Board of Water Supply
City and County of Honolulu

2019

RATE STUDY

Water for Life, Ka Wai Ola

REPORT –
FINAL

Water Rate Study

Honolulu Board of Water Supply

August 2019

CDM Smith

About the Cover:

Pure Water – Man's Greatest Need, 1958 - Juliette May Frasier

A large, richly colored mural spans the walls behind the customer service counter in the lobby of the Board of Water Supply (BWS) Public Service Building. The mural depicts agricultural activities on Oʻahu, from pre-contact to the 20th century.

A section of the mural was selected to adorn the cover of this Rate Study.

Juliette May Frasier was born in Honolulu in 1887. After graduating from Wellesley College withan arts degree, she returned to Hawaii to teach art.

Acknowledgements

The Rate Study follows upon the Honolulu Board of Water Supply's Long Range Financial Plan, which was adopted in 2018, and Water Master Plan, which was adopted in 2016. Critical to the development of the Rate Study was a diverse, collaborative team of contributors and reviewers. The following organizations and their staff have dedicated significant time and effort to shaping a reliable, sustainable water future for the people of O'ahu.

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Barry Usagawa, Water Master Plan Project Executive

Joseph Cooper, Water Rate Study Project Manager

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Jennifer Elflein, Customer Care

Michael Fuke, Field Operations

Kevin Ihu, Water System Operations

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Henderson Nuuhiwa, IT

Jason Takaki, Capital Projects

Barry Usagawa, Water Resources

Joseph Cooper, Finance

Program Management Team and Independent Peer Review

Stepp Consulting Inc.

Harris & Associates

Consultant Team

CDM Smith

Harris & Company

Public Financial Management, Inc.

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Abbreviations and Acronyms

AWWA	American Water Works Association
Board	BWS Board of Directors
BWS	Board of Water Supply
City	City and County of Honolulu
COS	costs of service
du	dwelling unit
E.M.	equivalent meters
ENV	Department of Environmental Services
ESPC	Energy Savings Performance Contract
FY	fiscal year
JABSOM	John A. Burns School of Medicine
k-gal	thousand gallons
M	million
mg	million gallons
mgd	million gallons per day
mo	month
O&M	operation and maintenance
R-1	See page 2-3
RO	reverse osmosis
SCADA	supervisory control and data acquisition
T&D	transmission and distribution

Section 1
Introduction

The City and County of Honolulu Board of Water Supply (BWS) is committed to providing the people of O'ahu with safe, dependable, and affordable water now and into the future. To meet this commitment, the BWS incurs annual costs to operate, maintain, repair, replace, expand, and upgrade the water system. To pay for these costs, the BWS must generate its own revenue through charges for services rendered. Water rates, which account for the majority of revenue, were last adjusted on July 1, 2015. This report documents the process for updating the water rates.

The BWS is a semi-autonomous agency that provides approximately 145 million gallons per day (mgd) of potable water and 10 mgd of non-potable water to roughly one million people in the City and County of Honolulu (City) on O'ahu. The municipal potable water system provides dependable service through a complex system of 2,100 miles of pipe, 386 source and booster pumps, 212 water sources (wells, tunnels, and shafts), and 171 water storage reservoirs. The BWS provides non-potable water for irrigation and industrial uses through a water recycling facility and several separate brackish water sources. Groundwater is the only source for the BWS potable water supply, coming from naturally filtered aquifers that can withstand periods of drought. The BWS water system delivers high quality water at sufficient quantities to provide for the health and safety of the community and has built-in redundancies and resiliency.

1.1 Purpose

The purposes of this report are:

- to examine the future revenues of the water utility under existing rates, the BWS's total operating expense and capital financing requirements, and the adequacy of projected revenues to meet the BWS's total requirements;
- to allocate the BWS's net revenue requirements (revenues to be generated by rates (or all expenses less non-rate and/or non-operating revenues)), or costs of service, for a representative test year to the various customer classes in accordance with the respective service requirements that each class places on the system; and
- to develop a suitable Schedule of Water Rates and Charges that should produce revenues adequate to meet the financial needs of the BWS on a basis that recognizes customer costs of service and BWS policy considerations.

The BWS operates on a fiscal year (FY) starting July 1. This report covers the five-year period of July 1, 2018 (FY 2019) through June 30, 2023 (FY 2023).

1.2 Methodology

This study followed American Water Works Association (AWWA) M1: *Principles of Water Rates, Fees and Charges*, 7th edition guidelines, best fitting the data available from the BWS. The AWWA

is an international scientific and educational association founded in 1881 to improve water quality and supply. This report presents the results of a detailed study of projected revenue requirements, costs of service allocations, and proposed rates for water service. Revenues and revenue requirements are projected for the study period of FY 2019 – FY 2023, recognizing anticipated changes in the number of customers and water use throughout the service area. The study of revenue requirements recognizes projected operation and maintenance expense, capital improvement requirements met from revenues, principal and interest payments on existing and projected revenue bond issues, as well as other system obligations, debt service coverage, and working capital requirements. Allocated costs of water service are developed for each class of customer and type of service based on considerations of the BWS's revenue needs and projected customer service requirements. Water rate adjustments are designed for customers in accordance with allocated costs of service and BWS policy and administrative considerations.

The rate making process can include three steps as shown in Figure 1-1: determining revenue requirements from a financial plan or cashflow projection, costs of service, and rate setting. Sometimes a utility already has a cashflow projection and the rate setting process focuses on costs of service and rate setting. Sometimes the focus is solely on rate setting from the known cashflow projection. For the BWS, the rate setting process rigorously stepped through all three components within a paradigm of strong public engagement.

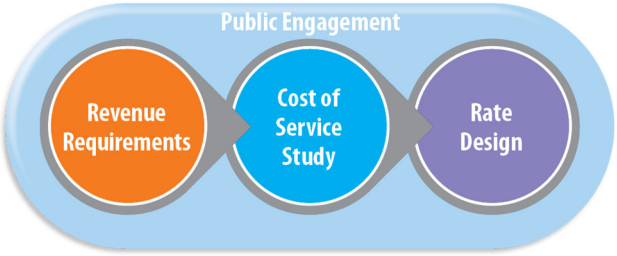


Figure 1-1. Primary Steps of Rate Making

The rate design process can vary between a simple process or an iterative process, soliciting feedback from internal and external stakeholders. The rate design process for the BWS, as shown in Figure 1-2, was an interactive and iterative process. Major steps in the process are shown in the center of the figure. The corresponding sections of this report and dates when those steps occurred are shown to the left and right, respectively. Results of surveys and Stakeholder Advisory Group key values set the initial trend for designing rates. Recommended Board guidance based on those initial rate designs was used to further refine the proposed rates. Additional feedback was solicited from the Stakeholder Advisory Group and the public, leading to the final review and acceptance of the proposed rates by the Board in August 2018. These steps are described in detail in this report. The Board Resolution adopting the rates is included in Appendix A.

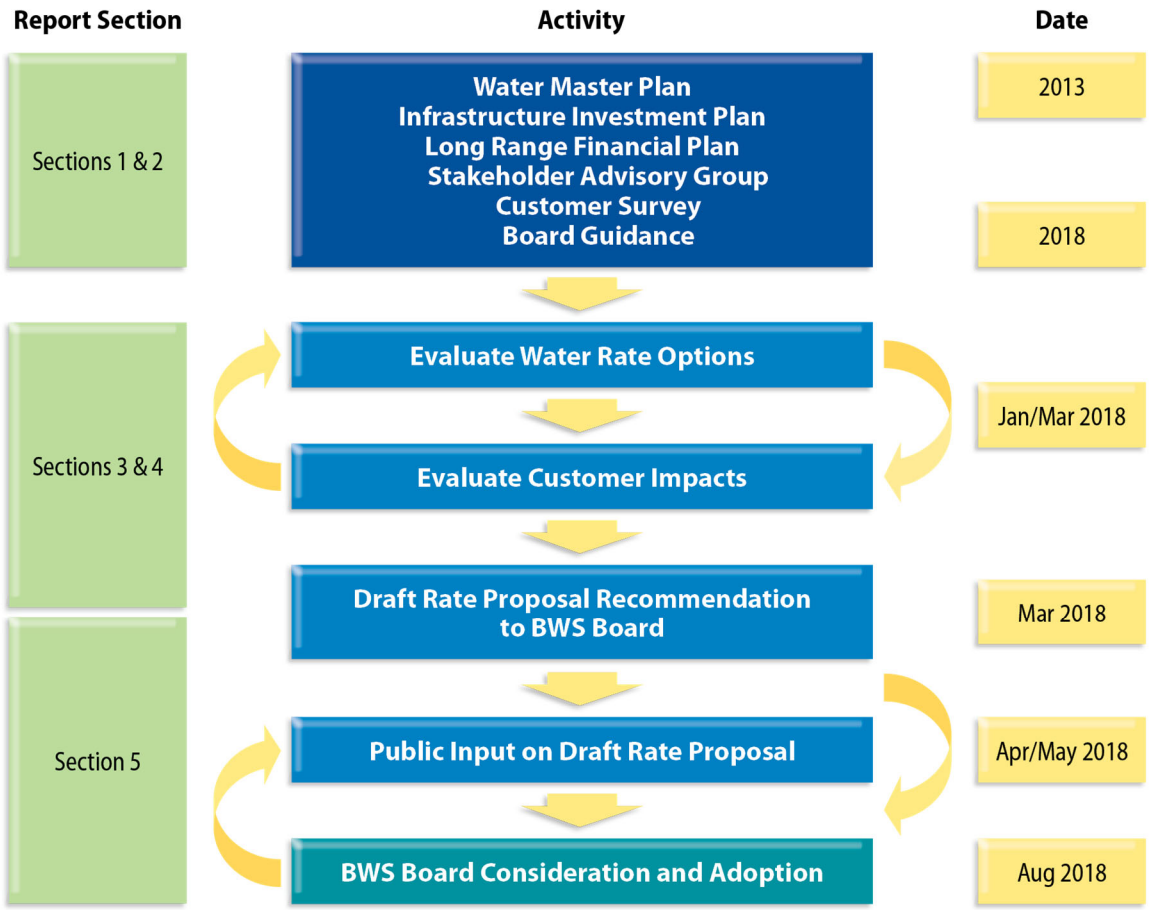


Figure 1-2. Iterative Rate Making Process

1.3 Foundations of the BWS's Rate Planning Process

1.3.1 Vision

The BWS's vision is Ka Wai Ola, Water for Life. This vision, the motivating force behind the BWS's planning policies and actions, captures the critical need for water – that water is the basis for life. With this vision comes the responsibility of the BWS's stewardship of, and the duty to manage, our natural water resources for both present and future generations. The ancient Hawaiians valued water as one of nature's greatest gifts and they lived in harmony with water. Land divisions (ahupua'a) mirrored the natural ecosystem – land was divided according to watershed boundaries, spanning from the mountain tops through upland forests to flatlands and the shore. Formal rules governed the use of water and regulations were established and enforced in order to cultivate the resources in each ahupua'a, to conserve as much as possible to lower the stress on the resources, and to ensure that a pure supply was available to everyone whether they lived in the mountains or close to the sea.

1.3.2 Mission

In Hawaii, water is a public trust resource and the BWS serves its customers with this trust in mind. The mission of the BWS is to provide safe, dependable, and affordable water now and into the future.

Safe addresses the multiple areas of individual and community needs. Water must meet all statutory and regulatory compliance standards in providing water for consumption and other uses. Water must provide for public health and safety such as firefighting and sanitation needs.

Dependable relies upon three factors:

- Sources of water must be sufficient and available now and into the future. The BWS ensures this through management of the watershed and groundwater supply, long range planning, and possible development of alternative sources of water.
- A water system that is designed, constructed, and operated with redundancy that continues delivery of water even with disruptions in parts of the system.
- Employees of the BWS who are committed to providing their customers with high quality water and excellent service.

Affordable water delivery is primary. The BWS establishes programs for efficiency in water use through conservation, infrastructure installation, and water system operations and maintenance. The BWS continually implements changes to its systems to deliver water at the most responsible cost to the customer.

To meet this mission, a variety of initiatives are either underway or have been completed. Among them are the Water Master Plan, development of Watershed Management Plans, the Water Conservation Plan, the Energy Savings Program, the Long Range Financial Plan, and the latest update to the Strategic Plan, as depicted in Figure 1-3. The Capital Improvement Program (referred to as the Infrastructure Investment Plan during the public engagement process) is derived from the recommendations in the Water Master Plan.

Figure 1-3. BWS Plans and Programs

1.3.3 Water Master Plan

To continue to efficiently and effectively fulfill this important mission, the BWS engaged in a rigorous three-year process to develop the Water Master Plan. The work effort integrated multiple elements in formulating the plan recommendations, including consistency with watershed management plans and development of strategies to ensure long-term sustainability in the face of growth, climate change, and other challenges. The analysis included performing a thorough condition assessment of the BWS infrastructure, developing hydraulic models for the entire BWS system, performing hydraulic evaluations of the water systems, and assessing necessary system improvements. The Water Master Plan provides the basis for identifying and prioritizing capital projects and a sustainable financial program. The Board adopted the Water Master Plan by resolution in October 2016[1] "institutionalizing its findings and direction and embedding them into the organization, institutionalizing its guidance for decades to come." The Board further resolved that the BWS proceed with implementing the Water Master Plan and empowered the Manager with flexibility for non-substantive adjustments. The Board requires that the Manager annually report any updates to the Water Master Plan, as well as the Health of the Water System Scorecard.

1.3.4 Capital Improvement Program

The Capital Improvement Program was developed to put the Water Master Plan into action. The program provides an engineering-based strategy for when specific water infrastructure projects

[1] BWS. 2016 Water Master Plan. Available at: https://www.boardofwatersupply.com/water-resources/water-master-plan. October 2016.

should be implemented and prioritizes renewal and replacement of portions of the water system based on risk.

1.3.5 Long Range Financial Plan

The Long Range Financial Plan was developed to support the recommendations from the Water Master Plan, the Infrastructure Investment Plan and Operating Budgets. It includes two planning horizons – short term and long term. Short term refers to the current budget year plus planning years 1-10, covering the period of FY 2018 – FY 2028. Long term refers to the subsequent period of FY 2029 – FY 2047. A ten-year financial model was developed for the short-term period. Qualitative analyses of various planning scenarios were applied for the long-term period to help evaluate uncertainties, identify strategies, inform customers and other stakeholders, and guide decision-makers as they continue to plan for O'ahu's water future. The Board adopted the Long Range Financial Plan in March 2018[2].

1.3.6 Strategic Plan

The Strategic Plan is a mechanism for the BWS to develop and apply near-term implementation actions based on the longer-term planning documents (e.g., the Water Master Plan). The BWS updated its 5-year Strategic Plan[3] for 2018 through 2022 and the Board adopted the plan in April 2017. The Strategic Plan provides an internal and external perspective of the commitment of the BWS employees to deliver its mission by focusing on three strategic goals – resource, operational, and financial sustainability. These three strategic goals are interrelated and coordinated with the three main points of the BWS's mission.

Resource Sustainability
Protect, conserve, and manage O'ahu's water supplies and watersheds now and into the future through adaptive and integrated strategies.

Operational Sustainability
Build an effective organization that continuously works to provide dependable water service.

Financial Sustainability
Implement sound fiscal strategies to provide safe, dependable, and affordable water service.

For each goal, the Strategic Plan established the specific objectives presented in Table 1-1, each of which is relevant to and is informed by the Water Master Plan.

[2] Board minutes. March 27, 2018. Resolution No. 886, 2018.
[3] BWS. Strategic Plan 2018 – 2022. Available at: https://www.boardofwatersupply.com/about-us/bws-strategic-plan. April 2017.

Table 1-1. BWS Strategic Plan Goals and Objectives

Strategic Goals	Category	Strategic Objectives	Water Master Plan Objective
Resource Sustainability	Climate Change	We will increase our understanding and adapt to climate change to manage O'ahu's water resources and protect the limited water supply.	Water Resources Sustainability
	Water Quality	We will protect, preserve, and collaborate to ensure the safety and quality of O'ahu's fresh water resource.	Water Quality, Health and Safety
	Watershed Management	We will ensure healthy forests, recognizing the essential role of watersheds for sustainable water supply (capture and recharge).	Water Resource Sustainability
	Water Conservation	We will conserve supply and system capacity by reducing per capita demand and increasing water efficiency.	Water Conservation
Operational Sustainability	Organization	We will ensure the necessary workforce, competencies, tools and resources to support current and future needs.	All Water Master Plan Objectives
	Infrastructure	We will renew and improve the water system to ensure water system adequacy, dependable service, and operational efficiency.	System Reliability and Adequacy
	Customer Service	We will proactively and consistently provide a quality experience in every customer interaction.	Cost and Affordability
	Technology	We will ensure that our technology systems are current and leverage opportunities in technology to effectively support current and future BWS needs.	System Reliability and Adequacy Cost and Affordability
Financial Sustainability	Financial Opportunities	We will pursue and leverage financial opportunities.	Cost and Affordability
	Financial Planning	We will develop and implement short- and long-term financial plans and policies.	Cost and Affordability

Source: Board of Water Supply, Strategic Plan 2018 – 2022, page 10.
Water Master Plan objectives shown for alignment between the Strategic Plan and Water Master Plan.

1.4 Engaging the Public

Public engagement was foundational to BWS's rate setting process. The BWS has actively sought public input throughout this process, including creating a Stakeholder Advisory Group with monthly meetings open to the public, conducting surveys, presenting at neighborhood boards, and numerous other activities. The inputs and feedback received from the different stakeholder groups and citizens engaged, shaped the targeted pipeline replacement program, financial policies, cost equity, and rate structure ultimately adopted by the Board.

The process had two main focuses. The first occurred during development of the financial plan, cost allocation and rate alternatives process. The Stakeholder Advisory Group played key roles in providing input to the rates development process. The second occurred after the proposed rates were developed and comprised the extensive public outreach via community meetings, additional stakeholder groups such as agricultural and business development communities.

1.4.1 Stakeholder Advisory Group Process

The successful Stakeholder Advisory Group process from the Water Master Plan effort was carried into the financial planning, cost of service, and rate setting process. The BWS values the input of the Stakeholder Advisory Group and believes it is an important part of an open and transparent process for setting rates. This group was instrumental in providing input on the financial plan, cost equity and rate structure for the Board's consideration.

The group is comprised of individual stakeholders representing the following interests:

- Agriculture
- Community organizations
- Developers
- Environmental
- Every council district
- Financial industry
- Golf
- Hawaiian culture
- Homeowner associations
- General contractors
- Large water users
- Realtors
- Seniors/ low income
- Travel/ tourism industry
- Small business
- Utilities

Through the Stakeholder Advisory Group, the BWS sought to learn more about the water-related perspectives and concerns of varied constituencies. By leveraging the Stakeholder Advisory Group's links with organizations and communities of interest, the BWS sought to strengthen the public's understanding of O'ahu's complex water issues and enhance public confidence in the BWS's commitment and ability to provide safe, dependable, and affordable water now and into the future.

As the BWS moved forward with decisions on the capital improvement program, financial plan, costs of service, and rate study, the members played a pivotal role by providing recommendations to the BWS on the best options to achieve the critical and delicate balance between water service adequacy and dependability, and infrastructure costs and rate affordability as well as recommendations regarding key financial policies and pipeline replacement scenarios.

Through monthly meetings, the group discussed and made recommendations for the BWS's consideration regarding:

- Key financial policies
- Pipeline replacement scenarios
- Subsidization of specific customer classes
- Affordability issues

Table 1-2, on the following page, lists the Stakeholder Advisory Group meetings directly related to developing the rates. The topics discussed in these meetings are discussed further in this

report. Meeting presentations, notes and materials from these Stakeholder Advisory Group meetings are posted on the BWS website[4].

Table 1-2. Stakeholder Advisory Group Meetings and Topics

Meeting	Date	Topics
10	November 15, 2016	Introduction to financial planning and water rates process
11	January 10, 2017	Financial planning policies overview
12	February 7, 2017	Overview of O&M components, revenue adjustments for different pipeline replacement scenarios
13	March 14, 2017	Strawman financial policies
14	April 19, 2017	Review strawman financial policies, pipeline break scenarios, sources/ uses of funds
15	May 18, 2017	Current rates & structure overview, how funds are used, rate objectives, financial policies
16	June 21, 2017	Value statements, fixed v. variable costs, overview of tiers, types of affordability programs, Water Systems Facilities Charge, costs of service
17	July 11, 2017	Zero sum game, affordability, Water Systems Facilities Charge
18	August 9, 2017	10-year financial forecast for different pipeline replacement scenarios, adopted FY 2018 budget, 30-year capital improvement program
19	September 12, 2017	Pipeline replacement review of scenarios 2 and 6, affordability, tier adjustment considerations, introduce “essential needs” concept
20	October 17, 2017	Reminder of adopted financial policies, review pipeline replacement scenario 2, zero sum game review, review residential and non-residential rates, subsidies for agricultural and non-potable customers
21	November 14, 2017	Fixed monthly charges, subsidies
22	December 7, 2017	Deep dive on fixed charges, 10-year revenue requirements
23	January 10, 2018	30-year financial outlook
24	February 21, 2018	Iterative rates modeling
25	March 13, 2018	Review Feb 2018 meeting
26	April 11, 2018	Water Systems Facilities Charge draft
27	July 10, 2018	Discuss input from public hearings/outreach on proposed rates

1.4.2 Outreach and Communications

Public outreach to the larger community regarding the Long Range Financial Plan and Rate Study was conducted in conjunction with the BWS’s comprehensive communications plan related to capital improvement programs and associated rate adjustments. Understanding the sensitivity of rate increases and benefits of keeping people informed, BWS reached out across the island to share results of the rate study, communicating proposed rates and the reasoning behind them. In

[4] The BWS stakeholder advisory group materials can be found at http://www.boardofwatersupply.com/cssweb/display.cfm?sid=125077.

total, these outreach efforts reached approximately 500,000 people. Public outreach and engagement related to rates included:

- Four regional public hearings held across O'ahu. All of the hearings were televised on Olelo, and the recorded videos were posted on the BWS website.
- Fifteen neighborhood board presentations were conducted, with more than 500 attendees.
- Ten interest group presentations were conducted with groups such as AARP, Chamber of Commerce Hawaii, developers, farmers, golf course managers, Hawaiian Electric, and the Honolulu Board of Realtors.
- Six City Council briefings were held, including the Mayor's cabinet of top City leadership.
- A prominent section of the BWS website was dedicated to proposed rate changes and received over 20,000 page views.
- A special edition of Water Matters, the BWS customer newsletter, was distributed to 170,000 account holders.
- Three articles in the local newspaper plus TV news coverage and social media posts.
- BWS staff participated in radio and TV interviews describing the proposed rates.
- Two surveys drew over 1,400 participants expressing their values and understanding of the new rates.

The BWS also met twice with the Small Business Regulatory Review Board to review the proposed changes to the rates and rate structure. The Small Business Regulatory Review Board considers any request from small business owners for review of any rule adopted by a state agency and to make recommendations to the agency regarding the need for a rule change. The BWS proactively presented the proposed rates to seek buy-in and to receive any feedback from a small business perspective. The Small Business Regulatory Review Board unanimously agreed to support the adoption of the proposed administrative rules.

Public feedback and comments were key objectives of these extensive outreach activities. Five individuals provided comment during the public hearing process and these comments were addressed during the hearings themselves. The BWS received an additional 33 comments via letters, email, BWS website, telephone and the Star Advertiser. Each commenter who provided contact information received a written response from BWS.

1.5 Roles and Responsibilities of the Board

As a semi-autonomous agency, the BWS is governed by a seven-member Board of Directors (Board). Five members are appointed by the Mayor and approved by the City Council. The remaining two directors are the Director of the Hawaii State Department of Transportation and the Chief Engineer of the City Department of Facility Maintenance. The Board sets policies and prescribes regulations for the management, control and operation of O'ahu's municipal water resources and distribution system, and sets and adjusts rates and charges for the furnishing of

water services. During this rate setting process, the Board received regular updates on the Stakeholder Advisory Group meetings including inputs and suggestions. The Board set policies (such as revised financial policies), selected a pipeline replacement scenario, set guardrails (i.e., a framework) by which to finalize rates and rate structures, and approved the rates.

The Board also created a Permitted Interaction Group comprising three members of the Board. The Permitted Interaction Group collaborated with the BWS senior management team to consider policy issues associated with the development of the updated schedule of water rates. From October 2017 to June 2018, monthly meetings were held with the Permitted Interaction Group to provide input regarding water rate policy issues, which was subsequently considered by the full Board as part of the water rate approval process. Table 1-3 lists the meetings and topics covered.

Table 1-3. Permitted Interaction Group Meetings and Topics

Meeting	Date	Topics
1	October 27, 2017	Sources and uses of funds; financial planning and water rates process; community values and objectives for water rate structure; water rate policy issues; current rate tiers; subsidies for agricultural, non-potable and R-1/RO water; and fixed monthly charges
2	November 29, 2017	Fixed monthly charges, fire protection charges, subsidies for affordable housing, homeless, and fire sprinkler installation projections.
3	December 13, 2017	Monthly customer charge, 10-year revenue requirement to implement the Water Master Plan
4	January 19, 2018	Water rate examples
5	February 23, 2018	Iterative results of water rate modeling
6	March 9, 2018	Iterative results of water rate modeling, water system facilities charge
7	April 18, 2018	Water system facilities charge
8	May 17, 2018	Summary of public hearings, water system facilities charge, subsidies
9	June 18, 2018	Summary of public hearings, subsidies

The Board approved the proposed rates in August 2018, which for residential water customers includes a new Essential Needs tier that provides up to 2,000 gallons per month per dwelling unit of water priced below cost to reflect affordability values as well as a higher use tier at a higher price to provide a financial incentive to use water more efficiently. Subsidies for Agricultural, Non-Potable, R-1 and RO customers also remain.

The overarching objective of the adopted water rates is to produce sufficient increases in revenues over a five-year period, providing the additional funds needed to implement the Water Master Plan and sustain safe, dependable, and affordable water resources on O‘ahu. Due to changes in the rate structure to meet the Board’s goals for cost of service recovery at the customer-class level, the percent change in a bill for a given customer may not reflect the annual revenue adjustment.

Based upon input received throughout the extensive public engagement process, the new rates were designed with the following goals in mind:

- increase investments in O‘ahu’s water infrastructure,
- decrease the frequency of water main breaks by increasing the rate of pipeline replacement,
- encourage conservation,
- provide funding for disaster recovery
- ensure that everyone pays more of their fair share of water service costs, and
- balance paying for infrastructure investments with a mix of cash, bonds, and low-interest loans to keep rates affordable.

Section 2

Financial Plan for 5-Year Water Rate Setting Period

The water rate study process begins with development of the financial plan, which answers these questions:

- Are projected revenues under current rates sufficient to meet net revenue requirements (costs associated with providing service)?
- If not, how much additional revenue is needed each year?

Once these two questions are answered, the process of developing and setting rates to support revenue requirements can begin. Since the BWS sets rates for a 5-year period, this report focuses on the first five years of the Long Range Financial Plan.

In March 2018, the Board adopted a Long Range Financial Plan that covers 30 years. This plan provides guidance as to the possible long-term impacts of financial policy decisions made today as well as a range of economic condition impacts. The plan first details the projected revenues and expenses for a 10-year period (FY 2019-FY 2028) based on the availability of sufficient and appropriate information for this timeframe. The plan then qualitatively examines revenues and expenses going out 30 years, as well as impacts to those cashflows from six different economic scenarios:

- Aggressive conservation: assume that demand decreases 1 percent per year.
- Aggressive growth: two sub-scenarios 1) high demand projection from the Water Master Plan and 2) 1 percent growth in usage per year
- Major natural disaster: assume damage to infrastructure increasing capital needs and reducing water rate revenue as service is interrupted or revenue collection is reduced.
- Major water source contamination: assume a major (~10 mgd) water source is impacted, increasing capital and O&M costs.
- Climate change: assume higher capital replacement due to groundwater salinity.
- Economic cycles: assume downturn similar to the great recession of 2008-2009.

This plan was developed as part of the intensive process with the Stakeholder Advisory Group. To develop a set of financial policies, this process included a several months-long, iterative discussion regarding the amount of working capital (amount of funds available to cover expenses), how to fund capital projects, appropriate level of debt service coverage, and maximum ratio of debt to net assets. The stakeholders reviewed the BWS's current financial policies, policies of comparable utilities, and bond rating agencies' guidance as a basis for suggesting revisions to the financial policies. Table 2-1 summarizes the old and new policies.

Table 2-1. Summary of Financial Policy Changes

Old	New
Unrestricted fund balance of 45 days of annual operating and maintenance expenses including debt service coverage	Target 180 days of operating and maintenance expenses, but never less than 60 days
1.6x senior debt service, 1.3x junior debt service	1.7x senior debt service, 1.6x all-in debt service
40-50 percent debt to net asset ratio	No more than 50 percent debt to net asset ratio
No specific contingency reserve	Included in revised target fund balance

The Stakeholder Advisory Group suggested these changes to maintain the BWS's strong credit ratings as well as concerns over having sufficient funds in the event of an emergency. The Board took the suggestions under consideration and adopted revised policies, which are included in Appendix B.

The stakeholder group also reviewed seven pipeline replacement scenarios that provided a range of levels of service (e.g., decreases in water main breaks) for different levels and rates of capital investment. The stakeholders weighed the level of service against the impact to annual costs (e.g., increased revenue to deliver a higher level of service) to determine the level of pipeline infrastructure replacement that could be funded in addition to other capital projects while also maintaining affordability. This input was shared with the Board, which recommended the financial plan and rate study process move forward with funding a strategy to reduce main breaks by ramping up main replacement to 1 percent per year within 10 years (constructed in 13 years), which eventually results in 21 miles per year replaced and is strongly aligned with the recommendations of the Water Master Plan.

The Long Range Financial Plan reflects the Board's policies and recommendations. The financial plan shown in this document focuses on the first five years of the Long Range Financial Plan, coinciding with the five-year rate setting period. This section steps through the development of the first 5-years of the financial plan, which is used to determine how much money the BWS needs to operate the water system each year.

2.1 Key Findings

The first 5-years of the financial plan (FY 2019-FY 2023) shows the BWS will need to generate additional revenue in order to meet projected annual operating costs, debt service, cash-funded capital, bond covenants, and required fund balances. An additional 2 percent of revenues is needed in both FY 2020 and FY 2021. An additional 4 percent of revenues is needed in both FY 2022 and FY 2023.

2.2 Projected Revenues Under Existing Rates

The first step is to project revenues from water sales and other sources, which requires understanding the customer classes, the existing rates, and projecting the number of bills and amount of billed water. These revenues comprise charges for services rendered (e.g., potable water delivery, non-potable water delivery, meter and service installation) and interest earnings. They do not include taxes or assessments. The BWS's main revenue source is water sales, which are derived from the number of accounts, the number of meters and customer usage.

2.2.1 Customer Classes

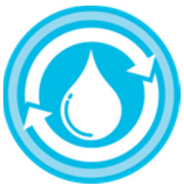
The BWS supplies potable and non-potable water to most of O'ahu. The majority of the BWS's customers receive water priced at retail rates with the balance of customers on contract rates. The current retail water customer classes are defined below:

Single-Family Residential: this customer class comprises single-family homes and duplexes.

Multi-Unit Residential: this customer class comprises residences not captured under Single-Family Residential such as triplexes, townhomes, condominiums and apartment buildings. Low-rise constitutes up to three stories in height. High-rise refers to higher than three living stories.

Non-Residential: this customer class comprises all customers whose property is not used for residential or agricultural purposes. Examples of Non-Residential customers include, commercial, industrial, government, religious, schools, hotels/ resorts and mixed commercial/ residential.

Agricultural: this customer class comprises those customers whose primary activities involve agriculture, stock raising or dairy farming on a commercial basis and have submitted an application for Agricultural service that is approved by the BWS. Only one dwelling unit is allowed on a meter qualifying for the agricultural quantity charge.



Non-Potable: this customer class comprises those customers that have elected to use non-potable brackish water for irrigation and landscape watering.

The BWS also provides infrastructure to support private fire protection systems. Private fire protection systems consist of special water services connected to automatic fire sprinkler systems usually installed in large buildings, multi-unit and high-rise complexes, and industrial plants. Private fire protection systems can also be connected to on-site private water systems with private fire hydrants usually in schools, shopping centers and townhouse complexes. These services consist of a lateral connection to the municipal water system, isolation valves, a detector check or FM meter and a backflow prevention device.

The BWS provides R-1 recycled wastewater for irrigation that meets the Reuse Guidelines Volume I: Recycled Water Facilities prepared by the Hawaii State Department of Health Wastewater Branch as well as reverse osmosis (RO) demineralized wastewater under contracts

with specific customers (contractual customers). The R-1 contractual rates fall into two categories: R-1 (Golf) and R-1 (Other) and reflect similar pricing within each subclass. However, R-1 (Golf) receives a larger discount due to the ancillary benefits golf courses provide such as stormwater abatement. The BWS also provides ocean cooling water under a contractual arrangement with the University of Hawaii, John A. Burns School of Medicine (JABSOM).

Most water customers pay for their water per the published Schedule of Rates and Charges for the Furnishing of Water and Water Service. This section describes the BWS's existing water rate schedule (in effect as of July 1, 2015 when rates were lasted increased).

2.2.2 Existing Rate Schedule

The existing rate schedule was last updated in 2011, with the last rate adjustment occurring on July 1, 2015 (FY 2016). That schedule consists of a billing charge and a quantity charge. The billing charge is a flat rate per month, regardless of meter size. The quantity charge varies by customer class and consists of three rate tiers (which vary by unit price and volume of water used) for Single-Family and Multi-Unit, two rate tiers for Agricultural, and a uniform rate for all water usage for Non-Residential and Non-Potable customers.

2.2.2.1 Billing Charge

The BWS charges its customers (except contractual customers) $9.26 per bill. The billing charge covers the costs of such things as the billing system, customer service and billing staff, meter maintenance and repair, meter reading and processing, and mailing bills.

