

**PROTOTYPE WATER CONSERVATION PLAN
FOR THE
DEPARTMENT OF LAND AND NATURAL RESOURCES
(DLNR)**



*Prepared for:
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawaii*

February 2005

FUKUNAGA AND ASSOCIATES, INC.

Consulting Engineers

1388 Kapiolani Boulevard, Second Floor

Honolulu, Hawaii 96814

(808) 944-1821

**PROTOTYPE WATER CONSERVATION PLAN
FOR THE
DEPARTMENT OF LAND AND NATURAL RESOURCES
(DLNR)**



Prepared for:
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawaii

February 2005

FUKUNAGA AND ASSOCIATES, INC.

Consulting Engineers

1388 Kapiolani Boulevard, Second Floor

Honolulu, Hawaii 96814

(808) 944-1821

TABLE OF CONTENTS

	<u>Page</u>
1. OVERVIEW	1-1
1.1. Hawaii's Physical Environment	1-1
1.2. Hawaii's Water Resource Challenges	1-2
2. PROJECT BACKGROUND	2-1
2.1. Bureau of Reclamation	2-1
2.2. BOR Water Conservation Field Services Program	2-1
2.3. Scoping of the DLNR Water Conservation Plan	2-2
2.3.1. BOR 9-Step Management Plan Format	2-2
2.3.2. Proposed Modifications to the BOR 9-Step Management Plan Format	2-4
3. PLAN APPROACH	3-1
3.1. Phase 1 – Description of Agency (DLNR)	3-1
3.2. Phase 2 – Inventory of Water Use Characteristics (Survey)	3-1
3.3. Phase 3 – Selected DLNR Facilities for Pilot Water Conservation Plan	3-1
3.4. Phase 4 – Development of Prototype Water Conservation Programs	3-3
3.5. Phase 5 – Summary and Recommendations	3-3
4. PHASE 1 – BACKGROUND INFORMATION ON THE DEPARTMENT OF LAND AND NATURAL RESOURCES	4-1
4.1. Background	4-1
4.2. Description of Boards and Commissions Attached to DLNR – State of Hawaii	4-2
4.2.1. Board of Land and Natural Resources	4-2
4.2.2. Commission on Water Resource Management	4-2
4.2.3. Kahoolawe Island Reserve Commission	4-4
4.3. Description of Advisory Boards, Commissions, Committees, and Councils Attached to DLNR – State of Hawaii	4-4
4.3.1. Animal Species Advisory Commission	4-4
4.3.2. Aquatic Life and Wildlife Advisory Committees	4-5
4.3.3. Endangered Species Recovery Committee	4-5
4.3.4. Hawaii Historic Places Review Board	4-5
4.3.5. Island Burial Councils	4-6
4.3.6. Kaneohe Bay Regional Council	4-6
4.3.7. Natural Area Reserves System Commission	4-7
4.4. Description of Divisions Attached to DLNR – State of Hawaii	4-7
4.4.1. Aquatic Resources Division	4-7
4.4.2. Division of Boating and Ocean Recreation	4-9
4.4.3. Bureau of Conveyances	4-11
4.4.4. Commission on Water Resource Management Staff	4-11
4.4.5. Division of Conservation and Resources Enforcement	4-13
4.4.6. Engineering Division	4-14
4.4.7. Division of Forestry and Wildlife	4-15
4.4.8. State Historic Preservation Division	4-17
4.4.9. Land Division	4-19

TABLE OF CONTENTS

	<u>Page</u>
4.4.10. Division of State Parks	4-21
4.4.11. Administrative Services Office	4-23
4.4.12. Office of the Chairperson	4-24
4.4.13. Office of Conservation and Coastal Lands	4-24
4.4.14. Office of Kahoolawe Island Reserve	4-24
4.4.15. Personnel Office	4-25
5. PRELIMINARY ASSESSMENT OF WATER USE CHARACTERISTICS	5-1
6. PHASE 2 – GENERAL INFORMATION SURVEY AND DATA GATHERING OF DLNR FACILITIES WATER USAGE	6-1
6.1. Survey Results	6-1
6.2. Comparison of Preliminary Assessment and Survey Results	6-2
7. PHASE 3 – SELECTED DLNR ACTIVITIES FOR PILOT WATER CONSERVATION PLAN	7-1
7.1. Evaluation of DLNR Facilities	7-1
7.2. Selection Criteria for Prototype DLNR Facilities	7-3
7.3. Screening of Prototype DLNR Facilities	7-4
7.4. Selection of Prototype DLNR Facilities	7-6
8. PHASE 4 – DEVELOPMENT OF PROTOTYPE WATER CONSERVATION PLAN	8-1
8.1. Conservation Plan Methodology	8-1
8.2. Conservation Plan Components	8-1
8.3. Prototype Facility – Kalanimoku State Office Building	8-6
8.3.1. Facility Water System Inventory	8-6
8.3.2. Existing Water Usage Characteristics and Historical Consumption Data	8-10
8.3.3. Assessment of Various Water Uses - Identification of Significant Uses	8-12
8.3.4. Applicable Water Conservation Measures	8-12
8.3.5. Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis	8-14
8.3.6. Kalanimoku State Office Building Conservation Plan	8-15
8.3.7. Conservation Plan Implementation Schedule	8-17
8.4. Prototype Facility – Kakaako Waterfront Park	8-18
8.4.1. Facility Water System Inventory	8-18
8.4.2. Existing Water Usage Characteristics and Historical Consumption Data	8-21
8.4.3. Assessment of Various Water Uses - Identification of Significant Uses	8-22
8.4.4. Applicable Water Conservation Measures	8-22
8.4.5. Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis	8-25
8.4.6. Kakaako Waterfront Park Conservation Plan	8-26
8.4.7. Conservation Plan Implementation Schedule	8-28
8.5. Prototype Facility – Ala Wai Small Boat Harbor	8-29
8.5.1. Facility Water System Inventory	8-29

TABLE OF CONTENTS

	<u>Page</u>
8.5.2. Existing Water Usage Characteristics and Historical Consumption Data	8-35
8.5.3. Assessment of Various Water Uses – Identification of Significant Uses	8-37
8.5.4. Applicable Water Conservation Measures	8-37
8.5.5. Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis	8-38
8.5.6. Ala Wai Small Boat Harbor Conservation Plan	8-40
8.5.7. Conservation Plan Implementation Schedule	8-42
8.6. Prototype Facility – Honokohau Small Boat Harbor	8-43
8.6.1. Facility Water System Inventory	8-43
8.6.2. Existing Water Usage Characteristics and Historical Consumption Data	8-48
8.6.3. Assessment of Various Water Uses – Identification of Significant Uses	8-49
8.6.4. Applicable Water Conservation Measures	8-49
8.6.5. Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis	8-51
8.6.6. Honokohau Small Boat Harbor Conservation Plan	8-53
8.6.7. Conservation Plan Implementation Schedule	8-55
8.7. Prototype Facility – DOFAW Hilo Baseyard	8-56
8.7.1. Facility Water System Inventory	8-56
8.7.2. Existing Water Usage Characteristics and Historical Consumption Data	8-60
8.7.3. Assessment of Various Water Uses – Identification of Significant Uses	8-62
8.7.4. Applicable Water Conservation Measures	8-62
8.7.5. Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis	8-63
8.7.6. DOFAW Hilo Baseyard Conservation Plan	8-65
8.7.7. Conservation Plan Implementation Schedule	8-66
9. PHASE 5 – SUMMARY AND RECOMMENDATIONS	9-1
9.1. DLNR Water Conservation Plan – Summary of Results	9-1
9.2. DLNR Water Conservation Plan – Findings/Conclusions	9-4
9.3. Framework for the Expansion of the Water Conservation Plan	9-8

TABLE OF CONTENTS

	<u>Page</u>	
<u>LIST OF FIGURES</u>		
3-1	Modified BOR 9-Step Management Plan Format	3-2
4-1	Department of Land and Natural Resources - Organizational Chart	4-3
7-1	General Location Map - Prototype Facilities, Oahu	7-7
7-2	General Location Map - Prototype Facilities, Hawaii	7-8
7-3	Prototype Facility Vicinity Map - Kalanimoku State Office Building	7-9
7-4	Prototype Facility Vicinity Map - Kakaako Waterfront Park	7-10
7-5	Prototype Facility Vicinity Map - Ala Wai Boat Harbor	7-11
7-6	Prototype Facility Vicinity Map - Honokohau Small Boat Harbor	7-13
7-7	Prototype Facility Vicinity Map - DOFAW - Hilo Baseyard	7-14
8-1	Conservation Plan Methodology Flow Chart	8-2
8-2	Photos of the Kalanimoku State Office Building	8-7
8-3	Photos of Kalanimoku State Office Building - Existing Plumbing Fixtures	8-9
8-4	Average Water Use Per Day for each monthly period	8-11
8-5	Photos of the Kakaako Waterfront Park	8-19
8-6	Photos of Kakaako Waterfront Park - Existing Plumbing Fixtures	8-20
8-7	Average Daily Water Use per monthly period	8-23
8-8	Site Plan - Ala Wai Boat Harbor	8-30
8-9	Photos of the Ala Wai Small Boat Harbor	8-31
8-10	Photos of the Ala Wai Boat Harbor - Existing Plumbing Fixtures	8-32
8-11	Average Water Use Per Day for each monthly period	8-36
8-12	Site Plan - Honokohau Small Boat Harbor	8-44
8-13	Photos of the Honokohau Small Boat Harbor	8-45
8-14	Photos of the Honokohau Small Boat Harbor - Existing Plumbing Fixtures	8-46
8-15	Average Water Use Per Day for each monthly period	8-50
8-16	Photos of the DOFAW Hilo Baseyard	8-57
8-17	Photos of the DOFAW Hilo Baseyard – Existing Plumbing Fixtures	8-59
8-18	Average Water Use Per Day for each monthly period	8-61

LIST OF TABLES

5-1	Average Monthly Water Cost by Division	5-2
5-2	Facility Count	5-2
6-1	Summary of Survey Responses Received	6-2
6-2	DLNR Water Conservation Survey Results Summary Table	6-3,6-4
6-3	Preliminary Assessment vs. Survey Information Water Demands	6-5
8-1	Kalanimoku Building – Plumbing Fixture Unit Count	8-8
8-2	Water Conservation Measures and Devices – Kalanimoku State Office Building	8-12
8-3	Projected Water Conservation Plan Implementation Cost for the Kalanimoku Building	8-14
8-4	Projected Water Conservation for the Kalanimoku State Office Building (Domestic Water Consumption)	8-16
8-5	Kakaako Waterfront Park - Plumbing Fixture Unit Count	8-18
8-6	Water Conservation Measures and Devices - Kakaako Waterfront Park	8-24

TABLE OF CONTENTS

	<u>Page</u>
8-7 Projected Water Conservation Plan Implementation Cost for the Kakaako Waterfront Park	8-25
8-8 Projected Water Conservation for the Kakaako Waterfront Park (Domestic Water Consumption)	8-27
8-9 Ala Wai Small Boat Harbor (Comfort Stations) – Plumbing Fixture Unit Count	8-33
8-10 Ala Wai Small Boat Harbor (Hawaii Yacht Club) –Plumbing Fixture Unit Count	8-33
8-11 Ala Wai Small Boat Harbor (Fuel Dock Facility) – Plumbing Fixture Unit Count	8-34
8-12 Ala Wai Small Boat Harbor (Other Facilities not Metered) – Plumbing Fixture Unit Count	8-34
8-13 Water Conservation Measures and Devices – Ala Wai Small Boat Harbor	8-38
8-14 Projected Water Conservation Plan Implementation Cost for the Ala Wai Boat Harbor	8-39
8-15 Projected Water Conservation for the Ala Wai Small Boat Harbor	8-41
8-16 Honokohau Harbor (Comfort Stations & Harbor Office) – Plumbing Fixture Unit Count	8-47
8-17 Honokohau Harbor (Boat Washdown & Boat Slips) –Plumbing Fixture Unit Count	8-47
8-18 Water Conservation Measures and Devices – Honokohau Harbor	8-51
8-19 Projected Water Conservation Plan Implementation Cost for the Honokohau Small Boat Harbor	8-52
8-20 Projected Water Conservation for the Honokohau Small Boat Harbor	8-54
8-21 Hilo Baseyard – DOFAW Facilities Plumbing Fixture Unit Count	8-58
8-22 Hilo Baseyard – USDA Forest Services Facility - Plumbing Fixture Unit Count	8-58
8-23 Water Conservation Measures and Devices – DOFAW Hilo Baseyard	8-63
8-24 Projected Water Conservation Plan Implementation Cost (Domestic Use)	8-64
8-25 Projected Water Conservation for the DOFAW Hilo Baseyard	8-65
9-1 Cost Benefit Summary Table	9-2
9-2 DLNR Water Conservation Plan – Summary Table	9-3
9-3 Estimated Percentage of Water Savings per Year	9-7

APPENDICES

Appendix 1 – Department of Land and Natural Resources Water Billing Table

Appendix 2 – Sample Survey Letter & Survey Form

Appendix 3 – Listing of Surveys Sent and Responses

Appendix 4 – Survey Summary Sheets

Appendix 5 – How to Buy a Water-Saving Replacement Toilet, Replacement Urinal, Showerhead, and Faucet

Appendix 6 – Water Conservation Measures – Samples

Appendix 7 – Projected Water Conservation Breakdown for the Ala Wai Small Boat Harbor

ACKNOWLEDGEMENTS

On behalf of the Commission on Water Resource Management (CWRM) and the Department of Land and Natural Resources (DLNR), we would like to express our sincere gratitude to the following individuals/organizations for their contributions to the development of the DLNR Water Conservation Plan. We extend special appreciation and aloha to:

- Meghan Statts, Daniel Mersburg, Jeff Newton, Hilton Berido, Carol She, Eddie Chiu, Earl Omoto, and Wesley Choi
Division of Boating and Ocean Recreation
- Roger Imoto, Charles Labrador, Miles Nakahara, Alvin Kiyono, Fern Duvall, John Cumming, Randy Manaba, Derwin Kwon, and Pat Costales
Division of Forestry and Wildlife (DOFAW)
- Lawrence Terlep, Tarey Low, Randy Awo, and Bob Fernandez
Division of Conservation and Resources Enforcement
- Charlene Unoki and Jason Koga
Land Division
- Dan Quinn, Jon Sasaki, Donald Llanes, Wayne Souza, Philip Ohta, Dwayne DeOcampo, Keith Minn, Ernest Romero, Richard Llanos, and Benjamin Asuncion
Division of State Parks
- Chris Kempner
Hawaii Community Development Authority
- James Hisano and Lynette Courtney-Noa
Department of Accounting and General Services, Central Services Division
- Thelma Kimura and Susan Uyesugi
Honolulu Board of Water Supply
- Crestita Hudman
Hawaii County, Department of Water Supply
- Ben Miura
Department of Accounting and General Services, Division of Public Works
- John Johnson, Amy Porter, and Tina Mullis
U.S. Department of the Interior, Bureau of Reclamation

OVERVIEW

DEPARTMENT OF LAND AND NATURAL RESOURCES – WATER CONSERVATION PLAN

1 OVERVIEW

1.1 Hawaii's Physical Environment

The Hawaiian Island chain stretches 1,523 miles southeast to northwest from Cape Kumukahi, the easternmost point of the Island of Hawaii, to tiny Kure Atoll to the north. The State consists of eight major islands and 124 minor islands. Total land area of the State is 6,427 square miles, or about 4,112,112 acres, which ranks Hawaii 47th of the 50 states.

The oldest islands are those in the northwestern portion of the chain. The youngest island, Hawaii, is known for its active volcanoes: Mauna Loa and Mauna Kea are the highest peaks in the State, with elevations of 13,679 feet and 13,796 feet, respectively. Maui is famous for Haleakala Crater, and the State's highest waterfall, Kahiwa Waterfall, is located on Molokai where water cascades over a 1,750-foot drop. Oahu is known for the highly recognizable profile of Diamond Head Crater on Waikiki Beach. Kauai's scenic spots include Waimea Canyon and Mount Waialeale.

Hawaii is divided into four counties: Hawaii, Maui (which includes the islands of Maui, Molokai, Lanai, and Kahoolawe), Oahu, and Kauai (Kauai and Niihau islands). The county is the lowest civil subdivision in the State. In addition to municipal water supply, counties in Hawaii provide other services, such as wastewater, fire and police protection, road maintenance, etc., that are normally performed by cities or towns in other states. Each county also elects a mayor and a county council.

The Hawaiian Islands experience only moderate changes in temperature throughout the year due to the year-round warm sea surface temperatures that warm the overlying atmosphere. There are only two seasons: the average daytime summer temperature at sea level is 85 degrees Fahrenheit (°F) or 29.4 degrees Celsius (°C), while the average daytime winter temperature is 78°F (25.6°C). Nighttime temperatures are approximately 10°F lower than daytime temperatures.

Through most of the year, Hawaii's weather patterns are primarily affected by high pressure zones in the north Pacific that pump relatively cool, moist trade winds down onto the islands' northeastern slopes. Most of the rain falls in the mountains and valleys on the windward (northeastern) side of the islands. The wettest months are from November to March. Droughts have affected the Hawaiian Islands regularly.

Hawaii is approaching the limits of ground-water resource development in some parts of the State. On Oahu, there are 397 million gallons per day (mgd) of ground water available for use without affecting stream flows. Water allocations currently total about 332 mgd, leaving about 65 mgd unallocated. Oahu's water appetite grows about 2 to 3 mgd per year. This means that the remaining 65 mgd of ground water may be committed within 20 or 30 years, requiring the use of more expensive alternatives like reusing treated wastewater, treating surface water, and desalting brackish or ocean water.

Present estimates of water availability throughout the state are based on limited data. This problem becomes increasingly urgent as Hawaii approaches the limits of its ground-water resources. For example, on Molokai, water allocations were made based on an estimate of 7 mgd for a particular aquifer, of which the majority of the water has been either allocated or reserved. Recent estimates indicate that the aquifer may yield only 3 to 5 mgd. On Maui, the over pumping of the Iao aquifer has threatened the island's major aquifer. Certain aquifers in the State have reached levels that warrant closer monitoring and the implementation of management strategies to protect these aquifers from degradation due to over-withdrawal.

1.2 Hawaii's Water Resource Challenges

Being located in the middle of the Pacific Ocean, Hawaii is often thought of as a lush tropical paradise. However, the State of Hawaii experiences many of the same natural resource challenges as the continental United States, where increases in population and urban development result in increasing demands on the limited water resources of the State.

From 1999 to 2001, Hawaii's municipal water consumption increased by almost 3% with most of the increase occurring in the City and County of Honolulu. Because of the increasing demand for potable water, the four counties are taking steps to increase the use of reclaimed water and provide the appropriate infrastructure. In 1999, the use of reclaimed water totaled approximately 13% of the volume of municipal consumption, and this figure is expected to increase with the eventual implementation of planned and proposed reclamation and reuse projects. Hawaii is also examining the feasibility of ocean water desalination to augment the potable water supply.

Hawaii has historically experienced sustained periods of lower than average rainfall resulting in water use restrictions that have raised the awareness of our islands' limited water resources. Most recently, in August of 2003, the Governor of Hawaii issued a proclamation of statewide drought in Hawaii. The drought proclamation appropriately elevated statewide awareness of drought conditions and called for close coordination between the State and counties to overcome prolonged drought conditions. With the potential for continued statewide droughts, water conservation planning should be an integral component of Hawaii's overall water resource management efforts.

Within the State of Hawaii, there are several State and county agencies (e.g., State Department of Transportation and the County Water Departments), which currently implement various water conservation program measures. Private businesses and organizations (e.g., Hawaii Green Business Program) have also incorporated varying degrees of water conservation within their operations. However, despite these efforts the State of Hawaii presently lacks an overall statewide water conservation program to provide guidance to agencies and businesses lacking any conservation programs and to coordinate the various on-going water conservation efforts across the State.

The Department of Land and Natural Resources (DLNR) through the Commission on Water Resource Management (CWRM) has embarked on a mission to develop a prototype water conservation plan for DLNR with potential application to other State agencies. One of the key objectives of the DLNR Water Conservation Plan is to ultimately establish policies and procedures for a statewide conservation program. Our long-term goals include addressing both potable and non-potable water demands, identifying practical water conservation measures, and developing implementation schedules and budgets for application of appropriate water conservation measures throughout State government, and eventually the State of Hawaii.

PROJECT BACKGROUND

DEPARTMENT OF LAND AND NATURAL RESOURCES – WATER CONSERVATION PLAN

2 PROJECT BACKGROUND

2.1 Bureau of Reclamation

The Bureau of Reclamation (BOR) has provided significant assistance to the State of Hawaii beginning with the passage of the Act of August 23, 1954 authorizing the Secretary of the Interior to investigate water resources on the islands of Oahu, Molokai, and Hawaii. Most recently, BOR has provided both technical and funding assistance to several State and county agencies in support of emergency drought relief and drought mitigation planning, agricultural water resource planning, and wastewater reclamation and reuse.

The following list describes past and recent BOR assistance to Hawaii:

- In 2003, approximately \$180,000 was appropriated to the State of Hawaii for emergency drought relief for the islands of Oahu, Maui, and Molokai.
- In 2002, \$300,000 in funding (1:1 cost share) was provided to the Hawaii Department of Agriculture for preparation of the Hawaii Water Resources Study authorized under Title I of P.L. 106-566. In addition, \$50,000 was also provided to the CWRM for the updating of the Hawaii Drought Plan.
- In 2001, approximately \$210,000 in emergency drought assistance was provided for the islands of Oahu, Molokai, and Hawaii.
- In 2001, BOR also provided engineering and planning assistance to the Hawaii County Wastewater Division for the Kealakehe Demonstration Wetlands Project on the island of Hawaii.
- From 1998 through 2000, technical/planning assistance was provided to the State for drought mitigation planning and the development of the Hawaii Drought Plan, Phase 1.
- In 1955, BOR provided technical assistance for Molokai's Waikolu Irrigation System through a federal loan granted under the Small Reclamation Projects Act of 1956 and also provided technical assistance for Kauai's Kokee Irrigation Project under a cooperative agreement with the Hawaii Irrigation Authority.

2.2 BOR Water Conservation Field Services Program

The Water Conservation Field Services Program (WCFSP) was created by the BOR in 1997. The WCFSP is designed to: encourage water conservation; assist water agencies to develop and to implement effective water management and conservation plans; coordinate with state and other local conservation program efforts; and generally foster improved water management on a regional, statewide and watershed basis. Areas of emphasis include: water management planning, conservation education, demonstration of innovative technologies, and implementation of conservation measures.

As part of its efforts to facilitate statewide water conservation, the CWRM in 2003 received assistance from the BOR through its Water Conservation Field Services Program in the amount of \$50,000. The grant from BOR served as start-up funding for the DLNR Water Conservation Plan, which was designed to aid in departmental implementation of water conservation measures and the future development of a statewide framework for water conservation.

2.3 Scoping of the DLNR Water Conservation Plan

The primary objective of this project was to develop a prototype State Agency Water Conservation Program that could be applied to typical government institutional facilities throughout the State of Hawaii.

In addition to the funding assistance provided, the WCFSP also made available a “proven” water conservation plan development format that could be followed by the CWRM. The BOR’s Municipal and Irrigation (M&I) Conservation Plan Guidebook, which provides methods and measures aimed at helping to improve overall water management, gave guidance to the CWRM in the scoping of the DLNR Water Conservation Plan.

Municipal and irrigation uses that are under consideration as part of this planning effort include landscape irrigation, which may have some transferability to agricultural water systems. However, conservation planning for State agricultural water systems may need to proceed separately.

2.3.1 BOR 9-Step Management Plan Format

The Bureau of Reclamation’s M&I Conservation Plan Guidebook sets forth specific planning criteria to help districts prepare water conservation plans called for in Section 210 (b) of the Reclamation Reform Act. The BOR 9-Step Management Plan Format provides an outline and requirements for development of a water conservation management plan that lead to improved water management and conservation.

The BOR 9-Step Management Plan Format is briefly described as follows:

1. **Description of District** – Background information on district organization, facilities, and operations, which facilitate understanding of the opportunities and constraints that exist for water management improvements.
2. **Inventory of Water Resources and Water Budget** – Documentation of water resources inventory assembled in Step 1 of the planning process. The inventory of water resources considers the quantity and quality of water sources and the amounts and kinds of water uses within a District. It is recommended that such information be presented in the form of an overall water budget.

3. **Problems, Opportunities and Goals** – Description of the water management problems identified and the district’s water management goals. Establishment of defined goals with measurable objectives is fundamental to an effective water conservation program. Define goals in such a way as to allow achievement to be measured.
4. **Existing Water Management Measures and Programs** – Description of current and historic water management practices. Evaluate and identify how existing water management efforts have worked in relation to the District evaluation of problems, opportunities and goals. Provide a description of measures implemented previously and the results achieved.
5. **Evaluation of Fundamental Water Management Measures** – Evaluation of water management practices such as water measurement and accounting system designed to measure and account for the water conveyed through the District distribution system to water users, water pricing structure that encourage efficiency improvements by water users, information and education program for users designed to promote increased efficiency of water use, designation of a water conservation coordinator.
6. **Evaluation of Additional Water Management Measures** – Evaluation of additional potential water management measures that may be suitable for improved water use efficiency within the District. For these measures provide a brief explanation and summary of the evaluation process and tabulations of any quantitative data analyses conducted.
7. **Selected Measures and Projected Results** – Description of the elements that make up the water management plan that is adopted. The programs and measures to be implemented should be described in detail, as should the expected effects and implications of these programs and measures. Provide a description of how these measures will help to achieve the conservation goals and methods of monitoring results.
8. **Environmental Review** – Discuss the environmental issues that may arise from the water management measures under consideration. Identify and evaluate the potential for environmental effects (both positive and negative) of implementing the plan.
9. **Implementation Schedule and Budget** – Presentation of a detailed schedule for implementation of the plan and a description of the budget and financing that will be required. The schedule and budget should address both money and labor required to implement the plan.

2.3.2 Proposed Modifications to the BOR 9-Step Management Plan Format

The development of the prototype DLNR Water Conservation Plan required some modifications to the BOR 9-Step Management Plan format. The proposed modifications were presented to BOR staff and were subsequently approved for implementation by CWRM. The modified technical approach for the plan involved:

- Gathering water use information from DLNR facilities to establish water use profiles, to categorize facility types, and to project program results and potential measures of effectiveness.
- Applying the modified plan format to selected prototype facilities to identify issues and/or obstacles that may be expected if the program were to be expanded statewide.
- Identifying applicable water conservation measures for selected facilities.
- Projecting water conservation results and estimates of effectiveness.
- Estimating water conservation program implementation costs.

The DLNR Water Conservation Plan was designed to serve as a logical and practical first step towards a larger, more comprehensive State agency water conservation plan. The DLNR Water Conservation Plan is intended as a pilot program, studying selected facilities as models for the further development of a statewide conservation plan.

DLNR was selected as a functional prototype for other State government agencies because it has multiple facility types and water usages (e.g., office buildings, baseyards, harbors, municipal/irrigation demands, potable/non-potable water systems). The “lessons learned” from this study can thus be applied to the development of a more comprehensive conservation program for all State agencies.

3 PLAN APPROACH

As discussed previously, the DLNR Water Conservation Plan utilized a modified BOR 9-Step Management Plan format in an attempt to develop a program that could address issues relevant to government/institutional uses, as compared to a regional water district. The modified BOR format proposed for the DLNR Water Conservation Plan program consists of five (5) phases that incorporate the nine-step BOR format, see Figure 3-1. The five phases of the DLNR plan (and their corresponding BOR plan component) are described below:

3.1 Phase 1 – Description of Agency (DLNR)

Phase 1 involved a description of the organizational structure of the Department of Land and Natural Resources. Included are descriptions of the boards and commissions attached to DLNR and the overall structure and functions of the divisions within the department. Phase 1 also involved a preliminary assessment of water use quantities at various DLNR Facilities.

(Phase 1 of the modified BOR plan correlates to Step 1 – Description of District of the BOR 9-step plan.)

3.2 Phase 2 – Inventory of Water Use Characteristics (Survey)

Phase 2 entailed a survey of DLNR division facilities to obtain additional information on the quantity and character of water use. Phase 2 also included a comparison of the survey information and the preliminary review of DLNR’s water consumption/billing records (completed in Phase 1).

(Phase 2 of the modified BOR plan correlates to Step 2 – Inventory of Water Resources & Water Budget under the BOR 9-step plan.)

3.3 Phase 3 – Selected DLNR Facilities for Pilot Water Conservation Plan

Phase 3 involved the development of criteria for selection of prototype DLNR facilities and evaluation of existing water management measures. The selection criteria were based on the following priorities:

- Facilities that can serve as a common model for other typical State facilities that have similar water use characteristics.
- Potential for water use reduction with an emphasis on facilities with high water usage.
- Facilities with little or no water conservation measures in place.

Original BOR 9-Step Management Plan Format

MODIFIED BOR 9-STEP MANAGEMENT PLAN FORMAT

Action Plan

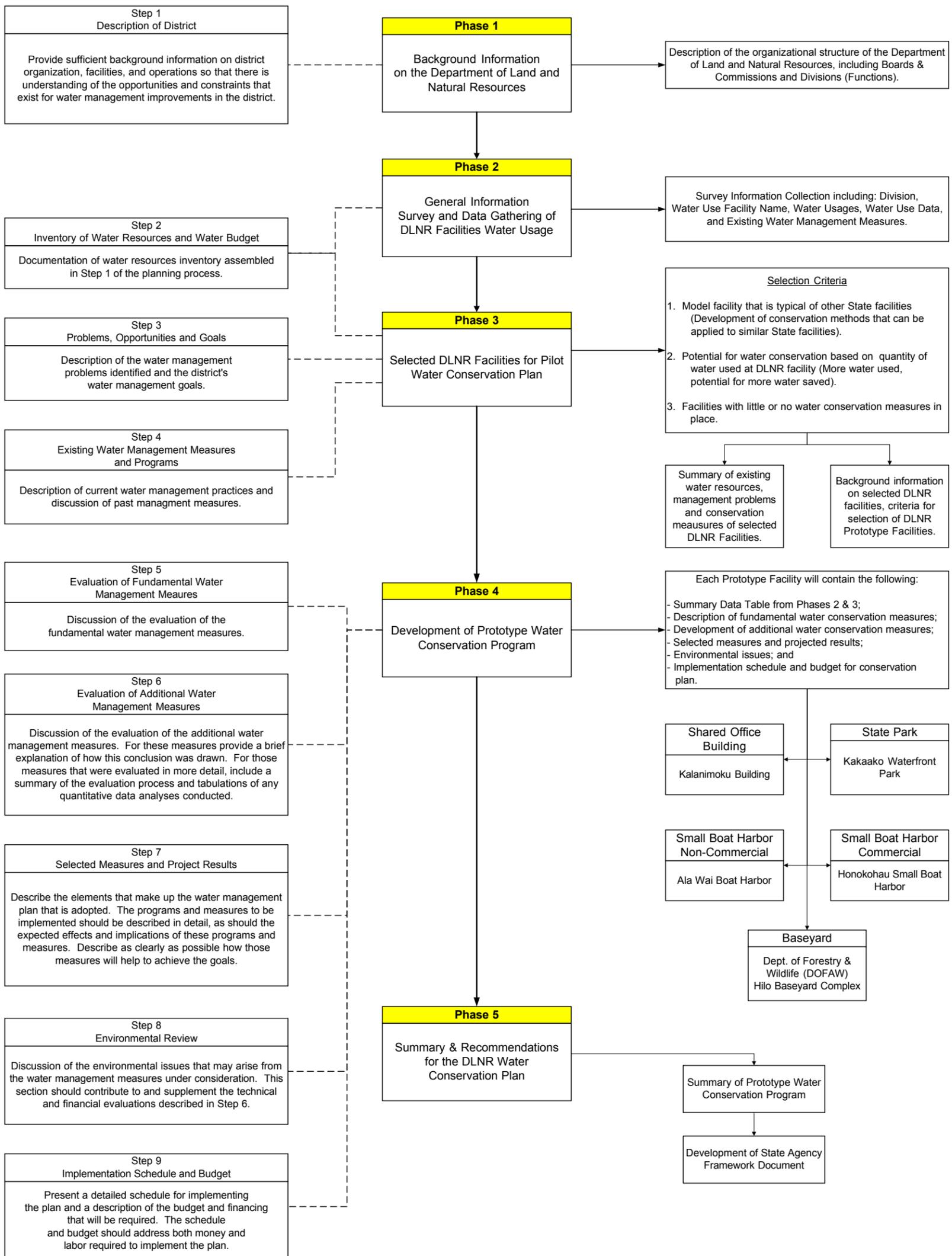


Figure 3-1

Modified BOR 9-Step Management Plan Format

An initial screening was done based upon the selection criteria. Further evaluation of existing water management measures was done for the selected prototype facilities, and if necessary, additional water usage data collection was conducted for those prototype facilities.

(Phase 3 of the modified BOR plan correlates to Step 3 – Problems, Opportunities & Goals, as well as, Step 4 – Existing Water Management Measures & Programs under the BOR 9-step plan.)

3.4 Phase 4 – Development of Prototype Water Conservation Programs

Phase 4 of the Water Conservation Plan involved the development of specific water conservation programs for the selected prototype facilities. Assessments of facility infrastructure and existing water use practices were conducted. Various water conservation measures were identified and assessed to determine the feasibility of implementing water conservation programs for each prototype facility. Phase 4 also included a discussion on environmental issues and the development of a proposed implementation schedule and budget for each facility.

(Phase 4 of the modified BOR plan correlates to Step 5 – Evaluation of Fundamental Water Management Measures, Step 6 – Evaluation of Additional Water Management Measures, Step 7 – Selected Measures & Projected Results, Step 8 – Environmental Review, and Step 9 - Implementation Schedule & Budget of the BOR 9-step plan.)

3.5 Phase 5 – Summary and Recommendations

Phase 5 concludes with a summary and recommendations pertaining to the DLNR Water Conservation Plan, along with a proposed Statewide Framework for expansion of the Water Conservation Plan approach. The Water Conservation Plan framework outlines an overall State agency strategy including projected impacts of the plan with assumptions and limitations.

4 PHASE 1 – BACKGROUND INFORMATION ON THE DEPARTMENT OF LAND AND NATURAL RESOURCES

4.1 Background

The Department of Land and Natural Resources (DLNR) (§26-15, Hawaii Revised Statutes, (HRS)) is headed by an executive board known as the Board of Land and Natural Resources (§171-4, HRS), except for matters relating to the State Water Code where the Commission on Water Resource Management (§174C-7, HRS) shall have exclusive jurisdiction and final authority, and except for matters relating to the Kahoolawe Island Reserve where the Kahoolawe Island Reserve Commission (§6K-5, HRS) shall have exclusive jurisdiction and final authority.

The DLNR is primarily responsible for managing, administering, and exercising control over public lands, water resources, ocean waters, navigable streams, coastal areas (excluding commercial harbor areas), state parks, historical sites, forests and forest reserves, aquatic life, public fishing areas, boating and ocean recreation, coastal programs, wildlife, game management areas and public hunting areas, the Natural Area Reserves System, Conservation Districts, the Kahoolawe Island Reserve, and other functions assigned by law.

DLNR is comprised of ten line divisions and five staff offices:

Line Divisions:

- Aquatic Resources Division
- Division of Boating and Ocean Recreation
- Bureau of Conveyances
- Commission on Water Resource Management
- Division of Conservation and Resources Enforcement
- Engineering Division
- Division of Forestry and Wildlife
- State Historic Preservation Division
- Land Division
- Division of State Parks

Staff Offices:

- Administrative Services
- Conservation and Coastal Lands
- Kahoolawe Island Reserve
- Office of the Chairperson
- Personnel

In addition to the previously mentioned executive board (Board of Land and Natural Resources) and commissions (Commission on Water Resource Management and the Kahoolawe Island Reserve Commission), the DLNR receives advice and guidance from the following other statutorily-established and administratively-attached commissions,

committees, boards and councils:

- Animal Species Advisory Commission (§197-2, HRS)
- Aquatic Life and Wildlife Advisory Committees (§197-4, HRS)
- Endangered Species Recovery Committee (§195D-25, HRS)
- Hawaii Historic Places Review Board (§6E-5.5, HRS)
- Island Burial Councils (§6E-43.5, HRS)
- Kaneohe Bay Regional Council (§200D-2, HRS)
- Natural Area Reserves System Commission (§195-6, HRS)

All statutorily established and administratively attached boards, commissions, committees, and council members, unless otherwise provided by law, serve four year terms and are nominated and appointed by the Governor, subject to approval by the Senate.

(See Figure 4-1, Organizational Chart of the Department of Land and Natural Resources)

4.2 Description of Boards and Commissions Attached to DLNR - State of Hawaii

4.2.1 Board of Land and Natural Resources

The Board of Land and Natural Resources (Board) is composed of seven members, one from each land district and three at-large, with no more than three members from the same political party. The Governor selects a Chairperson of the Board from among its members, who also serves in a full-time capacity as the Chairperson of the DLNR, performing those duties, and exercising those powers and authority, or so much thereof, as may be delegated by the Board.

The Board convenes regularly, not less than once a month, and deliberates on a variety of issues including lease issuances, renewals, extensions, and revocation, proposed administrative rules (rules), contract approvals, Conservation District Use Permits applications, and violations of departmental statutes and rules. The Board also establishes policies and criteria for the DLNR in order to carry out its duties and responsibilities.

Section 171-5, HRS, stipulates that any action taken by the Board shall be by a simple majority of the members present at a meeting qualified to vote, and that four members of the Board constitute a quorum to do business.

4.2.2 Commission on Water Resource Management

The Commission on Water Resource Management (CWRM) is made up of seven members. One member must have substantial experience or expertise in traditional Hawaiian water resource management techniques and in traditional Hawaiian riparian usage. The Chairperson of the DLNR and the Director of the Department of Health serve as ex-officio voting members. The Chairperson of the DLNR presides as the Chairperson of the CWRM, performing those duties, and exercising those powers and authority,

Organizational Chart

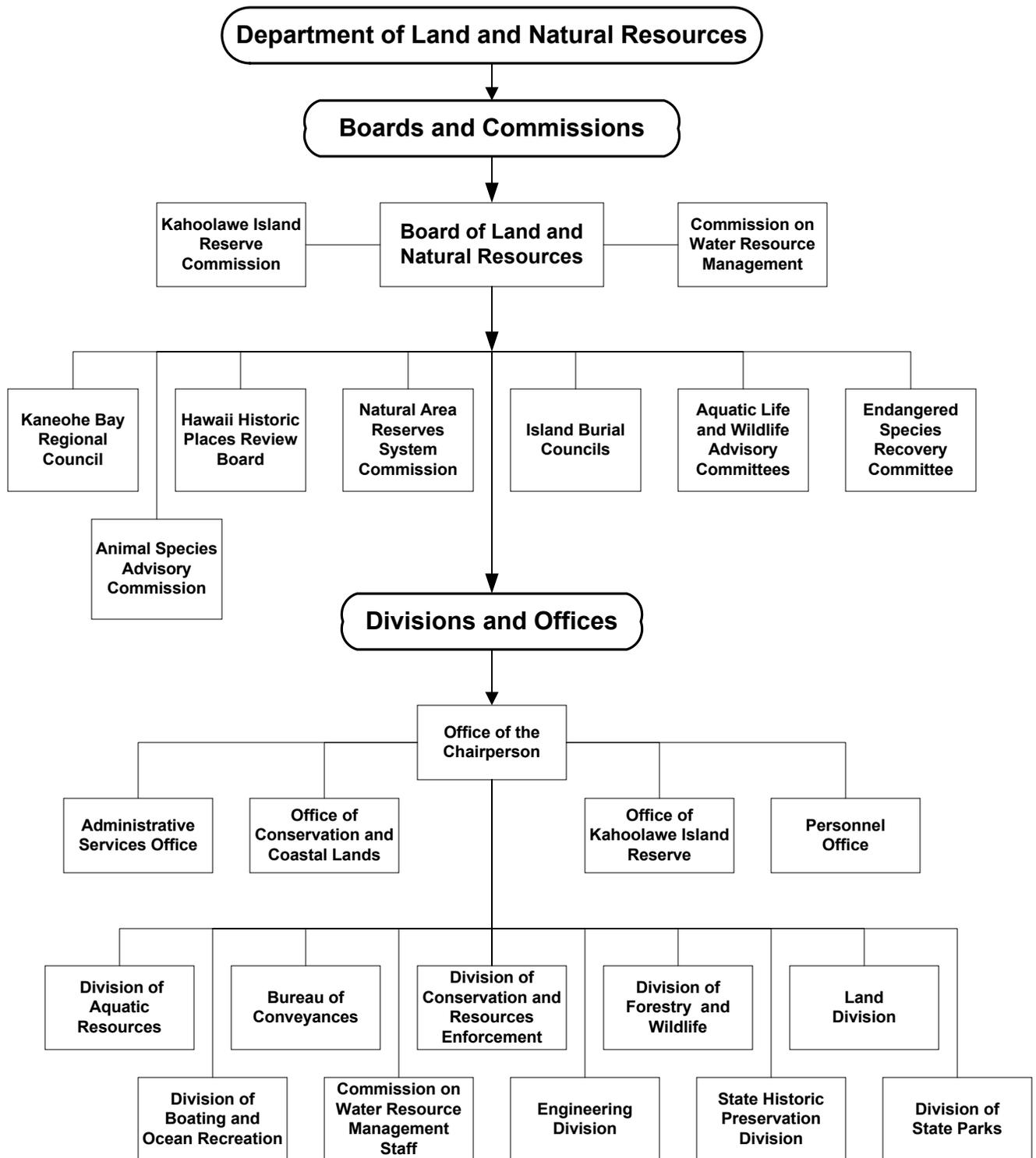


Figure 4-1
Department of Land & Natural Resources
Organizational Chart

or so much thereof, as may be delegated by the CWRM.

The general administration of the State Water Code (Chapter 174C, HRS) rests with the CWRM. The CWRM meets once a month to deliberate on matters relating to the State Water Code including but not limited to: the designation of water management areas, adopting instream flow standards, water use permit applications, proposed amendments to the Hawaii Water Plan, water use disputes, and violations of State Water Code statutes and administrative rules. Like its counterpart, the Board, the CWRM also establishes policies and criteria for the DLNR in order to carry out its duties and responsibilities.

4.2.3 Kahoolawe Island Reserve Commission

The Kahoolawe Island Reserve Commission (KIRC) is a seven-member commission, of which six members are nominated in the following manner:

- One member shall be a member of the Protect Kahoolawe Ohana;
- Two members shall be appointed by the Governor, from a list provided by the Protect Kahoolawe Ohana;
- One member shall be a trustee or representative of the Office of Hawaiian Affairs;
- One member shall be a county official appointed by the Governor from a list provided by the Mayor of the County of Maui; and
- One member shall be appointed by the Governor, from a list provided by native Hawaiian organizations.

The Chairperson of the DLNR serves as an ex-officio voting member. The Governor appoints the Chairperson of KIRC from among the members.

KIRC is charged with the exclusive administration and management of the Kahoolawe Island Reserve: establishing criteria, policies, and controls for permissible uses within the Island Reserve; coordinating the environmental restoration of the Island Reserve; providing for the perpetuation of Native Hawaiian customs, beliefs and practices; and serving as the Navy's single point of contact for State oversight of the cleanup of the Island Reserve.

4.3 Description of Advisory Boards, Commissions, Committees, and Councils Attached to DLNR - State of Hawaii

4.3.1 Animal Species Advisory Commission

The Animal Species Advisory Commission is comprised of thirteen members, including the Chairperson of each Aquatic Life and Wildlife Advisory Committee, three members of the DLNR designated by the Chairperson of the DLNR, and one of each from the professional fields of aquatic life, wildlife, and conservation and resources enforcement of which six members shall be scientists in the fields of botany, mammalogy, ichthyology, entomology, ornithology, and invertebrate zoology.

The Animal Species Advisory Commission advises the DLNR on any matter affecting the taking and conservation of aquatic life and wildlife including every proposal for the deliberate introduction of aquatic life and wildlife by the DLNR into any habitat within the State, whether the introduction proposed is from outside the State into the State, or from one area in the State into another area in the State.

4.3.2 Aquatic Life and Wildlife Advisory Committees

The Aquatic Life and Wildlife Advisory Committees are established in each of the counties of the State. Each Advisory Committee is composed of members of the Board representing their respective county, who serve as an ex-officio, nonvoting member. In addition, five members knowledgeable in the taking and conservation of aquatic life and wildlife make up the rest of the memberships of the Committees.

The Aquatic Life and Wildlife Advisory Committees meet to consider any matter affecting the taking and conservation of aquatic life and wildlife within their respective county, including proposed rules and the enforcement thereof.

4.3.3 Endangered Species Recovery Committee

The Endangered Species Recovery Committee is comprised of two field biologists with expertise in conservation biology, the Chairperson of the DLNR or the Chairperson's designee, the Ecoregion Director of the United States Fish and Wildlife Service or the Director's designee, the Director of the United States Geological Survey, Biological Resources Division or the Director's designee, and the Director of the University of Hawaii Environmental Center or the Director's designee.

The Endangered Species Recovery Committee reviews all application and proposals for habitat conservation plans, safe harbor agreements, and incidental take licenses, and makes recommendations based on a full review of the best available scientific and other reliable data.

4.3.4 Hawaii Historic Places Review Board

The Hawaii Historic Places Review Board consists of ten members, including one professionally qualified member of each of the following disciplines: archaeology, architecture, history, and sociology, and in addition, one person knowledgeable in traditional Hawaiian society and culture.

The Hawaii Historic Places Review Board orders and enters historic properties on the Hawaii Register of Historic Places on the basis of their value to Hawaii's heritage and recommends nominations of historic properties to the National Register of Historic Places, as well as maintaining the Hawaii Register of Historic Places. The Review Board is also responsible for reviewing and making recommendations to the state survey of historic preservation and the state historic preservation plan.

4.3.5 Island Burial Councils

The Island Burial Councils are established for the islands of Hawaii, Maui/Lanai, Molokai, Oahu, and Kauai/Niihau. Each Island Burial Council has a minimum of nine and a maximum of fifteen members that are nominated in the following manner:

A minimum of 20% of the regional representatives shall be appointed from a list of at least nine candidates provided by the Office of Hawaiian Affairs;

The DLNR shall develop a list in consultation with appropriate Hawaiian organizations, such as Hui Malama I Na Kupuna O Hawaii Nei; and

The membership of each Island Burial Council shall include at least one representative from each geographic region of the Island, as well as representatives of development and large property owner interests. Regional representatives shall be selected from the Hawaiian community on the basis of their understanding of the culture, history, burial beliefs, customs, and practices of native Hawaiians.

The Island Burial Councils determine the preservation or relocation of previously identified native Hawaiian burial sites; make recommendations regarding appropriate management, treatment, and protection of native Hawaiian burial sites, and on any other matters relating to native Hawaiian burial sites; and assist the DLNR in the inventory and identification of native Hawaiian burial sites.

4.3.6 Kaneohe Bay Regional Council

The Kaneohe Bay Regional Council is composed of seven voting members and ex-officio nonvoting members. The voting members of the Council include one representative from each of the following: the Kaneohe Neighborhood Board, the Kahaluu Neighborhood Board, the Kaneohe Bay Commercial Operators Association, the Kaneohe Bay Fishing Panel, the Kaneohe Bay Recreational Boating Association, the Hawaii Institute of Marine Biology of the University of Hawaii, and the Office of Hawaiian Affairs. Ex-officio nonvoting members include the Director of Health; the Superintendent of Education; two representatives of the DLNR, including one from the Division of Boating and Ocean Recreation and one from the Division of Aquatic Resources; the commanding officer of the Kaneohe Marine Corps Air Station; the Director of the Office of Planning; and the Director of Business, Economic Development, and Tourism; or their designated representatives. Additionally, the council may designate representatives of other appropriate agencies as ex-officio nonvoting members of the Council.

The Kaneohe Bay Regional Council facilitates the implementation of the Kaneohe Bay Master Plan as it relates to ocean use activities; advises and makes recommendations to the State and the County on matters regarding the use of Kaneohe Bay; develops short- and long-term goals based on the Master Plan; and serves as the public advocate for Kaneohe Bay.

4.3.7 Natural Area Reserves System Commission

The Natural Area Reserves System Commission (NARSC) is composed of thirteen members. Six of the members of the Commission must possess scientific qualifications as evidenced by an academic degree in wildlife or marine biology, botany, forestry, ecology, resource management, biogeography, zoology, or geology; one member must be a person possessing membership in a hiking organization organized in the State; and one member must possess membership in a hunting organization organized in the State. The Chairperson of the DLNR, the Superintendent of Education, the Director of the Office of Planning, the Chairperson of the Board of Agriculture and the President of the University of Hawaii, or their designated representatives, serve as ex-officio members of the NARSC.

The NARSC establishes criteria to be used in determining whether an area is suitable for inclusion within the Natural Area Reserves System; recommends to the Governor and the DLNR areas suitable for inclusion within the Natural Area Reserves System; and establishes policies and criteria regarding the management, protection, and permitted uses of areas which are part of the Natural Area Reserves System.

4.4 Description of Divisions Attached to DLNR – State of Hawaii

4.4.1 Aquatic Resources Division

The Aquatic Resources Division (Chapters 187A, 188, 189, 190, and 195D, HRS) is responsible for managing the State's aquatic resources and ecosystems for present and future generations. Major functions of the Division include:

Preserving and enhancing native and other resident fish and aquatic species and their habitats through active protection and other management measures such as public fishing areas, artificial reefs, fish aggregating devices, marine life conservation districts, shoreline fishery management areas, and refuges;

Broadening the State's economic base by promoting the growth, quality, and diversification of commercial fishery and aquaculture industries;

Promoting public understanding and awareness of aquatic resource and environmental protection, management, conservation and enhancement programs and use opportunities;

Enforcing all laws relating to the protecting, taking, killing, propagating, or increasing of aquatic life within the State and waters subject to its jurisdiction;

Providing opportunities for aquatic recreation activities such as saltwater and freshwater fishing, underwater photography, snorkeling, and nature studies of aquatic organisms and their habitat.

The Division is comprised of three branches: Commercial Fishery and Aquaculture, Aquatic Resources and Environment Protection, and Recreational Fishery.

Commercial Fishery and Aquaculture Branch:

Engages in activities to broaden the State's economic base by promoting the growth, quality and diversification of Hawaii's commercial fishery and aquaculture industries;

Develops, structures, and implements fishery development projects to aid in the expansion of the commercial fishing industry by conducting exploratory fishing surveys and other activities for under-utilized species, assessing the fishery resources in distant water areas, and assessing the effectiveness of fish aggregating devices;

Conducts management oriented biological investigations and analysis on heavily exploited fish and shellfish species; and

Operates and maintains the Anuenue Fisheries Research Center.

Aquatic Resources and Environment Protection Branch:

Engages in activities to preserve and enhance native and other resident fish and aquatic species and their habitats through active protection and other management measures;

Evaluates and conducts surveys to collect baseline and follow-up data for the establishment of marine life conservation districts, shoreline fisheries management areas, and other protective areas and/or sanctuaries to conserve, enhance and protect aquatic resources;

Conducts evaluations, including field investigations and site surveys, and prepares recommendations and comments on various permit applications for proposed construction projects, development projects and activities, exotic importations, and scientific collecting; and

Participates in recovery teams and other activities related to the enhancement of threatened or endangered species of aquatic organisms such as the Hawaiian monk seal, green sea turtles and humpback whales, and reviews proposals to list or de-list organisms from threatened or endangered status.

Recreational Fishery Branch:

Develops, structures, and undertakes fishery development plans necessary for effective implementation and attainment of the recreational fisheries program of the Department;

Conducts surveys, inventories and analysis of marine, estuarine and freshwater fish species and populations to enhance fishing opportunities; and

Performs development, maintenance, and management activities at established sanctuaries, marine life conservation districts, shoreline fisheries management areas, artificial reefs, fish aggregating devices, and public fishing areas.

4.4.2 Division of Boating and Ocean Recreation

The Division of Boating and Ocean Recreation (Chapters 200 and 200D, HRS) manages and administers the statewide ocean recreation and coastal areas programs pertaining to the ocean waters and navigable streams of the State (excluding commercial harbors) and small boat harbors including launching ramps and other boating facilities. Major functions of the Division include:

Planning, developing, operating, administering, and maintaining small boat harbors, launching ramps, other boating facilities, and associated aids to navigation throughout the State;

Administering and updating an ocean recreation management plan and administration/operation of a boating registration system for the State;

Regulating the recreational and commercial use of small boat harbors, launching ramps and other boating facilities;

Regulating boat regattas and other ocean water events;

Administering a marine casualty and investigation program; and

Conducting public education in boating safety and promoting public awareness and involvement in boating issues, activities and programs through publications, public meetings, workshops, public hearings, and news media.

