawaii Department of Transportation (HDOT)/ Landscape Industry Council of Hawaii (LICH)	christopher.a.dacus@hawaii.gov
Ellazar	Kristi	Mililani Town Association (MTA)	kellazar@mililanitown.org
Gushiken	Elson	ITC Water Mgt, Inc	elson@itcwater.com
Kau	Brian	Hawaii Department of Agriculture (HDOA)	brian.k.kau@hawaii.gov
Manuel	Kaleo	Hawaiian Homelands (DHHL)	kaleo.l.manuel@hawaii.gov
Matsunami	Garret	Castle & Cooke	gmatsunami@castlecooke.com
Nakahata	Mae	HC&S Co.	mnakahata@hcsugar.com
Pogue	Pam	Maui County Department of Water Supply (MDWS)	pam.pogue@co.maui.hi.us
Roth Venu	Lauren	Roth Ecological Design	lauren@rothecological.com
Sawai	Cat	City and County of Honolulu Board of Water Supply (BWS)	csawai@hbws.org
Usagawa	Barry	City and County of Honolulu Board of Water Supply (BWS)	busagawa@hbws.org
Watanabe	Warren	Hawaii Farm Bureau	warrenmcfb@hotmail.com
Wiig	Howard	Department of Business, Economic Development, and Tourism Energy Office	hwiig@dbedt.hawaii.org
Williams	Sharon	University of Hawaii-Manoa	sharonwi@hawaii.edu

Water Conservation Plan
Project Team Contact Information

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Ohye	Lenore	CWRM	587-0216	Lenore.N.Ohye@hawaii.gov
Solis	Debbie	USACE	438-0701	Deborah.A.Solis@usace.army.mil
Kaneko	Ross	CH2M HILL	440-0225	ross.kaneko@ch2m.com
Madison	Mark	CH2M HILL	(503)736-4453	mark.madison@ch2m.com
Nero	Wendy	CH2M HILL	(813)874-0777	wendy.nero@ch2m.com
Skeens	Brian	CH2M HILL	(678)530-4327	brian.skeens@ch2m.com
Smesrud	Jason	CH2M HILL	(503)736-4372	jason.smesrud@ch2m.com
Smith	Alyssa	CH2M HILL	440-0207	alyssa.smith@ch2m.com

January 10, 2013
WCAG Meeting #6
Facilitated Discussion Notes (Flip Chart Transcription)

Water Loss Audit Training

- AWWA-HI Section has an established training program that was originally set up for neighbor island training and outreach
- Hawaii Rural Water Association can also help with training – Gary Byrd conducts training workshops
- National AWWA may have a water loss audit training program available; HI Section can make an inquiry on training and trainers as well as any cost deferral for travel
- Hawaii Department of Health - Joanna Seto is the HI Section trustee(?) to National AWWA and could make the inquiry on training
- Continuing Education Units could be awarded to those who attend workshops
- EPA may have funding for training workshops
- Water System Operator certification may require water audit training
- Water Loss Audit Committee volunteers:
    - Pam Pogue – Maui DWS
    - Barry Usagawa – Honolulu BWS
    - Amy Brinker – Sierra Club Hawaii
    - Joy Buccat – Kauai Department of Water
    - Elson Gushiken (recruiting) – ITC Water Management
- There may be water loss audit equipment needs; in past AWWA-HI training local vendors supplied equipment
- There is also a need for supply/customer side water audit training
- There should be incentives for water loss audits, e.g., saving energy, water and money
- There is also a need for non-potable water system audits
- Water loss audits can help with a utility's water conservation goal setting

Irrigation Metering Demonstration Project/Workshop

- Suggestion that training could also be done with a partner with an existing measurement system, e.g., Kaanapali Land Management
- Crop types should be sub-metered
- Some incentives for this program include:
    - Better crop yields
    - Better water management
    - Better management of farming inputs
    - Increased productivity
    - Less cost

- A list of concerns and constraints for irrigation metering should be made
- Another consideration should be for "system integrity" in place of flow measurement
- Every irrigation system is unique and there needs to be careful consideration of the measurement point(s) on the system

- CWRM objectives are:
  (1) To obtain better information on agricultural uses and
  (2) Find ways to improve agricultural water use efficiency
  in order to increase water for agriculture
- Irrigation Metering Demo Project/Workshop Committee
  - Brian Kau – Hawaii Department of Agriculture
  - Mae Nakahata – Hawaiian Commercial and Sugar Company
  - Warren Watanabe – Hawaii Farm Bureau Federation
  - Elson Gushiken – ITC Water Mangement
- Need to look at several perspectives and definition of water "losses" what is waste?
- There are beneficial losses
- Long-term dependency on water lost from systems

<u>Future of WCAG</u>

- Strategic scheduling of meetings – e.g., same time as AWWA conferences
- WCAG Meeting Agenda should have an item for member update briefings/information exchange (what other organization/agencies are doing related to water conservation, climate change, etc.)
- Agreement to meet quarterly but not during the Hawaii Legislative session

Development of Statewide Water Conservation Plan

Water Conservation Advisory Group Meeting #6

January 10, 2013

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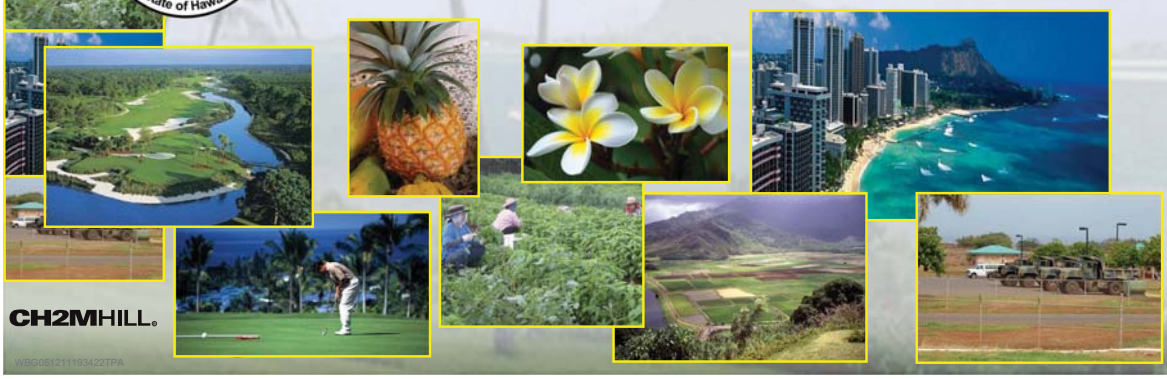

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Agenda

- 8:30-8:45 Welcome and Re-Introductions
- 8:45-9:00 Agenda Review and Meeting Objectives
- 9:00-9:30 Final Report – Summary & Findings
- 9:30-10:30 Implementation & Partnerships
- 10:30-10:45 BREAK
- 10:45-11:30 Future of WCAG

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Objectives

- Final Plan – summarize key findings
- Feedback on near-term implementation actions
- Determine the future of the WCAG and continuing partnerships

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Hawaii Water Conservation Plan Final Report – Summary

- WCAG comprised of over 30 representatives
- Six meetings well attended
- Municipal Military, Agriculture and Golf Course sectors
- Sector water use characterized
- BMPs identified and implementation approaches defined
- Implementation plan developed
- Comments on Draft addressed in Final Report

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Hawaii Water Conservation Plan Final Report – Key Findings

- Water conservation important to all sectors and WCAG members
- Need for improved data collection
- Many ongoing water conservation programs
- Some concerns about implementation and new policy/regulation
- Potential for water savings in all sectors – largest uses in Ag and Municipal