2.2.2.2 Quantity Charge

The quantity charge is designed to recover all costs not recovered by the billing charge. Table 2-2 shows the current quantity portion of the water rate schedule. The billed quantities are based on the rounded down usage on a thousand gallon (k-gal) basis for the billing period.

Table 2-2. Existing Quantity-based Rate Schedule

Item	$/k-gal
Single-Family	
Tier 1: 0 – 13 k-gal/du	$4.42
Tier 2: >13 – 30 k-gal/du	$5.33
Tier 3: > 30 k-gal/du	$7.94
Multi-Unit	
Tier 1: 0 – 9 k-gal/du	$4.42
Tier 2: >9 – 22 k-gal/du	$5.33
Tier 3: >22 k-gal/du	$7.94
Non-Residential	
All usage	$4.96
Agricultural	
Tier 1: 0 – 13 k-gal	$4.42
Tier 2: >13 k-gal	$1.89
Non-Potable	
All usage	$2.47
du = dwelling unit k-gal = thousand gallons	

Single-Family Residential customers are billed based on the per dwelling unit (du) usage in the billing period. A dwelling unit is equal to one single-family residence. Per dwelling unit usage that falls within Tier 1 (<= 13 k-gal/du) is billed at $4.42/k-gal. For per dwelling unit usage that is greater than 13 k-gal/du, the quantity portion of the bill is divided into the tiers. For example, if the billed usage for a single-family home is 35 k-gal/du, the first 13 k-gal would be billed at $4.42/k-gal, the next 17 k-gal (30-13=17) would be billed at $5.33/k-gal, and the remaining 5 k-gal (35-30=5), would be billed at $7.94/k-gal. The quantity portion of the bill, for a single dwelling unit at 35 k-gal, would be:

Tier 1 = 13 k-gal/du * 1 du * $4.42/k-gal = $57.46

Tier 2 = 17 k-gal/du * 1 du * $5.33/k-gal = $90.61

Tier 3 = 5 k-gal/du * 1 du * $7.94/k-gal = $39.70

Total = $187.77

Since a duplex has two dwellings units, it would pay $4.42/k-gal for the first 26 k-gal of billed water (13 k-gal/du * 2 du), $5.33/k-gal for the next 34 k-gal, and $7.94/k-gal for billed usage over 60 k-gal.

The rate structure for Single-Family Residential and Multi-Unit Residential customers is an inclining tier structure. As more water is used, the higher the unit price of each tier. This structure is used to encourage efficient use of water and water conservation. However, that price signal may not be received by the customer if the tier points are not set at appropriate usage levels. The tier points were last adjusted more than 10 years ago; therefore, it is a good time to review the user characteristics and to adjust the tier points, if needed, to meet the goals and objectives of the BWS. User characteristics are discussed in Section 4.

Non-Residential customers are charged a uniform rate of $4.96/k-gal due to the highly variable water usage within this customer class.

Agricultural customers are charged for water use under a declining tier rate structure. This structure is sometimes used when a goal or objective is to provide a discount to certain sectors as a means to encourage economic development. The BWS uses a declining tier rate structure for agricultural customers to support local agricultural. The first tier is set equal to the first tier of the Single-Family customer class recognizing that many agricultural customers are served water for both their home and their farm through a single meter. The second tier is discounted since the water in this tier is most likely used for agricultural irrigation.

Where available, customers can choose to receive non-potable water for irrigation and other allowed uses. Non-Potable customers are charged a uniform rate of $2.47/k-gal, which is about 50 percent of the Non-Residential rate.

2.2.2.3 Private Fire Protection Charge

The BWS provides private fire service water under Section 2-214 of the BWS's Rules and Regulations. New customers applying for private fire service are assessed a one-time charge. For

water lost through leakage or used for non-fire protection purposes, the water use is billed at the regular Schedule of Water Rates and Charges at the non-residential quantity charge rate.

2.2.2.4 Other Charges

The BWS has the ability to apply a power cost adjustment to the water bills. If total actual electricity costs exceed the projected costs used to develop the rates, then the BWS may increase the quantity charge $0.01/k-gal for every $600,000, or increment thereof, that the actual costs were over the projected costs in the following fiscal year. For example, if actual electricity costs were $1.2 million more than projected when developing the rates, the quantity charge for all tiers would increase $0.02/k-gal, in the following fiscal year.

The BWS has the ability to apply an environmental regulations compliance fee cost adjustment to the water bills. Similar to the power cost adjustment, the BWS may increase the quantity charge by $0.01/k-gal for every $600,000, or portion thereof, of additional costs that the BWS incurs to comply with any federal or state environmental law or regulation.

2.2.2.5 Summary of Contractual Service

While the majority of BWS customers are billed per the Schedule of Rates and Charges, the BWS does provide some water through contracts. The BWS provides R-1 recycled water under 37 contracts to 24 different customers. Of those contracts, all but five include a clause that allows the rate to switch automatically from the contractual rate to a published R-1 rate. Therefore, this rate study includes consideration of a published R-1 recycled water rate in addition to the published Non-Potable water rate.

The BWS also provides RO water for six industrial customers under seven contracts. For three of those customers, if an RO rate is published and all RO customers are subject to the published RO rate, their RO water rate would automatically switch to the published RO rate. Therefore, this rate study includes consideration of a published RO rate in addition to the published Non-Potable water rate.

The BWS offers standby emergency service on a contractual basis. Emergency/ temporary interconnections are requested by customers served by a non-BWS water system and provide temporary emergency service in the event of an outage in that water system. Water drawn by the customer is charged per contract terms. Activation of the service requires approval by the Manager and Chief Engineer and is contingent upon impacts to the BWS customers' level of service and the BWS's ability to meet the Department's Water System Standards.

2.2.3 Historical and Projected Number of Water Bills

Table 2-3 shows the historical and projected bills for all water customers except contract customers. The projection of bills assumes 0.1 percent per year growth in the number of Single-Family Residential, Multi-Unit Residential and Non-Residential customer accounts while other accounts are assumed to remain constant[1]. Approximately 90 percent of bills are Single-Family

[1] The Water Master Plan estimated growth in water demand to average 0.2 percent per year between 2012 and 2040. If average usage per bill stays constant, then a change in the number of customers equates to a

Residential customers. The contractual customers are not shown since they are not currently subject to the monthly billing charge and only account for 0.02 percent of bills.

Table 2-3. Historical and Projected Number of Bills, Annual

Customer Class	Historical			Projected					
	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Single-Family	1,736,709	1,753,767	1,757,268	1,759,025	1,760,784	1,762,545	1,764,308	1,766,072	1,767,838
Multi-Unit	72,726	72,975	72,857	72,930	73,003	73,076	73,149	73,222	73,295
Non-Residential	100,607	101,015	100,671	100,772	100,872	100,973	101,074	101,175	101,277
Agricultural	5,642	5,733	5,625	5,624	5,624	5,624	5,624	5,624	5,624
Non-Potable	1,012	888	846	846	846	846	846	846	846
Total	1,916,696	1,934,378	1,937,267	1,939,197	1,941,130	1,943,064	1,945,001	1,946,939	1,948,880

Note: Totals may not add due to rounding.

2.2.4 Historical and Projected Billed Water Usage

Table 2-4 shows the historical (FY 2015 - FY 2017) and projected study-period water use. In FY 2017, the BWS's customers' billed water use was 47,120 million gallons (mg). The Single-Family Residential and Non-Residential customer classes each account for about 35 percent of water sales. Multi-Unit Residential customers account for 20 percent. The remaining customers account for about 10 percent of billed water usage. Projected water usage is the number of projected bills times the average water use per bill. The average water use per bill is based on the five-year average demands shown in the Water Master Plan[2]. Projected demands decrease about 0.5 percent per year on average between FY 2015 and FY 2025, resulting in a projected water demand of 46,671 mg by FY 2023.

change in demand. If that growth is not realized, rates would not generate sufficient revenues to meet costs. Therefore, conservative financial planning means using more conservative growth assumptions than those estimated for capital needs assessments to ensure sufficient revenues even if customer demand is lower than forecast. Basing the financial plan on lower projected growth and usage helps minimize the potential need for future large rate adjustments should water demand fall short of projections.

[2] This reduction in average consumption is a result of the BWS's focus on sustainability and customers' ongoing conservation efforts. Stewardship includes both watershed protection and using water resources more efficiently, which enhances the overall sustainability of the resource. In addition, lower water demand leads to lower costs in the future as it enables the BWS to defer and reduce the need to construct additional, possibly more expensive, capacity in the system.

Table 2-4. Historical and Projected Annual Usage, mg

Customer Class	Historical			Projected					
	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Single-Family Residential	16,806	17,064	16,476	16,887	16,819	16,752	16,685	16,618	16,551
Multi-Unit Residential	9,732	9,892	9,814	9,846	9,806	9,767	9,728	9,689	9,650
Non-Residential	16,059	16,440	15,954	16,124	16,059	15,995	15,931	15,867	15,803
Agricultural	1,138	1,160	1,142	1,135	1,130	1,124	1,118	1,113	1,107
Non-Potable	681	667	617	626	623	620	617	614	611
Contractual									
RO	513	535	541	541	538	535	533	530	527
R-1 (Other)	1,126	1,099	1,017	976	971	966	962	957	952
R-1 (Golf)	1,539	1,562	1,559	1,507	1,499	1,492	1,484	1,477	1,469
Total, mg (1)	47,594	48,419	47,120	47,640	47,445	47,250	47,056	46,863	46,671

(1) Does not include private fire protection water usage due to the wide variability in the amount of water that could be billed.

Note: Totals may not add due to rounding.

Once the number of bills and water use is projected, the existing rates can be applied to project water sales revenues.

2.2.5 Water Sales Revenue Under Existing Rates

Water sales revenue was estimated for the study period by applying the existing rates to the customer accounts and billed water use projections. The revenue remains relatively flat, as shown in Table 2-5, reflecting that the projected slight growth in customer accounts almost offsets the forecasted decrease in demands during the study period. The jump in revenues between FY 2015 and FY 2016 reflects, in part, the rate adjustment that went into effect on July 1, 2015. The decrease in revenue between FY 2016 and FY 2017 reflects lower billed water use in that year. For the BWS, weather is the single biggest factor that impacts water sales from one year to the next.

Table 2-5. Historical & Projected Water Sales Revenue Under Existing Rates, $M

Customer	Historical			Projected					
	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Single-Family	$87.0	$96.6	$94.1	$96.6	$96.3	$96.0	$95.7	$95.4	$95.1
Multi-Unit	$40.6	$45.4	$45.4	$45.3	$45.1	$44.9	$44.7	$44.6	$44.4
Non-Residential	$73.4	$82.2	$80.2	$80.9	$80.6	$80.3	$80.0	$79.6	$79.3
Agricultural	$2.2	$2.4	$2.4	$2.4	$2.4	$2.3	$2.3	$2.3	$2.3
Automatic Fire Sprinkler	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Non-Potable	$1.5	$1.6	$1.5	$1.6	$1.5	$1.5	$1.5	$1.5	$1.5
Contractual Water (1)	$5.6	$5.8	$5.9	$5.8	$5.9	$6.0	$6.1	$6.2	$6.3
Total	$211.3	$235.3	$229.7	$232.7	$231.9	$231.2	$230.5	$229.8	$229.1

(1) Does not include Ocean Cooling.

Note: Totals may not add due to rounding.

2.2.6 Other Sources of Revenue

Table 2-6 summarizes the other revenue sources of the BWS. The BWS generates additional revenue from providing billing services for the Department of Environmental Services (ENV), meter installations (domestic and private fire), rental income, interest earnings, ocean cooling[3], and other miscellaneous sources.

Table 2-6. Historical and Projected Miscellaneous Revenue, $M

Category	Historical			Projected					
	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Other Water Revenues	$1.9	$1.6	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
ENV Billing	--	$2.8	$2.9	$2.9	$2.9	$2.9	$2.9	$2.9	$2.9
Private Fire Protection Install	$0.7	$0.8	$0.9	$0.9	$0.9	$0.9	$0.9	$0.9	$0.9
Revenues from Installations	$0.7	$0.2	$0.6	$0.4	$0.4	$0.4	$0.4	$0.4	$0.4
Merchandising & Jobbing	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3	$0.3
Misc. Non-operating Revenue	$0.2	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Non-operating Rental Income	$0.3	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Interest Income	$3.1	$4.2	$4.2	$2.8	$3.2	$3.4	$3.4	$3.5	$3.5
Ocean Cooling	$1.2	$1.3	$1.3	$1.3	$1.3	$1.4	$1.4	$1.4	$1.4
Total	$8.4	$11.4	$10.7	$9.1	$9.6	$9.8	$9.8	$10.0	$10.0

Note: Totals may not add due to rounding.

Other revenues except for interest income and ocean cooling are presumed to remain flat. Interest earnings are estimated at 1 percent of the average fund balances. The annual ton-hours of ocean cooling is presumed to remain constant and that the unit rates increase 2 percent per year, resulting in a forecasted 2 percent per year increase in ocean cooling revenues. These revenues help off-set some of the rate-based revenue requirements. Other water revenues decrease from FY 2016 to FY 2017 since the BWS no longer provides billing services to the Department of Water (County of Kaua'i) and Department of Water Supply (County of Mau'i).

2.2.7 Total Projected Revenue Under Existing Rates

Table 2-7 presents the historical and projected revenues through FY 2023 at current rates. These revenues will be lowered by any bad debt expense (e.g., unpaid water customer bills that are written off).

Table 2-7. Estimated Revenues, $M

Category	Historical			Projected					
	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Water Sales (Table 2-5)	$211.3	$235.3	$229.7	$232.7	$231.9	$231.2	$230.5	$229.8	$229.1
Miscellaneous (Table 2-6)	$8.4	$11.4	$10.7	$9.1	$9.6	$9.8	$9.8	$10.0	$10.0
Total	$219.7	$246.7	$240.4	$241.8	$241.5	$241.0	$240.3	$239.8	$239.1

Note: Totals may not add due to rounding.

[3] The BWS provides potable water for ocean cooling under contractual arrangement with the University of Hawaii's JABSOM. This contract is set to expire in 2025.

2.3 Revenue Requirements

Revenue requirements are the utility's annual costs to provide service, in this case, potable water, non-potable/ recycled water, and service for fire protection. Revenue requirements comprise annual operation and maintenance (O&M) costs, capital related costs (e.g., annual debt service, cash-funded capital), and reserve requirements (e.g., debt service reserve, working capital). The BWS needs to have sufficient financial resources to enable it to proactively maintain water infrastructure, reduce the amount of emergency repairs, and conduct needed infrastructure improvements and/or expansions (also known as capital improvements) in a timely manner, all while providing safe, dependable, and affordable water service to its customers. Projections of the cash requirements to meet annual system expenditures (or revenue requirements) are developed in this subsection. Once the annual revenue requirements are known, the additional revenue needed to address any shortfall in meeting revenue requirements can be determined.

2.3.1 Operation and Maintenance Expense

2.3.1.1 BWS O&M Projection

Table 2-8 summarizes the budgeted FY 2018 and projected FY 2019 – FY 2023 O&M costs provided by the BWS. The costs projected for FY 2019 - FY 2023 include a mix of FY 2018 dollars and future dollars (escalated).

Table 2-8. Budgeted and Projected O&M Developed by the BWS, $M

Division & Staff Office	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Office of the Manager & Chief Engineer	$0.9	$0.9	$1.0	$1.0	$1.0	$1.0
Executive Support Office	$9.0	$8.8	$8.9	$9.3	$9.4	$9.6
Communications Office	$1.2	$1.2	$1.2	$1.2	$1.4	$1.4
Ocean Cooling	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6
Human Resources Office	$0.7	$0.8	$0.8	$0.7	$0.8	$0.8
Water Quality Division	$5.7	$5.4	$5.1	$5.5	$5.6	$5.7
Customer Care Division	$6.2	$6.6	$6.8	$7.1	$7.4	$7.8
Land Division	$0.7	$0.7	$0.8	$0.8	$0.8	$0.9
Water Resources Division	$11.8	$10.9	$11.3	$11.5	$11.7	$11.9
Field Operations Division	$31.6	$32.8	$34.1	$35.5	$37.0	$38.6
Capital Projects Division	$6.6	$7.2	$7.7	$7.9	$8.3	$8.5
Water Systems Operations Division	$19.0	$16.9	$17.2	$17.8	$17.9	$18.7
IT Division	$13.2	$13.2	$13.0	$12.8	$13.8	$15.1
Finance Division	$5.1	$5.4	$5.4	$5.5	$6.1	$5.9
Fixed Charges (1)	$48.2	$49.2	$50.5	$51.8	$53.1	$54.5
Total (2)	$160	$161	$164	$169	$175	$181

(1) Fixed charges include costs for utilities such as electricity and benefits such as retirement and health insurance.
(2) Does not include future debt service as that is modeled as a separate part of the revenue requirements. Projected costs represent a mix of FY 2018 and future year dollars.
Note: Totals may not add due to rounding.

The projections reflect that parts of the O&M costs are driven by increases in the capital improvement program and increased focus on watershed management, conservation, and recycled water operations consistent with the recommendations of the Water Master Plan

adopted in 2016. Goals from the Water Master Plan that would increase O&M costs include the following:

- Watershed management O&M activities are targeted to equal 4 percent of the capital improvement program.
- Conservation-related O&M activities are targeted to equal 4 percent of the capital improvement program.
- The percent of pipes checked for leaks each year is increased from 18 percent to 25 percent, as well as additional planning to identify and prioritize high-risk pipes.
- Increased maintenance costs to increase the availability of pump stations from 82 percent to greater than 90 percent.
- Increased effort to investigate, identify, and plan remedies for water loss.
- Have 100 percent of sources, pump stations, water treatment plants, and reservoirs utilizing microwave backbone for control data by FY 2023; which increases supervisory control and data acquisition (SCADA) costs.

Since the BWS cost projections include a mix of FY 2018 and future year dollars, the projection was adjusted to bring all costs to future year dollars, as well as other adjustments as discussed in the following section.

2.3.1.2 Adjusted O&M Projection

The projection shown in Table 2-8 was adjusted in three ways to determine O&M related revenue requirements for the financial plan. First, those projected costs provided in FY 2018 dollars were converted to future year dollars using a factor of 2.5 percent per year, as shown in Table 2-9. The 2.5 percent factor was chosen based on input from the BWS and the fact that the 10-year Hawaii Consumer Price Index annual change has averaged 2.4 percent per year.

Table 2-9. Summary of Escalation to Future Year Dollars of the BWS's Projected O&M

Cost Category	Year Dollars	BWS Escalation Method (if any)	Escalation to Future Year (if needed)
Salary	Future Year	Real changes in costs (e.g., additional staff) plus: 2 percent per year increase through FY 2023, then 1 percent per year increase from FY 2024 through FY 2027 to bring dollars to future year dollars.	No further adjustment. Annual average change in costs between FY 2018 – FY 2028 is 2.7 percent per year.
Fixed Charges (Total)	Future Year		Annual average change in total costs between FY 2018 – FY 2028 is 2.5 percent per year.
Employee Retirement System		5 percent per year escalation	No further adjustment.
Central Administration Services		Fixed fee	No further adjustment.
Remaining Fixed Charges Items		2 percent per year escalation	No further adjustment.
Materials, Supplies, and Services	Current Year	Includes real changes in costs (e.g., process changes that require more supplies). Average annual change in real costs between FY 2018 and FY 2027 is 2.5 percent per year.	Additional 2.5 percent per year. Annual average change in costs between FY 2018 – FY 2028 is 5.1 percent per year.
Equipment	Current Year	Includes real changes in costs (e.g., process changes that require more equipment). Average annual real change in costs between FY 2018 and FY 2027 is - 0.9 percent per year.	Additional 2.5 percent per year. Annual average change in costs between FY 2018 – FY 2028 is 1.7 percent per year.

Second, the O&M projection was adjusted downward to reflect historical spending. This reduction was done to ensure that future costs were not overstated as O&M costs are a significant part of the annual revenue requirement. An analysis of the historical actual and budgeted O&M shows that, on average, the BWS spends 81 percent of its O&M budget, as shown in Table 2-10. However, to address this the BWS applied a more rigorous budgeting process for FY 2018. Therefore, an adjustment factor of 85 percent was applied to the projected O&M to calculate O&M related revenue requirements.

Table 2-10. Historical O&M Budgets and Actuals, $M

	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average
Budget	$143	$147	$156	$164	$172	$156
Actual	$123	$120	$131	$130	$130 (1)	$127
Percent of Budget	86%	81%	84%	80%	76%	81%

(1) preliminary FY 2017 actual O&M.

The third adjustment was to include a capital improvement program implementation allowance as an estimate of the cost of program/ project management services to administer the capital improvement program, either through internal resources or via consulting resources. The allowance is estimated at 1 percent of total construction costs based on discussions with the BWS.

The resulting O&M projection shown in Table 2-11 grows from $137 million in FY 2018 to $163 million in FY 2023. The annual average increase in adjusted O&M costs between FY 2018

and FY 2023 is 3.6 percent per year. Items designated as "Fixed Charges" in the O&M budget include items such as electric power for the water distribution facility, retirement contributions, and benefits. The Fixed Charges category accounts for about 30 percent of annual O&M costs. Field Operations account for about 20 percent of annual O&M. The Water Systems Operation Division accounts for about 11 percent of annual O&M costs.

Table 2-11. Adjusted Projected O&M, $M

Division & Staff Office	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Office of the Manager & Chief Engineer	$0.8	$0.8	$0.8	$0.9	$0.9	$0.9
Executive Support Office	$7.6	$7.7	$7.9	$8.4	$8.7	$9.0
Communications Office	$1.0	$1.0	$1.0	$1.1	$1.2	$1.2
Ocean Cooling	$0.5	$0.5	$0.6	$0.6	$0.6	$0.6
Human Resources Office	$0.6	$0.7	$0.7	$0.6	$0.6	$0.7
Water Quality Division	$4.9	$4.7	$4.5	$5.0	$5.1	$5.2
Customer Care Division	$5.2	$5.6	$5.9	$6.2	$6.5	$6.9
Land Division	$0.6	$0.6	$0.7	$0.7	$0.7	$0.8
Water Resources Division	$10.0	$9.4	$10.0	$10.3	$10.7	$11.1
Field Operations Division	$26.8	$28.2	$29.7	$31.4	$33.2	$35.2
Capital Projects Division	$5.6	$6.1	$6.6	$6.8	$7.1	$7.3
Water Systems Operations Division	$16.2	$14.5	$15.1	$15.8	$16.2	$17.1
IT Division	$11.2	$11.4	$11.5	$11.4	$12.6	$14.1
Finance Division	$4.3	$4.6	$4.6	$4.8	$5.4	$5.3
Fixed Charges	$41.4	$42.3	$43.4	$44.5	$45.7	$46.8
Capital Improvement Program Implementation Allowance	$0.0	$0.8	$1.0	$0.9	$1.2	$1.1
Total	$137	$139	$144	$149	$156	$163
BWS (Table 2-8)	$160	$161	$164	$169	$175	$181

Note: Total may not add due to rounding.

2.3.2 Capital Improvement Program and Funding

The approved Water Master Plan identifies the general capital needs to repair, replace, upgrade and/ or expand water system infrastructure. A detailed 6-year capital improvement program was developed in tandem with the recommendations from the Water Master Plan. This capital improvement program is based on the Long Range Financial Plan pipeline scenario that calls for ramping up to replace 21 miles of pipeline each year by the tenth year, which is about one percent of the 2,100 miles of pipeline island-wide, per the BWS Board recommendation made in August 2017. Annual capital-related costs of the program comprise cash and principal and interest payments on existing and future debt.

2.3.2.1 Capital Improvement Program

Anticipated annual capital improvement costs (escalated) vary between $144 million and $212 million over the study period FY 2018 to FY 2023 as shown in Table 2-12. The inflated dollars presume 3 percent per year inflation, which is conservatively higher than the 10-year historical change in Hawaii Consumer Price Index. Table 2-12 also shows how much of the projected capital improvement program is expected to be encumbered each year (either spent or contracts let). Not all of the capital improvement program may be encumbered due to projects being delayed, canceled or replaced. The projected encumbered rate is based on historical rates of capital encumbrances at the BWS, which averages 82 percent of the projected capital budget. Appendix C lists the projects included in the 6-year capital improvement program.

Table 2-12. Budgeted and Proposed Capital Improvement Program, $M

Capital Project Category	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Non-potable	$0.0	$0.0	$2.5	$7.5	$0.0	$12.1
Tools & Resources	$3.0	$3.7	$5.8	$2.3	$2.3	$2.7
Treatment	$2.1	$11.3	$11.9	$7.7	$33.5	$10.6
Sources	$10.1	$3.2	$0.7	$27.6	$23.0	$0.7
Facilities	$40.1	$51.3	$34.0	$26.3	$14.7	$8.1
Storage	$0.7	$18.5	$24.6	$8.8	$22.8	$35.3
Pumps	$43.5	$15.3	$22.4	$15.6	$8.8	$13.9
Pipelines	$44.9	$34.6	$58.4	$44.8	$77.8	$76.0
Total	$144	$138	$160	$141	$183	$159
Total – Escalated	$144	$146	$175	$158	$212	$190
Capital Improvement Program Encumbered	$118	$120	$144	$130	$174	$156

Note: Totals may not add due to rounding.

PIPELINE SCENARIOS

As a result of the Water Master Plan process, the BWS developed pipeline capital project costs for seven levels of service represented as pipeline break reduction. These seven scenarios, along with estimated impacts to revenue requirements, were presented to the Stakeholder Advisory Group. Working in small groups, the Stakeholder Advisory Group determined the top two preferred scenarios. This Stakeholder input was provided to the Board, which ultimately approved a pipeline capital improvement program that supports ramping up to replacing 21 miles (1 percent) of pipe a year.

- aggressive, but balances ability to implement with cost impact to customers

- allows for ramp up of staffing to implement the plan

- sustainable & affordable approach to infrastructure replacement & upgrades

These costs can be paid for through a mix of cash and debt, which ultimately comes from water rates and charges.

2.3.2.2 Capital Sources and Uses of Funds

As part of the Stakeholder Advisory Group process, the trade-offs between cash financing (also known as pay-as-you-go, "pay-go" or equity) and debt financing were discussed. While cash keeps the total cost lower because there are no financing costs, the burden for paying for long-lived assets resides solely on the current customers even though future customers benefit from those assets. Debt financing increases the total cost due to the financing costs (e.g., interest payments and issuance costs), but spreads those costs over many years (e.g., 10-30), which lowers the immediate impact on revenue requirements as well as spreads the costs between current and future users of those assets. The Stakeholder Advisory Group's input to the Board supported a mix of debt and equity to finance capital needs and to cap the debt-to-net asset ratio at 50 percent, as adopted by the Board and summarized in Table 2-1. Table 2-13 reflects using a mix of cash, bonds, State Revolving Fund loans and water system facilities charges to finance annual capital-related costs.

Table 2-13. Projected Capital Sources and Uses of Funds, $M

Name	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Carryover of Prior Year		$0	$0	$0	$91	$0
Sources of Funds						
Cash	$83	$77	$119	$64	$65	$66
Bond Issue	$0	$0	$0	$135	$0	$66
State Revolving Fund Loan	$1	$3	$5	$5	$5	$8
State Revolving Fund ESPC Loan (1)	$11	$11	$0	$0	$0	$0
Water System Facilities Charges Funds	$24	$29	$20	$18	$13	$15
Total Sources	$118	$120	$144	$221	$83	$156
Uses of Funds						
Capital Improvement Program Encumbered	$118	$120	$144	$130	$174	$156
Bond Cost of Issuance	$0	$0	$0	$1	$0	$0
Total Uses	$118	$120	$144	$130	$174	$156
Unused Funds	$0	$0	$0	$91	$0	$0

(1) ESPC = Energy Savings Performance Contract.

Note: Totals may not add due to rounding.

As shown in Table 2-13, a combination of cash and bond sales are used to fund the capital improvement program. Cash financing of the 6-year capital improvement program is projected to be $473 million and is planned to occur every year to smooth out the revenue requirements. Two bond issues are anticipated during the study period: the first in FY 2021 of $135 million and the second in FY 2023 of $66 million. Since cash funding occurs every year, any unused bond funds would be carried forward to the following year. Additional sources of funds include State Revolving Fund[4] loans and water system facilities charges. The BWS provided a projection of State Revolving Fund loans totaling $49 million over the study period. Water system facilities charges fund amounts are determined based on the percent of capital improvement program

[4] The State Revolving Fund is a program financed by the U.S. Environmental Protection Agency and administered by the Hawaii Department of Health.

each year that is considered to be growth-related, and total $118 million over the study period. In keeping with the revised financial policies adopted May 8, 2017, the amount of capital financed through debt is less than the amount financed with cash, which will keep the debt to net asset ratio below the cap of 50 percent.

Uses of funds comprise the encumbered capital improvement program and bond issuance costs, which are presumed to be 0.5 percent of the bond amount. Bond issuance costs cover all transaction costs associated with completing the sale of the debt. These costs include legal costs, marketing and underwriting fees (i.e., underwriter's discount), financial advisory fees, rating agency fees, and other expenses such as trustee fees, advertising, printing, etc.

2.3.3 Debt Service Requirements

Debt service requirements include principal and interest payments being made on bonds and loans previously issued, as well as forecasted payments for projected future bonds and loans.

2.3.3.1 Existing Debt Service

Existing debt service includes principal and interest payments on bonds and State Revolving Fund payments on loans obtained prior to the planning period. Table 2-14 shows the existing debt service schedule. Total debt service payments in FY 2019 are expected to drop to $21.4 million due to paying off several State Revolving Fund loans in FY 2018. By FY 2023, debt service on existing bonds and loans is expected to be $22 million.

Table 2-14. Existing Debt Service Through FY 2023, $M

	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Bonds	$17.7	$17.7	$17.7	$17.7	$17.7	$17.9
State Revolving Fund & JABSOM	$12.6	$3.1	$3.4	$3.6	$3.6	$3.6
State Revolving Fund Fees	$0.7	$0.6	$0.6	$0.5	$0.5	$0.5
Total	$31.0	$21.4	$21.6	$21.9	$21.8	$22.0

Note: Totals may not add due to rounding.

2.3.3.2 Projected New Debt Service

Projected new debt service includes the debt service on the anticipated bond issuances and State Revolving Fund loans shown in Table 2-13. Table 2-15 shows the projected debt service related to new bonds and State Revolving Fund loans for the proposed capital improvement program. Bond terms are forecast to be 30 years with a 4 percent interest rate through FY 2021 and 4.5 percent thereafter. The State Revolving Fund loan term is 20 years with an interest rate of 0.25 percent through FY 2021 and 0.5 percent thereafter. ESPC contract loans are interest free. Both State Revolving Fund loans and ESPC loans are subject to an annual fee of 1 percent of the outstanding annual balance. New debt service amounts are projected to add $0.1 million to $10.3 million per year to the revenue requirements over the study period, as shown in Table 2-15.

Table 2-15. Projected New Debt Service Through FY 2023, $M

	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Bonds	$0.0	$0.0	$0.0	$0.0	$7.8	$7.8
State Revolving Fund	$0.0	$0.6	$1.3	$1.6	$1.8	$2.1
State Revolving Fund Fees	$0.1	$0.3	$0.3	$0.3	$0.4	$0.4
Total	$0.1	$0.9	$1.6	$1.9	$10.0	$10.3

Note: Totals may not add due to rounding.

2.3.4 Working Capital

Working capital is the days cash available to help cover normal operations, extraordinary expenses (e.g., disaster recovery), bond covenant requirements and other reserve policies, as well as to provide some buffer in case water revenues are lower than projected. It is typically expressed as days of working capital and is defined as the working capital balance divided by the annual operating expenses.

The Stakeholder Advisory Group provided input to the Board in support of increasing the working capital target to 180 days and maintaining a minimum of 60 days. The Board considered and adopted this input as policy.

The Stakeholder Advisory Group extensively reviewed recommended working capital levels, including those of similar water utilities. For example, the Government Finance Officers Association recommends 90 days of cash with an absolute minimum of 45 days with additional working capital set aside for unanticipated "big ticket" repair and replacement, emergencies, disaster recovery, and rate stabilization[5]. A review of five similar water utilities plus Maui County and Hawaii County showed that total reserves ranged between 45 days to 300 days. Additionally, rating agencies favorably view higher days cash on hand and factor that into bond ratings. Better bond ratings translate into lower interest rates on bonds, which in turn translates into lower revenue requirements.

Per the revised financial policies, the BWS's unencumbered working capital target is 180 days of annual O&M costs with a minimum of 60 days. The revenue requirements shown in Table 2-16 are based on maintaining close to 180 days of working capital. The BWS would need to maintain a balance close to this in its operating fund in order to maintain the 180 day target each year.

Table 2-16. Projected 180 Days of Working Capital Through FY 2023, $M

	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Target	$67	$68	$71	$74	$77	$81

2.3.5 Revenue Requirements Summary

Table 2-17 presents the summary of the revenue requirements over the rate study period. Revenue requirements are projected to grow from $318 million in FY 2018 to $343 million by FY 2023.

[5] Government Finance Officers Association. (2011, February). *Working Capital Targets for Enterprise Funds.* Retrieved from http://www.gfoa.org/working-capital-targets-enterprise-funds

Table 2-17. Projected Revenue Requirements, $M

Line Item	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
O&M	$136.9	$139.2	$143.9	$149.2	$156.4	$163.3
Debt Service	$31.1	$22.3	$23.3	$23.8	$31.9	$32.3
Cash Funded Capital	$82.5	$76.6	$118.9	$63.6	$65.3	$66.4
Working Capital	$67.5	$68.6	$71.0	$73.6	$77.1	$80.5
Total	$318.0	$306.7	$357.0	$310.3	$330.7	$342.6

Note: Totals may not add due to rounding.