The Division is divided into four (4) Island District Boating Branches (Oahu, Maui, Kauai, and Hawaii), and is further subdivided into Sections by individual harbors with a Maintenance Section on each Island to service each Harbor Section, and an Engineering Branch which services all the District Boating Branches.

Oahu District Boating Branch:

Ala Wai Harbor
Haleiwa Harbor
Heeia Kea
Kahana Bay Launch Ramp Facility
Keehi Harbor/Lagoon
Maunalua Bay Launch Ramp Facility

Pokai Bay
Sand Island Launch Ramp Facility
Waianae Harbor
Waikiki Beach Waters

Maui District Boating Branch:

Hale O Lono Harbor (Molokai)
Hana Wharf and Ramp
Kaanapali
Kahului Ramp
Kaunakakai Harbor (Molokai)
Keanae Ramp
Kihei Ramp
Lahaina Roadstead
Lahaina Harbor
Maalaea Harbor
Mala Wharf and Ramp
Maliko Ramp
Manele Harbor (Lanai)

Kauai District Boating Branch:

Anini Ramp
Hanalei Bay and Pier
Kaunualii Ramp
Kikiaola Harbor
Kukuiula Harbor
Nawiliwili Harbor
Port Allen Harbor
Waikaea Canal
Wailua Ramp

Hawaii District Boating Branch:

Honokohau Boat Harbor
Kailua Kona Wharf
Kauhako Hookena Ramp
Kaulana Ramp
Kawaihae Harbor
Keauhou Boat Harbor
Milolii Landing
Pohoiki Ramp
Puako Ramp
Reed's Bay/Radio Bay
Wailoa Sampan Basin and Boat Harbor

4.4.3 Bureau of Conveyances

The Bureau of Conveyances (Chapters 490 Article 9, 501 and 502, HRS) serves as the State repository for documents affecting land ownership (Regular System and Land Court), as Hawaii is the only state that has a single statewide recording office. Major functions of the Bureau include:

Examining, recording, indexing, and microfilming over 344,000 Regular System and Land Court documents (Deeds, leases, assignments of lease, mortgages, assignment of mortgage, releases, notices, affidavits, uniform commercial code, contracts, agreements, federal/state tax liens, military discharge papers) and subdivision/condominium maps annually;

Issuing Land Court Certificates of Title;

Certifying copies of matters of record; and

Researching Uniform Commercial Code (UCC) requests.

The two major branches of the Bureau coincide with the two recognized recording systems in the State, the Regular System and Land Court.

Regular System Branch

Unregistered land is recorded in the Regular System. Any discrepancy arising in title to unregistered lands is settled in a court of law.

Land Court Branch

Documents relating to registered land are recorded in the Land Court System. When title is conveyed, the Bureau issues a Certificate of Title showing vested ownership, which is guaranteed by the State.

4.4.4 Commission on Water Resource Management Staff

The Commission on Water Resource Management (Chapter 174C, HRS), which shares the same name as the actual Commission (see 4.2.2 above), is responsible for the implementation of the State Water Code. The State Water Code is liberally interpreted to obtain maximum beneficial use of the waters of the State for purposes such as domestic uses, aquaculture uses, irrigation and other agricultural uses, power development, and commercial and industrial uses. Adequate provisions are made for the protection of traditional and customary Hawaiian rights, the protection and procreation of fish and wildlife, the maintenance of proper ecological balance and scenic beauty, and the preservation and enhancement of waters of the State for municipal uses, public recreation, public water supply, agriculture, and navigation. Further, the State Water Code is liberally interpreted to protect and improve the quality of waters of the State and

to provide that no substance be discharged into such waters without first receiving the necessary treatment or other corrective action. Major functions of the Commission staff include:

Administering the designation of and regulating the use of water resources in water management areas;

Developing interim and permanent instream flow standards;

Administering the Hawaii Water Plan and the integration of its constituent parts (State Water Resource Protection Plan, State Water Quality Plan, State Water Projects Plan, Agricultural Water Use and Development Plan and the County Water Use and Development Plans);

Formulating drought management plans for implementation during periods of prolonged water shortage, including water conservation plans and resource augmentation strategies to address water supply and demand, and resource sustainability; and

Collecting, analyzing and verifying hydrologic data, water resource information, and water usage statewide from wells and streams.

The Commission is divided into four branches: Ground-water Regulation, Stream Protection and Management, Planning, and Survey.

Ground-water Regulation Branch:

Recommends areas threatened by existing or proposed water withdrawals or diversions of water for designation as water management areas; and in ground-water management areas, processes applications for new ground-water uses or modifications to existing uses, and issues necessary permits thereof;

Establishes minimum standards for the construction of wells and the installation of pumps and pumping equipment;

Administers permit systems for the construction of wells, installations of pumps and pumping equipment; and

Administers the investigation and enforcement actions necessary for permit conformance, citizen complaints and in the resolution of ground-water related disputes.

Stream Protection and Management Branch:

Administers a statewide instream use protection program, including the establishment and amendment of instream flow standards;

Administers a permit system for the alteration of stream channels and the construction and modification of stream diversion works; and

Administers the investigation and enforcement actions necessary for permit conformance, citizen complaints and in the resolution of surface-water related disputes.

Planning Branch:

Develops, administers, updates and coordinates comprehensive, long-range plans, including the Hawaii Water Plan, for the protection, conservation, and management of the State's water resources;

Coordinates and directs the development of plans and studies involving assessments of water supply, demand, and usage;

Provides administrative support and coordinates the activities of the Hawaii Drought Council, Water Resources Committee, Drought Task Forces, and County/Local Drought Committees; and

Coordinates and assists in the preparation of risk/vulnerability assessments, studies, and investigations relating to resource augmentation, water conservation planning and drought response/mitigation, including preparation of statewide and regional water conservation plans in coordination with Commission directives and other agency programs.

Survey Branch:

Undertakes hydrologic investigations to determine the occurrence and availability of water supplies, including the determination of sustainable yields statewide;

Identifies areas of the State where saltwater intrusion is a threat to freshwater resources;

Performs geophysical logging of test holes and wells to collect data on rock formations, plumbness and alignment, and water characteristics such as static level, salinity, temperature, and conductivity; and

Administers cooperative agreements for basic data collection and resource investigations with the United States Geological Survey and other federal, state and county agencies, and private entities.

4.4.5 Division of Conservation and Resources Enforcement

The Division of Conservation and Resources Enforcement (Chapter 199, HRS), as its name implies, is the enforcement arm of the DLNR. While the Division's Conservation

and Resources Enforcement Officers are vested with full police powers, they are primarily charged with enforcing the DLNR's laws and rules. Major functions of the Division include:

Enforcing Title 12, Chapters 6D, 6E and 6K, HRS, and associated rules;

Investigating complaints, gathering evidence, conducting investigations, and conducting such field observations and inspections;

Cooperating with enforcement authorities of the State, counties, and federal government in the development of programs and mutual agreements for conservation resources enforcement activities within the State;

Cooperating with established search and rescue agencies of the counties and federal government in developing plans and programs, and mutual aid agreements for search and rescue activities within the State; and

Administering a hunter education program to inform and instruct individuals in wildlife resource conservation, outdoor ethics, and hunting safety.

The Division is comprised of four District Branches on each of the major islands (Oahu, Maui, Kauai and Hawaii) and four staff offices (Staff Development, Hunter Education, Investigation, and Program Support).

4.4.6 Engineering Division

The Engineering Division (Chapters 174, 179, 179D, and 180, HRS) provides engineering services throughout the DLNR. Major functions of the Division include:

Administering the Capital Improvement Project (CIP) program for the Department and administration of flood control/dam safety programs.

The Division is divided into two branches, the Project Planning and Management Branch and the Design, Inspection and Safety Branch.

Project Planning and Management Branch:

Prepares project proposals for the protection and enhancement of specific state resources within established plans; and

Directs and manages engineering services to the DLNR and formulates project financial plans for land acquisition, planning, design, and construction.

Design, Inspection and Safety Branch:

Provides detailed design on CIP and administers consultant service contracts;

Prepares and processes implementing agreements, including the prequalification of bidders, bid advertising, bid opening and evaluation, and award of contract;

Provides general supervision and inspection for project construction implementation;

Prepares execution plans and timetables for construction operations and inspects work for compliance with plans and specifications;

Monitors and enforces contract provisions;

Develops State flood control projects and coordinates the State's flood control activities; and

Administers the State's Flood Control and Floodplain Management programs in coordination with federal, state, and county agencies.

4.4.7 Division of Forestry and Wildlife

The Division of Forestry and Wildlife (Chapters 183, 183D, 185, 195, 195D, 195F, and 198D, HRS) is responsible for programs for the management, development, maintenance, research, and propagation of forests and wildlife resources; and the development and management of natural area reserves, and trail and access systems. Major functions of the Division include:

Developing and executing policies and procedures regarding the protection and enhancement of forest resources;

Implementing reforestation and forest stand improvement projects and administering the Forest Stewardship Program;

Suppressing forest and range fires;

Participating in trapping or release, and introduction of wildlife;

Managing the statewide public hunting program;

Administering the statewide Natural Area Reserves System and the Natural Area Partnership Program;

Coordinating the formulation of statewide watershed protection and management programs;

Coordinating the formulation of statewide wildlife programs and conducting programs for the enhancement of wildlife habitat; and

Administering the Na Ala Hele (statewide trail and access) Program.

The Division is comprised of six Program Sections, (Wildlife Resources Management, Forests Resources Management, Outdoor Recreation, Planning and Informational Services, Watershed Protection and Management, and Native Ecosystem Protection and Management), one Administrative Management Section and four District (Island) Branches, which carry out functions of the Program Sections for their respective islands.

Wildlife Resources Management Section:

Reviews plans, project proposals, permit requests, and environmental impact documents for effect on wildlife resources, and recommends decisions, actions, or mitigating measures;

Conducts surveys, inventories, and research on wildlife to provide information for management programs; and

Implements and coordinates public hunting opportunities statewide.

Forests Resources Management Section:

Reviews plans, project proposals, permit requests, and environmental impact documents for effect on forest resources, and recommends decisions, actions, or mitigating measures;

Develops rules, policies, and procedures regarding the protection and enhancement of forest resources; and

Plans and coordinates program of forest product development and utilization.

Outdoor Recreation Section:

Develops standards, policies, rules, and plans to carry out Na Ala Hele program activities;

Provides information on trail and access development to the public and other government agencies; and

Plans programs on forest recreation by providing opportunities and facilities such as hiking trails, camping sites, picnic grounds, view points, and nature walk paths.

Planning and Informational Services Section:

Coordinates formulation of statewide planning and information management programs;

Maintains a program for the dissemination of relevant natural resource information for utilization in broad management and specific project planning activities; and
Prepares annual federal assistance and other grant requests based upon project proposals.

Watershed Protection and Management Section:

Develops rules, policies and procedures regarding the protection and enhancement of watershed resources;

Promotes “best management practices” to provide a stewardship ethic which advocates sustainability of the State’s watersheds; and

Plans for the recovery and management of deteriorating and/or disturbed State watersheds as may be appropriate for watershed value enhancement by reforestation and other acceptable conservation management practices.

Native Ecosystems Protection and Management Section:

Develops long term strategic and short-term management plans of the Natural Area Reserves System and other protected areas;

Performs field research and investigations to plan for the protection and development of natural area reserves; and

Protects native ecosystems from feral ungulate damage and nonnative plant invasion through various means.

4.4.8 State Historic Preservation Division

The State Historic Preservation Division (Chapters 6D and 6E, HRS) is responsible for administering a statewide comprehensive historic preservation program. Major functions of the Division include:

Administering a program of historical, architectural and archaeological research and development, including surveys, excavations, scientific recording, interpretation, and publications on the State’s historical and cultural resources;

Reviewing and providing concurrence for projects by the State or its political subdivision, which may have an effect upon a historic property;
Coordinating the evaluation and management of burial sites;

Planning, organizing, and preparing information for the Hawaii Register of Historic Places and for listing in the National Register of Historic Places; and

Reviews and provides recommendations for any construction, alteration, disposition, or improvement of any nature which will affect a privately owned historic property listed on the Hawaii Register of Historic Places.

The Division is comprised of three branches (Historical and Cultural, Archaeological, and Architectural), and five District (Island) Archaeology Sections and one Inter-Agency Archaeology Section.

Historical and Cultural Branch:

Conducts historical and cultural research for the identification, documentation, evaluation, and registration of historic properties;

Develops and maintains a statewide inventory of properties of historical or cultural significance, which includes specific files, maps and a report library;

Coordinates with other governmental agencies at the federal, state, and county levels, including the President's Advisory Council on Historic Preservation, to assure compliance with State and Federal historic preservation laws; and

Makes policy recommendations with regards to the treatment and preservation of historic properties.

Archaeological Branch:

Conducts archaeological research programs for the identification, documentation, evaluation, and registration of historic properties;

Evaluates and coordinates the management of burial sites, providing scientific and planning expertise upon the discovery of burial sites in coordination with the Medical Examiner or Coroner;

Prepares scopes of work for state archaeological projects; and

Evaluates, processes, and administers historic preservation grants awarded to individuals, corporations, and governmental agencies.

Architectural Branch:

Conducts architectural research programs for the identification, documentation, evaluation, and registration of historic properties;

Prepares reports and Hawaii and National Register of Historic Places nominations for review and consideration; and

Reviews development proposals, which may affect historic properties. Evaluates and makes recommendations on architectural drawings, inventory reports, significance assessments and mitigation/preservation plans.

4.4.9 Land Division

The Land Division (Chapters 171, 182, and 190D, HRS) is responsible for managing public lands in ways that will promote the social, environmental and economic well-being of the State. Major functions of the Division include:

Acquiring lands and facilities through purchase, land exchange, and condemnation that have been determined necessary for public purposes;

Disposing of public lands for approved public and private purposes;

Encumbering public lands through leases, licenses, easements, and month-to-month permits to generate revenues for the General Fund; and

Planning and developing public lands for social and economic opportunities.

The Division is comprised of four District (Island) Branches, a Support Branch and a Central Processing Office.

District Branches:

Manages public lands in their respective geographical area;

Receives, reviews, analyzes, and processes requests for dispositions of public lands;

Enforces leases, permits, executive orders, and other encumbrances, including conducting property inspections;

Issues rights-of-entry for the interim use of public lands;

Coordinates, administers, and conducts land auctions;

Maintains unencumbered lands to keep them free from unauthorized uses and occupancies;

Conducts maintenance activities such as tree trimming, abandoned car removal, land clearing, and the clearing of channels, stream beds and banks, drainage ways and stream mouths on public lands;

Conducts eviction of tenants where required; and

Coordinates the planning, improvement, development, operation and maintenance of industrial parks.

Support Branch:

Reviews and analyzes specific land acquisition proposals from private and public sectors;

Conducts negotiations relating to land acquisitions and dispositions;

Establishes and reviews appraisal standards, guidelines and forms for appraisals of State lands for leases, permits and sales, and recommends selection of independent appraisers, participates in negotiation for and drawing up of formal contracts, and reviews independent appraisal reports for adequacy and completeness;

Performs highly complex property valuations of commercial, industrial, hotel, apartment, residential, agricultural, and conservation lands using professional appraisal techniques;

Monitors lease rental reopening dates and conducts reopening appraisals in a timely manner;

Defines rate structure guidelines to be followed by agencies executing agreements for users of state property;

Researches and ascertains the State's interests in real property for all types of lands, including streams, ditches, fisheries and fish ponds, schools, shoreline boundaries, submerged, eroded and accreted lands, roadways, easements, trails, lands set aside to governmental agencies, and private lands;

Researches records maintained by various agencies for original land titles, deeds, mortgages, agreements, grants, leases, decree of change of name, financing statements, liens, judgments, lis pendens, etc.;

Reviews and verifies private abstract titles on private lands to be acquired for public purposes;

Reviews, verifies or conducts title searches on ownership claims filed in court with respect to State claims, mineral rights, water rights, native rights etc.;

Manages and maintains the land inventory of all State and public lands for the State Land Information Management System; and

Processes requests for the certification of shorelines statewide for both private and State properties and coordinates contested case hearings on appeals to shoreline certifications.

Central Processing Office:

Provides centralized data and file management services.

4.4.10 Division of State Parks

The Division of State Parks (Chapter 184, HRS) is responsible for the management of state-owned parks, outdoor recreation areas, and historic sites. Major functions of the Division include:

Acquiring lands for development as an outdoor recreation area to be incorporated into the Hawaii State Parks System;

Developing lands into outdoor recreation areas; and

Developing interpretive information programs for state parks and/or park features.

The Division is comprised of three branches (Planning, Development, and Resources Management), four District (Island) Sections (which provide maintenance support to the Resources Management Branch), and a Staff Support Services Office.

Planning Branch:

Initiates and coordinates plans for the Division's parks, outdoor recreation areas, and historic sites; and

Reviews plans of other agencies and consultants as to their effects upon state parks and outdoor recreation areas.

Development Branch:

Designs and prepares technical specifications for construction and/or improvements;

Plans and coordinates land acquisition for recreational areas; and

Reviews bids submitted for construction and/or improvements.

Resources Management Branch:

Maintains, operates, conserves, and protects the Division's parks, outdoor recreation areas, and historic sites throughout the State;

Provides in-house construction and maintenance functions; and

Issues park use permits.

Oahu Section:

Aiea Bay State Recreation Area
Diamond Head State Monument
Hanauma Bay State Underwater Park
Heeia State Park
Iolani Palace State Monument
Kaena Point State Park
Kahana Valley State Park
Kakaako Waterfront Park
Keaiwa Heiau State Recreation Area
Kewalo Basin
Kukaniloko Birthstones State Monument
Laie Point State Wayside
Makapuu Point State Wayside
Malaekahana State Recreation Area
Nuuanu Pali State Wayside
Puu o Mahuka Heiau State Monument
Puu Ualakaa State Wayside
Royal Mausoleum State Monument
Sacred Falls State Park
Sand Island State Recreation Area
Ulupo Heiau State Monument
Waahila Ridge State Recreation Area
Wahiawa Freshwater State Recreation Area

Maui Section:

Halekii-Pihana Heiau State Monument
Iao Valley State Monument
Kaumahina State Wayside
Makena State Park
Palaau State Park (Molokai)
Polipoli Spring State Recreation Area
Puaa Kaa State Wayside
Waianapanapa State Park
Wailua Valley State Wayside

Hawaii Section:

Akaka Falls State Park
Hapuna Beach State Recreation Area
Kalopa State Recreation Area
Kealakekua Bay State Historical Park
Kona Coast (Kekaha Kai) State Park
Kohala Historical Sites State Monument

Lapakahi State Historical Park
Lava Tree State Monument
MacKenzie State Recreation Area
Manuka State Wayside
Mauna Kea State Recreation Area
Old Kona Airport State Recreation Area
Wailoa River State Recreation Area
Wailuku River State Park

Kauai Section:

Ahukini State Recreation Pier
Haena State Park
Kokee State Park
Na Pali Coast State Park
Polihale State Park
Russian Fort Elizabeth State Historical Park
Wailua River State Park
Waimea Canyon State Park

Staff Support Services Office:

Inventories and monitors state park features;

Establishes and maintains a statewide interpretive plan which determines interpretive project priorities and selects parks of high interpretive value for the Aina Hoomalu Program;

Develops interpretive information programs for various parks and/or park features;

Administers contracts for park studies and interpretive projects;

Conducts field research, provides technical information for interpretative plans, displays, brochures, and other public information projects, and coordinates and oversees the construction and maintenance of interpretive facilities and devices; and

Coordinates the Federal Land and Water Conservation Grant Program and the Statewide Outdoor Recreation Planning Program.

4.4.11 Administrative Services Office

The Administrative Services Office provides budgetary and accounting support to the DLNR, including processing departmental payroll; vendor encumbrances and payments; billing and collecting State land rentals and water licenses; collecting or accounting for all other revenues and deposits; preparing financial reports; coordinating and providing

internal and external audit functions; maintaining a centralized system for monitoring federal grant awards and processing reimbursement claims; coordinating and assisting with the electronic data processing and other telecommunications needs of the DLNR; and overseeing risk management for the DLNR.

4.4.12 Office of the Chairperson

The Office of the Chairperson, as its name would imply, is home to the Chairperson and the two Deputy Directors of the DLNR. This Office is responsible for making policy decisions, setting departmental policies, directives, and procedures, and overseeing the activities of the Divisions and Staff Offices.

4.4.13 Office of Conservation and Coastal Lands

The Office of Conservation and Coastal Lands (Chapter 183C, HRS) is responsible for providing regulation and enforcement of land use laws within the State Land Use Conservation District. Major functions of this Office include:

Reviewing, analyzing, and processing requests for various types of land uses within the Conservation District;

Providing enforcement of Conservation District regulations and conditions of approved Conservation District Use Permits, including the processing of Conservation District violations;

Implementing the State Coastal Lands Program in conducting beach restoration projects and activities;

Developing statewide plans and policies for the management of beach erosion issues and coordinating activities with the Coastal Zone Management Program; and

Conducting field investigations to assess erosion problems and solutions.

4.4.14 Office of the Kahoolawe Island Reserve

The Office of the Kahoolawe Island Reserve provides staff support to the Kahoolawe Island Reserve Commission. The Office develops policies and directives of the Commission, including coordinating the environmental restoration of the Reserve; providing for the perpetuation of Native Hawaiian customs, beliefs and practices; and serving as the Navy's single point of contact for State oversight of the cleanup.

4.4.15 Personnel Office

The Personnel Office provides support services to all of the Divisions and Staff Offices of the DLNR. Major services include guidance and technical assistance in position classification, employee relations, and employee training and development. The Office also assists the Divisions and Staff Offices in carrying out the collective bargaining contracts and the grievance process. The Personnel Office maintains a centralized system for processing, recording, reporting and filing the personnel transactions and records of all employees. The Personnel Office prepares and makes recommendations for the adoption of personnel policies and procedures within the DLNR. Finally, the Office works with the Divisions and Staff Offices in developing and updating the organization plans.

5 PRELIMINARY ASSESSMENT OF WATER USE CHARACTERISTICS

To gain some insight into actual water use by DLNR, metered water use data for DLNR facilities were compiled from DLNR billing records of invoices received from municipal and other public water purveyors. The data does not include water used at facilities that pay for water through some other kind of billing code, such as electrical costs for operating a pump for an individual stand-alone system (e.g. a private well or stream diversion) or facilities billed through a different department (e.g., the Department of Accounting and General Services for certain shared office buildings).

Due to inconsistencies in invoicing and billing dates, it was not possible to obtain metered data for each DLNR facility for a specific time period. Therefore, the data generally represent a month-long period in the May 2002 to July 2002 time frame. Where the billing covered a two-month period, the data were adjusted to reflect monthly water use by assuming equal quantities of use in each of the two months. The data were used to obtain a preliminary assessment of the quantity of water used at DLNR facilities.

The preliminary assessment indicated that the department as a whole uses significant quantities of water and that some DLNR facilities are very high water users. This information pointed toward potential opportunities for water management improvement at various DLNR facilities. The water billing data are contained in Appendix 1.

The water billing records were reviewed for duplicative records and actual water service. Records lacking a designated facility name and/or service address were omitted from consideration. The adjusted billing data show that DLNR has 82 facilities that were billed for approximately 31,167,000 gallons of water (95.65 acre-feet) per month, or about 1.025 million gallons per day (mgd). For the selected period, the Division of State Parks was the largest water user, with over 0.490 mgd of water use. The Division of Forestry and Wildlife was the smallest consumer, with just 0.006 mgd of water use.

In addition to assessing the total water consumption by division, estimated monthly costs for the purchase of such water were determined for the various DLNR divisions. Based on the water use for the 82 facilities, an average cost of over \$60,700 per month was paid by the DLNR.

The following Table 5-1 shows a summary of this preliminary data by division. As noted above, the 82 facilities represented the majority of DLNR facilities (but did not include all 138 of the facilities under the jurisdiction of the DLNR).

Table 5-1 Average Monthly Water Cost by Division

Division	Average Water Use (mgd)	Average Monthly Cost*
Aquatic Resources	0.151	\$ 8,969.00
Boating and Ocean Recreation	0.368	\$ 21,859.00
Forestry and Wildlife	0.006	\$ 356.00
State Parks	0.491	\$ 29,165.00
Other DLNR Facilities (Division not identified)	0.006	\$ 356.00
TOTAL	1.022	\$ 60,707.00

* Average monthly cost based upon (average water use x 30-days x \$1.98/1,000 gallons).

The data in Appendix 1 show that the highest single water-using facility was the Division of Aquatic Resources' Sand Island State Recreation Area A (Anuenue Fishery), which used approximately 0.150 mgd. Other significant water-using facilities (initially determined to be those facilities with greater than 400,000 gallons per month) are identified in Appendix 1. There were a total of 16 facilities using greater than 400,000 gallons per month. These facilities were considered possible candidates for further detailed water conservation planning.

As previously mentioned the DLNR has approximately 138 facilities under its jurisdiction. These facilities were initially grouped into eight (8) broad categories based on general water use characteristics. DLNR facilities across the State have different water demands based on the operational requirements of each facility. For example, a park facility may require water for comfort stations and irrigation, while a harbor facility may require water for boat wash-down, comfort stations, maintenance, and irrigation. End uses within each category are assumed to be similar, although the total water demand per facility may vary greatly depending on the size and staffing of the facility. The category types and number of facilities within each category are shown in Table 5-2.

Table 5-2 Facility Count

Facility Type	No. of Facilities
Office Facility	27
Small Boat Harbor – Commercial Activities	19
Small Boat Harbor – No Commercial Activities	2
Boat Ramp/Pier/Anchorage Facility *	23
Maintenance Baseyard	7
Nursery	4
Park Facility	54
Aquaculture Facility	2
TOTAL	138

* The Boat Ramp/Pier/Anchorage Facility category, according to the Division of Boating and Ocean Recreation, have little or no water service and therefore was eliminated as a category type.

6 PHASE 2 – GENERAL INFORMATION SURVEY AND DATA GATHERING OF DLNR FACILITIES WATER USAGE

In order to compile the information necessary to identify and screen final candidates for the prototype facility selection process, a survey form was sent to all DLNR divisions. Appendix 2 contains a sample of the survey form and letter. The survey form requested the following information:

- a. DLNR Division
- b. Island
- c. Water Use Facility Name
- d. Service Address
- e. Tax Map Key
- f. Contact Name & Phone
- g. Number of Staff at Facility (per day)
- h. Number of Public Users of Facility (per day)
- i. General Water Use(s) & Estimated Quantity Used
- j. Specific Water Uses (i.e. domestic, irrigation, etc.)
- k. Quality of Water Used
- l. Description of Landscaping
- m. Description of Irrigation System/Schedule, and Maintenance Program
- n. Current Water Conservation Measures/Programs

The primary goal of the survey form was to obtain additional detailed facility information, particularly for those facilities identified through the preliminary assessment as being significant water users (greater than 400,000 gallons per month). The survey form was sent to all DLNR Divisions and all significant water users. The survey form was used to verify facility water use quantities from the preliminary assessment, identify any other DLNR facilities that could be considered prototype candidates (i.e., stand-alone systems not previously identified through the preliminary assessment or facilities billed through a different department), and evaluate existing water management practices and water conservation measures.

6.1 Survey Results

A total of 41 survey responses were received. Survey responses were returned for all 16 of the facilities initially identified through the preliminary assessment as being significant water users (> 400,000 gallons per month). An additional 25 responses were received for the other DLNR facilities. Appendix 3 contains a complete listing of the surveys sent and received and also identifies the division contacts that were established for the purposes of this study. The category types and number of facilities that responded to the survey are shown in the following Table 6-1.

Table 6-1
Summary of Survey Responses Received

Facility Type	No. of Facilities
Office Facility	11
Small Boat Harbor – Commercial Activities	5
Small Boat Harbor – No Commercial Activities	2
Maintenance Baseyard	5
Nursery	1
Park Facility	15
Aquaculture Facility	2
TOTAL	41

Survey summary sheets for the 41 responses to the survey from the various DLNR facilities are included in Appendix 4. Table 6-2 summarizes information received from the survey effort. The Boat Ramp/Pier/Anchorage Facility category did not have facility staff at these locations and therefore, survey responses were not received from these facilities. According to the Division of Boating and Ocean Recreation the majority of these facilities have little or no water service and was eliminated as a facility category.

The survey responses provided insight into the quantity and character of water used at the facilities, as well as opportunities for conserving water, including potential conversion to non-potable supply source for end uses that do not require potable water quality. From the survey information, the 41 facilities were analyzed with respect to:

- The function of the facility and building occupancy data, which help to explain existing water demand.
- The nature and quantities of various end uses at each facility, from which a water use profile for the facility was generated.
- The quantity of potable water used at each facility to meet a potable versus non-potable need. Use of an alternative non-potable supply source to meet non-potable needs would help to stretch the available potable supply and ensure the highest and best use of available water supplies.
- Existing conservation measures.

6.2 Comparison of Preliminary Assessment and Survey Results

The responses that were received varied greatly in the level of detail and completeness of responses. The shortfall in survey responses resulted in part from the lack of understanding of the importance of the survey, but was largely due to competing work priorities within each division and limited staff resources with which to complete the facility “inventory” of water use.

Table 6-2
DLNR WATER CONSERVATION SURVEY
RESULTS SUMMARY TABLE

Suvery Number	Department of Land and Natural Resources Facility Name	DLNR Division	Facility Type	Occupancy Data (per day)		Water Demand (gpd)	Potential Conservation through conversion to Non-Potable (gpd)	Irrigation System	Existing Water Conservation Measures (Low Volume/Retrofits)				
				DLNR Staff	Others				Toilets	Urinals	Showers	Faucets	Other
1	Anuenue Fisheries Research Center	Division of Aquatic Resources	Aquaculture Facility	12	4	770,214 *	14	Yes	No	No	No	No	* This water demand was tied to a special project that no longer has this large water requirement.
2	Hilo Research Fisheries Station	Aquatic Resources Hilo (HRFS)	Aquaculture Facility	3	0	11,000	7,300	No	Yes	N/A	Yes	Yes	
3	DOCARE Baseyard	Division of Conservation & Resource Enforcement (DOCARE)	Maintenance Baseyard	6	0	70	0	No	Yes	N/A	N/A	N/A	
4	DOFAW - Hilo Baseyard	Division of Forestry & Wildlife (DOFAW)	Maintenance Baseyard	40	11	6,566	300	Yes	No	No	No	No	
5	Kahului Forestry Baseyard	DOFAW	Maintenance Baseyard	15	10	300	200	Yes	Yes	Yes	No	No	
6	Kauai DLNR Baseyard	DOFAW	Maintenance Baseyard	16	2	1,100	1,100	Yes	Yes	N/A	N/A	N/A	
7	Makiki Oahu Branch / Baseyard	DOFAW	Maintenance Baseyard	20	0	1,300	700	Yes	Yes	Yes	Yes	Yes	
8	DOFAW - Kamuela State Tree Nursery	DOFAW	Nursery	8	0	n/a	n/a	N/A	N/A	N/A	N/A	N/A	
9	DAGS State Office Building	Kauai - Land Division	Office Facility	4	0	n/a	n/a	No	No	No	No	No	
10	DOCARE Oahu Branch Office	DOCARE	Office Facility	5	5	n/a	n/a	Yes	Yes	N/A	N/A	No	
11	Field Office (Cabin)	DOCARE	Office Facility	6	0	50	0	No	Yes	N/A	Yes	Yes	
12	Hawaii Branch Administrative Office	DOCARE	Office Facility	7	0	30	0	No	Yes	Yes	Yes	Yes	
13	Hilo State Office Building	Hawaii District Land Office	Office Facility	14	0	n/a	n/a	N/A	N/A	N/A	N/A	N/A	
14	Kakuhihewa State Office Building	State Historic Preservation	Office Facility	16	0	n/a	n/a	N/A	N/A	N/A	N/A	N/A	
15	Kalanimoku Building	Commission on Water Resource Management	Office Facility	224	650	38,000	18,000	Yes	Yes*	Yes*	N/A	Yes*	1. Leak detection and repair. 2. Retrofit kits. 3. Irrigation management. * Only approximately 15% of the fixtures in the building have been converted/retrofitted to water conservation fixtures.
16	Kauai State Building	DOCARE	Office Facility	6	0	30	0	No	Yes	N/A	N/A	N/A	
17	State Office - Maui DOCARE	DOCARE	Office Facility	3	1	n/a	n/a	N/A	N/A	N/A	N/A	N/A	
18	State Office Building	Maui District Land Office	Office Facility	14	0	20	0	No	N/A	N/A	N/A	N/A	
19	West Hawaii Wildlife Office	Division of Forestry & Wildlife	Office Facility	5	0	33	0	N/A	N/A	N/A	N/A	N/A	
20	5309 Ditch	DOFAW	Park Facility	0	0	150	0	No	N/A	N/A	N/A	N/A	1. Low volume float controled valves. 2. Main line metering shut off, 2000 gal max. / setting. 3. Valve leak checks, service level checks with repairs.
21	Aiea Bay State Recreation Park	Division of State Parks	Park Facility	1	0	6,000	1,000	Yes	No	No	N/A	No	
22	Diamond Head State Monument	Division of State Parks	Park Facility	2	0	6,000	1,000	Yes	No	No	N/A	No	
23	Hapuna Beach State Recreation Area	Division of State Parks	Park Facility	3	1,000	n/a	n/a	Yes	No	No	No	No	
24	Iao Valley State Park	Division of State Parks	Park Facility	1	0	14,500	0	Yes	No	No	N/A	No	
25	Kakaako Waterfront Park - Kewalo Basin	Division of State Parks	Park Facility	5	0	16,000	12,000	Yes	No	No	N/A	No	

Table 6-2 (Cont.)
DLNR WATER CONSERVATION SURVEY
RESULTS SUMMARY TABLE

Suvery Number	Department of Land and Natural Resources Facility Name	DLNR Division	Facility Type	Occupancy Data (per day)		Water Demand (gpd)	Potential Conservation through conversion to Non-Potable (gpd)	Irrigation System	Existing Water Conservation Measures (Low Volume/Retrofits)				
				DLNR Staff	Others				Toilets	Urinals	Showers	Faucets	Other
26	Kanaha Pond Wildlife Sanctuary	DOFAW	Park Facility	0	0	755,956 *	0	No	N/A	N/A	N/A	N/A	*Water pumped from private water source - to maintain water level of pond.
27	Kaumahina State Wayside	Division of State Parks	Park Facility	1	0	4,000	0	Yes	Yes	No	N/A	No	Portable toilets are currently being used. Funding for a new comfort station has been approved. Estimated construction completion should be in approximately 2 years.
28	Malaekahana State Recreation Area	Division of State Parks	Park Facility	2	0	3,000	0	Yes	No	No	No	No	
29	Palaau State Park (Molokai)	Division of State Parks	Park Facility	1	0	1,250	0	Yes	No	No	N/A	No	
30	Polipoli Spring State Recreation Park	Division of State Parks	Park Facility	1	0	140	0	Yes	Yes	N/A	N/A	Yes	
31	Puaa Kaa State Wayside	Division of State Parks	Park Facility	1	0	5,000	0	Yes	No	No	N/A	No	
32	Wahiawa Freshwater State Recreation Area	Division of State Parks	Park Facility	1	0	4,000	3,000	Yes	No	No	N/A	No	
33	Waikolu Overlook	DOFAW	Park Facility	4	12	n/a	n/a	Yes	Yes	No	No	Yes	System not connected at this time.
34	Wailua River State Park - Marina	Division of State Parks	Park Facility	5	2,500	12,700	100	Yes	No	No	No	No	
35	Ala Wai Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor - No Commercial Activities	8	0	48,199	0	Yes	Yes *	No	No	No	Checking to see if plumbers can change to water conservation urinals, faucets & showerheads. *The Ala Wai Harbor Office has some water conservation fixtures.
36	Keehi Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor - No Commercial Activities	8	500	n/a	n/a	Yes	Yes	No	No	No	1. Would like to install water sub-meters for tracking of water use.
37	Heeia Kea Small Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor - Commercial Activities	3	50	14,000	0	No	Yes	Yes	N/A	No	
38	Honokohau Small Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor - Commercial Activities	23	300	116,500	113,600	Yes	Yes	No	No	Yes	1. Understanding water bill. 2. Informative water bill.
39	Kawaihae Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor - Commercial Activities	1	100	4,600	3,600	No	Yes	No	No	Yes	1. Understanding water bill. 2. Informative water bill.
40	Lahaina Small Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor - Commercial Activities	5	0	14,200	0	No	No	No	No	No	
41	Waianae Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor - Commercial Activities	3	1,000	5,000	2,500	Yes	No	No	No	No	1. Signs at wash rack informing boaters that they should limit their washing time to 15 minutes each. 2. Making spring nozzles required by boaters using the wash rack. 3. Irrigating only in early morning hours prior to 9 AM.

Due to the limited survey data, it was decided that more reliance would be placed on the results of the preliminary assessment of water billing records and that further in-depth evaluation would be focused on the subsequent analysis of the selected prototype facilities.

The comparison of the preliminary assessment (water billing records) and survey information resulted in a comparison of sixteen facilities. Table 6-3 summarizes the water demand (in gallons per month) from the preliminary assessment vs. the water demand reported in the surveys.

**Table 6-3
Preliminary Assessment vs. Survey Information Water Demands**

Facility Name	DLNR Division	Facility Type	Preliminary Assessment – Water Supply Billing (gallons per month)	Water Demand – Conservation Survey (gallons per month)
Anuenue Fisheries Research Center	Division of Aquatic Resources	Aquaculture Facility	4,514,000	3,600,000
Makiki Oahu Branch / Baseyard	Division of Forestry and Wildlife	Other	26,000	39,000
Aiea Bay State Recreation Area	Division of State Parks	Park Facility	885,000	180,000
Diamond Head State Monument	Division of State Parks	Park Facility	834,000	180,000
Hapuna Beach State Recreation Area	Division of State Parks	Park Facility	1,442,000	n/a
Iolani Palace State Monument*	DAGS	Park Facility	826,000	n/a
Kakaako Waterfront Park	Division of State Parks	Park Facility	4,377,000	480,000
Malaekahana State Recreation Area	Division of State Parks	Park Facility	787,000	90,000
Wahiawa Freshwater State Recreation Area	Division of State Parks	Park Facility	1,531,000	120,000
Wailua River State Park – Marina	Division of State Parks	Park Facility	724,000	381,000
Ala Wai Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor – No Commercial Activities	1,257,000	1,445,970

Keehi Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor – No Commercial Activities	413,000	n/a
Heeia Kea Small Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor – Commercial Activities	406,000	420,000
Kawaihae Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor – Commercial Activities	1,124,000	1,110,000
Honokohau Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor – Commercial Activities	3,284,000	3,495,000
Waianae Boat Harbor	Division of Boating and Ocean Recreation	Small Boat Harbor – Commercial Activities	815,000	150,000

n/a – not available, * Under jurisdiction of Dept. of Accounting and General Services

There was some disparity between the preliminary assessment (water supply billing records) and the water demand reported in the surveys. Eight out of sixteen facilities were either unverified or significantly different.

The discrepancy between the water billing records and water use reported on the surveys could be attributed to facility staff not being aware of water consumption at their facilities. Some of the survey responses indicated that water use quantities were based on their estimates of water usage and not water billing records. Educating the DLNR staff to increase awareness of their existing water consumption and potential for water conservation can be implemented as part of the water conservation program. This will be discussed in the Phase 4 – Development of Prototype Water Conservation Plan.

The water conservation survey data collected did not invalidate any of the potential candidates but did add a potential candidate, the Kalanimoku Building (State office building). The Kalanimoku Building is a shared office facility with the DLNR, Department of Accounting and General Services (DAGS), Department of Transportation (DOT), and the U.S. Department of Agriculture, Forest Services. According to the survey form the Kalanimoku Building uses approximately 1,140,000 gallons of water per month, adding it to the list of significant water users. Through the survey and preliminary assessment, a total of 41 facilities were identified as final candidates for selection as prototype facilities.

7 PHASE 3 – SELECTED DLNR FACILITIES FOR PILOT WATER CONSERVATION PLAN

7.1 Evaluation of DLNR Facilities

DLNR has a wide variety of facilities, ranging from parks and recreational facilities with vast expanses of open space to administrative office buildings where state employees conduct their normal course of business. As part of the preliminary assessment to identify potential prototype facilities, 138 DLNR facilities were initially grouped into eight (8) general categories based on their water use characteristics.

Survey results (for 41 facilities) were then compared to the preliminary assessment of water billing records. Water use characteristics for those 41 facilities were further screened resulting in the identification of six (6) specific facility categories.

These categories were as follows:

- Office Facilities
- State Parks Facilities
- Recreational Small Boat Harbors
- Commercial/Recreational Small Boat Harbors
- Maintenance Baseyards
- Other Facilities

The specific categories developed were based on common facility functions, their respective water use characteristics, and operating conditions. This effort served as an initial filter of facilities for final prototype selection.

The six prototype DLNR facility categories are described as follows:

- **Office Facilities:** Office facilities were identified as a very common public, as well as private, facility category. The preliminary assessment revealed 27 office buildings which house DLNR division offices/operations, most of which are commonly shared with other State agencies.
- **State Park Facilities:** Parks and recreational facilities were also determined to be a very common State and county facility category. There are 54 State park facilities under the jurisdiction of the department.
- **Recreational Small Boat Harbors:** This facility category included 2 such facilities throughout Hawaii. They are the Ala Wai Boat Harbor and the Keehi Boat Harbor, which are operated by the State. The recreational small boat harbor category is defined as those harbor facilities that are strictly for recreational use and do not allow any commercial operations (such as recreational tours or activities).

- **Commercial/Recreational Small Boat Harbors:** This facility category is similar to, but more common than, those harbors solely limited to recreational users. There are 19 commercial/recreational type harbors operated by the State (e.g., Waianae Boat Harbor, Oahu; Lahaina Harbor, Maui; and Honokohau Harbor, Hawaii; etc.). The commercial/recreational small boat harbor category is defined as those harbor facilities that allow commercial operations of recreational tours or activities. Commercial operators are required to obtain a permit from the State to operate their business from these harbor facilities.
- **Maintenance Baseyards:** This category was determined to be one of the most common facility type for State and county agencies. Virtually every public agency is supported by some type of maintenance baseyard, including at least one facility located on each island or district. There are 7 maintenance baseyard facilities operated by the department.
- **Other Facilities:** This category was established for those facilities, which based on their operations and/or water use characteristics were determined to be unique from the other DLNR facilities. Facilities falling into this category were removed from further consideration as potential prototype facilities for the purposes of this study.

The following is a list of the 41 facilities that responded to the DLNR Water Conservation Survey broken down by category type.

- Office Facilities
 - Department of Accounting and General Services (DAGS) – DLNR Kauai Land Division
 - Department of Conservation & Resource Enforcement (DOCARE) Oahu Branch Office
 - DOCARE Field Office – Kauai
 - DOCARE Hawaii Branch Administrative Office
 - State Office Building – Maui District Land Office
 - Hilo State Office Building – Hawaii District Land Office
 - Kakuhihewa State Office Building – State Historic Preservation
 - Kalanimoku Building – Commission on Water Resource Management
 - Kauai State Building – DOCARE
 - Maui State Office – DOCARE
 - West Hawaii Wildlife Office – DOFAW
- State Park Facilities
 - 5309 Ditch
 - Aiea Bay State Recreation Park
 - Diamond Head State Monument
 - Hapuna Beach State Recreation Area
 - Iao Valley State Park
 - Kakaako Waterfront Park
 - Kanaha Pond Wildlife Sanctuary

- Kaumahina State Wayside
- Malaekahana State Recreation Area
- Palaaui State Park
- Polipoli Spring State Recreation Park
- Puaa Kaa State Wayside
- Wahiawa Freshwater State Recreation Area
- Waikolu Overlook
- Wailua River State Park

- Recreational Small Boat Harbors
 - Ala Wai Boat Harbor
 - Keehi Boat Harbor

- Commercial/Recreational Small Boat Harbors
 - Heeia Kea Small Boat Harbor
 - Honokohau Small Boat Harbor
 - Kawaihae Boat Harbor
 - Lahaina Small Boat Harbor
 - Waianae Boat Harbor

- Maintenance Baseyard
 - DOCARE Baseyard
 - Hilo Baseyard - DOFAW
 - Kahului Forestry Baseyard – DOFAW
 - Kauai DLNR Baseyard – DOFAW
 - Makiki Oahu Branch Baseyard – DOFAW

- Other Facilities
 - Anuenue Fisheries Research Center – Division of Aquatic Resources (DAR)
 - Hilo Research Fisheries Station – DAR
 - Kamuela State Tree Nursery - DOFAW

7.2 Selection Criteria for Prototype DLNR Facilities

The development of a rational selection procedure to identify prototype facilities involved the establishment of evaluation criteria that could logically filter through the various types of facilities and focus on maximizing the potential for significant water conservation, not just at the individual facility level, but potentially statewide.

Three (3) primary criteria were developed for the identification/selection of DLNR prototype facilities. The 41 potential candidates within the six (6) facility categories were screened based upon the selection criteria. In the end, five (5) facility categories were identified for development of a prototype water conservation plan (Phase 4).

- **Criterion No. 1:** The first criterion used in the selection of prototype facilities was whether the water use characteristics at a given facility was typical of other facilities

in DLNR, as well as other agencies statewide. The rationale for this criterion was that conservation measures developed for these prototype facilities could be applied to many similar facilities. If a small percentage reduction in water consumption for the prototype facility could be realized, application of these measures to other similar facilities could result in a significant reduction in overall water use by the State.

- **Criterion No. 2:** The second criterion used was the identification of facilities with significant water consumption (>400,000 gallons per month). It was reasoned that the potential for significant water use reduction was greatest at high water use facilities. Implementing conservation measures that result in even a small percentage reduction of water consumption would still result in a significant reduction in the total volume of water consumed by a high use facility.

- **Criterion No. 3:** The third criterion for facility selection was the relative lack of existing water conservation measures. This criterion was used to eliminate certain facilities from further analysis within this study. Facilities with fully implemented water conservation measures were eliminated from consideration, since their potential for further water use reduction would be minimal. However, a recommendation of this study would be to evaluate facilities with existing conservation programs and compare their effectiveness with measures implemented as a result of the proposed program.

7.3 Screening of Prototype DLNR Facilities

DLNR Facility ¹	Criterion 1: Typical Facility	Criterion 2: High Consumption (>400,000 gallons/month)	Criterion 3: Lack of Existing Conservation Measures
1. Anuenue Fisheries Research Center*		X	X
2. Hilo Research Fisheries Station			
3. DOCARE Baseyard	X		
4. DOFAW – Hilo Baseyard	X		
5. Kahului Forestry Baseyard	X		
6. Kauai DLNR Baseyard	X		
7. Makiki Oahu Branch / Baseyard	X		
8. Kamuela State Tree Nursery			N/A
9. DAGS State Office Building – Kauai	X		X
10. DOCARE Oahu Branch Office	X		

¹ Identified through preliminary assessment of water billing records and survey responses.

* Water Demand was tied to a special project that no longer is in place, which caused an unusually high water requirement.

N/A – Information Not Available.

DLNR Facility ¹	Criterion 1: Typical Facility	Criterion 2: High Consumption (>400,000 gallons/month)	Criterion 3: Lack of Existing Conservation Measures
11. DOCARE Field Office (Cabin)	X		
12. DOCARE Hawaii Branch Admin. Office	X		
13. Hilo State Office Building	X		N/A
14. Kakuhihewa State Office Building	X		N/A
15. Kalanimoku Building	X	X	X
16. Kauai State Building – DOCARE	X		
17. State Office – Maui DOCARE	X		N/A
18. State Office Building – Land Office	X		N/A
19. West Hawaii Wildlife Office	X		N/A
20. 5309 Ditch – DOFAW	X		N/A
21. Aiea Bay State Recreation Park	X	X	X
22. Diamond Head State Monument	X	X	X
23. Hapuna Beach State Recreation Area	X	X	X
24. Iao Valley State Park	X		X
25. Kakaako Waterfront Park	X	X	X
26. Kanaha Pond Wildlife Sanctuary	X		N/A
27. Kaumahina State Wayside	X		
28. Malaekahana State Recreation Area	X		X
29. Palaaau State Park	X		X
30. Polipoli Spring State Recreation Park	X		
31. Puaa Kaa State Wayside	X		X
32. Wahiawa Freshwater State Rec. Area	X	X	X
33. Waikolu Overlook	X		
34. Wailua River State Park – Marina	X	X	X
35. Ala Wai Boat Harbor		X	X
36. Keehi Boat Harbor		X	X
37. Heeia Kea Small Boat Harbor	X	X	X
38. Honokohau Small Boat Harbor	X	X	X
39. Kawaihae Boat Harbor	X	X	
40. Lahaina Small Boat Harbor	X	X	X
41. Waianae Boat Harbor	X	X	X

¹ Identified through preliminary assessment of water billing records and survey responses.

* Water Demand was tied to a special project that no longer is in place, which caused an unusually high water requirement.

N/A – Information Not Available.

7.4 Selection of Prototype DLNR Facilities

After reviewing the various facilities within each category, five (5) existing DLNR facilities, which best met the selection criteria were selected for further assessment and development of applicable water conservation measures. In general, the highest water use facilities in the aforementioned general categories were selected as prototype facilities. They were also screened to confirm that little to no existing water conservation measures were already in place.

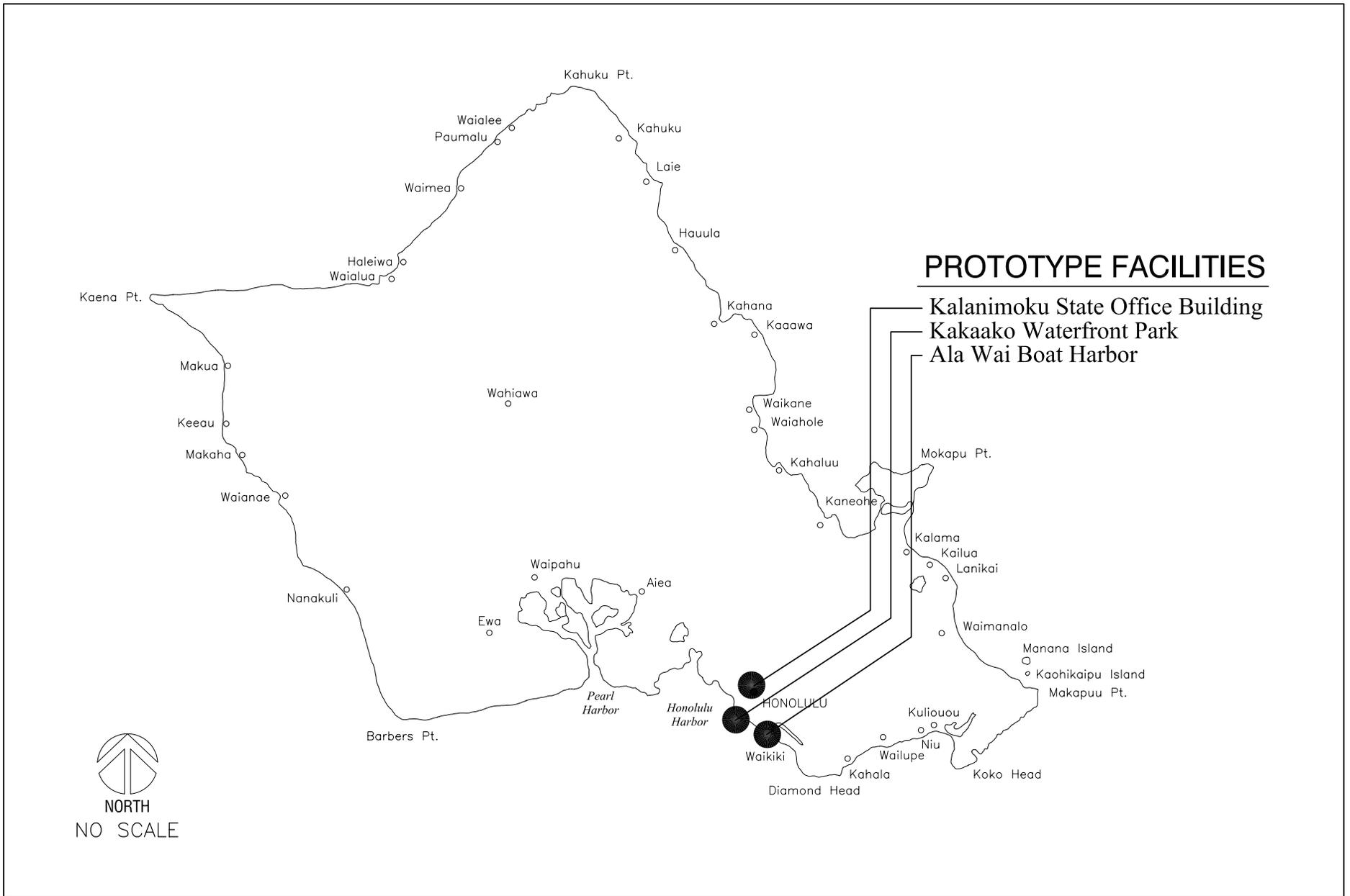
Three of the prototype facilities are located on the island of Oahu. These facilities are the Kalanimoku State Office Building, Kakaako Waterfront Park, and the Ala Wai Boat Harbor, see Figure 7-1. Two of the prototype facilities are located on the island of Hawaii. These facilities are the Honokohau Small Boat Harbor and the Division of Forestry and Wildlife – Hilo Baseyard, see Figure 7-2.