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Hawaii Water Conservation Plan Final Report – Key Findings

- Water conservation implementation will be a mix of programs and policy
- Good potential for collaboration and partnering
- 10-year Implementation Plan flexible and may change based on available resources
- CWRM staffing and funding constraints
- Near-term implementation programs:
  - *Water loss audit training (PWS)*
  - *Irrigation metering demo project/workshop*

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Implementation and Partnerships – Water Loss Audit Training

- Partner with county water departments, AWWA-HI and/or HRWA
- Follow IWA/AWWA methods
- Training in each County
- Looking for partners
- Initially target large PWS
- Will be followed by policy requiring audits

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Implementation and Partnerships – Irrigation Metering Demo/ Workshops

- Partner with USGS & RC&D Councils
- Need willing operator/irrigators
- Typical large irrigation system and small individual diverter
- Training in each County
- Looking for partners
- Will be followed by enforcement of reporting requirements

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Break

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Future of WCAG

- Continue working relationship with WCAG
- Formalize WCAG and schedule regular meetings
- WCAG roles:
  - 5-year Plan review/update
  - Program evaluation
  - Policy development
  - Implementation

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Current WC Initiatives to Watch

- LICH water conservation initiative
- BWS water conservation program
- UH Manoa stormwater management
- Green Business Program
- DAGS Energy Conservation Performance Contracting
- 2013 legislature – participation/testimony
  - Green plumbing codes

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Next Steps

- Survey WCAG to evaluate process
- 1-2 years
  - Water loss audit training workshops
  - Irrigation metering demo project / workshops
- 3-5 years
  - WaterSense/high efficiency equipment rebate or replacement programs
  - Irrigation water purveyor / user workshops
  - Policy: enforce surface water use reporting requirement; mandatory PWS water loss audit

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DRAFT 1-4-13

Water Conservation Program Implementation
Proposed Water Loss Audit Training Work Plan

Executive Summary

The Commission on Water Resource Management (Commission) plans to implement water loss audit training workshops for public water system (PWS) operators across the state. Public water systems serve the public but can be publicly or privately owned. Initially, large PWS operators will be trained, followed by the smaller systems. The purpose of this is to enable operators to either perform standardized water loss audits or to intelligently use contractors to complete standardized water loss audits. The benefits of water audits and loss control include reduction in unnecessary water withdrawals, revenue recovery, and improved system efficiency. Following the training, the Commission expects to make it a requirement that PWS complete water loss audits and report their findings to the Commission on a regular basis. Training will be a collaborative effort involving the county municipal water departments and other interested stakeholders. It may be necessary to hire contractors to assist with developing a standard methodology, lesson plan and to lead/facilitate the workshops. The training workshops should be completed within 12-months.

Introduction and Background

Municipal water departments and military water systems together deliver over 205 million gallons of water per day (not including other public water systems). The Commission's Hawaii Water Conservation Plan completed in 2013, identifies water loss audit training for PWS operators as a high priority near-term implementation action; with the emphasis on standardizing the audit methodology. This training is important since a follow-on (long-term) water conservation implementation action is requiring PWS to conduct an annual water loss audit and report the findings to the Commission on a periodic basis. The Hawaii Department of Health CDWB defines PWS as those systems that provide water for human consumption to at least 15 service connections or serves an average of at least 25 people for at least 60 days each year and recognizes 130 public water systems across the state. PWS can be either publicly or privately owned and serve populations ranging from less than 50 to over 50,000. Note that there is likely a threshold population served by a PWS where the benefit of conducting a water loss audit would not exceed its cost. This raises a question on whether water loss audits should be required for all PWS or for only the larger ones that would yield significant water savings. According to the AWWA M36 Manual (Water Audits and Loss Control Programs), water loss audits combined with water loss control have multiple benefits to the PWS, including: reduced apparent and real losses, improved data integrity, better use of available water resources, and reduced disruption to customers.

Goals and objectives

The goal of this program is to train PWS operators to conduct water loss audits following a standardized methodology. A related goal is to demonstrate the importance of a water loss audit and how this would benefit the PWS. Due to the large number of PWS, training will be initially targeted at large PWS operators. Subsequent training would be targeted at medium followed by small operators. (CEU credits?)

Objective 1: Establish partnerships with stakeholders and collaborators who can assist
Objective 2: Identify classes (e.g., small, medium, large) of PWS based on population served
Objective 3: Develop standardized methodology for conducting water loss audits
Objective 4: Develop water loss audit workshop lesson plan and training materials
Objective 5: Conduct water loss audit training workshops in each county – initially focusing on large PWS followed by medium, then small PWS.

The training of large PWS operators would be completed within 12-months.

Resources and Constraints

There are numerous potential partners and collaborators to assist with reaching this project's objectives. This includes affected public water systems, Hawaii Department of Health, Hawaii Rural Water Association (HWRA), U.S. Army Corps of Engineers (USACE), American Water Works Association – Hawaii Section (AWWA-HI), and private contractors. Commission staff and funding is committed to successfully implementing this program.

Constraints to implementation could include prolonged procurement procedures to hire contractor if needed; some PWS may be reluctant to participate; development of a lesson plan that would effectively train operators; and loss of momentum within Water Conservation Advisory Group (WCAG). Note: For PWS that are regulated by the Hawaii Public Utility Commission (PUC), any PWS rule changes would require PUC approval. This may be a challenge when annual water loss audits are required in the future.

Strategy and Actions

Collaboration is important for this program to succeed. Achieving early buy-in and approval from key stakeholders will enable this program to move forward. This group of stakeholders should be comprised of WCAG members willing to assist, either through face meetings or teleconference, and forming the Water Loss Audit Committee This Committee would help complete the Objectives described above. Each County's municipal water department would be asked to host or co-host the workshop within their respective county. The HWRA and the AWWA-HI would also be asked to assist. Technical assistance may be needed from private contractors specializing in water loss audit training.

Action 1: Establish Water Loss Audit Committee (WLAC) through telephone and e-mail correspondence
Action 1a: Conduct a WLAC program planning meeting to complete Actions 2-4 below
Action 1b: Develop detailed schedule
Action 2: Determine the number of PWS across the state and make a list of PWS falling into three size categories
Action 3: Decide on a water loss audit methodology and the level of detail that is expected
Action 3a: Determine whether or not contractor is needed for technical assistance and specify what would be needed (i.e., developing methodology, conducting training workshops, etc.)
Action 3b: Develop scope of work for contractor
Action 3c: Commission approval for hiring contractor
Action 3d: Procurement
Action 4: Draft lesson plan (w/contractor)

Action 4a: Develop training materials (w/contractor)
Action 4b: Distribute to WLAC for review
Action 5a: Schedule workshops with county municipal water departments – date, time, location, refreshments, etc.
Action 5b: Send meeting invitations and agendas and make staff travel arrangements
Action 5c: Conduct workshops
Action 6: Meet with WCAC to evaluate workshop effectiveness and next steps

Appendices

Appendix A – Partners

Appendix B – Budget

Appendix C – Schedule

Appendix D – Technical References

From Hawaii Water Conservation Plan
Procedure for Conducting and Requiring Annual Water Loss Audit
Issue: Need for standardization in water loss reporting by public water systems
Solution (BMP): Water Loss Control
Implementation Type: Education and Regulatory
Implementation Program: Education will take place on the AWWA/IWA Water Audit methodology and AWWA Free Water Audit Software © for public water systems in Hawaii. Following the training, public water systems will be required to conduct water loss audits using the methodology and software and submit to CWRM on an annual basis.
Responsibility for Implementing: CWRM will use existing educational materials available from AWWA and other states that have implemented similar programs. Municipal water system staff familiar with this methodology could participate and assist with education statewide. Requirement will phase in based on water system size, as appropriate.
Funding Source/Partners: USACE, CWRM, municipal water systems. Hawaii Rural Water Association
Staff Needs: 0.3 FTE for 2 years
Program Expenses: $10,000 for first year, $5,000 for year 2