2.3.6 Cashflow Summary

The cashflow brings together the revenues and expenses discussed above into a single picture. System revenues must be sufficient to finance the costs of operation and maintenance, routine annual capital improvements, debt service costs on existing and proposed debt, and cash financing of capital while maintaining an adequate operating reserve, complying with all revenue bond coverage requirements, and complying with the BWS financial policies. Table 2-18 summarizes the projected revenues under existing rates, non-rate based income, and projected revenue adjustments needed to meet revenue requirements. The table shows that revenue requirements can be met in FY 2019 without an adjustment to rate-based revenues, followed by a 2.0 percent increase in FY 2020, a 2.0 percent increase in FY 2021, a 4.0 percent increase in FY 2022, and a 4.0 percent increase in FY 2023, effective at the beginning of each fiscal year (July 1).

Table 2-18. Cashflow Summary

	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Billed Wtr User Charges Under Approved Rates [1]						
Single-family	$96,645,149	$96,339,757	$96,035,807	$95,732,827	$95,430,813	$95,130,720
Multi-unit	$45,261,170	$45,083,420	$44,906,124	$44,729,733	$44,554,251	$44,378,769
Non-Residential	$80,905,706	$80,586,223	$80,268,229	$79,951,228	$79,635,716	$79,321,693
Agricultural	$2,369,098	$2,357,460	$2,346,027	$2,334,406	$2,322,973	$2,311,744
Automatic Fire Sprinkler	$84,320	$84,320	$84,320	$84,320	$84,320	$84,320
Non-Potable	$1,554,054	$1,546,397	$1,538,740	$1,531,083	$1,523,426	$1,515,769
Total Water Billed Charges	$226,819,497	$225,997,577	$225,179,247	$224,363,597	$223,551,499	$222,743,015
User Charge Revenue Adjustment:						
Year / Adjustment / First Year Months Effective						
2019 / 0.0% / 6		$0	$0	$0	$0	$0
2020 / 2.0% / 12			$4,503,585	$4,487,272	$4,471,030	$4,454,860
2021 / 2.0% / 12				$4,577,017	$4,560,451	$4,543,958
2022 / 4.0% / 12					$9,303,319	$9,269,673
2023 / 4.0% / 12						$9,640,460
Water User Charge Revenue Adjustment	$0	$0	$4,503,585	$9,064,289	$18,334,800	$27,908,951
Total Billed Water User Charge Revenue	$226,819,497	$225,997,577	$229,682,832	$233,427,886	$241,886,299	$250,651,966
Contractual Water Revenue [2]	$5,848,595	$5,941,609	$6,034,162	$6,128,208	$6,223,839	$6,320,417
Other Revenue Sources [3]	$6,371,829	$6,397,841	$6,424,373	$6,451,435	$6,479,039	$6,507,195
Bad Debt Expense	($453,639)	($451,995)	($459,366)	($466,856)	($483,773)	($501,304)
Interest Income	$2,757,302	$3,198,920	$3,374,640	$3,387,339	$3,517,134	$3,502,837
Total Revenue	**$241,343,584**	**$241,083,952**	**$245,056,641**	**$248,928,012**	**$257,622,538**	**$266,481,111**
Annual Expenditures						
Operation and Maintenance Expense	$136,852,700	$139,187,800	$143,885,500	$149,240,600	$156,392,900	$163,283,800
Debt Service						
Existing Debt - Bonds	$17,723,159	$17,725,023	$17,722,128	$17,723,242	$17,722,550	$17,907,486
Existing Debt - State Revolving Fund & JABSOM	$12,629,294	$3,108,852	$3,363,426	$3,621,811	$3,631,837	$3,641,976
State Revolving Fund Fees - Existing Loans	$662,481	$587,323	$558,868	$526,570	$492,884	$459,054
Proposed Debt - Bonds	$0	$0	$0	$0	$7,810,360	$7,810,360
Proposed Debt - State Revolving Fund	$0	$613,015	$1,328,675	$1,585,290	$1,841,904	$2,105,236
State Revolving Fund Fees - Proposed Loans	$122,338	$258,572	$295,384	$329,750	$361,664	$421,177
Subtotal Debt Service	$31,137,272	$22,292,785	$23,268,481	$23,786,663	$31,861,199	$32,345,289
Transfers to:						
Cash Funded Capital	$82,526,000	$76,590,000	$118,912,500	$63,633,000	$65,312,000	$66,418,000
Total Annual Expenditures	**$250,515,972**	**$238,070,585**	**$286,066,481**	**$236,660,263**	**$253,566,099**	**$262,047,089**
Beginning of Year Balance	$107,357,788	$98,185,400	$101,198,767	$60,188,927	$72,456,676	$76,513,115
Annual Increase (Decrease)	($9,172,388)	$3,013,367	($41,009,840)	$12,267,749	$4,056,439	$4,434,022
End of Year Operating Fund Balance	**$98,185,400**	**$101,198,767**	**$60,188,927**	**$72,456,676**	**$76,513,115**	**$80,947,137**
Target 180 Days of O&M [4]	$67,489,003	$68,640,559	$70,957,233	$73,598,104	$77,125,266	$80,523,518
Minimum 60 Days of O&M [4]	$22,496,334	$22,880,186	$23,652,411	$24,532,701	$25,708,422	$26,841,173
Debt Service Coverage on Bonds [5]	5.90	5.75	5.71	5.62	3.96	4.01
"All-in" Debt Service Coverage [6]	3.36	4.57	4.35	4.19	3.18	3.19
Estimated Days Working Capital [7]	262	265	153	177	179	181
For Bond Rating Information						

[1] Calculated using the existing water rates.
[2] Revenue from R-1 and RO contracts.
[3] Includes fire protection installations, billing services for ENV, Ocean Cooling and other misc income.
[4] 180 Days of O&M within 10 years of FY2018, minimum of 60 days.
[5] Bond covenant requirement is 1.2, BWS policy is 1.7 on senior debt.
[6] BWS policy is 1.6 on "all-in" debt.
[7] The end of year balance divided by the daily operating expenses.

In addition to supporting sufficient revenue to meet revenue requirements, this schedule of revenue increases addresses the revised financial policies adopted by the Board in May 2017.

- Days of working capital remains above the 60-day minimum. The planned drawdown of the operating fund balance in FY 2020 brings the days of working capital to about 150.
- Days of working capital returns to 180 days by FY 2023, ahead of the 10-year timeframe.
- The debt service coverage ratio for senior debt is projected to drop from a high of 6.23x in FY 2018 to 3.96x in FY 2022, well above the policy target of 1.7x and the bond covenant requirement of 1.2x.
- The "all-in" debt service coverage ratio is projected to drop from a high of 4.57x in FY 2019 to 3.18x in FY 2022, well above the policy target of 1.6x coverage.
- Total debt issues between FY 2018 and FY 2023 cover 30 percent of total encumbered capital over the same period, below the 50 percent debt cap.
- Future debt issues are presumed to be fixed rate debt, keeping the amount of variable rate debt below the 20 percent cap.

The Stakeholder Advisory Group reviewed the debt service coverage ratios of similar utilities such as DC Water, San Antonio Water System, Las Vegas Valley Water District, San Diego Water Department, and Los Angeles Department of Water and Power, as well as guidance from credit rating agencies. Comparing those ratios to the ratios BWS had in place at the time, as well as the pros/cons of lower or higher coverage ratios, led to the Stakeholder Advisory Group supporting a change to a slightly higher senior debt coverage ratio and a new total debt coverage ratio. The Board considered and adopted this input as part of the BWS Debt and Working Capital Management Policy.

Section 3
Cost of Service Allocations

Once the revenue requirements are known, the costs to provide service to customers, also known as the cost of service, can be allocated to customer classes. These net revenue requirements must be recovered through rates. The cost of service analysis is the process of determining the cost of providing water service to each of the defined customer classifications. This analysis includes the functionalization and allocation of water system revenue requirements (the costs of service) followed by the distribution of costs by customer classification based on the annual usage, peak demands, and customer-related costs for which each class of service is responsible. The allocations of these costs to functional costs, cost centers and ultimately to the customer classes take into account the quantity of water used, relative peak demand requirements placed on the system, the number and size of services to customers, and other relevant factors. The allocation process ultimately determines the costs on a unit basis (e.g., number of customers, usage). The unit rates then help guide the process for setting rates. This process follows the guidelines set out in AWWA M1: *Principles of Water Rates, Fees, and Charges*, 7th edition.

The purpose of the cost of service analysis is to understand to what extent the costs incurred in serving each customer class are being recovered from that customer class. If the costs allocated to each class are not being fully recovered by each class, that may be due to a policy/ guideline (intentional action) and/or may be due to changes in behavior and/ or better data (unintentional). In either case, cost of service recovery can be adjusted through changes in the rates and/ or structure.

Cost of service results herein are presented for a representative test year, FY 2019[1].

3.1 Key Findings

The cost of service analysis shows some customer class revenues are greater than the calculated cost of service while revenues for other customer classes are below those classes' costs of service. Therefore, some inequity exists under the current rates and rate structure. Some of this may be intentional; for example, pricing Non-Potable, R-1 and RO water below their costs of service to encourage use of these resources. Another potential intentional subsidy is economic-development based, such as with agriculture or golf courses. Other subsidies may be unintentional; occurring as the mix of the BWS's water system assets, O&M activities, and customer usage patterns change, and/or as better customer and water system data are available.

[1] Note the cost of service analysis information presented to the Stakeholder Advisory Group in 2017 was developed using FY 2016 to understand how historical revenues matched cost of service at the customer class level.

Based on the cost of service analysis, stakeholder input, and guidance from the Board, the rates and charges should be revised to bring each customer class closer to its cost of service, except where specific policies or guardrails direct otherwise.

3.2 Costs of Service to be Allocated

The costs to be allocated to the various customer classes consist of the total revenue requirement less income received from other sources (net revenue requirements). Table 3-1 shows the development of the costs that must be recovered through rates for FY 2019. Operating expenses are projected to be $139.2 million in FY 2019. These costs are adjusted for other revenues and bad debt expense (amount of bills that are written off in any given year due to customers' failure to pay) resulting in a net operating expense of $134.6 million. Capital and Other Costs are expected to total $98.9 million in FY 2019 and include the principal and interest payments on outstanding debt and revenues used to pay for major capital projects. These costs are offset by interest income. Additionally, $3.0 million is added to the operating fund balance, which increases the amount of revenue needed from rates. Since no partial year revenue adjustments are planned for FY 2019, the annualized rate adjustment is $0. Therefore, the net Capital and Other Costs is $98.7 million. The total cost is projected to be $233.3 million in FY 2019.

Table 3-1 Projected Costs of Service, FY 2019

	Operating Expense ($M)	Capital and Other Costs ($M)	Total ($M)
Total Revenue Requirements			
Operation & Maintenance Expense	$139.2		$139.2
Total Debt Service		$22.3	$22.3
Cash Financed Capital		$76.6	$76.6
Subtotal	$139.2	$98.9	$238.1
Less Other Operating Revenue			
Misc. Revenues	$5.1		$5.1
Bad Debt Expense	($0.5)		($0.5)
Interest Income		$3.2	$3.2
Subtotal	$4.6	$3.2	$7.8
Less Adjustments			
Change in Funds Available (1)		($3.0)	($3.0)
Annualized Rate Adjustment		$0.0	$0.0
Subtotal	$0	($3.0)	($3.0)
Cost to be Recovered from Rates	$134.6	$98.7	$233.3

(1) A positive amount indicates a drawdown of the available operating fund balance to cover expenses. A negative amount indicates an addition to the balance, which is an increase to the costs to be recovered from rate based revenue.
Note: Totals may not add due to rounding.

3.3 Functionalization of Costs

Once the costs to be recovered from rate-based revenue is determined, the costs are allocated to cost components recognizing the function(s) served by an asset or O&M activity. These functional cost components generally represent the types of operational activity with which a particular cost is identified, such as supply, pumping, treatment, or special categories. The functional cost components used in this analysis are as follows:

- Sustain
  - Non-Potable Water
  - RO Water
  - R-1 Water
  - Ocean Cooling
- Capture
  - Source
- Treat
  - Treatment
- Move
  - Transmission and Distribution (T&D)
- Store
  - Storage
- Deliver
  - Customer Billing
  - Customer Meters
  - Public Fire Protection

3.3.1 Capital and Other Costs Allocation

Capital and Other Costs are allocated based on net plant investment (original cost less depreciation), which typically includes assets on the books at the end of the most recent fiscal year plus planned capital improvements through the test year, FY 2019.

Plant asset information through June 30, 2017 was used as the most recently completed fiscal year at the time of the study. As of the end of FY 2017, the BWS has more than 12,000 assets representing land; structures and improvements; equipment; collecting/ impounding reservoirs; wells and springs; infiltration galleries/ tunnels; distribution reservoirs and standpipes; T&D mains; meters and services; hydrants; and ocean cooling. This asset data was depreciated through the end of FY 2019. The original cost less depreciation of assets on the books at the end

of FY 2019 is estimated to be $947 million. Then each asset cost was allocated to one or more of the functional cost components based on best engineering judgement as to the function of each individual asset.

The net plant investment for the test year also accounts for projects that may be complete by the end of the test year. These projects include construction work in progress and estimated capital improvement projects that would be in service by the end of FY 2018 and by the end of FY 2019. These original costs are depreciated through FY 2019 based on average usage lives[2] for the general project groups (e.g., source, pipeline, treatment). The estimated original cost less depreciation of projects expected to be in service by the end of the test year is $236 million. The project groups are allocated to functional categories based on best engineering judgement.

The original cost less depreciation of the assets on the books plus original cost less depreciation of construction work in progress and capital improvement projects estimated to be in service are totaled to get the net plant investment by functional cost component. The total estimated net plant investment at the end of the test year is $1,183 million.

The allocation of net plant investment costs to the functional cost components is shown in Table 3-2.

Table 3-2. Net Plant Investment Allocation to Functional Cost Categories, FY 2019 $M

Functional Cost Component	Investment
Source	$117.9
Treatment	$51.3
Storage	$111.3
T&D	$793.3
Customer Billing	$6.2
Customer Meters	$36.9
Public Fire Protection	$27.7
Non-Potable Water	$10.2
RO Water	$20.0
R-1 Water	$4.2
Ocean Cooling	$4.4
Total	$1,183

Note: Totals may not add due to rounding.

3.3.2 Operating Expense Allocation

O&M expenses are allocated to the functional cost components based on the purpose of each division/ staff office as defined in the annual O&M budget document and/ or based on allocations provided by the BWS program leads. Appendix D lists allocation methodologies for the associated division/ staff offices. Table 3-3 presents the allocation of the O&M expenses to the functional cost components.

[2] Development of average useful lives is discussed in Appendix E.

Table 3-3.O&M Expense Allocation to Functional Cost Categories, FY 2019, $M

Functional Cost Components	O&M Expenses
Source	$32.1
Treatment	$4.3
Storage	$4.6
T&D	$62.7
Customer Billing	$13.2
Customer Meters	$10.6
Public Fire Protection	$2.1
Non-Potable Water	$1.1
RO Water	$3.3
R-1 Water	$4.2
Ocean Cooling	$0.9
Total	$139.2

Note: Totals may not add due to rounding.

3.4 Allocation to Cost Centers

Once costs have been allocated to functional cost components, those functional costs are then allocated to cost centers. The AWWA base-extra capacity method is used to allocate functional costs to cost centers, recognizing the incremental (or extra capacity) elements of some functional costs. Cost centers recognize the service drivers imposed on the water system by its customers; for example, annual volume of water consumed, the peak water demands incurred, the number of customers in the system, and the number of fire services required to maintain adequate fire protection. The principal cost centers are base costs, extra capacity costs, customer costs, and direct fire protection. Other cost centers may be used in addition to the principal cost centers based on other characteristics of the utility. The cost centers used for this analysis are shown below:

- Base Capacity
- Extra Capacity – Maximum Day
- Extra Capacity – Peak Hour
- Customer Billing
- Customer Meters (Equivalent Meters, E.M.)
- Public Fire Protection
- Non-Potable Water
- RO
- R-1
- Ocean Cooling

Base costs are those that vary directly with the quantity of water used, as well as those costs associated with serving customers under average load conditions. Extra capacity costs represent those operating costs incurred due to demands in excess of average use and capital-related costs for additional plant and system capacity beyond that required for average use. Total extra capacity costs are subdivided into maximum day and peak hour. Development of the base-extra capacity allocation factors is discussed later in this section.

Customer-related costs are those costs that tend to vary in proportion to the number of customers connected to the system. At a minimum, these costs include meter reading, billing, collection and accounting costs, as well as maintenance and capital costs associated with meters and services. These cost centers may also include additional costs since the majority of costs of a

water utility are fixed (meaning they don't change as usage changes). For example, a portion of distribution costs are often assigned to the customer-related cost centers since distribution piping is in place because a customer exists not only because of the amount of flow. While assigning more of the utility's fixed costs to a fixed cost center, such as the Customer Billing cost center, helps with revenue stability, it also decreases the amount of control customers can exercise on their bills by managing water consumption. Since the BWS values a customer's ability to control its water bill through limiting water consumption, only the billing, meter, and a prorated share of general and administrative costs are allocated to fixed components.

Fire protection costs include those associated with providing and maintaining fire hydrants for fire protection purposes. Non-potable, RO, R-1, and Ocean Cooling cost centers capture capital and operating costs related to providing those services.

3.4.1 Developing Base-Extra Capacity Allocation Factors

To spread base-extra capacity costs to base, maximum day and peak hour cost centers, analysis of historical system maximum day and peak hour demands to average day demands was conducted to determine the base, maximum day and peak hour capacity allocation factors. To calculate the system-wide (coincident) maximum day demand factor, the SCADA pumping data from 2010-2013 was reviewed. On the maximum day, the pumpage across all zones was added and then divided by the annual average day demand across all zones. This was done for each year, 2010-2013. Analysis of the 2010-2013 maximum day and average day demand shows that the maximum day demand ratio across the entire system is 1.23 and occurred in 2013 (see Water Master Plan Table 5-2). This ratio indicates that 81.3 percent (1/1.23) of the capacity of facilities designed and operated to meet maximum day demand (e.g., source) is required for average, or base, use. The remaining 18.7 percent is required for maximum day capacity requirements.

To calculate the system-wide peak hour factor, 15-minute SCADA data was retrieved on the maximum day of demand of year 2013. On this day, hourly demand was calculated by summing the inflows, outflows and tank volume changes in each zone. The highest hourly demand is the peak hour demand. The ratio of peak hour to maximum day was then calculated for each zone. The average of the peak factors from each zone, weighted by the average zone demand, comes to 1.70. The total peak hour factor (the ratio of peak hour demand to average day demand) is estimated to be 1.23 x 1.70 or 2.09[3]. This ratio indicates that 47.85 percent (1/2.09) of the capacity of facilities designed and operated to meet peak hour demand (e.g., storage) is required for average, or base, use. The maximum day requirements equal 11 percent ((1.23-1)/2.09). The remaining 41.15 percent is required for peak hour extra capacity requirements. The base-extra capacity cost allocation factors are shown in Table 3-4.

[3] Note that the Water Master Plan did not calculate an average system-wide peak hour demand factor but applied one of three factors to each pressure zone depending on size. However, for the analysis described herein, the system-wide factor is appropriate.

Table 3-4. Base-Extra Capacity Allocation Factors

Cost Component	Demand Factor	Base	Maximum Day	Peak Hour
Base	1.00	100.00%		
Maximum Day	1.23	81.30%	18.70%	
Peak Hour	2.09	47.85%	11.00%	41.15%

3.4.2 Net Plant Allocation to Cost Centers

Table 3-5 shows the transformation of net plant functional costs to cost centers, as well as the percent allocation to each cost center. These percents are used to allocate annual capital-related expenses.

Table 3-5. Net Plant Investment Allocated to Cost Centers, FY 2019, $M

Functional Cost Components	Total Net Plant	Base	Extra Cap.		Customer		Public Fire Prot.	Non-Pot	RO	R-1	Ocean Cool.
			Max Day	Peak Hour	Bills	E.M.					
Source	$118	$96	$22								
Treatment	$51	$42	$10								
Storage	$111	$53	$12	$46							
T&D	$793	$380	$87	$326							
Customer Billing	$6				$6						
Customer Meters	$37					$37					
Public Fire Prot.	$28						$28				
Non-Potable Water	$10							$10			
RO Water	$20								$20		
R-1 Water	$4									$4	
Ocean Cooling	$4										$4
Total	$1,183	$570	$131	$372	$6	$37	$28	$10	$20	$4	$4
Allocation	100.0%	48.2%	11.1%	31.5%	0.5%	3.1%	2.3%	0.9%	1.7%	0.4%	0.4%

Note: Totals may not add due to rounding.
E.M. = Equivalent Meters

Table 3-6 shows the application of the net plant investment cost center percent allocations from Table 3-5 to the total test year Capital and Other Costs of $98.7 million shown in Table 3-1, to derive the amounts in each cost center.

Table 3-6. Allocation of Capital and Other Costs, FY 2019

Cost Center	Allocation	Cost, $M
Base	48.2%	$47.6
Extra Capacity – Max Day	11.1%	$10.9
Extra Capacity – Peak Hour	31.5%	$31.0
Customer Billing	0.5%	$0.5
Customer Equivalent Meters	3.1%	$3.1
Public Fire Protection	2.3%	$2.3
Non-Potable Water	0.9%	$0.8
RO Water	1.7%	$1.7
R-1 Water	0.4%	$0.4
Ocean Cooling	0.4%	$0.4
Total	100.0%	$98.7

Note: Totals may not add due to rounding.

3.4.3 O&M Expense Allocated to Cost Centers

Net O&M expense is reduced by non-rate revenue (other revenues less bad debt expense) , as shown in Table 3-1, resulting in an estimated net O&M expense for FY 2019 of $134.6 million. Table 3-7 summarizes the results of allocating the net O&M functional cost components to the cost centers. Appendix D includes the allocation methodology for non-rate revenue sources.

Table 3-7. Net O&M Cost Allocation to Cost Centers, FY 2019, $M

Functional Cost Components	Total	Base	Extra Cap.		Customer		Public Fire Prot.	Non-Pot	RO	R-1	Ocean Cool.
			Max Day	Peak Hour	Bills	E.M.					
Source	$32.1	$26.1	$6.0								
Treatment	$4.3	$3.5	$0.8								
Storage	$4.6	$2.2	$0.5	$1.9							
T&D	$62.7	$30.0	$6.9	$25.8							
Customer Billing	$13.2				$13.2						
Customer Meters	$10.6					$10.6					
Public Fire Prot.	$2.1						$2.1				
Non-Potable Water	$1.1							$1.1			
RO Water	$3.3								$3.3		
R-1 Water	$4.2									$4.2	
Ocean Cooling	$0.9										$0.9
Total O&M	$139.2	$61.8	$14.2	$27.7	$13.2	$10.6	$2.1	$1.1	$3.3	$4.2	$0.9
Less Non-rate Revenue	$4.6	$0.2	$0.04	$0.1	$3.0	$1.3	$0.01	$0.004	$0.01	$0.01	$0.003
Net O&M	$134.6	$61.6	$14.2	$27.6	$10.3	$9.3	$2.1	$1.1	$3.3	$4.2	$0.9
Allocation	100.0%	45.8%	10.5%	20.5%	7.6%	6.9%	1.6%	0.8%	2.4%	3.1%	0.7%

Note: Totals may not add due to rounding.

3.5 Allocating to Customer Classes

Once the costs have been allocated to the cost centers, these costs can be distributed to customer classes of service based on the respective impact of the customer classes on each of the cost centers. Demand patterns of customers vary depending on their maximum day and peak hour rates of demand relative to average demands. For example, lawn watering or irrigation, which can be seasonal and/or dependent on the weather, may place higher peak demands on the system than a large manufacturing facility, which may require water on a relatively uniform basis throughout the day and year. These differences in demand patterns can create differences in the costs to serve those customers. Developing unit costs of service helps allocate costs across customer classes based on the demands those customers place on the system.

While the analyses from the Water Master Plan indicate that the system-wide maximum day demand ratio is 1.23, the data do not provide an indication of how this might vary by customer class. To address this, billing data must be used. For each potable water customer class, the average day demand was calculated for the month with the most demand using the FY 2016 billing data. The annual average day demand was also calculated for each potable water customer class using the FY 2016 billing data. The maximum month peaking factor for the entire system was calculated by dividing the maximum month demand by the annual average day demand and is 1.13. It is known from Water Master Plan Table 5-2 that the system-wide maximum day peaking factor is 1.23. Therefore, the maximum day over maximum month peaking factor must be 1.23 / 1.13, or 1.09, as shown in the bottom of Column E of Appendix F, which shows the peaking factor calculations. This 1.09 peaking factor (representing the relationship of peak day demand to peak month demand) was then applied to the customer classes in the same proportion as their maximum month peaking factor, which yields a maximum day peaking factor for each customer class.

Similarly, it is known from hydraulic modeling that the system-wide peak hour factor is 2.09, as shown on the bottom of Column J in Appendix F. To estimate the peak hour peaking factor by customer class, the peak hour over maximum day peaking factor for each class was estimated. For residential systems, a regression analysis showed that the peak hour factor to average day peaking factor was approximately 2.58. The other customer classes were then set to make the resulting average peak hour factor equal to the known 2.09 system factor from modeling. The resulting customer class peaking factors are shown in Table 3-8.

Table 3-8. Potable Water Customer Class Peaking Factors

Customer Class	Maximum Day Peaking Factor (Maximum Day over Average Day)	Peak Hour Peaking Factor (Peak Hour over Average Day)
Single-family	130%	260%
Multi-unit	105%	210%
Non-Residential	125%	165%
Agricultural	120%	120%

3.5.1 Estimated Units of Service

Since the responsibility for recovering the cost of service depends on the total units served by each cost center, the units of service are developed for each customer class. For example, base costs vary with the volume of water requirements. Therefore, the unit cost for the base cost center is the total base cost divided by the total volume served. Similar determinations of the units associated for extra capacity (maximum day and peak hour) and equivalent meters are made for each of the customer classes.

The estimated units of service for the customer classes are shown in Table 3-9. The units of service associated with each customer class estimate the impact each customer class places on the cost centers. The number of equivalent meters, using 3/4 inch or smaller meters as the base meter size, is derived by developing a meter equivalency ratio using the BWS's meter costs and then applying those ratios to the number of meters of each size (ranging from 5/8-inch to 12-inch)[4].

Table 3-9. Estimated Units of Service, FY 2019

					Max Day Requirements			Peak Hour Requirements				
	Bills	Equivalent Meters	Annual Use	Average Daily Use	Capacity Factor	Total Capacity	Extra Capacity	Capacity Factor	Total Capacity	Extra Capacity	Ocean Cooling	Public Fire Protect.
Customer Class	No.	No.	k-gal	k-gal/day	%	k-gal/day	k-gal/day	%	k-gal/day	k-gal/day	ton-hrs	Hydrants
Potable												
Single-family	1,760,784	152,731	16,819,000	46,079	130%	59,903	13,824	260%	119,807	73,727		
Multi-unit	73,003	28,039	9,806,100	26,866	105%	28,209	1,343	210%	56,419	29,553		
Non-Residential	100,872	34,238	16,058,900	43,997	125%	54,996	10,999	165%	72,595	28,598		
Agricultural	5,624	1,389	1,129,500	3,095	120%	3,713	619	120%	3,713	619		
Fire Service - Private	22,860					111	111		1,220	1,109		
Fire Service - Public						999	999		11,020	10,021		21,414
Total Potable	1,963,144	216,397	43,813,500	120,037			27,895			143,627		
Non-Potable												
Non-Potable	846	355	622,900	1,707								
Contractual												
RO	84	640	538,016	1,474								
R-1 (Golf)	87	531	971,200	2,661								
R-1 (Other)	279	396	1,499,100	4,107								
Ocean Cooling											7,248,575	

The maximum day and peak hour factors for each class (from Table 3-8) are applied to customer class annual use information to calculate the maximum day and peak hour demands placed on the system by each customer class.

Extra capacity requirements for fire protection service recognize estimated peak fire flow requirements. Peak fire flow requirements for four simultaneous fires consisting of 4,000, 2,000, 1,500, and 1,000 gallons per minute flows for 3-, 2-, 1- and 1-hour durations (maximum day), respectively, and for a 24-hour duration (maximum hour) are used to estimate the peak demand impact of fire protection service. These flows and durations are per the Water Master Plan Table 5-1 for industrial/ large commercial, Multi-Unit Residential high rise/ small commercial, Multi-Unit Residential low rise, and Single-Family Residential, respectively. The resultant peak fire demand quantities have been allocated between public and private fire protection based on equivalent 6-inch hydrants and connections.

[4] Excludes private and public fire service.

While the contractual customers currently are charged based on the contracts' terms, most of the contracts include an automatic switch to a R-1 or RO rate, if published. Therefore, the estimated units of service of these two customer classes are also shown. Additionally, R-1 is shown for golf customers and other customers ("other") because these two groups within the R-1 customer class have different contractual rates, which may be important when comparing the allocated cost of service to revenues generated by the customer classes.

3.5.2 Unit Costs of Service

Table 3-10 presents the unit cost associated with each cost center for the test year. Unit cost is calculated by totaling the Operating Expense (Table 3-7) and Capital and Other Costs (Table 3-6) at the cost center level and dividing by the total number of units for each respective cost center, as determined from the information in Table 3-9.

Table 3-10. Unit Costs of Service, FY 2019

	Cost Center	Units	Units of Service	Operating Expense, $M	Capital and Other Costs, $M	Total COS, $M	Unit Costs of Service
Potable Water	Base	k-gal	43,813,500	$61.6	$47.6	$109.2	$2.49
	Extra Cap. - Max Day	k-gal/day	27,895	$14.2	$10.9	$25.1	$900.04
	Extra Cap. - Peak Hour	k-gal/day	143,627	$27.6	$31.0	$58.7	$408.42
	Customer - Billing	# of Bills	1,964,440	$10.3	$0.5	$10.8	$5.50
	Customer - Meters	E.M.	218,319	$9.3	$3.1	$12.4	$56.75
	Public Fire Protection	Hydrants	21,414	$2.1	$2.3	$4.4	$206.12
	Non-Potable	k-gal	622,900	$1.1	$0.8	$2.0	$3.18
	RO	k-gal	538,016	$3.3	$1.7	$4.9	$9.14
	R-1	k-gal	2,470,300	$4.2	$0.4	$4.6	$1.84
	Ocean Cooling	ton-hrs	7,248,575	$0.9	$0.4	$1.3	$0.18
	Total	$		$134.6	$98.7	$233.3	

Note: Totals may not add due to rounding.

The resultant unit cost of service can then be applied to each customer class's demand on the system to determine each class's share of the cost of service, which is shown in Table 3-11. The unit costs of service from the last column of Table 3-10 are shown in the top row of Table 3-11. These unit costs are applied to the units of service associated with each customer class (Table 3-9) to derive the total costs associated with serving each customer class.

Table 3-11. Allocation of Unit Costs of Service to Customer Classes

		Potable Water									
	Total $M	Base k-gal	Extra Cap - Max Day k-gal/day	Extra Cap - Peak Hour k-gal/day	Customer: Billing # of Bills	Customer: Equiv. Meters E.M.	Public Fire Protection Hydrants	Non-Potable l-gal	RO Water k-gal	R-1 Water k-gal	Ocean Cooling ton-hrs
Unit Cost of Service, $/unit		2.49	900.04	408.42	5.50	56.75	206.12	3.18	9.14	1.84	0.18
Single-family											
Units		16,819,000	13,824	73,727	1,760,784	152,731					
Costs	$102.8	$41.9	$12.4	$30.1	$9.7	$8.7					
Multi-unit											
Units		9,806,100	1,343	29,553	73,003	28,039					
Costs	$39.7	$24.4	$1.2	$12.1	$0.4	$1.6					
Non-Residential											
Units		16,058,900	10,999	28,598	100,872	34,238					
Costs	$64.1	$40.0	$9.9	$11.7	$0.6	$1.9					
Agricultural											
Units		1,129,500	619	619	5,624	1,389					
Costs	$3.7	$2.8	$0.6	$0.3	$0.0	$0.1					
Non-Potable											
Units					846	355		622,900			
Costs	$2.0				$0.005	$0.02		$2.0			
RO											
Units									538,016		
Costs	$4.9								$4.9		
R-1 (Golf)											
Units										971,200	
Costs	$1.8									$1.8	
R-1 (Other)											
Units										1,499,100	
Costs	$2.8									$2.8	
Ocean Cooling											
Units											7,248,575
Costs	$1.3										$1.3
Fire Service - Private											
Units			111	1,109	22,860						
Costs	$1		$0.1	$0.5	$0.13						
Fire Service - Public											
Units			999	10,021			21,414				
Costs	$9		$0.9	$4.1			$4.4				
Total, $M	$233.3	$109.2	$25.1	$58.7	$10.8	$12.4	$4.4	$2.0	$4.9	$4.6	$1.3

Note: Totals may not add due to rounding.

3.6 Comparison of Costs of Service to Revenues Under Existing Rates by Customer Class

Table 3-12 summarizes the total costs of service allocated to each of the customer classes and compares that to projected revenues generated under the existing rates for those classes during FY 2019. This comparison identifies where any discrepancies might exist. The costs of service have been adjusted to proportionately allocate public fire service costs to the potable water customers based on the cost to serve each potable water customer class because all potable water customers benefit from public fire service. Since no revenue increase is projected for FY 2019 (see Table 2-18), the results show no overall revenue adjustment; however, within the customer classes some disparity exists in the recovery of a class's cost of service.