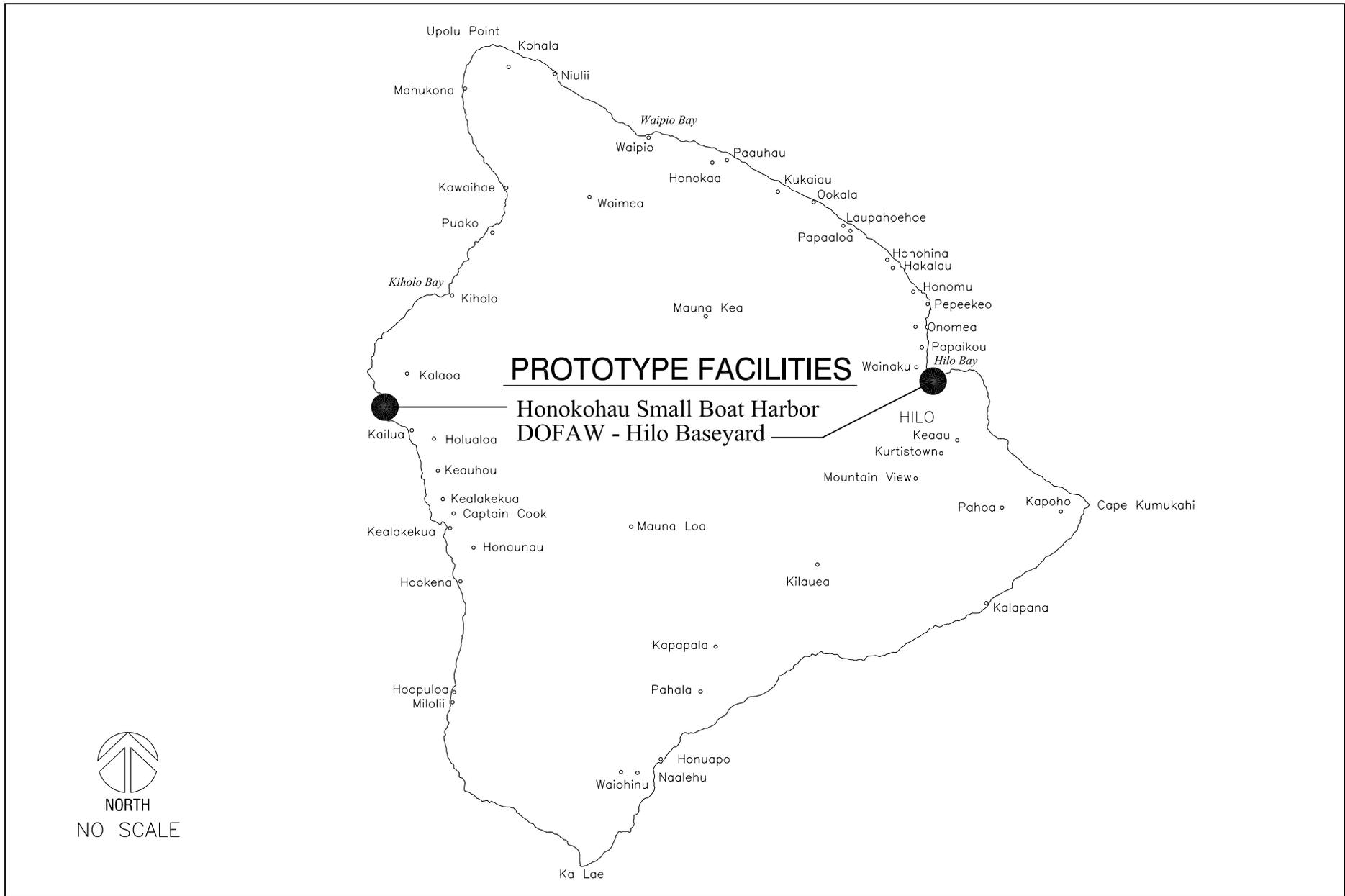
The Kalanimoku State Office Building was selected as a prototype office facility. The Kalanimoku State Office Building houses various departments of the State and is located at 1151 Punchbowl Street in Honolulu, see Figure 7-3. The potential for water conservation would result from measures applied to irrigation operations and typical domestic-type, potable water use (such as restroom and toilet facilities).

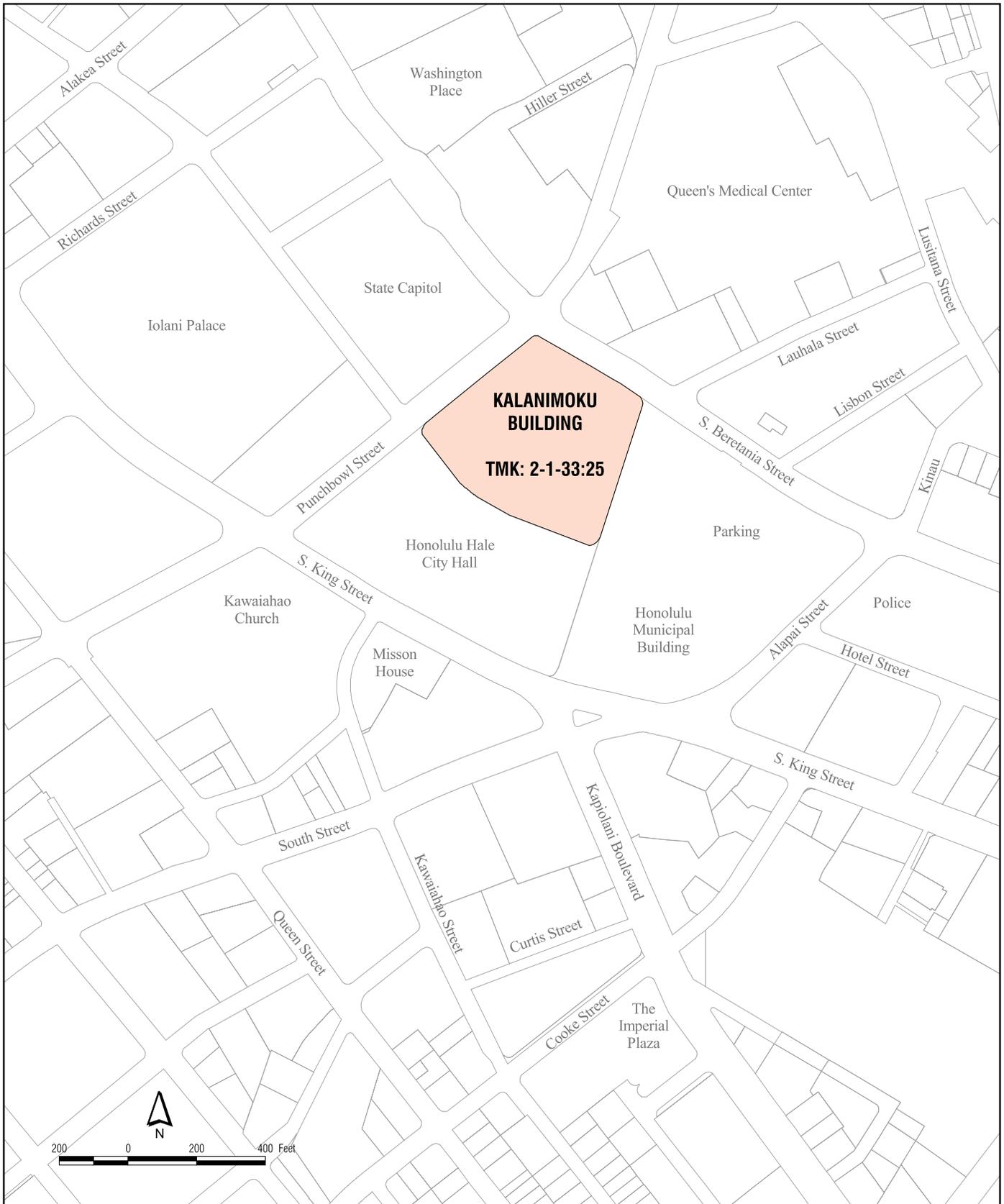
The facility screening indicated that the Kalanimoku Office Building met all three of the facility selection criteria: Criterion No. 1 – typical facility, Criterion No. 2 – high water usage and Criterion No. 3 – relative absence of water conservation measures.

The Kakaako Waterfront Park was chosen as the prototype State park and recreational area facility. Kakaako Waterfront Park is located at the end of Ahui Street and Ohe Street off Ala Moana Boulevard in Honolulu, see Figure 7-4. The Waterfront Park covering 35 acres is a well-used recreational area featuring shore fishing and access for ocean activities. The park also offers a waterfront promenade, picnic areas, an amphitheater, observation areas and restroom facilities with showers. The potential for water conservation would come in the form of measures applied to landscape irrigation and potable water use in restroom and shower facilities. Our evaluation indicated that Kakaako Waterfront Park also met all three of the facility selection criteria.

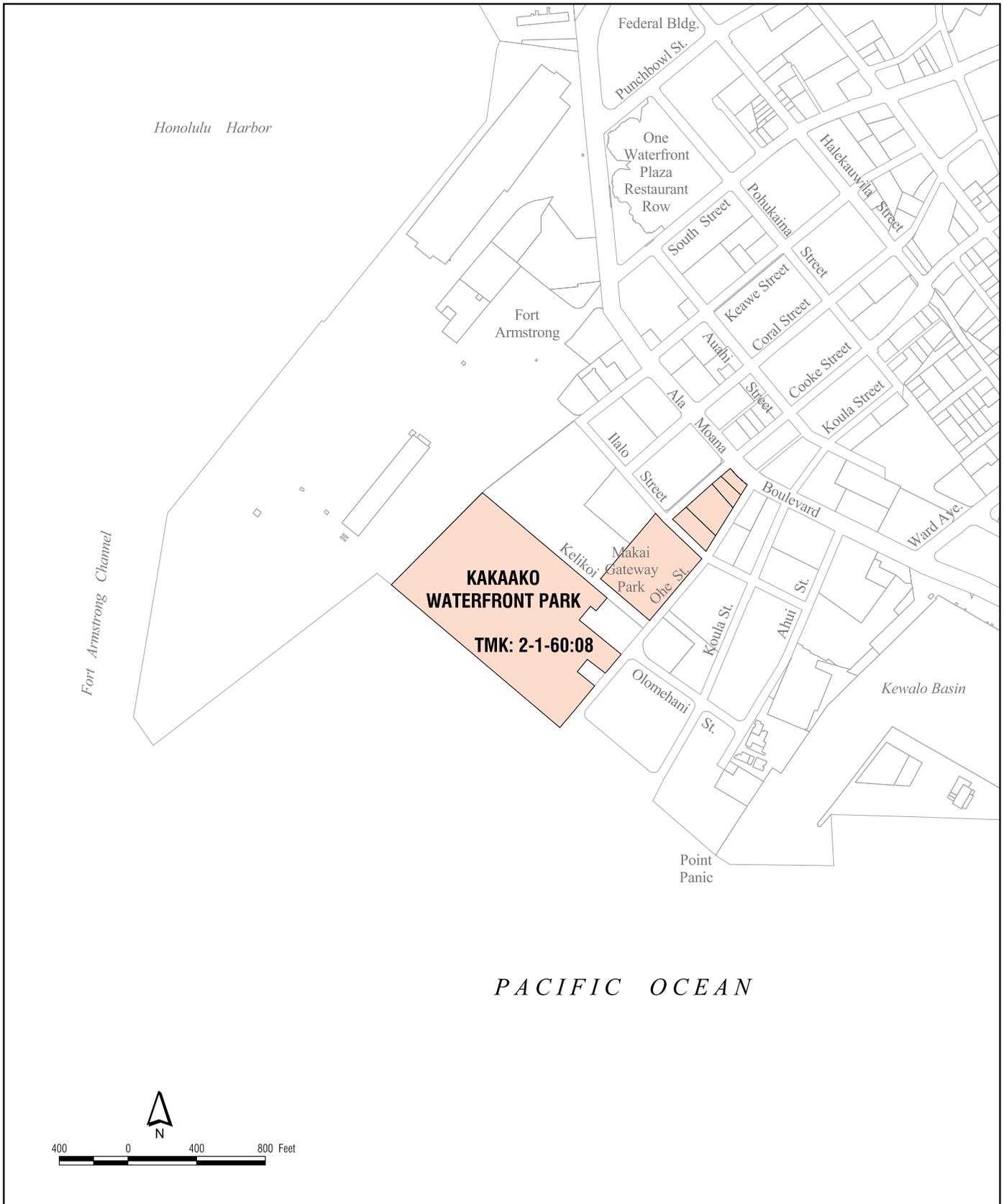
The Ala Wai Boat Harbor was selected as the prototype facility for recreational small boat harbors. The Ala Wai Harbor is located on the south coast of Oahu, between Waikiki and Ala Moana beaches, see Figure 7-5. The harbor includes areas used by the Hawaii Yacht Club, Waikiki Yacht Club, and the Royal Hawaiian Ocean Racing Club. The harbor encompasses a total of 128 acres and can accommodate vessels up to 85 feet in length. There are 699 berths with dock, 85 moorings, one ramp, and 22 dry storage spaces. The harbor also consists of a vessel wash down area, harbor office, restrooms and showers, fuel facility, which includes moorings and laundry service, and boat repair facility and chandlery. The potential for water conservation would come from measures applied to water use for boat washdown and domestic-type potable water use at the harbor.



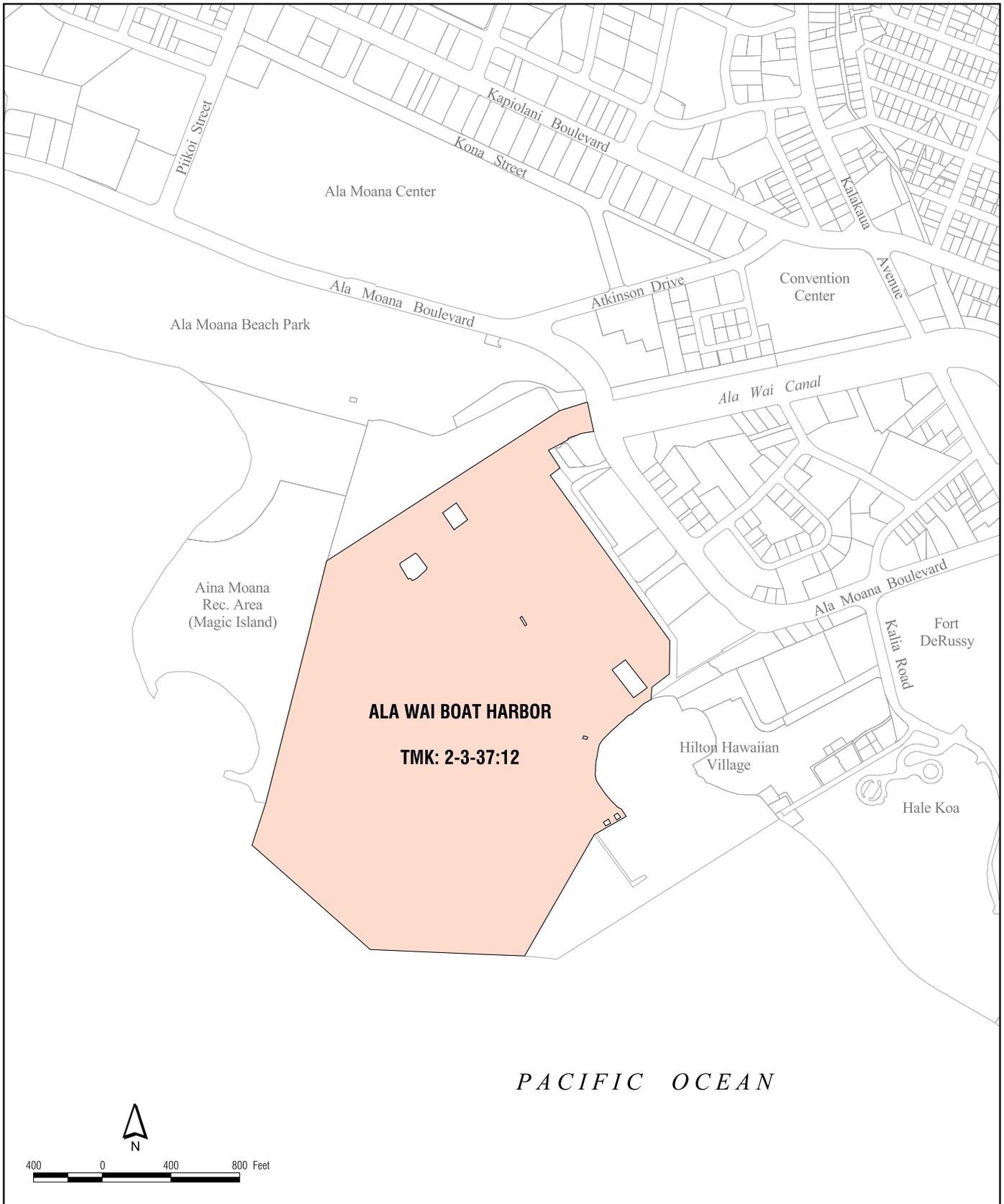




PROTOTYPE FACILITY VICINITY MAP - Kalanimoku State Office Building
Figure 7-3



PROTOTYPE FACILITY VICINITY MAP - Kakaako Waterfront Park
Figure 7-4



PROTOTYPE FACILITY VICINITY MAP - Ala Wai Boat Harbor
Figure 7-5

The data indicated that most of the recreational small boat harbor facilities met two of three facility selection criteria: Criterion No. 2 - high water usage; and Criterion No. 3 – relative absence of water conservation measures. Only the Ala Wai Boat Harbor Office has implemented water conservation measures with water saving fixtures.

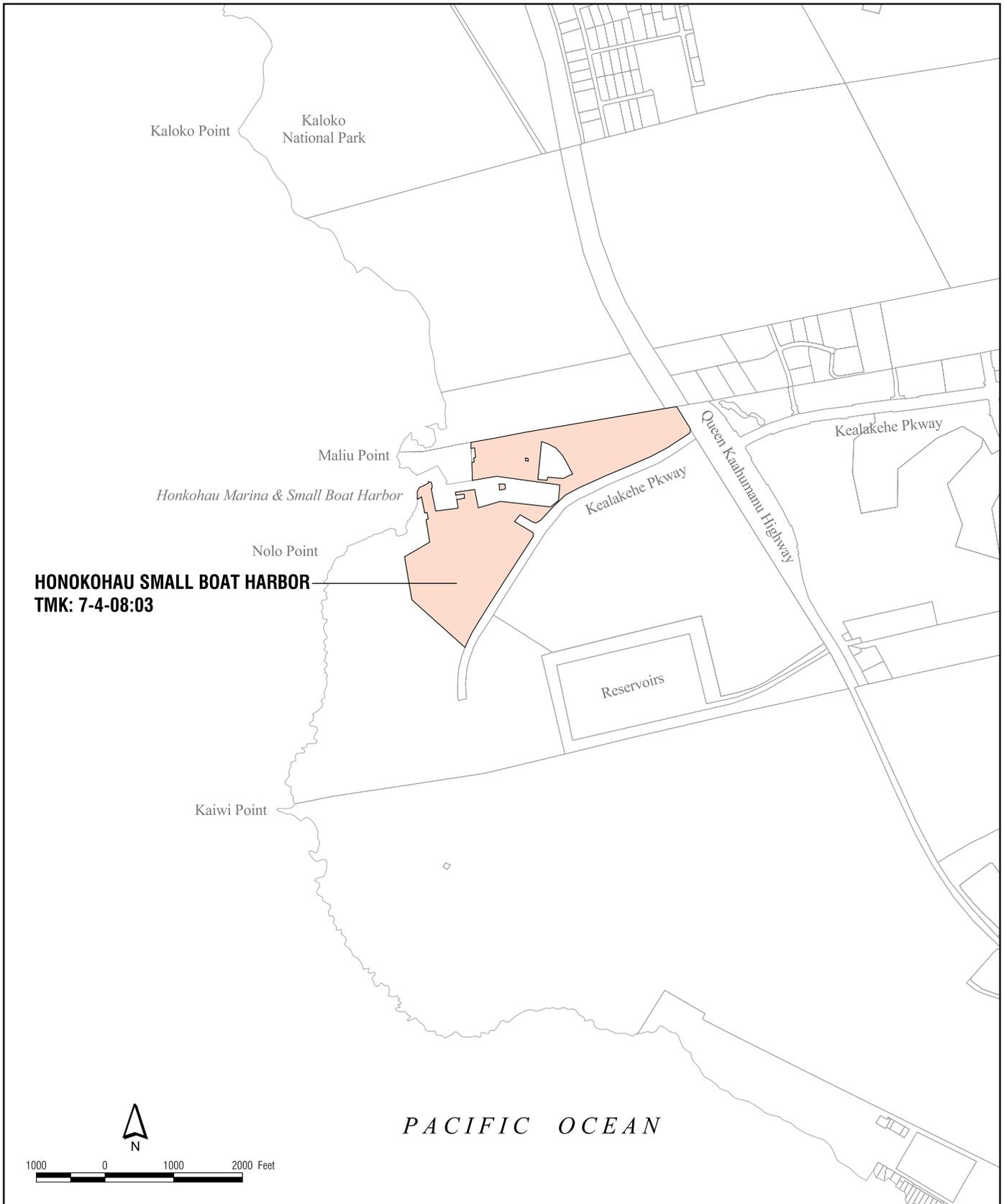
The Honokohau Small Boat Harbor was selected as the commercial/recreational small boat harbor prototype facility. The Honokohau Harbor is located on the west coast of Hawaii approximately three miles northwest of Kailua-Kona Wharf, see Figure 7-6. The harbor consists of a dredged channel that leads to two basins. The harbor encompasses 142.3 acres and has 262 moorings, 4 ramps (two 30-foot wide, 2 lane ramps), piers A-H, 2 T-piers, outer basin, vessel washdown area, fuel facility, harbor office and restrooms. The potential for water conservation would come from measures applied to water use for boat washdown, domestic-type potable water use at the harbor, and water use by the commercial users such as equipment maintenance and clean-up.

Screening of the survey data indicated that Honokohau Small Boat Harbor also met all three of the facility selection criteria.

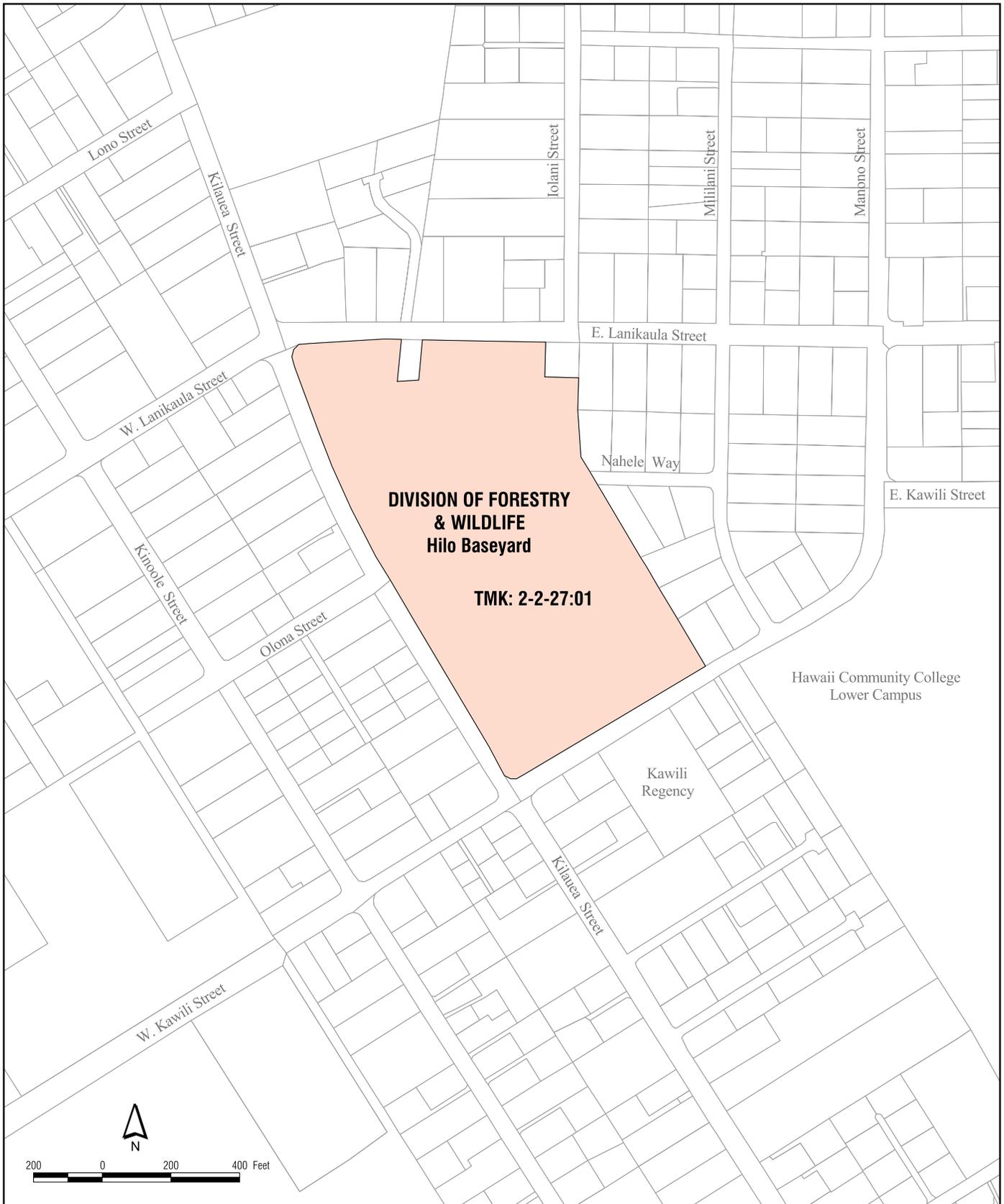
The Department of Forestry & Wildlife (DOFAW) – Hilo Baseyard was selected as the prototype for maintenance baseyard facilities. DOFAW's Hilo Baseyard is located at 19 E. Kawili Street in Hilo, Hawaii, see Figure 7-7. The baseyard consists of general office, repair shop, operation shop, and nursery. The potential for water conservation comes from measures applied to water use for maintenance operations, domestic-type potable water use, nursery and landscape irrigation.

The survey data showed that the Hilo Baseyard facility met only one of the facility selection criteria: Criterion No. 1 – typical facility.

Having sorted the 41 facilities into six (6) general categories and then selecting (5) specific prototype facilities based upon three (3) selection criteria, the next step was to develop prototype water conservation plans for each selected prototype facility (Phase 4).



PROTOTYPE FACILITY VICINITY MAP - Honokohau Small Boat Harbor
Figure 7-6



**PROTOTYPE FACILITY VICINITY MAP - DOFAW - Hilo Baseyard
Figure 7-7**

8 PHASE 4 – DEVELOPMENT OF PROTOTYPE WATER CONSERVATION PLAN

8.1 Conservation Plan Methodology

A prototype water conservation plan methodology was developed to identify appropriate water conservation measures that could be applied initially to the five selected prototype facilities, and in the future to other State facilities with similar water use characteristics. By evaluating facility water usage and physical infrastructure, and then identifying and assessing the effectiveness of various water conservation measures, the feasibility of implementing water conservation programs can be determined for each prototype facility. The general methodology developed for this effort involved the following components:

- Facility water system inventory;
- Existing water usage characteristics and historical consumption data;
- Assessment of various water uses – identification of significant uses;
- Identification of applicable water conservation measures;
- Applicable water conservation measures feasibility assessment – cost benefit analysis;
- Facility conservation plan:
 - Selected water conservation measures and incentives
 - Projected water conservation & cost savings
 - Environmental review of the conservation plan implementation; and
- Facility conservation plan implementation schedule.

The objective of developing this methodology was to provide a systematic and consistent approach for identifying and evaluating facilities, estimating the effectiveness of selected conservation measures and assessing the feasibility of implementing conservation programs. The conservation program development methodology flow chart is presented in Figure 8-1. Each component of the conservation plan is summarized in the following section.

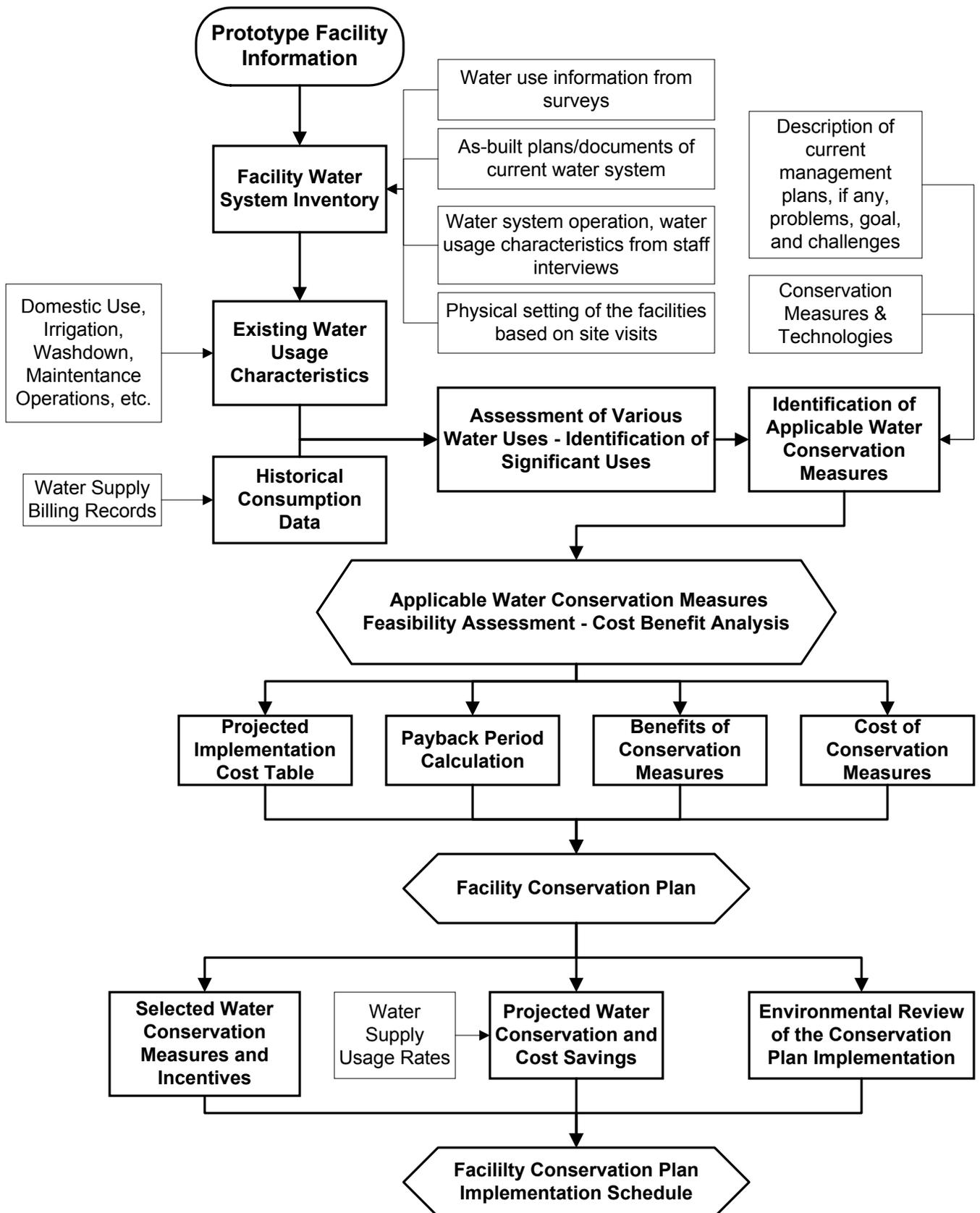
8.2 Conservation Plan Components

Facility Water System Inventory

The first component of the conservation plan involved the collection of background information on the prototype facility's water system. The collected information included:

- Water use information from surveys received from facilities;
- As-built plans and related documents to evaluate the current water system infrastructure that serves the facilities;
- Water system operation, including typical water usage characteristics based on interviews with facility staff; and

**Figure 8-1
Conservation Plan Methodology
Flow Chart**



- Physical setting of the facilities based on site visits.

The information compiled in this initial phase established the baseline water use condition around which a water conservation program would be formulated. The inventory of the prototype facilities' water infrastructure and usage characteristics was the basis for identification of water conservation opportunities by providing an understanding of where and how water was being used, the existence or relative lack of conservation measures, past experience with water conservation programs, and water management challenges and goals. Actual counts of plumbing fixtures such as water closets (toilets), urinals, lavatory (sinks), basins (janitorial sinks), drinking fountains, washdown hose connections, etc., provided a general indication of the more significant water uses at the various facilities. The inventory also gave an indication of the types of physical conservation measures that could be applied. Site visits and staff interviews provided insight on the facilities' operations and a general indication of what would be appropriate for facilities in their particular physical setting. Information gained from the visits and/or interviews supplemented the data gathered from surveys and as-built plan/document review.

Current water management problems, goals and challenges were summarized for each of the prototype facilities and included in this section.

Existing Water Usage Characteristics and Historical Consumption Data

Evaluation of the current water usage and consumption history for each prototype facility was performed to provide basic water use characteristics, as well as an indication of patterns in water use. For example, was water use fairly consistent throughout the year, or did it show seasonal variations? Analysis of these patterns was helpful in determining the potential effectiveness of selected conservation measures. The water usage at each of the prototype facilities was identified through the preliminary assessment of water use, the information surveys submitted by the facilities, and follow-up interviews with the facility staff. Water usage for each facility was broken down into categories such as domestic use, irrigation, washdown, maintenance operations, etc.

A minimum of 2 years of water billing records were obtained from the County water supply departments to develop a water consumption history for each prototype facility. As stated earlier, the water consumption history was used to establish typical water usage patterns throughout the year for each prototype facility. The water consumption history will also be used to assess program effectiveness by comparing water usage before and after the proposed conservation measures are implemented.

Assessment of Various Water Uses – Identification of Significant Uses

An assessment of each prototype facility's significant water uses was conducted to get an understanding of the facility's water use practices. The assessment included a review of information compiled from submitted water use surveys and follow-up interviews with the facility staff. Also used were the as-built plans of the facility's water infrastructure, or if plans were not available, results from facility site inspections.

Calculations and/or estimations of water usage were performed based on the assessment effort to identify points within the various facilities where water use was significant. These points of water use were then evaluated for appropriate water conservation measures. Estimated actual water usage for the purposes of calculating water use savings are based on the following prioritized information sources for the prototype facilities:

- 1) Survey information provided by prototype facility on water usage breakdown;
- 2) Facilities latest 30-day metered water use records; and
- 3) Average water usage from BWS or DWS water billing records.

Each facility varied in their ability to breakdown their facility's water usage; therefore, actual water usage was developed based on the best available information.

For facilities where detailed plans could be obtained, water use percentages for the different types of plumbing fixtures were estimated based on the Uniform Plumbing Code's (UPC) fixture unit counts. The fixture unit is a standard water consumption unit that is used for sizing water lines within buildings. The method that was applied in this effort provided a weighted distribution of water usage based on the various types of fixtures installed and used at each prototype facility. Generally, fixtures with higher fixture unit values were capable of discharging higher flows (e.g., flush valves installed on toilets versus a drinking fountain); therefore, the proportion of water use was more heavily weighted to those high flow fixtures. In other facilities, where detailed plans were not available, more generalized estimates were made based on the various categories of use, such as toilet facilities, irrigation, or equipment washdown. As a result of this effort, an estimated water use percentage was assigned to each fixture in the facility or to the various water use categories.

Identification of Applicable Water Conservation Measures

Once the significant water use activities and "points of use" were identified at each facility and existing water conservation measures, or lack thereof, were determined, appropriate water conservation measures were selected. Water conservation measures are devices or practices that reduce water usage, preferably by reducing or eliminating waste. Conservation measures can be generally grouped into two categories: (1) physical devices or equipment ("hardware"), and (2) "non-structural" behavior modification, or water management practices. Hardware measures include various types of devices, such as low-consumption toilets and urinals; waterless and composting toilets and urinals; low-volume faucets; low-flow shower heads; use of native, drought-tolerant landscaping; drip irrigation; automatic shut-off hoses; and rain and moisture sensors. "Non-structural" measures such as behavior modification or water use management typically involve public education and water conservation awareness.

Water conservation incentives may also be used to increase water users' awareness and interest about the value of reducing water use. Incentives that motivate water users to

implement conservation measures can be classified into three categories: educational, financial, and regulatory. Educational incentives and public outreach are essential to making the average person become aware of the program's goals, benefits, and opportunities to adopt specific water-saving measures (e.g., conservation checklists developed for State facilities, providing historical water consumption information to facility staff, etc.). Incentives should not only increase public awareness, but should motivate water users to implement available water conservation measures that yield water savings. Financial and regulatory incentives (e.g., block rate structure, over pumpage penalties) often get public attention because they can result in adverse consequences if not heeded, either in terms of additional user costs or violator penalties.

Research was conducted to gather information on the latest water conservation measures available. The U.S. Department of Energy provides water conservation information entitled, "How to Buy a Water-Saving Replacement Toilet, and Urinal, Water-Saving Showerhead, and Faucet," see Appendix 5. Information on water conservation technologies and innovations were reviewed, and the most appropriate water conservation measures were included in the program developed for each prototype facility. Selected conservation measures were based on each facility's specific water usage, with a focus on the more significant water uses at each of the prototype facilities. Not every conservation measure was applicable to all prototype facilities.

A summary of the current water management plans for each facility will be included, if applicable, along with the problems, goals and challenges facing each facility's water management.

Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis

The feasibility of implementing conservation plans for each of the prototype facilities was evaluated using conventional cost benefit analysis techniques, comparing the implementation costs with the economic benefits. This type of evaluation would generally provide the necessary justification for proceeding with a given project. A second, less objective assessment was also considered, which involved reviewing the proposed plans from the aspect of beneficial water conservation. The concept of beneficial water conservation involves reducing waste of our precious water resources and minimizing adverse environmental impacts, which endanger our water supply. These benefits may be considered intangible in that their direct economic value cannot be quantified; however, such societal externalities should be "weighed" and considered in the formulation of water management and conservation plans.

Facility Conservation Plan

A conservation plan was developed for each of the selected prototype facilities, incorporating all of the previously mentioned components. The individual plans summarize the findings in the following format:

- Selected Water Conservation Measures and Incentives – A detailed description of water conservation measures and incentives to be applied to the selected prototype facility, the projected implementation cost (including labor), and a summary of the evaluation process and tabulation of any quantitative data analyses conducted are contained in each plan;
- Projected Water Conservation & Cost Savings – The estimated savings in water consumption and resulting economic cost savings and any intangible benefits (i.e., those not resulting in direct economic gains) were also identified and discussed, where applicable; and
- Environmental Review of the Conservation Plan Implementation – The positive and negative environmental effects that may be associated with the conservation measures to be implemented were addressed and summarized in each plan.

Facility Conservation Plan Implementation Schedule

The development of a schedule for implementation of individual conservation measures into a conservation program for each prototype facility would generally involve the prioritization of selected measures. Water conservation measures developed in the plan will be divided into two implementation components:

- Interim Conservation Measures – are those that could be applied right away to achieve or perpetuate immediate water savings; and
- Long-Range Conservation Measures – are those that could be applied over time or in the future to achieve long-term water savings.

The recommended schedule should be used as a general guideline to coordinate the implementation timing of water conservation measures and incentives with other planned improvement projects scheduled at the various facilities.

8.3 Prototype Facility – Kalanimoku State Office Building

8.3.1 Facility Water System Inventory

The Kalanimoku State Office Building is located at 1151 Punchbowl Street on the island of Oahu. The Kalanimoku Building is a five-story structure, surrounded by landscaped areas that encompass approximately 5.3 acres, see Figure 8-2. The Kalanimoku Building serves several agencies including the State of Hawaii Department of Accounting and General Services (DAGS), Department of Land and Natural Resources (DLNR), and the Department of Transportation (DOT). The Kalanimoku Building also houses the United States Department of Agriculture’s Forest Services.

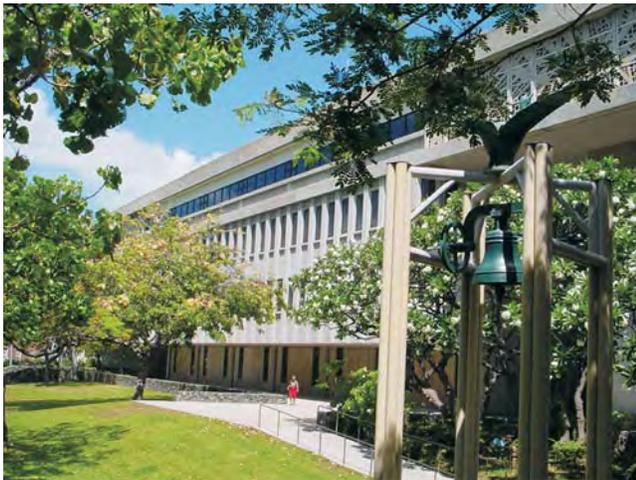


Figure 8-2
Photos of the
Kalanimoku State Office Building

The Kalanimoku State Office Building houses a total of approximately 875 staff from the various departments previously mentioned. The Kalanimoku Building’s operation is typical of any office building, with the majority of water use within the building coming from domestic uses (e.g., toilets, urinals, sinks, drinking fountains, etc. See Figure 8-3 for photos of the existing plumbing fixtures). The Kalanimoku Building’s surrounding landscaped area is irrigated by an existing automatic spray system.

Water Consumption

According to the Department of Accounting and General Services (the agency responsible for the Kalanimoku Building’s operation and maintenance), the Kalanimoku Building’s general office water use is approximately 20,000 gallons per day, while the landscape irrigation demand is approximately 18,000 gallons per day. This translates to a monthly water demand of about 600,000 gallons (for general office) and 540,000 gallons (for irrigation).

Water Use – Plumbing Fixtures

Based on available construction plans and site inspections, the total plumbing fixture count for the Kalanimoku Building is summarized in Table 8-1.

Table 8-1 Kalanimoku Building – Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	79	5	395
Urinal	17	5	85
Lavatory	55	2	110
Basin / Sink	9	4	36
Drinking Fountain	21	2	42
Total Fixture Units			668

Water Use – Irrigation

The Kalanimoku Building’s landscaped area consists of a sprinkler irrigation system first installed in 1974. The landscaped area surrounding the Kalanimoku Building has a total fixture unit count of 515.

Water Management Problems, Goals, and Challenges

The Kalanimoku Building does not currently have a formal water management plan. The Department of Accounting and General Services accounts for water usage with Board of Water Supply monthly water billings. The Kalanimoku Building maintenance staff have tried to implement water conservation measures with retrofit changes to existing fixtures with little success due to design problems with retrofits. The Kalanimoku Building does



Typical Lavatories & Urinals from
Basement Restroom Facility



Typical Custodial Faucet from
1st Floor Janitorial Room



Typical Wash Basin
from Basement Facility



Drinking Fountains from
1st Floor Restroom Facility



Typical Water Closet from
1st Floor Restroom Facility



Typical Lavatories from
Basement Restroom Facility

Figure 8-3
Photos of Kalanimoku State Office Building
Existing Plumbing Fixtures

not have any known water quality problems and the current water system adequately serves the facility.

The conservation goals for the Kalanimoku Building are to achieve a 15% water use reduction, to estimate cost savings over the long term, and to free up water supplies for additional uses. The conservation program results will be monitored by metered water use (BWS water billings).

The Kalanimoku Building does not have an educational program currently in place to promote water conservation. Unlike BWS rates and charges for residential water services, which are based on a tiered pricing structure that encourages water conservation among residential customers, BWS rates and charges for commercial/business services are based on a standard rate per 1,000 gallons, which does not necessarily encourage water conservation. There is no audit or incentive program for irrigation water users.

8.3.2 Existing Water Usage Characteristics and Historical Consumption Data

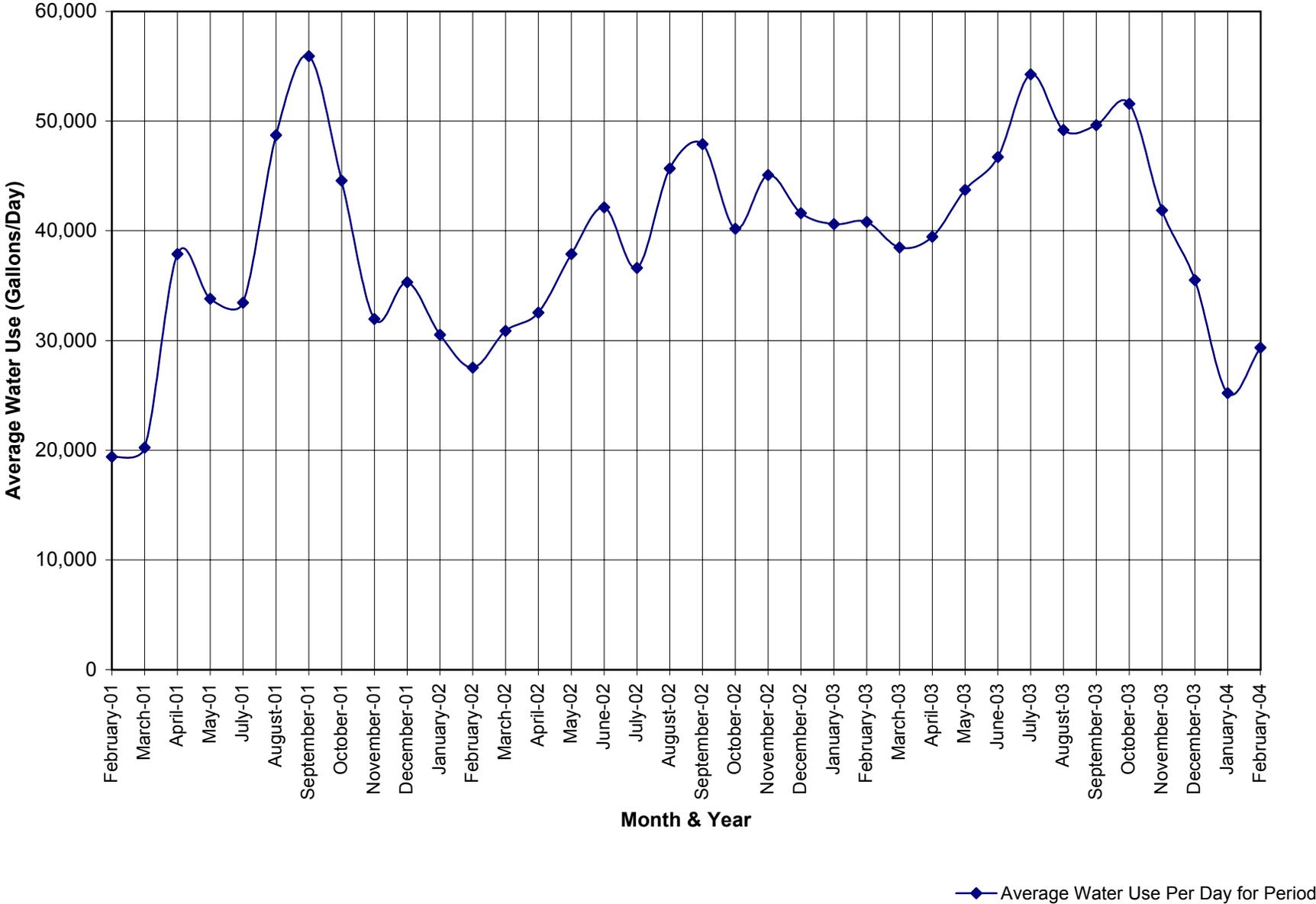
The Kalanimoku Building's water usage falls under two basic categories: domestic use and irrigation. The Kalanimoku Building's daily operations require the use of potable water to meet the domestic needs of staff and visitors to the facility. Potable water is also used for daily irrigation of landscaped areas surrounding the building. The Kalanimoku Building was constructed in 1974, and plumbing fixtures installed at that time were not designed to be especially water efficient. The development of more efficient water plumbing fixtures began in the 1980's. The average water-use rates for the restroom facility fixtures installed at the Kalanimoku Building are estimated as follows:

- Water Closets (Toilets w/ flush valves) – 3.5 gallons per flush (gpf);
- Urinals – 3.5 gpf; and
- Lavatories – 3.0 to 7.0 gpm (Average 5.0 gpm).

Water consumption history for the Kalanimoku Building was obtained through the Honolulu Board of Water Supply for the record period of February 2001 to February 2004. The average water consumption per day for the record period was 39,060 gallons per day. The maximum average daily usage for the record period was 55,900 gallons/day (October 2001) and the minimum average daily usage for the record period was 19,400 gallons/day (February 2001). Figure 8-4 graphically summarizes average water use per day for each monthly period from February 2001 to February 2004.

From the water consumption history chart, it appears that the water use for the Kalanimoku Building typically increases during the months of July through September, which would correlate to the dryer periods of the year. Increases in irrigation needs may be attributed to this trend. Currently, the Kalanimoku Building is served by one meter for all potable water usage, including both domestic and irrigation requirements. (Consideration should be given to separately meter the irrigation and domestic use to get a better understanding of the true water use breakdown between domestic and irrigation water use at the Kalanimoku Building.)

**Figure 8-4
Kalanimoku Building
Average Water Use Per Monthly Period**



8.3.3 Assessment of Various Water Uses - Identification of Significant Uses

As stated earlier, the only two significant water uses for the Kalanimoku Building are domestic use and irrigation. According to the DAGS survey information, the water used for domestic and irrigation are almost equal, 20,000 gallons/day (domestic use) and 18,000 gallons/day (irrigation). The reported water use at the Kalanimoku Building from the survey information gathered totaled 38,000 gallons/day. The average water consumption history from Board of Water Supply records was 39,060 gallons/day, verifying the survey information.

8.3.4 Applicable Water Conservation Measures

There are two primary water uses in the Kalanimoku Building: domestic use and irrigation. Domestic water use includes drinking fountains, restroom facilities and custodial facilities; irrigation water use includes landscaped areas surrounding the Kalanimoku Building and an existing irrigation system. The existing irrigation system was installed during the construction of the Kalanimoku Building. Various modifications and repairs have been made over the years to maintain the existing irrigation system.

Existing drinking fountains are relatively water efficient due to automatic shut-off mechanisms. Basins and sinks for custodial services are limited to janitorial staff who control water usage at these facilities and can be educated on water conservation measures. Drinking fountains and basins/sinks were not considered for water conservation measures because these facilities made up a small percentage of the total water usage fixtures in the Kalanimoku Building (this will be discussed in section 8.3.6). The water conservation measures selected for the Kalanimoku Building included low-consumption flushometer-valve toilets, low-consumption urinals, and low-volume faucets, see Table 8-2.

Table 8-2
Water Conservation Measures and Devices – Kalanimoku State Office Building

Water Conservation Measures – Domestic Water Use

Type of Fixture	Existing Water Usage	Water Conservation Measure	Conservation Water Usage	Water Savings Percentage
Water Closet (Toilet)	3.5gpf*	Low-Consumption Flushometer-Valve Toilets	1.6 gpf	54%
Urinal	3.5 gpf	Low-Consumption Urinals	1 gpf	71%
Lavatory	5 gpm**	Low-Volume Faucets (Metering)	0.5 gpm	90%

* Gallons per flush

** Gallons per minute

Water Conservation Measures – Irrigation Water Use

Type of Fixture	Existing Water Usage	Water Conservation Measure	Conservation Water Usage	Water Savings Percentage
Existing Irrigation System/Existing Landscaping	18,000 gpd*	New Irrigation System	15,300 gpd	15%

*Gallons per day

There were several other water saving devices available, such as composting and incinerating toilets and urinals, but these were considered impractical for this application. Low-flow fixtures would require the least amount of modification to the existing facilities and are the most practical conservation measures, see Appendix 6 for information on these water conservation measures.

The water conservation measures selected for the landscaped areas surrounding the Kalanimoku Building include metering water use for irrigation and replacement of the existing irrigation system with a new, more water-efficient irrigation system, including soil moisture probes and sensors. Other water conservation measures for the landscaped areas include selection of native and low-water use plants, monitoring and optimizing the irrigation schedule, soil improvements, and application of mulches to retain soil moisture.