Annual Water Loss Program
Issue: Need for standardization in water loss reporting at military installations
Solution (BMP): Distribution System Audits, Leak Detection, and Repair
Implementation Type: Education and Regulatory
Implementation Program: Education will take place on the AWWA/IWA Water Audit methodology and AWWA Free Water Audit Software © for military installations in Hawaii. Following the training, military installations should conduct water loss audits using the methodology and software and submit to CWRM on an annual basis.
Responsibility for Implementing: CWRM will use existing educational materials available from AWWA and other states that have implemented similar programs. Municipal water system staff

familiar with this methodology could participate and assist with education statewide.
Requirement will phase in based on water system size, as appropriate.
Funding Source/Partners: USACE, CWRM, municipal water systems, military installations, Hawaii Rural Water Association
Staff Needs: 0.1 FTE for 2 years
Program Expenses: $2,000/year for 2 years (years 1-2)

DRAFT 1-9-13

Water Conservation Program Implementation
Proposed Irrigation Metering Demonstration Project Work Plan

Executive Summary

The Commission on Water Resource Management (Commission) plans to implement an irrigation water metering (measurement) demonstration project for agricultural operators and agricultural irrigators. The purpose is to provide training on practical methods of surface water flow measurement in order to improve surface water use measurement and reporting across the State. Accurate water use records are essential to operators for effectively managing their water. The Commission plans to enforce the requirement that water users measure and report their water use to the Commission on a monthly basis. Training will be a collaborative effort involving the U.S. Geological Survey (USGS), county Resource Conservation and Development Councils (RC&D), and other interested stakeholders. It will be necessary to pay for some of these specialized services offered by these partners. The training workshops would focus on both large and small scale operations in each county and should be completed within 12-months.

Introduction and Background

Agricultural water use in Hawaii is estimated to be over 300 million gallons per day (mdg) –with most of this water diverted from surface water streams. However, the actual use is probably significantly higher since most stream diverters and irrigators do not measure or report their water use. The first step in achieving water efficiency is determining accurate data on how much water is being used. The Commission's Hawaii Water Conservation Plan completed in 2013, identifies an irrigation metering demonstration project as a high priority near-term implementation action that will provide agricultural operators and irrigators training and instruction on how to measure their water use. In developing the Hawaii Water Conservation Plan, stakeholders stated that measurement of stream diversions and ditch systems would be difficult and costly. This demonstration project is intended to provide irrigators the knowledge and training to establish and maintain a practical and accurate means to measure their water use. This training is important since a follow-on (long-term) water conservation implementation action will be enforcing the State Water Code administrative rules requiring all stream diverters to measure and report their water use.

Goals and objectives

The goal of this program is to train agriculture irrigators and water purveyors (who divert water from streams) to establish and maintain a practical and accurate system to measure their water use. The method of measurement should be an established practice and acceptable to the Commission, while being simple to install and maintain. Cost for establishment and maintenance is an important factor and should be a consideration when selecting the measurement methods. In Hawaii, there are principally two typical stream diversion/irrigation systems that the training should target. One is the large, plantation-style irrigation system with multiple stream diversions and lengthy transmission systems. The other is the small, single stream diversion system used to irrigate diversified/truck crops or taro. Different methods of measurement may be used, depending on the type of irrigation system. (CEU credits?)

Objective 1: Establish partnerships with stakeholders and collaborators (USGS, farmers, RC&Ds)
Objective 2: Identify farmers or irrigators willing to allow their system to become a demonstration project – one or two in the large and small system categories (field visit w/USGS to determine suitability)
Objective 3: Identify appropriate methods of flow measurements for selected systems
Objective 4: Develop demonstration project workshop program, handbook, materials, etc.
Objective 5: Complete demonstration project/training workshop for one large and one small irrigation system in each county

The demonstration project workshops would be completed within 12-months.

Resources and Constraints

There are numerous potential partners and collaborators to assist with reaching this project's objectives. This includes U.S. Army Corps of Engineers (USACE), U.S. Geological Survey, County Resource Conservation and Development Councils (RC&D), and agricultural water (surface water) system operators/users. Commission staff and funding is committed to successfully implementing this program.

Constraints to implementation could include finding willing farmers or irrigation system operators/purveyors, prolonged procurement procedures to hire RC&D and USGS; development of a demonstration project that would effectively train workshop attendees; and loss of momentum within Water Conservation Advisory Group (WCAG).

Strategy and Actions

Collaboration is important for this program to succeed. Achieving early buy-in and approval from key agricultural stakeholders will enable this program to move forward and should include some WCAG members willing to assist with the demonstration project workshop. The demonstration projects/workshops would be a collaborative effort between the Commission, USGS and RC&D. The USGS would be hired to assist with demonstration project offering technical assistance and expertise for: (1) classroom type training and (2) field installation and field training on measurement equipment. The county RC&D Council would be hired to plan and facilitate the demonstration workshop, including invitations and coordinating with USGS and volunteer irrigation system or farmer. This demonstration project should also be videotaped for dissemination over the internet.

Action 1: Establish Irrigation Metering Committee (IMC) through telephone and e-mail correspondence
Action 1a: Contact project partners and schedule planning meeting (USGS, RC&D, etc.)
Action 2: Contact SCWDs, Farm Bureau, NRCS, etc. to identify farmers/irrigators to host demonstration/workshops
Action 2a: Contact farmers/irrigators to gain permission to hold demonstration project/workshop
Action 2b: Conduct field visit with partners to determine demonstration site suitability
Action 3: Work with USGS to determine appropriate measurement methodology and required materials for each demonstration site
Action 4: Develop project scope of work, partner responsibilities

Action 4a: Obtain Commission approval for hiring contractor
Action 4b: Procurement: P.O, contract or MOA with partners for services
Action 4c: Develop training materials (w/contractors)
Action 4d: Schedule workshops
Action 4e: Distribute to IMC for review
Action 5: Make staff travel arrangements
Action 5a: Conduct workshops
Action 5b: Meet with IMC to evaluate workshop effectiveness and next steps

Appendices

Appendix A – Partners

Appendix B – Budget

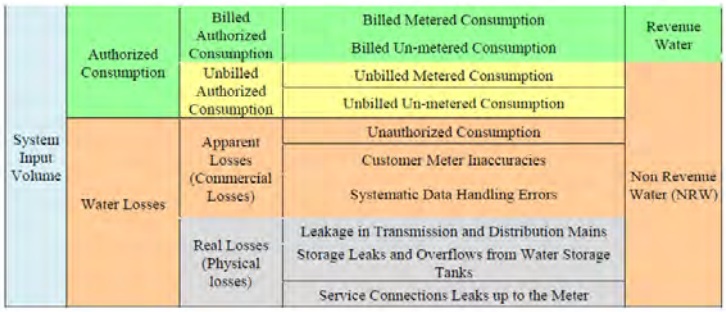
Appendix C – Schedule

Appendix D – Technical References

From Hawaii Water Conservation Plan
Irrigation Metering Demonstration Project
Issue: Lack of water use measurement
Solution (BMP): Volumetric measurement of irrigation water use
Implementation Type: Education and Incentive
Implementation Program: Cost-sharing demonstration project with one or two (initially) large water purveyor and small irrigator to install and operate water measurement devices on or near their diversions or wells. The devices should be inexpensive to install, maintain, and operate. Ideally, systems that are already metering all field deliveries would be selected to allow more comprehensive irrigation system wide water budgets. This will establish a proof of concept that can be transferred to other irrigation systems.
Responsibility for Implementing: CWRM will select irrigation systems and facilitate cost-share/technical assistance; CWRM will partner with NRCS to utilize EQIP or AWEP programs as applicable, with USGS to provide technical assistance.Irrigation water purveyors will contribute cost-share and in-kind services.
Funding Source/Partners: USACE, CWRM, HDOA, NRCS, USGS, Resource Conservation and Development Council (RC&D), UH Cooperative Extension Servivce, irrigation system partners
Staff Needs: 0.2 FTE for 2 years
Program Expenses: $10,000/year for 2 years (years 1-2)

Appendix B
BMP Templates

BMP MU1—Water Loss Control



Photos courtesy of EPA.