Table 3-12. Comparison of Allocated Costs of Service with Revenue Under Existing Rates, FY 2019

Customer Class	Unadjusted Costs of Service	Adjustment (1)	Costs of Service	Revenue Under Existing Rates	Revenue Increase (Decrease) from Costs of Service
Single-family	$102,803,500	$4,597,400	$107,400,900	$96,339,800	11%
Multi-unit	$39,703,000	$1,775,500	$41,478,500	$45,083,400	(8%)
Non-Residential	$64,087,400	$2,866,000	$66,953,400	$80,586,200	(17%)
Agricultural	$3,733,600	$167,000	$3,900,600	$2,357,500	65%
Fire Service – Private	$678,500	$0	$678,500	$84,300	705%
Fire Service – Public	$9,405,800	-$9,405,800	$0	$0	
Subtotal Potable	$220,411,900	$0	$220,411,800	$224,451,200	(2%)
Non-Potable	$2,008,500	$0	$2,008,500	$1,546,400	30%
Contractual					
RO	$4,956,400	$0	$4,956,400	$2,709,100	*83%*
R-1 (Golf) (2)	$1,821,000	$0	$1,821,000	$534,200	*241%*
R-1 (Other)	$2,787,600	$0	$2,787,600	$2,698,400	*3%*
R-1 Total	$4,608,600	$0	$4,608,600	$3,232,600	*43%*
Ocean Cooling	$1,280,400	$0	$1,280,400	$1,326,600	*(3%)*
Total	$233,265,800	$0	$233,265,800	$233,265,800	0%

(1) Re-allocating public fire costs proportionally to potable water customers based on total cost of service.
(2) Recycled water is often subsidized to encourage its use instead of potable water so that potable water resources may be conserved for future demand.
Note: These values vary slightly from public presentations as analyses were further refined.
Note: Totals may not add due to rounding.

While the rates for customers under contracts are determined per the contract language, they have been included in the analysis as a measurement of how well the revenue generated under those contract rates recovers the cost of serving each of those customers. To the extent that contract rates are below the cost of service, which is not unusual as many utilities have lower rates to encourage the use of recycled or reclaimed water, those unrecovered costs are paid by the other customer classes. For example, golf courses receiving R-1 water under contract receive this water at a discount because of tangible benefits provided by golf courses such as stormwater catchment, which provides water quality benefits by preventing the water from being discharged to the ocean; "take or pay" contractual terms, which obligate golf courses to pay for a minimum amount of water regardless of use; as well as offsetting demand, which extends the availability of existing potable water supplies for future use.

Rate-based revenues for Multi-Unit Residential and Non-Residential customers over-recover their COS. Rate-based revenues for Single-Family Residential, Agricultural customers, and the Non-Potable customer classes under-recover their COS.

Private fire service charges potentially under-recover costs because the current automatic fire sprinkler rate structure only charges based on non-fire related usage plus a one-time fee. The more common fire protection rate structure to recover fire protection costs is a flat annual or monthly charge based on the fire meter service size.

The contractual customers that would be subject to a R-1 rate, if published, also under-recover their allocated costs of service. As a class, R-1's indicated revenue increase would be 43 percent. As shown in Table 3-12, golf courses served under R-1 contracts receive the majority of the subsidy within that class.

3.7 Subsidies (Revenues Under Existing Rates Less than Cost of Service)

Table 3-12 shows that some subsidies currently occur among the customer classes. Some of this may be intentional, like pricing Non-Potable, R-1 and RO water at below the cost of service to encourage its use. The benefit of using those resources is that potable water sources are conserved for activities that require potable water and for future generations. Another possible intentional subsidy is economic-development based, such as with agriculture or golf courses. The BWS and its stakeholders may perceive an economic benefit to providing Agricultural users water at a discounted rate to support the farming economy as well as a discount to golf courses to incentivize the tourist industry. Other subsidies may be unintentional and occur as the mix of assets and O&M activities change, customer usage patterns change, or as better customer and/or system data is available.

Based on the cost of service analysis and Stakeholder Advisory Group input, the Board provided the following guidelines for cost recovery:

ZERO SUM GAME

Cost recovery is a zero-sum game. If the revenues generated by one customer class are not sufficient to cover its cost of service, then the revenues from other customer classes will have to make up the difference.

The Stakeholder Advisory Group learned this through playing the Zero-Sum Game. The game board was pie-shaped, with each slice representing a customer class. Poker chips were distributed among the slices in proportion to revenues for comparison to actual cost of service. Divided into three small groups, each group had to reach consensus on how much revenue should come from each customer class in comparison to its cost of service. The total cost of service had to be recovered. After much debate, each group reached a consensus, which was shared with the whole group. The consensus results:

1 – Agricultural customers should continue to be subsidized

2 – Single-family customers should pay a larger share of their cost of service

3 – Multi-unit customer class revenues should be lowered so that the class isn't recovering more than its cost of service.

- Incremental increase to Single-Family Residential customer class revenues to bring the class to about 95 percent cost of service recovery by FY 2023.
- Incremental decrease to Multi-Unit Residential customer class revenues to bring the class down to 100 percent cost of service recovery by FY 2023.
- Maintain cost recovery for the Agricultural customer class at 60 percent of its cost of service.
- Bring the Non-Potable customer class to 80 percent cost of service recovery.
- Keep the R-1 customer class at about 70 percent cost of service recovery.
- Bring the RO water customer class to about 63 percent cost of service recovery.

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Section 4

Alternative Water Rate Structures

This section examines possible changes to the water rate structures considering the cost of service findings, as well as findings related to user characteristics, which are discussed below. Stakeholder Advisory Group input to the alternative rates examination are noted throughout.

4.1 Key Findings

4.1.1 User Characteristics

Both Single-Family and Multi-Unit Residential water rates use a tiered rate structure. Analysis of the FY 2015 and FY 2016 billing data indicates that the vast majority of usage falls within the first tier for both classes. The data suggests that depending on goals and objectives for tier setting, (such as encouraging efficient use of water) the tiers should be adjusted.

The Non-Residential customer class is billed based on a uniform rate, regardless of the amount of usage. This class includes several premise types such as government, hotels, commercial, irrigation, and golf courses. Some of these premise types exhibit higher peaking tendencies than others. Detailed data on usage characteristics for the various premise types is not available and would be costly and time-consuming to develop. If there is a desire to subdivide the Non-Residential rate customer class into small, more homogenous groups, then planning, data collection and analysis efforts should be initiated to consider this during the next anticipated rate setting period.

4.1.2 Board Guardrails on Alternative Rate Structures

Based on the cost of service analysis, input from the Stakeholder Advisory Group, and initial rate structure modeling, the Board developed guardrails at its Water Rate Workshop on January 5, 2018. These guardrails provided the decision-making framework for refinement of rates and structures to derive the recommended rates. The guardrails are as follows:

Fixed Charge Guardrail: Change structure of monthly charge to vary by meter size.

The current flat-rate customer charge structure does not recognize the cost differences related to maintaining different sized meters. However, the cost of service analysis separately identified costs related to customer billing and customer meters. By applying these findings, a meter-based structure was developed based on the BWS meter cost ratios for those customer-related costs that vary by meter size. Customer-related costs that do not vary by meter size were still determined on a per bill basis. The two charges were combined to create a single, monthly customer charge that depends on meter size.

Residential Guardrails: Shift tiers to encourage more conservation and establish an "Essential Needs" tier. Adjust Single-Family and Multi-Unit Residential rates closer to 100 percent cost of service recovery.

The quantity charge structure and unit rates were also reviewed. Analysis of usage characteristics of Single-Family and Multi-Unit Residential customers showed that usage patterns have changed since the tiers were set. Based on discussion with the BWS staff, the Stakeholder Advisory Group, and consideration of the Board guardrails, new tiers were developed for the residential customer classes. A discounted first tier was added, with charges to customers below cost, to provide for essential needs. The higher cost fourth tier (currently the third tier) was designed to continue to encourage efficient use of water. The unit rate for the second tier was set so that the 6 k-gal/mo/du bill for Single-Family and 5 k-gal/mo/du for Multi-Unit customers would remain about the same in FY 2020 as they are today. The third tier unit rate was set to reach targeted cost of service recovery for each class. For Single-Family customers, the target was to reach 95 percent of cost of service recovery by FY 2023 up from a projected 90 percent for FY 2019. The gradual progress towards these targets reflects a desire to prevent or reduce rapid increases in rates due to moving to 100 percent cost of service recovery in the first year. . Since Multi-Unit customers already recover more than their cost of service, they are targeted to be close to 100 percent cost of service recovery by FY 2023, down from a projected 109 percent in FY 2019.

Agricultural Guardrail: Retain existing Agricultural customer subsidy levels.

Since Agricultural customer class tiers have historically recognized that the meter may also serve a home, the Agricultural class tiers have been updated commensurate with changes in the Single-Family tiers. The first and second tiers and rates are the same as the Single-Family customer class. The third tier was set to achieve an overall 60 percent cost of service recovery for the Agricultural customer class, which is consistent with historical cost recovery percentages.

Non-Residential Guardrail: Make no changes to Non-Residential rate structure.

Upon review of Non-Residential usage, it was determined that the uniform quantity charge structure will remain for Non-Residential customers due to the highly variable water usage patterns among the wide range in types and sizes of customers within this customer class. The quantity charge increases at half the annual revenue adjustment over the study period.

Non-Potable Guardrail: Increase recycled and Non-Potable rates to recover more of their costs of service, especially for RO customers.

R-1 and RO customers are currently all served under negotiated contracts. Moving forward, uniform quantity rates will be published for R-1 (Golf), R-1 (Other), and RO, and will be based on costs of service and other policy decisions. For example, Non-Potable and recycled rates are often set below the cost of service to encourage the use of recycled resources as they reduce the demand on potable water resources. Setting these rates below the cost of service helps meet the Sustain mission of the BWS. Proposed rates were presented to the BWS staff and the Stakeholder Advisory Group and were revised based on feedback to limit projected revenue increases from R-1 and RO (individually) to no more than two times the cumulative revenue adjustment over the 5-year period.

Private Fire Service Guardrail: Establish a fire meter standby charge.

Private fire services/ sprinklers are currently charged a one-time fee plus the Non-Residential quantity charge for non-fire flows (e.g., testing). This results in revenue streams that are difficult to track against the costs to serve these customers. Therefore, a monthly meter-based charge was developed and discussed with the BWS, the Stakeholder Advisory Group, and the Board for input. These monthly charges replace the current one-time fee. Charges for non-fire-related water use will still apply and will be based on the Non-Residential water rate.

Additional Constraint.

Due to re-aligning rates to bring most customer classes closer to cost of service recovery, as well as re-aligning tiers to address the Essential Needs tier and encouraging conservation, cumulative changes in rates and bills for each customer class will not match the overall cumulative increase in required revenue. Therefore, an additional constraint was developed to attempt to limit the cumulative percentage increases to no more than two times the projected percent revenue increase for each customer class.

4.2 Water User Characteristics

4.2.1 Data Gathered

To develop the user characteristics, numerous discussions and meetings were held with the BWS staff, and the following data sources were gathered and utilized:

- Historical billing data for FY 2015 and FY 2016, provided by the BWS from its billing database
- Water Master Plan, October 2016
- Schedule of Water Rates and Charges
- Contracts for those customers receiving R-1 or RO water under contractual arrangements, provided by the BWS.

4.2.2 User Characteristics

Because different types or classes of customers have different patterns of water usage and place different demands on the water system, understanding customer class usage patterns helps when analyzing the cost of service and developing water rate structures. User characteristics also help determine the most appropriate rate structure to meet goals and objectives beyond recovering sufficient revenue to meet annual revenue requirements.

The BWS supplied billing data for FY 2015 and FY 2016 from its billing database. These data were used to examine the water use patterns of the major customer classes (i.e., Single Family, Multi-Unit, Agricultural, Non-Residential and Non-Potable).

Monthly usage for each customer class was examined to determine any seasonality. Usage curves were developed for the Single-Family, Multi-Unit and Agricultural classes in order to better

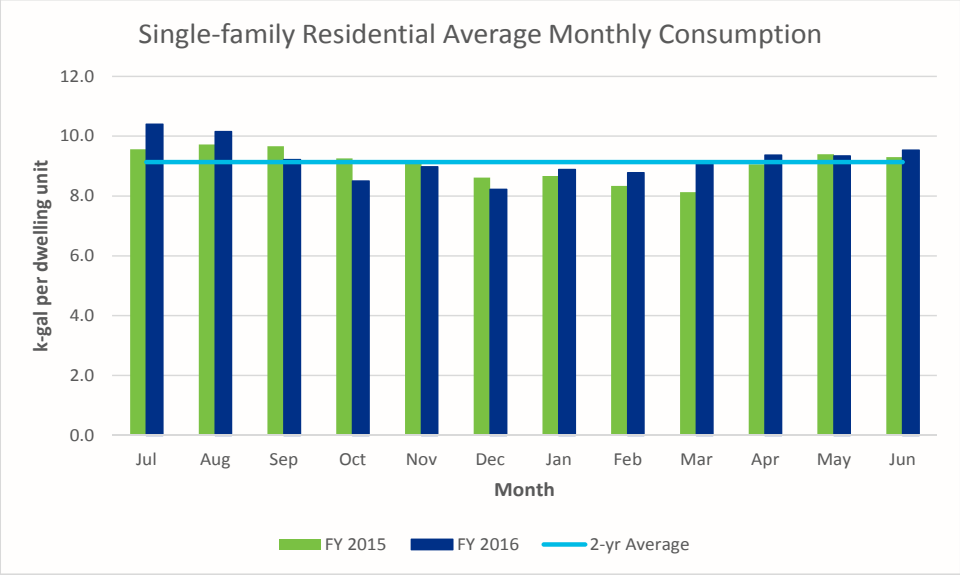
understand water use patterns for these customer classes, all of which are billed under a tiered rate structure.

4.2.2.1 Residential

The BWS splits residential customers into single-family and multi-unit dwellings. The Single-Family Residential customer class contains single-family homes (one dwelling unit) and duplexes (two dwelling units). The Multi-Unit Residential customer class includes such residences as townhomes, triplexes and apartments. Analysis for these two customer classes is done on a per dwelling unit (du) basis.[1]

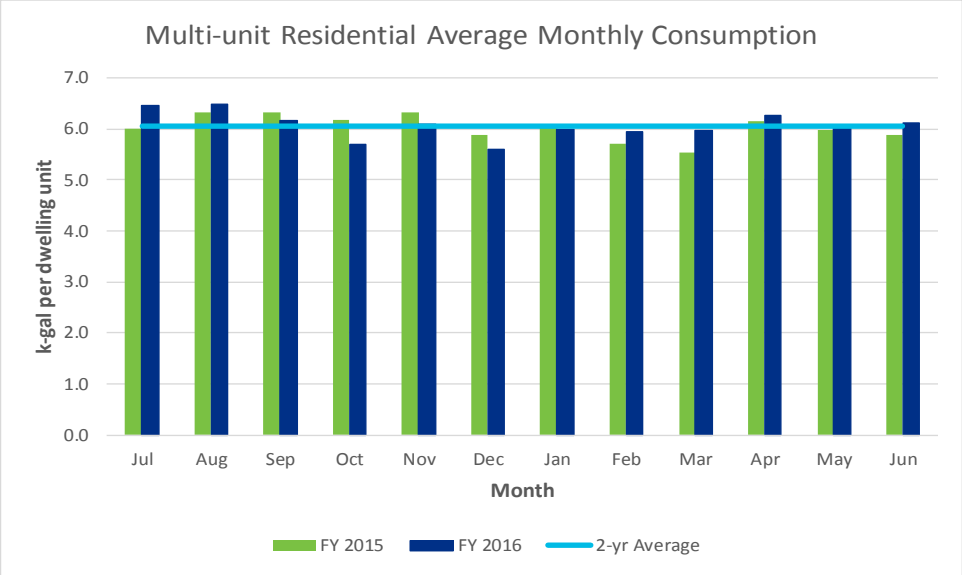
Single-Family Residential and Multi-Unit Residential average monthly water consumption on a per dwelling unit basis for FY 2015 and FY 2016 are shown in Figure 4-1 and Figure 4-2, respectively. Single-Family customers have an average billed water usage of about 9 k-gal/mo/du while Multi-Unit's average billed water usage is about 6 k-gal/mo/du. Single-Family Residential's higher average usage is due to a greater amount of landscape irrigation and other outdoor usage when compared to Multi-Unit Residential customers. These figures illustrate that these residential customers have relatively little seasonal variation in water usage, which is expected given O'ahu's temperate climate.

Figure 4-1. Single-Family Residential Average Monthly Water Consumption, k-gal/du, FY 2015 and FY 2016



[1] Data was adjusted for outlier data points (e.g., one significantly higher bill compared to other bills for an account) or for accounts where the billing data looked questionable (e.g., many different dwelling units listed for an account, extremely high usage). About 15 accounts were excluded.

Figure 4-2. Multi-Unit Residential Average Monthly Water Consumption, k-gal/du, FY 2015 and FY 2016



The BWS currently has a three-tier rate structure for residential customers. Knowing how much water usage typically falls within these tiers helps to determine if the tiers should be adjusted based on goals such as encouraging efficient use of water. To show what percent of total customer class usage occurs at different usage levels, usage curves were developed.

Usage curves developed from a bill tabulation are useful for identifying and analyzing customer water usage patterns, evaluating both existing and alternative water-usage rate tiers, and determining utility billing revenue under alternative rate schedules. A bill tabulation shows the number of bills issued at various levels of water usage over a specific period, in this case, FY 2015 and FY 2016. From this tabulation, the cumulative billed usage at each level is calculated and expressed on a percent basis. The cumulative billed usage at each level is presented in a usage curve like in Figure 4-3. The vertical axis is the percent of total water usage for the customer class. The horizontal axis is the monthly billed usage levels presented on a logarithmic scale. The curves show how much of the total amount of annual water consumed by the customer class is used at different monthly bill amounts. The blue bars demark the upper block of Tier 1 and Tier 2. For the Single-Family customer class, the mean usage is 9 k-gal/mo/du, the median usage is 7 k-gal/mo/du, and the mode is 5 k-gal/mo/du.

Figure 4-3. Single-Family Residential Water Usage Pattern, FY 2015 and FY 2016

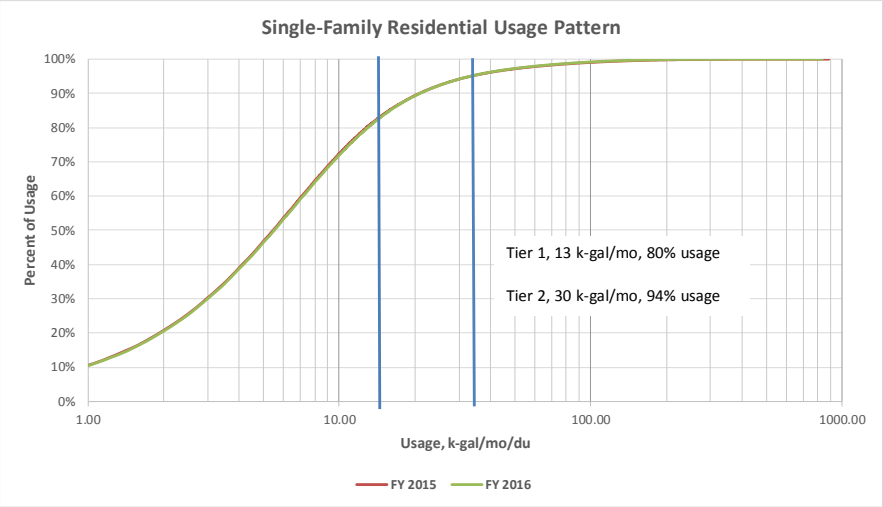
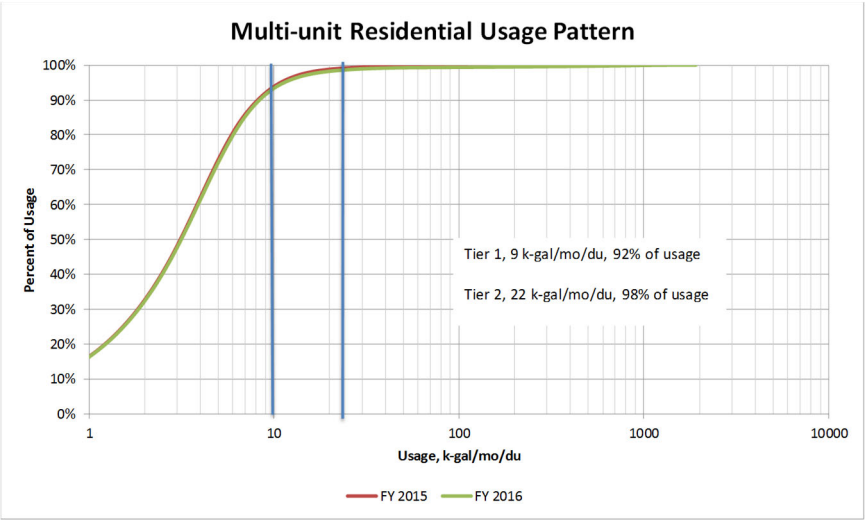


Figure 4-4 shows the usage curve for Multi-Unit Residential customers on a per dwelling unit basis. Approximately 92 percent of usage occurs within the first tier (0-9 k-gal/mo/du). Approximately 98 percent of usage occurs within the first two tiers (0 - 22 k-gal/mo/du). As with Single-Family Residential, with so much usage captured within the first and second tiers it leads one to conclude that the original intent of setting those tier points is no longer met. Additionally, Multi-Unit Residential tiers are often set so that the same amount of cumulative usage on a percentage basis falls within the Multi-Unit Residential tiers as falls within the Single-Family Residential tiers. For example, to have 80 percent of the Multi-Unit Residential usage fall within Tier 1 (corresponding to the current amount of usage in Single-Family Tier 1), the Tier 1 upper limit for Multi-Unit customers would need to move from 9 k-gal/mo/du to 6 k-gal/mo/du. Over time, as usage patterns have changed, this probable connection between Single-Family Residential and Multi-Unit Residential usage within tiers has diverged. At the very least, the Multi-Unit Residential tiers need to be reset to coincide with the current percent usage within Single-Family Residential tiers. The Multi-Unit Residential mean usage is 6.0 k-gal/mo/du, the median usage is 5.25 k-gal/mo/du, and the mode is 4.5 k-gal/mo/du.

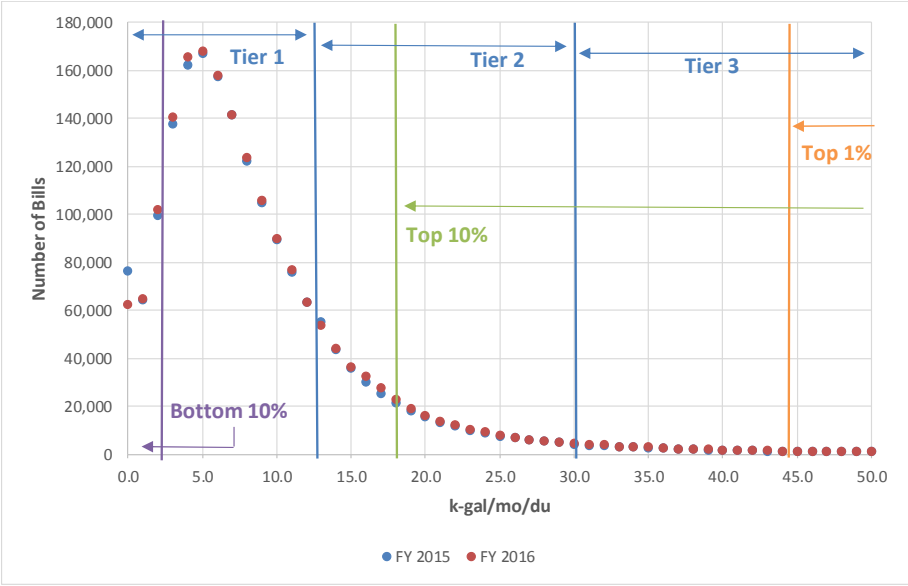
Figure 4-4. Multi-Unit Residential Dwelling Unit Water Usage Pattern, FY 2015 and FY 2016



As shown in Figure 4-3, Single-Family Residential customers use about 80 percent of their annual water within the first tier (0-13 k-gal/mo/du). This can be seen by following the left-most blue line up until it intersects with the curve and then following that point horizontally and left to the vertical axis. The right-most blue line represents the top of Tier 2, which is 30 k-gal/mo/du, and shows that 94 percent of usage occurs within the first two tiers. About 6 percent of water sold falls into the third tier. With so much usage captured within the first and second tiers, it's likely that the original intent of setting those tier points is no longer met.

Figure 4-5 shows the number of Single-Family Residential bills at various monthly water usage levels up to 50 k-gal/mo/du. The maximum number of bills occurs at 5.0 k-gal/mo/du. To build this graph, the per dwelling unit billed water levels were rounded to the nearest 0.5 k-gal/mo/du.

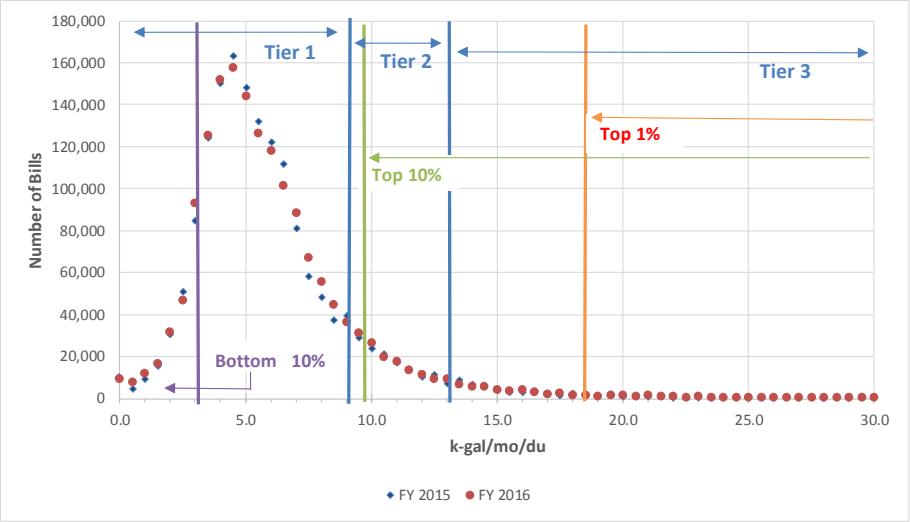
Figure 4-5. Single-Family Residential Number of Bills at Different Usage Levels, FY 2015 and FY 2016



When the tiers were placed in effect on July 1, 1993 (Resolution 615), the water usage patterns in Tiers 1 and 2 were probably lower than current levels. If true, this curve suggests that customers have likely been reducing water use through conversion to low-flow devices and/or individual conservation measures since the tiers were initially developed. Section 7 of the Water Master Plan discusses decreasing water use trends in more detail, including an island-wide decrease in overall demand and in per capita demand over the last 25 years. With so much water usage falling within the first two tiers, it is appropriate to re-evaluate the tiers in light of goals and objectives set by the BWS.

Figure 4-6 shows the number of bills for Multi-Unit customers at various usage levels using the billing database. The maximum number of bills occurs at 4.5 k-gal/mo/du. To build this graph, the per dwelling unit bill levels were rounded to the nearest 0.5 k-gal/mo/du.

Figure 4-6. Multi-Unit Residential Number of Bills at Different Usage Levels, FY 2015 and FY 2016



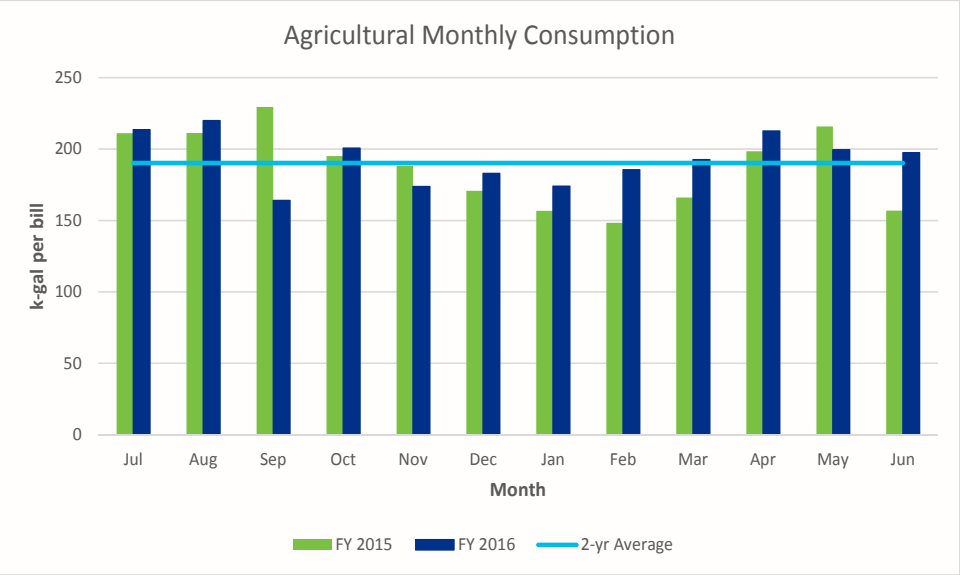
4.2.2.2 Agricultural

The BWS offers an Agricultural customer class rate to those who qualify. To qualify, the customer must submit an application each year showing that they are engaged in agriculture on a commercial basis and have that application approved by the BWS. The average monthly consumption per bill for the Agricultural customer class is shown in Figure 4-7. This class shows peaking tendencies between April and September. In general, the months of June through September are the driest months, roughly corresponding to billing months[2] of July through October. May and October are seasonal transition months. Rainfall also varies greatly by location

[2] Depending on when a particular customer's billing cycle starts and ends, the usage may or may not be for the same month as the bill period end date. For example, if a bill period ends at the beginning of August, the majority of water use covered in the bill occurred in July. If a bill period ends in the middle of the August, it captures some July and some August usage. Bill periods ending at the end of August would capture mostly usage within August.

on the island. The agricultural areas are generally in moderate rainfall areas based on comparing Figure 8-1 of the Water Master Plan with the 2015 O'ahu crop summary map produced by the University of Hawaii and the Hawaii State Department of Agriculture (Appendix G).

Figure 4-7. Agricultural Average Monthly Water Consumption, k-gal per bill, FY 2015 and FY 2016

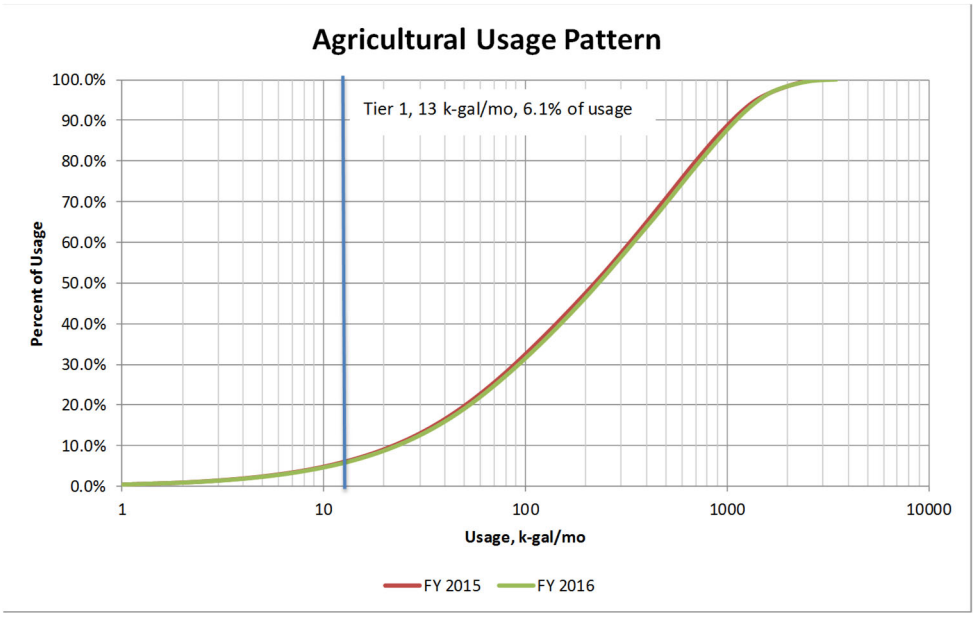


Rainfall totals in the last six months of FY 2015 (Jan – June 2015) were near or below average for O'ahu. This may explain why water consumption in April 2015 and May 2015 appears higher than average. However, August 2015 (FY 2016) was abnormally wet; accounting, at least in part, for the lower billed usage in September 2015 (FY 2016). October is the historical start to the wet season and rainfall in October and November 2015 (FY 2016) was at or above average levels. January and February 2016 are close to the average due to an uncharacteristically dry December 2015 and January 2016 (FY 2016) due to El Nino. A continued drier March 2016 is reflected in the higher April 2016 billed usage[3]. While rainfall amounts do vary by location on the island, there is a general weather influence to the Agricultural class' usage levels.

Since customers within this class can serve both their homes and agricultural needs through one meter, water usage for this class is billed under a two-tiered, declining block rate structure. The first tier and rate are set to be the same as Single-Family Residential under the presumption that most of the usage in this tier is for household needs. The second tier, meant to capture agricultural needs, is offered at a lower rate. Figure 4-8 shows that 6 percent of the Agricultural customer class' water use falls within the first tier. This seems reasonable as the presumption is that the majority of water use by these customers would be for agricultural use.