The Department of Accounting and General Services is currently undertaking a project to replace the existing irrigation system at the Kalanimoku Building. From discussions with the project’s landscape architect, the new irrigation system to be installed at the Kalanimoku Building will be more efficient and save approximately 15% on irrigation water consumption. The new irrigation system includes the following improvements:

- High efficiency sprinkler heads (91% vs. 75% for old system);
- Rain sensors shut-off sprinkler system (set at ¼” rainfall);
- Pressure regulators keeping water pressures within 10% of optimum operating pressures;
- Sprinkler system designed for existing facilities (old system covered sidewalk areas which were constructed later); and
- New solid-state controllers, which are more accurate than old dial type timers.

Another water conservation measure that could be applied to the Kalanimoku Building is the sub-metering of irrigation water consumption separately from the domestic water consumption used in the Kalanimoku Building. This measure does not have direct water usage savings, but enables the staff of the Kalanimoku Building to monitor water usage at the facility and properly apply water conservation measures to the facility.

Other water conservation measures that could be applied at the Kalanimoku State Office Building include the following:

- Education of custodial staff on water conservation measures, such as turning off

- water while not in use for janitorial services;
- Training of maintenance staff on upkeep of low-flow fixtures;
- Installation of signs that encourage water conservation in comfort stations or work areas where water is used; and
- Installation of signs with information on who to call should a comfort station/restroom facility need repair.

8.3.5 Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis

The implementation cost (including materials and labor) for the proposed water conservation measures at the Kalanimoku Building is summarized in Table 8-3.

Table 8-3
Projected Water Conservation Plan Implementation Cost for the Kalanimoku Building

Type of Fixture	Number of Fixtures	Cost per Fixture *	Estimated Total Fixture Cost
Low-Consumption Flushometer-Valve Toilets	79	\$ 610	\$ 48,200
Low-Consumption Urinals	17	\$ 630	\$ 10,700
Low-Volume Faucets (Metering)	55	\$ 550	\$ 30,300
TOTAL COST			\$ 89,200

*Planning cost based on Board of Water Supply conversion of water fixtures for the City and County of Honolulu’s municipal facilities to water conserving fixtures, implementation 2001-2003 (includes 20% contingency).

The water savings for the Kalanimoku Building was estimated at 11,170 gallons per day for domestic use (see Table 8-4), which translates to \$22.10 per day (\$1.98/1,000 gallons – BWS water rate) or an estimated \$8,100 per year savings. With an initial implementation cost of \$89,200, the payback period would be approximately 11 years.

The construction cost estimate for the replacement of the irrigation system surrounding the Kalanimoku Building is \$ 210,000.00. A primary reason for replacing the existing irrigation system is due to the age of the current system and changes to the landscaped area surrounding the Kalanimoku Building over the years. In the past, only “piecemeal” replacement and repairs had been performed on the irrigation system. The system has served out its expected design life (30 years). The water savings from the new irrigation system was estimated at 2,700 gallons per day for irrigation use, which translates to \$5.35 per day (\$1.98/1,000 gallons – BWS water rate) or an estimated \$2,000 per year savings.

Therefore, the water use cost savings from the new irrigation system can be seen as an added benefit of replacing an old, antiquated system that has reached the end of its useful

life. The construction cost estimate for installation of one (1) water sub-meter and box to monitor irrigation water consumption would be approximately \$2,500.

The cost of water conservation measures at the Kalanimoku Building include the following:

- Cost of conservation devices (hardware);
- Cost to install conservation devices and water meter;
- Program monitoring and evaluation; and
- Cost of any necessary renovation of existing plumbing, appliances, or related connections.

The benefits of water conservation at the Kalanimoku Building include the following:

- Positive public relations (State facility saving water resources and setting the example for other facilities);
- Increased water-user awareness of water conservation and water accountability;
- Water cost savings over the long-term; and
- Environmental benefits outlined in section 8.3.6.

8.3.6 Kalanimoku State Office Building Conservation Plan

The development of the conservation plan for the Kalanimoku Building focuses on the two major water uses identified in the facility assessment: domestic use and irrigation. For domestic use, water conservation measures identified for the Kalanimoku Building include low-consumption flushometer-valve toilets, low-consumption urinals and low-volume faucets (metering type). According to DAGS, some of the current fixtures have been retrofitted to low-flow type fixtures (approximately 15%); however, several of the partial retrofits have not worked and would require full replacements to function adequately. Therefore, some of the partial retrofits have been replaced with original type fixtures. The potential for water conservation remains for more than 85% of the fixtures at the Kalanimoku Building.

As mentioned earlier, the existing drinking fountains are relatively water efficient due to shut-off mechanisms and only represent 6% of the total fixtures in the Kalanimoku Building. The basins/sinks for janitorial services represent 5% of the total fixtures in the Kalanimoku Building and usage of these facilities is limited to janitorial staff. Therefore, drinking fountains and basins/sinks were not considered for water conservation measure application. Non-structural conservation measures can also be implemented (e.g., signs for numbers to call if restroom is in need of repair, instructions plates on new water saving fixtures, employee training on water conservation measures, etc.).

For irrigation, water conservation measures for the landscaped areas surrounding the Kalanimoku Building will come from a new, more water efficient irrigation system planned for construction, along with other landscape efficient measures. Other landscape efficient measures include the use of native and low-water use turf and plants, regular

irrigation system checks for leaks, soil improvements, and application of mulches to retain soil moisture.

Another water conservation measure involves the installation of a water sub-meter for irrigation water consumption at the Kalanimoku Building. This conservation measure is vital for the facility to develop and monitor the water conservation program.

The projected water conservation and cost savings for the Kalanimoku Building are summarized in Table 8-4.

Table 8-4
 Projected Water Conservation for the Kalanimoku State Office Building
 (Domestic Water Consumption)

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Estimated Water Usage (gpd)*	Water Conservation Savings Percentage	Estimated Water Saved (gpd)
Water Closet (Toilet)	395	59 %	11,800	54%	6,400
Urinal	85	13%	2,500	71%	1,800
Lavatory	110	16%	3,300	90%	2,970
Basin/Sink	36	5%	1,100	n/a	-
Drinking Fountain	42	6%	1,300	n/a	-
TOTAL	668	100%	20,000	-	11,170

*gpd – gallons per day

The total projected water conservation for the Kalanimoku State Office Building is 11,170 gallons per day for domestic use and 2,700 gallons per day for irrigation based on 15% water savings from a new irrigation system. The total water savings of 13,870 gallons per day could save the State \$ 27.46 per day (\$1.98/1,000 gallons). This translates to approximately \$840.00 per month or about \$10,100.00 per year.

There are no known environmental or cultural resources within the facility. The environmental benefits from implementation of a conservation program at the Kalanimoku Building will:

- Reduce water use and extend the lifespan of the current infrastructure;
- Reduce water waste and save precious water resources;
- Reduce wastewater generated from facility requiring treatment and disposal;
- Minimize runoff from over-irrigation;
- Minimize the environmental impacts of new water supply infrastructure;

- Reduce point source and non-point source pollution; and
- Reduce the risk of water supply shortage conditions.

There are no real negative environmental effects with the implementation of a conservation program at the Kalanimoku Building except for temporary impacts, such as construction activity during installation of water conservation measures within the Kalanimoku Building and replacement of the irrigation system in the surrounding landscaped area. These environmental effects are temporary and are far out-weighted by the benefits of the conservation program implementation.

8.3.7 Conservation Plan Implementation Schedule & Cost

The conservation plan implementation schedule and cost for the Kalanimoku Building is summarized below.

Year 1

Proposed Work:

- Fixture retrofits (Cost: \$90,000);
- One (1) sub-meter installation (Cost: \$2,500);
- Educate maintenance staff on upkeep of low-flow/low-volume fixtures (Cost: to be absorbed in existing operating budget); and
- Install signs to encourage water conservation and reporting of fixture problems (Cost: to be absorbed in existing operating budget).

(Note: The irrigation system replacement has been fully funded and programmed by the State; therefore, this conservation measure is not considered in this implementation schedule.)

Proposed Monitoring Activities:

- Facility Manager to inspect and replace signage as needed (Cost: to be absorbed in existing operating budget).

Proposed staff hours (included in proposed budget)

Proposed budget \$92,500

Year 2

Proposed Work: None

Proposed Monitoring Activities:

- CWRM to compare metered water use with previous years to see if water conservation goals are being achieved, i.e., projected water use reduction and projected cost savings (Cost: to be absorbed in existing operating budget).

8.4 Prototype Facility - Kakaako Waterfront Park

8.4.1 Facility Water System Inventory

The Kakaako Waterfront Park is located at 709 Kelikoi Street in the Kakaako district on the island of Oahu. The park runs along the shoreline west of Kewalo Basin. The Kakaako Waterfront Park is under the jurisdiction of the Hawaii Community Development Authority (HCDA), although it is considered a DLNR State Park facility. The Kakaako Waterfront Park covers approximately 35 acres and is a well-used recreational area, featuring shoreline fishing and access to ocean activities, see Figure 8-5. The park also includes a waterfront promenade, picnic areas, an amphitheater, comfort stations (restroom facilities), and outdoor showers, see Figure 8-6 for photos of the existing plumbing fixtures. Two comfort stations, three drinking fountains, and the outdoor showers are located along the promenade. A third comfort station is located north of the park entrance.

A staff of five DLNR personnel handles maintenance of the Kakaako Waterfront Park facilities. The HCDA contracts this service to the DLNR. The DLNR staff maintains the comfort stations and the promenade areas; they also trim the lawn areas. Maintenance of the irrigation systems, fertilization, and irrigation of the landscaped areas of the park are handled by a private contractor.

Water Consumption

According to BWS water meter readings between November 2001 and February 2004, the average daily water consumption (irrigation and domestic use) for the entire Kakaako Waterfront Park facility was approximately 96,380 gallons per day.

Water Use - Plumbing Fixtures

Based on available constructions plans and site inspections, the total plumbing fixture count for the Kakaako Waterfront Park is summarized in Table 8-5.

Table 8-5 Kakaako Waterfront Park - Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	17	5	85
Urinal	5	5	25
Lavatory	12	2	24
Shower	6	4	24
Drinking Fountain	4	2	8
Hose Bib (Spigot)	4	5	20
Total Fixture Units			186

Figure 8-5
Photos of the
Kakaako Waterfront Park





Ewa Comfort Station



Drinking Fountain



Showers



Ewa Comfort Station
Urinal and Lavatory



Diamond Head Comfort Station
Water Closets

Figure 8-6
Photos of the Kakaako Waterfront Park
Existing Plumbing Fixtures

Water Use - Irrigation

The Kakaako Waterfront Park contains an extensive landscape irrigation system to take care of various trees, shrubs, ground covers, and grass areas in the park. The landscaped area covers approximately 15 acres. The irrigation system uses above ground sprinklers made up of Rainbird and Toro sprinkler system components. A private contractor through the HCDA maintains the irrigation system. Information on the total fixture count for the irrigation system was unavailable.

Water Management Problems, Goals, and Challenges

The Kakaako Waterfront Park does not currently have a formal water management plan. The Hawaii Community Development Authority (HCDA) accounts for water usage with Board of Water Supply monthly water billings. The Kakaako Waterfront Park does not have any known water quality problems.

The conservation goals for the Kakaako Waterfront Park are to achieve a 15% water use reduction, to estimate cost savings over the long term, and to free up water supplies for additional uses. The conservation program results will be monitored by metered water use (BWS water billings).

The Kakaako Waterfront Park does not have an educational program currently in place to promote water conservation. Unlike BWS rates and charges for residential water services, which are based on a tiered pricing structure that encourages water conservation among residential customers, BWS rates and charges for commercial/business services are based on a standard rate per 1,000 gallons, which does not necessarily encourage water conservation. There is no audit or incentive program for irrigation water users.

8.4.2 Existing Water Usage Characteristics and Historical Consumption Data

The Kakaako Waterfront Park's water usage falls under two basic categories: domestic use and irrigation. Domestic use includes usage of restrooms in two comfort stations, two outdoor showers, and three drinking fountains located along the promenade. Water usage varies according to the number of park users and water consumption. Water consumption is higher during weekends, holidays and special events held at the Kakaako Waterfront Park. The average water use rates for the various fixtures installed in the Kakaako Waterfront Park are estimated as follows:

- Water Closets (Toilets w/ flush valves - 3.5 gallons per flush (gpf);
- Urinals - 3.5 gpf;
- Lavatories - 3.0 to 7.0 gpm (average 5.0 gpm); and
- Showers - 2.75 to 4.0 gpm (average 3.4 gpm).

Water consumption history for the Kakaako Waterfront Park for the period between November 2001 and February 2004 was obtained from the Honolulu Board of Water Supply (BWS). The average water consumption per day during that period was

96,380 gallons/day. The average daily water consumption for the Kakaako Waterfront Park facility varied from a low of 32,307 gallons/day (January 2004) to a high of 156,000 gallons/day (September of 2002). Figure 8-7 graphically summarizes average water use per day for each monthly period from November 2001 to February 2004.

As indicated by Figure 8-7, water usage was highest during the drier summer months and diminished during the wetter winter and spring months. A significant portion of the water consumption fluctuations could be attributed to irrigation use because the irrigation system is manually turned off during wet weather. Normally, the automated irrigation system is operated daily. Due to limitations of the irrigation system pumping capacity, half the irrigation system is operated daily resulting in irrigation of half of the landscaped portions of the park each day.

8.4.3 Assessment of Various Water Uses - Identification of Significant Uses

As stated earlier, the only two significant water uses for the Kakaako Waterfront Park are domestic use and irrigation. Based on water consumption history and information from HCDA, the average irrigation water use is 93,740 gallons/day while domestic water usage averages 2,640 gallons/day. Domestic water usage, including comfort stations (restrooms), showers, drinking fountains, and the maintenance building facilities account for 2.7 % of the total water usage at the park. Four existing BWS meters monitor Kakaako Waterfront Park's total water consumption.

The above quantities are average daily consumptions over the period between November 2001 and February 2004. As charted in Figure 8-7, the water consumption varies considerably from dry to wet weather periods.

8.4.4 Applicable Water Conservation Measures

There are two primary water uses at the Kakaako Waterfront Park: domestic use and irrigation. Domestic water use includes drinking fountains, showers and comfort station facilities; irrigation water use includes landscaped areas surrounding the Kakaako Waterfront Park and an existing irrigation system. The Kakaako Waterfront Park has approximately 15 acres of grass, ground cover, shrubs, and trees that require irrigation. Irrigation takes place during the evening in circuits controlled by automated control valves. Half of the park's landscaped areas are irrigated each night; two nights are required to water the entire park. Various modifications, repairs and adjustments have been made over the years to maintain the existing irrigation system.

The water conservation measures selected for the Kakaako Waterfront Park included low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets, and low-flow shower heads, see Table 8-6. There were several other water saving devices available, such as composting and incinerating toilets and urinals, but these were considered impractical for this application. Low-volume fixtures would require the least amount of modification to the existing facilities and are the most practical conservation measures, see Appendix 6 for information on these water conservation measures.

Figure 8-7
Kakaako State Park
Average Daily Water Use Monthly Period

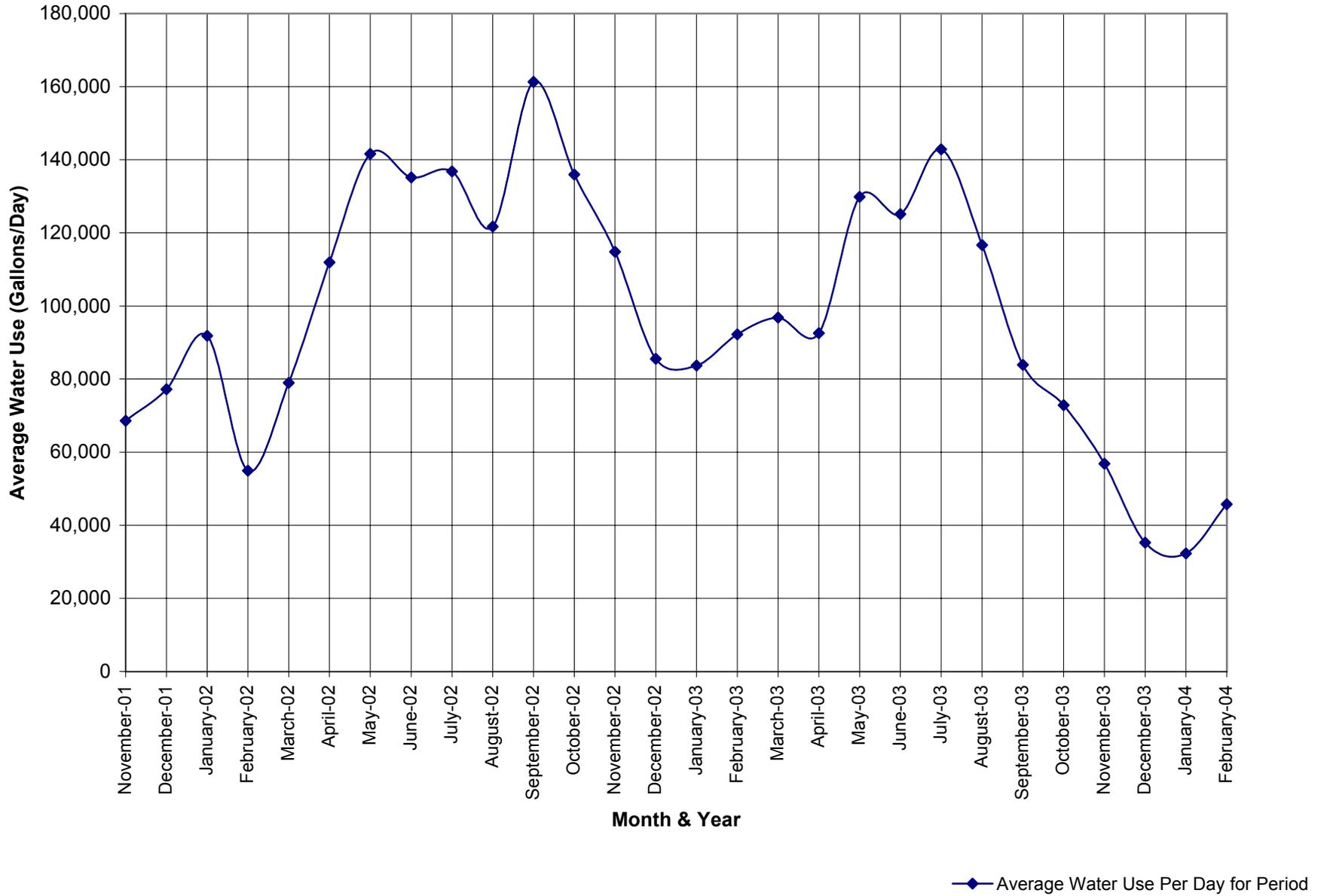


Table 8-6
Water Conservation Measures and Devices - Kakaako Waterfront Park

Water Conservation Measures – Domestic Water Use

Type of Fixture	Existing Water Usage	Water Conservation Measure	Conservation Water Usage	Water Savings Percentage
Water Closet (Toilet)	3.5 gpf*	Low-Consumption, Flushometer Valve Toilets	1.6 gpf	54%
Urinal	3.5 gpf	Low-Consumption Urinals	1 gpf	71%
Lavatory	5 gpm**	Low-Volume Faucets (Metering)	0.5 gpm	90%
Shower	3.4 gpm	Low-Flow Showerheads	2.5 gpm	26%

* Gallons per flush ** Gallons per minute

Water Conservation Measures – Irrigation Water Use

Type of Fixture	Existing Water Usage	Water Conservation Measure	Conservation Water Usage	Water Savings Percentage
Existing Irrigation System/Existing Landscaping	93,740 gpd*	New Irrigation System	79,680 gpd	15%

* Gallons per day

Irrigation usage accounts for approximately 97% of the water consumption at the Kakaako Waterfront Park. Although the current irrigation practices efficiently and adequately irrigate the existing landscape, the deficiencies of the existing system require frequent timer and controller adjustments to be made and supplemented by manual adjustments.

Water conservation measures directed toward conservation of irrigation water usage could reduce water consumption at the park. Replacement of the irrigation system or components of the system would involve installation of efficient low-trajectory sprinkler heads, better distribution of sprinkler heads, solid state replacement timers, and rain and moisture sensors to reduce water usage. A new irrigation system will be more efficient and save approximately 15% on irrigation water consumption. Another alternative would be to retrofit the existing irrigation system at the park; however, the actual water savings and implementation would require a more in-depth study of the current irrigation system and possible retrofit components.

Replacement of the existing plantings with low-water use plants may also help conserve water; however, the HCDA would like to maintain the local/native plants for the Kakaako Waterfront Park to keep a Hawaiian sense of place.

Other water conservation measures that could be applied at the Kakaako Waterfront Park include the following:

- Education of custodial staff on water conservation measures, such as turning off water while not in use;
- Training of maintenance staff on upkeep of low-flow fixtures;
- Installation of signs that encourage water conservation in comfort stations or work areas where water is used; and
- Installation of signs with information on who to call should a comfort station/restroom facility need repair.

8.4.5 Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis

The implementation cost (including materials and labor) for the proposed water conservation measures at the Kakaako Waterfront Park is summarized in Table 8-7.

Table 8-7
Projected Water Conservation Plan Implementation Cost for the
Kakaako Waterfront Park

Type of Fixture	Number of Fixtures	Cost per Fixture*	Estimated Total Fixture Cost
Low-Consumption Flushometer-Valve Toilets	17	\$610	\$10,400
Low-Consumption Urinals	5	\$630	\$ 3,200
Low-Volume Faucets (Metering)	12	\$550	\$ 6,600
Low-Flow Shower Heads	6	\$650	\$ 3,900
TOTAL COST			\$24,100

* Planning cost based on Board of Water Supply conversion of water fixtures for the City and County of Honolulu municipal facilities to water conserving fixtures, implementation 2001-2003. (includes 20% contingency)

The planning cost estimate for the replacement of the irrigation system at the Kakaako Waterfront Park is approximately \$1.85 million based on discussions with various landscape contractors.

The water savings for the Kakaako Waterfront Park’s domestic and irrigation use is estimated at 15,300 gallons per day, which translates to \$ 30.29 per day (\$1.98/1,000 gallons – BWS water rate) or approximately \$ 11,100 per year savings. Savings for domestic water conservation measures alone is approximately \$ 940 per year because of the relatively small percentage of domestic water requirements as compared to irrigation water requirements.

With an initial implementation cost of \$1.87 million, the payback period would extend beyond the useful life of the park’s proposed domestic and irrigation water system improvements. Therefore, replacement of the irrigation system only for water conservation purposes would be infeasible. However, should the irrigation system require major repair or replacement in the future, it would be prudent to implement water conservation measures at that time.

The cost of water conservation measures at the Kakaako Waterfront Park include the following:

- Cost of conservation devices (hardware);
- Cost to install conservation devices;
- Program monitoring and evaluation; and
- Cost of any necessary renovation of existing plumbing, appliances, or related connections.

The benefits of water conservation at the Kakaako Waterfront Park include the following:

- Positive public relations (State facility saving water resources and setting the example for other facilities);
- Increased water-user awareness of water conservation and water accountability;
- Water cost savings over the long-term; and
- Environmental benefits outlined in section 8.4.6.

8.4.6 Kakaako Waterfront Park Conservation Plan

The development of the water conservation plan for the Kakaako Waterfront Park focuses on reduction of both domestic and irrigation water consumption. For domestic use, water conservation measures identified for the Kakaako Waterfront Park include low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets and low-flow shower heads. According to HCDA, the current fixtures at the park facility are not water conservation type fixtures and potential for water conservation exists for domestic water use. For irrigation, the potential for water conservation from the existing irrigation system is great, but is complex and involved. A new irrigation system to replace the existing system would be required to realize substantial water savings. The new irrigation system could be designed and incorporated into the long-range HCDA master plans for the Kakaako Waterfront Park. Realization of savings from the replacement of the landscape irrigation system will depend on the HCDA’s future plans for improvements of the landscaping and irrigation system.

The primary domestic water uses at the Kakaako Waterfront Park are for the park’s comfort stations and showers. Reduction of domestic water usage involves the replacement of existing plumbing fixtures with water saving devices. The projected water conservation and cost savings for the Kakaako Waterfront Park are summarized in Table 8-8.

Table 8-8
 Projected Water Conservation for the Kakaako Waterfront Park
 (Domestic Water Consumption)

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Estimated Water Usage (gpd)*	Water Conservation Savings Percentage	Estimated Water Saved (gpd)
Water Closet (Toilet)	85	46%	1,214	54%	656
Urinal	25	13%	344	71%	244
Lavatory	24	13%	343	90%	310
Shower	24	13%	343	26%	90
Drinking Fountain	8	4%	106	n/a	-
Hose Bibb (Faucet)	20	11%	290	n/a	-
TOTAL	186	100%	2,640	-	1,300

* gpd - gallons per day

The total projected water conservation for the Kakaako Waterfront Park is approximately 1,300 gallons per day for domestic use and 14,000 gallons per day for irrigation based on 15% water savings from a new irrigation system. The total water savings of 15,300 gallons per day could save the State \$30.29 per day (\$1.98/1,000 gallons). This translates to approximately \$909.00 per month (30 days) or \$11,100 per year. The total water savings for domestic water conservation alone is 1,300 gallons per day, saving the State \$2.57 per day (\$1.98/1,000 gallons), which translates to approximately \$77.00 per month (30 days) or approximately \$940.00 per year.

There are no known environmental or cultural resources within the facility. The environmental benefits from implementation of a conservation program at the Kakaako Waterfront Park will:

- Reduce water use and extend the lifespan of the current infrastructure;
- Reduce water waste and save precious water resources;
- Reduce wastewater generated from facility requiring treatment and disposal;
- Minimize runoff from over-irrigation;

- Minimize the environmental impacts of new water supply infrastructure;
- Reduce point source and non-point source pollution; and
- Reduce the risk of water supply shortage conditions.

There are no real negative environmental effects with the implementation of a conservation program at the Kakaako Waterfront Park except for temporary impacts, such as construction activity during installation of water conservation measures and replacement of the irrigation system in the landscaped areas. These environmental effects are temporary and are far out-weighed by the benefits of the conservation program implementation.

8.4.7 Conservation Plan Implementation Schedule & Cost

The conservation plan implementation schedule and cost for the Kakaako Waterfront Park is summarized below.

Year 1

Proposed Work:

- Fixture retrofits (Cost: \$24,100);
- Educate maintenance staff on upkeep of low-flow/low-volume fixtures (Cost: to be absorbed in existing operating budget); and
- Install signs to encourage water conservation and reporting of fixture problems (Cost: to be absorbed in existing operating budget).

(Note: Retrofit improvements to the Kakaako Waterfront Park’s irrigation system are proposed for funding through the Honolulu’s Board of Water Supply; therefore, this conservation measure is not considered in this implementation schedule.)

Proposed Monitoring Activities:

- Facility Manager to inspect and replace signage as needed (Cost: to be absorbed in existing operating budget).

Proposed staff hours (included in proposed budget) Proposed budget \$24,100

Year 2

Proposed Work: None

Proposed Monitoring Activities:

- CWRM to compare metered water use with previous years to see if water conservation goals are being achieved, i.e., projected water use reduction and projected cost savings (Cost: to be absorbed in existing operating budget).

8.5 Prototype Facility – Ala Wai Small Boat Harbor

8.5.1 Facility Water System Inventory

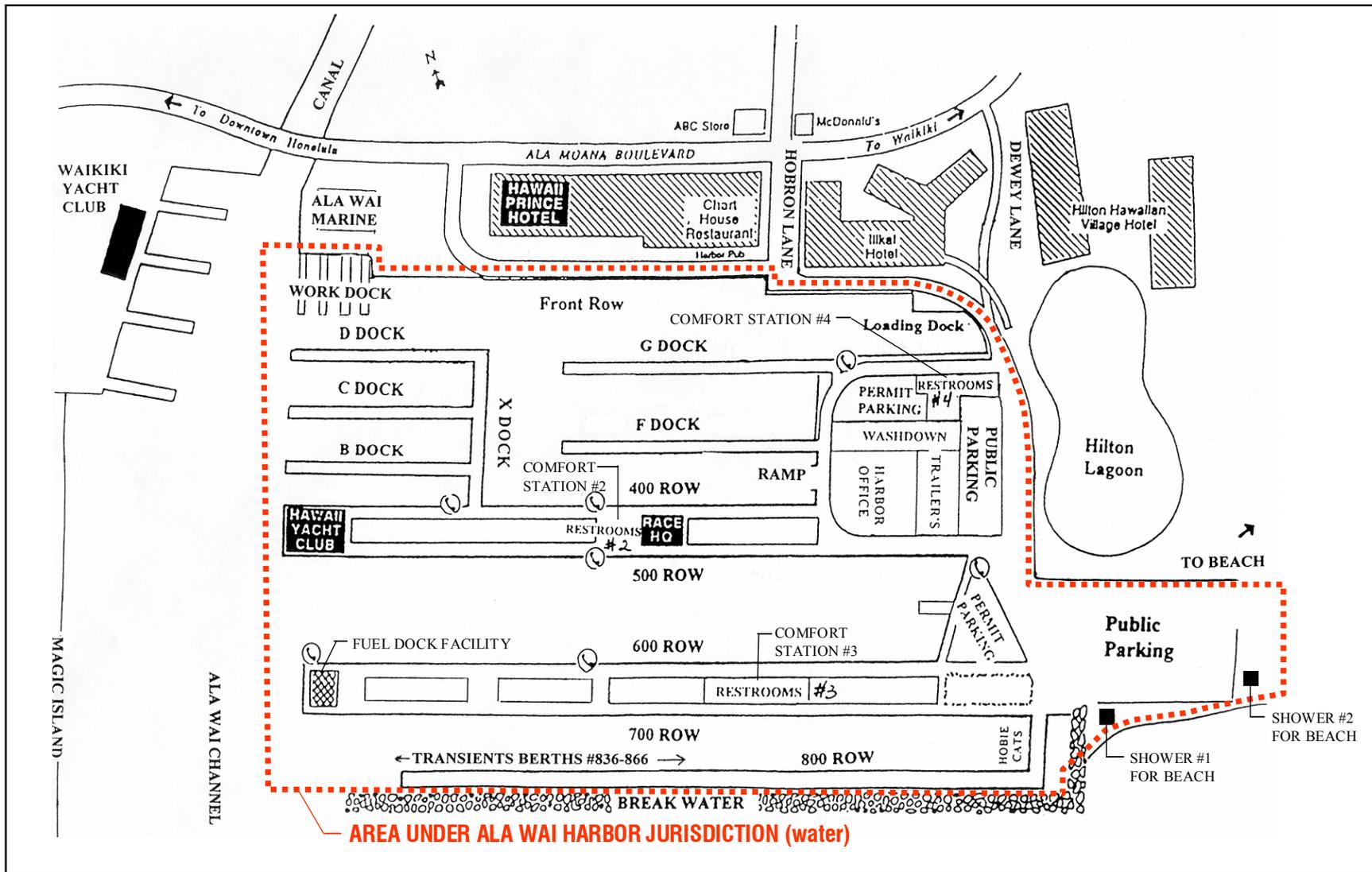
The Ala Wai Small Boat Harbor (Ala Wai Harbor) is located on the south coast of Oahu, between Waikiki and Ala Moana beaches. The Ala Wai Harbor is designated strictly for “recreational boating activities” meaning the utilization of watercraft for sports, hobbies, or pleasure. The harbor does not allow moorage for commercial vessels and commercial vessel activities. The harbor encompasses a total of 128 acres, which includes 699 berths with dock, 85 moorings, one ramp, and 22 dry storage spaces, see Figure 8-8 for site plan. The harbor can accommodate vessels up to 85 feet in length. The harbor includes areas used by the Hawaii Yacht Club, the Waikiki Yacht Club, and the Royal Hawaiian Ocean Racing Club.

The Ala Wai Harbor is under the jurisdiction of DLNR’s Division of Boating and Ocean Recreation; see Figure 8-9 for photos of the Ala Wai Harbor. The Ala Wai Harbor’s water system serves the harbor’s main office facility, three restroom facilities (comfort stations), boat washdown area, outdoor showers for surfers/beach goers, a small irrigation system, and water connections for individual boat slips in the harbor, see Figure 8-10 for photos of the existing plumbing fixtures and water use facilities. The harbor also includes a fuel dock facility and the Hawaii Yacht Club, both users of the Ala Wai Harbor water system. The Waikiki Yacht Club leases its site from the Ala Wai Harbor, but has its own water service connection and water meter; therefore, it is independent from the Ala Wai Harbor’s water system. The Race Headquarters for the Transpac Honolulu Committee uses an office facility at the harbor for coordination of the Trans-Pac Yacht races. However, there is no water service to the headquarters building.

Water Consumption

Based on information from the Division of Boating and Ocean Recreation (agency responsible for the Ala Wai Harbor’s operation and maintenance) the harbor uses about 1,446,000 gallons per month or 48,200 gallons per day (based on their most current 30-day water billing record for the harbor facility). The harbor office has a total staff of 8 employees. The Ala Wai Harbor has several sub-meters that are used to monitor water consumption at several facilities in the harbor. The breakdown of typical water usage for the sub-metered facilities at the harbor is as follows:

- Comfort Station #2 – 128,000 gallons per month;
- Comfort Station #3 – 70,000 gallons per month;
- Comfort Station #4 – 52,000 gallons per month;
- Hawaii Yacht Club – 162,000 gallons per month;
- Fuel Dock Facility – 145,000 gallons per month; and
- Washdown Facility, Piers/Docks, and Beach Shower Facility (Unmetered) – 889,000 gallons per month (Balance of the Water Used at Ala Wai Harbor).



SITE PLAN – Ala Wai Boat Harbor

Figure 8-9
Photos of the Ala Wai Boat Harbor



Ala Wai Boat Harbor - Main Office Building



Ala Wai Boat Harbor - 800 Row



Between 500 ROW & 600 ROW



Ala Wai Boat Harbor - 600 Row



Docking along Front ROW -
in front of the Hawaii Prince Hotel

Figure 8-10
Photos of the Ala Wai Boat Harbor
Existing Plumbing Fixtures



Comfort Station #2
Water Closet



Comfort Station #3
Lavatories



Comfort Station #2
Urinals



Comfort Station #4
Shower



Pier Hose Bibbs



Shower #1
for Beach

The Ala Wai Harbor does not have sub-meters for the boat washdown facility, piers/docks, and the shower facilities for surfers/beach goers (Showers #1 and #2); therefore, water consumption for these facilities goes unmonitored.

Water Use – Plumbing Fixtures

Based on available construction plans, site inspections, and harbor staff interviews, the total plumbing fixture count for the Ala Wai Harbor’s three (3) comfort stations is summarized in Table 8-9.

Table 8-9 Ala Wai Small Boat Harbor (Comfort Stations) – Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	27	5	135
Urinal	9	5	45
Lavatory	20	2	40
Shower	17	4	68
Basin / Sink	3	4	12
Hose Bib (Spigot)	6	5	30
Drinking Fountain	1	2	2
Total Fixture Units Comfort Stations			332

The Ala Wai Harbor has two other facilities that lease property in the harbor area and utilize the Ala Wai Harbor’s water system. The Hawaii Yacht Club is located at the end of 400/500 ROW and the Fuel Dock Facility is located at the end of 600/700 ROW.

Table 8-10 summarizes the plumbing fixture count for the Hawaii Yacht Club and Table 8-11 summarizes the plumbing fixture count for the Fuel Dock Facility.

Table 8-10 Ala Wai Small Boat Harbor (Hawaii Yacht Club) – Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet Toilet)	6	5	30
Urinal	3	5	15
Lavatory	9	2	18
Basin / Sink	5	4	20
Hose Bib (Spigot)	24	5	120
Drinking Fountain	1	2	2
Total Fixture Units Hawaii Yacht Club			205

Table 8-11 Ala Wai Small Boat Harbor (Fuel Dock Facility) –
Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	2	5	10
Urinal	1	5	5
Lavatory	2	2	4
Shower	2	4	8
Basin / Sink	1	4	4
Hose Bib (Spigot)	5	5	25
Washing Machine	5	10	50
Total Fixture Units Fuel Dock Facility			106

Table 8-12 summarizes the plumbing fixture count for the rest of the harbor facilities, including the boat washdown facility, piers/docks, and beach shower facilities that are not currently metered.

Table 8-12 Ala Wai Small Boat Harbor (Other Facilities Not Metered) –
Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	2	5	10
Urinal	1	5	5
Lavatory	2	2	4
Shower	4	4	16
Basin / Sink	1	4	4
Hose Bib (Spigot)	724	5	3620
Drinking Fountain	1	2	2
Total Fixture Units Other Facilities Not Metered			3,661

Water Use – Irrigation

The Ala Wai Harbor’s landscaped area consists of a sprinkler irrigation system for coconut trees and grass areas. The total landscaped area is less than 0.25 acres. No information was available on the irrigation system’s fixture unit count.

Water Management Problems, Goals, and Challenges

The Ala Wai Harbor does not currently have a formal water management plan. The Division of Boating and Ocean Recreation accounts for water usage with Board of Water Supply monthly water billings. The Ala Wai Harbor does not have any known water quality problems, but the current water system suffers from lack of pressure due to the

age of the antiquated water system.

The conservation goals for the Ala Wai Harbor are to account for all water usage at the facility, to achieve a 15% water use reduction, to estimate cost savings over the long term, and to free up water supplies for additional uses. The conservation program results will be monitored by metered water use (BWS water billings).

The Ala Wai Harbor does not have an educational program currently in place to promote water conservation. Unlike BWS rates and charges for residential water services, which are based on a tiered pricing structure that encourages water conservation among residential customers, BWS rates and charges for commercial/business services are based on a standard rate per 1,000 gallons, which does not necessarily encourage water conservation. There is no audit or incentive program for irrigation water users.

8.5.2 Existing Water Usage Characteristics and Historical Consumption Data

The Ala Wai Small Boat Harbor's water usage falls under several basic categories: domestic use, boat washdown, and irrigation. The Ala Wai Harbor's daily operations require the use of potable water to meet the domestic needs of the harbor staff, harbor users, beach goers, and visitors. Potable water is also used for irrigating limited landscaped areas. The construction of the Ala Wai Small Boat Harbor began in 1951. According to the harbor staff, the current water system is out-dated and lacks sufficient water pressure to properly serve the entire harbor. Much of the waterlines are corroded and in need of replacement, but due to budget limitations, improvements to the water system have not been scheduled.

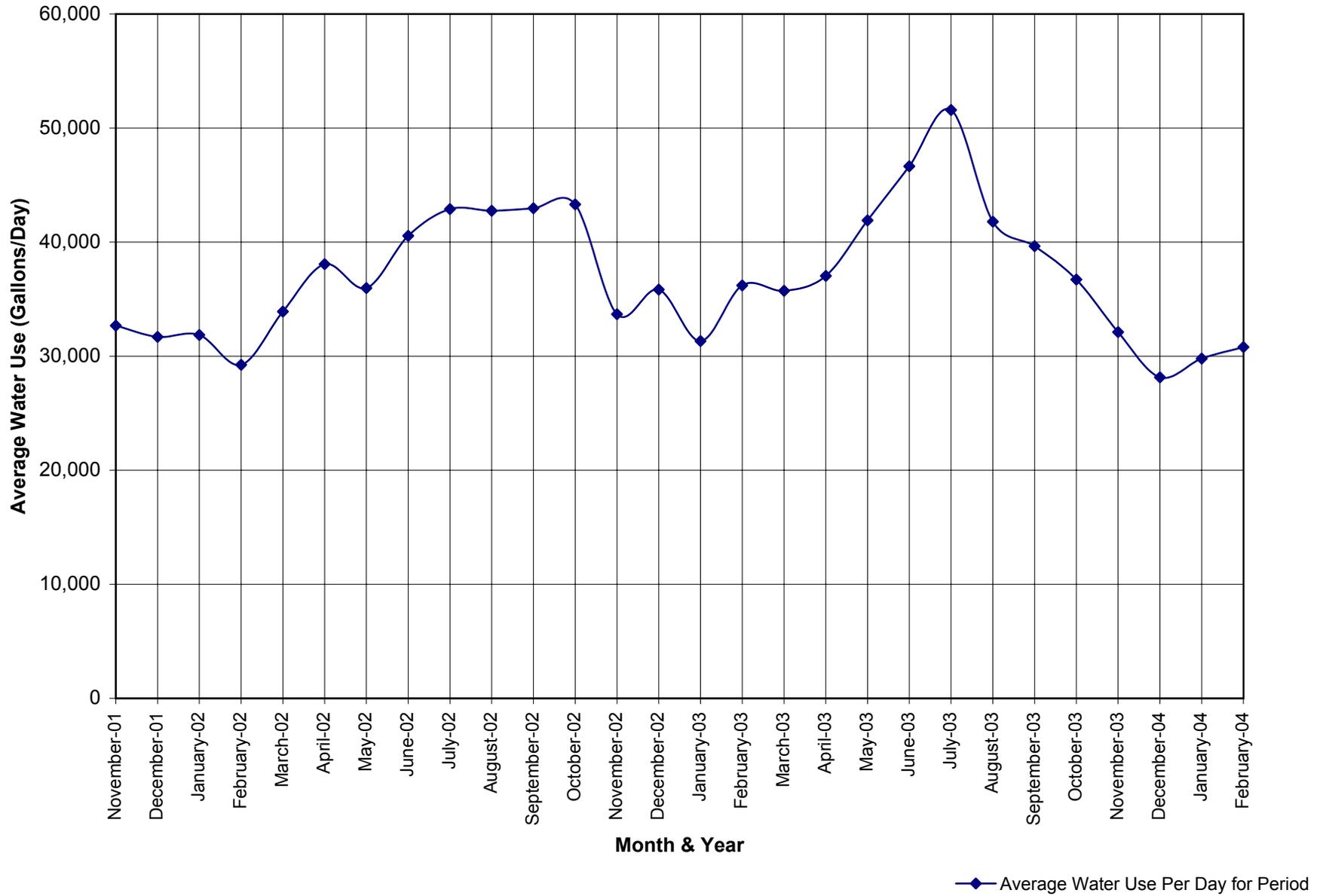
The average water-use rates for the various fixtures installed at the Ala Wai Harbor are estimated as follows:

- Water Closets (Toilets w/flush valves) – 3.5 gallons per flush (gpf);
- Urinals – 3.5 gpf;
- Lavatories – 3.0 to 7.0 gpm (Average 5.0 gpm); and
- Showers – 2.75 to 4.0 gpm (Average 3.4 gpm).

Water consumption history for the Ala Wai Boat Harbor was obtained through the Honolulu Board of Water Supply (BWS) for the record period of November 2001 to February 2004. The average water consumption per day for the record period was 37,000 gallons per day (versus 48,200 gallons/day which was based on the harbor's most current billing record). The maximum average daily usage for the record period was 51,600 gallons/day (July 2003) and the minimum average daily usage for the record period was 28,100 gallons/day (December 2004). Figure 8-11 graphically summarizes the average water use per day for each monthly period from November 2001 to February 2004.

From the water consumption history chart, it appears that the water use for the Ala Wai Harbor typically increases during the months of June through August, which would correlate to the summer period when recreational boating use and ocean recreational

**Figure 8-11
Ala Wai Boat Harbor
Average Daily Use Per Monthly Period**



activities tend to be highest. Currently, one BWS water meter for all potable water usage serves the Ala Wai Harbor. As stated earlier, Ala Wai Harbor has several sub-meters that are used for metering of the three comfort stations, the Hawaii Yacht Club and the Fuel Dock Facility.

8.5.3 Assessment of Various Water Uses – Identification of Significant Uses

The harbor's water usage can be divided into four geographical areas based on the sub-metering of water at the Ala Wai Harbor. The four areas and approximate water use percentages are as follows:

- Harbor Comfort Stations – 17%;
- Hawaii Yacht Club – 11%;
- Fuel Dock Facility – 10%; and
- Other Water Uses Not Metered (Boat Washdown, Harbor Office Building, Docks/Piers and Showers for beach areas) – 62%.

The majority of water use at the Ala Wai Harbor serves the boat washdown, harbor office, docks/piers, and shower facilities for beach goers. Sixty two percent of the harbor's water use is not sub-metered and detailed breakdown for the water usage in this group is difficult.

8.5.4 Applicable Water Conservation Measures

There are three primary water uses at the Ala Wai Harbor: domestic use, boat washdown, and irrigation. Domestic water use includes drinking fountains, restroom facilities at comfort stations, water connections for harbor users, and shower facilities for beach goers. Boat washdown use includes washdown facilities and various other harbor operation and maintenance activities. Small sprinkler irrigation systems and hand watering irrigate landscaped areas. Landscaping at the Ala Wai Harbor is limited (< 0.25 acre); therefore, the total landscaped areas do not amount to significant water usage. Various repairs have been made over the years to maintain the harbor water system, but overall, the Ala Wai Harbor's water system is antiquated and in need of replacement.

Existing drinking fountains are relatively water efficient due to automatic shut-off mechanisms. Basins and sinks for custodial services are limited to janitorial staff who control water usage at these facilities and can be educated on water conservation measures. The water conservation measures selected for the Ala Wai Harbor included low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets, and low-flow shower heads, see Table 8-13.

There were several other water saving devices available, such as composting and incinerating toilets and urinals, but these were considered impractical for this application. Low-flow fixtures require the least amount of modification to the existing facilities and are the most practical conservation measures, see Appendix 6 for information on these water conservation measures.

Table 8-13
Water Conservation Measures and Devices – Ala Wai Small Boat Harbor

Type of Fixture	Existing Water Usage	Water Conservation Measure	Conservation Water Usage	Water Savings Percentage
Water Closet (Toilet)	3.5 gpf*	Low-Consumption, Flushometer Valve Toilets	1.6 gpf	54%
Urinal	3.5 gpf	Low-Consumption Urinals	1 gpf	71%
Lavatory	5 gpm**	Low-Volume Faucets (Metering)	0.5 gpm	90%
Shower	3.4 gpm	Low-Flow Shower Heads	2.5 gpm	26%

* Gallons per flush

** Gallons per minute

Another water conservation measure that could be applied to the Ala Wai Harbor is the sub-metering of the boat washdown area, pier/dock fingers, and beach shower facilities. This measure does not have direct water usage savings, but enables the harbor staff to monitor usage at the facility and properly apply water conservation measures to the harbor facility.

Other water conservation measures that could be applied at the Ala Wai Harbor include the following:

- Education of custodial staff on water conservation measures, such as turning off water while not in use;
- Training of maintenance staff on upkeep of low-flow fixtures;
- Education of harbor users with flyers or letters on water conservation measure they can implement;
- Require automatic shut-off hose nozzles for all boat slip water connections;
- Installation of signs that encourage water conservation in comfort stations or work areas where water is used; and
- Installation of signs with information on who to call should a comfort station/restroom facility need repair.

8.5.5 Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis

The implementation cost (including materials and labor) for the proposed water conservation measures at the Ala Wai Harbor is summarized in Table 8-14.

Table 8-14
 Projected Water Conservation Plan Implementation Cost for the Ala Wai Harbor

Type of Fixture	Number of Fixtures	Cost per Fixture*	Estimated Total Fixture Cost
Low-Consumption Flushometer-Valve Toilets	37	\$610	\$22,570
Low-Consumption Urinals	14	\$630	\$ 8,820
Low-Volume Faucets (Metering)	33	\$550	\$18,150
Low-Flow Shower Heads	23	\$650	\$14,950
TOTAL COST			\$64,490

* Planning cost based on Board of Water Supply conversion of water fixtures for the City and County of Honolulu municipal facilities to water conserving fixtures, implementation 2001-2003. (includes 20% contingency)

The water savings for the Ala Wai Harbor was estimated at 4,540 gallons per day, which translates to \$8.99 per day (\$1.98/1,000 gallons – BWS water rate) or approximately \$3,300 per year savings. With an initial implementation cost approximately of \$64,500, the payback period would be approximately 20 years. The water conservation measures implemented above will affect approximately 40% of the total water usage at the Ala Wai Harbor. The other 60% of total water usage at the Ala Wai Harbor is attributed to the harbor users of the piers/docks and hose bib connections, which currently go unmonitored.

According to the harbor staff, the existing water system is antiquated and in need of replacement. The current water system suffers from corrosion problems and lacks adequate pressure to properly serve the entire harbor facility; therefore, a new water system would be required to adequately serve the harbor facility. The most beneficial conservation measure may be the implementation of water sub-metering with the replacement of the existing water system. Sub-meters to monitor water use at the docks/piers could be installed for docks (B, C, D, F, G, and X), berths (400 ROW, 500 ROW, 600 ROW, 700 ROW, and 800 ROW), and Showers #1 and #2. Sub-metering of these facilities would account for over 60% of water use at the harbor facility. The construction cost estimate for installation of seven (7) water sub-meters and boxes to monitor water consumption would be approximately \$17,500.

Once there is an understanding of the entire harbor’s water use, programs could be developed to make water users in the harbor accountable for their water usage. Water conservation program development for the harbor could come in the form of fees or facility charges for excessive water usage. Currently, harbor users are assessed a standard flat slip fee which includes slip rental and water usage.

The cost of water conservation measures at the Ala Wai Harbor include the following:

- Cost of conservation devices (hardware);
- Cost to install conservation devices and water meters;
- Program monitoring and evaluation; and
- Cost of any necessary renovation of existing plumbing, appliances, or related connections.

The benefits of water conservation at the Ala Wai Harbor include the following:

- Positive public relations (State facility saving water resources and setting the example for other facilities);
- Increased water-user awareness of water conservation and water accountability;
- Water cost savings over the long-term; and
- Environmental benefits outlined in section 8.5.6

8.5.6 Ala Wai Small Boat Harbor Conservation Plan

The development of the conservation plan for the Ala Wai Harbor focuses on the major water uses identified in the facility assessment: domestic use and boat washdown (e.g. pier/dock usage and harbor operations). Water conservation measures identified for the Ala Wai Harbor include low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets (metering type) and low-flow shower heads.

As mentioned earlier, the existing drinking fountains are relatively water efficient due to shut-off mechanisms and represent less than 1% of the total fixtures at the Ala Wai Harbor. The basins/sinks for janitorial services represent less than 0.5% of the total fixtures at the Ala Wai Harbor and usage of these facilities is limited to janitorial staff; therefore, drinking fountains and basins/sinks were not considered for water conservation measure application. Non-structural conservation measures can also be implemented (e.g., signs for numbers to call if restroom is in need of repair, instructions plates on new water saving fixtures, employee training on water conservation measures, etc.).

The projected water conservation and cost savings for the Ala Wai Harbor is summarized in Table 8-15.

Table 8-15
 Projected Water Conservation for the Ala Wai Small Boat Harbor

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Estimated Water Usage (gpd)*	Water Conservation Savings Percentage	Estimated Water Saved (gpd)
Water Closet (Toilet)	185	4%	3,600	54%	1,940
Urinal	70	2%	1,400	71%	990
Lavatory (Sink)	66	2%	1,300	90%	1,170
Shower	92	2%	1,700	26%	440
Basin / Sink (Janitorial)	40	1%	800	n/a	-
Hose Bib (Spigot)	3,795	88%	26,400	n/a	-
Drinking Fountain	6	0%	100	n/a	-
Washing Machines	50	1%	1,700	n/a	-
TOTAL	4,304	100%	37,000	-	4,540

*gpd – gallons per day

The total projected water conservation for the Ala Wai Harbor is 4,540 gallons per day for domestic use from mainly restroom facilities (see Appendix 7, for detailed breakdown of projected water conservation). Therefore, the total water savings of 4,540 gallons per day could save the State \$8.99 per day (\$1.98/1,000 gallons). This translates to approximately \$3,300.00 per year.

The largest fixture unit count at the Ala Wai Harbor is from hose bib connections provided by the Ala Wai Harbor to serve harbor users. Hose bib connections (approximately 750) account for 88% of all the fixtures in the Ala Wai Harbor. Hose bib connections provide water to harbor users such as resident and transient boaters, Hawaii Yacht Club, the Fuel Dock Facility, and boat washdown area. Unfortunately, there is no way at the present time to monitor the water usage at the Ala Wai Harbor’s piers/docks and washdown area. The installation of additional sub-metering of water uses within the Ala Wai Harbor to account for water usage at the piers/docks and washdown areas is recommended.

There are no known environmental or cultural resources within the facility. The environmental benefits from implementation of a conservation program at the Ala Wai Small Boat Harbor will:

- Reduce water use and extend the lifespan of the current infrastructure;
- Reduce water waste and save precious water resources;
- Reduce wastewater generated from facility requiring treatment and disposal;
- Minimize runoff from over-irrigation;
- Minimize the environmental impacts of new water supply infrastructure;
- Reduce point source and non-point source pollution; and
- Reduce the risk of water supply shortage conditions.