Category
Municipal.
Description
Water loss control is the calculation and reduction of water losses according to industry standard methodology. The industry standard is the International Water Association/American Water Works Association (IWA/AWWA) Water Audit Methodology as outlined in the AWWA M36 Manual, Third Edition, *Water Audits and Loss Control Programs*.
Water Savings
High – Depending on system specific conditions, water loss reductions can be significant. However, appropriate water loss accounting must take place first, through a validated audit.
Cost
Medium – After the completion of the water loss audit, specific projects can be identified to control water losses, and the payback can be calculated.
Schedule
The schedule for this BMP is for CWRM to set dates for initial water audit submission and provide technical assistance to water systems in preparation.

BMP MU2—Rain Barrel Programs

Photos courtesy of EPA.

Category
Municipal.
Description
Rain barrels, when installed at residential or large properties, collect rainwater from roof gutters to be used at a later time for non-potable outdoor purposes, such as irrigation.
Water Savings
Low – Rain barrels generally do not save large amounts of water. However, there is the potential to offset some potable water use for irrigation.
Cost
Low – Rain barrels themselves are a low-cost item ($50 to $75), but the cost to run the BMP, including the outreach, promotion, and staff time, can increase the cost, depending on the scale of the program.
Schedule
The schedule for this BMP varies according to the implementation. However, 1 year is a good starting point to get the necessary participation and momentum for the BMP.

BMP MU3—Irrigation Upgrade Programs

Photos courtesy of EPA.

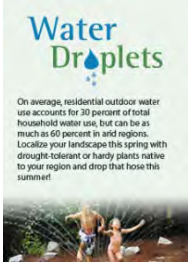
Category
Municipal.
Description
Irrigation upgrade programs are the assessment and replacement of automatic irrigation components with more water-efficient technologies, such as controller systems that use real-time weather or soil moisture input or efficient application technologies such as rotary heads or drip irrigation. These are typically targeted to large irrigation systems (non-residential).
Water Savings
High – The reduction in water use from the implementation of water-efficient irrigation technologies can be as much as 50%. Accurate programming and design is critical to the effectiveness.
Cost
Medium – The cost of water-efficient technology varies depending on the component being installed. Controllers are generally expensive, while application technologies are mid-range costs.
Schedule
The schedule for this BMP varies according to the implementation. But up to 5 years is usually effective.

BMP MU4—Water Reuse

Photo courtesy of EPA.

Category
Municipal.
Description
Water reuse is the practice of using potable water for more than one end use before disposal. The second use is for non-potable use. Typical implementations are distribution of highly treated wastewater for non-potable uses such as irrigation or industrial process water. Other reuse types are gray water reuse from certain indoor end uses (shower, lavatory, washing machine) that can be reused with minimal treatment for non-potable uses such as irrigation or toilet flushing. Standards for treatment, maintenance, and use should be developed, if not in place already.
Water Savings
High – The water savings from water reuse can be very high, but only if replacing potable water use, not creating a new non-potable use.
Cost
High – The cost of water reuse, especially highly treated wastewater is high because of the treatment and conveyance cost. Forms of gray water reuse can be less costly, because the source is closer to the use.
Schedule
The schedule for this BMP includes feasibility studies within the first 2 years and master planning in the next 2 years. Construction will follow afterwards. For gray water, a period of 5 years would be typical.

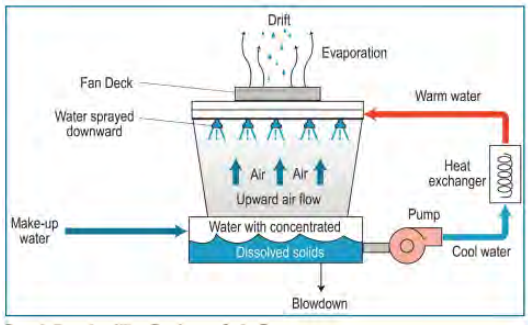
BMP MU5—Education and Outreach



Photos courtesy of EPA.

Category
Municipal.
Description
Education and outreach is the development and dissemination of materials about ways to become more water efficient, and the value of water. This can also include highlighting new equipment and/or practices that increase water efficiency, as well as training and demonstrations.
Water Savings
Low – The water savings from education are normally hard to quantify, but most successful in promoting other BMPs and rate structures that will achieve the savings.
Cost
Medium – The cost of education and outreach can be high, depending on the level of outreach. It can be as low as one person's time to prepare materials and visit classrooms, or purchasing formal advertising and outreach activities.
Schedule
The schedule for this BMP includes upfront time for CWRM to develop statewide materials, and several years to follow for the municipal water systems to implement them.

BMP MU6—Efficient Commercial Equipment



Photos courtesy of EPA and DOE.

Category
Municipal.
Description
Efficient commercial equipment is the identification and promotion of water using equipment for commercial users that are more water-efficient than those currently available or in use. These equipment items can include toilet flush valves, urinals, kitchen pre-rinse spray valves, ice machines, and cooling towers. Typically, the water savings is very definable and payback can be calculated for these devices, based on their use.
Water Savings
High – The water savings from efficient commercial equipment can be very high, especially if replacing older, inefficient equipment.
Cost
Medium – The cost of water efficient commercial equipment is not generally more expensive than non-efficient equipment. Typically, they utilize the use of air-cooling, rather than water-cooling, to save water.
Schedule
The schedule for this BMP includes time for promotion and demonstration, as well as CWRM policy development.

BMP MU7—Irrigation Technology

Photo courtesy of EPA.

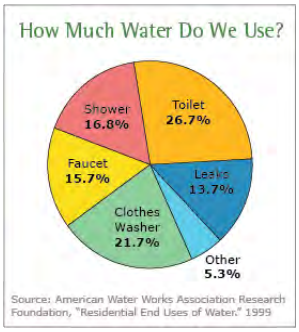
Category
Municipal.
Description
Irrigation technology is the promotion and installation of irrigation technology for automatic systems typically in residential or small landscape situations. These technologies can include inexpensive rain shutoff switches that can be added to irrigation controllers and weather-based irrigation system controllers that are becoming more affordable for residential and small landscape uses.
Water Savings
High – The reduction in water use from the implementation of water-efficient irrigation technologies can be as much as 50%. Accurate programming and design is critical to the effectiveness.
Cost
Medium – The cost of irrigation technology varies, since rain shutoff switches are inexpensive, but advanced smart controllers can be very expensive.
Schedule
The schedule for this BMP varies according to the implementation. But up to 5 years is usually effective.

BMP MU8—Green Business Program

Photo courtesy of EPA.