[3] Monthly Precipitation Summaries. (2015-2016). prepared by the National Weather Service, Honolulu, HI Weather Forecast Office. Retrieved from http://www.prh.noaa.gov/hnl/pages/hydrology.php

Figure 4-8. Agricultural Water Usage Pattern, FY 2015 and FY 2016



4.2.2.3 Non-Residential

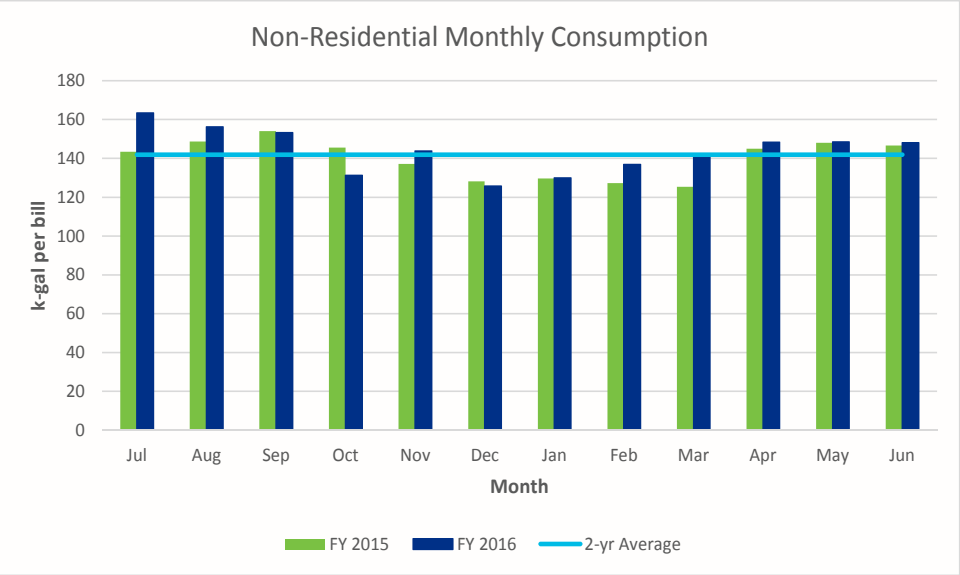
As with residential and Agricultural customers, the monthly water usage pattern for Non-Residential customers was evaluated. This customer class encompasses a wide range of premise types. The most common, based on number of accounts, are shown in Table 4-1.

Table 4-1. Most Common Non-Residential Premise Types, Number of Accounts

Premise Type	FY 2015	FY 2016
Commercial	5,659	5,625
City Government	669	673
Irrigation	600	608
Industrial	586	584
State Government	553	548
Religion	415	408
Hotel	224	211

The monthly average water use pattern for the Non-Residential customer class is shown in Figure 4-9. This pattern indicates that this customer class may have a slight seasonal variance.

Figure 4-9. Non-Residential Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016



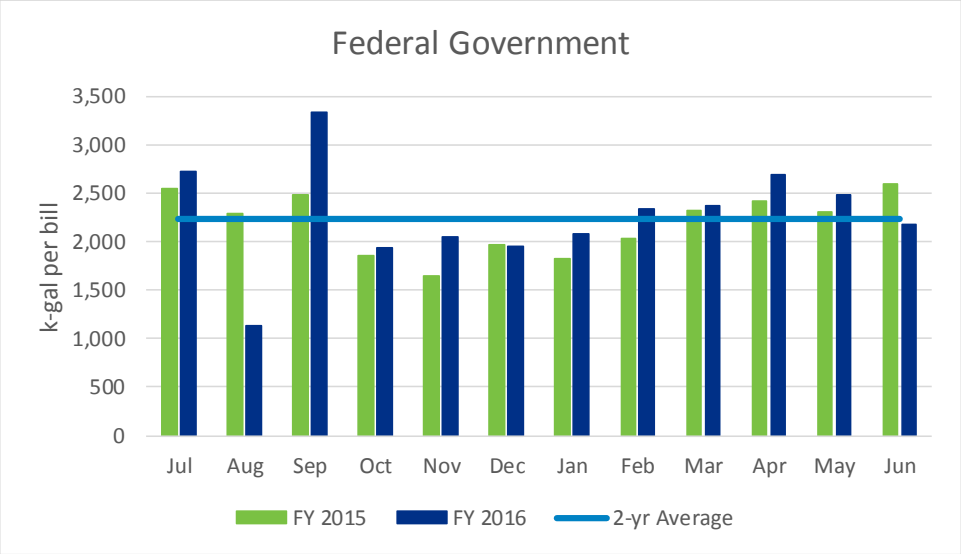
Since this customer class includes a range of premise types, the monthly usage of some of these premise types was examined individually. The premise types using the largest amounts of Non-Residential water are commercial, government (city, state) and hotel. These customers account for 80 percent of the water consumed annually within the Non-Residential customer class. The premise types with the highest average use per bill are federal government, golf course and hotel. Table 4-2 shows the percent of annual Non-Residential usage of these premise types. While the 50 federal government accounts and 19 golf course accounts are not overall large water users as a percent of the class, they do have the highest average use per bill.

Table 4-2. Highest Non-Residential Premise Types: Measured Two Ways

Premise Type	Percent of Non-Res. Water Use		Average Use per Bill
	FY 2015	FY 2016	(k-gal/bill)
Federal Government	7%	7%	2,330
Golf Courses	1%	1%	1,009
Hotel	13%	12%	825
State Government	15%	16%	424
City Government	12%	12%	275
Commercial	41%	40%	109

Figure 4-10 through Figure 4-15 present the monthly average use per bill for federal government, golf courses, hotel, state government, city government, and commercial.

Figure 4-10. Federal Government Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016

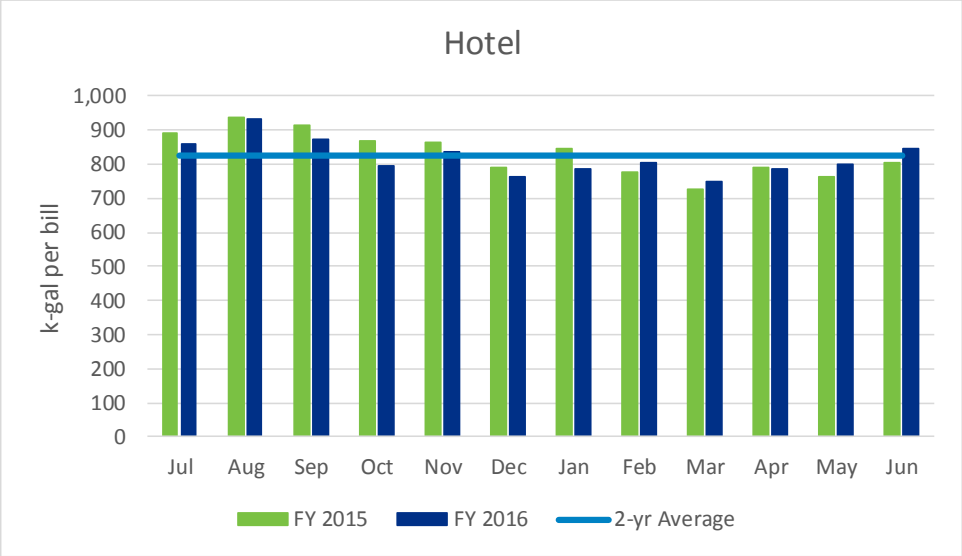


Federal government customers have the highest average use per bill. Federal government accounts have a moderate seasonality component. The BWS may want to engage those customers in conversation over their water use to better understand their needs and usage patterns.

Figure 4-11. Golf Course Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016

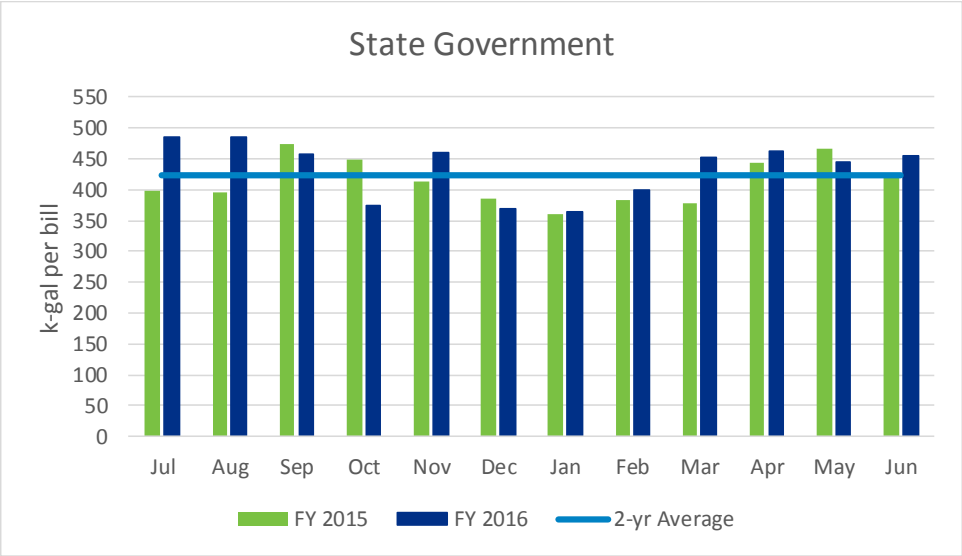
Golf courses receiving potable water under the Non-Residential rate account for 1 percent of annual Non-Residential customer class water usage, but have the second highest average use per bill. These customers exhibit a clear seasonal usage pattern, as would be expected.

Figure 4-12. Hotel Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016



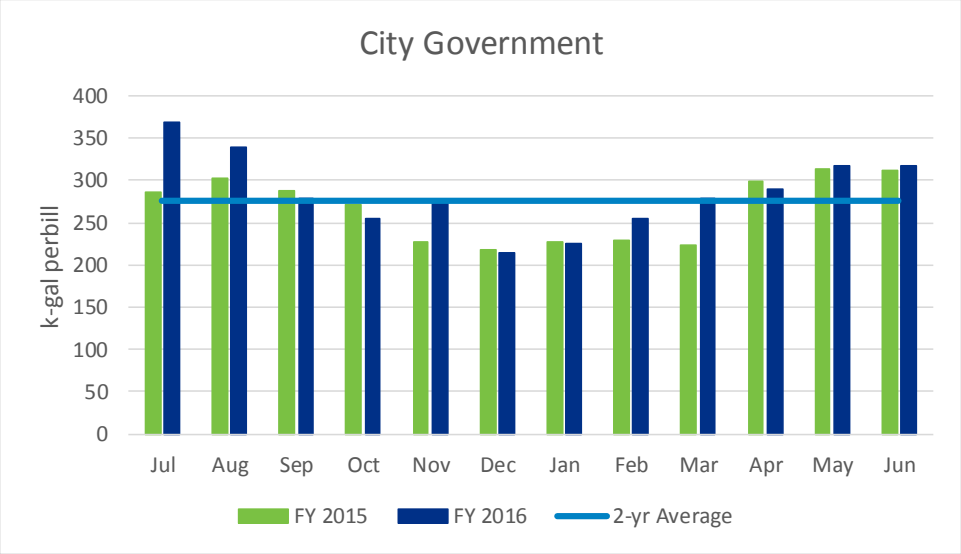
The hotel premise type accounts for about 12-13 percent of annual Non-Residential water consumption. This premise type also has the third highest average usage per bill of the Non-Residential premise types. Monthly usage increases from about June through about November. Tourism statistics for visitor arrivals to O'ahu by month for 2010 – 2015, on average, indicate a peak in tourists in December and in June – August, as shown in Appendix H. These months roughly correlate to the billing months of January and July – September. But July through September also roughly correlates to hotter/ drier months. Therefore, it is difficult to distinguish if the hotels' water usage pattern varies based on tourism, weather or a combination of both.

Figure 4-13. State Government Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016



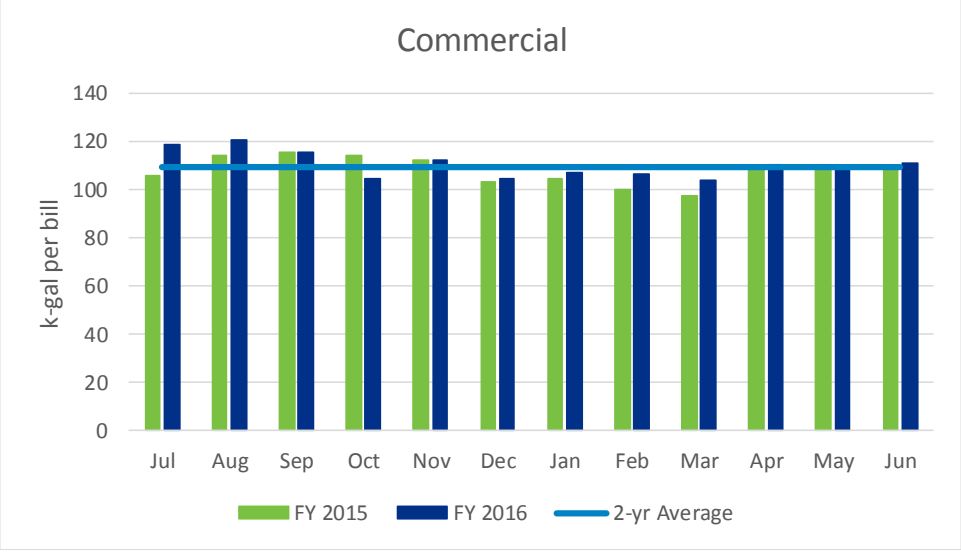
The state government premise type is another high user group, accounting for approximately 15 percent of annual Non-Residential customer water use. This group has potentially two peaking periods, the spring and late summer. The BWS may want to engage those customers in conversation over their water use to better understand their needs and usage patterns.

Figure 4-14. City Government Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016



The city government premise type is another high user group, accounting for 12 percent of annual Non-Residential customer water use. This group has a summer peaking pattern, potentially tied to watering landscaping at city parks.

Figure 4-15. Commercial Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016

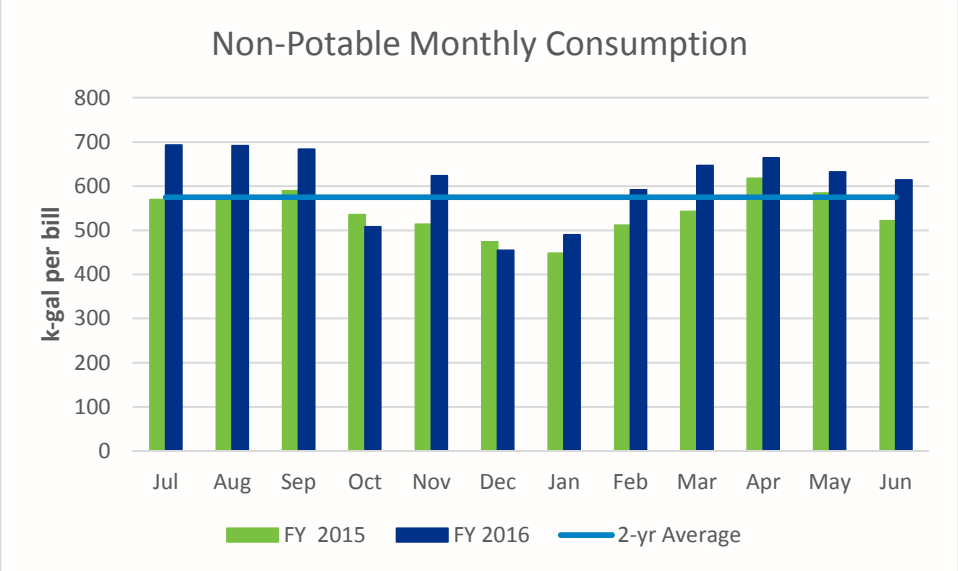


While commercial customers account for 40 percent of annual Non-Residential usage, the average use per bill of customers within this premise type is relatively low. Users within this class also do not show as strong a peaking characteristic as other premise types.

4.2.2.4 Non-Potable and Recycled

The BWS offers non-potable water for irrigation and landscape watering type uses. Customers taking this water are charged under the published Non-Potable water rate. This class comprises 90 customers that use about 655 million gallons per year, or 1 percent of the total annual water usage. The average monthly water consumption for Non-Potable customers is shown in Figure 4-16. These customers show a seasonal variation from April to September, roughly correlating to the typically drier period of June through September.

Figure 4-16. Non-Potable Average Water Consumption, k-gal per Bill, FY 2015 and FY 2016



In addition to the Non-Potable customer class, the BWS provides recycled R-1 and RO (demineralized) water to customers via contracts. Up to 10 million gallons per day of R-1 water is available for irrigation and industrial use. Twenty-four customers receive R-1 water. R-1 water use accounts for 5.5 percent of total annual water use. Up to 2 million gallons per day of RO water is available. Six customers receive RO water, which accounts for 1 percent of the water sold annually.

4.3 Evaluating Alternative Water Rate Structures

Due to two main drivers, alternative water rate structures were evaluated and discussed with the Stakeholder Advisory Group and Board. The first driver was the results of the cost of service analysis, which show disparities between costs of service recovered by different customer classes. The second driver was tiered rate structures that capture upwards of 80-90 percent of water usage within the first tier, which is almost equivalent to having a uniform rate and not supportive of conservation goals.

The remainder of this section discusses water rate structures that may be appropriate for the BWS, examines some alternatives, and discusses managing subsidization of certain customer classes.

4.3.1 Types of Quantity-Based Water Rate Structures

Quantity-based water rate structures can take a wide variety of forms; however, not all of those forms will effectively achieve a water provider's intended goals. For example, the BWS's current tiers for Single-Family and Multi-Unit customers no longer send as effective a water conservation signal since at least 80 percent of water usage falls within the first tier. Therefore, as part of the rates study several alternative structures were reviewed in view of providing price signals to targeted groups to encourage water conservation and/or more efficient use of water. The structures may be implemented individually or combined with other structures where appropriate to achieve the desired results.

4.3.1.1 Inclining Tiers

Inclining tier rate structures increase the unit price of water as more is consumed. This is the type of rate structure the BWS currently uses for Single-Family and Multi-Unit Residential customers. Inclining tier structures work well for sending conservation price signals when applied to a specific customer type, such as residential customers. The tiers can be developed so that the total cost of service is recovered, but the allocation among the tiers sends price signals to the highest users and those users that occasionally enter a higher tier (e.g., when watering lawns or filling pools). Customers are reminded that they are consuming a significant quantity of water and placing higher demands on the system.

Inclining tier structures are set to have different prices for essential needs water, basic water, and discretionary water uses. Since these levels of water differ significantly for residential, commercial, and industrial customers, inclining tier structures designed for conservation work best when applied to a specific customer class (i.e., customer class rates). Furthermore, inclining tier structures work best when applied to customer classes where usage within the class is fairly homogeneous (that is, most customers within the class exhibit similar usage patterns).

4.3.1.2 Seasonal Rates

Seasonal rates recognize that a water system may be stressed more during a specified period of time; for example, a dry season. In seasonal pricing, conservation-oriented rates would be implemented in the peak water use season. The recurring seasonal change in rates would signal to customers that it is time to practice water conservation. A single seasonal rate structure can be applied to all customers or to a specific customer class. Both uniform and tiered rates can be used in conjunction with seasonal rates (e.g., a uniform rate during the non-peak season and tiered rates during the peak season).

Given the temperate climate on O'ahu, seasonal rates may not be as effective as in other parts of the country. However, some premise types within the Non-Residential customer class show some seasonality in usage, including hotels and golf courses. For these classes, it may be appropriate to develop seasonal rates. However, the impact to tourism/ business viability must be considered. If higher hotel rates or less green golf courses prevent both residents and tourists from using those resources, then those businesses may be negatively impacted. Based on feedback from the BWS, seasonal water rates for certain premise types were not evaluated at this time.

4.3.1.3 Base/ Excess Use

Another possible rate structure is base/ excess use. In this structure, a base use is established for each customer. Base use is often set at some percentage of average use, for example, 110 percent of 12-month average monthly use or 100 percent of average winter consumption (AWC). The additional amount over average recognizes the variability of month-to-month usage while still maintaining a price signal in the Excess Use portion to conserve or use water more efficiently. The base would be applied on a daily basis to account for variances in the number of days in a specific billing cycle. The strength of this structure is that it encourages customers to level out their demand by moving the timing of different activities so that daily water usage is more uniform.

While this structure is almost exclusively used for commercial or industrial customers, some cities such as El Paso, Texas and Wichita, Kansas use this type of structure for residential as well as commercial and industrial customers, basing usage on a percentage of AWC. For example, Wichita Water Utilities' rate schedule has a base meter charge and a 3-tier commodity charge. The same schedule is used for residential and commercial customers but differs for inside city and outside city customers. The three tiers are: up to 110 percent of AWC, the next 200 percent of AWC, and in excess of 310 percent of AWC. AWC is defined as the average usage in the previous months of December through February. When used for residential customers, this schedule highlights the variance between a customer's base usage and more discretionary outdoor summer usage.

The ability to implement this rate structure depends on the billing program and would place an additional burden on billing staff, increasing costs that are then passed onto the customer. Therefore, this structure was not evaluated at this time.

4.3.1.4 Uniform Rates

A uniform rate is a constant unit price for all metered units of water. A uniform rate may be developed for all customers or a uniform rate for a certain customer class (e.g., residential, non-residential, agricultural). Because of cost of service considerations, a uniform rate would work best on a customer class basis.

Conceptually, uniform rates may be an attractive pricing alternative due to its ease in understanding and the relative revenue stability compared to other rate structures (e.g., no concern regarding curtailed water usage in a high tier). However, uniform rates do not send as aggressive a price signal for conservation as inclining tier blocks. Higher water users will pay a higher water bill, but there is no extra incentive in place to encourage efficient water use.

Uniform rates are often used for non-residential customers because this customer class can encompass a wide range of customer sizes and usage patterns. This wide range makes using an inclining block or declining block more difficult to design since the determination of tiers may not be consistent with the various water usage patterns within the class. To the extent a customer can curtail unnecessary water use, the customer has some control over its bill. The BWS currently uses a uniform rate for Non-Residential and Non-Potable customers.

4.3.1.5 Interruptible Rates

Interruptible rates can also be used to reduce system peak day demand when the system is being stressed. This rate is typically offered to non-residential customers. Customers on this type of rate typically pay a lower charge overall in exchange for the water utility being able to turn off water service when system conditions warrant a significant water curtailment. While the lower rate is attractive for customers on this rate structure, those commercial or industrial customers whose businesses are not set up to withstand an outage can be adversely affected. Therefore, if this rate were to be offered, it would be important for the BWS to educate customers on the potential business risks associated with interruptible water service. Interruptible rates work best for discretionary water uses such as irrigation.

An interruptible rate would require the BWS to forecast day-ahead weather and to notify interruptible rate customers. The BWS would have to rely upon the customer to not use water and possibly charge fines for those interruptible customers that did not stop usage when requested. As an alternative, BWS staff would have to manually shut-off and turn back on each meter. Depending on the number of customers, this would be impractical without carrying extensive staff and vehicles for this one task. However, with an advanced metering infrastructure (AMI), the BWS could automatically turn meters on and off remotely. With low seasonality, this rate structure might not be appropriate for the BWS and is not considered at this time.

4.3.1.6 Budget-Based Billing

Budget-based billing is an even more targeted form of the base/ excess use rate structure. Instead of using a percent of average winter demand to determine a base amount of water use, an efficient level of base water use is determined for each customer. The utility sets specific standards for what is, and what is not, considered efficient use of water for an individual customer. Water use above this efficient level is typically priced at a penalty level to discourage inefficient usage. The efficient budget level for a particular customer may remain the same or may vary throughout the year based on seasonality, weather, industrial processing requirements, or other metrics. Typically, both indoor and outdoor water budgets are set. Budget-based billing is most often applied to residential customers.

Factors that determine if budget-based billing is a good fit for a utility include the utility's need to encourage water conservation, the cost of implementation and administration, customer acceptance, and equity concerns. Water-budget rates require more customer usage data such as the number of persons per household, irrigable landscape area, evapotranspiration requirements, and other types of water-use related data. Due to these extensive data needs and costly administrative requirements, budget-based rates are not considered for the BWS.

4.3.1.7 Surcharges

A surcharge is a separate charge added to existing rate structures. Generally, surcharges are designed to capture a targeted amount of revenue, such as the BWS's power cost adjustment. Surcharges are most often applied for a limited time.

4.3.2 Subsidies and Affordability

Subsidies are typically used to meet policy objectives of utility boards and management. Subsidies may be employed to encourage use of non-potable or recycled water where

appropriate, to encourage economic development, or to provide residential customer assistance. However, sometimes a customer class or classes may be subsidized unintentionally.

Based on the analysis shown in Table 3-12, several of the BWS customer classes recover less than their costs of service. These classes are either intentionally or unintentionally subsidized by other customer classes. Contractual customers do not recover their costs of service based on the contractual rates and allocated costs to serve. Non-potable customers are commonly charged below cost of service to encourage use of these resources to reduce demand on potable water resources.

4.3.2.1 Unintentional Subsidies

Unintentional subsidies are those that occur over time due to several factors including changing water demand patterns, better customer usage data, net plant investment changes, and/ or O&M expenses change. These changes impact the allocations to base, maximum day or peak hour cost centers. Examples include a particular customer class that conserves more water reducing its peak impact on the system, or investment in water storage significantly changes, or O&M expenses related to pipeline repair and replacement significantly changes.

These subsidies are generally corrected each time a cost of service study is conducted. Based on the cost of service analysis, it appears that an unintentional subsidy has developed for the Single-Family customer class. This may, in part, be an artifact of using the same peaking factors for the Single-Family and Multi-Unit classes in the prior study and switching to customer-class specific demand factors in the current analysis.

4.3.2.2 Intentional Subsidies

Intentional subsidies are those subsidies that were intentionally developed as part of a utility goal or objective. For example, non-potable and recycled water rates are often set below their respective costs of service to encourage the use of these resources. Using these resources lowers overall demand, and possibly peak demand, on the potable water system.

The subsidization of Agricultural customers, Non-Potable and some contractual customers is understood to have been intentional, to either encourage the use of non-potable water (where appropriate) or as an economic incentive (e.g., agricultural).

4.3.2.3 Affordability Programs

Subsidy programs (or affordability programs) are often used to assist certain segments of the population such as low income or fixed income customers. Examples of affordability program elements include:

- Bill discounts and credits
- Flexible terms for repayment
- Temporary or crisis assistance
- Water efficiency and leak repair
- Community and local government assistance

- Income-based discounts

A common component of these affordability programs is the use of existing qualification programs of other agencies to identify eligible customers, which helps keep program administration costs low. The following lists examples of assistance programs provided by the BWS and other water utilities. These programs were reviewed by the Stakeholder Advisory Group and Board.

BWS AFFORDABILITY PROGRAM

The BWS's existing affordability program includes the following elements to assist its water customers who may have occasional difficulty paying their bills:

- zero-interest payment plan,

- multiple steps and accommodations to avoid turn off,

- bill adjustment for underground leaks, and

- referral to community social service agencies

Bill Discounts and Credits

Bill discounts and credits are offered to customers that meet specific criteria. For example, California Water Services Company offers a 50 percent discount on fixed monthly charges, up to $360 per year, for those customers enrolled in Women Infants and Children, Medicare, or other assistance programs. For another example, Seattle Public Utilities offers a 50 percent discount on the water bill for households whose household income is less than 70 percent of the median household income for the area.

Flexible Terms for Repayment

Flexible terms for repayment is another option utilities use to provide targeted subsidies. The BWS offers zero-interest repayment plans to help customers pay off past-due amounts. Albuquerque, New Mexico moved to levelized monthly payments based on annual average use to help customers better plan for paying water bills. Detroit has a 10/30/50 payment plan that allows customers to pay off past-due amounts over 24 months with zero interest and 10 percent down. If one of those payments is missed, then the customer may re-enroll by making a 30 percent payment on the remaining balance. If a second payment is missed, the customer may re-enroll one more time with a 50 percent payment on the remaining balance.

Temporary or Crisis Assistance

Temporary or crisis assistance programs are limited in scope to help customers when they are experiencing a crisis such as loss of job. The BWS provides multiple steps and accommodations to avoid turn-off of water service. Portland, Oregon offers a $150 crisis voucher every 12 months under its Low-Income Utility Assistance Program. The utility also offers programs to delay water shut-off, waive delinquency charges, and offers interest-free payment plans to customers facing medical emergencies, loss of job, divorce, or other life disruptions. Kansas City, Missouri offers a one-time credit, up to $500 per year, for customers facing water turnoff due to emergencies. Seattle Public Utilities also offers emergency assistance of 50 percent of an unpaid bill up to $371 annually.

Water Efficiency or Leak Repair

Some utilities offer programs to identify opportunities for water efficiency or to identify and repair leaks. By using more water efficient appliances and fixing leaks (including leaky faucets), customers can directly lower their water bills. The BWS provides bill adjustments for underground leaks. In Portland, Maine, customers with a household income less than the median household income for the area may qualify for plumbing repairs as well as replacement and installation of water saving devices. The East Bay Municipal Utility District in California offers a rebate for purchasing qualifying Energy Star appliance models. Aurora, Colorado will pay to replace aging plumbing fixtures with new water-efficient devices for households that receive low-income benefits for electricity. King County, Washington offers a $100 rebate toward low-flow toilets to replace pre-2004 toilets.

Community and Local Government Assistance

Subsidies can also come from entities other than the water utility. The BWS refers customers to community social-service support such as Helping Hands and Catholic Charities. The Washington Suburban Sanitary Commission (WSSC) in Maryland helps financial hardship customers pay delinquent bills. This program is administered through the Salvation Army. The program is funded through donations by customers via a round-up bill payment, WSSC employee contributions, and the general public. The Greater Washington Urban League in Washington D.C. has a program called Serving People by Lending a Supporting Hand that helps low-income customers pay bills. This program is funded by customers via a round-up bill payment and private donations. Scranton, Pennsylvania offers one-time water and sewer grants of $500 for customers whose income is below 150 percent of the federal poverty guidelines. These customers can also receive an 80 percent discount on the monthly water service fee.

Income-based Discounts

Philadelphia, Pennsylvania has enacted an income-based water rate assistance program. Rates are set as a fixed percentage of household income, with a minimum bill of $12 per month. For those whose household income is between 0 – 50 percent of the federal poverty level, the bills are equal to 2 percent of monthly income. For those whose household income is between 50 – 100 percent of the federal poverty level, the bills are equal to 2.5 percent of monthly income. For those whose household income is between 100 – 150 percent of the federal poverty level, the bills are equal to 3 percent of monthly income.

Other Subsidies Under Consideration

The BWS considered an affordability tier in its residential customer class quantity charges, which will be discussed later in this section. The BWS also considered other subsidies for homeless shelters, for a fire sprinkler retrofit program for high-rise housing, and for affordable housing.

4.3.3 Testing Water Rate Structures

Alternative customer and quantity charges have been developed to better match cost of service recovery, address affordability concerns, and encourage water conservation. Since the financial plan shows the first revenue adjustment occurring on July 1, 2019 (FY 2020), the following analysis of rate structures uses FY 2020. The financial plan indicates that $237 million needs to be generated by rate-based revenue plus R-1 and RO contractual revenue in FY 2020, which reflects an increase in projected revenue of 2 percent. Of that $237 million, the cost of service

results indicated that $23.5 million should be recovered through the customer and meter charge. The remaining amount should be recovered through the quantity charge.

4.3.3.1 Monthly Customer Charge Alternative

The BWS currently has a flat monthly billing charge that appears on each bill, which is the same for all customers, regardless of meter size. Another common method of recovering costs allocated to the customer cost centers, is to have a customer charge based on meter size. This charge reflects that some costs (e.g., related to meter shop/ maintain/ replace, field operations, automotive, and backflow and cross connection) vary by meter size and customers with larger meters should pay their share of that cost. Some types of costs that would be the same regardless of meter size include customer care, billing and collections, information technology, water resources, and finance. These costs would be allocated per the number of bills and the unit cost would be the same for all customers.

The Stakeholder Advisory Group was treated to an in-depth look at the difference in costs to purchase and maintain different sizes of meters. They also examined the impact to the customer charge for an equivalently sized meter when using AWWA capacity ratios and BWS meter costs to determine equivalency.

Consistent with the Stakeholder Advisory Group's strong value of equity, they recommended the BWS consider switching to a meter-size based monthly charge. This shifts the recovery of costs associated with larger water meters to those customers with the larger meters. These are the same users for which the fixed portion of the bill is generally only a

To allocate the costs that vary by meter size, a meter ratio is used to place meters on an equivalent basis. This analysis uses the BWS's meter cost information to develop meter ratios using the 3/4-inch meter as the base meter size. Where meter cost information is not available, capacity ratios may be used. Table 4-3 shows the relationship of meter costs compared to the 3/4-inch meter. These ratios are used to determine the total number of equivalent meters and then to allocate the equivalent meter unit costs back to the meter sizes.

Table 4-3. BWS Meter Cost Ratios and Equivalent Meters

Meter Size	BWS Meter Cost	Meter Cost Ratio	Projected Number of Meters (FY 2020)	Number of Equivalent Meters
5/8"	--	1.0	67,616	67,616
3/4"	$86	1.0	79,286	79,286
1"	$141	1.6	7,581	12,129
1.5"	$171	2.0	2,820	5,640
2"	$590	6.9	3,516	24,258
3"	$753	8.8	417	3,671
4"	$1,538	17.9	270	4,841
6"	$2,829	32.9	143	4,689
8"	$4,372	50.8	300	15,248
12" (1)	--	111	10	1,150
Total			161,959	218,528

(1) AWWA M1 Table B-2 for C712-15 type meter maximum operating capacity, best fit curve to estimate flow for 12" meter and capacity ratio compared to 3/4" meter.

The cost of service analysis for FY 2020 has allocated $23.5 million to the customer-related cost centers for potable and non-potable customers. The billing-related portion of this allocation is

$10.9 million. Dividing by the projected 1.97 million bills for FY 2020, the unit price is $5.61/bill. The meter-related portion of the allocation is $12.6 million. Dividing by the number of equivalent meters results in a unit price of $57.74/meter/year, or $4.81 per month per equivalent meter. Multiplying the monthly equivalent meter unit price by the ratios shown in Table 4-3, results in the unit price for each meter size, as shown in Table 4-4. Table 4-4 shows what the fixed charge schedule will look like for FY 2020, the first year for new rates, if it were based on meter size.

Table 4-4. Alternative Monthly Customer Charge Schedule, Meter Size Based, FY2020

Meter Size	Billing-related, $/mo	Meter-related, $/mo	Total Charge, $/mo	# of Bills at Meter Size	Revenue, $M
5/8”	5.61	4.81	10.42	811,397	$8.5
3/4"	5.61	4.81	10.42	951,437	$10.0
1”	5.61	7.70	13.31	90,967	$1.2
1.5”	5.61	9.62	15.23	33,837	$0.5
2”	5.61	33.20	38.81	42,188	$1.6
3”	5.61	42.34	47.95	5,006	$0.2
4”	5.61	86.13	91.74	3,245	$0.3
6”	5.61	158.30	163.91	1,710	$0.3
8”	5.61	244.42	250.03	3,602	$0.9
12”	5.61	535.70	541.31	124	$0.1
Total					$23.5

Note: Totals may not add due to rounding.