There are no real negative environmental effects with the implementation of a conservation plan at the Ala Wai Harbor except for temporary impacts, such as construction activity during installation of water conservation measures. These environmental impacts are temporary and are far out-weighted by the benefits of the conservation program implementation.

8.5.7 Conservation Plan Implementation Schedule & Cost

The conservation plan implementation schedule and cost for the Ala Wai Harbor is summarized below.

Year 1

Proposed Work:

- Fixture retrofits (Cost: \$64,500);
- Seven (7) sub-meter installations (Cost: \$17,500);
- Educate maintenance staff on upkeep of low-flow/low-volume fixtures (Cost: to be absorbed in existing operating budget);
- Install signs to encourage water conservation and reporting of fixture problems (Cost: to be absorbed in existing operating budget); and
- Promote awareness of water conservation benefits and encourage the use of automatic shut-off nozzles for all boat slip water connections (Cost: to be absorbed in existing operating budget).

(Note: The implementation of water conservation measures through the replacement of the existing water system would be a major capital improvement cost and would require further study of the harbor's water requirements and existing water system; therefore, this conservation measure is not considered in this implementation schedule.)

Proposed Monitoring Activities:

- Facility Manager to inspect and replace signage as needed (Cost: to be absorbed in existing operating budget).

Proposed staff hours (included in proposed budget)

Proposed budget \$82,000

Year 2

Proposed Work: None

Proposed Monitoring Activities:

- CWRM to compare metered water use with previous years to see if water conservation goals are being achieved, i.e., projected water use reduction and projected cost savings (Cost: to be absorbed in existing operating budget).

8.6 Prototype Facility – Honokohau Small Boat Harbor

8.6.1 Facility Water System Inventory

The Honokohau Small Boat Harbor (Honokohau Harbor) is located on the west coast of Hawaii approximately three miles northwest of Kailua-Kona Wharf. The harbor consists of a dredged channel that leads to two basins. The harbor encompasses 142.3 acres and has 270 moorings (boat slips), 4 ramps (two 30-foot wide, two lane ramps), piers A-H, 2 T-piers, an outer basin, vessel washdown area, fuel facility, harbor office and two comfort stations, see Figure 8-12 for site plan.

The harbor area also includes other buildings (separately metered): a restaurant complex leased by Gentry, a boat storage facility, a fuel dock leased by Gordon Crabtree, a private sailing club (leased), and a canoe club (leased). These facilities have their own water service connections and water meters and are independent from the Honokohau Harbor's water system; therefore, these facilities will not be addressed by this study. The Honokohau Harbor allows commercial operations of recreational tours or activities, as well as recreational boating activities (e.g., use of watercraft for sports, hobbies, or pleasure).

The Honokohau Harbor is under the jurisdiction of DLNR's Division of Boating and Ocean Recreation, see Figure 8-13 for photos of the Honokohau Harbor. The Honokohau Harbor's water system serves the harbor's main office facility, two (2) comfort stations, vessel washdown area, irrigation system, and water connections for individual boat slips in the harbor. The potential for water conservation would come from measures applied to water use for boat washdown, domestic-type potable water use at the harbor, and commercial water use such as equipment maintenance and clean-up. See Figure 8-14 for photos of the existing plumbing fixtures and water use facilities.

Water Consumption

Based on information from the Division of Boating and Ocean Recreation (agency responsible for the Honokohau Boat Harbor's operation and maintenance), the harbor uses about 3,495,000 gallons per month or 116,500 gallons per day (based on their most current 30-day water billing record for the harbor facility.) The harbor office building is

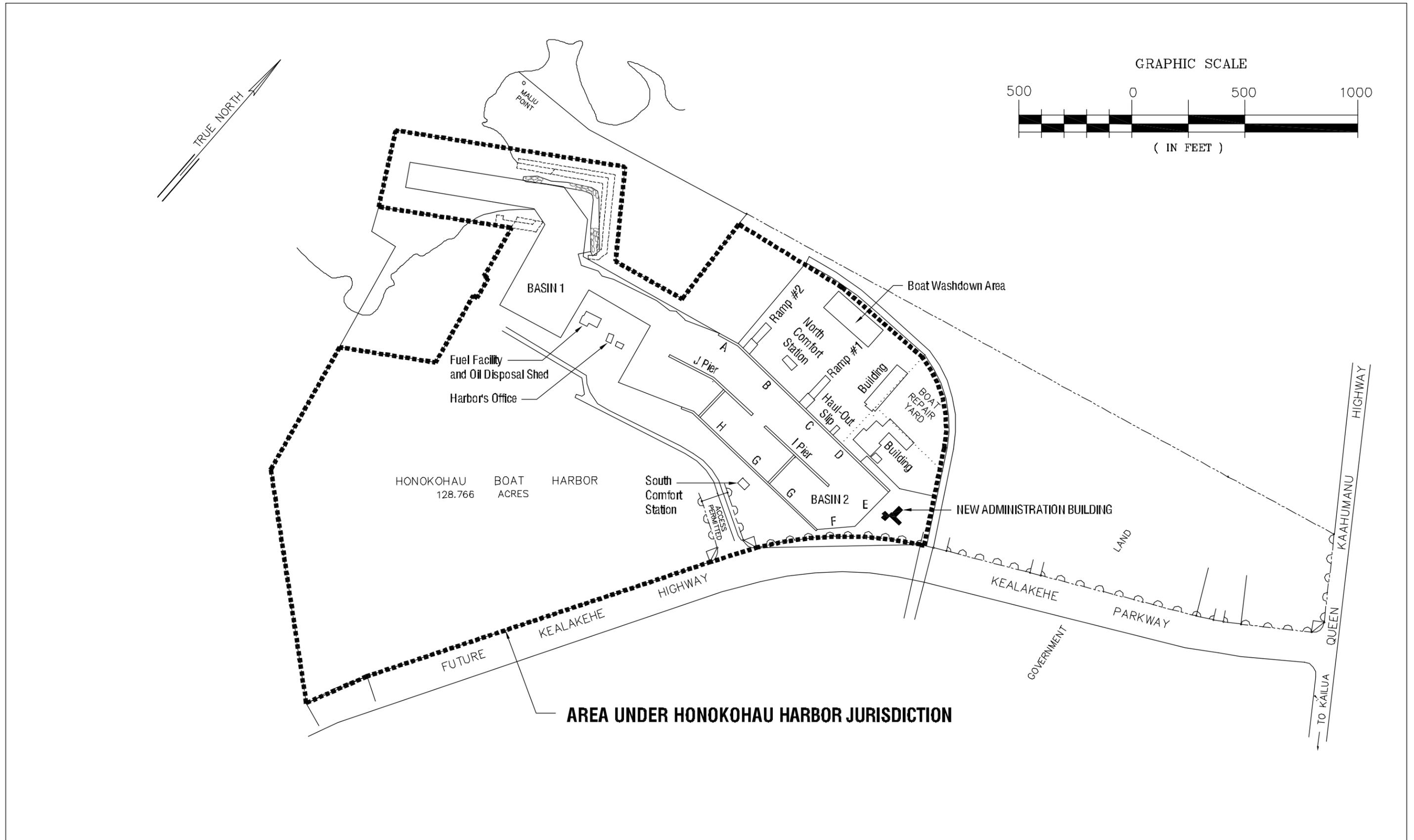


Figure 8-13
Photos of the Honokohau Small Boat Harbor



Honokohau Harbor Office Building



Commercial Boat Slips



Boat Ramp Area



Recreational Boat Slips



Comfort Station



T-Piers

Figure 8-14
Photos of the Honokohau Small Boat Harbor
Existing Plumbing Fixtures



Women's Lavatory -
Harbor Office Building



Women's Water Closet -
Harbor Office Building



Women's Shower -
Harbor Office Building



Harbor Office Building -
Kitchen Basins



Comfort Station -
Men's Urinals & Lavatories



Drip Irrigation System



Irrigation Sprinkler at Office Building

shared by a total of 23 DLNR staff members from the Division of Conservation and Resource Enforcement, Division of Aquatic Resources, State Historic Preservation, as well as the Division of Boating and Ocean Recreation. The breakdown of water usage for the facilities at the harbor are estimated as follows:

- Harbor Office – 12,000 gallons per month;
- Landscape Irrigation – 420,000 gallons per month;
- Comfort Stations – 75,000 gallons per month;
- Boat Washdown Area (Vessel Washdown) – 1,719,000 gallons per month; and
- Moored Boats – 1,269,000 gallons per month.

Water Use – Plumbing Fixtures

Based on available construction plans and harbor staff interviews, the total plumbing fixture count for the Honokohau Harbor’s two (2) comfort stations and harbor office is summarized in Table 8-16.

Table 8-16 Honokohau Harbor (Comfort Stations & Harbor Office) – Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	16	5	80
Urinal	5	5	25
Lavatory	16	2	32
Shower	1	4	4
Basin / Sink	1	4	4
Hose Bib (Spigot)	12	5	60
Drinking Fountains	3	2	6
Total Fixture Units Comfort Stations & Harbor Office			211

Table 8-17 summarizes the plumbing fixture count for the boat washdown facility and the boat slips.

Table 8-17 Honokohau Harbor (Boat Washdown & Boat Slips) – Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Hose Bib (Spigot)	280	5	1,400
Total Fixture Units Boat Washdown & Boat Slips			1,400

Water Use – Irrigation

The Honokohau Harbor’s landscaped area consists of a drip irrigation system for coconut trees and naupaka hedges. The total landscaped area is approximately 5 acres. No information was available on the irrigation systems fixture unit count.

Water Management Problems, Goals, and Challenges

The Honokohau Harbor does not currently have a formal water management plan. The Division of Boating and Ocean Recreation accounts for water usage with Department of Water Supply monthly water billings. The Honokohau Harbor does not have any known water quality problems, but the existing water system is rather antiquated. According to the harbor staff, the current water system is out-dated and lacks sufficient water pressure to serve the entire harbor, much like the Ala Wai Small Boat Harbor. Much of the waterlines are corroded and in need of replacement, but due to budget constraints, improvements to the water system are not currently scheduled.

The conservation goals for the Honokohau Harbor are to account for all water usage at the facility, to achieve a 15% water use reduction, to estimate cost savings over the long term, and to free up water supplies for additional uses. The conservation program results will be monitored by metered water use (DWS water billings).

The Honokohau Harbor does not currently have any educational program in place to promote water conservation. The DWS rates and charges for water service are based on a tiered pricing, which encourages water conservation.

8.6.2 Existing Water Usage Characteristics and Historical Consumption Data

The Honokohau Harbor’s daily operations require the use of potable water to meet the domestic needs of the harbor staff, harbor users, visitors and irrigation of landscaped areas. The harbor’s water usage can be broken down into several basic categories: domestic use, boat washdown, and irrigation.

The average water-use rates for the various fixtures installed at the Honokohau Harbor are estimated as follows:

- Water Closets (Toilets w/flush valves) – 3.5 gallons per flush (gpf);
- Urinals – 3.5 gpf;
- Lavatories – 3.0 to 7.0 gpm (Average 5.0 gpm); and
- Showers – 2.75 to 4.0 gpm (Average 3.4 gpm).

Water consumption history for the Honokohau Harbor was obtained through the County of Hawaii’s Department of Water Supply (DWS) for the record period of March 2002 to March 2004. The average water consumption per day for the record period was 118,700 gallons per day. The maximum average daily usage for the record period was 164,300 gallons/day (August 2002) and the minimum average daily usage for the record period

was 104,300 gallons/day (April 2002). Figure 8-15 graphically summarizes the average water use per day for each monthly period from March 2002 to March 2004.

From the water consumption history chart, it appears that the water use for the Honokohau Harbor typically increases during the months of July through September, which would correlate to the summer period when recreational boating use and irrigation requirements tend to be higher. Currently, the Honokohau Harbor is served by three DWS water meters for all potable water usage at the harbor.

8.6.3 Assessment of Various Water Uses – Identification of Significant Uses

The harbor's water usage can be divided into five geographical areas based on water system information received from the Honokohau Harbor staff. The five areas and approximate water use percentages are as follows:

- Harbor Office – <1%;
- Landscape Irrigation – 12%;
- Public Comfort Stations – 2%;
- Boat Washdown - 49%; and
- Boat Slips for Moored Boats - 36%.

The majority of water use at the Honokohau Harbor is attributed to the boat washdown and consumption at the boat slips. Almost 50% of the total water usage at the Honokohau Harbor is generated by boat washdown activities.

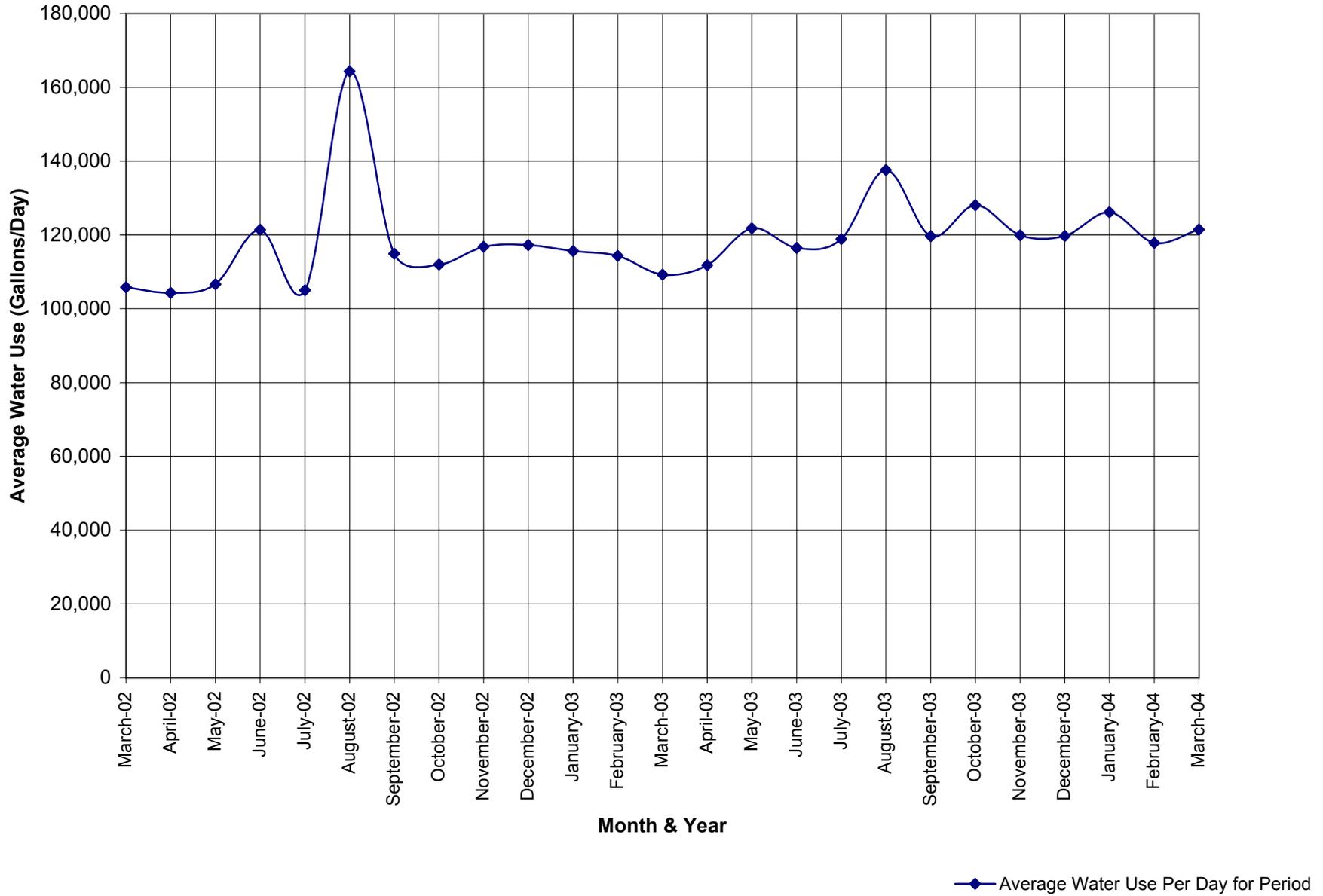
8.6.4 Applicable Water Conservation Measures

There are three primary water uses at the Honokohau Harbor: domestic use, boat washdown, and irrigation. Domestic water use includes drinking fountains, restroom facilities at comfort stations, water connections for harbor users, and shower facilities for beach goers. Boat washdown use includes washdown facilities and various other harbor operation and maintenance activities. Irrigation water use includes a drip irrigation system for landscaped areas. Various repairs have been made over the years to maintain the harbor water system, but overall, the Honokohau Harbor's water system is antiquated and in need of replacement.

Existing drinking fountains are relatively water efficient due to automatic shut-off mechanisms. Basins and sinks for custodial services are limited to janitorial staff who control water usage at these facilities and can be educated on water conservation measures. Drinking fountains and basins/sinks were not considered for water conservation measures because these facilities made up a small percentage of the total water usage fixtures at the Honokohau Harbor (this will be discussed in section 8.6.6).

The water conservation measures selected for the Honokohau Harbor included low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets, and low-flow shower heads, see Table 8-18. Low-flow fixtures require the least amount

**Figure 8-15
Honokohau Harbor
Average Daily Water Use Per Monthly Period**



of modification to the existing facilities and are the most practical conservation measures, see Appendix 6 for information on these water conservation measures.

Table 8-18
Water Conservation Measures and Devices – Honokohau Harbor

Type of Fixture	Existing Water Usage	Water Conservation Measure	Conservation Water Usage	Water Savings
Water Closet (Toilet)	3.5 gpf*	Low-Consumption, Flushometer Valve Toilets	1.6 gpf	54%
Urinal	3.5 gpf	Low-Consumption Urinals	1 gpf	71%
Lavatory (Sink)	5 gpm**	Low-Volume Faucets (Metering)	0.5 gpm	90%
Shower	3.4 gpm	Low-Flow Shower Heads	2.5 gpm	26%

* Gallons per flush

** Gallons per minute

Another water conservation measure that could be applied to the Honokohau Harbor is the sub-metering of the boat washdown area, pier/dock fingers, and irrigation system. This measure does not have direct water savings, but enables the harbor staff to monitor water usage at the facility and properly apply water conservation measures to the harbor facility.

Other water conservation measures that could be applied at the Honokohau Harbor include:

- Education of custodial staff on water conservation measures, such as turning off water while not in use;
- Training of maintenance staff on upkeep of low-flow fixtures;
- Education of harbor users with flyers or letters on water conservation measures they can implement;
- Require automatic shut-off hose nozzles for all boat slip water connections;
- Installation of signs that encourage water conservation in comfort stations or work areas where water is used; and
- Installation of signs with information on who to call should a comfort station/restroom facility need repair.

8.6.5 Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis

The implementation cost (including materials and labor) for the proposed water conservation measures at the Honokohau Harbor is summarized in Table 8-19.

Table 8-19
 Projected Water Conservation Plan Implementation Cost for the Honokohau Harbor

Type of Fixture	Number of Fixtures	Cost per Fixture*	Estimated Total Fixture Cost
Low-Consumption Flushometer-Valve Toilets	16	\$610	\$ 9,760
Low-Consumption Urinals	5	\$630	\$ 3,150
Low-Volume Faucets (Metering)	16	\$550	\$ 8,800
Low-Flow Shower Heads	1	\$650	\$ 650
TOTAL COST			\$22,360

* Planning cost based on Board of Water Supply conversion of water fixtures for the City and County of Honolulu municipal facilities to water conserving fixtures, implementation 2001-2003. (includes 20% contingency)

The water savings for the Honokohau Harbor was estimated at 5,800 gallons per day, which translates to \$ 16.24 per day (\$2.80/1,000 gallons – DWS water rate) or \$5,900 per year savings. With an initial implementation cost of approximately \$22,400, the payback period would be approximately 3 3/4 years. The water conservation measures implemented above will affect approximately 3 % of the total water usage at the Honokohau Harbor. The other 97% of total water usage at the Honokohau Harbor is attributed to the harbor users of the boat slips, boat washdown areas using spigots, and landscape irrigation.

According to the harbor staff, the existing water system is antiquated and in need of replacement. The current water system suffers from corrosion problems and lacks adequate pressure to properly serve the entire harbor facility; therefore, a new water system would be required to adequately serve the harbor facility. The two T-piers (I and J) in the middle of the harbor have problems with breaking and leaking pipes because water lines are located beneath the pier and the brackets holding the pipes in place are rusting, allowing the water lines to sag. The most beneficial conservation measure may be the implementation of water sub-metering with the replacement of the existing water system. Sub-meters to monitor water use at the boat slips could be installed for piers A – H and T-piers (I and J). Sub-metering of these facilities would allow monitoring and better management of over 90% of water use at the harbor facility. The construction cost estimate for installation of five (5) water sub-meters and boxes to monitor water consumption would be approximately \$12,500.

Once there is an understanding of the entire harbor’s water use, programs could be developed to make consumers in the harbor accountable for their water usage. Funding for implementation of a water conservation program at the harbor could come in the form

of fees or facility charges for excessive water usage. Currently, harbor users are assessed a standard flat slip fee which includes slip rental and water usage.

The cost of water conservation measures at the Honokohau Harbor include the following:

- Cost of conservation devices (hardware);
- Cost to install conservation devices and water meters;
- Program monitoring and evaluation; and
- Cost of any necessary renovation of existing plumbing, appliances, or related connections.

The benefits of water conservation at the Honokohau Harbor include the following:

- Positive public relations (State facility saving water resources and setting the example for other facilities);
- Increased water-user awareness of water conservation and water accountability;
- Water cost savings over the long-term; and
- Environmental benefits outlined in Section 8.6.6.

8.6.6 Honokohau Small Boat Harbor Conservation Plan

The development of the conservation plan for the Honokohau Harbor focuses on the major water uses identified in the facility assessment: domestic use, irrigation, and boat washdown (e.g. harbor operations and slip usage). Water conservation measures identified for the Honokohau Harbor include low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets (metering type) and low-volume showers.

The projected water conservation and cost savings for the Honokohau Harbor are summarized in Table 8-20.

Table 8-20
 Projected Water Conservation for the Honokohau Small Boat Harbor

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Estimated Water Usage (gpd)*	Water Conservation Savings Percentage	Estimated Water Saved (gpd)
Water Closet (Toilet)	80	5%	5,100	54%	2,800
Urinal	25	2%	1,600	71%	1,100
Lavatory	32	2%	2,000	90%	1,800
Shower	4	0%	300	26%	100
Basin / Sink	4	0%	300	n/a	-
Hose Bib (Spigot)	1460	91%	92,800	n/a	-
Drinking Fountain	6	0%	400	n/a	-
TOTAL	1,611	100%	102,500	-	5,800

*gpd – gallons per day

The total projected water conservation for the Honokohau Harbor is 5,800 gallons per day for domestic use from mainly restroom facilities. Therefore, the total water savings of 5,800 gallons per day could save the State \$16.24 per day (\$2.80/1,000 gallons). This translates to \$5,900.00 per year. Water conservation measures for domestic usage, including water saving fixtures at comfort stations/restroom facilities, would provide only minimal water conservation according to this analysis.

The largest fixture unit count at the Honokohau Harbor is from hose bib connections provided by the Honokohau Harbor to serve harbor users. Hose bib connections (approximately 280) account for 91% of all the fixtures in the Honokohau Harbor. Hose bib connections provide water to harbor users such as transient boaters and boat washdown area. Unfortunately, there is no way at the present time to monitor the water usage at the Honokohau Harbor’s boat slips and washdown area. To account for water usage at the boat slips, boat washdown area and irrigation system, the development of extended sub-metering of water uses within the Honokohau Harbor is recommended, along with installation of auto shut-off nozzles.

According to the harbor staff, approximately 14,000 gallons per day is dedicated to the landscaped area (approximately 5 acres) with approximately 350 coconut trees and naupaka hedges. The existing irrigation system is drip and is relatively efficient according to the harbor staff. The harbor’s irrigation system accounts for about 12% of the total water usage at the harbor.

There are no known environmental or cultural resources within the facility. The environmental benefits from implementation of a conservation program at the Honokohau Small Boat Harbor include the following:

- Reduce water use and extend the lifespan of the current infrastructure;
- Reduce water waste and save precious water resources;
- Reduce wastewater generated from facility requiring treatment and disposal;
- Minimize the environmental impacts of new water supply infrastructure;
- Reduce point source and non-point source pollution; and
- Reduce the risk of water supply shortage conditions.

There are no real negative environmental effects with the implementation of a conservation plan at the Honokohau Harbor except for temporary impacts such as construction activity during installation of water conservation measures. These environmental effects are temporary and are far out-weighted by the benefits of the conservation program implementation.

8.6.7 Conservation Plan Implementation Schedule & Cost

The conservation plan implementation schedule and cost for the Honokohau Harbor is summarized below.

Year 1

Proposed Work:

- Fixture retrofits (Cost: \$22,400);
- Five (5) sub-meter installations (Cost: \$12,500);
- Educate maintenance staff on upkeep of low-flow/low-volume fixtures (Cost: to be absorbed in existing operating budget);
- Install signs to encourage water conservation and reporting of fixture problems (Cost: to be absorbed in existing operating budget); and
- Promote awareness of water conservation benefits and encourage the use of automatic shut-off nozzles for all boat slip water connections (Cost: to be absorbed in existing operating budget).

(Note: The implementation of water conservation measures through the replacement of the existing water system would be a major capital improvement cost and would require further study of the harbor's water requirements and existing water system; therefore, this conservation measure is not considered in this implementation schedule.)

Proposed Monitoring Activities:

- Facility Manager to inspect and replace signage as needed (Cost: to be absorbed in existing operating budget).

Proposed staff hours (included in proposed budget)

Proposed budget \$34,900

Year 2

Proposed Work: None

Proposed Monitoring Activities:

- CWRM to compare metered water use with previous years to see if water conservation goals are being achieved, i.e., projected water use reduction and projected cost savings (Cost: to be absorbed in existing operating budget).

8.7 Prototype Facility – DOFAW Hilo Baseyard

8.7.1 Facility Water System Inventory

The Division of Forestry and Wildlife (DOFAW) Hilo Baseyard Complex (Hilo Baseyard) is located on the east side of the island of Hawaii. The Hilo Baseyard consists of several governmental agency facilities that serve various functions including general office use, vehicle and equipment repair, and a nursery/arboretum. The facility is shared with other government agencies including the U.S. Department of Agriculture – Forest Services and the DLNR State Parks Division, see Figure 8-16 for photos of the Hilo Baseyard.

The Hilo Baseyard’s water system serves the DOFAW main office building, fire control storage building, fuel station facility, arboretum, nursery, and three residential houses on the property that serve as office/storage, residence for DOFAW interns, and residence for the baseyard’s manager, see Figure 8-17 for photos of the existing plumbing fixtures and water use facilities. The State Parks Division rents space in a building on the property, which has its own water service connection and water meter and is therefore independent from the Hilo Baseyard water system. According to the State Parks’ staff, the facility’s maintenance building is used to store park supplies, such as toilet paper, paper towels, cleaning materials, etc. The only water service provided at this building is one hose bib.

Water Consumption

Based on information from the Division of Forestry and Wildlife (agency responsible for the Hilo Baseyard’s operation and maintenance), the baseyard uses about 198,000 gallons per month or 6,600 gallons per day (based on their most current 30-day water billing record for the baseyard facility). The facility has no sub-metering of water use at the facility and no direct metering of the various types of water use. The Hilo Baseyard has a total staff of 40 DLNR employees in addition to the USDA Forest Services, which has a total staff of 11 employees.

**Figure 8-16
Photos of the
DOFAW Hilo Baseyard**



Hilo Baseyard Office Complex



Hilo Baseyard Office Complex



USDA Forest Services Building Shared with DOFAW



Arboretum



Baseyard Manager's Residence

Water Use – Plumbing Fixtures

Based on available construction plans and staff interviews, the total plumbing fixture count for the Hilo Baseyard facility is summarized in Table 8-21.

Table 8-21 Hilo Baseyard – DOFAW Facilities
Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	11	5	55
Urinal	2	5	10
Lavatory	11	2	22
Shower	8	4	32
Basin / Sink	4	4	16
Hose Bib (Spigot)	19	5	95
Drinking Fountain	1	2	2
Washing Machine	1	10	10
Dishwasher	1	4	4
Total Fixture Units DOFAW Facilities			246

The DOFAW leases office and warehouse space to the USDA Forest Services. Table 8-22 summarizes the plumbing fixture count for the USDA Forest Services Facility.

Table 8-22 Hilo Baseyard – USDA Forest Services Facility
Plumbing Fixture Unit Count

Type of Fixture	Number of Fixtures	Fixture Units per Fixture	Fixture Unit Count
Water Closet (Toilet)	1	5	5
Urinal	1	5	5
Lavatory	1	2	2
Basin / Sink	2	4	8
Hose Bib (Spigot)	3	5	15
Drinking Fountain	1	2	2
Total Fixture Units USDA Forest Services			37

Water Use – Irrigation

The Hilo Baseyard’s landscaped area consists of a nursery and arboretum with a sprinkler irrigation system. The total landscaped area is approximately 1 acre. No information was available on the irrigation system’s fixture unit count.



DOFAW Office Building - Lavatory



DOFAW Office Building -
Lavatory & Water Closet



DOFAW Office Building - Shower



USDA Forest Services -
Showers



USDA Forest Services -
Men's Restroom

Figure 8-17
Photos of the DOFAW Hilo Baseyard
Existing Plumbing Fixtures

Water Management Problems, Goals, and Challenges

The Hilo Baseyard does not currently have a formal water management plan. The Division of Forestry and Wildlife accounts for water usage with the Department of Water Supply monthly water billings. The Hilo Baseyard does not have any known water quality problems and the current water system adequately serves the facility.

The conservation goals for the Hilo Baseyard are to achieve a 15% water use reduction, to estimate cost savings over the long term, and to free up water supplies for additional uses. The conservation program results will be monitored by metered water use (DWS water billings).

The Hilo Baseyard does not currently have any educational program in place to promote water conservation. The DWS rates and charges for water service are based on a tiered pricing schedule, which encourages water conservation.

8.7.2 Existing Water Usage Characteristics and Historical Consumption Data

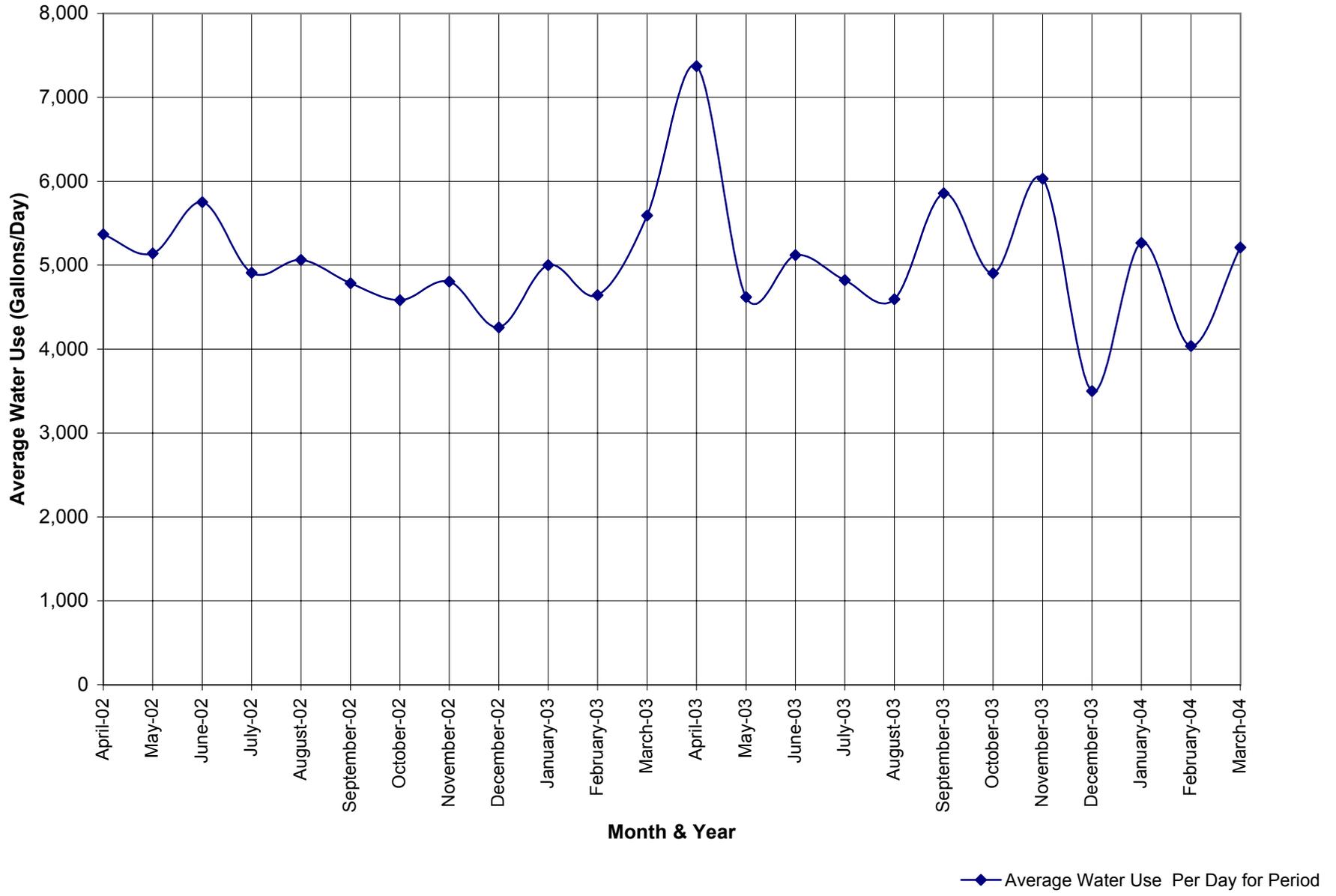
The Hilo Baseyard's water usage falls under three basic categories: domestic use, facility operation and maintenance, and irrigation. The Hilo Baseyard's daily operations require the use of potable water to meet the domestic needs of the baseyard staff, operation and maintenance uses (i.e. equipment washdown) and maintenance of landscaped areas. The DOFAW staff currently occupies a new office complex built in 1998. The Hilo Baseyard Office Complex has water-conserving fixtures already installed; therefore, water conservation efforts will be focused on the remaining facilities that are not installed with water conservation measures.

The average water-use rates for the various fixtures installed at the Hilo Baseyard (not including the new Hilo Baseyard Office Complex) are estimated as follows:

- Water Closets (Toilets w/flush valves) – 3.5 gallons per flush (gpf);
- Urinals – 3.5 gpf;
- Lavatories – 3.0 to 7.0 gpm (Average 5.0 gpm); and
- Showers – 2.75 to 4.0 gpm (Average 3.4 gpm).

Water consumption history for the Hilo Baseyard was obtained through the County of Hawaii's Department of Water Supply (DWS) for the record period of April 2002 to March 2004. Currently, two DWS water meters serve the Hilo Baseyard: One meter is for all potable water usage at the baseyard and the other meter is for fire flow service. The average water consumption per day for the record period was approximately 5,000 gallons per day (versus 6,600 gallons/day which was estimated by the baseyard staff). The maximum average daily usage for the record period was 7,400 gallons/day (April 2003), and the minimum average daily usage for the record period was 3,500 gallons/day (December 2003). Figure 8-18 graphically summarizes the average water use per day for each monthly period from April 2002 to March 2004.

Figure 8-18
DOFAW Hilo Baseyard
Average Daily Use per Monthly Period



Based on the water consumption history chart, water use at the Hilo Baseyard appeared to be relatively consistent, with slight fluctuations in consumption during the year. Peaks in water consumption (e.g. April 2003) correlated to lower rainfall periods, while water consumption near its lowest levels (e.g. December 2003) correlated to higher rainfall periods. It was presumed that landscape irrigation might be a significant factor in the variation of water consumption at the facility.

8.7.3 Assessment of Various Water Uses – Identification of Significant Uses

As stated earlier, water usage at the baseyard is not sub-metered and a detailed breakdown of water usage for this facility was not available; therefore, estimates were made from review and analysis of existing data. Based on water consumption history and monthly rainfall data, an attempt to correlate water consumption and rainfall was made. The irrigation system utilized at the baseyard is a manual irrigation system; therefore, baseyard staff controls the irrigation of the nursery/arboretum.

The average water consumption for the Hilo Baseyard was approximately 5,000 gallons/day based on DWS water billing records. Based on discussions with the baseyard staff, irrigation water usage is estimated to be approximately 15% of the total water consumption, or 750 gallons/day. Therefore, it can be estimated that 85%, or 4,250 gallons/day of water consumption, is for domestic and operational water use.

8.7.4 Applicable Water Conservation Measures

There are three primary water uses at the Hilo Baseyard: domestic use, facility operation and maintenance, and irrigation. Domestic water use includes drinking fountains, showers and restroom facilities. Facility operation and maintenance water use includes equipment washdown and various other facility activities. Irrigation water use includes a sprinkler irrigation system for landscaped areas. As stated earlier, the new Hilo Baseyard Office Complex is equipped with water-conserving fixtures; therefore, water conservation retrofits for the office complex fixtures will not be necessary.

The water conservation measures selected for the rest of the Hilo Baseyard included low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets, and low-flow shower heads, see Table 8-23. Low-flow fixtures require the least amount of modification to the existing facilities and are the most practical conservation measures, see Appendix 6 for information on these water conservation measures.

Table 8-23
Water Conservation Measures and Devices – DOFAW Hilo Baseyard

Type of Fixture	Existing Water Usage	Water Conservation Measure	Conservation Water Usage	Water Savings Percentage
Water Closet (Toilet)	3.5 gpf*	Low-Consumption, Flushometer Valve Toilets	1.6 gpf	54%
Urinal	3.5 gpf	Low-Consumption Urinals	1 gpf	71%
Lavatory	5 gpm**	Low-Volume Faucets (Metering)	0.5 gpm	90%
Shower	3.4 gpm	Low-Flow Shower Heads	2.5 gpm	26%

* Gallons per flush

** Gallons per minute

Other water conservation measures that could be applied at the Hilo Baseyard include the following:

- Education of employees on water conservation measures, such as training on maintenance of low-flow fixtures;
- Education of baseyard staff on water conservation measures that can be implemented (e.g. automatic shut-off hose nozzles);
- Installation of signs to encourage water conservation in restroom facilities or work areas where water is used; and
- Installation of signs with information on who to call should a restroom facility need repair.

8.7.5 Applicable Water Conservation Measures Feasibility Assessment – Cost Benefit Analysis

The implementation cost (including materials and labor) for the proposed water conservation measures at the Hilo Baseyard is summarized in Table 8-24.

Table 8-24
 Projected Water Conservation Plan Implementation Cost (Domestic Use)

Type of Fixture	Number of Fixtures	Cost per Fixture*	Estimated Total Fixture Cost
Low-Consumption Flushometer-Valve Toilets	12	\$610	\$ 7,320
Low-Consumption Urinals	3	\$630	\$ 1,890
Low-Volume Faucets (Metering)	12	\$550	\$ 6,600
Low-Flow Shower Heads	12	\$650	\$ 7,800
Total			\$23,610

* Planning cost based on Board of Water Supply conversion of water fixtures for the City and County of Honolulu municipal facilities to water conserving fixtures, implementation 2001-2003. (includes 20% contingency)

As stated earlier, the water savings for the Hilo Baseyard was estimated at 850 gallons per day, which translates to \$2.38 per day (\$2.80/1,000 gallons – DWS water rate) or \$900.00 per year savings. With an initial approximate implementation cost of \$23,600, the payback period would be approximately 26 years. The feasibility of implementing conservation measures at the Hilo Baseyard could be realized if major renovations are scheduled for the baseyard facility.

Sub-metering of the irrigation system could account for the water usage of the nursery and arboretum. The construction cost estimate for installation of one (1) water sub-meter and box to monitor irrigation water consumption would be approximately \$2,500.

The cost of water conservation measures at the Hilo Baseyard include the following:

- Cost of conservation devices (hardware);
- Cost to install conservation devices and water meter;
- Program monitoring and evaluation; and
- Cost of any necessary renovation or existing plumbing, appliances, or related connections.

The benefits of water conservation at the Hilo Baseyard include the following:

- Positive public relations (State facility saving water resources and setting the example for other facilities);
- Increased water-user awareness of water conservation and water accountability;
- Water cost savings over the long-term; and
- Environmental benefits outlined in Section 8.7.6.

8.7.6 DOFAW Hilo Baseyard Conservation Plan

Water conservation measures identified for the Hilo Baseyard include low-consumption flushometer-valve toilets, low-consumption urinals, low-volume faucets (metering type) and low-flow shower heads. The current irrigation system for the baseyard and nursery is manually operated and accounts for a small percentage of the total water use at the baseyard. According to baseyard staff, the irrigation system is minimally operated because of the ample rainfall that is typical of the Hilo area. The projected water conservation and cost savings for the Hilo Baseyard are summarized in Table 8-25.

Table 8-25
Projected Water Conservation for the DOFAW Hilo Baseyard

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Estimated Water Usage (gpd)*	Water Conservation Savings Percentage	Water Saved (gpd)
Water Closet (Toilet)	60	21%	700	54%	380
Urinal	15	5%	170	71%	120
Lavatory	24	9%	280	90%	250
Shower	32	11%	370	26%	100
Basin/Sink	24	9%	280	n/a	-
Hose Bib (Spigot)	110	39%	1,280	n/a	-
Drinking Fountain	4	1%	50	n/a	-
Washing Machine	10	4%	120	n/a	-
Dish Washer	4	1%	50	n/a	-
TOTAL	283	100%	3,300	-	850

*gpd – gallons per day

The total projected water conservation for the Hilo Baseyard is 850 gallons per day for domestic use including restroom facilities and operations and maintenance facilities. Therefore, the total water savings of 850 gallons per day could save the State \$2.38 per day (\$2.80/1,000 gallons). This translates to approximately \$900.00 per year.

There are no known environmental or cultural resources within the facility. The environmental benefits from implementation of a conservation program at the Hilo Baseyard will:

- Reduce water use and extend the lifespan of the current infrastructure;
- Reduce water waste and save precious water resources;
- Reduce wastewater generated from facility requiring treatment and disposal;
- Minimize runoff from over-irrigation;
- Minimize the environmental impacts of new water supply infrastructure;
- Reduce point source and non-point source pollution; and
- Reduce the risk of water supply shortage conditions.

There are no real negative environmental effects with the implementation of a conservation plan at the Hilo Baseyard except for temporary impacts such as construction activity during installation of water conservation measures. These environmental impacts are temporary and are far out-weighed by the benefits of the conservation program implementation.

8.7.7 Conservation Plan Implementation Schedule & Cost

The conservation plan implementation schedule and cost for the Hilo Baseyard is summarized below.

Year 1

Proposed Work:

- Fixture retrofits (Cost: \$23,600);
- One (1) sub-meter installation (Cost: \$2,500);
- Educate maintenance staff on upkeep of low-flow/low-volume fixtures (Cost: to be absorbed in existing operating budget); and
- Install signs to encourage water conservation and reporting of fixture problems (Cost: to be absorbed in existing operating budget).

Proposed Monitoring Activities:

- Facility Manager to inspect and replace signage as needed (Cost: to be absorbed in existing operating budget).

Proposed staff hours (included in proposed budget)

Proposed budget \$26,100

Year 2

Proposed Work: None

Proposed Monitoring Activities:

- CWRM to compare metered water use with previous years to see if water conservation goals are being achieved, i.e., projected water use reduction and projected cost savings (Cost: to be absorbed in existing operating budget).

9 PHASE 5 – SUMMARY AND RECOMMENDATIONS

9.1 DLNR Water Conservation Plan - Summary of Results

The primary objective of this project is to develop a prototype Water Conservation Program that could be applied to typical government facilities throughout the State of Hawaii. It is envisioned that the DLNR Water Conservation Plan would serve as a model for a larger, more extensive statewide water conservation program.

DLNR was selected as a prototypical State agency for this project since it operates a variety of different facility types with various water use characteristics (e.g., office buildings, baseyards, harbors, parks, municipal/irrigation demands). The “lessons learned” from this study could then be applied in the development of a comprehensive conservation program expanded to include all State agencies.

The DLNR Water Conservation Plan utilized a modified version of the Bureau of Reclamation (BOR) Conservation Management Plan approach. The methodology used was reviewed and approved by the BOR. The standard BOR approach was modified to address issues relevant to government/institutional uses, as compared to a regional water district for which the standard approach was developed. The modified BOR format used for the DLNR Water Conservation Plan program consisted of five (5) phases, which incorporated the required elements of the standard nine-step BOR format.

The DLNR Water Conservation Plan focused on five (5) prototype facilities that were selected through a preliminary screening process. The prototype facilities exhibited potential for significant water conservation, either at the individual facility level or through application of selected conservation measures at similar facilities, statewide. The five selected prototype facilities were:

- Kalanimoku State Office Building;
- Kakaako Waterfront Park;
- Ala Wai Small Boat Harbor;
- Honokohau Small Boat Harbor; and
- DOFAW Hilo Baseyard

Conservation plans for each of the individual prototype facilities were developed based on information gathered through staff surveys and interviews, water use records, construction plans and site inspections. The water conservation plan developed for each prototype facility included: projected water conservation (gallons/year), recommended conservation measures, implementation cost and schedule, and projected cost savings per year. (See Table 9-1 for cost benefit summary.) Table 9-2 is a summary of information gathered including: average water usage (gallons/month), plumbing fixture unit counts and recommended water conservation measures identified for each of the prototype facilities.

Table 9-1
Cost Benefit Summary Table

Prototype Facility	Projected Total Water Conservation (gallons/year)	Year 1 Conservation Measures Implementation Cost						Year 1 Conservation Measures Cost Savings per Year	
		Low-Volume / Flow Fixtures *	Irrigation System Improvement Options		Water Sub- Metering	Other Conservation Measures		Low-Volume / Flow Fixtures	Irrigation System Replacement
			Replacement	Retrofits		Informational Signs	Educating Employees		
Kalanimoku State Office Building	5,062,800	\$89,200	\$210,000 ¹	N/N	\$2,500	O/B	O/B	\$8,100	\$2,000
Kakaako Waterfront Park	5,584,800	\$24,100	\$1,850,000 ²	N/A	N/N	O/B	O/B	\$900	\$10,200
Ala Wai Small Boat Harbor	1,657,100	\$64,500	N/F	N/F	\$17,500	O/B	O/B	\$3,300	-
Honokohau Small Boat Harbor	2,117,000	\$22,400	N/F	N/F	\$12,500	O/B	O/B	\$5,900	-
DOFAW Hilo Baseyard	310,300	\$23,600	N/F	N/F	\$2,500	O/B	O/B	\$900	-

N/F - Not Feasible (unless part of normal repair/replacement program)

N/N - Not Necessary

N/A - Not Available

O/B - Cost to be absorbed by facility's operating budget

* Cost includes materials and installation plus 20% contingency

1 - Kalanimoku Building irrigation system replacement currently scheduled due to the age of current system and changes to the landscaped areas.

2 - Planning cost estimate for replacement of the Kakaako Waterfront Park irrigation system.

Table 9-2
DLNR Water Conservation Plan - Summary Table

Prototype Facility	Average Water Use (gallons per month)	Plumbing Fixture Unit Counts		Recommended Water Conservation Measures							
		Domestic Use	Landscape Irrigation	Low-Volume		Low-Flow		Irrigation System Replacement / Retrofitting	New Water Sub-Metering	Signs to Encourage Water Conservation	Educating Employees on Water Conservation
				Toilets	Urinals	Faucets	Showers				
Kalanimoku State Office Building	1,188,100	668	515	Yes	Yes	Yes	n/a	Yes ¹	Yes	Yes	Yes
Kakaako Waterfront Park	2,931,600	186	N/A	Yes ⁴	Yes ⁴	Yes ⁴	Yes ⁴	Yes ²	No ³	Yes	Yes
Ala Wai Small Boat Harbor	1,125,400	4,304	N/A	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Honokohau Small Boat Harbor	3,610,500	1,611	N/A	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
DOFAW Hilo Baseyard	152,100	283	N/A	Yes ⁴	Yes ⁴	Yes ⁴	Yes ⁴	No	Yes	Yes	Yes

* N/A - Not Available

* n/a - Not Applicable

1 - Kalanimoku Building irrigation system currently scheduled for replacement due to the age of the existing system and changes to the landscaped areas.

2 - Current irrigation system should be replaced or retrofitted with more water efficient irrigation system and/or components.

3 - Kakaako State Park has sub-meters to monitor domestic and irrigation usages.

4 - Conservation measures not justified solely on the basis of cost benefit/savings, however installation of water saving fixtures as part of normal replacement/repair program would be feasible.

The installation of low-volume/flow fixtures and water sub-metering would be the feasible first step in the implementation of the DLNR Water Conservation Plan. An evaluation of facilities with existing conservation programs should be compared for their effectiveness with measures implemented through the proposed conservation program. Implementation of other Conservation Measures such as irrigation system retrofits or replacement should be considered, especially when funding becomes available, or if major improvements or reconfiguration to the irrigation system are necessary.

9.2 DLNR Water Conservation Plan – Findings / Conclusions

The following sections summarize the some of the insights and “lessons learned” from the assessments performed at each prototype facility.

Kalanimoku State Office Building:

- Domestic water consumption could be reduced by 56% with the installation of water saving fixtures/devices while; irrigation water use could be reduced by approximately 15% with the installation of a new water efficient irrigation system. The projected net reduction in total water consumption is approximately 36% with the proposed water conservation efforts at the Kalanimoku Building.
- Cost benefit/savings for fixture retrofits could be directly realized with an approximate payback period of 11 years for domestic water usage through the proposed conservation measures.
- Sub-metering of water use for the irrigation system should be implemented to determine actual domestic water use versus irrigation water use.

Kakaako Waterfront Park

- Domestic water consumption could be reduced by 49% with the installation of water saving fixtures/devices while; irrigation water use could be reduced by approximately 15% with the installation of a new water efficient irrigation system. The projected net reduction in total water consumption is approximately 16% with the proposed water conservation efforts at the Kakaako Waterfront Park.
- Cost benefit/savings for fixture retrofits would be realized with an approximate payback period of 26 years. The replacement of existing water fixtures with water saving fixtures cannot be justified solely on the basis of cost benefit/savings because of the currently low domestic water consumption. However, installation of water saving fixtures as part of a normal replacement/repair program for existing fixtures (considered part of normal maintenance costs) would make conversion to water conservation measures feasible.
- Full replacement of the existing irrigation system cannot be justified solely on the basis of cost benefit/savings and water conservation efficiency; however, it would be feasible to implement water conservation measures when

repairs/replacements are required. Replacement of malfunctioning or worn irrigation system components such as sprinkler heads, irrigation timers, etc. would be an opportune time to install water saving irrigation components.

- A more immediate option for consideration is the retrofitting of the existing irrigation system. This option, however, would require a more detailed study of the current irrigation system, and the development of specific measures to achieve maximum water savings and optimize water use. The percent reduction of irrigation water consumption could be determined by monitoring of irrigation water consumption after retrofitting of the system is completed.

Ala Wai Small Boat Harbor

- Domestic water consumption could be reduced by approximately 12% with the installation of water saving fixtures/devices at the Ala Wai Harbor. These savings do not include potential water savings that may be realized from implementation of water conservation measure for boat slip users. These types of water connections accounted for about 60% of the water consumed at the facility.
- Cost benefit/savings for fixture retrofits would be realized with an approximate payback period of 20 years.
- Water usage by the resident boaters cannot currently be monitored without installation of a sub-metering system within the Ala Wai Harbor water system. Sub-metering of this facility would provide for more effective monitoring of 60% of the water use at the harbor, and enable a clearer identification of areas where water use could be optimized. The installation of a sub-metering system to account for water usage at the piers/docks and wash-down area is therefore recommended.
- The Ala Wai Harbor staff, as an additional interim measure, should promote awareness of water conservation benefits and should encourage the use of automatic shut-off nozzles on all hose bib connections serving boat slips at the Harbor.
- Irrigation water conservation measures were not feasible because of the limited landscaping area (less than 0.25 acres) and minimal landscape irrigation.

Honokohau Small Boat Harbor

- Domestic water consumption could be reduced by approximately 5% with the installation of water saving fixtures/devices at the Honokohau Harbor. These savings do not include potential water savings that may be realized from implementation of water conservation measure for boat slip users.
- Cost benefit/savings for fixture retrofits would be realized with an approximate payback period of 4 years.
- Water usage by the boaters cannot currently be monitored without installation of a sub-metering system for the Honokohau Harbor water system. The installation of extended sub-metering of water uses within the Honokohau Harbor to better account for water usage at the piers/docks and wash-down area is recommended.