Category
Municipal.
Description
Green business programs are the development of new or promotion of existing green business programs. The intent is to highlight individual business that have implemented green business practices, such as energy and water efficiency above and beyond existing requirements, such as the U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) programs, and others.
Water Savings
Medium – The water savings from green business programs vary depending on the emphasis of water efficiency. Most green business/building programs focus on energy, primarily.
Cost
Medium – The cost of qualifying for a green business program depends on the requirements. It can be high for existing buildings, but often not much additional cost for new buildings.
Schedule
The schedule for this BMP is typically 5 years to gain awareness and participation.

BMP MU9—Water Use Surveys



Photos courtesy of EPA.

Category
Municipal.
Description
Water use surveys include the development of water user assessment surveys to evaluate and benchmark opportunities for water efficiency improvements at individual customers. General surveys and materials can be developed for standardized users, while more customer specific audits must be performed for some commercial, hotel/motel/resorts, and large landscape users.
Water Savings
Low – The water savings from water use surveys do not generally create water savings on their own, but can increase uptake in other BMPs that can be promoted through the completion of a water use survey.
Cost
Low – The cost of water use surveys is usually low, especially if it is a voluntary self-assessment program.
Schedule
The schedule for this BMP should be 5 years for development of the water use surveys and participation by individual water customers.

BMP MU10—WaterSense Certified/Labeled Equipment

Photo courtesy of EPA.

Category
Municipal.
Description
WaterSense certified/labeled equipment is the promotion of the U.S. Environmental Protection Agency (EPA) WaterSense program, which includes the certification and labeling of water using fixtures and appliances that use 20% less water than existing requirements, and are quality performance tested.
Water Savings
High – The water savings from WaterSense products can be high. While the water savings is 20% from existing requirements, it can be as much as 70% from older, existing equipment, such as toilets.
Cost
Medium – The cost of WaterSense certified equipment is usually not higher than existing requirements, and there is a very large selection of labeled equipment in each category.
Schedule
The schedule for this BMP typically should be 3 to 4 years, if a requirement is developed, but promotion can begin immediately and continue for 5 to 10 years as the WaterSense program continues to expand.

BMP MI1—Install Meters at Users/Buildings

Photo courtesy of the Alliance for Water Efficiency.

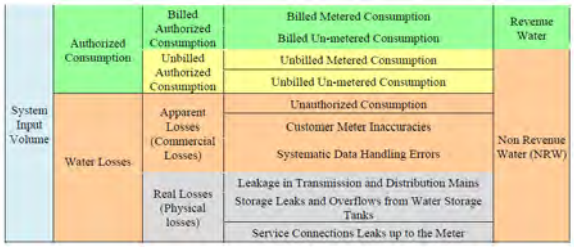
Category
Military.
Description
Install meters at users/buildings is a BMP to prioritize on-base military users and/or buildings to install water use meters to better track water usage. There should also be a monthly meter reading program, and if applicable, a reporting mechanism to the users/building tenants.
Water Savings
Medium – Depending on what is done with the meter readings, the water savings can be medium. If the meters are read regularly, and usage is provided to users/building tenants, they can see the effects of their water saving efforts over time. Volumetric billing of water use would also increase water savings.
Cost
High – The cost can be high to retrofit existing buildings with meters. The cost of installing them on new buildings is low.
Schedule
The schedule for this BMP is for military installations to set annual targets for meter installations, as well as specific buildings. Reporting on progress to meet 100% metered could take 5 to 10 years.

BMP MI2—Information and Education Programs

Photo courtesy of DOE.

Category
Military.
Description
Information and education programs are the preparation and dissemination of materials about water conservation and efficiency and reducing water waste and loss. These materials could include existing material being used at other military installations. Refer to FEMP BMP #2 for further information (CH2M HILL, 2002).
Water Savings
Medium – Depending on the amount of awareness and existing education, the water savings could be medium from this BMP. The savings from this BMP rely on extensive and diverse educational programs.
Cost
Low – The cost for this program mostly includes the preparation and production of educational materials to be displayed throughout the military installations. Most of the information can be adapted from existing materials.
Schedule
The schedule for this BMP should be that materials be installed within 1 year and maintained and rotated for up to 5 years.

BMP MI3—Distribution System Audits, Leak Detection, and Repair



Photos courtesy of EPA.

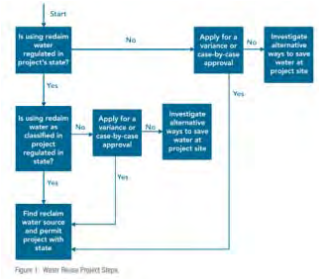
Category
Military.
Description
Distribution system audits, leak detection, and repair is the identification and reduction of leaks and other water losses and performing an audit according to industry standard methodology. The industry standard is the IWA/AWWA Water Audit Methodology as outlined in the *AWWA M36 Manual, Water Audits and Loss Control Programs* (AWWA, 2009). Refer to FEMP BMP #3 (CH2M HILL, 2002) for further information.
Water Savings
High – The water savings from this BMP can be high, depending on the existing level of water system leakage.
Cost
Medium – After completing a water loss audit, leak detection and repair activities can be selected to achieve payback and cost-effectiveness.
Schedule
The schedule for this BMP would be that military installations would conduct their initial annual audits within 1 year, and commence leak detection and repair efforts annually.

BMP MI4—Water Efficient Fixtures

Photos courtesy of EPA.

Category
Military.
Description
This BMP is the use of more water efficient fixtures in new buildings, and the retrofitting of equipment into existing buildings to reduce water use. These fixtures may include 1-pint urinals, WaterSense toilets, faucets, showerheads, efficient commercial toilet flush valves, and others. Another source of information for this is the FEMP and SPiRiT to LEED transition program. Refer to FEMP BMPs #6 and #7 (CH2M HILL, 2002) for further information.
Water Savings
High – The water savings from water efficient fixtures can be high, especially if retrofitting older, high water using fixtures.
Cost
Medium – The cost of retrofitting can be calculated and payback determined, but generally is medium.
Schedule
The schedule for this BMP includes identification of buildings in year 1, and replacement in years 2 through 5.

BMP MI5—Look for Opportunities to Reuse or Recycle Water; Alternate Water Sources



Photos courtesy of DOE.

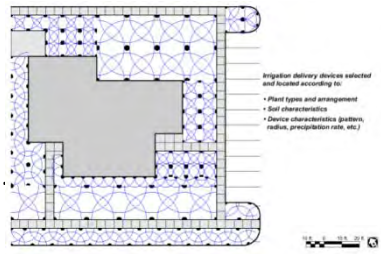
Category
Military.
Description
This BMP is the practice of identifying opportunities to reuse or recycle water, or use alternate water sources for the original purpose. This could be identifying water uses that could be either substituted with reuse or alternate supplies, or where the water could be captured and reused for another water use. Refer to FEMP BMP #14 for further information (CH2M HILL, 2002).
Water Savings
High – The water savings from water reuse can be very high, but only if replacing potable water use with an alternate water source, not creating a new use.
Cost
High – The cost of water reuse, especially highly treated wastewater is high because of the treatment and conveyance cost. Forms of gray water reuse can be less costly, because the source is closer to the use. Other alternate water source costs could vary depending on specific conditions.
Schedule
The schedule for this BMP includes inventory and feasibility study time in the first 2 years, and then up to 5 years for implementation and reporting.

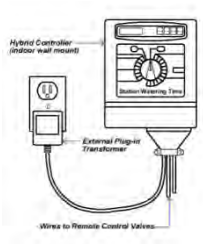
BMP MI6—Water-Efficient Landscaping

Photos courtesy of USAF.