If the flat billing charge were retained, the FY 2020 charge would be $12.10/bill. Under a meter size approach, smaller meters, which account for 91 percent of meters, would experience a decrease in the fixed portion of their bills, reflecting the lower cost to serve smaller meters.

4.3.3.2 Quantity Charge Alternatives – Residential Customer Classes

The quantity charge recovers costs based on the amount of water used by a customer. The following discusses various quantity charge options for Single-Family and Multi-Unit customers.

Single-Family Residential

Single-Family customers include both single-family homes and duplexes. As discussed earlier, the first tier within Single-Family Residential recovers 80 percent of the water used by the customer class under current rates. This amount is quite high for a first tier. When setting up an inclining-block tier structure for the Single-Family Customer class, the first step is to determine how much water sold should be subject to the upper tier(s). Depending on the desired level of conservation, anywhere from 5 to 20 percent of water sold would be captured in the highest tier. To set the other tier points, industry practice is to divide the remaining water sold roughly equally between the first two tiers or to set the first tier at approximately half the water sold and then place the remainder in the second tier. A four-tier structure could also be used to create both a top tier to encourage water efficiency and a first tier to capture essential use or a discount tier. For example, Tier 1 could be a discount block, Tier 4 captures the top 5 or 10 percent of usage and the remainder is split between the second and third tiers (either Tier 2 at 50 percent of usage, or split evenly between the tiers, or other reasonable metric).

Another element in rate design is setting the price for the upper tier of usage relative to the price for water in the other tiers. The more aggressive the desire to encourage water conservation, the

higher the price needs to be. Implementing penalty levels work best if the utility has a limited amount of water to sell and must achieve conservation. Pricing 10 percent of water sold at the upper tier is somewhat of an inducement for customers to be more efficient. Pricing 20 percent of the water sold at a much higher price will typically result in usage reductions. For the BWS use of penalty level pricing must be balanced with the prevalence of multigenerational households, many of which may be on limited incomes. Their water use can extend into the higher tiers merely because of the number of people living in the household. The tiers and unit prices used in this analysis do not begin to approach penalty levels. When setting rates for the higher tiers, there is also the potential for revenue erosion as customers cut back consumption due to higher rates.

Two alternative residential structures were developed for the BWS: both are 4-tier inclining blocks with an essential needs tier. The difference between these two alternatives is in how much water is captured in the fourth tier. The first tier captures what would be considered usage associated with essential water needs (e.g., washing hands, flushing indoor toilets, bathing, drinking water, cooking). The second tier represents the typical use of water in a single-family dwelling. The third tier relates to discretionary uses such as lawn irrigation, which can be curtailed during system peak demand periods, or could be considered price sensitive. The fourth tier captures the highest usage to encourage more efficient use of water.

For these examples, the first tier, Essential Needs, was developed based on a reasonable estimate of 2 k-gal/mo/du to meet essential water use, as shown in Table 4-5. This represents the most essential needs of a three-person household (21.5 gallons per capita per day). California is currently considering designating 55 gallons per capita per day as a standard amount of indoor water use, which represents prudent use of water (like the types of use captured in the proposed second tier). A recent Water Research Foundation end use study shows that average indoor residential use in the United States is about 60-65 gallons per capita per day. Therefore, the top of Tier 1: Essential Needs was set to 2 k-gal/mo/du.

The Stakeholder Advisory Group and Board strongly values affordability. This lead to examining an Essential Needs Tier, which included determining the amount of usage for that tier as well as its price relative to other tiers.

Table 4-5. Estimate of Essential Needs for 3-Person Household in One Month

Use	Gallons	Unit	Daily Total (gal per day per household)	Assumption	30-Day Month (gal per mo. per household)
Dishwasher	4	per load	4	1 load per day	120
Shower	2	per minute	30	5 minute shower	900
Toilet	1.6	per flush	14.4	3 flushes per person	432
Drinking	1	per day	3	1 gal. per person per day	90
Cooking	1	per day	3	1 gal. per person per day	90
Clothes Washer	20	per load	10	1 load every other day	300
Total			64.4		1,932

Note: Totals may not add due to rounding.

Examples of different tier blocks and rates for the Single-Family Residential customer class are shown below.

Single-Family Residential Inclining Block, 4-Tier, Top 10% of Usage in Fourth Tier

With the first tier set, the annual usage curves shown in Section 4.2.2.1 are used to determine the other tier points. The cumulative usage of all bills up to about 6 k-gal plus the usage up to 6 k-gal for bills greater than 6 k-gal represents about 50 percent of annual usage. The last 10 percent of annual usage is the sum of usage above 20 k-gal for bills at or above 21 k-gal. The last 5 percent of annual usage is the sum of usage above 29 k-gal for bills at or above 30 k-gal. Therefore, the top of Tier 2 was set to 6 k-gal/mo/du and the top of Tier 3 was set to 21 k-gal/mo/du. This structure captures about 10 percent of usage in the top tier instead of about 5 percent under the current tier point of 30 k-gal/mo/du. The projected FY 2020 cost of service for the BWS's Single-Family customer class is $109 million, of which about $99 million (or about 91 percent) is targeted for recovery through rates in FY 2020[4]. Of that amount, about $19 million is to be recovered through the customer charge, leaving about $80 million to be recovered through the quantity charge. Table 4-6 presents unit rates, tiers and estimated quantity revenue for this alternative.

Table 4-6. Single-Family Alternative Top 10% in Tier 4, FY 2020

Unit Rate, $/k-gal	Alternative Tiers k-gal/mo/du	Percent Bills in Block, %	Usage in Block, %	Usage in Block, k-gal	Estimated Revenue, $M
$3.79	0 – 2	13	20.7	3,467,602	$13.1
$4.46	>2 – 6	34	32.8	5,494,558	$24.5
$4.91	>6 – 21	47	36.5	6,114,371	$30.0
$7.46	Over 21	6	10.0	1,675,170	$12.5
				16,751,700	**$80.2**

Note: Totals may not add due to rounding.

Single-Family Residential Inclining Block, 4-Tier, Top 5% of Usage in Fourth Tier

This next example looks at shrinking the amount of usage captured in the highest tier, in part to minimize the impact on low income, multigenerational households. As a means to check if the top tier level might disproportionally impact low-income multigenerational households, the location of customers with the highest water usage was overlaid with income data from the American Community Survey, which is produced by the U.S. Census Bureau[5].

The Stakeholder Advisory Group and Board were very sensitive to the impact of rate structures on low-income multigenerational households, whose usage could be high simply due to the number of people in the household. Therefore, the analysis examined keeping the top tier at its current level of capturing about the top 5 percent of usage.

The top 5 percent of usage occurs at about 30 k-gal/mo/du for the Single-Family customer class. The unit rates for tiers 1 and 2 used in this alternative are the same as in the first alternative, as shown in Table 4-7. The third and fourth tier unit prices are set to achieve cost recovery of

[4] The intent is that single-family cost of service recovery will be gradually brought up from about 90 percent in FY 2019 to about 95 percent by FY 2023 to move single-family customers closer to their cost of service while at the same time avoiding rapid increases in rates from adjusting the rates too quickly.

[5] https://www.census.gov/programs-surveys/acs/

91 percent (or about $80 million, as shown in Table 4-6). The fourth tier has been priced higher in this example than it is under the current rates.

Table 4-7. Single-Family Alternative 4-Tier Options Compared to Current Structure, FY 2020

Unit Rate, $/k-gal	Alternative Tiers k-gal/mo/du	Percent Bills in Block, %	Usage in Block, %	Usage in Block, k-gal	Estimated Revenue, $M
$3.79	0 – 2	13	20.7	3,467,602	$13.1
$4.46	>2 – 6	34	32.8	5,494,558	$24.5
$5.06	>6 – 30	51	40.6	6,801,190	$34.4
$8.46	Over 30	3	5.9	988,350	$8.4
				16,751,700	**$80.4**

Note: Totals may not add due to rounding.

While this example shrinks the top tier to the top 5 percent of usage, the unit rate also increases, sending a stronger price signal to those top users. This smaller top tier also has the benefit of reducing potential impacts to low income, multigenerational households.

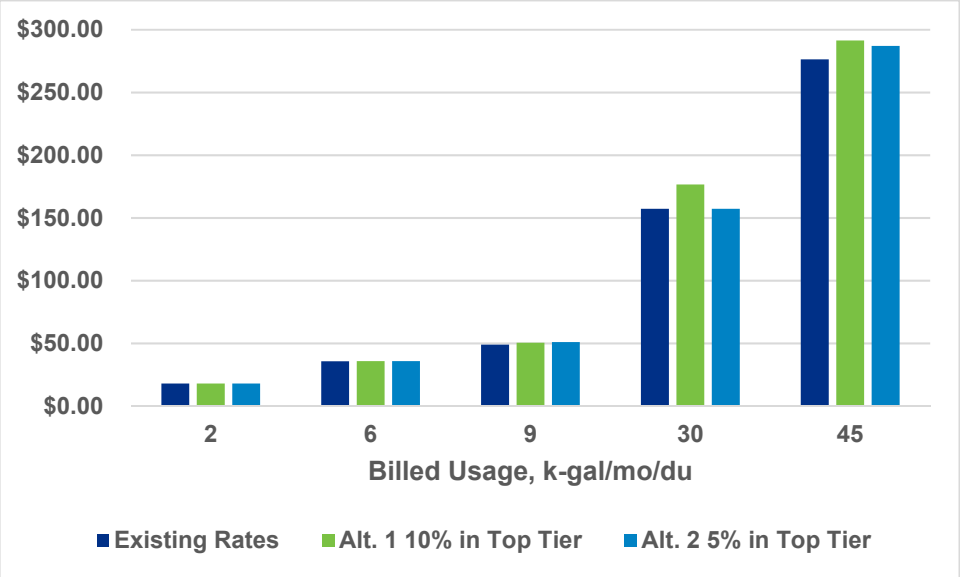
Single-Family Residential Typical Bill Analysis

Table 4-8 shows the impact of these two alternatives on sample Single-Family bills. The table also shows the bill amounts under the current rate structure. These sample bills are for one dwelling unit. Figure 4-17 graphically compares the alternatives to the existing bill.

Table 4-8. Single-Family Alternatives Comparison – Example Bills, Existing and FY 2020

Bill Amount, k-gal/mo/du	Meter Size	Existing: T1: 0-13 T2: 14-30 T3: Over 30	Alternative 1: T1: 0-2 T2: 3-6 T3: 7-21 T4: Over 21	Alternative 2: T1: 0-2 T2: 3-6 T3: 7-30 T4: Over 30
		k-gal/mo/du	k-gal/mo/du	k-gal/mo/du
2	¾"	$18.10	$18.00	$18.00
6	¾"	$35.78	$35.84	$35.84
9	¾"	$49.04	$50.57	$51.02
30	¾"	$157.33	$176.63	$157.28
45	1"	$276.43	$291.42	$287.07

Figure 4-17. Comparison of Single-Family Alternative Bills (FY 2020) to Existing Bill



Multi-Unit Residential

Multi-Unit Residential customers include residential customers in triplexes, condominiums and apartments. Due to the large number of multi-unit dwellings served by the BWS, sufficient data exist to treat this customer class independently from the Single-Family Residential customer class. The alternatives below aim to capture about the same percentage of usage within each tier as for the Single-Family customer class. The unit pricing also generally mimics the relationships between tiers for the Single-Family customer class. Similar to Single-Family Residential, under the current rate structure, the first tier within Multi-Unit Residential recovers 92 percent of the water used by the customer class. This amount is high for a first tier. Therefore, two alternatives for adjusted tiers and unit pricing have been examined and are shown below.

Multi-Unit Residential Inclining Block, 4-Tier, Top 10% of Usage in Fourth Tier

The top 10 percent of usage occurs at about 8 k-gal/mo/du for Multi-Unit customers. About 50 percent of usage occurs at about 3 k-gal/mo/du. With an essential needs tier set to 2 k-gal/mo/du, the second tier was pushed up to 4 k-gal/mo/du, or about 60 percent of the usage. An essential needs tier for a residential customer (either Single-Family or Multi-Unit) should be similar. The top of tier 3 was set to 8 k-gal/mo/du, so that the fourth tier captures the top 10 percent of usage.

Of the projected $237 million in revenue requirements for FY 2020, $42 million has been allocated to the Multi-Unit customer class. However, based on discussions with the BWS, the cost recovery for Multi-Unit Residential will be stepped down from about 109 percent in FY 2019 to 100 percent by FY 2023. Therefore, the target cost recovery for Multi-Unit in FY 2020 is 107 percent, or $45 million. If $2 million is recovered through the customer charge, that leaves $43 million to be recovered through the quantity charge. Table 4-9 presents unit rates, tiers and estimated quantity charge revenue for this alternative.

Table 4-9. Multi-Unit Alternative Top 10% in Tier 4, FY 2020

Unit Rate, $/k-gal	Alt. Tiers k-gal/mo/du	Percent Bills in Block, %	Usage in Block, %	Usage in Block, k-gal	Est. Rev., $M
$3.70	0 – 2	14	32.6	3,183,977	$11.8
$4.35	>2 – 4	27	29.2	2,851,906	$12.4
$4.80	>4 – 8	39	27.4	2,676,103	$12.8
$5.85	Over 8	20	10.8	1,054,814	$6.2
				9,766,800	**$43.2**

Note: Totals may not add due to rounding.

Multi-Unit Residential Inclining Block, 4-Tier, Top 5% of Usage in Fourth Tier

The top 5 percent of usage occurs at about 10 k-gal/mo/du for the Multi-Unit customer class. The unit rates for this structure are the same for tiers 1 and 2 as in the previous Multi-Unit Residential example. The unit prices for the third and fourth tiers are set to achieve cost recovery of 107% (or about $43 million as shown in Table 4-6). Table 4-10 presents unit rates, tiers and estimated quantity charge revenue for this alternative.

Table 4-10. Multi-Unit Alternative 4-Tier Options Compared to Current Structure, FY 2020

Unit Rate, $/k-gal	Alt. Tiers k-gal/mo/du	Percent Bills in Block, %	Usage in Block, %	Usage in Block, k-gal	Est. Rev., $M
$3.70	0 – 2	14	32.6	3,183,977	$11.8
$4.35	>2 – 4	27	29.2	2,851,906	$12.4
$4.95	>4 – 10	47	31.8	3,105,842	$15.4
$5.90	Over 10	12	6.4	625,075	$3.7
				9,766,800	**$43.2**

Note. Totals may not add due to rounding.

Multi-Unit Residential Typical Bill Analysis

Table 4-11 shows the impact of these two alternatives to sample Multi-Unit Residential bills. The table also shows the bill amounts under the current rate structure. Figure 4-18 and Figure 4-19 graphically compare the alternatives to the existing bill.

Table 4-11. Multi-Unit Alternatives Comparison – Example Bills, Existing and FY 2020

Bill Amount, k-gal/mo/du	Meter Size	Dwelling Units	Existing T1: 0-9 T2: 9-22 T3: >22	Alt. 1 T1: 0-2 T2: 2-4 T3: 4-8 T4: >8	Alt. 2 T1: 0-2 T2: 2-4 T3: 4-10 T4: >10
			k-gal/mo/du	k-gal/mo/du	k-gal/mo/du
2	¾"	3	$35.78	$32.62	$32.62
5	¾"	3	$75.56	$73.12	$73.57
6.7	3"	272	$8,005	$7,888	$7,996
6.9	3"	304	$9,225	$9,114	$9,244
8.7	8"	144	$5,557	$5,936	$5,929
14.1	8"	277	$18,576	$19,932	$19,657

Note: The per dwelling unit usage is calculated by dividing the total usage by the number of dwelling units.

Figure 4-18. Comparison of Multi-Unit Alternative Bills (FY 2020) to Existing Bill, Three Dwelling Units

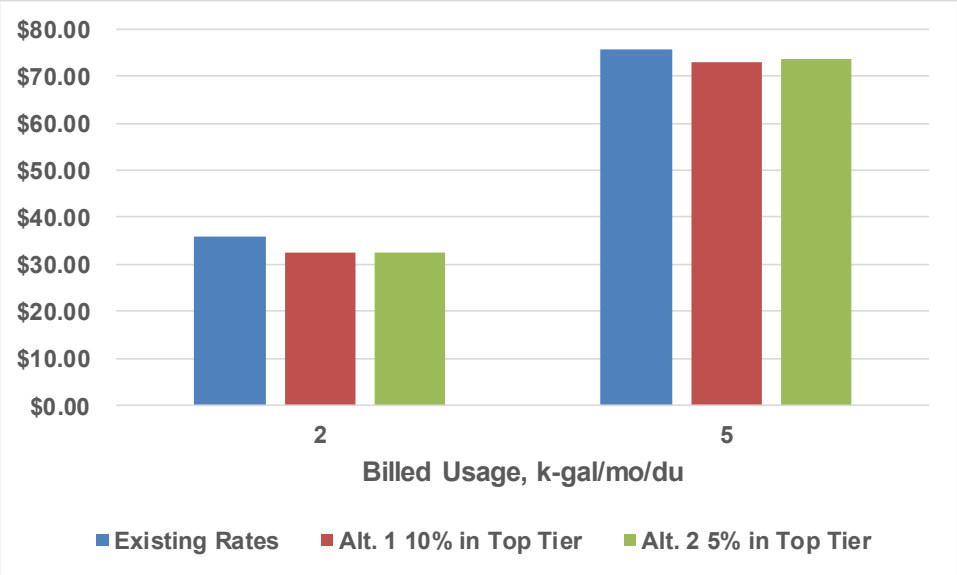
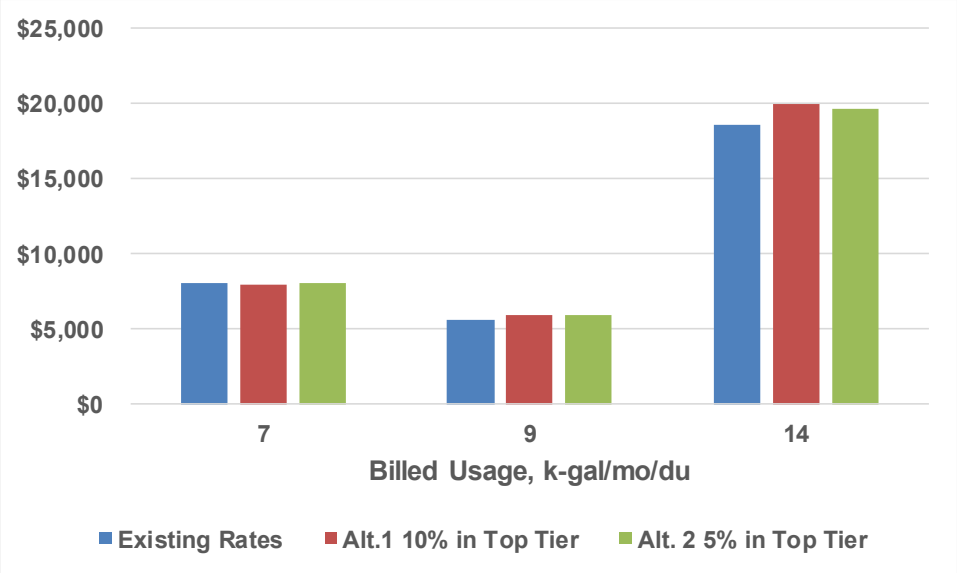


Figure 4-19. Comparison of Multi-Unit Alternative Bills (FY 2020) to Existing Bill, 144-277 Dwelling Units



4.3.3.3 Quantity Charges for Non-Residential Customer Classes

This section provides a brief overview of the quantity charge structures for the non-residential customer classes, which includes Non-Residential (e.g., commercial, government), Agricultural, Non-Potable, R-1 and RO. Based on discussions with the BWS staff and Board recommendations, the quantity charge structure will not change (except for Agricultural). However, the unit rates will be adjusted in accordance with the Board guardrails.

Non-Residential

No changes are proposed to the uniform quantity rate structure currently used for the Non-Residential customer class. The unit rate will be determined as half the annual revenue adjustment since this customer class recovers about 120 percent of its allocated costs. By applying a lower revenue increase to this customer class, it is expected that the cost recovery of this customer class will decrease to 117 percent by the end of FY 2023.

Agricultural

Currently, the Agricultural rate structure is tied to the Single-Family Residential rate structure, with a declining second tier to encourage agricultural development. This same general structure will remain, with the first two tiers set the same as the first two tiers of Single-Family Residential, recognizing that the first two tiers of Single-Family Residential capture basic single-family use. The highest Agricultural tier is set at a discount. The Agricultural class currently recovers about 60 percent of its cost of service. The third tier is set so that the overall Agricultural customer class cost recovery remains at 60 percent.

Non-Potable

No changes are proposed to the uniform quantity rate structure currently used for the Non-Potable customer class. This customer class currently recovers about 77 percent of its allocated COS. This recovery will be stepped up to 80 percent by FY 2023.

Recycled (R-1)

Customers receiving R-1 water currently receive that water under the terms of their individual contracts. However, per the terms of many of those contracts, if the BWS publishes a R-1 rate, the customers would automatically switch to that rate. There are two general groups receiving R-1 water (golf courses and irrigators), each paying a uniform but different quantity charge. The golf courses pay about $0.55/k-gal (no customer charge) and the irrigators pay about $1.75/k-gal (no customer charge). Under a published rate schedule, these customers would pay the customer charge plus a uniform quantity charge. The subsidization of this class, as a whole, would continue to encourage the use of recycled water so that potable water remains available for those uses that require potable water. The deeper subsidization of the golf courses would also remain as they provide additional tangible benefits such as storm water retention. Agricultural customers that could receive this water would also receive the subsidization, which encourages availability of local produce. The R-1 customer class currently recovers about 70 percent of its cost of service, and this level of recovery is expected to be maintained.

Reverse Osmosis (RO) Water

The BWS provides RO demineralized recycled wastewater from the Honouliuli Water Reclamation Facility. Six electric power plants and oil refiners receive RO water under contracts. Some of these contracts allow for a switch to a published rate. A published rate would include both the customer charge and a uniform quantity charge. This customer class would also continue to receive some subsidization to encourage the use of RO water so that potable water can be reserved for uses that require potable water.

4.3.3.4 Private Fire Service

The BWS currently charges a one-time fee for fire service and also bills for non-fire water use that flows through the fire service at the same unit rate as Non-Residential customers. If the customer provides proof that the fire service was used to put out a fire, then the bill is negated. A more common method of charging for private fire service is to set a flat bill based on fire meter size to recover the costs associated with private fire service infrastructure. Charging a fixed monthly amount increases revenue stability and simplifies tracking of cost of service recovery for this customer class.

The costs allocated to private fire protection are distributed to private fire customers based on an equivalent fire connection using 6-inch as the base size since fire hydrants are typically on a 6-inch service. Table 4-12 shows the number of equivalent private fire connections.

Table 4-12. Equivalent Hydrants and Fire Connections, FY2020

Fire Meter Size	Relative Flow Capacity Factor (1)	Equivalent Hydrant Ratio	Public Fire Hydrants	Private Fire Connections
2" and smaller	6.2	0.06		44
3"	18.0	0.16		0
4"	38.3	0.34		464
6"	111.3	1.00	21,414	679
8"	237.2	2.13		718
12"	689.0	6.19		0
Total			21,414	1,905
Equivalent Hydrant Ratio x Number of Hydrants or Connections			21,414	2,371

(1) equivalent flow basis per the Continuity Equation where flow equals pipe area times velocity (Q = A x V). Velocity is set based on the Hazen-Williams Equation (V = 1.318 x C x R^0.63 x S^0.54) where the hydraulic radius (R) is equal to the pipe area divided by its wetted perimeter which reduces to the pipe diameter divided by 4. Since the coefficient (C), head loss (S) and all coefficients cancel out in this equation, when used in a ratio with another pipe, the Continuity Equation results in the ratio of the different pipe diameters to the 2.63 power.

The FY 2020 cost of service shows that the cost to provide fire service is expected to be $691,984. Based on the number of private fire connections at the different meter sizes, a monthly rate schedule would look like Table 4-13.

Table 4-13. Alternative Fire Meter Standby Charge, FY 2020

Private Fire Meter Size	Charge $/mo	# of Private Fire Connections	Estimated Revenue
2" and smaller	6.72	44	$3,548
3"	8.82	0	$0
4"	12.43	464	$69,210
6"	25.42	679	$207,122
8"	47.83	718	$412,103
10"	81.52	0	$0
12"	128.24	0	$0
Total		1,905	$691,984

Note: Totals may not add due to rounding.

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Section 5

Proposed Water Rate Adjustments

5.1 Proposed Water Rate Structures

Following the guardrails established by the Board, input from the Stakeholder Advisory Group, and iterative evaluation of potential options as described in Section 4, proposed water rates and rate structures were developed. The following presents the proposed 5-year water rates, which include some changes to rate structures.

5.1.1 Customer Charge

The existing monthly billing charge will remain in effect until June 30, 2019. On July 1, 2019, the billing charge will move from the flat fee of $9.26 per bill charged to all non-contract customers, to a monthly customer charge that varies by meter size assessed to all potable, non-potable and recycled water customers. This customer charge is assessed for each month that service is provided, regardless of usage. The proposed charges are shown in Table 5-1.

Table 5-1. Proposed Customer Charges and Effective Date

Effective Date	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
Meter Size	$/mo	$/mo	$/mo	$/mo
5/8” or 3/4”	10.42	10.80	11.38	12.09
1”	13.31	13.79	14.45	15.28
1.5”	15.23	15.78	16.50	17.41
2”	38.81	40.18	41.61	43.45
3”	47.95	49.64	51.35	53.55
4”	91.74	94.95	97.98	101.92
6”	163.91	169.63	174.84	181.64
8”	250.03	258.76	266.57	276.78
12”	541.31	560.18	576.78	598.53

5.1.2 Quantity Charge

The existing quantity rates and tiers will remain in effect through June 30, 2019. On July 1, 2019, the quantity rates and tiers shown in Table 5-2 will take effect.

Table 5-2. Proposed Quantity Charges by Customer Class

Effective Date	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
Customer Class	**$/k-gal**	**$/k-gal**	**$/k-gal**	**$/k-gal**
Single-family (Monthly per dwelling unit)				
Tier 1: Essential Needs First 2,000 gallons	3.79	3.91	4.17	4.46
Tier 2 2,001-6,000 gallons	4.46	4.60	4.90	5.25
Tier 3 6,001-30,000 gallons	5.06	5.20	5.50	5.85
Tier 4 Over 30,000 gallons	8.46	8.60	8.90	9.25
Multi-Unit (Monthly per dwelling unit)				
Tier 1: Essential Needs First 2,000 gallons	3.70	3.71	3.72	3.77
Tier 2 gallons 2,001-4,000 gallons	4.35	4.36	4.38	4.43
Tier 3 4,001-10,000 gallons	4.95	4.96	4.98	5.03
Tier 4 Over 10,000 gallons	5.90	5.91	5.93	5.98
Non-Residential All Usage	5.01	5.06	5.16	5.27
Agricultural (Monthly per account)				
Tier 1: Essential Needs First 2,000 gallons	3.79	3.91	4.17	4.46
Tier 2 2,001-6,000 gallons	4.46	4.60	4.90	5.25
Tier 3 Over 6,000 gallons	1.95	1.98	2.05	2.12
Non-Potable/ Brackish All Usage	2.53	2.62	2.75	2.90
Recycled Water				
R-1 Golf (1) All Usage	0.57	0.59	0.62	0.65
R-1 Other (1) All Usage	1.84	1.88	1.92	1.96
RO (1) All Usage	5.76	5.88	6.12	6.36

(1) Contract customers will switch to the published rate unless specifically stated otherwise in the customer's contract.

5.1.3 Fire Meter Standby Charge

The Fire Meter Standby Charge, for readiness to serve, applies to services used exclusively for private fire protection purposes, including automatic fire sprinkler services connected to alarm

systems, fire hydrants, and wet standpipes. Fire service charges will be charged a flat monthly charge based on fire meter size. Table 5-3 presents the proposed change and charges, which will take effect on July 1, 2019.

Table 5-3. Proposed Fire Meter Standby Charge

Effective Date	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
Fire Meter Size	$/mo	$/mo	$/mo	$/mo
2" and smaller	6.72	6.95	7.42	7.99
3"	8.82	9.08	9.64	10.29
4"	12.43	12.74	13.44	14.23
6"	25.42	25.94	27.13	28.44
8"	47.83	48.69	50.74	52.94

In addition to the Standby Charge, any misuse or non-fire protection related water usage will be billed at twice the highest quantity charge in effect at that time.

5.1.4 Other Charges, Services and Waivers

5.1.4.1 Adjustments to Published Rates

The BWS has two possible adjustments to published rates: power cost adjustment and environmental fee adjustment. These charges reflect that changes may occur between 5-year rate studies and provide the BWS with a mechanism to make small adjustments to the water rates, if needed. These changes take effect in September 2018.

Power Cost Adjustment. If total actual electricity costs in a year exceed the projected power costs used to develop the rates, then in the following fiscal year the BWS may increase the quantity charge for all customer classes $0.01/k-gal for every $500,000 that the actual costs were over the projected costs[1]. For example, if actual electricity costs in year 1 were $1 million more than used in the rate study, the quantity charge would increase $0.02/k-gal in year 2 (added to the published rate).

Environmental Regulations Compliance Fee Cost Adjustment. The BWS may increase the quantity charge by $0.01/k-gal for every $500,000 of additional costs that the BWS incurs to comply with any federal or state environmental law or regulation. This adjustment recognizes that new regulations may be imposed between rate studies (during the 5-year period covered by the published rates) and provides the BWS the ability to adjust the quantity charge to reflect additional costs that the BWS would incur to meet the new regulations.

5.1.4.2 Standby Emergency Water Service

The BWS provides standby emergency water service on a case-by-case basis through a contractual arrangement for such services. Contracts are negotiated by the Manager and Chief Engineer. Delivery of emergency water is contingent upon the BWS's ability to meet Water

[1] This is based on Table 3-10 showing that the annual use equals 47,444,716 k-gal. Therefore, a rate increase of $0.01/k-gal would yield $474,444, or about $500,000, in additional revenue.

System Standards requirements and that existing customers of the system do not experience unintentional impacts to their service.

5.1.4.3 Waivers

The BWS may waive water system facilities charges for qualified affordable and homeless dwelling units, up to 500 dwelling units per year. The BWS recognizes the lack of affordable housing and homelessness as two of the biggest problems facing Honolulu. As such, it has established criteria under which the water system facilities charges may be waived. This coincides with the Mayor's initiative on affordable housing and homelessness. This waiver provision shall expire on June 30, 2023.

The BWS may waive the new meter charges for residential fire sprinkler retrofits, recognizing that retrofitting high-rise apartments/ condominium buildings with fire sprinklers due to a change in code can adversely impact low-income residents by raising rents/ homeowner association costs beyond their means. The waiver also reflects the BWS's concern for the health and safety of its customers and is doing what it can to help make fire sprinkler retrofits less costly. This waiver provision shall expire on June 30, 2023.

5.2 Revenue Under Proposed Rates & Comparison to Cost of Service

Table 5-4 compares the projected revenue for FY 2019, under the existing rates, which will still be in effect, to the projected cost of service for FY 2019. Since the rate schedule is not changing in FY 2019, the Indicated Revenue Increase column shows no change. The Proposed Revenue as a Percent of Cost of Service column shows an imbalance in cost recovery because the existing rates are still in effect for FY 2019. The proposed rates that begin in FY 2020 (effective July 1, 2019) are designed to phase-in a closer alignment to cost recovery for the Single-Family and Multi-Unit customer classes.

Table 5-4. Comparison of Allocated Cost of Service with Revenue Under Existing Rates, FY 2019

Customer Class	Cost of Service	Revenue Under Existing Rates	Revenue Under Proposed Rates (1)	Indicated Revenue Increase Over Existing Rates	Proposed Revenue as a Percent of Cost of Service
Single-Family	$107,400,900	$96,339,800	$96,339,800	0%	90%
Multi-Unit	$41,478,500	$45,083,400	$45,083,400	0%	109%
Non-Residential	$66,953,300	$80,586,200	$80,586,200	0%	120%
Agricultural	$3,900,600	$2,357,500	$2,357,300	0%	60%
Fire Service – Private	$678,500	$84,300	$84,300	0%	12%
Subtotal Potable	$220,411,900	$224,451,200	$224,451,100	0%	102%
Non-Potable	$2,008,500	$1,546,400	$1,546,400	0%	77%
Contractual				0%	
RO	$4,956,400	$2,709,100	$2,709,100	0%	55%
R-1 (Golf)	$1,821,000	$534,200	$534,200	0%	29.%
R-1 (Other)	$2,787,600	$2,698,400	$2,698,400	0%	97%
Ocean Cooling	$1,280,400	$1,326,600	$1,326,600	0%	104%
Total	$233,265,800	$233,265,800	$233,265,800	0%	100%

(1) Rates do not change in FY 2019.
Note: Totals may not add due to rounding.

Table 5-5 presents the projected revenue, indicated revenue increase, and cost recovery information for FY 2020, the first year of rate adjustments. The Indicated Revenue Increase column shows the projected additional percent revenue increase for each customer class. The projected additional revenue reflects both the increased revenue requirements and adjustments to cost recovery at the customer-class level. The Proposed Revenue as a Percent of Cost of Service column reflects how well the projected revenues recover the costs to service at the customer-class level. For example, the Single-Family customer class is projected to increase cost recovery from 90 percent in FY 2019 to 91 percent in FY 2020 while the Multi-Unit customer class is projected to decrease cost recovery from 109 percent in FY 2019 to 107 percent in FY 2020, following the trends established for these customer classes by the Board's guardrails.