- The Honokohau Harbor staff, should, as an additional interim measure, promote awareness of water conservation benefits and should encourage the use of automatic shut-off nozzles on all hose bib connections serving boat slips at the Harbor.
- Irrigation water usage quantity should be verified by sub-metering, upon which irrigation system retrofit or replacement could be evaluated to maximize water saving and optimize water use.

DOFAW Hilo Baseyard

- Water consumption could be reduced by approximately 17% with the installation of water saving fixtures/devices at the Hilo Baseyard.
- Cost benefit/savings for fixture retrofits would be realized with an approximate payback period of 26 years.
- Sub-metering at this facility would provide for more efficient monitoring of water use at the facility.
- The replacement of existing water fixtures with water saving devices cannot be justified solely on the basis of cost benefit/savings. However, installation of water saving fixtures as part of a normal replacement/repair program for existing fixtures (considered part of normal maintenance costs) would make conversion to water conservation measures feasible.

During the development of the DLNR Water Conservation Plan, it became apparent that each facility studied was unique and required site-specific considerations in the formulation of each water conservation plan. Based on the study of each prototype facility, estimated potential water savings were calculated for each facility. The estimated percentage of water savings for each facility varied, see Table 9-3. The Kalanimoku State Office Building revealed the highest potential water saving percentage at an estimated 36%. The Honokohau Small Boat Harbor revealed the lowest potential water savings percentage of an estimated 5%.

Based on the facilities studied and the varying water saving percentages that could be achieved, it is recommended that DLNR set a conservative agency goal of 10% water conservation savings. Currently, the DLNR uses an average of approximately 31 million gallons per month for their facilities. In achieving the agency conservation goal of 10%, the DLNR could realize a water savings of approximately 3.1 million gallons per month (or a savings of \$6,100 per month based on \$1.98/1,000 gallons).

This conservation goal should be pursued based on additional follow-on studies/assessments of each DLNR facility. The individual follow-on studies/assessments would lead to development of facility-specific water conservation plans aimed at achieving, or surpassing the agency water conservation goal.

Table 9-3
Estimated Percentage of Water Savings per Year

Prototype Facility (Facility Classification)	Approximate Total Water Consumption at Facility (gallons/month)	Estimated Water Savings through Proposed Water Conservation Measures (gallons/month)	Estimated Percentage of Water Savings per month
Kalanimoku State Office Building (Office Building)	1,188,100	421,900	36%
Kakaako Waterfront Park (State Park Facility)	2,931,600	465,400	16%
Ala Wai Small Boat Harbor (Recreational Small Boat Harbor)	1,125,400	138,100	12%
Honokohau Small Boat Harbor (Commercial/Recreational Small Boat Harbor)	3,610,500	176,400	5%
DOFAW Hilo Baseyard (Maintenance Baseyard)	152,100	25,900	17%

9.3 Framework for the Expansion of the Water Conservation Plan

As stated earlier, one of the key objectives of the project was to apply the knowledge gained from this effort to the development of a statewide water conservation plan. The project was initiated as a pilot program, studying several facilities as models for application to other State agencies. An additional goal was to develop an assessment approach and planning methodology that could be used in the formulation of a statewide water conservation plan.

Facility Water Conservation Assessment Methodology

The development of facility-specific water conservation plans begins with understanding each individual facility's water usage. The creation and adoption of a consistent assessment methodology to evaluate water usage and identify possible water conservation measures is the first step in developing facility-specific water conservation plans. The water conservation assessment methodology could be used as a template by State agencies to conduct internal evaluations of their facilities (either by their in-house staff or by consultants to perform the assessments).

The water conservation assessment methodology should consist of the following basic steps:

1. Identification of Current Water Use at the Facility:
 - Facility water system inventory – understanding the current water system layout;
 - Gather historical water consumption data (i.e. water billings, water metering records);
 - List of all water uses including domestic, irrigation, maintenance, etc.;
 - Water quantities used on average by each water use type. This may require the installation of sub-metering systems to determine specific water usage by category (e.g. domestic use, irrigation, maintenance operations); and
 - Identify significant water uses.
2. Identification of Existing Conservation Measures:
 - List all existing water conservation measures;
 - Assess existing water conservation measures and any previous attempts to implement water conservation measures and gain understanding of relative success or failure; and
 - Identify areas without water conservation measures.
3. Identification of applicable/practical water conservation measures:
 - List potential water conservation measures to be considered; and
 - Discuss potential water conservation measures with facility staff.
4. Potential Water Conservation Measures Cost Benefit Analysis and Environmental Assessment:
 - Develop projected water conservation plan implementation costs;

- Develop estimated projected water savings based on water conservation measures selected;
 - Evaluate water conservation plan feasibility through cost benefit analysis;
 - Environmental Assessment – identifying resources and any possible negative impacts; and
 - Develop final recommended water conservation plan based on cost benefit and environmental analysis.
5. Conservation Plan Implementation Schedule:
- Develop timetable of interim and long-term conservation measures for agency implementation.
6. Development of initial steps to be taken by facility:
- Possible installation of sub-metering systems to monitor water usage;
 - Identify implementation costs, including labor;
 - Identify activities for monitoring performance and results;
 - Educate facility staff on water conservation measures;
 - Post signs to educate water users on water conservation; and
 - Post signs identifying contacts if facility is in need of repair.

The development of facility-specific water conservation plans for all State agencies is a vital starting point for water conservation throughout the State of Hawaii. Cooperative efforts between the State and counties can enhance the development of a statewide conservation program. Government agencies should also pursue public/private partnerships to implement and promote water conservation efforts, which will increase public awareness of the importance of water conservation.

Water Conservation Plan Coordinator

Until such time that a dedicated position is established to coordinate water conservation plans and initiatives at the state level, CWRM will have oversight, but each facility would have a project manager assigned for individual facility plan implementation.

APPENDICES

DEPARTMENT OF LAND AND NATURAL RESOURCES – WATER CONSERVATION PLAN

Appendix 1

Appendix 1
DLNR Water Billing Table

DLNR Division	Water Use Facility	Service Address	Water Meter No.	Account No.	Start Billing Period	End Billing Period	Billing Period Consumption Gallons	Billing Period Month(s)	Sig. User	Water Consumption per Month
Div of Aquatic Res-Hawaii		Kam Ave Glnr Bait Hs	0007208754	002-28050005	5/30/02	6/27/02	11,000	1		11000
Div of Aquatic Res-Oahu	Sand Island State Recreation A	560 Sand Island Access Rd	00099013	1143601-1028449	6/13/02	7/15/02	4,514,000	1	*	4,514,000
Div of Boating & Ocean Rec-Hawaii	Honokohau Small Boat Harbor	74-380 Kealakehe Parkway	0031915214	007-87296510-10	6/21/02	7/25/02	2,188,000	1	*	2,188,000
		74-380 Kealakehe Parkway	0031915732	007-87297010-10	6/21/02	7/25/02	421,000	1		421,000
		Qn Kaahumanu Hwy Hon	0096034972	007-87296490-10	6/21/02	7/25/02	675,000	1		675,000
Div of Boating & Ocean Rec-Hawaii	Kawaihae Boat Harbor	Kawaihae Rd Dept Of	0060228300	006-83035140-10	5/28/02	6/24/02	1,124,000	1	*	1,124,000
Div of Boating & Ocean Rec-Hawaii		Kawaihae Rd Cold Str	0000357470	006-83063350-11	6/24/02	7/24/02	287,000	1		287,000
Div of Boating & Ocean Rec-Hawaii		Puako Bch Dr Puako B	0005248540	006-84020000-10	5/28/02	6/24/02	42,000	1		42,000
Div of Boating & Ocean Rec-Hawaii		Kam Ave Wailoa Brdg	0007233673	002-26099700-10	5/30/02	6/27/02	11,000	1		11,000
Div of Boating & Ocean Rec-Hawaii		Alii Dr Kailua Hrbor	0017054384	007-85799940-10	5/24/02	6/24/02	0	1		0
Div of Boating & Ocean Rec-Hawaii		Manono St 5' P/Hyd 1	0026059856	002-10050500-10	5/30/02	6/27/02	118,000	1		118,000
Div of Boating & Ocean Rec-Hawaii		Kailua Pier Comfort	0031920731	007-85799970-10	5/24/02	6/24/02	154,000	1		154,000
Div of Boating & Ocean Rec-Hawaii		Kam III Rd Mthly Dln	0034569219	007-85011330-10	5/28/02	6/21/02	12,000	1		12,000
Div of Boating & Ocean Rec-Hawaii		Kaleiopapa Rd Mthly 14	0038445771	007-85011360-10	5/28/02	6/21/02	109,000	1		109,000
Div of Boating & Ocean Rec-Hawaii		Lihwai St Suisan Sd	0038661564	002-26099600-10	5/30/02	6/27/02	5,000	1		5,000
Div of Boating & Ocean Rec-Hawaii		Manono St Brdg By Sm	0095016840	002-10050000-10	5/30/02	6/27/02	45,000	1		45,000
Div of Boating & Ocean Rec-Kauai	Kikiaola Small Boat Harbor	9000 Kaumualii Hwy	93000644	1007196-1003649	4/23/02	6/20/02	443,000	2		221,500
Div of Boating & Ocean Rec-Kauai	Nawiliwili Small Boat Harbor	0000 Waapa Rd	9311496	1018683-1003469	4/17/02	6/14/02	432,000	2		216,000
Div of Boating & Ocean Rec-Kauai	Port Allen Small Boat Harbor	0000 Waialo Rd	90008008	1018932-1014812	4/30/02	6/27/02	508,000	2		254,000
Div of Boating & Ocean Rec-Kauai		0000 Kaloloku Rd	00000692	1006435-1001613	5/22/02	7/22/02	194,000	2		97,000
Div of Boating & Ocean Rec-Kauai		4636 Amio Rd	95001245	1001429-1001613	5/13/02	7/10/02	31,000	2		15,500
Div of Boating & Ocean Rec-Maui	Kaunakakai Small Boat Harbor	35 Kaunakakai Place	95374480	1006741-1005915	5/17/02	7/16/02	256,000	2		128,000
Div of Boating & Ocean Rec-Maui	LAH Boat Harbor Comfort Stn		97589730	1033703-1005910	5/3/02	7/2/02	112,000	2		56,000
Div of Boating & Ocean Rec-Maui	Lahaina Small Boat Harbor	675 Wharf Street	96931108	1032559-1005910	5/3/02	7/2/02	852,000	2	*	426,000
Div of Boating & Ocean Rec-Maui	Maalaea		95896562	1019274-1005910	5/28/02	7/26/02	73,000	2		36,500
Div of Boating & Ocean Rec-Maui	Maalaea		95896567	1019275-1005910	5/28/02	7/26/02	13,000	2		6,500
Div of Boating & Ocean Rec-Maui	Maalaea Comfort Station		97633167	1019286-1005910	5/28/02	7/26/02	36,000	2		18,000
Div of Boating & Ocean Rec-Maui	Maalaea Wharf		95896564	1019298-1005910	5/28/02	7/26/02	309,000	2		154,500
Div of Boating & Ocean Rec-Maui	Mala Wharf		96944534	1020806-1005910	5/7/02	7/8/02	391,000	2		195,500
Div of Boating & Ocean Rec-Maui	Mala Wharf Cmft Stn		95799803	1020807-1005910	5/7/02	7/8/02	152,000	2		76,000
Div of Boating & Ocean Rec-Maui	Manele Boat Harbor		23677757	68902100	4/5/02	6/11/02	273,000	2		136,500
Div of Boating & Ocean Rec-Maui		KAH Boat Ramp Washdown	95483636	1009642-1024505	4/26/02	6/25/02	134,000	2		67,000
Div of Boating & Ocean Rec-Oahu	Ala Wai Boat Harbor	1651 Ala Moana Blvd	98070168	1011869-1028448	5/20/02	6/20/02	1,257,000	1	*	1,257,000
Div of Boating & Ocean Rec-Oahu	Haleiwa Boat Harbor	66-025 Haleiwa Rd	21507390	1032591-1028448	5/31/02	7/2/02	267,000	1		267,000
Div of Boating & Ocean Rec-Oahu	Heeia Kea Small Boat Harbor	46-499 Kamehameha Hwy	01600690	1064901-1028448	4/30/02	5/30/02	406,000	1	*	406,000
Div of Boating & Ocean Rec-Oahu	Keeki Boat Harbor	4 Sand Island Access Rd	4102120	1143666-1028448	6/13/02	7/15/02	413,000	1	*	413,000
Div of Boating & Ocean Rec-Oahu	Waianae Boat Harbor	85-491 Farrington Hwy	21809980	1028001-1028448	6/6/02	7/10/02	815,000	1	*	815,000
		85-491 Farrington Hwy	80189607	1028001-1028448	6/6/02	7/10/02	0	1		0

Appendix 1
DLNR Water Billing Table

DLNR Division	Water Use Facility	Service Address	Water Meter No.	Account No.	Start Billing Period	End Billing Period	Billing Period Consumption Gallons	Billing Period Month(s)	Sig. User	Water Consumption per Month
Div of Forestry & Wildlife-Hawaii		1643 Kilauea Ave Rf	0005507488	002-12099700-10	5/30/02	6/27/02	161,000	1		161,000
Div of Forestry & Wildlife-Hawaii		DLNR Hilo Office Com	0007073355	002-55008695-10	5/29/02	6/28/02	0	1		0
Div of Forestry & Wildlife-Maui		5309 Ditch	43399234	77200000	4/17/02	6/17/02	9,000	2		4,500
Div of Forestry & Wildlife-Oahu		2135 Makiki Heights Dr	98060051	1105714-1028453	5/17/02	6/19/02	26,000	1		26,000
Div of State Parks-Hawaii	Akaka Falls Park	Akaka Falls Lfc Rear	0053153317	002-50046000-10	6/26/02	7/26/02	50,000	1		50,000
Div of State Parks-Hawaii	Hapuna Beach State Recreation Area		0004905027	006-84067960-10	6/24/02	7/24/02	632,000	1	*	632,000
			0005275177	006-84067955-10	6/24/02	7/24/02	810,000	1		810,000
Div of State Parks-Hawaii	Kalopa State Park		0009015772	004-69037500-10	6/25/02	7/25/02	42,000	1		42,000
Div of State Parks-Hawaii	Lava Tree State Park	Pahoa Kapoho Rd Nxt	0005414058	001-07050000-10	6/20/02	7/25/02	6,000	1		6,000
Div of State Parks-Hawaii	Napoopoo Park	Puuhohua Bch Rd Napo	0009015623	008-92026860-10	6/20/02	7/23/02	39,000	1		39,000
Div of State Parks-Hawaii	Old Kona Airport		0016612847	007-85797550-10	6/21/02	7/25/02	312,000	1		312,000
Div of State Parks-Hawaii	Rainbow Falls	Rainbow Dr L/Dr Ent	0095017046	002-33001500-10	5/31/02	6/28/02	50,000	1		50,000
Div of State Parks-Hawaii	Wailoa Canoe Shed	Manono St P/Pole 4	0001046300	002-10050600-10	6/27/02	7/30/02	2,000	1		2,000
Div of State Parks-Hawaii	Wailoa State Park	Manono St Opp Pump S	0003906415	002-10051000-10	5/30/02	6/27/02	72,000	1		72,000
Div of State Parks-Hawaii	Wailuku River Park	Wailuku Dr Boiling P	0005938750	002-34011300-10	6/26/02	7/29/02	43,000	1		43,000
Div of State Parks-Hawaii		Kawili St Tree Nrsry	0029677171	002-12099690-10	6/27/02	7/30/02	0	1		0
Div of State Parks-Kauai	Russian Fort	0000 Kaunualii Hwy	24856039	1007206-1013457	4/24/02	6/21/02	364,000	2		182,000
Div of State Parks-Kauai	Wailua River State Park - Marina	3-5971 Kuhio Hwy Building A	97044001	1010031-1003663	3/21/02	5/21/02	1,448,000	2	*	724,000
Div of State Parks-Kauai		0000 Kuamoo Rd	6248609	1009750-1003663	4/5/02	6/3/02	46,000	2		23,000
Div of State Parks-Kauai		Wailua Rd	95000384	1019110-1003663	3/21/02	5/21/02	26,000	2		13,000
Div of State Parks-Kauai		Kuamoo Rd	96000901	1009747-1014809	3/21/02	5/21/02	133,000	2		66,500
Div of State Parks-Kauai		9758C Laau Rd	84000805	1010987-1003663	4/24/02	6/21/02	20,000	2		10,000
Div of State Parks-Oahu	Aiea Bay State Rec Park	99-031 Kamehameha Hwy	22056371	1155590-1028466	6/10/02	7/11/02	874,000	1	*	874,000
			96040161	1155588-1028466	6/10/02	7/11/02	11,000	1		11,000
Div of State Parks-Oahu	Diamond Head State Monument	510 18th Ave	90188211	1001479-1028467	6/25/02	7/24/02	1,121,000	1	*	1,121,000
Div of State Parks-Oahu	Hawaii Nature Center	2109 Makiki Heights Dr	93020720	1105712-1027769	5/3/02	7/8/02	0	2		0
Div of State Parks-Oahu	Iolani Palace State Monument	365 S Hotel St	85189608	1142801-1028466	6/18/02	7/17/02	826,000	1	*#	826,000
Div of State Parks-Oahu	Kakaako Water Front Park	741 Ilalo St	00701008	1050677-1028466	6/20/02	7/22/02	505,000	1	*	505,000
		741 Ilalo St	00701020	1050676-1028466	6/20/02	7/22/02	705,000	1		705,000
		709 Kellikoi St	90099405	1078062-1028466	6/20/02	7/22/02	3,164,000	1		3,164,000
		709 Kellikoi St	93040421	1078063-1028466	6/18/02	7/17/02	3,000	1		3,000
Div of State Parks-Oahu	Keaiwa Heiau State Park	99-1849 Aiea Heights Dr	82070076	1006119-1028466	6/10/02	7/11/02	50,000	1		50,000
Div of State Parks-Oahu	Malaekahana State Recreation Area	56-355 Kamehameha Hwy	99060196	1162097-1027768	4/10/02	5/31/02	787,000	1	*	787,000
Div of State Parks-Oahu	Malama Park	Hio Place	96931012	1006744-1024454	3/14/02	5/17/02	7,000	2		3,500
Div of State Parks-Oahu	Sand Island State Recreation A	3 Sand Island Rd	79159402	1143657-1028466	6/13/02	7/15/02	130,000	1		130,000
Div of State Parks-Oahu	Wahiawa Freshwater State Recreation Area	380 Walker Ave	95070323	1152845-1028466	5/31/02	7/2/02	1,531,000	1	*	1,531,000
Div of State Parks-Oahu		52-300 Kamehameha Hwy	01216743	1065639-1028466	5/30/02	7/1/02	5,000	1		5,000
			01403371	1065638-1028466	5/30/02	7/1/02	0	1		0

Appendix 1
DLNR Water Billing Table

DLNR Division	Water Use Facility	Service Address	Water Meter No.	Account No.	Start Billing Period	End Billing Period	Billing Period Consumption Gallons	Billing Period Month(s)	Sig. User	Water Consumption per Month
Div of State Parks-Oahu	Kahana Valley State Park	52-222 Kamehameha Hwy	01700651	1065610-1028467	5/30/02	7/1/02	219,000	1		219,000
Div of State Parks-Oahu	Heeia State Park	46-461 Kamehameha Hwy	01700778	1064898-1028466	5/30/02	7/1/02	29,000	1		29,000
Div of State Parks-Oahu	Royal Mausoleum State Monument	2261 Nuuanu Ave	14811889	1121861-1028466	6/19/02	7/18/02	56,000	1		56,000
Div of State Parks-Oahu		510 18th Ave	4826623	1001476-1028467	6/25/02	7/24/02	0	1		0
Div of State Parks-Oahu		401 S Hotel St	6588585	1142802-1028466	6/18/02	7/17/02	0	1		0
Div of State Parks-Oahu		1069 Richards St	79030223	1141930-1028466	6/18/02	7/17/02	15,000	1		15,000
Div of State Parks-Oahu	Puu Ualakaa State Wayside	3280 Round Top Dr	85030832	1142354-1028466	6/19/02	7/18/02	27,000	1		27,000
Div of State Parks-Oahu		99-090 Kamehameha Hwy	89020587	1066870-1028466	6/10/02	7/12/02	0	1		0
			90020121	1066866-1028467	6/10/02	7/12/02	0	1		0
Div of State Parks-Oahu		365 S Hotel St	99159401	1142801-1028466	6/18/02	7/17/02	322,000	1		322,000
Div of State Parks-Oahu		3 Sand Island Rd		WWM1334	4/30/02	5/30/02	168,000	1		168,000
Div of State Parks-Oahu		55-615 Kamehameha Hwy		WAMAL01LKAM615	5/15/02	6/12/02	249,000	1		249,000
Div of Water & Land Dev-Oahu		91-591 Kalaeloa Blvd	02600839	1060523-1028468	6/5/02	7/9/02	0	1		0
DLNR-Hawaii	Waimea Tree Nursery	State Tree Nrsry Lal	0008036421	006-55008590-10	5/28/02	6/24/02	0	1		0
DLNR-Hawaii	Waimea Tree Nursery	Mamalaha Hwy Kamuel 8	0015591183	006-80096900-10	5/28/02	6/24/02	15,000	1		15,000
DLNR-Hawaii	Waimea Tree Nursery	Hwy Mamal	0027429446	006-80096850-10	5/28/02	6/24/02	1,000	1		1,000
DLNR-Maui		Northend Field 5339		90770000	4/29/02	5/28/02	155,000	1		155,000

Appendix 2

LINDA LINGLE
GOVERNOR OF HAWAII



PETER T. YOUNG
CHAIRPERSON
MEREDITH J. CHING
CLAYTON W. DELA CRUZ
CHIYOME L. FUKINO, M.D.
BRIAN C. NISHIDA
HERBERT M. RICHARDS, JR.
ERNEST Y.W. LAU
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

Ref: g:/work/regulate/temp/survey form cover letter3
MEMORANDUM

TO: Alvin Tamashiro
State Historic Preservation Division

FROM: *for* Peter T. Young *apvt*
Chairperson

SUBJECT: Survey Form for DLNR Water Conservation Plan

The Commission on Water Resource Management (Commission) has received a \$50,000 grant from the U.S. Bureau of Reclamation (BOR) to develop a water conservation plan for the Department of Land and Natural Resources (DLNR). This project is part of a phased approach to the development of a comprehensive water conservation plan for all state agencies to address potable and non-potable water demands through conservation practices and enhanced water use efficiency. Upon acceptance of the plan by the BOR, it is expected that Hawaii will become eligible for future federal funding to implement the plan provisions.

Please identify all division facilities that house division staff. In addition, if any of these are significant water users (> 0.4 million gallons per month), please fill out one of the blank survey forms that have been provided.

We have selected Fukunaga & Associates, Inc. (FAINC) to provide professional water resource planning services. On behalf of FAINC, we respectfully request your assistance and cooperation in this planning effort. Please return the list of facilities and survey forms to:

Fukunaga and Associates, Inc.
1388 Kapiolani Blvd., 2nd Floor
Honolulu, HI 96814
Attn: Lance Manabe

If you have any questions about the survey form, please contact Lance Manabe at 944-1821. Because this project has a December, 2003 completion deadline under the terms of the grant agreement, please complete and return the survey forms by July 31, 2003.

We would like to sincerely thank each Division administrator and contact person in advance for partnering with the Commission in this worthwhile and exciting project. If you have any questions about this project, please contact Dean Nakano at 587-0240.

Attachment(s)

cc: Don Hibbard, PhD., Administrator

WATER CONSERVATION PLAN - SURVEY FORM

Commission on Water Resource Management
Department of Land and Natural Resources

The Commission on Water Resource Management is developing a water conservation plan for the Department of Land and Natural Resources through a grant received from the U.S. Bureau of Reclamation. This project is part of a phased approach to the development of a comprehensive water conservation plan for all state agencies to address potable and non-potable water demands through conservation practices and enhanced water use efficiency. Upon acceptance of the plan by the Bureau of Reclamation, it is expected that Hawaii will become eligible for future federal funding to implement the plan provisions. This phase of the water conservation plan development will focus on larger water-using facilities. In order to obtain the additional information necessary to determine each facility's water conservation potential, this survey form was developed. Please complete this survey to the best of your ability.

If you have any questions please call Lance Manabe at (808) 944-1821.

Please return this survey form to: Fukunaga and Associates, Inc.
1388 Kapiolani Boulevard, 2nd Floor
Honolulu, Hawaii 96814
Attn: Lance Manabe

DLNR Division-Office:	<input type="text"/>	Island:	<input type="text"/>
Water Use Facility Name:	<input type="text"/>		
Facility Address:	<input type="text"/>		
Tax Map Key(s):	<input type="text"/>		
Facility Contact Name:	<input type="text"/>		
Phone Number:	<input type="text"/>	Fax Number:	<input type="text"/>

Is Facility Shared with Other Departments/Agencies?	<input type="text"/>	(Yes or No)
If Yes, List Departments / Agencies who share the facility:	<input type="text"/>	
Number of DLNR Staff at Facility (Per Day):	<input type="text"/>	
Number of Other Users of Facility (Per Day):	<input type="text"/>	If not applicable, N/A.

Water Usage Information Please describe each type of water usage at your facility. (For example: General office, landscape irrigation, public comfort station, equipment washdown, etc.)

Example:

General Description of Water Use: **Landscape Irrigation**

Quality of Water Used: **Potable** (i.e. Potable, Non-Potable, Recycled or Other)

Source of Water Used: **State-owned Well** (i.e. County Water System, State Water System, Private Water System or Other))

Quantity of Water Used: **1,500** gallons per day Quantity: **Estimated** or Metered (circle one)

General Description of Water Use:

Quality of Water Used: (i.e. Potable, Non-Potable, Recycled or Other)

Source of Water Used: (i.e. County Water System, State Water System, Private Water System or Other))

Quantity of Water Used: gallons per day Quantity: Estimated or Metered (circle one)

General Description of Water Use:

Quality of Water Used: (i.e. Potable, Non-Potable, Recycled or Other)

Source of Water Used: (i.e. County Water System, State Water System, Private Water System or Other))

Quantity of Water Used: gallons per day Quantity: Estimated or Metered (circle one)

General Description of Water Use:

Quality of Water Used: (i.e. Potable, Non-Potable, Recycled or Other)

Source of Water Used: (i.e. County Water System, State Water System, Private Water System or Other))

Quantity of Water Used: gallons per day Quantity: Estimated or Metered (circle one)

General Description of Water Use:

Quality of Water Used: (i.e. Potable, Non-Potable, Recycled or Other)

Source of Water Used: (i.e. County Water System, State Water System, Private Water System or Other))

Quantity of Water Used: gallons per day Quantity: Estimated or Metered (circle one)

Water System Information

Are there any water system problems at your facility? (Yes or No)

If Yes, describe your water system problems in the space provided below:

(i.e. Low water pressure, excessive water pressure, water quality, etc.)

Landscaping and Irrigation System Information

Do you have landscaped areas? (Yes or No) Total landscaping area: Acres

If Yes, Describe the existing landscaping. (i.e. grass, planting areas, trees, brush, etc.)

Describe your existing irrigation system: (i.e. sprinklers, drip irrigation, hand water, etc.)

Describe your current irrigation schedule:

Current Water Conservation Measures (if applicable)

Low Volume(Flush) Toilets: (Yes or No) Toilet Leak Check/Repair: (Yes or No)

Toilet Retrofit Device(s): (Yes or No)

Types of Toilet Retrofit Device(s): (i.e. Displacement devices, toilet dams, early closure devices, efficiency adjustments for flush valves, etc.)

Low Volume(Flush) Urinals: (Yes or No) Urinal Leak Check/ Repair: (Yes or No)

Low-Volume(Flow) Showerheads: (Yes or No)

Showerhead Retrofit Device(s): (Yes or No)

Types of Showerhead Retrofit Device(s): (i.e. Timed shut-off valves, flow restrictors, etc.)

Low-Volume(Flow) Faucets: (Yes or No) Faucet Leak Check/ Repair: (Yes or No)

Faucet Retrofit Devices: (Yes or No)

Types of Faucet Retrofit Device(s): (i.e. Aerators, metered valve, self-closing, sensor-activated, etc.)

List Other Water Conservation Measures you are currently using or are planning to implement:
(For examples see next page)

Other Water Conservation Measures List

Information and Education

- Understanding water bill
- Information available
- Informative water bill
- Water bill inserts
- Public education program
- Workshops
- Advisory committee

Costing and Pricing

- Cost of service accounting
- User charges
- Metered rates
- Cost analysis
- Non-promotional rates
- Advanced pricing methods

Water Use Audits

- Audits of large volume users
- Large landscape audits
- Selective end use audits

Pressure Management

- System-wide pressure regulation
- Selective use of pressure reducing valves

Replacement and Promotions

- Rebates and incentives (commercial)
- Promotion of new technologies

Water Conservation Program

- Shortage allocation policies
- Operation & maintenance program
- Monitoring program
- Water conservation coordinator
- Drought/shortage contingency plan
- Plumbing regulations

Water Accounting and Loss Control

- Account for water
- Repair known leaks
- Analyze non-account water
- Water system audit
- Leak detection and repair strategy
- Automated sensors/telemetry
- Loss prevention

Universal Metering

- Source water metering
- Service connection metering and reading
- Meter public use water
- Fixed interval metering reading
- Meter accuracy analysis
- Test, calibrate repair and replace meters

Retrofits

- Retrofit kits available
- Distribution of retrofit kits
- Targeted programs

Reuse and Recycling

- Industrial applications
- Large volume irrigation applications

Water use Regulation

- Water use standards and regulations

Landscape Efficiency

- Promotion of landscape efficiency
- Landscape planning and renovation
- Selective irrigation submetering
- Irrigation management

Appendix 3

Appendix 3
Listing of Survey Sent and Responses
DLNR Water Conservation Plan

DLNR Division	Island	Facility Name	Contact Person Letter Addressed to	Contact Person for Facility	Contact Phone	Survey Sent	Significant Water User*	Survey Rec'd
Aquatic Resources	Hawaii	General Survey	Robert T. Nishimoto			X		
Aquatic Resources	Hawaii	Hilo Research Fisheries Station	Robert T. Nishimoto	Robert Nishimoto	974-6201			X
Aquatic Resources	Oahu	General Survey	Michael Fujimoto			X		
Aquatic Resources	Oahu	Anuenue Fisheries Research Center	Michael Fujimoto	David Onizuka	832-5006	X	X	X
Aquatic Resources	Maui	General Survey	Skippy Hau			X		
Aquatic Resources	Molokai	General Survey	William K.C.L. Puleloa			X		
Aquatic Resources	Hawaii	General Survey	William J. Walsh			X		
Aquatic Resources	Kauai	General Survey	Donald Heacock			X		
Boating & Ocean Recreation	Hawaii	General Survey	Nancy Murphy			X		
Boating & Ocean Recreation	Hawaii	Honokohau Small Boat Harbor	Nancy Murphy	Dan Mersburgh	329-4997	X	X	X
Boating & Ocean Recreation	Hawaii	Kawaihae Boat Harbor	Nancy Murphy	Dan Mersburgh	329-4997	X	X	X
Boating & Ocean Recreation	Kauai	General Survey	Vaughan Tyndzik			X		
Boating & Ocean Recreation	Maui	General Survey	Carol She			X		
Boating & Ocean Recreation	Maui	Lahaina Small Boat Harbor	Carol She	Carol She	243-5824	X	X	X
Boating & Ocean Recreation	Oahu	General Survey	Stephen Thompson			X		
Boating & Ocean Recreation	Oahu	Ala Wai Boat Harbor	Stephen Thompson	Meghan Statts	973-9727	X	X	X
Boating & Ocean Recreation	Oahu	Heeia Kea Small Boat Harbor	Stephen Thompson	Earl Omoto	233-3603	X	X	X
Boating & Ocean Recreation	Oahu	Keehi Boat Harbor	Stephen Thompson	Wesley Choi	832-3464	X	X	X
Boating & Ocean Recreation	Oahu	Waianae Boat Harbor	Stephen Thompson		697-7095	X	X	X
Commission on Water Resources Management	Oahu	Kalanimoku Building	Lenore Nakama	Lynette Courtney-Now	586-0538	X	X	X
Conservation and Resource Enforcement	Hawaii	General Survey	Lenny Terlep			X		
Conservation and Resource Enforcement	Hawaii	Hawaii Branch Administrative Office	Lenny Terlep	Lawrence Terlep	974-6208			X
Conservation and Resource Enforcement	Kauai	General Survey	Tary Low			X		
Conservation and Resource Enforcement	Kauai	Kauai State Builidng	Tary Low	Tary Low	274-3521			X
Conservation and Resource Enforcement	Kauai	DOCARE Baseyard	Tary Low	Tary Low	274-3521			X
Conservation and Resource Enforcement	Kauai	Field Office (Cabin)	Tary Low	Tary Low	274-3521			X
Conservation and Resource Enforcement	Maui	General Survey	Randy Awo			X		
Conservation and Resource Enforcement	Maui	State Office - Maui DOCARE	Randy Awo	Randy Awo	984-8110			X
Conservation and Resource Enforcement	Oahu	General Survey	Bob Fernandez			X		

Appendix 3
Listing of Survey Sent and Responses
DLNR Water Conservation Plan

DLNR Division	Island	Facility Name	Contact Person Letter Addressed to	Contact Person for Facility	Contact Phone	Survey Sent	Significant Water User*	Survey Rec'd
Conservation and Resource Enforcement	Oahu	DOCARE Oahu Branch Office	Bob Fernandez	Bob Fernandez	453-6786			X
Engineering Division	Oahu	General Survey	Eric Uyasa			X		
Forestry & Wildlife	Hawaii	General Survey	Jon Giffin			X		
Forestry & Wildlife	Hawaii	Kamuela State Tree Nursery	Jon Giffin	Charles Labrador	887-6061			X
Forestry & Wildlife	Hawaii	West Hawaii Wildlife Office	Jon Giffin	Miles Nakahara	887-6063			X
Forestry & Wildlife	Hawaii	Hilo Baseyard	Jon Giffin	Roger Imoto	974-4221			X
Forestry & Wildlife	Kauai	General Survey	Alvin Kiyono			X		
Forestry & Wildlife	Kauai	Kauai DLNR Baseyard	Alvin Kiyono	Alvin Kiyono	274-3433			X
Forestry & Wildlife	Maui	General Survey	Meyer Ueoka			X		
Forestry & Wildlife	Maui	Kanaha Pond Wildlife Sanctuary	Meyer Ueoka	Fern Duvall	873-3502			X
Forestry & Wildlife	Maui	Kahului Forestry Baseyard	Meyer Ueoka	John Cumming	984-8107			X
Forestry & Wildlife	Maui	Waikolu Overlook	Meyer Ueoka	Randy Manaba	553-1745			X
Forestry & Wildlife	Maui	Lanai Cooperative Game Management Area	Meyer Ueoka	Derwin Kwon	565-7916			X
Forestry & Wildlife	Oahu	General Survey	Pat Costales			X		
Forestry & Wildlife	Oahu	Makiki Oahu Branch / Baseyard	Pat Costales	Pat Costales	973-9787			X
Land Division	Hawaii	General Survey	Harry Yada			X		
Land Division	Hawaii	Hilo State Office Building	Harry Yada	Glenn Okada	974-6400			X
Land Division	Kauai	General Survey	Charlene Unoki			X		
Land Division	Kauai	DAGS State Office Building	Charlene Unoki	Charlene Unoki	274-3491			X
Land Division	Maui	General Survey	Jason Koga			X		
Land Division	Maui	State Office Building	Jason Koga	DAGS	243-5772			X
Land Division	Oahu	General Survey	Gary Martin			X		
State Historic Preservation	Kauai	General Survey	Nancy McMahon			X		
State Historic Preservation	Maui	General Survey	Melissa Kirkendall			X		
State Historic Preservation	Oahu	General Survey	Alvin Tamashiro			X		
State Historic Preservation	Oahu	General Survey	Sara Collins			X		
State Historic Preservation	Oahu	General Survey	Patrick McCoy			X		
State Historic Preservation	Oahu	Kakuhihewa State Office Building	Alvin Tamashiro	DAGS	831-6734			X
State Parks	Hawaii	General Survey	Glenn Taguchi			X		

Appendix 3
Listing of Survey Sent and Responses
DLNR Water Conservation Plan

DLNR Division	Island	Facility Name	Contact Person Letter Addressed to	Contact Person for Facility	Contact Phone	Survey Sent	Significant Water User*	Survey Rec'd
State Parks	Hawaii	Hapuna Beach State Recreation Area	Glenn Taguchi	Donald Llanes	882-6206	X	X	X
State Parks	Kauai	General Survey	Wayne Souza			X		
State Parks	Kauai	Wailua River State Park - Marina	Wayne Souza	Wayne H. Souza	274-3446	X	X	X
State Parks	Maui	General Survey	Philip Ohta			X		
State Parks	Maui	Polipoli Spring State Recreation Park	Philip Ohta	Philip Ohta	984-8192			X
State Parks	Maui	Iao Valley State Park	Philip Ohta	Philip Ohta	984-8192			X
State Parks	Maui	Kaumahina State Wayside	Philip Ohta	Philip Ohta	984-8192			X
State Parks	Maui	Puaa Kaa State Wayside	Philip Ohta	Philip Ohta	984-8192			X
State Parks	Maui	Palaau State Park (Molokai)	Philip Ohta	Philip Ohta	984-8192			X
State Parks	Oahu	General Survey	Jon Sasaki			X		
State Parks	Oahu	Aiea Bay State Recreation Park	Jon Sasaki	Dwayne DeOcampo	483-2511	X	X	X
State Parks	Oahu	Diamond Head State Monument	Jon Sasaki	Keith Minn	733-4099	X	X	X
State Parks	Oahu	Iolani Palace State Monument	Jon Sasaki	Under DAGS		X	X	
State Parks	Oahu	Kaka'ako Waterfront Park	Jon Sasaki	Ernest Romero	587-2591	X	X	X
State Parks	Oahu	Malaekahana State Recreation Area	Jon Sasaki	Richard Llanos	389-2390	X	X	X
State Parks	Oahu	Wahiawa Freshwater State Recreation Area	Jon Sasaki	Benjamin Asuncion	622-6316	X	X	X

Appendix 4

DLNR Water Conservation Plan

Survey Summary

Facility Name: Anuenue Fisheries Research Center

DLNR Division-Office: Division of Aquatic Resources

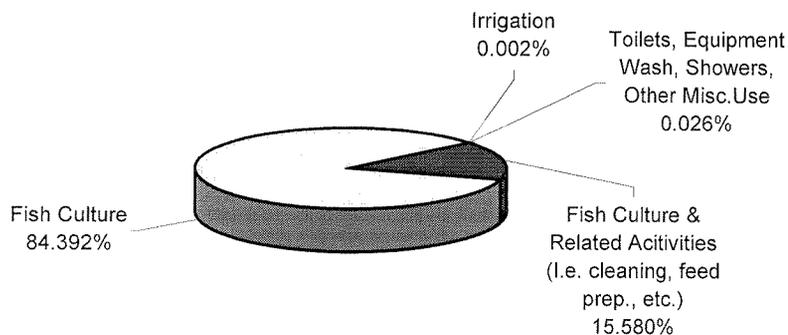
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
12	0	4	16

Water Use Profile:

Anuenue Fisheries Research Center



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Irrigation	14	14
Fish Culture & Related Activities (i.e. cleaning, feed prep., etc.)	120,000	0
Fish Culture	650,000	0
Toilets, Equipment Wash, Showers, Other Misc. Use	200	0
TOTAL	770,214	14

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan
Survey Summary

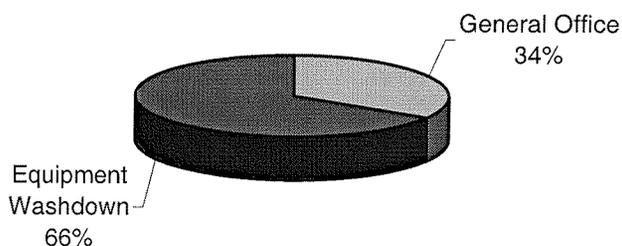
Facility Name: Hilo Research Fisheries Station
DLNR Division-Office: Aquatic Resources Hilo (HRFS)
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
3	0	0	3

Water Use Profile:

Hilo Research Fisheries Station



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source (gpd)
General Office	3,700.00	0
Equipment Washdown	7,300.00	7,300
TOTAL	11,000.00	7,300

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	No
Urinals	N/A	N/A	N/A
Shower Heads	Yes	No	N/A
Faucets	Yes	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: DOCARE Baseyard

DLNR Division-Office: DOCARE

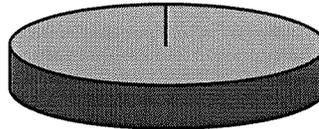
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
6	0	0	6

Water Use Profile:

DOCARE Baseyard



Equipment Washdown, Comfort Station
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Equipment Washdown, Comfort Station	70	0
TOTAL	70	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	N/A	Yes
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

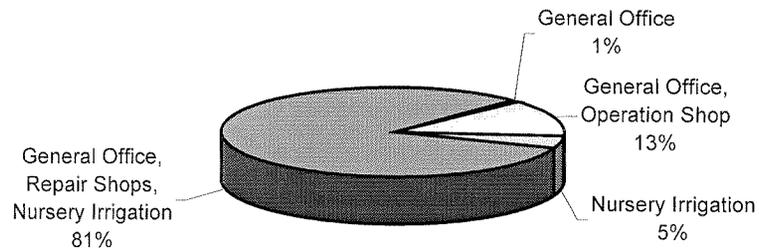
Facility Name: DOFAW - Hilo Baseyard
DLNR Division-Office: Division of Forestry & Wildlife (DOFAW), Hilo Baseyard Complex
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
40	0	11	51

Water Use Profile:

DOFAW - Hilo Baseyard



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
General Office, Repair Shops, Nursery Irrigation	5,366	0
General Office	50	0
General Office, Operation Shop	850	0
Nursery Irrigation	300	300
TOTAL	6,566	300

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Kahului Forestry Baseyard

DLNR Division-Office: DLNR/DOFAW

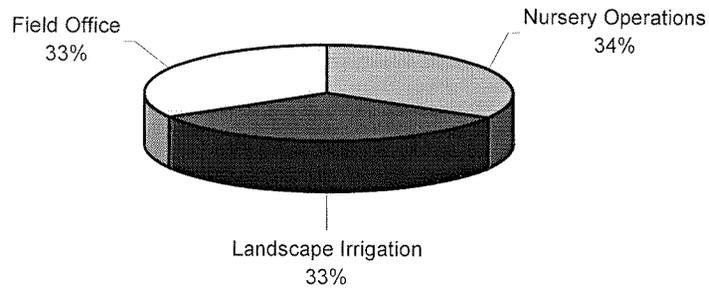
Function:

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
15	0	10	25

Water Use Profile:

Kahului Forestry Baseyard



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Nursery Operations	100	100
Landscape Irrigation	100	100
Field Office	100	0
TOTAL	300	200

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	Yes
Urinals	Yes	N/A	Yes
Shower Heads	No	No	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Kauai DLNR Baseyard

DLNR Division-Office: Forestry & Wildlife

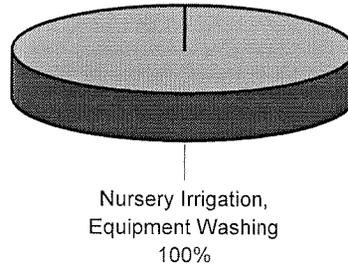
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
16	0	2	18

Water Use Profile:

Kauai DLNR Baseyard



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Nursery Irrigation, Equipment Washing	1,100	1,100
TOTAL	1,100	1,100

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	N/A	Yes
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Makiki Oahu Branch / Baseyard

DLNR Division-Office: DOFAW (Oahu Branch)

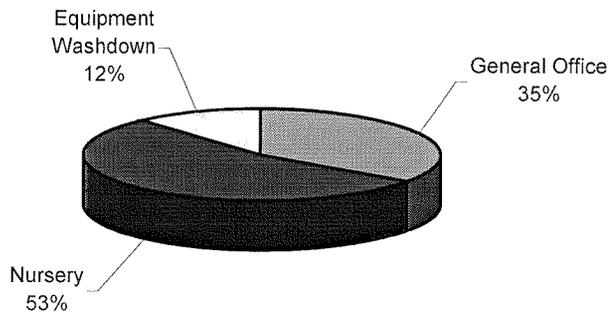
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
20	0	0	20

Water Use Profile:

Makiki Oahu Branch / Baseyard



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
General Office	450	0
Nursery	700	700
Equipment Washdown	150	0
TOTAL	1,300	700

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	N/A	Yes
Urinals	Yes	N/A	Yes
Shower Heads	Yes	N/A	N/A
Faucets	Yes	N/A	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: DOFAW - Kamuela State Tree Nursery
DLNR Division-Office: Division of Forestry & Wildlife (DOFAW)
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
8	0	0	8

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
Fire Hydrant	0	Metered	0%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
Fire Hydrant	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: DAGS State Office Building

DLNR Division-Office: Kauai - Land Division

Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
4	0	0	4

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
General Office	N/A	Metered	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
General Office	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	No
Urinals	No	N/A	No
Shower Heads	No	No	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: DOCARE Oahu Branch Office
DLNR Division-Office: DOCARE Oahu Branch
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
5	0	5	10

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
N/A	N/A	N/A	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
N/A	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	No
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Field Office (Cabin)

DLNR Division-Office: DOCARE

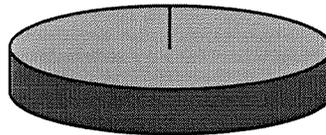
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
6	0	0	6

Water Use Profile:

Field Office (Cabin)



General Cabin Use,
Equipment
Washdown
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
General Cabin Use, Equipment Washdown	50	0
TOTAL	50	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	N/A	Yes
Urinals	N/A	N/A	N/A
Shower Heads	Yes	Yes	N/A
Faucets	Yes	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Hawaii Branch Administrative Office

DLNR Division-Office: DOCARE - Hawaii Branch

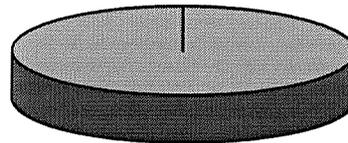
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
7	0	0	7

Water Use Profile:

Hawaii Branch Administrative Office



General Office
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
General Office	30	0
TOTAL	30	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	Yes	N/A
Urinals	Yes	N/A	N/A
Shower Heads	Yes	N/A	N/A
Faucets	Yes	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Hilo State Office Building
DLNR Division-Office: Hawai'i District Land Office
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
14	0	0	14

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
General Office	N/A	N/A	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
General Office	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Kakuhihewa State Office Building
DLNR Division-Office: State Historic Preservation
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
16	0	0	16

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
N/A	N/A	N/A	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
N/A	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

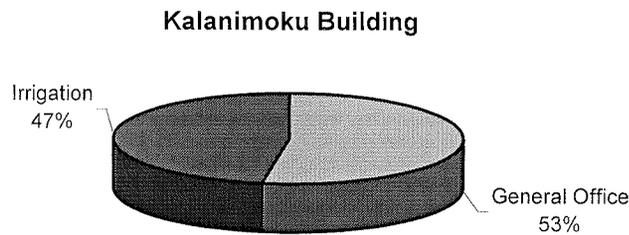
Survey Summary

Facility Name: Kalanimoku Building
DLNR Division-Office: Commission on Water Resource Management
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
224	0	650	874

Water Use Profile:



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
General Office	20,000	0
Irrigation	18,000	18,000
TOTAL	38,000	18,000

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	Yes	Yes
Urinals	Yes	N/A	Yes
Shower Heads	N/A	N/A	N/A
Faucets	No	Yes	Yes

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. Leak detection and repair.
2. Retrofit kits.
3. Irrigation management.

DLNR Water Conservation Plan

Survey Summary

Facility Name: Kauai State Building

DLNR Division-Office: DOCARE

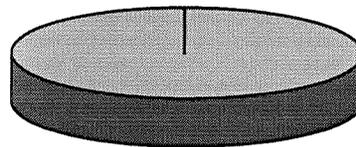
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
6	0	0	6

Water Use Profile:

Kauai State Building



Comfort Station
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
Comfort Station	30	0
TOTAL	30	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	N/A	Yes
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: State Office - Maui DOCARE
DLNR Division-Office: Division of Conservation and Resources Enforcement
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
3	0	1	4

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
Tap Water (For coffee, occasional washing of hands.)	N/A	N/A	N/A
10-Cup Coffee Maker (1x per day)	N/A	N/A	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Tap Water (For coffee, occasional washing of hands.)	N/A	N/A
10-Cup Coffee Maker (1x per day)	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Maui District Land Office

DLNR Division-Office: State Office Building

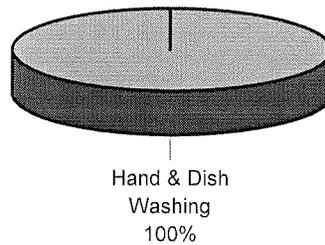
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
14	0	0	14

Water Use Profile:

Maui District Land Office



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Hand & Dish Washing	20	0
Restroom (Shared with other building occupants and public.)	N/A	N/A
TOTAL	20	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

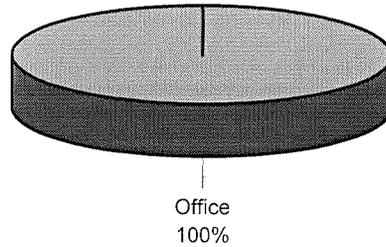
Facility Name: West Hawaii Wildlife Office
DLNR Division-Office: Division of Forestry & Wildlife (DOFAW)
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
5	0	0	5

Water Use Profile:

West Hawaii Wildlife Office



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Office	33	0
TOTAL	33	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

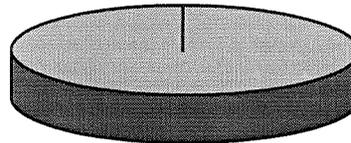
Facility Name: 5309 Ditch
DLNR Division-Office: Division of Forestry & Wildlife
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
0	0	0	0

Water Use Profile:

5309 Ditch



Game Mammal &
 Bird Water Units (8)
 100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Game Mammal & Bird Water Units (8)	150	0
TOTAL	150	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. Low volume float controlled valves.
2. Main line metering shut off, 2000 gallon max/setting.
3. Valve leak checks, service love checks with repairs.