Category
Military.
Description
Water-efficient landscaping is the use of landscaping practices that reduce irrigation water requirements. This includes the selection of plants and layout of the landscaping to reduce water requirements. Refer to FEMP BMP #4 for further information (CH2M HILL, 2002).
Water Savings
Medium – The water savings from water-efficient landscaping can be as much as 20% from traditional landscaping. The seven steps of Xeriscape™ can be used to calculate the savings.
Cost
Low – The cost of water efficient landscaping is not generally very high.
Schedule
The schedule for this BMP includes time for auditing, planning, and implementation, up to 5 years total.

BMP MI7—Water-Efficient Irrigation

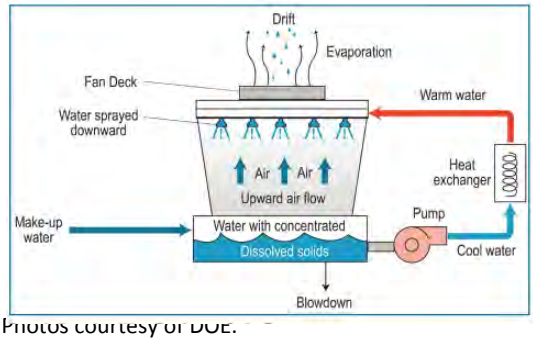




Photos courtesy of USAF.

Category
Military.
Description
Water-efficient irrigation is the assessment and replacement of automatic irrigation components with more water-efficient technologies, such as controller systems that use real-time weather or soil moisture input or efficient applications such as rotary heads or drip irrigation. Refer to FEMP BMP #5 for further information (CH2M HILL, 2002).
Water Savings
High – The reduction in water use from the implementation of water-efficient irrigation technologies can be as much as 50%. Accurate programming and design is critical to the effectiveness.
Cost
Medium – The cost of efficient irrigation systems is more than traditional equipment, but only if advanced technology is used.
Schedule
The schedule for this BMP varies according to the implementation. But up to 5 years is usually effective.

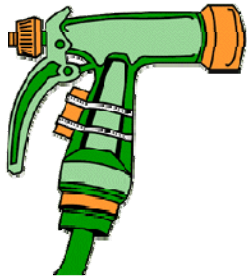
BMP MI8—Cooling Tower Management



Photos courtesy of DOE.

Category
Military.
Description
Cooling tower management is the proactive maintenance and management of cooling towers to reduce leaks and water use. The water consumption of a cooling tower can be reduced by increasing the cycles of concentration, or amount of time the water is cycled through before being replaced with fresh water. Refer to FEMP BMP #10 for further information (CH2M HILL, 2002).
Water Savings
Medium – The water savings from cooling tower management can vary depending on existing conditions, but could be medium.
Cost
Medium – The cost of implementing this program is not excessive, especially if an existing maintenance program can be enhanced to include water efficiency of cooling towers.
Schedule
The schedule for this BMP is typically 2 to 5 years to assess all existing cooling towers.

BMP MI9—Use a Bucket and Hose with Spray Nozzle When Washing Vehicles



Photos courtesy of EPA.

Category
Military.
Description
This BMP is intended to promote the use of spray nozzles on hoses when washing vehicles, to prevent wasted water when not initially wetting or rinsing the vehicle during the wash process.
Water Savings
Medium – The water savings from this BMP occur if there is no use of spray nozzles currently. The water saved by using a spray nozzle, instead of letting the water run on the ground is as much as 50%.
Cost
Low – The cost of spray nozzles and buckets for washing vehicles is low.
Schedule
The schedule for this BMP should be full implementation in the first year, and then maintenance and progress for the next 2 to 4 years.

BMP MI10—Maintenance Program to Repair Clogged Line/Valves/Meters and Check All Valves, Pressure-Reducing Valves, and Meters in the Water System

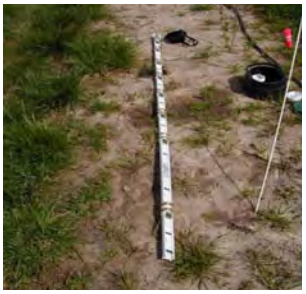
Photos courtesy of EPA.

Category
Military.
Description
This BMP is to perform maintenance on the water system to prevent leaks and interruptions in operation. The intent is to be proactive rather than reactive, and develop a maintenance program to systematically check the components of the water system.
Water Savings
Low – The water savings from this BMP are related to preventing malfunctions of water system devices.
Cost
Medium – The cost of maintaining water system components involves enhancement of existing maintenance programs to include additional items.
Schedule
The schedule for this BMP should include the development of maintenance plans in year 1, and implementation and reporting in years 2 through 5.

BMP AG1—Volumetric Measurement of Irrigation Water Use

Category
Agriculture (Water Users and Water Purveyors).
Description
Volumetric measurement of irrigation water use is the first step in providing the data necessary to assess water use efficiency. This BMP includes the volumetric flow measurement at main diversion points from surface or groundwater and volumetric flow measurement at field diversions from main irrigation delivery systems. Volumetric measurement at main diversion and delivery points can provide the data needed to assess irrigation distribution efficiency and to identify potential irrigation water conservation projects. Volumetric measurement at all field diversions from the main delivery systems can be used further to assess water use efficiency at the field scale and can also be used as the basis for volumetric billing rate schedules to provide economic incentives for water conservation.
Water Savings
High – Flow measurement aids in identifying and eliminating leaks and other sources of water loss.
Cost
Moderate – Costs depend upon the size and type of the conveyance facility and whether convenient points of measurement (e.g., weirs and other water control structures, pipe manifolds, etc.) already exist. Incentive funding is available from NRCS through EQIP for eligible landowners.
Schedule
This BMP can be implemented quickly (within 1 year) for willing participants. However, developing a wide-reaching education outreach program and achieving wide-spread adoption could take more time to develop (5 to 10 years).

BMP AG2—Climate and Soil Moisture Based Irrigation Scheduling



Photos courtesy of U.S. Bureau of Reclamation.

Category
Agriculture (Water Users).
Description
Climate and soil moisture based scheduling is the use of real-time climate and soil moisture data to adjust irrigation schedules. Data from weather stations that measure precipitation and evapotranspiration calculation variables (solar radiation, wind speed, air temperature, and relative humidity) can be coupled with irrigation scheduling procedures to adjust operations in response to climatic demands. Use of direct soil moisture monitoring, coupled with climate input for irrigation scheduling and forecasting is the most effective method for optimizing irrigation applications to satisfy crop water requirements without excess water delivery.
Water Savings
High – Use of scientific methods for irrigation scheduling with at least weekly schedule adjustments can significantly reduce water use.
Cost
Low to Moderate – The equipment costs of a rain gauge and soil moisture sensor (starting at $50 each) as the minimum equipment and the cost of adjusting irrigation schedules are low. However, capital and operation and maintenance (O&M) costs for accurate weather stations suitable for irrigation scheduling can be moderate in cost. Depending upon the implementation approaches, costs could include education and outreach programs, incentive payments to encourage adoption, and/or the cost to develop a statewide network of climate data stations and web-based data dissemination system. Incentive funding is available from the Natural Resources Conservation Service (NRCS) through the Environmental Quality Incentives Program (EQIP) for eligible landowners.
Schedule
This BMP can be implemented quickly (within 1 year) for willing participants. However, developing a wide-reaching education outreach program, developing a statewide climate data network, and achieving wide-spread adoption could take more time to develop (could be achieved within 5 years with adequate funding).

BMP AG3—On-Farm Irrigation Audits and Water Management Plans

Photo courtesy of USDA NRCS.