Table 5-5. Comparison of Allocated Cost of Service with Revenue Under Existing Rates, FY 2020

Customer Class	Cost of Service	Revenue Under Existing Rates	Revenue Under Proposed Rates	Indicated Revenue Increase Over Existing Rates	Proposed Revenue as a Percent of Cost of Service
Single-Family	$109,157,000	$96,035,800	$99,135,700	3.2%	91%
Multi-Unit	$42,124,600	$44,906,100	$45,278,800	0.8%	107%
Non-Residential	$67,981,300	$80,268,200	$82,671,700	3.0%	122%
Agricultural	$3,956,000	$2,346,000	$2,376,800	1.3%	60%
Fire Service – Private	$691,900	$84,300	$692,000	720.9%	100%
Subtotal Potable	$223,910,900	$223,640,500	$230,155,100	2.9%	103%
Non-Potable	$2,059,800	$1,538,700	$1,593,400	3.6%	77%
Contractual (1)					
RO	$5,056,000	$2,758,200	$3,120,900	13.1%	62%
R-1 (Golf)	$1,873,900	$531,500	$581,900	9.5%	31%
R-1 (Other)	$2,868,900	$2,744,500	$2,769,000	0.9%	97%
Ocean Cooling	*$1,300,600*	*$1,353,100*	*$1,353,100*	*0.0%*	*104%*
Total	$237,070,200	$232,566,500	$239,573,400	3.0%	**101%**

(1) For the contractual customers, Revenue Under Existing Rates is based on the forecasted pricing based on contract escalation terms. For RO and R-1 customers, the Revenue Under Proposed Rates are shown using the proposed published (rather than contractual) rates. Projected Revenues for Ocean Cooling remain under contract rates and escalation terms.
Note: Totals may not add due to rounding.

Table 5-6 summarizes the revenue recovery as a percent of each customer class's cost of service for the 5-year time period, FY 2019-FY 2023. Over this period, the Single-Family customer class's cost recovery is expected to step up to 95 percent, and the Multi-Unit customer class's cost recovery is expected to step down to 100 percent. The Non-Residential customer class experiences an initial increase in cost recovery because this customer class has a larger portion of the large meter sizes than the other classes, and the quantity charge is increasing slightly as well (at half the projected annual revenue adjustment). However, the Non-Residential customer class's cost recovery is projected to slowly start decreasing in FY 2021. The Agricultural customer class is projected to maintain about 60 percent cost recovery over the period. The monthly fire standby charge is designed to recover 100 percent of its cost of service. The Non-Potable customer class's cost recovery is expected to step up to 80 percent in FY 2023. RO's cost of service recovery is projected to increase to 63 percent if all contract customers switch to the published rates on July 1, 2019. R-1's total cost of service recovery is projected to remain at 70 percent, with golf's share increasing slightly and irrigation's share decreasing slightly, presuming all contract customers switch to the published rates on July 1, 2019.

Table 5-6. Customer Class Proposed Revenue as a Percent of Cost of Service

Customer Class	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Single Family	90%	91%	92%	93%	95%
Multi-Unit	109%	107%	106%	103%	100%
Non-Residential	120%	122%	121%	119%	117%
Agricultural	60%	60%	60%	60%	60%
Fire Service – Private	12%	100%	100%	100%	100%
Non-Potable	77%	77%	78%	79%	80%
RO	55%	62%	62%	62%	63%
R-1 (Golf)	29%	31%	31%	32%	32%
R-1 (Other)	97%	97%	96%	95%	94%
R-1 Total	*70%*	*71%*	*70%*	*70%*	*70%*
Total	100%	101%	101%	100%	100%

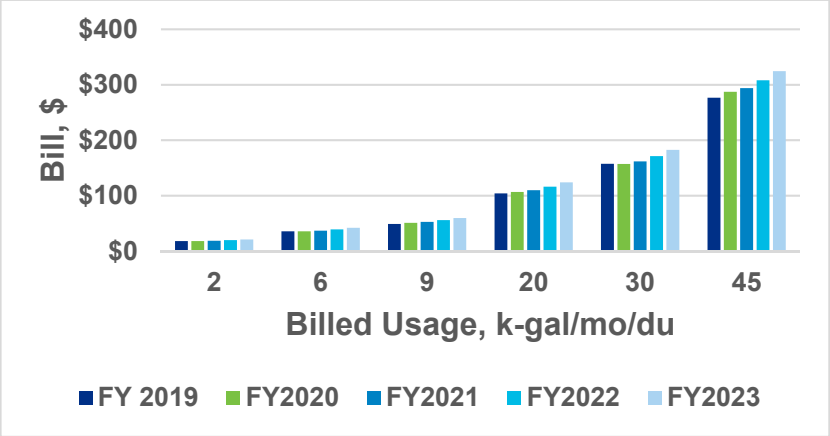
5.3 Typical Bills

The following presents the change in sample bills between FY 2019 and FY 2023 for Single-Family Residential, Multi-Unit Residential, Non-Residential and Agricultural customers. A Single-Family bill comparison to other utilities is also presented.

5.3.1 BWS Customers

Figure 5-1 presents the total bill at different levels of Single-Family billed usage per dwelling unit (du), ranging from the essential needs level, to about 50 percent usage, to the mathematical average bill, to the top 1 percent of bills level. Table 5-7 presents the year-to-year change in the total monthly bill for the examples shown in Figure 5-1.

Figure 5-1. Typical Bill Comparison Single-Family Customer Class



Note: the 45 k-gal/mo/du bill presumes a 1-inch meter. All other usage levels presume a 3/4 inch meter.

Table 5-7. Monthly Bill Change, Single-Family Sample Customers

Billed Usage (1), k-gal/mo/du	FY 2020	FY 2021	FY 2022	FY 2023
2	-$0.10	$0.62	$1.10	$1.29
6	$0.06	$1.18	$2.30	$2.69
9	$1.98	$1.60	$3.20	$3.74
20	$2.65	$3.14	$6.50	$7.59
30	-$0.05	$4.54	$9.50	$11.09
45	$10.64	$6.74	$14.08	$16.46

(1) Meter size is 3/4 inch for billed usage levels except 45 k-gal/mo/du, which is 1 inch.

Figure 5-2 presents the total monthly bill for two small Multi-Unit Residential usage levels presuming a 3/4-inch meter and 3 dwelling units. Figure 5-3 and Figure 5-4 show similar information for typical Multi-Unit Residential low-rise and high-rise customers, respectively.

Figure 5-2. Typical Bill Comparison Small Multi-Unit Customers, 3/4", 3 du

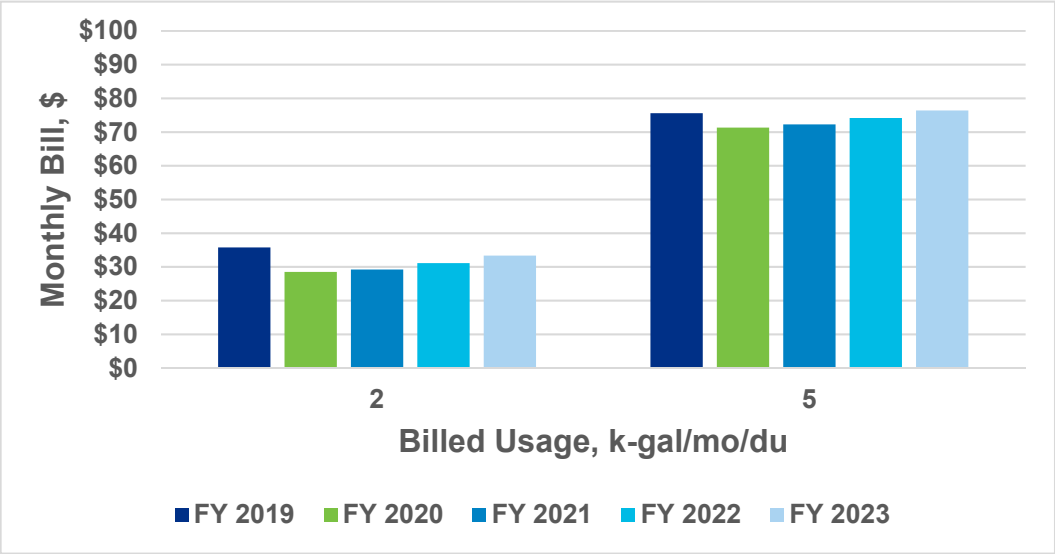
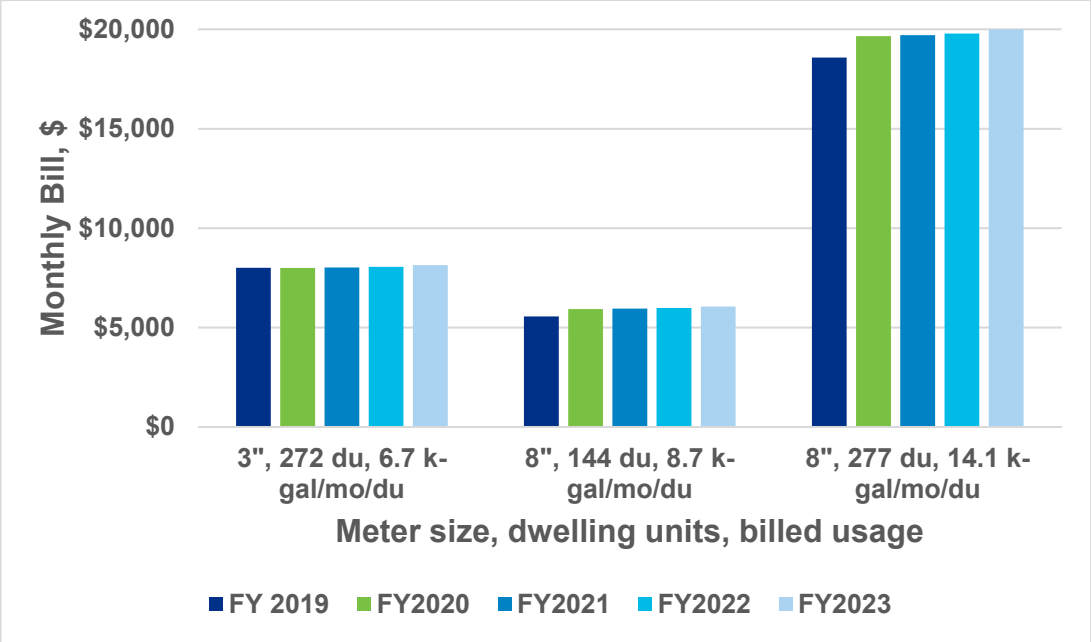
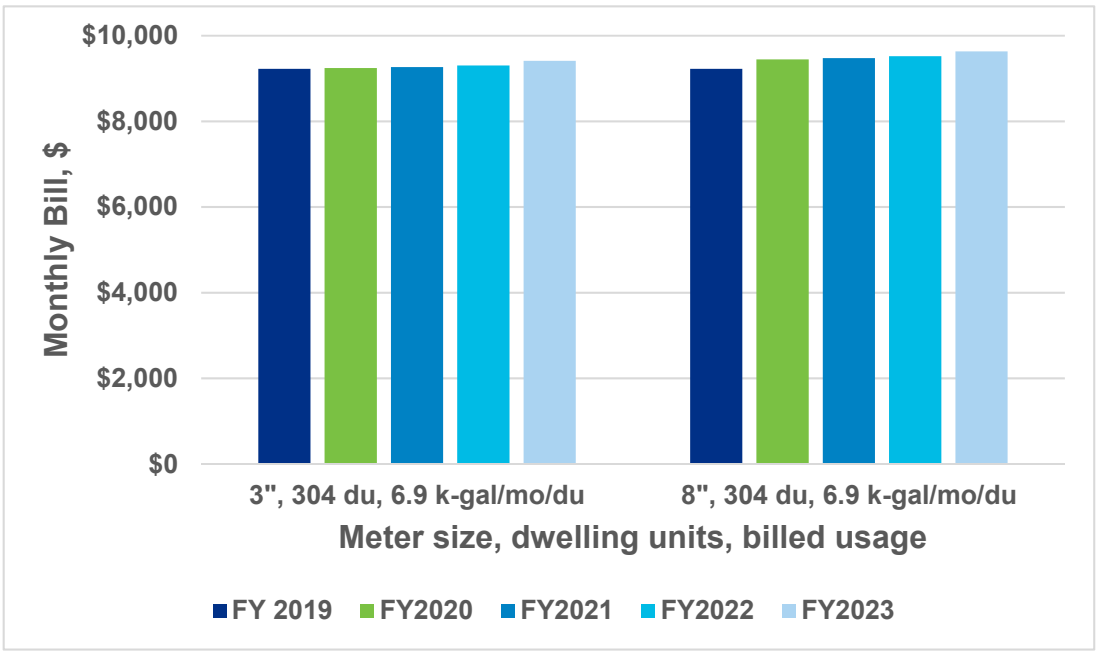


Figure 5-3. Typical Bill Comparison Multi-Unit Low Rise



Note: Per dwelling unit usage is calculated from the total usage divided by the number of dwelling units.

Figure 5-4. Typical Bill Comparison Multi-Unit High Rise



Note: Per dwelling unit usage is calculated from the total usage divided by the number of dwelling units.

Table 5-8 shows the year-to-year change in the monthly bill for the indicated usage, meter size and number of dwelling units. The largest low-rise user would feel the most impact because the average monthly usage per dwelling unit of 14 k-gal currently falls within the second tier but will fall within tier 4 under the proposed rates. That usage level represents the top 3 percent of usage

among Multi-Unit Residential customers. This change is consistent with the BWS goal of encouraging conservation and charging those customers who use more water a higher price.

Table 5-8. Monthly Bill Change, Multi-Unit Sample Customers

Billed Usage (k-gal/mo/du), meter size, dwelling units	FY 2020	FY 2021	FY 2022	FY 2023
Multi-Unit Small				
2 k-gal, 3/4", 3 du	-$3.16	$0.44	$0.64	$1.01
5 k-gal, 3/4", 3 du	-$1.99	$0.53	$0.82	$1.46
Multi-Unit Low Rise				
7 k-gal, 3", 272 du	-$9	$20	$32	$93
9 k-gal, 8", 144 du	$373	$21	$30	$73
14 k-gal, 8", 277 du	$1,081	$48	$80	$206
Multi-Unit High Rise				
7 k-gal, 3”, 304 du	$19	$23	$37	$106
7 k-gal, 8”, 304 du	$221	$30	$43	$114

Table 5-9 shows the dollar change in the monthly bill from year-to-year for sample Non-Residential customers. The customers with larger meters will see a larger increase in FY 2020 compared to FY 2021 because of the impact of the change to a meter-size based customer charge. Otherwise, these changes are consistent with the overall revenue increase.

Table 5-9. Monthly Bill Change, Non-Residential Sample Customers

Customer Class	Meter Size	Avg. Monthly Usage, k-gal	FY 2020	FY 2021	FY 2022	FY 2023
Restaurant	1.5”	229	$17	$12	$24	$25
Church	2”	233	$41	$13	$25	$27
Office Building	3”	458	$61	$25	$49	$51
Hotel	6”	1,525	$230	$83	$163	$170
School or College	8”	2,940	$387	$157	$311	$326
Large Shopping Center	3”	4,906	$282	$250	$508	$529
Large Landscaped Area	8”	9,914	$733	$510	$1,031	$1,074
Large Industrial	8”	31,232	$2,040	$1,598	$3,239	$3,373

Figure 5-5 presents a comparison of bills for three typical Agricultural customers at the meter and average billed monthly usage shown. The 3/4-inch examples see little to no change in their bill initially because of the switch to the meter-based customer charge. These changes are relatively modest.

Figure 5-5. Typical Bill Comparison Agricultural

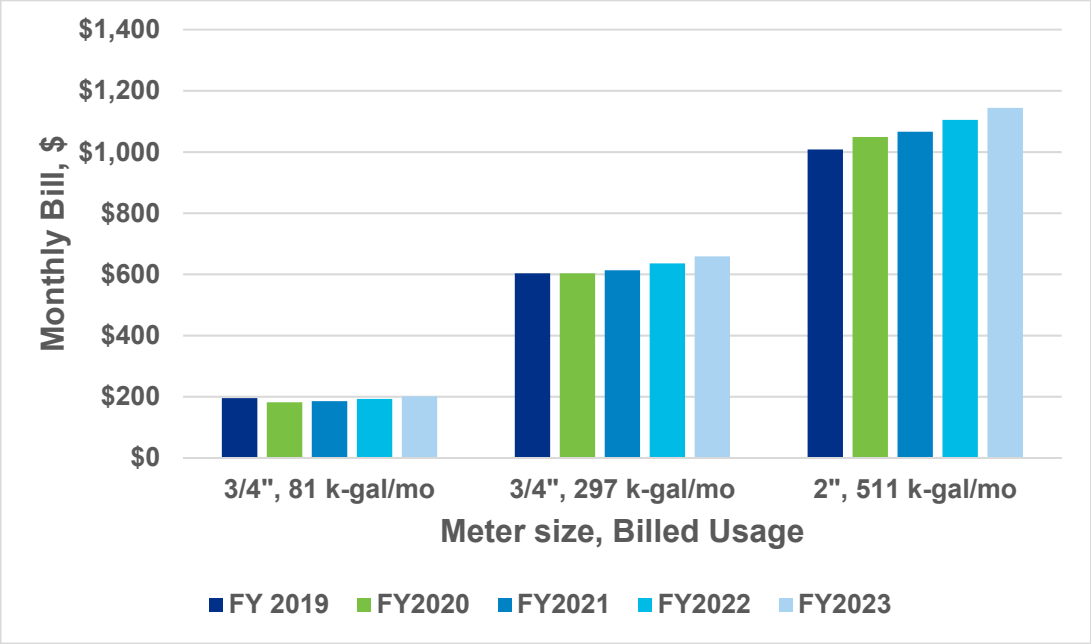


Table 5-10 presents the year-to-year change in a bill at the specified meter size and monthly billed usage level for three sample Agricultural customers.

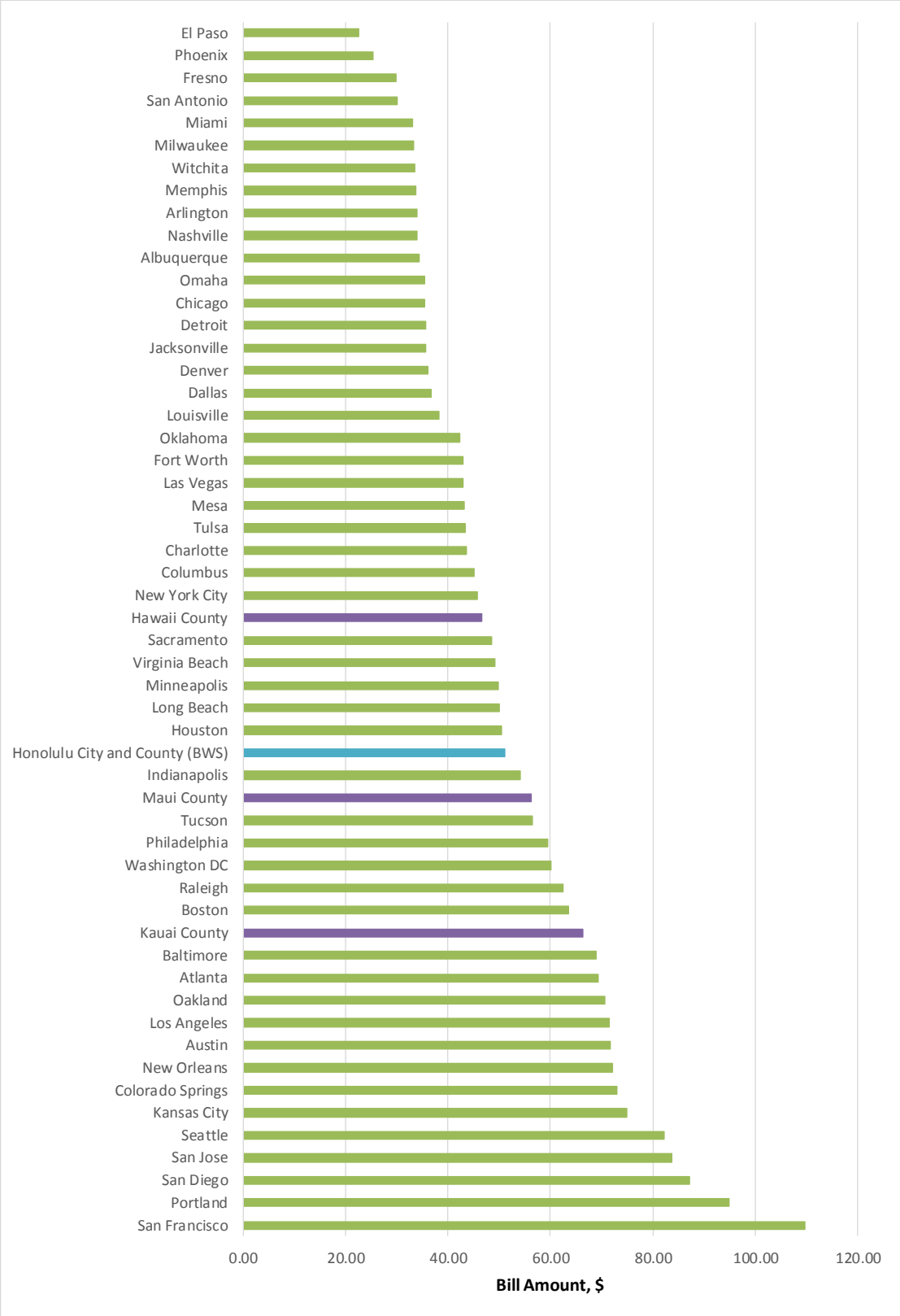
Table 5-10. Monthly Bill Change, Agricultural Sample Customers

Meter Size	Avg. Usage, k-gal/mo	FY 2020	FY 2021	FY 2022	FY 2023
3/4”	81	-$13	$3	$8	$8
3/4”	297	$0	$10	$23	$23
2”	511	$41	$17	$39	$39

5.3.2 Comparison to Other Utilities

Figure 5-6 presents a comparison of the BWS’s proposed rates for FY 2020 with the rates as of October 2018 of other county water systems in the state and the 50 largest cities in the United States for a Single-Family customer billed for 9 k-gal and using a 3/4" meter size, comparable to the BWS’s smallest meter size. The BWS is generally in the middle of bills in comparison to the other counties and largest cities. The teal color is the BWS, the purple bars are the other islands in ascending order: Hawaii County, Maui County, and Kauai County. It is also appropriate to note that many of the utilities in this survey have not yet adopted rates for July 2019, resulting in BWS’s survey position appearing higher than it actually will be at that time.

Figure 5-6. Multicity Comparison of Single-Family Residential Bill at 9 k-gal, 3/4" meter size



5.4 Public Input on Draft Rate Proposal and Board Approval

Once the set of recommended rates was developed based on significant input from the Stakeholder Advisory Group and Permitted Interaction Group, and following Board approval in March 2018 to seek public input on the draft rate proposal, an extensive public outreach effort related to the proposed rate schedule began. Public hearings were held in four regions across O'ahu during April and May 2018. Sixty-five people attended in person, and the meetings were televised on Olelo Community Media. Meeting video was also posted on the BWS website. A total of five speakers provided public comment, two of whom were opposed to changes to residential rates or were concerned about the impacts to retirees on fixed incomes.

Additional live meetings included neighborhood boards and special interest groups. Fifteen neighborhood board presentations were conducted as of August 27, 2018 with over 500 attendees, in total. Overall, comments at the neighborhood board meetings were positive and supportive of the BWS's approach and rationale for the water rate increases. Ten interest group presentations were conducted with groups such as AARP, Chamber of Commerce Hawaii, developers, farmers (including Farm Bureau), golf course managers, Hawaiian Electric, and the Honolulu Board of Realtors, with an estimated attendance of 150 people. Six city council member briefings were held including a briefing to the City Cabinet on June 19, 2018.

Additional outreach via paper and electronic media were also used to reach the public. The BWS website presenting the proposed changes to rates received over 20,000 page views. A special edition of Water Matters, the BWS customer newsletter, which focused on the proposed water rates, was distributed to all the BWS customers, local newspapers, social media, TV and radio stations. The BWS staff participated in radio and TV interviews describing the proposed rates. In total, these outreach efforts are estimated to have reached approximately 500,000 people.

From all of this outreach, feedback was received from an additional 33 people. Three supported the proposed rates, fifteen opposed, six requested clarification and the remainder inquired about issues that were not rate-related. Nearly all who opposed the proposed rates appear to be Single-Family residential customers. Concerns ranged from impacts to customers on fixed or low incomes to conservation equity to inefficiencies of a monopoly.

Additionally, a small business impact statement of the proposed changes to the rates and associated definitions, other charges and waivers was presented to the Small Business Regulatory Review Board. The impact statement specifically addressed concerns small businesses might have with changes in water rates, such as potential bill impacts, restrictions on water usage, and/or ease of understanding. Impacts to small businesses are anticipated to be in the range of 6 to 9 percent cumulatively (for Agricultural: 3 to 13 percent, cumulatively) over 5 years. Between the impact statement and presentation, small business representatives in the Stakeholder Advisory Group, and a presentation to the Chamber of Commerce Hawaii, the BWS kept small businesses informed of the changes. Response was neutral to positive.

The Board approved the Schedule of Water Rates and Charges on August 27, 2018. Resolution No. 889, 2018 became effective on September 15, 2018.

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Section 6
Conclusion

The BWS last enacted a schedule of rate increases in 2011 for the period of January 1, 2012 through July 1, 2015. Rates have not changed since July 1, 2015. While the BWS has been able to use available fund balances in addition to rate-based revenues to cover operating expenses since then, increased investments in infrastructure will require more revenue than what can be expected under current rates. As a result, rates need to be increased to generate additional revenues.

The five-year rate plan (July 2018 through June 2023) does not require any change in rates until July 1, 2019. Over the remaining four-year period, the proposed rates are estimated to bring in about 2 percent, 2 percent, 4 percent and 4 percent in additional revenues in each of the years starting July 1, respectively. This is comparable to estimated inflation. Cumulatively over the five-year period, the proposed rate schedule is projected to result in a 12.5 percent increase in revenues. Note that these increases in revenues do not match increases in rates for individual customer classes as a result of simultaneously implementing changes to the rate structure to meet the objectives of the Board's guardrails.

In alignment with the guardrails, the following rate structure changes will be implemented:

- The monthly charge, to be called a customer charge, has been changed to reflect meter size.
- The residential water rates and tiers have been adjusted to meet two key guardrails: 1) provide an Essential Needs tier that offers up to 2,000 gallons per month per dwelling unit of water at below cost and 2) encourage efficient use of water/ water conservation through the use of a fourth tier with higher priced water as part of the BWS's mission to sustain O'ahu's watersheds and water supply.
- Residential rates have been designed to bring Single-Family Residential customers and Multi-Unit Residential customers closer to 100 percent cost of service recovery.
- Agricultural rates have been designed to maintain 60 percent cost of service recovery to support island farming.
- The quantity-based rates for Non-Residential customers have been set to increase at half the required annual revenue adjustment (e.g., the projected revenue adjustment for FY 2020 is 2 percent; therefore, the Non-Residential quantity charge is increased by 1 percent from its current level to derive the FY 2020 quantity charge). This mechanism will slowly lower this Non-Residential customer class's cost of service recovery closer to 100 percent.
- Rates for recycled (R-1 and RO) and Non-Potable water customers have increased to recover more of their cost of service. However, the percent of cost of service recovery still

recognizes the benefits provided by customers using recycled and non-potable water resources.

- Private fire service has been changed to a monthly fixed charge, based on fire service meter size. This change is designed to fully recover the annual cost of providing this service.

Overall, these changes seek to move customer classes closer to paying each classes' fair share of system costs, except where under recovery is intended to support community values, such as encouraging local agriculture and sustaining the potable water resource by encouraging the use of non-potable and recycled water.

In advance of the next rate study, the BWS may want to consider exploring:

- Whether the Non-Residential customer class can and/or should be subdivided into smaller, more homogenous groups of customers for which a basis for greater definition in cost allocation and equitable rate setting could be established. Doing so would necessitate review of existing Non-Residential customer premise types and likely the creation of additional premise types in order to develop an adequate data set to support the required analyses;
- Validating the peaking factors developed in the cost of service analysis, for each customer class place a statistically significant number of demand meters on customer premises and record data for at least a year;
- Separating residential and non-residential meters for mixed-use buildings; and
- Separating residential and agricultural meters for farms currently using one meter for domestic and irrigation uses.

Appendix A

Board Resolution Adopting Rates

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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU

RESOLUTION NO. 889, 2018

ADOPTING THE REVISIONS TO THE SCHEDULE OF RATES AND CHARGES FOR THE FURNISHING OF WATER AND WATER SERVICE FOR FISCAL YEARS 2019 – 2023, EFFECTIVE SEPTEMBER 10, 2018 THROUGH JUNE 30, 2023

WHEREAS, after notices of publication, five public hearings were held by the Board of Water Supply on April 26, 2018, May 14, 2018, May 15, 2018, May 24, 2018, and August 27, 2018, for the purpose of considering proposed revisions to the Schedule of Rates and Charges for the Furnishing of Water and Water Service; and

WHEREAS, testimonies presented at said hearings and received in writing through August 27, 2018 on the proposed revisions were given due consideration; and

WHEREAS, the Board of Water Supply held 27 meetings with a Stakeholder Advisory Group to solicit feedback and gather input on the Water Master Plan, Infrastructure Investment Plan, Long Range Financial Plan, and proposed changes to the water rates and charges; and

WHEREAS, the mission of the Board of Water Supply is to provide safe, dependable, and affordable water now and into the future; and

WHEREAS, a Water Master Plan adopted in October 2016 identifies the needs of the Board of Water Supply in order to meet its mission; and

WHEREAS, an Infrastructure Investment Plan was developed from the findings of the Water Master Plan to identify and schedule capital improvements to implement the findings and recommendations in the Water Master Plan in order to meet the mission of the Board of Water Supply; and

WHEREAS, a Long Range Financial Plan adopted by the Board of Water Supply in March 2018 was developed and included a projection of ten-year revenue requirements, evaluation of financing strategies, supporting revised Financial Policies adopted by the Board of Water Supply in May 2017, and assessment of long-term (30-year) trends and risks associated with supporting the Infrastructure Investment Plan; and

WHEREAS, a five-year cost of service and rate study were completed to determine the necessary revenue adjustments to support implementation of the findings in the Water Master Plan and the Infrastructure Investment Plan; and

WHEREAS, the Board of Water Supply seeks to increase its annual replacement of pipeline to 21 miles per year over the next decade; and

WHEREAS, the cost of service analysis identified opportunities to adjust rates and charges to better align revenues with the costs to serve different customer classes; and

WHEREAS, the rate study identified opportunities to incentivize efficient use of water within the residential customer classes by changing tiers and rates; and

WHEREAS, the Board of Water Supply recognizes the importance of affordable water to meet essential household needs; and

WHEREAS, the Board of Water Supply recognizes the benefits of a viable local agricultural industry on Oahu and the importance of an affordable supply of water for that industry; and

WHEREAS, the Board of Water Supply recognizes the benefit of encouraging the use of recycled and non-potable water resources as a way to manage and sustain the potable water resources on Oahu; now, therefore

BE IT RESOLVED by the Board of Water Supply, City and County of Honolulu, that in support of these objectives and the mission of the Board of Water Supply, the Schedule of Rates and Charges be revised, as attached hereto, and that said rates and charges shall become effective from and after September 10, 2018.

ADOPTED:

BRYAN P. ANDAYA
Chair

Honolulu, Hawaii
August 27, 2018

APPROVED

RESOLUTION NO. 889, 2018, ADOPTING THE REVISIONS TO THE SCHEDULE OF RATES AND CHARGES FOR THE FURNISHING OF WATER AND WATER SERVICE FOR FISCAL YEARS 2019-2023, EFFECTIVE SEPTEMBER 10, 2018 THROUGH JUNE 30, 2023 WAS ADOPTED ON AUGUST 27, 2018			
	AYE	NO	COMMENT
BRYAN P. ANDAYA	X		
KAPUA SPROAT	X		
DAVID C. HULIHEE			ABSENT
KAY C. MATSUI	X		
RAY C. SOON	X		
ROSS S. SASAMURA	X		
JADE T. BUTAY			ABSENT

Revision to the Schedule of Rates and Charges for the Furnishing of Water and Water Service

Amended by Resolution No. 889, 2018, effective September 10, 2018

Schedule for September 10, 2018 – June 30, 2019

Billing Charge

There is a billing charge each time a bill is issued effective as follows:

Sep. 10, 2018
$9.26

Quantity Charge

In addition to the Billing Charge, there is a charge for all water used, rounded down to the nearest 1,000 gallons (k-gal), effective as follows:

Single-Family Residential (Monthly per dwelling unit)	Sep. 10, 2018
Tier 1 First 13,000 gallons	$4.42
Tier 2 13,001 – 30,000 gallons	$5.33
Tier 3 Over 30,000 gallons	$7.94
Multi-Unit Residential (Monthly per dwelling unit)	**Sep. 10, 2018**
Tier 1 First 9,000 gallons	$4.42
Tier 2 9,001 – 22,000 gallons	$5.33
Tier 3 Over 22,000 gallons	$7.94
Non-Residential	**Sep. 10, 2018**
All Usage	$4.96
Agricultural (Monthly per account)	**Sep. 10, 2018**
Tier 1 First 13,000 gallons	$4.42
Tier 2 Over 13,000 gallons	$1.89
Non-Potable/Brackish	**Sep. 10, 2018**
All Usage	$2.47

Customer Class Definitions

Potable Water means all water that meets State Department of Health Drinking Water Standards. For all customers, all potable water used for irrigation will be billed in accordance with the primary usage of the property. Potable water customers are divided into the following classes:

Residential
Single-family residential refers to single-family and duplex residences.

Multi-Unit refers to multi-unit residences including apartments, condominiums and townhouses. Low-rise constitutes up to three stories in height. High-rise refers to higher than three living stories.