DLNR Water Conservation Plan

Survey Summary

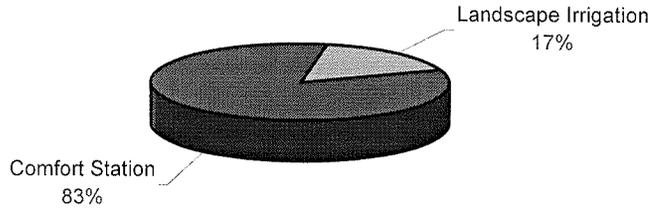
Facility Name: Aiea Bay State Recreation Park
DLNR Division-Office: Division of State Parks
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	0	1

Water Use Profile:

Aiea Bay State Recreation Park



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Landscape Irrigation	1,000	1,000
Comfort Station	5,000	0
TOTAL	6,000	1,000

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	No
Urinals	No	N/A	No
Shower Heads	N/A	N/A	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

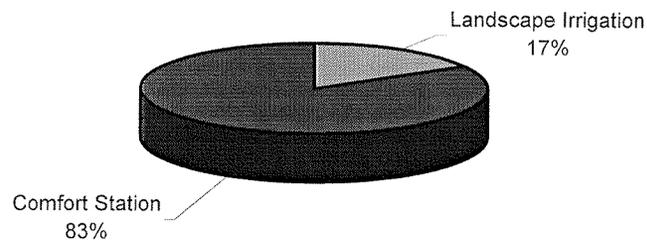
Facility Name: Diamond Head State Monument
DLNR Division-Office: Division of State Parks
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
2	0	0	2

Water Use Profile:

Diamond Head State Monument



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Landscape Irrigation	1,000	1,000
Comfort Station	5,000	0
TOTAL	6,000	1,000

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	No
Urinals	No	N/A	No
Shower Heads	N/A	N/A	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Hapuna Beach State Recreation Area
DLNR Division-Office: Division of State Parks
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
3	0	1000	1003

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
Beach, Restroom and Shower Use	N/A	Metered	N/A
Restroom and Dining Facility for Lodgers	N/A	Metered	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Beach, Restroom and Shower Use	N/A	N/A
Restroom and Dining Facility for Lodgers	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

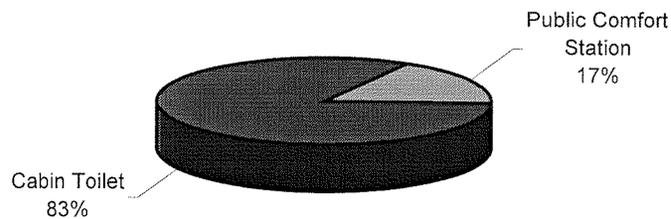
Facility Name: Iao Valley State Park
DLNR Division-Office: Division of State Parks
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	0	1

Water Use Profile:

Iao Valley State Park



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Public Comfort Station	2,500	0
Cabin Toilet	12,000	0
TOTAL	14,500	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	N/A	N/A	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

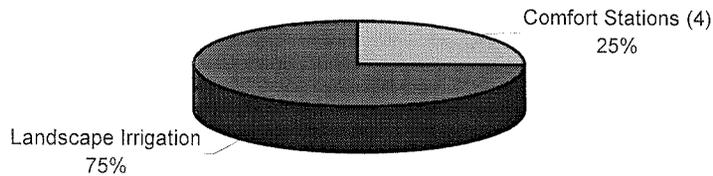
Facility Name: Kakaako Waterfront Park - Kewalo Basin
DLNR Division-Office: Division of State Parks
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
5	0	0	5

Water Use Profile:

Kakaako Waterfront Park - Kewalo Basin



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Comfort Stations (4)	4,000	0
Landscape Irrigation	12,000	12,000
TOTAL	16,000	12,000

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	No
Urinals	No	N/A	No
Shower Heads	N/A	N/A	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Kanaha Pond Wildlife Sanctuary

DLNR Division-Office: Division of Forestry & Wildlife

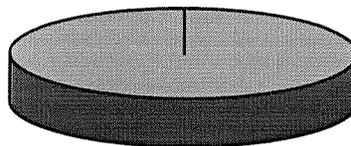
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
0	0	0	0

Water Use Profile:

Kanaha Pond Wildlife Sanctuary



Maintain Water Level
of Pond at 2.0' at
Waterguage
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
Maintain Water Level of Pond at 2.0' at Waterguage	755,956	0
TOTAL	755,956	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	N/A	N/A	N/A
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	N/A	N/A	N/A

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

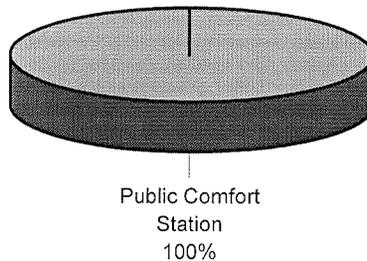
Facility Name: Kaumahina State Wayside
DLNR Division-Office: Division of State Parks
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	0	1

Water Use Profile:

Kaumahina State Wayside



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Public Comfort Station	4,000	0
TOTAL	4,000	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	Yes
Urinals	No	N/A	Yes
Shower Heads	N/A	N/A	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

OTHER

1. Portable toilets are currently being used.
2. Funding for a new comfort station has been approved.
3. Estimated construction completion should be approximately 2 years.

DLNR Water Conservation Plan

Survey Summary

Facility Name: Malaekahana State Recreation Area

DLNR Division-Office: Division of State Parks

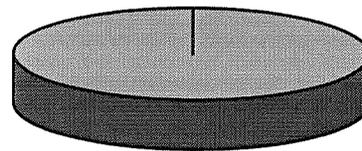
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
2	0	0	2

Water Use Profile:

Malaekahana State Recreation Area



Comfort Stations (3)
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Comfort Stations (3)	3,000	0
TOTAL	3,000	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	No
Urinals	No	N/A	No
Shower Heads	No	No	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Palaau State Park (Molokai)

DLNR Division-Office: Division of State Parks

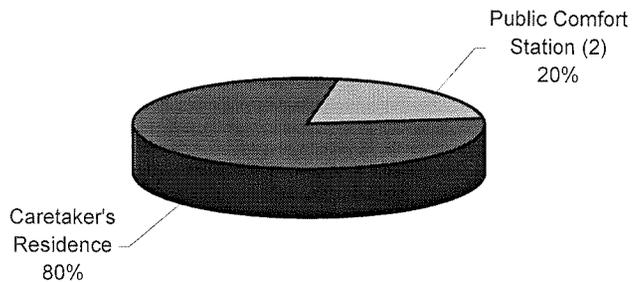
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	0	1

Water Use Profile:

Palaau State Park (Molokai)



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Public Comfort Station (2)	250	0
Caretaker's Residence	1,000	0
TOTAL	1,250	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	N/A	N/A	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Polipoli Spring State Recreation Park

DLNR Division-Office: Division of State Parks

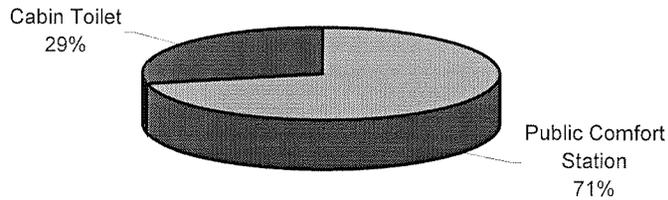
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	0	1

Water Use Profile:

Polipoli Spring State Recreation Park



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Public Comfort Station	100	0
Cabin Toilet	40	0
TOTAL	140	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	Yes
Urinals	N/A	N/A	N/A
Shower Heads	N/A	N/A	N/A
Faucets	Yes	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Puaa Kaa State Wayside

DLNR Division-Office: Division of State Parks

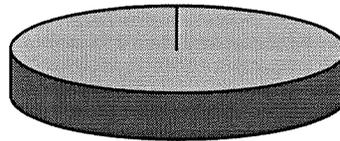
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	0	1

Water Use Profile:

Puaa Kaa State Wayside



Public Comfort
Station
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
Public Comfort Station	5,000	0
TOTAL	5,000	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	N/A	N/A	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

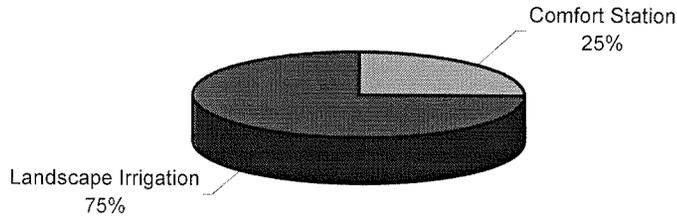
Facility Name: Wahiawa Freshwater State Recreation Area
DLNR Division-Office: Division of State Parks
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	0	1

Water Use Profile:

Wahiawa Freshwater State Recreation Area



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Comfort Station	1,000	0
Landscape Irrigation	3,000	3,000
TOTAL	4,000	3,000

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	No
Urinals	No	N/A	No
Shower Heads	N/A	N/A	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

Facility Name: Waikolu Overlook
DLNR Division-Office: DLNR - DOFAW - Maui
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
4	0	12	16

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
Flush Toilet & Hand Washing	N/A	N/A	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
Flush Toilet & Hand Washing	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	Yes
Urinals	No	N/A	No
Shower Heads	No	No	N/A
Faucets	Yes	No	No

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. System not connected at this time.

DLNR Water Conservation Plan

Survey Summary

Facility Name: Wailua River State Park - Marina

DLNR Division-Office: Division of State Parks

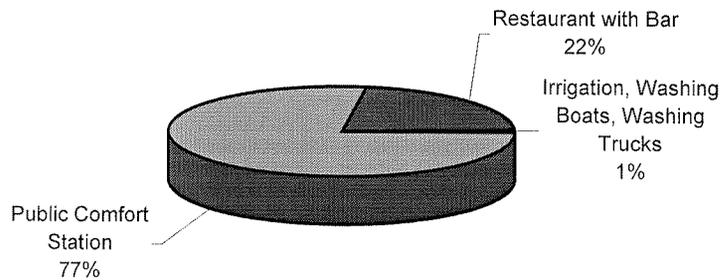
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
5	0	2500	2505

Water Use Profile:

Wailua River State Park - Marina



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Public Comfort Station	9,800	0
Restaurant with Bar	2,800	0
Irrigation, Washing Boats, Washing Trucks	100	100
TOTAL	12,700	100

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

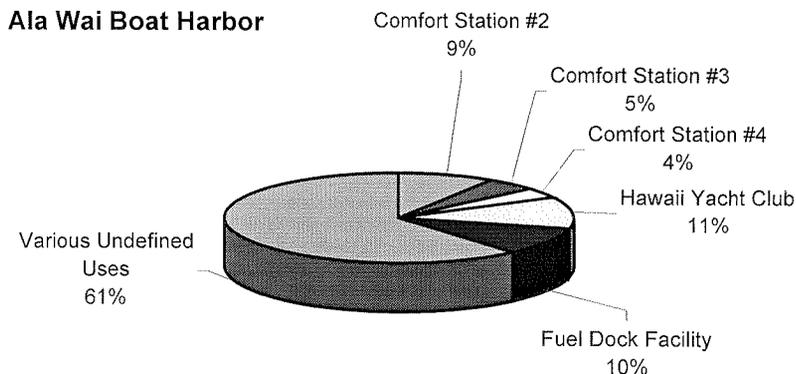
Survey Summary

Facility Name: Ala Wai Boat Harbor
DLNR Division-Office: Division of Boating and Ocean Recreation
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
8	0	0	8

Water Use Profile:



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Comfort Station #2	4267	0
Comfort Station #3	2333	0
Comfort Station #4	1733	0
Hawaii Yacht Club	5400	0
Fuel Dock Facility	4833	0
Various Undefined Uses	29,633	0
TOTAL	48,199	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes *	Yes	Yes
Urinals	No	N/A	No
Shower Heads	No	No	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. Checking to see if plumbers can change to water conservation urinals, faucets & showerheads.

* Water conserving toilets only.

DLNR Water Conservation Plan

Survey Summary

Facility Name: Keehi Boat Harbor
DLNR Division-Office: Division of Boating and Ocean Recreation
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
8	0	500	508

Water Use Profile:

End Use	Daily Water Consumption	Consumption Estimated / Metered	Percentage of Total Use
Trailer Boat Washdown Area	N/A	Estimated	N/A
Restricted Access Shower Facility	N/A	Estimated	N/A
Public Restroom Facility	N/A	Estimated	N/A
Harbor Office Facility	N/A	Estimated	N/A

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Consevation (gpd)
Trailer Boat Washdown Area	N/A	N/A
Restricted Access Shower Facility	N/A	N/A
Public Restroom Facility	N/A	N/A
Harbor Office Facility	N/A	N/A
TOTAL	N/A	N/A

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	N/A	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. Would like to install water sub-meters for tracking of water use.

DLNR Water Conservation Plan

Survey Summary

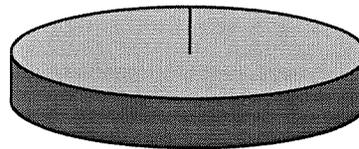
Facility Name: Heeia Kea Small Boat Harbor
DLNR Division-Office: Division of Boating and Ocean Recreation
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
3	0	50	53

Water Use Profile:

Heeia Kea Small Boat Harbor



Boat Washdown &
Comfort Station
100%

Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Boat Washdown & Comfort Station	14,000	0
TOTAL	14,000	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	No
Urinals	Yes	N/A	No
Shower Heads	N/A	N/A	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

Survey Summary

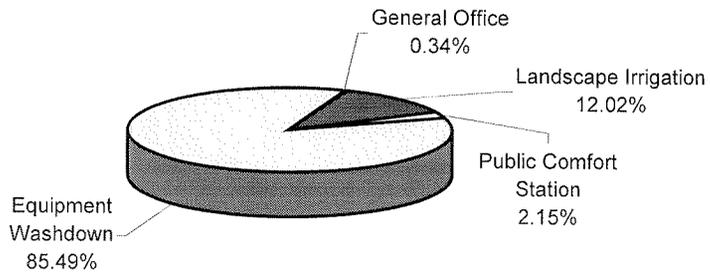
Facility Name: Honokohau Small Boat Harbor
DLNR Division-Office: Division of Boating and Ocean Recreation
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
23	0	300	323

Water Use Profile:

Honokohau Small Boat Harbor



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
General Office	400	0
Landscape Irrigation	14,000	14,000
Public Comfort Station	2,500	0
Equipment Washdown	99,600	99,600
TOTAL	116,500	113,600

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	Yes	No	Yes

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. Understanding water bill.
2. Informative water bill.

DLNR Water Conservation Plan

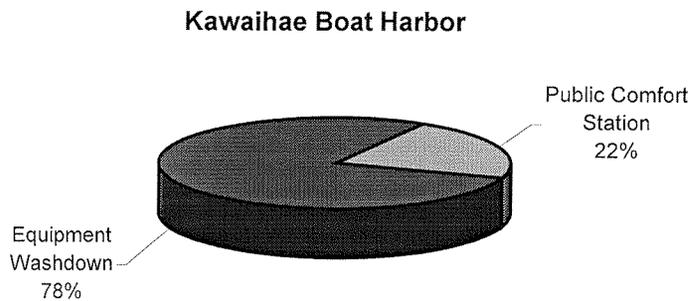
Survey Summary

Facility Name: Kawaihae Boat Harbor
DLNR Division-Office: Division of Boating and Ocean Recreation
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
1	0	100	101

Water Use Profile:



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Public Comfort Station	1,000	0
Equipment Washdown	3,600	3,600
TOTAL	4,600	3,600

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	Yes	No	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	Yes	No	Yes

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. Understanding water bill.
2. Informative waste bill.

DLNR Water Conservation Plan

Survey Summary

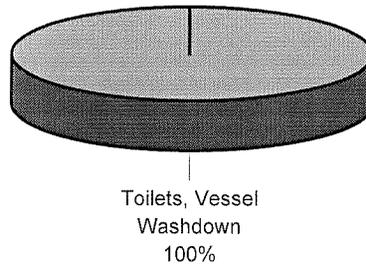
Facility Name: Lahaina Small Boat Harbor
DLNR Division-Office: Division of Boating and Ocean Recreation
Function: State Park

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
5	0	0	5

Water Use Profile:

Lahaina Small Boat Harbor



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Toilets, Vessel Washdown	14,200	0
TOTAL	14,200	0

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	No
Urinals	No	N/A	No
Shower Heads	No	No	N/A
Faucets	No	No	No

(N/A indicates response not provided or information not covered by survey)

DLNR Water Conservation Plan

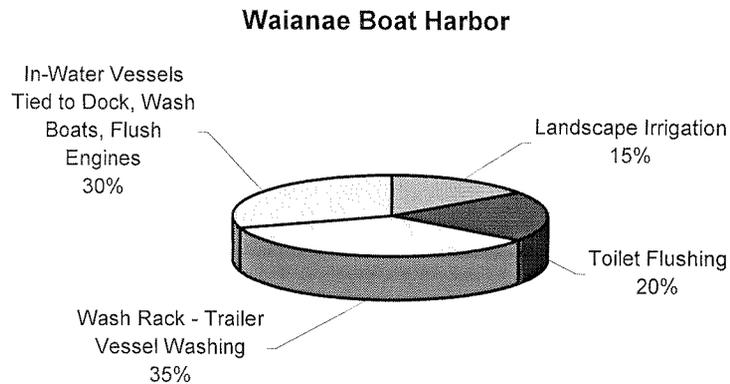
Survey Summary

Facility Name: Waianae Boat Harbor
DLNR Division-Office: Division of Boating and Ocean Recreation
Function: Office Building

Occupancy Data:

No. of DLNR Staff (per day)	No. of Non-DLNR Staff (per day)	Other Users (per day)	Total (per day)
3	0	1000	1003

Water Use Profile:



Potable Water Demand vs. Potential Potable Water Conservation Through Conversion to Non-Potable Supply Source:

End Use	Potable Water Demand (gpd)	Potential for Potable Water Conservation (gpd)
Landscape Irrigation	750	750
Toilet Flushing	1,000	0
Wash Rack - Trailer Vessel Washing	1,750	1,750
In-Water Vessels Tied to Dock, Wash Boats, Flush Engines	1,500	0
TOTAL	5,000	2,500

Existing Conservation Measures:

Fixture Type	Low Volume	Retrofit	Leak Check/Repair
Toilets	No	No	Yes
Urinals	No	N/A	Yes
Shower Heads	No	No	N/A
Faucets	No	No	Yes

(N/A indicates response not provided or information not covered by survey)

OTHER:

1. Signs at wash rack informing boaters that they should limit their washing time to 15 minutes each.
2. Making spring nozzles required by boaters using the wash rack.
3. Irrigating only in early morning hours prior to 9 AM.

Appendix 5



Energy Efficiency and Renewable Energy
Federal Energy Management Program

How to Buy a Water-Saving Replacement Toilet

Why Agencies Should Buy Efficient Products

- Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE ENERGY STAR® product labeling program.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy and water efficiency, while saving taxpayer dollars.

Federal Supply Source:

- Defense Logistics Agency (DLA)
Phone: (800) DLA-2852 or (215) 737-8249
DSN 444-8249 (Dan DiLossi)
dscp103.dscp.dla.mil/gi/general/pgplum.htm

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
Phone: (800) 363-3732
www.eren.doe.gov/femp/procurement
- American Water Works Association "WaterWiser" is a good resource for water conservation and efficiency information.
Phone: (800) 559-9855
www.waterwiser.org
- California Energy Commission (CEC) has a list of certified plumbing fixtures.
Phone: (916) 654-5106
ftp://energy.ca.gov/pub/efftech/appliance
- Home Energy magazine provides water conservation tips.
Phone: (510) 524-5405
www.homeenergy.org
- Consumer Reports rates plumbing fixtures.
www.consumerreports.org
- Contact your local water utility for details about local water conservation programs and incentives.
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
Phone: (202) 646-7950

Efficiency Recommendation		
Product Type	Recommended Flush Rate ^{a,b}	Best Available Flush Rate
Toilet	1.6 gpf or less	1.5 gpf

Definition

The Recommended Flush Rate is exactly that required by the Energy Policy Act of 1992. This Recommendation is issued for the purpose of promoting early replacement.

a) Based on ASME test procedure A112.19.6-1990

b) The Recommended Flush Rate applies to "flushometer" (flush valve) as well as "gravity tank" toilets, and is measured in gallons per flush (gpf).

The federal supply source for toilets is the Defense Logistics Agency (DLA). When buying from a commercial source (retailer or distributor), select or specify models with flush rates that meet the recommended level. All toilets manufactured for use in the U.S. after 1996 are required to meet this level.

Where to Find Water-Saving Replacement Toilets

There is a wide range in flushing performance of new toilets. It is advisable to test various models under actual conditions before purchasing in volume.

Buyer Tips

For initial installation of a low-flush toilet, "snake" drain lines and replace the entire fixture. After a low-flush gravity tank unit is in operation, only the valve and ballcock need be replaced if the rest of the fixture still functions. With flush-valve toilets, make sure valves are properly adjusted. Leaky valves are a source of enormous water loss in both flush-valve and tank toilets, and are especially common in hard-water areas. These leaks are often invisible and inaudible. Semi-annual dye tablet testing is a simple and inexpensive way to detect leaks.

Installation and User Tips

There are a variety of retrofit devices available to reduce the water flow of existing toilets. Some of these measures are effective and reliable while others can lead to plumbing problems. Consult your local water utility for appropriate water-saving options and rebate programs.

For specialized situations like prisons or hospitals, non-ceramic, metal toilets are available which have straight drain lines and have a flush rate of 0.5 gallons per flush (gpf). Replacing 3.5 gpf with 0.5 gpf toilets can lead to lifetime water savings even larger than those shown in the Cost-Effectiveness table, below.

Technology Tips

Early replacement of a high flush-rate toilet can produce hundreds of dollars of water savings over the life of the new unit, as shown in the following table.

Early Replacement

Toilet Cost-Effectiveness Example A – Average Water Costs			
Performance	Typical Existing Unit	New Unit^a	Best Available
Gallons per flush (gpf)	3.5 gpf	1.6 gpf	1.5 gpf
Annual Water Use	27,300 gallons	12,500 gallons	11,700 gallons
Annual Water Cost	\$110	\$50	\$45
10-year Water Cost	\$910	\$420	\$390
Lifetime Water Cost Savings (for replacing existing unit 10 years early)	-	\$490	\$520

Definition

The 10-year Water Cost is the sum of the discounted value of annual water costs, based on average usage and an assumption that early replacement of the toilet occurs at the midpoint of a 20-yr. useful life. A discount rate of 3.4% is based on federal guidelines (effective from April, 2000 to March, 2001). Future water and wastewater treatment costs are conservatively assumed to increase only at the rate of inflation.

a) The flush rate of the new unit just meets the current federal standards for toilets.

Cost-Effectiveness Assumptions

Savings estimates are based on an existing flush rate of 3.5 gpf. Toilet use is assumed to be 30 flushes per day, and 260 days per year. The water price is assumed to be \$4/1,000 gallons.

Using the Cost-Effectiveness Table

In the example shown above, early replacement of the existing toilet with a new unit at the recommended flush rate of 1.6 gpf will save \$490 in water costs over a 10-year period (the time before the old fixture would normally be replaced). Likewise, the Best Available model, with a flush rate of 1.5 gpf, will save \$520 in water costs over a 10-year period. The example assumes that no water is lost through leakage.

What if my Water Price is different?

To adjust the Lifetime Water Cost Savings in the table above for a different water price, multiply the figures listed by this ratio: $\left(\frac{\text{Your price in } \$/1000 \text{ gallons}}{\$4.00/1000 \text{ gallons}}\right)$. In many areas of the country, water costs dramatically exceed the average, deeming early toilet replacement particularly cost-effective. In the example below, water cost is assumed to be \$10/1,000 gallons.

Metric Conversion

1 gallon = 3.8 liters

Toilet Cost-Effectiveness Example B – High Water Costs			
Performance	Typical Existing Unit	New Unit^a	Best Available
Gallons per flush (gpf)	3.5 gpf	1.6 gpf	1.5 gpf
Annual Water Use	27,300 gallons	12,500 gallons	11,700 gallons
Annual Water Cost	\$270	\$125	\$120
10-year Water Cost	\$2,300	\$1,050	\$1,000
Lifetime Water Cost Savings (for replacing existing unit 10 years early)	-	\$1,250	\$1,300

a) The flush rate of the new unit meets the current federal standards for toilets.





**Energy Efficiency and Renewable Energy
Federal Energy Management Program**

Federal Supply Sources:

- Defense Logistics Agency (DLA)
Phone: (800) DLA-2852 or (215) 737-8249
DSN 444-8249 (Dan DiLossi)
dscpl103.dscpl.dla.mil/gi/general/pgplum.htm
- General Services Administration (GSA)
Phone: (817) 978-8640

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
Phone: (800) 363-3732
www.eren.doe.gov/femp/procurement
- American Water Works Association "WaterWiser" is a good resource for water conservation and efficiency information.
Phone: (800) 559-9855
www.waterwiser.org
- California Energy Commission (CEC) has a list of certified plumbing fixtures.
Phone: (916) 654-5106
ftp://energy.ca.gov/pub/efftech/appliance
- *Home Energy* magazine provides water conservation tips.
Phone: (510) 524-5405
www.homeenergy.org
- *Consumer Reports* rates plumbing fixtures.
www.consumerreports.org
- Contact your local water utility for details about local water conservation programs and incentives.
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
Phone: (202) 646-7950

How to Buy a Water-Saving Replacement Urinal

Why Agencies Should Buy Efficient Products

- Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE ENERGY STAR® product labeling program.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy and water efficiency, while saving taxpayer dollars.

Efficiency Recommendation		
Product Type	Recommended Flush Rate^a	Best Available Flush Rate
Urinal	1.0 gallons or less	0.0 gallons

a) Based on ASME test procedure A112.19.6-1990

The federal supply sources for urinals are the Defense Logistics Agency (DLA) and, for waterless models, the General Services Administration (GSA). All urinals for sale through commercial sources should also comply with the recommended level, since any urinal manufactured for use in the U.S. after 1993 must not exceed one gallon per flush, by law.

Infrared or ultrasound sensors can help avoid water waste attributable to double flushing. Siphonic jet and blowout urinals, which flush automatically at given intervals, can be configured with timers or sensors that avoid automatic flushing during unoccupied hours.

Retrofitting an existing urinal with a water-conserving valve can save substantially on water use at little cost.

For specialized situations like prisons or hospitals, non-ceramic, metal urinals are available which have straight drain lines and a 0.5 gpf rate. Replacing an existing 3.0 gpf with a 0.5 gpf urinal can produce very large lifetime water savings, especially where water costs are high.

Waterless urinals offer enormous water cost savings. A waterless urinal uses a chemical trap with a low specific gravity chemical. This allows waste to flow down the discharge pipe without permitting sewer gases to escape. Daily maintenance cleaning of these urinals is important for odor control. Costs of chemicals and traps need to be compared with water cost savings.

Definition

The Recommended Flush Rate is exactly that required by the Energy Policy Act of 1992. This Recommendation is issued for the purpose of promoting early replacement.

Where to Find Water-Saving Replacement Urinals

Buyer Tips

Technology Options

Early replacement of high flush rate urinals can produce water cost-savings of several hundred dollars, as shown in the following tables.

Early Replacement

Definition

The 10-year Water Cost is the sum of the discounted value of annual water costs, based on average usage and an assumption that early replacement of the urinal occurs at the midpoint of a 20-yr. useful life. A discount rate of 4.1% is based on federal guidelines (effective from April, 2000 to March, 2001). Future water and wastewater treatment costs are conservatively assumed to increase only at the rate of inflation.

Urinal Cost-Effectiveness Example A – Average Water Costs			
<i>Performance</i>	<i>Typical Existing Unit</i>	<i>New Unit^a</i>	<i>Best Available</i>
Gallons per flush (gpf)	3.0 gpf	1.0 gpf	0.0 gpf
Annual Water Use	23,400 gallons	7,800 gallons	0 gallons
Annual Water Cost	\$90	\$30	\$0
10-year Water Cost	\$800	\$250	\$0
Lifetime Water Cost Savings (for replacing existing unit 10 years early)	-	\$550	\$800

a) The flush rate of the new unit meets the current federal standards for urinals.

Cost-Effectiveness Assumptions

Savings estimates are based on the flush rate for an existing unit of 3.0 gpf. Urinal use is assumed to be 30 flushes per day, and 260 days per year. The water price is assumed to be \$4/1,000 gallons (supply + wastewater treatment).

Understanding the Cost-Effectiveness Table

In the example shown above, early replacement of the existing urinal with a new unit at the recommended flush rate of 1.0 gpf will save \$550 in water costs over a 10-year period (the time before the old fixture will be replaced). Likewise, the Best Available model, a waterless urinal, will save \$800 in water costs over a 10-year period. The example assumes that no water is lost through leakage in either of the water-using models.

What if my Water Price is different?

To adjust the Lifetime Water Cost Savings in the table above for a different water price, multiply the \$550 figure listed by this ratio: $\left(\frac{\text{Your price in } \$/1,000 \text{ gallons}}{\$4.00/1,000 \text{ gallons}}\right)$. In many areas of the country, water costs dramatically exceed the average, deeming early urinal replacement particularly cost-effective. In the example below, water cost is assumed to be \$10/1,000 gallons.

Metric Conversion

1 gallon = 3.8 liters

Urinal Cost-Effectiveness Example B – High Water Costs			
<i>Performance</i>	<i>Typical Existing Unit</i>	<i>New Unit^a</i>	<i>Best Available</i>
Gallons per flush (gpf)	3.0 gpf	1.0 gpf	0.0 gpf
Annual Water Use	23,400 gallons	7,800 gallons	0 gallons
Annual Water Cost	\$230	\$80	\$0
10-year Water Cost	\$1,950	\$650	\$0
Lifetime Water Cost Savings (for replacing existing unit 10 years early)	-	\$1,300	\$1,950

a) The flush rate of the new unit meets the current federal standards for urinals.





**Energy Efficiency and Renewable Energy
Federal Energy Management Program**

How to Buy a Water-Saving Showerhead

Why Agencies Should Buy Efficient Products

- Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE ENERGY STAR® product labeling program.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy and water efficiency, while saving taxpayer dollars.

Federal Supply Source:

- General Services Administration (GSA)
Phone: (817) 978-8640

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
Phone: (800) 363-3732
www.eren.doe.gov/femp/procurement
- American Water Works Association's "WaterWiser" is a good resource for water conservation and efficiency information.
Phone: (800) 559-9855
www.waterwiser.org
- California Energy Commission (CEC) has a list of certified plumbing fixtures.
Phone: (916) 654-5106
ftp://energy.ca.gov/pub/efftech/appliance
- Home Energy magazine provides water conservation tips.
Phone: (510) 524-5405
www.homeenergy.org
- Consumer Reports rates plumbing fixtures.
www.consumerreports.org
- Contact your local water utility for details about local water conservation programs and incentives.
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
Phone: (202) 646-7950

Efficiency Recommendation

Product Type	Recommended Flow Rate ^a	Best Available Flow Rate
Showerhead	2.2 gallons per minute or less	1.5 gallons per minute ^b

- a) Based on ASME test procedure A112.18.1M-1994, with an inlet water pressure of 80 pounds per square inch.
b) Some lower-flow models exist, but shower quality is considerably sacrificed.

The federal supply source for water-saving showerheads is the General Services Administration (GSA), which offers them through its "Special Order" program. Request models that meet this Efficiency Recommendation. When buying from a commercial source (retailer or distributor), select or specify models with a flow rate that meets the recommended level.

A common complaint is that some "low-flow" showerheads give an unsatisfactory shower. However, there is a substantial difference in the quality of spray for different showerheads, even among models with the same flow rate. For spray pattern ratings and other features, refer to *Consumer Reports*. Before purchasing a large volume of showerheads, consider sampling a few different models for user satisfaction.

Although showerhead flow rates are reported at an inlet water pressure of 80 psi (in accordance with the Energy Policy Act of 1992), the actual flow rate of the showerhead will depend on the actual inlet water pressure.

Early replacement of a older, high-flow showerheads can lead to even greater water and energy savings than shown in the Cost-Effectiveness table, below. For example, replacing an older (4.0 gpm) unit with a recommended new showerhead (2.2 gpm) will have a 3-5 month payback and save \$500-1000 over a ten year period,

Where to Find Water-Saving Showerheads

Buyer Tips

Early Replacement

assuming average federal utility rates. Some older showerheads become occluded by mineral buildup and dispense significantly less water than their rated flows, however, mitigating savings from replacement units.

Showerhead Cost-Effectiveness Example			
<i>Performance</i>	<i>Base Model^a</i>	<i>Recommended Level</i>	<i>Best Available</i>
Water Use Only			
Gallons per minute (gpm)	2.5 gpm	2.2 gpm	1.5 gpm
Annual Water Use	18,250 gallons	16,060 gallons	10,950 gallons
Annual Water Cost	\$73	\$64	\$44
Lifetime Water Cost	\$610	\$540	\$370
With Electric Water Heating			
Annual Energy Use	2,370 kWh	2,120 kWh	1,540 kWh
Annual Energy Cost	\$142	\$127	\$92
Lifetime Energy Cost	\$1,090	\$980	\$710
Lifetime Energy and Water Cost Savings	-	\$180	\$620
With Gas Water Heating			
Annual Energy Use	131 therms	120 therms	94 therms
Annual Energy Cost	\$53	\$48	\$38
Lifetime Energy Cost	\$450	\$410	\$320
Lifetime Energy and Water Cost Savings	-	\$110	\$370

a)The flow rate of the Base Model just meets the current federal standards for showerheads.

Cost-Effectiveness Assumptions

Showerhead use is assumed to be 10 minutes per shower, 2 showers per day, 365 days per year. The showerhead water temperature is assumed to be 106°F and the inlet water pressure 80 psi. The assumed electricity and gas prices are 6¢/kWh and 40¢/therm, the federal average energy prices in the U.S. The assumed combined water and waste-water price is \$4/1,000 gallons.

Using the Cost-Effectiveness Table

In the example shown above, a new showerhead with a Recommended flow rate of 2.2 gpm will generate \$180 in water and energy cost savings when water heating is electric, or \$110 in savings if water is heated with gas. Similarly, a Best Available showerhead, with a flow rate of 1.5 gpm, will save \$620 (with electric water heating) or \$370 (with gas water heating). Since first-cost premiums are either small or non-existent for these showerheads, their purchase is virtually certain to be cost-effective.

What if my Water or Energy Price is different?

Recalculate your Lifetime Energy or Water Cost by using your own water and energy prices, and make the corresponding adjustments in the Lifetime Energy and Water Cost Savings. For example, to adjust for a different electricity price, multiply the Lifetime Energy Cost by this ratio: $\left(\frac{\text{Your price in } \$/kWh}{6.0 \text{ } \$/kWh}\right)$. Similar adjustments can be made for different gas and water prices.

Definition

Lifetime Energy or Water Cost is the sum of the discounted value of annual energy or water costs, based on average usage and an assumed showerhead life of 10 years. Future energy price trends and a discount rate of 3.4% are based on federal guidelines (effective from April, 2000 to March, 2001). Future water and waste water treatment costs are conservatively assumed to increase only at the rate of inflation.

Metric Conversions

1 gallon = 3.8 liters
 1 therm = 100,000 Btu
 = 29.3 kWh
 = 105.5 MJ
 1 psi = 6.9 kPa
 °F = (1.8 * °C) + 32





**Energy Efficiency and Renewable Energy
Federal Energy Management Program**

How to Buy a Water-Saving Faucet

Why Agencies Should Buy Efficient Products

- Executive Order 13123 and FAR section 23.704 direct agencies to purchase products in the upper 25% of energy efficiency, including all models that qualify for the EPA/DOE ENERGY STAR® product labeling program.
- Agencies that use these guidelines to buy efficient products can realize substantial operating cost savings and help prevent pollution.
- As the world's largest consumer, the federal government can help "pull" the entire U.S. market towards greater energy and water efficiency, while saving taxpayer dollars.

Federal Supply Source:

- General Services Administration (GSA)
Phone: (817) 978-8640

For More Information:

- DOE's Federal Energy Management Program (FEMP) Help Desk and World Wide Web site have up-to-date information on energy-efficient federal procurement, including the latest versions of these recommendations.
Phone: (800) 363-3732
www.eren.doe.gov/femp/procurement
- American Water Works Association's "WaterWiser" is a good resource for water conservation and efficiency information.
Phone: (800) 559-9855
www.waterwiser.org
- California Energy Commission (CEC) has a list of certified plumbing fixtures.
Phone: (916) 654-5106
[ftp://energy.ca.gov/pub/efftech/appliance](http://energy.ca.gov/pub/efftech/appliance)
- *Home Energy* magazine provides water conservation tips.
Phone: (510) 524-5405
www.homeenergy.org
- *Consumer Reports* rates plumbing fixtures.
www.consumerreports.org
- Contact your local water utility for details about local water conservation programs and incentives.
- Lawrence Berkeley National Laboratory provided supporting analysis for this recommendation.
Phone: (202) 646-7950

Efficiency Recommendation			
Product Type	Recommended Flow Rate^a	Best Available Flow Rate	Self-Closing
Faucet^b	2.0 gallons per minute or less	1.5 gallons per minute	0.25 gallons per cycle

- a) Based on ASME test procedure A112.18.1M-1996, with an inlet water pressure of 60 pounds per square inch (psi).
- b) This Recommendation covers residential kitchen and bathroom sink faucets, as well as commercial bathroom sink faucets.

The federal supply source for water-saving faucets is the General Services Administration (GSA), which offers them through its "Special Order" program. Request models that meet this Efficiency Recommendation. When buying from a commercial source (retailer or distributor), select or specify models with a flow rate that meets the recommended level.

Self-closing and metered faucets shut off automatically after a specified time, or when the user moves away, resulting in significant water savings. A typical on-cycle is 10 seconds, in compliance with the Americans with Disabilities Act (ADA) regulations.

Adding a faucet aerator is a cost-effective way to save water. Faucet aerators replace the faucet head screen, lowering the flow by adding air to the spray. High-efficiency aerators can reduce the flow from 2-4 gpm to less than 1 gpm at a fraction of the cost of replacing faucets. Refer to *Home Energy* and *Consumer Reports* for more information on aerators (see "For More Information").

Early replacement of older, high flow faucets can lead to even greater water and energy savings than shown in the cost-effectiveness table below.

Definition

Self-Closing Faucet means a fitting that has an automatic shutoff after a preset time, or when the user moves away.

Where to Find Water-Saving Faucets

Buyer Tips

Early Replacement

Faucet Cost-Effectiveness Example

Performance	Base Model ^a	Recommended Level	Best Available	Self-closing
Water Use Only				
Gallons per minute/cycle	2.2 gpm	2.0 gpm	1.5 gpm	0.25 gpc ^b
Annual Water Use	17,160 gallons	15,600 gallons	11,700 gallons	3900 gallons
Annual Water Cost	\$69	\$62	\$47	\$16
Lifetime Water Cost	\$570	\$520	\$390	\$130
For Electric Water Heating				
Annual Energy Use	970 kWh	890 kWh	700 kWh	310 kWh
Annual Energy Cost	\$58	\$54	\$42	\$19
Lifetime Energy Cost	\$450	\$410	\$320	\$140
Lifetime Energy and Water Cost Savings	-	\$90	\$310	\$750
For Gas Water Heating				
Annual Energy Use	54 therms	50 therms	42 therms	24 therms
Annual Energy Cost	\$21	\$20	\$17	\$10
Lifetime Energy Cost	\$180	\$170	\$140	\$80
Lifetime Energy and Water Cost Savings	-	\$60	\$220	\$540

a) The flow rate of the Base Model just meets the current federal standards for faucets, based on ASME standard test conditions.

b) The duration of 1 cycle is based on the Americans with Disabilities Act (ADA) specification of 10 seconds.

Cost-Effectiveness Assumptions

Faucet use is assumed to last for 1 minute, 30 times per day, and 260 days per year. The faucet water temperature is assumed to average 80°F and the inlet water pressure 60 psi. For self-closing faucets, each faucet use is assumed to require 2 on-cycles. The assumed electricity and gas prices are 6¢/kWh and 40¢/therm, the federal average energy prices in the U.S. The assumed combined water and waste-water price is \$4/1,000 gallons.

Using the Cost-Effectiveness Table

In the example above, a new faucet which just meets the Recommended flow rate of 2.0 gpm generates \$90 in water and energy cost savings when water heating is electric, or \$60 in savings if water is heated with gas. Similarly, a Best Available faucet, with a flow rate of 1.5 gpm, saves \$310 (with electric water heating) or \$220 (with gas water heating). Since first-cost premiums are either small or non-existent for these faucets, their purchase is virtually certain to be cost-effective. Enormous cost savings, of \$750 (electric) and \$540 (gas), are evidenced with the 0.25 gpc self-closing faucet. However, these faucets generally cost substantially more, and usually require additional maintenance.

What if my Water or Energy Price is different?

Recalculate your Lifetime Energy or Water Costs by using your own water and energy prices, and make the corresponding adjustments in the Lifetime Energy and Water Cost Savings. For example, to adjust for a different electricity price, multiply the Lifetime Energy Cost by this ratio: $\left(\frac{\text{Your price in } \text{¢/kWh}}{6.0 \text{ ¢/kWh}}\right)$. Similar adjustments can be made for different gas and water prices.

Definition

Lifetime Energy or Water Cost is the sum of the discounted value of annual energy or water costs, based on average usage and an assumed faucet life of 10 years. Future energy price trends and a discount rate of 3.4% are based on federal guidelines (effective from April, 2000 to March, 2001). Future water and waste water treatment costs are conservatively assumed to increase only at the rate of inflation.

Metric Conversions

1 gallon = 3.8 liters
 1 therm = 100,000 Btu
 = 29.3 kWh
 = 105.5 MJ
 1 psi = 6.9 kPa
 °F = (1.8 * °C) + 32



Appendix 6

SCOT[®]/METERING

Slow-Closing Omni-Temperature and Fixed Temperature Faucets



2"
51mm

1 1/2"
38mm

Symmons[®]

SCOT[®]...Born to Save

On Water:

As shown below, the SCOT faucet delivers 0.5 gpm for 30 seconds, for a total of 0.25 gallons. In the same time period, a standard faucet would deliver 1.1 gallons. That's a minimum savings of 0.6 gallons per comparable use. But of course there is no comparison. SCOT closes automatically and the cycle time can be set for less than 30 seconds for even greater savings, while the standard faucet could be left running.

On Energy:

Compared to fixed-temperature metering faucets, SCOT is an energy miser, because users can select cold water only. That means less hot water demand. Compared to standard metering faucets, SCOT's temperature selection can save countless gallons of hot water.

On Waste Water:

Where local sewage costs are predicated on the volume of water used as shown below, SCOT faucets (with flow rates 77% lower than standard faucets) can reduce such costs significantly.

On Costly Additional Equipment:

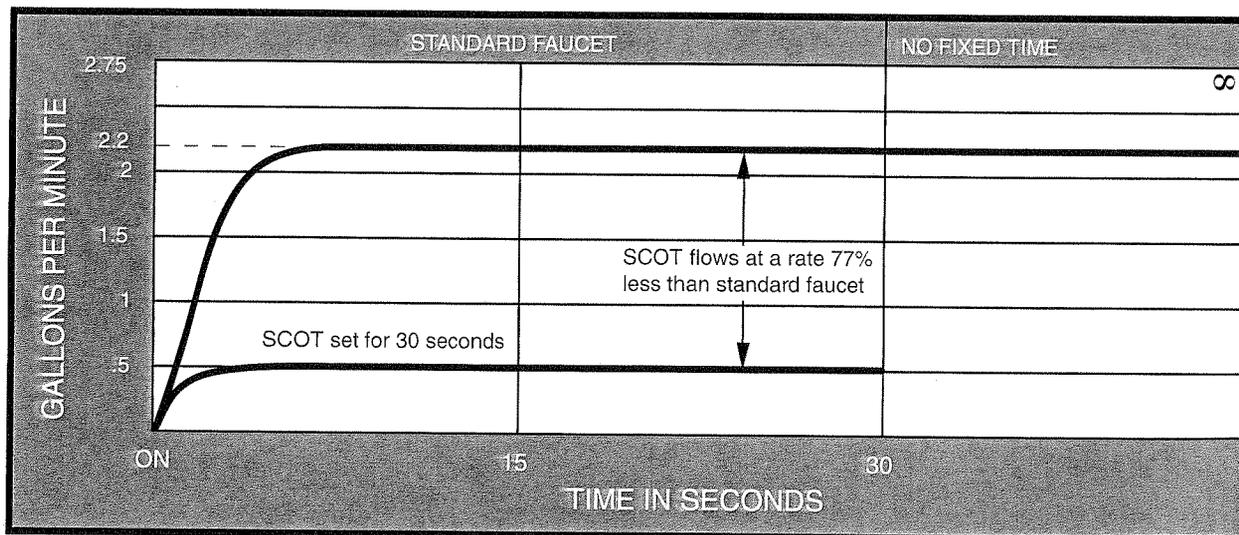
Unlike standard faucets or conventional metering faucets, SCOT does not require additional mixing valves upstream to supply tempered water at 110° F due to its limit stop.

On Housekeeping:

The hands-off closing feature of SCOT reduces the build-up of wet soap and other matter on its polished chrome finish... an important clean-up benefit for hotels and commercial applications.

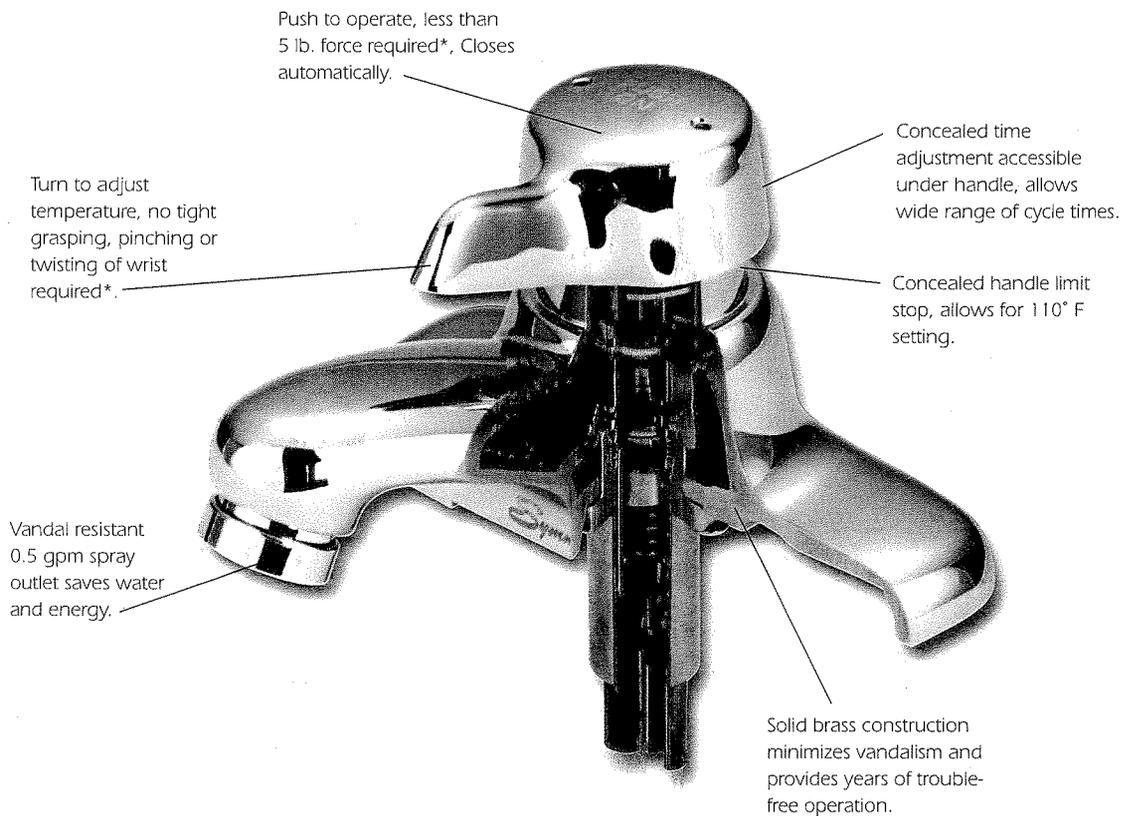
On Your Next Project:

Specify SCOT faucets and see how much you can save!



SCOT[®]...Built to Last

The rugged design of our SCOT faucet features brass, bronze, and stainless steel functioning parts which are housed in a heavy-duty, cast brass body for maximum trouble-free performance. If your next project requires a durable metering faucet that is built to withstand the rigors of high use commercial or institutional projects, think SCOT, the faucet that's Built to Last.



SCOT... for all users



*The compliance guide of the Americans with Disabilities Act requires that controls be operable with one hand, not requiring tight grasping or twisting of the wrist, and capable of being activated with a force of five pounds or less. The SCOT faucet meets these requirements and is designed to accommodate those users who can only activate controls with a minimum of force.

Metering Faucets without Temperature Selection

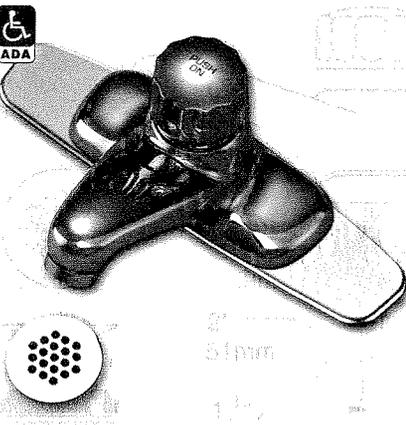


S-61-G Metering faucet. Cast brass 4" centerset slow-closing lavatory faucet to meter a single tempered water supply. Time limit stop to adjust flow time. Includes in-line check/screen assembly. Spray outlet with 0.5 gpm flow rate. Vandal resistant. Grid strainer drain assembly.

S-61-P Metering faucet with pop-up drain assembly.

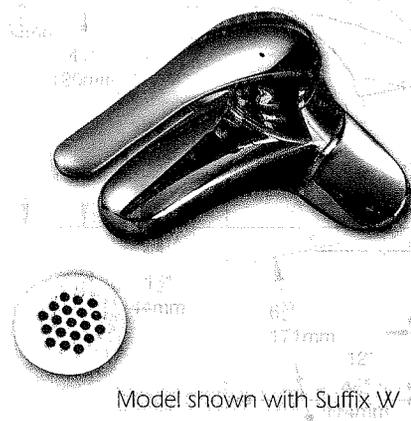
S-61-1 Faucet with lift rod only

S-61 Faucet only



S-61-G-DP Metering faucet with adaptor plate drilled on 8" centers. Cast brass slow-closing lavatory faucet to meter a single tempered water supply. Time limit stop to adjust flow time. Includes in-line check/screen assembly. Spray outlet with 0.5 gpm flow rate. Vandal resistant. Grid strainer drain assembly.

S-61-DP Faucet with adaptor plate only



Conventional Faucet for use where Metering Faucet is not desired

S-20-2-G-FR SYMMETRIX® 4" centerset single lever lavatory faucet. Lever handle with red/blue indicators. Spray outlet with 0.5 gpm flow rate. Vandal resistant. Grid strainer drain assembly.

S-20-2-FR Faucet with pop-up drain assembly.

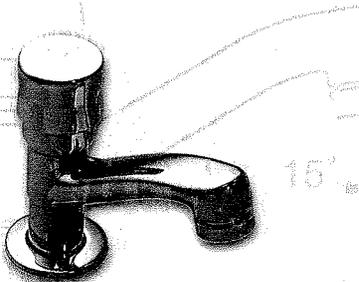
S-20-FR Faucet only.

Modifications: **Suffix A:** Standard aerator in place of spray outlet (standard aerator flow rate is 1.25 gpm at 50 psi) **Suffix IPS:** 1/2" male IPS connections • **Suffix DP:** Adaptor plate for 8" center installations (S-61 series only) • **Suffix G:** Grid strainer drain assembly • **Suffix P:** Pop-up drain assembly • **Suffix OFG:** Offset grid strainer • **Suffix W:** 6" long wrist operation handle with red/blue indicators (S-20 series only)

Metering Faucets

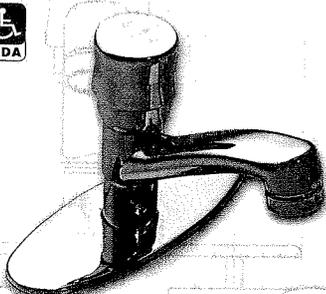
without Temperature Selection

- Solid brass and bronze construction provides durable performance in high use applications.
- Push to operate; Requires less than 5 lb. force to activate. Meets requirements of ANSI A-117.1 and the Americans with Disabilities Act (ADA).
- Vandal resistant design prevents damage and theft.
- Low flow 0.5 gpm (1.9 L/min.) vandal resistant spray outlet helps conserve water and energy. Provides full rate of flow throughout cycle .25 g/cycle (1.0 L/cycle).
- Concealed time adjustment accessible under cap allows cycle time to be accurately set to the needs of users.
- Replaceable brass cartridge allows for ease of repair.



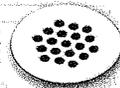
S-71-G Single Post Metering faucet to meter a single cold, hot or tempered water supply. Adjustable time limit stop to adjust flow time. Vandal resistant 0.5 gpm spray outlet. Grid strainer drain assembly.

S-71 Faucet only



S-72-G Metering faucet with deck plate to accommodate 4" center, 3 hole mounting sink basins. Faucet to meter a single cold, hot or tempered water supply. Adjustable time limit stop to adjust flow time. Vandal resistant 0.5 gpm spray outlet. Grid strainer drain assembly.

S-72 Faucet with deck plate only



Modifications: **Suffix A:** Standard aerator in place of spray outlet (standard aerator flow rate is 1.25 gpm at 50 psi) • **Suffix OFG:** Offset grid strainer • **Suffix C:** Cold marking on cap (S-71 Series) • **Suffix H:** Hot marking on cap (S-71 Series) • **Suffix QC:** Quick closing feature • **Suffix NA:** Non-aerated laminar flow outlet • **Suffix DP:** Adapter plate for 8" center installations

SCOT®

S-60 Series

Metering Faucet

S-61 Series

Slow-Closing Omni Temperature Lavatory
Faucet & Metering Lavatory Faucet

INSTALLATION, OPERATION AND SERVICE INSTRUCTIONS

IMPORTANT:

Water lines **MUST** be thoroughly flushed **BEFORE** and **AFTER** installing the faucet to prevent foreign matter i.e. copper chips, sand, stones, etc. from clogging and possibly damaging the sealing surfaces of the cartridge.

INSTALLATION

(Supply stop valves must have a 3/8" O.D. compression outlet.)

1. **S-60 Series:** Remove nut and ferrule from supply stops, install in-line check/screen assembly (LL-71B) on male outlet of stops.
2. Install SPF-KIT loosely on faucet. Position faucet through sink or counter with mounting gasket under base. Secure faucet tightening nuts from under side.
3. Install drain assembly. Seal under flange with putty.
4. **S-60 Series:** Carefully bend copper supplies to meet water supplies using palms of hands to avoid kinking tubing or fracturing solder joints. Connect hot supply to left tube and cold supply to right tube using appropriate lengths of 3/8" O.D. tubing between faucet supplies and in-line check/screen assembly.