Category
Agriculture (Water Users).
Description
Irrigation systems often degrade in performance over time as equipment wears out, repairs are made with mismatched replacement components, and as crops or irrigation areas are changed. Irrigation operations that do not follow a plan for adjusting water applications to meet varying water demands throughout the irrigation season also presents an opportunity for water conservation. Regularly scheduled irrigation system audits are a good way to assess the performance of an irrigation system against industry benchmarks and design standards and to create a punch list of repairs or upgrades that may be needed to correct performance problems. Development and adherence to an irrigation water management plan (IWMP) that considers climate, cropping, water supply and labor limitations is probably the single best way to improve irrigation water use efficiency at the farm scale.
Water Savings
High – Elimination of leaks, improvement of distribution uniformity, and following an IWMP can significantly reduce irrigation water usage.
Cost
Low – The equipment costs for fixing leaks and replacing worn nozzles is low and the cost of technical assistance to complete audits and prepare IWMPs is also relative low. Incentive funding is available from NRCS through EQIP for eligible landowners.
Schedule
This BMP can be implemented quickly (within 1 year) for willing participants. However, developing a wide-reaching education outreach program and achieving wide-spread adoption could take more time to develop (could be achieved within 5 years with adequate funding).

BMP AG4—Upgrade of On-Farm Systems to Higher Efficiency Systems

Row crop photos courtesy of USDA NRCS.

Category
Agriculture (Water Users).
Description
Installation and operation of high efficiency on-farm systems (sprinkler, micro-spray, drip) can be effective in reducing irrigation water use in comparison to flood and older or low-technology sprinkler systems.
Water Savings
Moderate to High – The amount of water savings depends upon the original and converted on-farm irrigation application system.
Cost
Moderate – Costs depend upon the existing infrastructure that is usable for the converted system and the type of converted system selected and can range from approximately $1,000 to $10,000 per acre. Incentive funding is available from NRCS through EQIP for eligible landowners.
Schedule
This BMP can be implemented quickly (within 2 years) for willing participants. Implementation includes planning and design and then construction outside of the peak irrigation season for established crops.

BMP AG5—Crop Residue Management, Conservation Tillage, and Terracing for Improved Rainfall Capture on Irrigated Lands

Photo courtesy of USDA NRCS.

Category
Agriculture (Water Users).
Description
Surface soil compaction of crop and grazing lands and steep slopes can result in rainfall runoff that reduces the effectiveness of rainfall in satisfying crop water demands. Exposed bare soils following traditional tillage also increase surface evaporation rates relative to mulched surfaces. These conditions result in the need for additional supplemental irrigation and/or reduced crop or rangeland production. Conservation tillage, crop residue management, rotational grazing programs, and terracing of steep slopes can be used to maintain proper surface infiltration, reduce evaporation losses, and improve rainfall capture.
Water Savings
Low to Moderate – The amount of water savings depends upon the existing soil conditions and cropping system and the future improvements.
Cost
Low – Costs depend upon the type of activities and whether any special farming equipment is necessary.
Schedule
This BMP can be implemented quickly (within 1 year) for willing participants. Conservation tillage operations that require special tillage or planting equipment may take longer.

BMP AG6—Lining and Piping of Irrigation Canals

Category
Agriculture (Water Purveyors).
Description
Leakage from unlined irrigation canals can be significantly reduced through projects to install liners that reduce canal seepage or projects that replace canals with enclosed conduits (piping). Piping of canals can have the added benefit of capturing energy that can be harnessed for hydroelectric projects or to reduce irrigation pumping energy requirements.
Water Savings
Moderate to High – The amount of water savings depends upon the existing soil conditions controlling seepage losses and canal operations controlling operational spills in the case of canal piping projects.
Cost
High – Costs depend upon the type of facilities installed. With pressurization from canal piping projects, there is potential to reduce pumping energy or to generate energy through hydroelectric generators.
Schedule
Implementation of this BMP requires planning, design, and construction coordinated outside of the period for peak water deliveries. Typical implementation time is at least 2 years from initial planning to project completion.

BMP AG7—Lining of Earthen Impoundment Embankments

Category
Agriculture (Water Purveyors).
Description
Lining of earthen impoundment embankments can be used to reduce the amount of seepage and water loss through those embankments. This measure can have the added benefit of increased safety and risk/liability reduction for water impoundments.
Water Savings
Moderate to High – The amount of water savings depends upon the existing soil conditions controlling seepage losses at the reservoir site.
Cost
High – Costs depend upon the size of embankment, type of liner, and remoteness of the site.
Schedule
Implementation of this BMP requires planning, design, and construction coordinated outside of the period for peak water deliveries. Typical implementation time is at least 2 years from initial planning to project completion.

BMP AG8—Rehabilitation of Aging and Leaking Pipes, Flumes, Gates, Structures, Impoundments

Category
Agriculture (Water Purveyors).
Description
Many of the major irrigation systems in Hawaii were originally constructed more than 50 years ago. Repair and/or replacement of aging and leaking pipes, flumes, gates, structures, and impoundments can significantly reduce water losses. These measures can have the added benefit of increased safety and risk/liability reduction for irrigation distribution systems.
Water Savings
Moderate to High – The amount of water savings depends upon the existing infrastructure conditions and the amount of leakage under current conditions.
Cost
Moderate to High – Costs depend upon the facility being improved. Replacement of aged infrastructure will generally be higher initial cost than repair and/or lining of existing facility components.
Schedule
Implementation of this BMP requires planning, design, and construction coordinated outside of the period for peak water deliveries. Typical implementation time is at least 2 years from initial planning to project completion.

BMP AG9—Water Control Structure Automation

Category
Agriculture (Water Purveyors).
Description
Controlling and matching water deliveries to water demands through open channel conveyance systems is a difficult task. Reductions in water demands or increases in water levels at main diversions often result in operational spills from canal systems. Installing automated water control structures that respond to upstream or downstream water levels or respond to operational inputs from remote controls can significantly reduce operational spills. This BMP does not require comprehensive system control as described in the BMP for centralized canal supervisory control and data acquisition (SCADA), but can rely just on local control.
Water Savings
Moderate to High – The amount of water savings depends upon the control structure operations and the amount of water level fluctuation under current conditions.
Cost
Moderate to High – Costs depend upon the whether the existing water control structures can be automated or need replacement to allow automation.
Schedule
Implementation of this BMP requires planning, design, and construction coordinated outside of the period for peak water deliveries. Typical implementation time is at least 2 years from initial planning to project completion.

BMP AG10—Centralized Canal Supervisory Control and Data Acquisition Systems

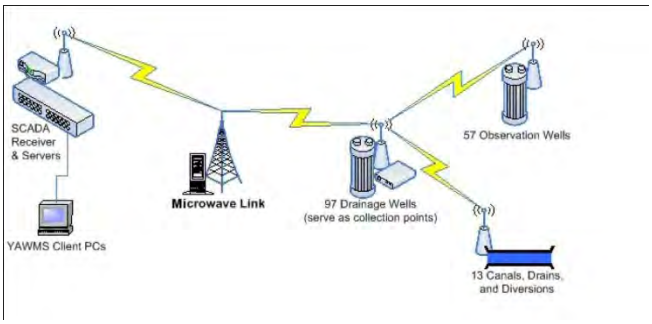


Photo courtesy of U.S. Bureau of Reclamation.

Category
Agriculture (Water Purveyors).
Description
Many large irrigation systems in Hawaii span wide areas from main diversion points out to farm turnouts at the ends of the delivery system. Main water control points in the systems are also often in remote locations that can be time consuming to access. Use of centralized SCADA systems coordinated with remote communications (radio or satellite) can be a powerful tool in allowing an irrigation system manager to remotely monitor flows in various sections of the system and to adjust water control structures to match water deliveries to water demands. These systems provide the added benefit of increased safety and risk/liability reduction for irrigation distribution systems.
Water Savings
High – The amount of water savings depends upon the control structure operations and the amount of system supply/demand imbalance under current conditions.
Cost
High – Costs depend upon the level of water control automation versus remote monitoring of levels/flows that are desired and the communication protocols (radio, satellite, etc.) that are feasible for the site conditions.
Schedule
Implementation of this BMP requires planning, design, and construction coordinated outside of the period for peak water deliveries. Typical implementation time is at least 2 years from initial planning to project completion.