S-61 Series: Connect cold or tempered supply to faucet supply using appropriate length of 3/8" O.D. tubing between faucet and in-line check/screen assembly.

5. **S-60 Series:** To flush faucet remove aerator (LN-100 or LN-101) and turn valve handle to full cold position. Open supply and depress handle holding down for 10 seconds, rotate handle to hot position, open supply and repeat above procedure. Hold down handle and rotate from left to right to flush lines thoroughly. Allow faucet to shut off and replace aerator.

S-61 Series: To flush faucet remove aerator (LN-100 or LN-101) and open supply stop depress handle and hold down for 10 seconds. Repeat several times and allow faucet to shut off. Replace aerator.

Adjustment of cycle time and temperature

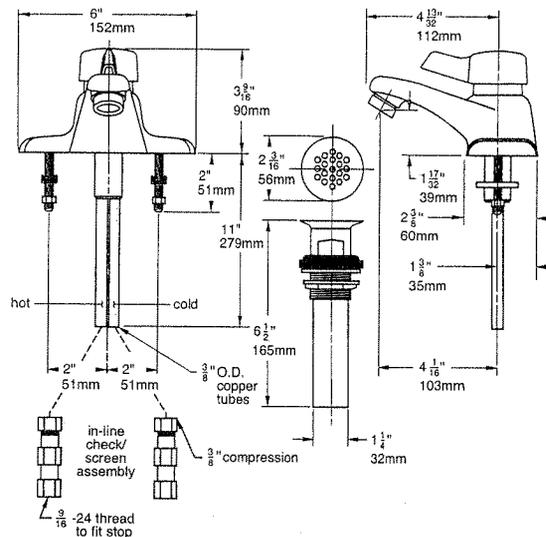
After faucet has been operated through a number of cycles and supply water temperature is at designed levels, adjustments to these features can be made as follows.

Cycle Time: To increase time, loosen allen screw (LL-27) with a 3/32" hex socket key, remove handle (LT-100 or LL-104) and remove one or more of the washers (LL-28) on stem. To reduce time, add washers.

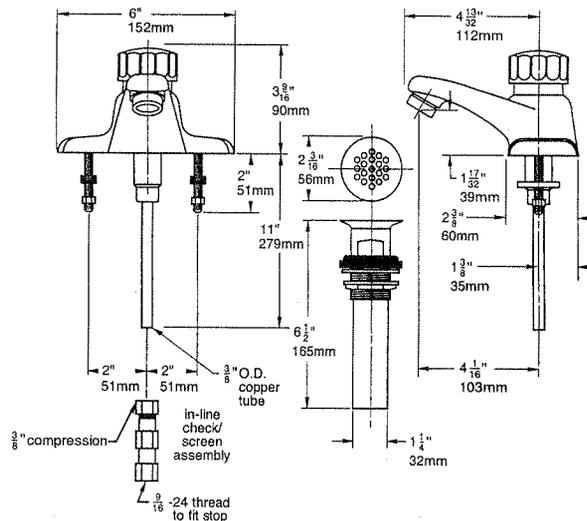
Temperature limit adjustment (S-60 Series only):

Loosen allen screw (LL-27) with a 3/32" hex socket key.

S-60 Series



S-61 Series



Remove handle (LL-104), loosen nut (LL-6) and turn stem (LL-1A) to desired maximum temperature (110°F recommended). Turn limit stop washer (LL-23N) clockwise until a positive stop is reached against back of faucet. Tighten nut (LL-6), replace and tighten handle (LL-104). Faucet will operate from the full cold position to the maximum hot temperature that has been set.

Reverse operation (S-60 Series only)

For piping simplicity in back to back installation or when hot supply is on right, the faucets internal operation can be quickly reversed. Remove handle (LL-104), nut (LL-6), and limit stop washers (LL-22N) & (LL-23N), turn stem 180° so that red marking is facing toward front. Replace limit stop washers, adjust to desired temperature (see adjustment procedure in preceding paragraph), reassemble faucet reversing above procedure. Faucet will operate from the full cold position to the maximum hot temperature that has been set.

Simmons®

Metering Faucet S-61 Series

- LL-1 Control spindle
- LL-1A Control cartridge
- LL-1B Control cartridge for quick-closing
- LL-2A Cycle spindle assembly
- LL-3N Upper housing
- LL-4 Piston washer screw
- LL-8 Cycle spindle guide
- LL-11 Piston cylinder
- LL-12 Piston
- LL-16 Shut-off seat
- LL-24 Control rod
- LL-27 Handle set screw
- LL-28 Cycle time washers
- LL-31 Retaining ring
- LL-32 Piston spring
- LL-35 Thrust washer
- LL-37 Shut-off washer
- LL-44 Spindle guide large o-ring
- LL-45 Shut-off seat o-ring
- LL-46 Control spindle small o-ring
- LL-47 Control spindle large o-ring
- LL-48 Upper housing o-rings (3)
- LL-49 Piston o-ring
- LL-75 Spindle guide huva cup
- LL-76 Huva cup retainer
- LL-105 Shell
- LL-106 Base plate gasket
- LN-12 Anchor stud
- LN-100 Aerator (vandal resistant 0.5 gpm)
- LN-101 Aerator (vandal resistant)
- LT-4A Piston assembly
- LT-71B In-line check/screen assembly
- LT-100 Handle
- LT-108 Supply housing
- SPF-KIT Mounting Kit
- TT-36 Undercover plate screws (2)

Tools required for disassembly

Order LL-KIT-W, consisting of:

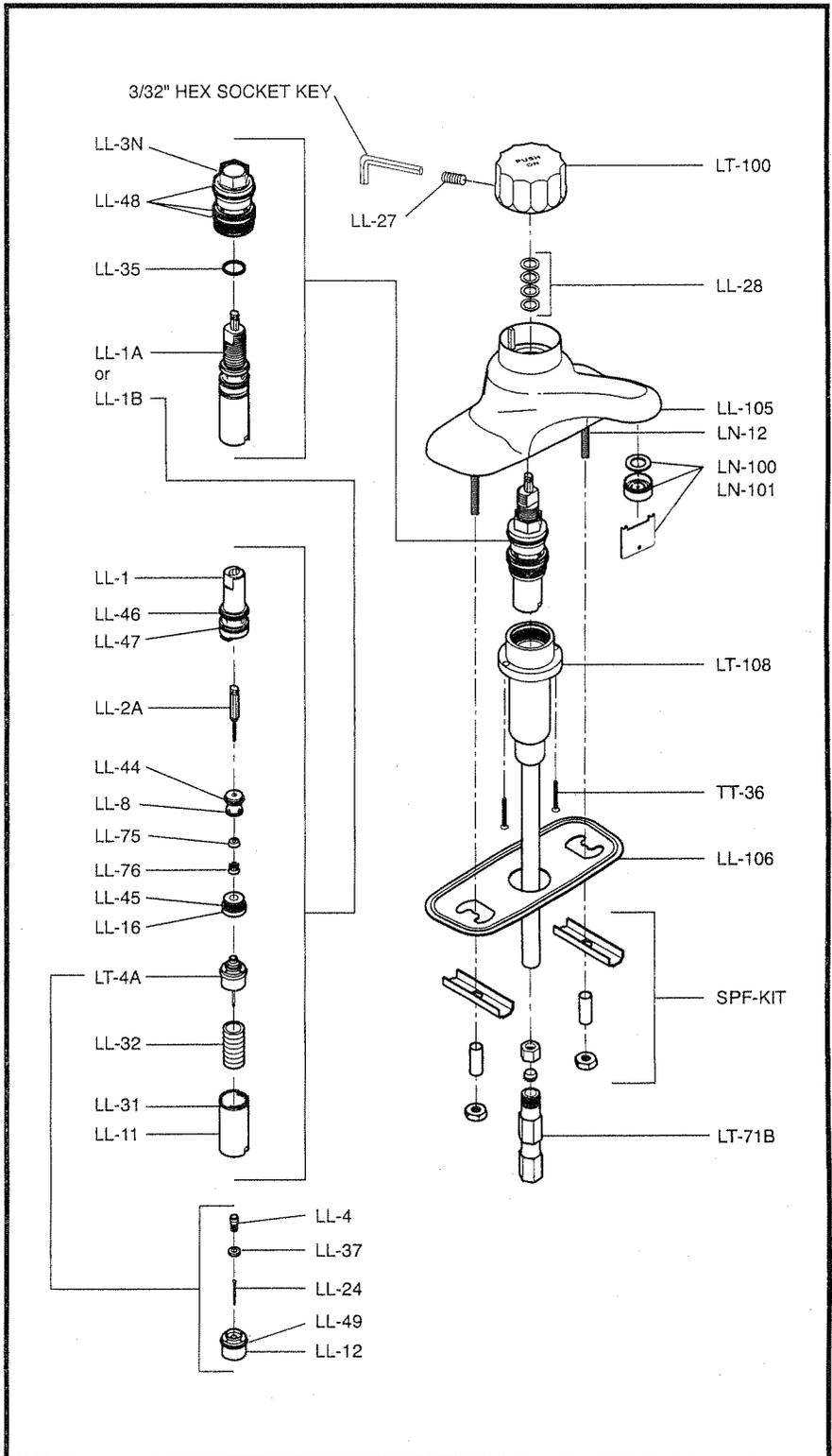
- LL-27W 3/32" hex socket key to remove handle set screw
- LL-9W 15/16" socket to remove shell locking nut
- LL-60K Spray outlet wrench to remove spray outlet (included with faucet)

Other standard tools required:

Adjustable or 1 1/16" and 3/4" open end wrench, small phillips screwdriver, pliers

Repair Kit LL consists of:

- LL-4, LL-8, LL-13, LL-24, LL-31, LL-32, LL-33, LL-35, LL-37, LL-42, LL-43, LL-44, LL-45, LL-46, LL-47, LL-48, LL-49, LL-73, LL-75, LL-76.



SERVICE INSTRUCTIONS

- General repair will require the repair or replacement of the cartridge unit.
- Shut off water supply to the faucet.
- Remove handle with 3/32" hex socket key.
- S-60 Series:** Remove cycle time washers (LL-28), limit stop retainer nut (LL-6), and limit stop washers (LL-22N and LL-23N).
S-61 Series: Remove cycle time washers (LL-28).
- S-60 Series:** Remove upper housing (LL-3N) with an adjustable wrench, slide housing off control cartridge (LL-1A).
S-61 Series: Remove upper housing (LL-3N) with an adjustable wrench, slide housing off control cartridge (LL-1A).
- S-60 Series:** Control cartridge (LL-1A) can be either replaced or repaired at this point. Disassemble cartridge by opening retaining ring (LL-31) and sliding down piston cylinder (LL-11).
- S-61 Series:** Control cartridge (LL-1A) can be either replaced or repaired at this point.
- S-60 Series:** Ordinary service requires only the replacement of the piston/o-ring assembly (LT-4A) and spring (LL-32). Complete rebuilding of the cartridge can be accomplished with repair KIT-LL.
- S-61 Series:** Ordinary service requires only the replacement of the piston/o-ring assembly (LT-4A) and spring (LL-32). Complete rebuilding of the cartridge can be accomplished with repair KIT-LL.
- S-60 Series:** When re-installing cartridge be sure to align red marking facing back on a normal installation and towards the front on a reverse operation installation.
- Reassemble, reversing above procedure.

TROUBLE SHOOTING CHART

Problem	Cause	Solution (Follow service instructions)
Faucet runs to long or to short.	Timing	Remove handle - then add washers (LL-28) to stem to shorten time or remove washers to lengthen time.
Faucet drips	Seat washer worn or foreign matter (chips, dirt, solder, etc.) is between washer and seat surface.	Disassemble cartridge and remove piston (LT-4A). Unscrew LL-4 and clean seat washer (LL-37). Check S.S. pin (LL-24) for burr then reassemble.
Faucet runs constantly.	Seat washer not closing on seat surface or seat washer and/or seat surface worn.	Remove piston (LT-4A) and spring (LL-32). Check for burr on pin (LL-24) and check spring. Both LT-4A and LL-32 may have to be replaced. Excessive wear may require cartridge replacement LL-1A.
Water leaks from under handle.	Stem washers worn.	Remove cartridge and replace washers using KIT-LL.
Faucet leaks on or under counter.	Supply housing o-rings worn.	Replace LL-48 o-rings.
Faucet bleeding between hot and cold (SCOT S-60 series only).	LL-71B check/screens not installed.	Two chrome plated 3/8" check/screens are supplied with every faucet and must be installed.
Faucet bleeding between hot and cold (SCOT S-60 series only).	LL-71B check/screens are installed.	Replace LL-13 seats.
Handle is loose.	Set screw has loosened.	Tighten set screw.

5-Year Limited Commercial Warranty

Symmons warrants to the original purchaser that any Symmons product when used in industrial, commercial or business use will be free of defects in material and workmanship during normal use for a period of 5 years from the date of purchase. At our option, we will either have you send the defective part or product prepaid to us for inspection, or we may elect to send you the replacement part or product without investigation. A replacement for any defective part will be supplied FREE OF CHARGE for installation by the purchaser. Defect or damage caused by the use of replacement parts other than Symmons Genuine Replacement Parts will void this warranty. This warranty excludes product damage due to installation error, product abuse, or product misuse whether performed by a contractor, service company or yourself.

Damage to the chrome and/or other decorative finishes on Symmons products may be a result of improper handling or abusive treatment. Finishes should only be cleaned with a soft, damp cloth or sponge. Use of polish, abrasive cleaners, solvents, or acid cleaners will damage the finish and void this warranty.

There are no other express warranties on this product and ALL WARRANTIES OF MERCHANTABILITY AND OTHER IMPLIED WARRANTIES ARE LIMITED IN ACCORDANCE WITH APPLICABLE LAW. SYMMONS INDUSTRIES, INC., EXPRESSLY DISCLAIMS CONTINGENT LIABILITY AND CONSEQUENTIAL DAMAGE OF EVERY KIND. Since some states do not allow limitations on how long an implied warranty lasts or an exclusion or limitation of incidental or consequential damages the above limitation or exclusion may not be applicable. This warranty gives specific legal rights. Other rights may vary from state to state.

To obtain warranty service, write to Symmons Industries, Inc., 31 Brooks Drive, Braintree, MA 02184-3804 or call our Customer Service Department at 1-800-SYMMONS. If writing to us, please include proof of purchase, the model number of the product with a brief description of the problem, your name, address and phone number.

SYMMONS INDUSTRIES, INC.

31 Brooks Drive, Braintree, MA 02184-3804

TEL: 1-800-SYMMONS, (781) 848-2250 FAX: 1-800-961-9621, (781) 843-3849

Web site: www.symmons.com

© 2000-2004 Symmons Industries, Inc. Printed in U.S.A. REV 111902

ZV-384 3-Hole 2.5m 1/04

ZV-385 Folded

SLOAN.

SLOAN FLUSHOMETERS

Selection Guide

OPTIMA PLUS®

ROYAL®

REGAL

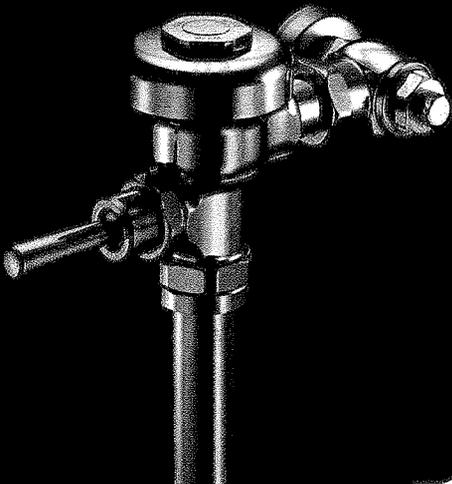
GEM-2®

NAVAL®

DOLPHIN®

MICROPLUMB®

FLUSHMATE®



REGAL[®] FLUSHOMETERS

Regal Brings You Back to Basics
Without Compromising Quality

Application Guide

The components of the Regal valve reflect the proud design heritage of the Sloan family of Flushometers. They include an accurate, non-adjustable flush delivery, a high copper, low zinc semi-red cast brass alloy and an oscillating, non-hold open handle. In addition, the Regal is easy to repair and maintain, with a guaranteed performance and a three-year, limited warranty. Also, the Regal XL upgrade includes a variety of "extras" for special project considerations, including: ADA Handle, Vandal-Resistant Stop Cap and Sweat Solder Adapter Kit. Best of all, Regal Flushometers are available at costs competitive with foreign sourced "copycat" valves.

Regal[®] Flushometer

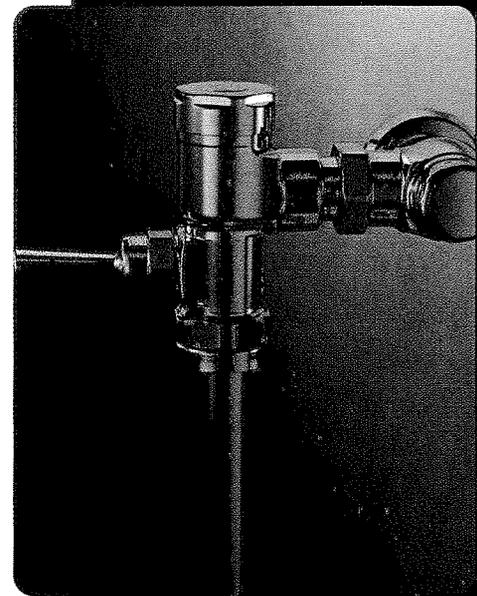
Quiet, diaphragm Flushometers with the following features:

- Metal Oscillating, Non-Hold Open Handle
- Bak-Chek™ Angle Stop
- Vandal Resistant Stop Cap
- Adjustable Tailpiece
- Vacuum Breaker Flush Connection
- Spud Coupling, Wall and Spud Flanges
- Low Consumption Flush Accuracy Controlled by Para-Flo™ Inside Parts Kit
- Diaphragm, Handle Packing, Stop Seat and Vacuum Breaker Molded from PERMEX™ Elastomeric Compound for Chloramine Resistance
- Valve Body, Cover, Tailpiece and Control Stop manufactured per ASTM Alloy Classification for Semi-Red Brass
- Valve complies with applicable sections of ASSE 1037, ANSI/ASME 112.19.6 and Military Specification V-29193

Variations include: ADA Compliant Handle, Bio-Gard® Handle, Trap Primers, Sweat Solder Adapter Kits with Stamped Flanges, Sweat Solder Adapter & Cast Wall Flanges with Set Screws, Bumpers on Control Stops

GEM•2® FLUSHOMETERS

World Class Quality



Application Guide

Gem•2® Flushometer

Quiet, piston-type Flushometers with the following features:

- Filtered By-Pass
- ADA Compliant Metal Oscillating Non-Hold Open Handle
- Bak-Chek™ Angle Stop
- Vandal Resistant Stop Cap
- Adjustable Tailpiece
- Vacuum Breaker Flush Connection
- Spud Coupling and Wall Flange
- Valve Body, Cover, Tailpiece and Control Stop manufactured per ASTM Alloy Classification for Semi-Red Brass
- Valve complies with applicable sections of ASSE 1037, ANSI/ASME 112.19.6 and Military Specification V-29193

Variations include: Flush Connections, Trap Primers, Sweat Solder Adapter Kits, Cast Set Screw Wall Flanges, Extended Bumpers on Angle Stops, Split or Solid Ring Pipe Supports

Sloan Gem•2® Flushometers offer you superior functional features and advanced water handling characteristics. As the best performing piston valve on the market, it is designed to accurately meter water delivery from 15 to 100 psi and is available in a 1.6 gallon (6-liter) low consumption flush. Urinal models are also available with a 1-gallon (3.8 liter) flush. The Gem•2 Flushometer is non-adjustable and automatically compensates for changes in water pressure.

SLOAN FLUSHOMETERS

Versatility and Flexibility

Sloan Flushometers are available in a wide variety of styles to meet any installation need.

Fixtures and Flushing Volumes

- 1.6 gpf (6.0 Lpf) - low consumption
- 3.5 gpf (13.2 Lpf) - water saver

The Royal Flushometer is also available with a 9.0 liter (2.4 gallon) flush for international applications

Urinal Flushometers

- 0.5 gpf (1.9 Lpf) - ultra low flush
- 1.0 gpf (3.8 Lpf) - low consumption
- 1.5 gpf (5.7 Lpf) - water saver

Service Sink Flushometers

- 6.5 gpf (24.5 Lpf) flush delivery

Accessories

Sloan Flushometers are available with a wide variety of accessories and variations. Please refer to the appropriate sections in the Sloan catalog.

Made in the USA

Manufactured in the USA by Sloan Valve Company under one or more of the following patents: 5,295,655; 9,542,718; 5,558,120; 5,564,460. Other patents pending.

SLOAN®

SLOAN VALVE COMPANY

10500 Seymour Avenue
Franklin Park, IL 60131
800-9VALVE9
847-671-4300
FAX 847-671-6944
<http://www.sloanvalve.com>

Insist on the Best...

Insist on Sloan Valve Company Products

Over 90 years of experience has earned Sloan Valve Company a reputation for Quality. There is no better choice for engineered performance than Sloan.

A Family of Reliable Products

Sloan manufactures and sells more Flushometers to world markets than all other brands combined. Our innovative designs, high quality, dependable operation and long life have become benchmarks of an industry.

World Class Performance

The Royal, with its world-class quality and a wide range of installations, can be found in cities throughout the world, serving a variety of building requirements in high rises, hospitals, and other commercial construction.

Sloan Offers Excellence

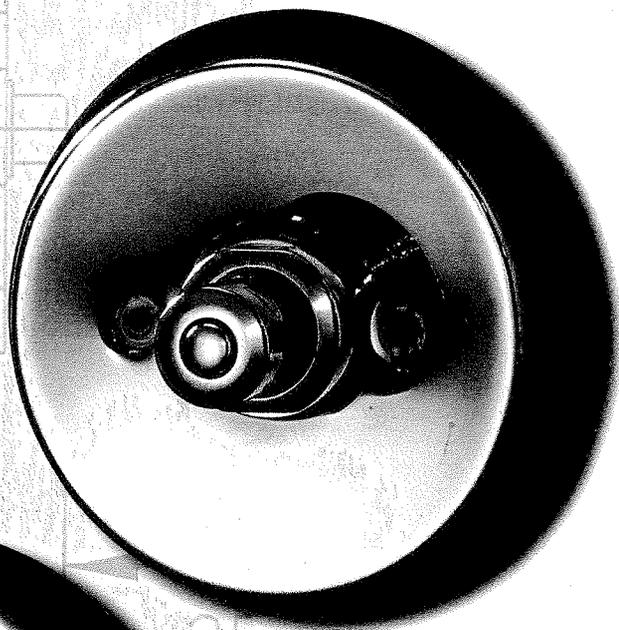
Our focus has been delivering products that provide consistent, reliable performance. Since our beginnings in 1906, we have delivered Quality to the plumbing industry. That's why today, more than any other manufacturer, the name Sloan has come to stand for the highest level of Quality. Your building deserves the very best. It deserves Sloan Excellence.

0816429

©2002 Sloan Valve Company
Printed in USA

SHOWEROFF®

Metering Shower Valves and Systems



Symmons®

SHOWEROFF®

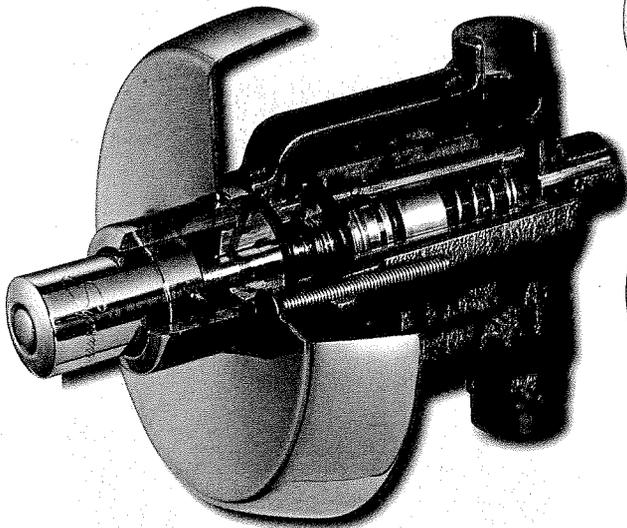
Metering Shower Valves

Shower On, SHOWEROFF!

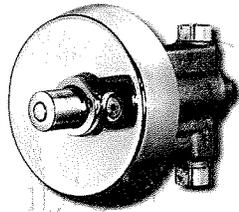
SHOWEROFF metering shower valves and systems from Symmons provide a positive solution to the issues of water waste and hot water energy savings.

A durable, piston-actuated metering shower valve, Showeroff provides a full shower flow for approximately 45 seconds*, and never forgets to shut itself off. The cycle can be repeated indefinitely, but the shower can not be left running. Ideal for public showers, detention facilities or any shower application where there is a need to positively control shower water usage.

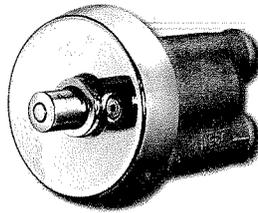
As a single supply metering valve, Showeroff can be supplied with a single cold or tempered water supply line. See back page for thermostatic mixing valve selection.



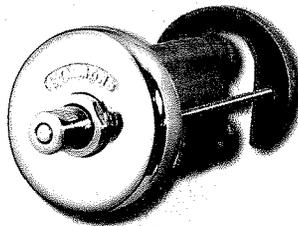
(*Shower cycle time can vary depending on water temperature and pressure.)



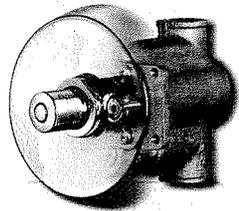
4-420 SHOWEROFF concealed metering shower valve with integral stop and 1/2" sweat connections. All mounting fasteners for valve are vandal-resistant recessed hex socket type.



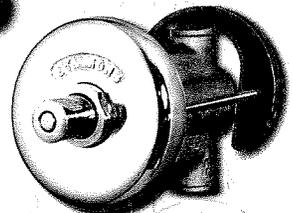
4-427 SHOWEROFF concealed metering shower valve with integral stop and 1/2" IPS back connections. All mounting fasteners for valve are vandal-resistant recessed hex socket type.



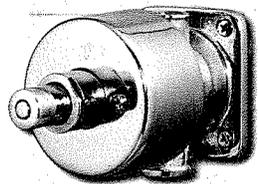
4-427-R SHOWEROFF concealed metering shower valve with integral stop, 1/2" IPS back connections and escutcheon with rear mounting plate and thru bolts, rear access corridor model.



4-428 SHOWEROFF concealed metering shower valve with integral stop for thin wall and 1/2" IPS connections. All mounting fasteners for valve are vandal-resistant recessed hex socket type.



4-428-R SHOWEROFF concealed metering shower valve with integral stop for thin wall, 1/2" IPS connections and escutcheon with rear mounting plate and thru bolts, rear access corridor model.

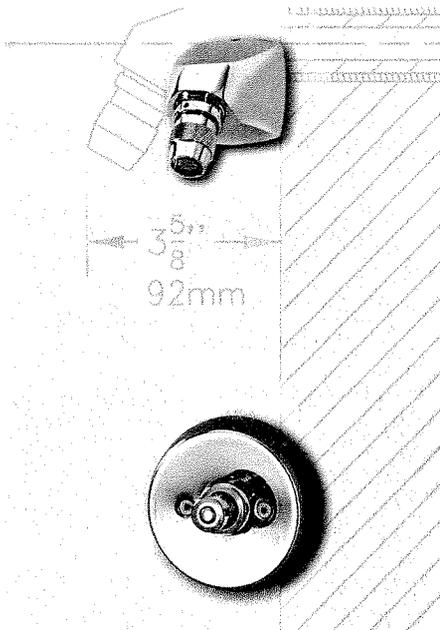


4-425 SHOWEROFF exposed metering shower valve with integral stop and wall flange.

Modifications (4-425 only):

Suffix A: Anchor Plate for ceramic tile

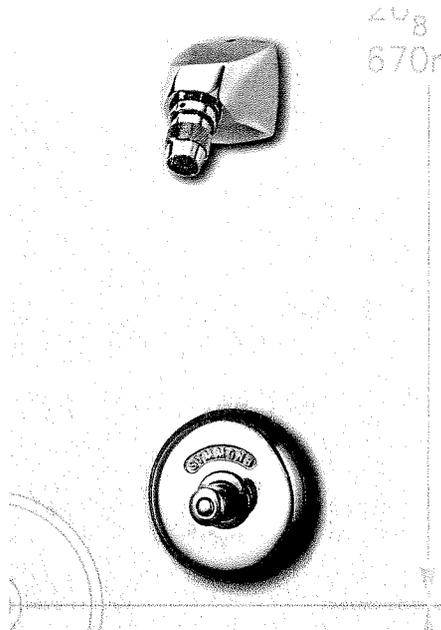
Suffix B: Back Plate & Bolts



3-310 SHOWEROFF concealed metering shower valve with integral stop and 1/2" IPS **back connections** (model 4-427). Fre-Flo institutional shower head with adjustable spray (model 4-295B). All mounting fasteners for valve and head are vandal-resistant recessed hex socket type.

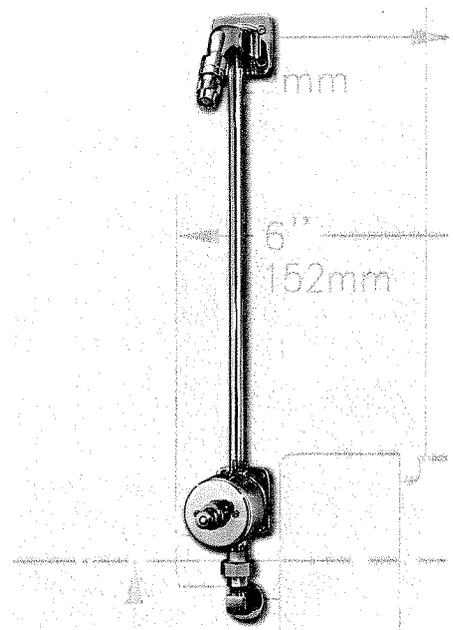
3-320 SHOWEROFF concealed metering shower valve with integral stop for thin wall and 1/2" IPS connections (model 4-428). Fre-Flo institutional shower head with adjustable spray (model 4-295B). All mounting fasteners for valve and head are vandal-resistant recessed hex socket type.

3-325 SHOWEROFF concealed metering shower valve with integral stop and 1/2" sweat connections (model 4-420). Fre-Flo institutional shower head with adjustable spray (model 4-295). All mounting fasteners for valve and head are vandal-resistant recessed hex socket type.



3-310-R SHOWEROFF concealed metering shower valve with integral stop, 1/2" IPS **back connections** and escutcheon with **rear mounting** (model 4-427-R). Fre-Flo institutional shower head with adjustable spray (model 4-295B). Back plate and thru bolts for extra thick wall. Mounting fastener for head is vandal-resistant recessed hex socket type.

3-320-R SHOWEROFF concealed metering shower valve with integral stop for thin wall, 1/2" IPS connections and escutcheon with rear mounting (model 4-428-R). Fre-Flo institutional shower head with adjustable spray (model 4-295B). Back plate and thru bolts for extra thick wall. Mounting fastener for head is vandal-resistant recessed hex socket type.



3-330 SHOWEROFF exposed metering shower valve with integral stop (model 4-425), wall flange, union and street ell with escutcheon. 20" head riser with extended head bracket (model 4-445). Fre-Flo shower head with adjustable spray (model 4-285).

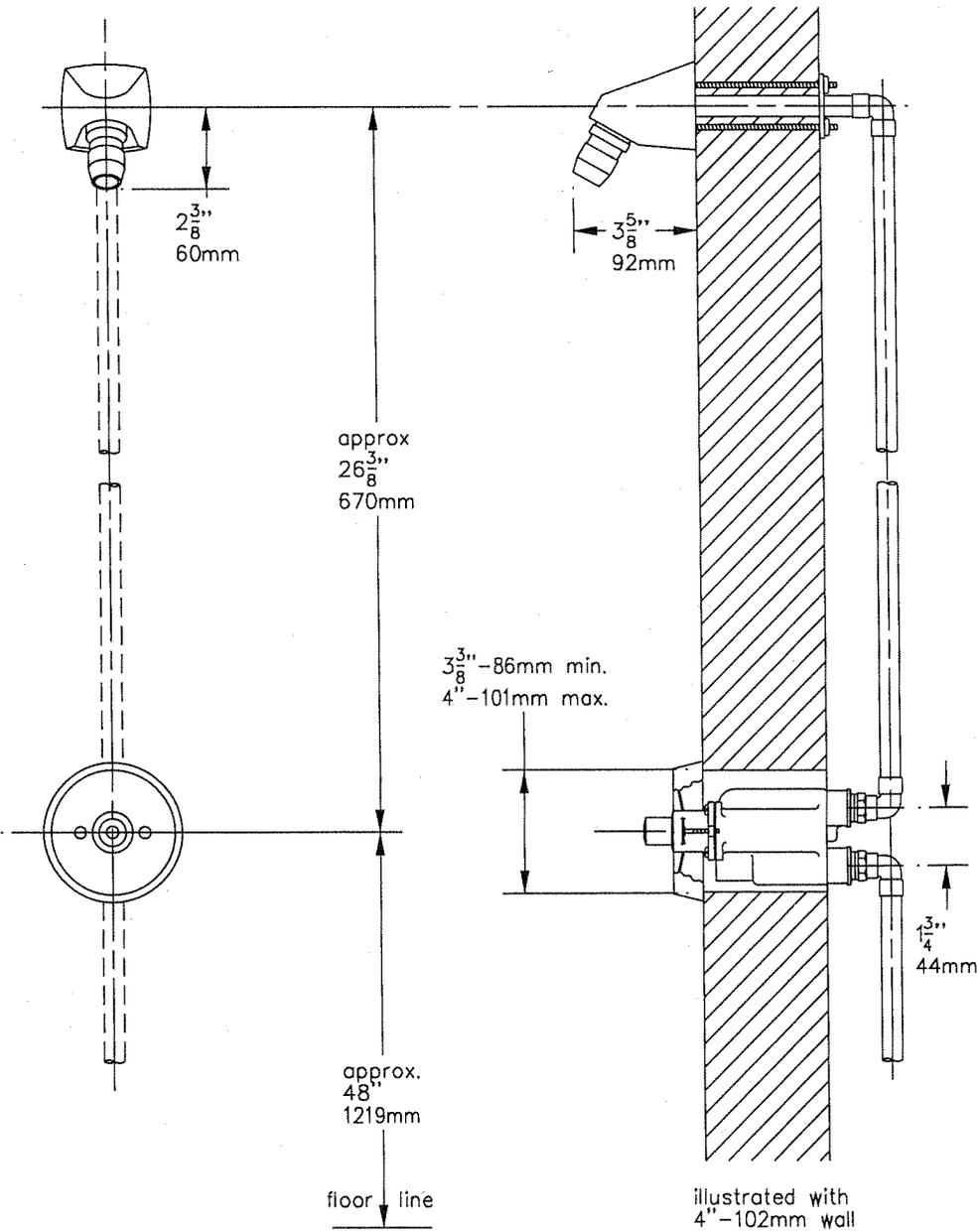
Modifications (3-330 only):

Suffix A: Anchor Plates for ceramic tile

Suffix B: Back Plates & Bolts

3-310

Showeroff® shower limiter valve with integral stop and 1/2" IPS back connections. Fre-Flo institutional shower head with adjustable spray. Nozzle-type design for maximum protection against hard water mineral build-up. Back plate and thru bolts for extra thick wall. All mounting fasteners for valve and head are vandal resistant recessed hex socket type.



This drawing to be used for rough-in installation only. All floor to center dimensions optional. Concealed piping and fittings not furnished by manufacturer. For ADA compliance (Americans with Disabilities Act) consult ADAAG or your state regulations for proper product choice and mounting locations. For complete installation, adjustment and service information see installation instructions.

Symmons® INDUSTRIES, INC.

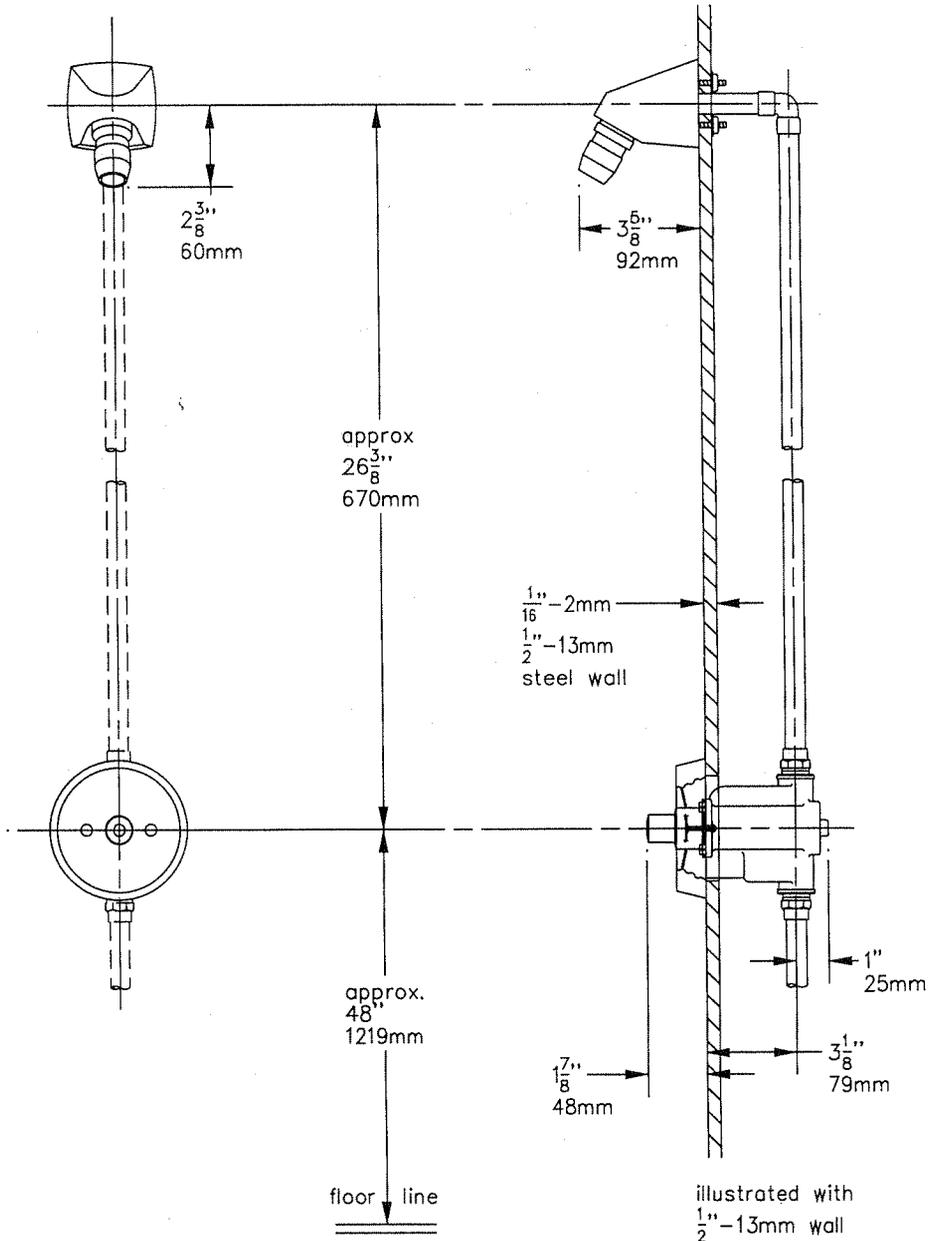
31 Brooks Drive, Braintree, MA 02184-3804

Tel: 1-800-SYMMONS, (781) 848-2250 Fax: 1-800-961-9621, (781) 843-3849

Web site: www.symmons.com © 2001-2004 Symmons Industries, Inc. 072501

3-320

Showeroff® shower limiter valve with integral stop for steel wall and 1/2" IPS connections. Fre-Flo institutional shower head with adjustable spray. Nozzle-type design for maximum protection against hard water mineral build-up. All mounting fasteners for valve and head are vandal resistant hex socket type.



This drawing to be used for rough-in installation only. All floor to center dimensions optional. Concealed piping and fittings not furnished by manufacturer. For ADA compliance (Americans with Disabilities Act) consult ADAAG or your state regulations for proper product choice and mounting locations. For complete installation, adjustment and service information see installation instructions.

Symmons® INDUSTRIES, INC.

31 Brooks Drive, Braintree, MA 02184-3804

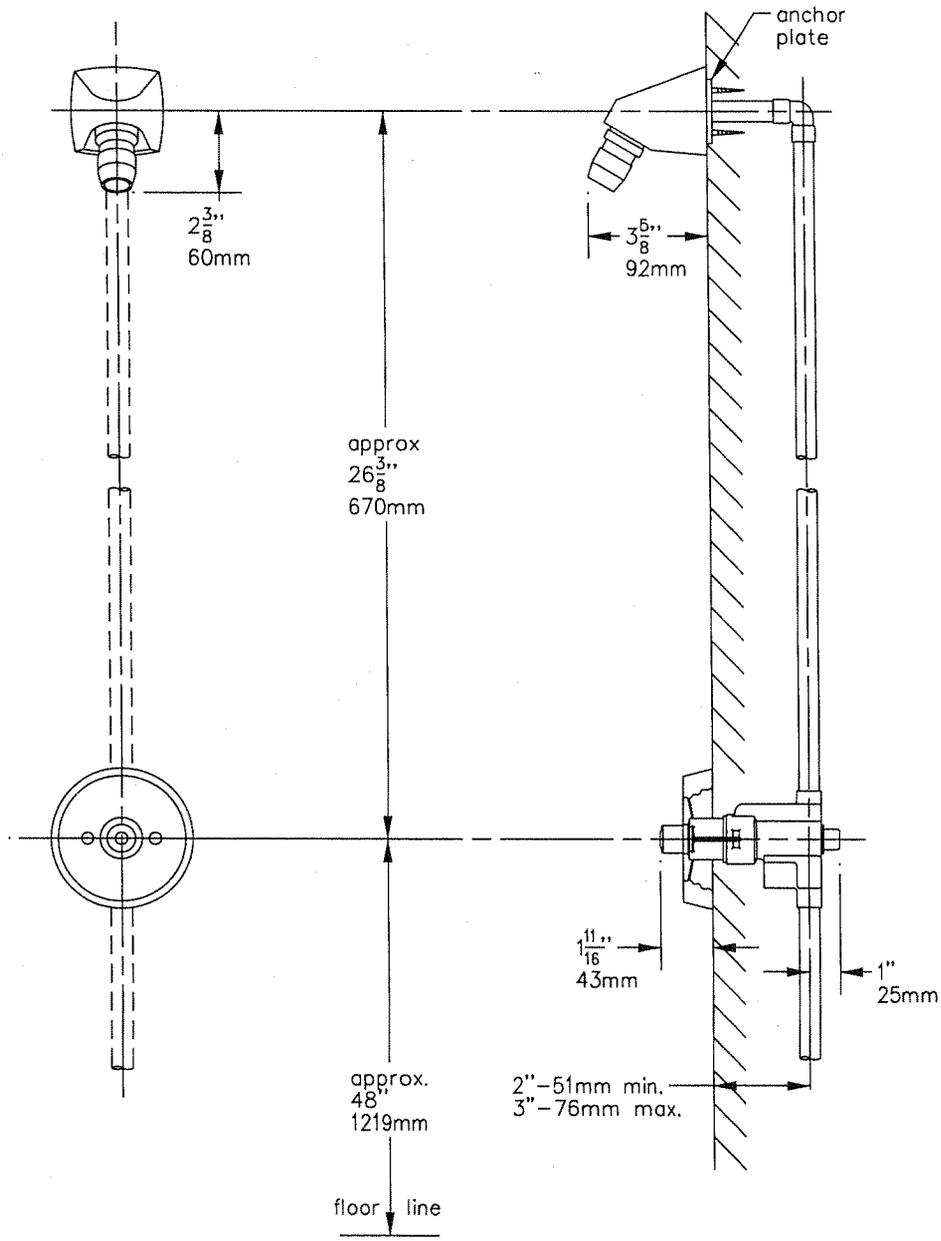
Tel: 1-800-SYMMONS, (781) 848-2250 Fax: 1-800-961-9621, (781) 843-3849

Web site: www.symmons.com © 2001 Symmons Industries, Inc. 072501

3-325

Showeroff® shower limiter valve with integral stop and 1/2" sweat connections. 4-295 Fre-Flo institutional shower head with adjustable spray. Nozzle-type design for maximum protection against hard water mineral build-up. All mounting fasteners for valve and head are vandal resistant recessed hex socket type.

Suffix A: Anchor plate for use with ceramic tile



This drawing is to be used for rough-in installation only. All floor to center dimensions are optional. Concealed piping and fittings are not furnished by the manufacturer. For ADA compliance (Americans with Disabilities Act) consult ADAAG or your state regulations for proper product choice and mounting locations. For complete installation, adjustment, and service information, see the installation instructions.

Symmons® INDUSTRIES, INC.

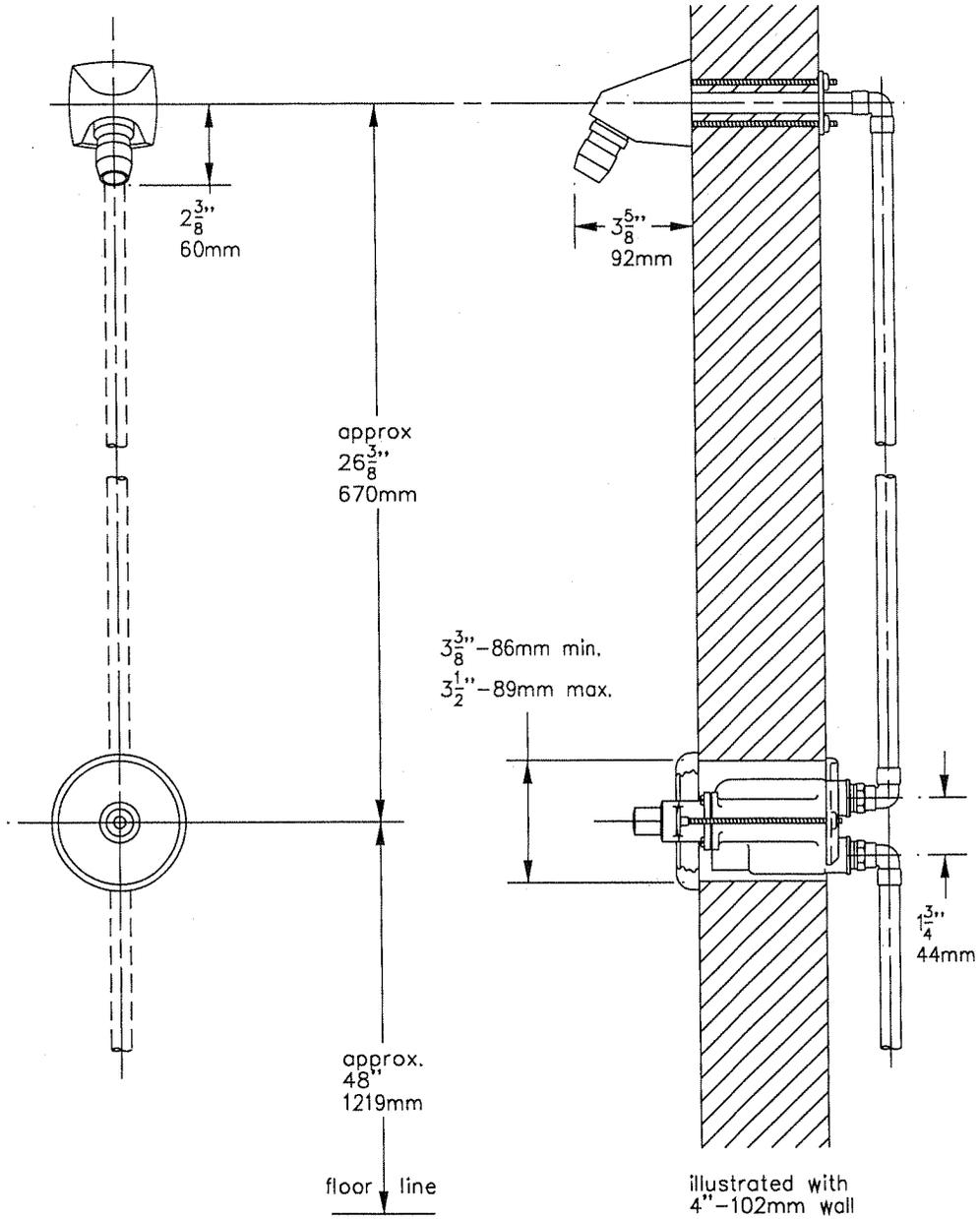
31 Brooks Drive, Braintree, MA 02184-3804

Tel: 1-800-SYMMONS, (781) 848-2250 Fax: 1-800-961-9621, (781) 843-3849

Web site: www.symmons.com © 2001 Symmons Industries, Inc. 072501

3-310-R

Showeroff® shower limiter valve with integral stop, 1/2" IPS back connections and escutcheon with rear mounting. Fre-Flo institutional shower head with adjustable spray. Nozzle-type design for maximum protection against hard water mineral build-up. Back plate and thru bolts for extra thick wall. All mounting fasteners for valve and head are vandal resistant hex socket type.



This drawing to be used for rough-in installation only. All floor to center dimensions optional. Concealed piping and fittings not furnished by manufacturer. For ADA compliance (Americans with Disabilities Act) consult ADAAG or your state regulations for proper product choice and mounting locations. For complete installation, adjustment and service information see installation instructions.

Symmons® INDUSTRIES, INC.

31 Brooks Drive, Braintree, MA 02184-3804

Tel: 1-800-SYMMONS, (781) 848-2250 Fax: 1-800-961-9621, (781) 843-3849

Web site: www.symmons.com © 2001-2003 Symmons Industries, Inc. 072501

Appendix 7

Appendix 7

Projected Water Conservation Breakdown for Ala Wai Small Boat Harbor

Water Conservation Savings

Comfort Stations

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Water Usage (gpd)	Water Conservation Savings Percentage	Water Saved (gpd)
Water Closet (Toilet)	135	41%	2,591	54%	1,400
Urinal	45	14%	864	71%	600
Lavatory	40	12%	768	90%	700
Showers	68	20%	1,305	26%	300
Basin/Sink	12	4%	230	-	-
Drinking Fountains	2	1%	42	-	-
Spigots	30	9%	576	-	-
Total	332	100%	6,371		3,000

Hawaii Yacht Club

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Water Usage (gpd)	Water Conservation Savings Percentage	Water Saved (gpd)
Water Closet (Toilet)	30	15%	607	54%	300
Urinal	15	7%	303	71%	200
Lavatory	18	9%	364	90%	300
Basin/Sink	20	10%	404	-	-
Drinking Fountains	2	1%	40	-	-
Spigots	120	59%	2,426	-	-
Total	205	100%	4,145		800

Fuel Dock Facility

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Water Usage (gpd)	Water Conservation Savings Percentage	Water Saved (gpd)
Water Closet (Toilet)	10	9%	348	54%	200
Urinal	5	5%	174	71%	100
Lavatory	4	4%	139	90%	100
Showers	8	8%	278	26%	100
Basin/Sink	4	4%	139	-	-
Spigots	25	24%	869	-	-
Washing Machines	50	47%	1,738	-	-
Total	106	100%	3,685		500

Other Facilities not Metered

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Water Usage (gpd)	Water Conservation Savings Percentage	Water Saved (gpd)
Water Closet (Toilet)	10	0%	62	54%	30
Urinal	5	0%	31	71%	20
Lavatory	4	0%	25	90%	20
Showers	16	0%	99	26%	30
Basin/Sink	4	0%	25	-	-
Spigots	3620	99%	22,468	-	-
Drinking Fountains	2	0%	12	-	-
Total	3661	100%	22,722		100

All Facilities

Type of Fixture	Fixture Unit Count	Percentage of Total Fixtures	Water Usage (gpd)	Water Usage (gpd) Rounded (100s)	Water Conservation Savings Percentage	Water Saved (gpd)
Water Closet (Toilet)	185	4%	3,607	3,600	54%	1,940
Urinal	70	2%	1,372	1,400	71%	990
Lavatory	66	2%	1,295	1,300	90%	1,170
Showers	92	2%	1,682	1,700	26%	440
Basin/Sink	40	1%	799	800	-	-
Spigots	3795	88%	26,339	26,400	-	-
Drinking Fountains	6	0%	95	100	-	-
Washing Machines	50	1%	1,738	1,700	-	-
Total	4304	100%	36,927	37,000	Total Water Saved	4,540