BMP GC1—Use of Qualified Irrigation Designers and Contractors

Category
Golf Course.
Description
Water efficient irrigation systems start with proper design, installation, and post-construction documentation (as-built drawings and O&M recommendations). Use of qualified and experienced designers and contractors is the best way to ensure a water efficient irrigation system.
Water Savings
Moderate to High – The amount of water savings depends upon the differential water use efficiency of poorly and well designed/constructed systems.
Cost
Low – Mostly administrative.
Schedule
Implementation of the registry could be completed within 1 year.

BMP GC2—Onsite Weather Station and Climate Based Scheduling

Category
Golf Course.
Description
Climate based scheduling is the use of real-time climate data to adjust irrigation schedules. Data from onsite weather stations that measure precipitation and evapotranspiration calculation variables (solar radiation, wind speed, air temperature, and relative humidity) are coupled with irrigation scheduling procedures to adjust operations in response to climatic demands. Use of an onsite weather station is especially important in Hawaii where precipitation gradients can be extreme over short distances.
Water Savings
High - Use of scientific methods for irrigation scheduling with at least weekly schedule adjustments can significantly reduce water use.
Cost
Moderate – Costs depend upon the type of station selected and the communication protocols (radio, direct wire, etc.) that are used for relaying data to the irrigation manager.
Schedule
Implementation of onsite weather stations and developing irrigation scheduling procedures to utilize the data for irrigation operations can be completed within 1 year.

BMP GC3—Daily Inspection and Repairs

Category
Golf Course.
Description
Maintaining good operating conditions of an irrigation system through daily inspection and repairs is an important part of conserving water. This involves inspecting and repairing broken, malfunctioning, or leaking pipes, valves, fittings, and sprinklers. It also involves inspection and correction of over-irrigation in areas of poor drainage.
Water Savings
High – The amount of water savings from repairing just a couple of leaks or malfunctioning sprinklers can be large.
Cost
Low – This is a standard duty of site maintenance personnel.
Schedule
Implementation of this BMP is continuous.

BMP GC4—Regularly Scheduled Irrigation System Audits

Category
Golf Course.
Description
Irrigation systems often degrade in performance over time as equipment wears out, repairs are made with mismatched replacement components, and as landscape areas are changed. Regularly scheduled irrigation system audits are a good way to assess the performance of an irrigation system against industry benchmarks and design standards and to create a punch list of repairs or upgrades that may be needed to correct performance problems. An irrigation audit can also be used to accurately measure precipitation rates and distribution uniformity and develop irrigation scheduling recommendations based upon system performance. Guidelines for performing irrigation audits on golf courses are available through the Irrigation Association. Certification for golf irrigation auditors is also available through the Irrigation Association.
Water Savings
Moderate to High – The amount of water savings depends upon the current condition of the irrigation system.
Cost
Low – No equipment necessary. The cost is for outside services by qualified auditors.
Schedule
A system-wide audit can be completed in approximately a week and is recommended annually.

BMP GC5—Aeration of High Traffic Areas for Improved Infiltration

Category
Golf Course.
Description
In heavily trafficked areas of golf courses, surface soil compaction can reduce infiltration rates and can result in increased surface runoff and lower irrigation efficiency. Regular aeration programs can be used to alleviate surface compaction with the additional benefits of improving turf quality and playability.
Water Savings
Moderate – The amount of water savings depends upon soil conditions and irrigation system coverage over high traffic areas.
Cost
Low – Usually a standard part of golf course turf maintenance.
Schedule
Implementation of this BMP is continuous.

BMP GC6—Centralized Irrigation System Control

Category
Golf Course.
Description
Centralized irrigation system control provides greater flexibility in changing schedules to match water demands and to coordinate the rotation of irrigation run times around the system. With this control comes increased opportunity to fine-tune and change irrigation schedules to conserve water.
Water Savings
High – The amount of water savings depends upon the level of control under current conditions.
Cost
Moderate to High – Costs for upgrades depend upon the level of control and automation under current conditions (e.g., fully manual to fully automated with centralized control versus partially automated to fully automated with centralized control).
Schedule
Implementation of this BMP requires planning, design, and construction. Typical implementation time is about 1 year from initial planning to project completion.

BMP GC7—Multiple Flow Meters in Distribution System for Leak Detection

Category
Golf Course.
Description
In addition to main water source flow meters, installing flow meters on different zones or regions within an irrigation system can aid in the detection and repair of leaks. A methodology to estimate the scheduled and expected delivery volumes is also needed for comparison to metered flow records. These procedures can be automated to set leak alarms when coupled with a centralized irrigation control system.
Water Savings
Moderate – The amount of water savings from repairing just a couple of leaks or malfunctioning sprinklers can be large.
Cost
Moderate – Costs depend upon the number of meters installed and the communication protocols (radio, direct wire, etc.) that are feasible for the site conditions.
Schedule
Implementation of this BMP requires planning, design, and construction coordinated outside of the period for peak water deliveries. Typical implementation time is 1 year from initial planning to project completion.

BMP GC8—Drip Systems for Trees/Shrubs

Category
Golf Course.
Description
In tree and shrub landscaping areas, sprinkler systems can be replaced with drip or micro irrigation systems to deliver the required amount of water directly to plant root systems without overwatering adjacent areas.
Water Savings
Moderate – The amount of water savings depends upon the density of the tree/shrub plantings and corresponding ability to reduce the wetted area density with micro irrigation.
Cost
Moderate – Costs may include re-piping spray irrigation zones for micro irrigation.
Schedule
Implementation of this BMP requires planning, design, and construction coordinated outside of the period for peak water deliveries. Typical implementation time is about 1 year from initial planning to project completion.

BMP GC9—Replacing Non-Play Turf Areas with Xeriscaping

Category
Golf Course.
Description
Water efficient landscape design and plant selection can significantly reduce irrigation water requirements in comparison to turf areas. Turf areas outside of normal play are good candidates for conversion to xeriscaping. Redesign and independent scheduling of irrigation systems serving these areas is also needed.
Water Savings
High – Some xeriscape planting may be sustained without irrigation. Others may be sustained with minimal micro irrigation.
Cost
High – Costs include turf removal and new landscape plantings along with redesigned micro irrigation systems to serve new plantings.
Schedule
Implementation of this BMP requires planning, design, and construction. Typical implementation time is about 1 year from initial planning to project completion.

BMP GC10—Use of Non-Potable Water Sources

Category
Golf Course.
Description
Use of non-potable water sources can help to reduce demand pressures on potable water supplies. However, efficient use of all water sources including non-potable water is still important for wise stewardship of Hawaii's water resources. In Hawaii, non-potable water sources might include reclaimed municipal or industrial wastewater or brackish groundwater. Specific requirements for use and public contact may depend upon the level of treatment provided. A salinity management plan is also advised for the use of brackish water sources.
Water Savings
High – There may be no saving in total water use and sometimes there could be an increase in use to manage salinity. However, when considering the savings of otherwise potable quality water reserved for other uses and the utilization of non-potable water that would otherwise be discharged to the ocean, the savings are 1-for-1.
Cost
High – The primary costs are the treatment and distribution/conveyance of non-potable water to the place of use.
Schedule
Implementation of this BMP requires planning, permitting, design, and construction. Typical implementation time is at least 2 years from initial planning to project completion.