Agricultural
Agricultural refers to a parcel devoted to agricultural activities. To qualify for Agricultural Quantity Charges, a customer must submit a written application to the Board of Water Supply and furnish satisfactory proof that they are engaged in agriculture on a commercial basis. Only one dwelling unit will be allowed on a meter qualifying for the agricultural quantity charges. To continue to qualify, the application must be renewed each fiscal year.

Non-Residential
Non-residential refers to any property not used for residential or agricultural purposes. To determine appropriate quantity charges, combinations of residential and non-residential may require separate meters for each use; e.g. separate residential and non-residential meters.

Non-Potable/Brackish

Non-Potable/ Brackish refers to customers that receive non-potable/ brackish water. This water does not meet State Department of Health Drinking Water Standards. The Non-Potable Quantity Charges shall not supersede existing or individually negotiated non-potable quantity charge agreements.

Standby Charge: A Standby Charge will be negotiated by the Manager and Chief Engineer with each private water system contracting for interconnection service. Such service shall be provided only during emergency or temporary service outages with the intent to protect against interrupted water service supporting normal private system requirements. Water used shall be charged at the applicable quantity rate for each thousand gallons. Approval of activation and duration is contingent upon impacts to BWS customers' level of service and BWS's ability to meet Water System Standards requirements. Activation of service will require a written request submitted to the Manager and Chief Engineer at least 48 hours before service is required, unless waived by the Manager and Chief Engineer.

Water service shall be provided in accordance with Board of Water Supply Rules and Regulations Section 1-101 Availability of Water which requires that "the Department have sufficient pressure and water supply available for domestic use and fire protection and can assume new or additional service without detriment to those presently being served."

Power Cost Adjustment: When total power, or electricity, costs to the Board of Water Supply exceed the amount used in calculating the annual Schedule of Rates and Charges, then the Quantity Charge may be increased $0.01 per 1,000 gallons for every $500,000 incremental power cost overage in the following fiscal year.

Environmental Regulations Compliance Fee Cost Adjustment: The Quantity Charge may be increased $0.01 per 1,000 gallons for each $500,000 of additional costs that the Board of Water Supply is required to incur in order to comply with any Federal or State environmental law or regulation.

Waiver of Water System Facilities Charge for Qualified Affordable and Homeless Dwelling Units

The Board of Water Supply may waive the Water Systems Facilities Charges and new meter cost for qualified on-site affordable and homeless dwelling units, up to 500 dwelling units per year. The waivers will be granted when the building permit is submitted for approval. To qualify, the dwelling units must be certified as either affordable or homeless dwelling units by the appropriate agency of the City and County of Honolulu. Waiver of the Water System Facilities Charge will apply only to fixture units associated with the certified dwelling units. The amount of the meter waiver shall be calculated as a percentage of the number of certified dwelling units to the total number of dwelling units in the project. If the annual cap of 500 dwelling units has not been reached and a project is proposed that would qualify for more than the remaining number of dwelling units in that year, the Manager and Chief Engineer has the discretion to increase that year's limit. This waiver provision shall expire on June 30, 2023.

Waiver of Meter Charges for Residential Fire Sprinkler Retrofits

The Board of Water Supply may waive the new meter charges for high rise multi-unit residential fire sprinkler retrofits. This waiver provision shall expire on June 30, 2023.

Schedule for July 1, 2019 – June 30, 2023

Customer Charge

There is a customer charge each month service is provided based on the meter size effective as follows:

Meter Size	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
5/8" or 3/4"	$10.42	$10.80	$11.38	$12.09
1"	$13.31	$13.79	$14.45	$15.28
1.5"	$15.23	$15.78	$16.50	$17.41
2"	$38.81	$40.18	$41.61	$43.45
3"	$47.95	$49.64	$51.35	$53.55
4"	$91.74	$94.95	$97.98	$101.92
6"	$163.91	$169.63	$174.84	$181.64
8"	$250.03	$258.76	$266.57	$276.78
12"	$541.31	$560.18	$576.78	$598.53

Quantity Charge

In addition to the Customer Charge, there is a charge for all water used, rounded down to the nearest 1,000 gallons (k-gal), effective as follows:

Single-Family Residential (Monthly per dwelling unit)	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
Tier 1: Essential Needs First 2,000 gallons	$3.79	$3.91	$4.17	$4.46
Tier 2 2,001 – 6,000 gallons	$4.46	$4.60	$4.90	$5.25
Tier 3 6,001 – 30,000 gallons	$5.06	$5.20	$5.50	$5.85
Tier 4 Over 30,000 gallons	$8.46	$8.60	$8.90	$9.25
Multi-Unit Residential (Monthly per dwelling unit)	**July 1, 2019**	**July 1, 2020**	**July 1, 2021**	**July 1, 2022**
Tier 1: Essential Needs First 2,000 gallons	$3.70	$3.71	$3.72	$3.77
Tier 2 2,001 – 4,000 gallons	$4.35	$4.36	$4.38	$4.43
Tier 3 4,001 – 10,000 gallons	$4.95	$4.96	$4.98	$5.03
Tier 4 Over 10,000 gallons	$5.90	$5.91	$5.93	$5.98
Non-Residential	**July 1, 2019**	**July 1, 2020**	**July 1, 2021**	**July 1, 2022**
All Usage	$5.01	$5.06	$5.16	$5.27
Agricultural (Monthly per account)	**July 1, 2019**	**July 1, 2020**	**July 1, 2021**	**July 1, 2022**
Tier 1: Essential Needs First 2,000 gallons	$3.79	$3.91	$4.17	$4.46
Tier 2 2,001 – 6,000 gallons	$4.46	$4.60	$4.90	$5.25
Tier 3 Over 6,000 gallons	$1.95	$1.98	$2.05	$2.12

Non-Potable/Brackish	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
All Usage	$2.53	$2.62	$2.75	$2.90
Recycled Water				
R-1 Golf	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
All Usage	$0.57	$0.59	$0.62	$0.65
R-1 Other	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
All Usage	$1.84	$1.88	$1.92	$1.96
Reverse Osmosis (RO)	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
All Usage	$5.76	$5.88	$6.12	$6.36

Fire Meter Standby Charge

For those receiving private fire service, there is an additional fire meter standby charge billed monthly based on the size of the fire meter effective as follows:

Fire Meter Size	July 1, 2019	July 1, 2020	July 1, 2021	July 1, 2022
2" and smaller	$6.72	$6.95	$7.42	$7.99
3"	$8.82	$9.08	$9.64	$10.29
4"	$12.43	$12.74	$13.44	$14.23
6"	$25.42	$25.94	$27.13	$28.44
8"	$47.83	$48.69	$50.74	$52.94

Customer Class Definitions

Potable Water means all water that meets State Department of Health Drinking Water Standards. For all customers, all potable water used for irrigation will be billed in accordance with the primary usage of the property. Potable water customers are divided into the following classes:

Residential

Single-family residential refers to single-family and duplex residences.

Multi-Unit refers to multi-unit residences including apartments, condominiums and townhouses. Low-rise constitutes up to three stories in height. High-rise refers to higher than three living stories.

Agricultural

Agricultural refers to a parcel devoted to agricultural activities. To qualify for Agricultural Quantity Charges, a customer must submit a written application to the Board of Water Supply and furnish satisfactory proof that they are engaged in agriculture on a commercial basis. Only one dwelling unit will be allowed on a meter qualifying for the agricultural quantity charges. To continue to qualify, the application must be renewed each fiscal year.

Non-Residential

Non-residential refers to any property not used for residential or agricultural purposes. To determine appropriate quantity charges, combinations of residential and non-residential may require separate meters for each use; e.g. separate residential and non-residential meters.

Non-Potable Water means all water that does not meet State Department of Health Drinking Water Standards. It is divided into the following classes:

Non-Potable/ Brackish
Customers that receive non-potable/ brackish water.

R-1 Recycled Water
R-1 recycled water is recycled wastewater that meets State Department of Health Reuse Guidelines.
R-1 Golf are those customers that receive R-1 water used primarily for golf course irrigation.
R-1 Other are those customers that receive R-1 recycled water for uses other than golf course irrigation

Reverse Osmosis (RO) Demineralized Water
RO water is recycled wastewater that has been demineralized through reverse osmosis.

The R-1 Golf, R-1 Other and RO Customer and Quantity Charges shall not supersede existing or individually negotiated charges unless expressly identified in the contract.

Fire Meter Standby Charge
The Fire Meter Standby Charge, for readiness to serve, applies to services used exclusively for private fire protection purposes, including automatic fire sprinkler services connected to the alarm systems, fire hydrants, and wet standpipes. These must be protected against theft and leakage or waste of water. No connections or usage of water for other than fire-fighting and system testing purposes is allowed. In addition, for any misuse or non-fire protection related water use, such usage will be billed at twice the highest quantity charge in effect at that time. For any such misuse or leakage, the Customer shall be subject to penalty pursuant to Chapter 1, Article 3, Section 1-3.1 of the Revised Ordinances of Honolulu. Except for misuse and non-fire protection related use as described above, there are no quantity charges associated with these services.

Standby Charge: A Standby Charge will be negotiated by the Manager and Chief Engineer with each private water system contracting for interconnection service. Such service shall be provided only during emergency or temporary service outages with the intent to protect against interrupted water service supporting normal private system requirements. Water used shall be charged at the applicable quantity rate for each thousand gallons. Approval of activation and duration is contingent upon impacts to BWS customers' level of service and BWS's ability to meet Water System Standards requirements. Activation of service will require a written request submitted to the Manager and Chief Engineer at least 48 hours before service is required, unless waived by the Manager and Chief Engineer.

Water service shall be provided in accordance with Board of Water Supply Rules and Regulations Section 1-101 Availability of Water which requires that "the Department have sufficient pressure and water supply available for domestic use and fire protection and can assume new or additional service without detriment to those presently being served."

Power Cost Adjustment: When total power, or electricity, costs to the Board of Water Supply exceed the amount used in calculating the annual Schedule of Rates and Charges, then the Quantity Charge may be increased $0.01 per 1,000 gallons for every $500,000 incremental power cost overage in the following fiscal year.

Environmental Regulations Compliance Fee Cost Adjustment: The Quantity Charge may be increased $0.01 per 1,000 gallons for each $500,000 of additional costs that the Board of Water Supply is required to incur in order to comply with any Federal or State environmental law or regulation.

Waiver of Water System Facilities Charge for Qualified Affordable and Homeless Dwelling Units

The Board of Water Supply may waive the Water Systems Facilities Charges and new meter cost for qualified on-site affordable and homeless dwelling units, up to 500 dwelling units per year. The waivers will be granted when the building permit is submitted for approval. To qualify, the dwelling units must be certified as either affordable or homeless dwelling units by the appropriate agency of the City and County of Honolulu. Waiver of the Water System Facilities Charge will apply only to fixture units associated with the certified dwelling units. The amount of the meter waiver shall be calculated as a percentage of the number of certified dwelling units to the total number of dwelling units in the project. If the annual cap of 500 dwelling units has not been reached and a project is proposed that would qualify for more than the remaining number of dwelling units in that year, the Manager and Chief Engineer has the discretion to increase that year's limit. This waiver provision shall expire on June 30, 2023.

Waiver of Meter Charges for Residential Fire Sprinkler Retrofits

The Board of Water Supply may waive the new meter charges for high rise multi-unit residential fire sprinkler retrofits. This waiver provision shall expire on June 30, 2023.

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Appendix B

Revised Financial Policies

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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com

May 8, 2017

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

Chair and Members:

Subject: Adoption of Resolution No. 873, 2017, Adopting the Board of Water Supply Debt and Working Capital Management Policies

One of the strategic objectives of the Board of Water Supply's 2018 – 2022 Strategic Plan, adopted by the Board at their April 24, 2017 meeting, is to "develop and implement short and long term financial plans and policies."

The current financial policies were approved by the Board on September 27, 2004. After researching best practices at other water utilities and getting public comment through our Stakeholder Advisory Group, we have revised these policies and organized them into a framework of four major Debt and Working Capital Management Policies: 1) Fund Balance/Working Capital, 2) Purposes and Use of Debt, 3) Debt to Net Asset Ratio, and 4) Debt Service Coverage Ratio. These policies will be a foundation for the development of our financial plan and water rate study.

We respectfully recommend that the Board adopt the Board of Water Supply Debt and Working Capital Management Policies.

Respectfully submitted,

ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

Attachments

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

RESOLUTION NO. 873, 2017

RESOLUTION ADOPTING THE BOARD OF WATER SUPPLY DEBT AND WORKING CAPITAL MANAGEMENT POLICIES

WHEREAS, the Board of Water Supply, City and County of Honolulu takes to heart and is committed to its vision of "Ka Wai Ola – Water for Life", which captures the critical need of water as the basis of life; and

WHEREAS, the Board of Water Supply's mission is to provide safe, dependable, and affordable water to our customers now and into the future; and

WHEREAS, the Debt and Working Capital Management Policies provide the financial framework to support the Board of Water Supply's 30-year Water Master Plan adopted by the Board of Directors on October 24, 2016, and the Board of Water Supply's 2018 – 2022 Strategic Plan adopted by the Board of Directors on April 24, 2017; now, therefore,

BE IT RESOLVED by the Members of the Board of Water Supply, City and County of Honolulu, that the Board of Water Supply Debt and Working Capital Management Policies be adopted to provide financial guidance for the Department.

ADOPTED:

BRYAN P. ANDAYA
Chair

Honolulu, Hawaii
May 8, 2017

Board of Water Supply

Debt and Working Capital Management Policies

Purpose: The financial policies are developed to ensure the financial integrity of the Board of Water Supply, support strong credit ratings, reduce and mitigate rate increases in the future and to support the Board of Water Supply's long range financial planning objectives.

1. **Working Capital**

    a. Description. Working Capital (also called Uncommitted Operating Fund Balance) is needed to ensure the Board of Water Supply's ongoing ability to fund operating and maintenance expenses, debt service and construction payments in a timely manner. Sufficient funds should be committed to enable the Board of Water Supply to reliably meet its obligations, accounting for differences between when costs are incurred and revenues are received. Working Capital should be sufficient to cover contingencies, including disasters and other unforeseen events. Finally, Working Capital should provide sufficient flexibility and strength to support the Board of Water Supply's credit rating objectives.

    b. Working Capital Target. The Board of Water Supply's objective will be to maintain 180 days cash on hand, where days cash on hand is defined as the number of days of operating expenses that could be covered by Working Capital (exclusive of those funds committed to capital projects or construction contracts). The 180 days cash target is to provide funds for unplanned events such as disaster recovery and rate stabilization. The 180 days cash target is intended to be achieved gradually over an approximately 10-year period, from the adoption of this policy, in order to minimize rate impacts. The Board of Water Supply will maintain a minimum of 60 days cash on hand. The Board of Water Supply may use financial tools such as cost-effective lines of credit, commercial paper, and insurance for use in emergencies and natural disaster recovery to supplement cash and investments to provide financial capacity of more than 180 days cash on hand.

    c. Working Capital greater than 180 days may be re-programmed to fund long-term capital projects in future years.

2. **Purposes and Use of Debt**

    a. Description. Debt may be issued as fixed or variable-rate obligations, and may be used to finance long-term capital projects. The Board of Water Supply may incur debt through state or federal programs such as the State Revolving Fund

(SRF) and Water Infrastructure Finance and Investment Act (WIFIA), by issuing debt in the public market, or through a private placement or direct borrowing.

b. Use of Debt. The Board of Water Supply will issue debt to fund long-lived capital projects. By issuing debt to fund capital projects, the Board of Water Supply can better align the costs (through annual debt service payments) with the effective useful life of a facility or project, more effectively allocating the cost of facilities to those customers who benefit from the facilities over time. In addition, the use of debt is a valuable tool to mitigate spikes in capital spending resulting from large project expenditures, helping to reduce needed rate increases.

The longest maturity of any debt issuance will be no longer than the expected useful life of the facility to be constructed. Debt will be issued in compliance with all tax and other federal and state regulations.

Short-term debt may be issued from time to time to fund projects in anticipation of a future long-term bond issue (e.g., a Bond Anticipation Note) or future revenues (e.g., Revenue Anticipation Note). The Board of Water Supply may also utilize revolving credit loans, commercial paper, or similar programs to provide interim construction financing in anticipation of future long-term bond issues, revenue inflow, or to provide funding during unplanned events such as natural disasters as described under Working Capital.

c. Debt Structure. The Board of Water Supply will use a mix of fixed and variable rate debt that is expected to yield the lowest cost of borrowing, but will limit the percent of variable rate debt to no more than 20% of outstanding debt. The Board of Water Supply may issue debt on either a senior lien or a subordinate lien. Senior lien debt will have the highest claim on Net Revenues, followed by subordinate lien debt.

3. Debt to Net Asset Ratio

a. Description. The debt to net asset ratio is a measure of financial leverage, and is defined as the ratio of total outstanding debt, including SRF loans and any other borrowing (including both senior and subordinate debt) to net assets.

b. Debt to Net Asset Ratio Target. To ensure financial flexibility in the future, as well as maintain strong credit ratings, the Board of Water Supply will target a Debt to Net Asset Ratio of no more than 50%.

4. Debt Service Coverage Ratio

a. Description. The Debt Service Coverage Ratio is a measure of financial margin or the amount of funds available to pay debt service, including all borrowings such

as SRF loans, after paying for all operating and maintenance expenses. It is computed as the ratio of net revenues (total revenues less operating and maintenance expenses, plus depreciation) to annual debt service.

b. Debt Service Coverage Target. The Board of Water Supply may issue debt on either of its senior or subordinate liens. As the senior lien has the first claim on Net Revenues, the Board of Water Supply will maintain a Debt Service Coverage Ratio on senior lien debt equal to or greater than 1.7, with an "all-in" (that is, a Debt Service Coverage Ratio equal to Net Revenues divided by all outstanding debt, regardless of lien) equal to or greater than 1.6.

Appendix C

6-Year Capital Improvement Program

The following lists the Capital Improvement Program projects and costs provided by the BWS on December 4, 2017 for use in the rate study analysis.

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PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Aala St and N Vineyard Blvd	Pipelines	-	-	-	-	717,700	-
Advanced TCP Treatment at Various GAC Facilities	Treatment	-	-	2,000,000	-	30,000,000	10,000,000
Ahilama Road 8-Inch Main	Pipelines	250,442	-	-	1,044,000	-	-
Ahuimanu Cross Country 16-inch Main Replacement Environmental	Pipelines	197,718	-	-	-	-	-
Ahuimanu Cross Country Main Abandonment and System Improvements	Pipelines	131,812	-	-	690,200	-	-
Aiea 497 Rezone	Pumps-trans	-	-	-	-	66,600	-
Aina Haina 170 0.5 MG Reservoir No. 2	Storage	-	-	3,300,000	-	-	-
Aina Koa Booster No. 4 and Aina Koa Well II Facilities Repair	Pumps-trans	-	-	-	69,000	-	-
Aina Koa Booster No. 5 Facilities Repair	Pumps-trans	0	-	-	53,000	-	-
Ainapua St and Ala Mahamoe	Pipelines	-	-	-	-	-	1,471,300
Akanoho Place 8-Inch Main	Pipelines	-	-	2,171,100	-	-	-
Ala Aolani 12-Inch Main	Pipelines	-	7,643,000	-	-	-	-
Ala Moana Blvd and Ena Rd Area WSI	Pipelines	-	-	579,100	-	-	-
Ala Moana Blvd and Piikoi St Area WSI	Pipelines	0	-	-	440,300	-	-
Ala Moana Boulevard 24-Inch Main - Ala Wai Canal Crossing	Pipelines	-	-	-	323,600	-	-
Ala Moana Boulevard 24-Inch Main - Keawe Street to Ward Avenue	Pipelines	-	-	-	-	-	500,200
Ala Moana Boulevard 24-Inch Main - Richards Street to Keawe Street	Pipelines	0	-	-	-	-	634,500
Ala Moana Boulevard 24-Inch Main - Ward Avenue to Atkinson Drive	Pipelines	-	-	-	-	634,500	-
Ala Moana Water System Improvements, Part I	Pipelines	-	-	846,000	-	-	-
Ala Napunani at Ala Ilima 16-inch Main	Pipelines	-	-	-	72,300	-	-
Ala Wai Blvd at McCully St 16-inch Main	Pipelines	-	-	-	-	351,100	-
Ala Wai Membrane Bioreactor Facility	Nonpotable	-	-	1,650,000	-	-	-
Alewa Heights Booster No. 1 MCC Replacement	Pumps-trans	-	-	-	-	-	-
Alewa Heights Booster No. 3 MCC Replacement and Facilities Repairs	Pumps-trans	-	-	-	-	-	328,000
Aliipoe Dr and Paihi St Area WSI	Pipelines	0	-	392,300	-	-	-
AMR-AMI Upgrades	Facilities	-	1,145,000	-	-	-	-
Analii St WSI	Pipelines	-	-	-	-	323,700	-
Apio Lane 8-Inch Main	Pipelines	-	-	-	-	-	90,000
Auloa Road and Ulukahiki Street 12-inch Main	Pipelines	0	-	4,885,500	-	-	-
Backup Power Systems for Wireless Systems	Facilities	0	3,700,000	-	-	-	-
Barbers Point 215 Water System Improvements	Pipelines	-	-	550,000	-	-	-
Beretania Engineering Building Window Replacement	Facilities	2,636,234	-	-	-	-	-
Beretania Modernization - Interior Renovation of Engineering Building	Facilities	-	1,100,000	-	-	-	-
Beretania Office Building and Parking Structure	Facilities	-	1,400,000	-	-	-	-

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Beretania Pump Station Renovation	Pumps-trans	0	-	-	-	1,395,900	-
Beretania Site Master Plan	Facilities	1,318,117	-	-	-	-	-
Beretania St 12-inch Blow-off Main	Pipelines	105,449	-	-	552,500	-	-
Business Intelligence_Digital Dashboard	Tools & Resources	0	741,000	1,300,000	-	-	-
Construction Management for Various BWS Construction Projects	Tools & Resources	1,318,117	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Customer Information System	Tools & Resources	-	216,000	1,014,000	-	-	-
Data Center Renovation	Facilities	197,718	-	-	-	-	-
Diamond Head Water System Improvements, Part III	Pipelines	-	-	-	1,100,000	-	-
Dillingham Blvd at Kohou St 12 inch	Pipelines	-	-	-	-	905,400	-
Document Management System	Tools & Resources	-	480,000	1,210,000	-	-	-
East Kapolei 215 3.0 MG Recycled Water Reservoir	Nonpotable	-	-	800,000	-	-	12,100,000
Elelupe Rd and Kuliouou Rd WSI	Pipelines	-	-	-	743,100	-	-
Emergency Generator Installation - Kalihi Yard and Shaft, Halawa Shaft, and Kunia Wells I	Pumps-trans	10,149,499	-	-	-	-	-
Emergency Generator Installation - Phase 2	Pumps-trans	-	-	-	-	-	-
Emergency Generator Installation - Phase 3	Pumps-trans	-	-	-	-	-	-
Emergency Generator Installation - Phase 4	Pumps-trans	-	-	-	-	-	-
Ewa Shaft Tunnel Improvements	Sources	3,954,350	-	-	20,000,000	20,000,000	-
Exploratory Well Program	Sources	0	150,000	150,000	650,000	650,000	650,000
Facility Repair and Renovation	Facilities	8,435,947	1,900,000	1,900,000	1,900,000	1,900,000	1,900,000
Farrington Highway at Waianae Kai Beach 16 and 8 inch	Pipelines	0	-	-	108,400	-	-
Farrington Hwy 24 inch	Pipelines	-	-	-	559,500	-	-
Farrington Hwy 24in Renewal - Part I	Pipelines	0	2,294,700	-	-	-	-
Farrington Hwy and Maipalaoa Rd	Pipelines	0	-	-	-	811,200	-
Farrington Hwy and Waipahu Depot St Area WSI	Pipelines	-	412,200	-	-	-	3,515,900
Financial Information Systems	Tools & Resources	-	-	-	-	-	264,000
Fort Weaver Rd and Makule Rd Area WSI	Pipelines	0	-	-	709,700	-	-
GAC Facility Improvements	Treatment	790,870	600,000	600,000	600,000	600,000	600,000
GAC Treatment for Waipio Heights Wells and Waipio Height Wells I	Treatment	-	6,165,100	-	-	-	-
Geotechnical Evaluation of Retaining Walls at Reservoirs	Storage	-	-	65,600	-	-	-
Glen Avenue WSI	Pipelines	-	-	-	-	-	-
Hahaione WSI	Pipelines	-	-	800,300	-	-	-
Haiku Chlorinator and Haiku Well Fencing. Drainage, and Pavement Improvements.	Sources	-	-	-	1,222,400	-	-
Haiku Stairs Removal	Facilities	-	-	170,000	-	-	-
Hakimo Rd at Farrington Hwy WSI	Pipelines	-	-	-	-	-	486,600

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Hala Drive 20 inch	Pipelines	-	-	-	-	-	692,800
Halawa Booster No. 1 MCC Replacement	Pumps-trans	-	-	-	-	-	-
Halawa Shaft and Moanalua Wells Alternatives Study	Treatment	659,058	-	-	-	-	-
Haleiwa Wells Electrical Upgrades	Pumps-source	-	-	-	-	-	-
Halupa Street 12-Inch Main	Pipelines	184,536	-	-	1,656,000	-	-
Hao St and Lawelawe St	Pipelines	-	-	-	-	-	801,000
Hawaii Loa Booster No. 1 Pump and MCC Replacement	Pumps-trans	0	-	-	577,000	-	-
Hawaii Loa Booster No. 2 Pump and MCC Replacement	Pumps-trans	-	-	-	-	577,000	-
Hawaii Loa Booster No. 3 MCC Replacement	Pumps-trans	-	-	-	-	-	-
High Priority Seismic Reservoir Upgrades	Storage	-	-	-	-	818,600	-
High-Risk Reservoir Inspections - 2019	Storage	-	53,000	-	-	-	-
Hoaeae Wells Pump Replacement and Electrical Upgrades	Pumps-source	0	5,815,700	-	-	-	-
Honolulu District 42-Inch Mains - Liliha To Moiliili (Phase I)	Pipelines	-	-	2,114,900	-	19,540,050	19,540,050
Honolulu District 42-Inch Mains - Liliha To Moiliili (Phase II)	Pipelines	-	-	-	-	1,797,700	-
Honouliuli Wells II Pump and Disconnect Switch Replacement	Pumps-source	-	262,000	-	-	642,000	-
Hookela Pl 6-inch Main	Pipelines	-	-	-	205,200	-	-
Hui Kelu St	Pipelines	0	-	-	-	-	237,400
Hui Ulili St and Hui Io St	Pipelines	-	-	-	-	-	820,800
Hui Ulili Street 12-Inch and 8-Inch Mains	Pipelines	2,240,798	-	-	-	-	-
Kaahele St at H1 16 inch	Pipelines	-	-	407,700	-	-	-
Kaahumanu Wells Electrical Upgrades	Pumps-source	-	-	-	-	-	-
Kaamilo Booster and Kaamilo Wells Renovation	Pumps-source	263,623	-	-	2,275,900	-	-
Kahilinai Pl and Aiea Heights Dr	Pipelines	-	-	460,800	-	-	-
Kahuailani Street Water System Improvements	Pipelines	-	-	2,105,400	-	-	-
Kahuku Wells Unit No. 3	Pumps-source	2,636,234	-	-	-	-	-
Kaiaka St at Haleiwa Rd 8-inch Main	Pipelines	0	-	-	65,400	-	-
Kailua and Hamakua 14 inch	Pipelines	0	-	-	437,000	-	-
Kailua Heights Booster Electrical Upgrades and Facility Repairs	Pumps-trans	-	-	-	-	451,000	-
Kailua Road 8-Inch Main	Pipelines	0	-	440,000	-	-	-
Kaimuki Pump Station Exploratory Wells	Sources	-	-	-	-	-	-
Kaimuki Pump Station Structural Repairs	Pumps-source	-	-	-	-	-	-
Kaimuki Station Well Replacements	Sources	-	-	-	-	-	-
Kaimuki Water System Improvements	Pipelines	-	-	-	-	-	-

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Kakela Drive 14 inch	Pipelines	-	-	-	173,600	-	-
Kalaeloa Seawater Desalination Facility	Treatment	-	4,512,500	9,262,500	7,125,000	2,850,000	-
Kalakaua Ave at Kuhio Ave Area WSI	Pipelines	-	566,300	-	-	-	-
Kalakaua Avenue Water System Improvements, Phase II	Pipelines	-	-	-	-	-	-
Kalakaua Avenue Water System Improvements, Phase III	Pipelines	-	-	350,000	-	-	-
Kalakaua Avenue Water System Improvements, Phase IV	Pipelines	0	1,016,200	-	-	-	-
Kalama Valley Pressure Reducing Valve Improvements	Pumps-trans	-	-	390,000	-	-	-
Kalama Valley Water System Improvements, Part II	Pipelines	-	-	-	-	5,665,000	-
Kalanianaole Highway 12 inch	Pipelines	-	-	-	-	-	575,400
Kalawahine 180 2.0 MG Reservoir	Storage	-	17,166,667	8,583,333	-	-	-
Kalawahine Well - Production	Sources	-	-	-	-	-	-
Kalawahine Well EA	Sources	-	-	-	150,000	-	-
Kalihi Hi-Service Booster Electrical Upgrades	Pumps-trans	-	-	-	-	-	-
Kalihi Shaft MCC Replacement	Pumps-source	-	-	-	-	-	-
Kalihi Water System Improvements, Part VI	Pipelines	-	-	-	-	6,281,300	-
Kam Highway at Aiea Kai Place	Pipelines	-	-	-	-	-	768,100
Kam Highway at Kahana Bay Beach 30 inch	Pipelines	-	-	-	647,300	-	-
Kam Highway at Tutu St 16 inch	Pipelines	0	-	-	-	1,046,400	-
Kam IV Rd at Likelike Highway	Pipelines	0	-	-	-	-	866,600
Kamaile Plantation Wells Sealing	Sources	-	-	378,100	-	-	-
Kamakini St, Waialae Ave and Kanewai St	Pipelines	-	-	-	-	935,100	-
Kamehameha Heights Water System Improvements, Part III	Pipelines	-	5,641,600	-	-	-	-
Kamehameha Highway - Haleiwa Water System Improvements, Part I	Pipelines	-	-	-	-	-	7,444,600
Kamehameha Highway - Haleiwa Water System Improvements, Part II	Pipelines	-	-	-	-	-	6,397,700
Kamehameha Highway- 16-inch Water Main, Part I	Pipelines	-	-	11,632,200	-	-	-
Kamehameha Hwy and Paleka Rd Area WSI	Pipelines	-	1,821,600	-	-	-	6,772,667
Kamehameha Hwy at Lipoa Place Area WSI	Pipelines	0	-	538,400	-	-	-
Kamehameha Hwy at Puhuli St WSI	Pipelines	-	2,215,100	-	-	-	-
Kamehameha Hwy at Pupukea Rd WSI	Pipelines	0	469,500	-	-	-	4,004,300
Kamiloiki Booster No. 1 MCC Replacement	Pumps-trans	230,670	-	-	867,900	-	-
Kaneohe Bay Dr and Kamehameha Hwy WSI	Pipelines	0	718,400	-	-	-	4,006,400

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Kanunu St and Keeaumoku St 8-inch Main	Pipelines	-	-	-	155,600	-	-
Kaonohi Booster No. 1 and Kaonohi Wells Facilities Repairs	Pumps-trans	0	-	-	40,000	-	-
Kaonohi Booster No. 2 MCC Replacement and Facility Repairs	Pumps-trans	-	-	-	523,000	-	-
Kapaa 272 Reservoir Improvements	Storage	0	-	7,465,500	7,465,500	-	-
Kapahulu 24 inch	Pipelines	0	-	-	451,000	-	-
Kapolei Base Yard and BWDF - Phase I	Facilities	0	9,694,560	19,389,120	14,541,840	4,847,280	-
Kapolei Parkway 12-inch Main	Pipelines	171,355	-	-	-	1,518,000	-
Kaumakani St 12 inch	Pipelines	-	-	-	-	1,071,600	-
Kealahou St and Hawaii Kai Dr WSI	Pipelines	-	-	380,900	-	-	-
Keana Rd and Hikiwale St 8-inch Main	Pipelines	0	-	282,700	-	-	-
Keolu Bridge Pipe Hanger Replacement	Pipelines	85,678	-	-	-	-	-
Keolu Dr 8 inch	Pipelines	-	-	-	-	-	534,200
Keolu Hills Water System Improvements - Part II	Pipelines	-	-	-	4,385,400	-	-
Kili Drive 16-Inch Main, Part II	Pipelines	-	-	-	-	158,600	-
Kipou Street 8-Inch Main	Pipelines	0	-	-	-	825,900	-
Kokea St and Auld Ln WSI	Pipelines	-	-	-	285,800	-	-
Kualakai Parkway 16-Inch Recycled Water Main	Nonpotable	-	-	-	7,500,000	-	-
Kuhio Ave and Kaiulani Ave WSI	Pipelines	1,630,774	-	-	-	-	-
Kulaaupuni St and St Johns Rd	Pipelines	0	-	737,700	-	-	-
Kuliouou Booster Roof Repairs	Pumps-trans	-	-	51,000	-	-	124,300
Kunia Wells II Treatment Study	Treatment	659,058	-	-	-	-	-
Kunia Wells III	Pumps-source	-	173,000	-	-	421,300	-
Kunia Wells IV	Sources	-	-	-	-	-	-
Kunia Wells IV Exploratory Well	Sources	395,435	-	-	-	2,000,000	-
Kuulei Rd 24 inch	Pipelines	0	-	712,900	-	-	-
Kuwale 242	Storage	-	-	3,822,300	-	-	17,641,550
Kuwale Rd and Puuhulu Rd Area WSI	Pipelines	0	-	-	-	-	8,044,350
Lanakila Water System Improvements	Pipelines	-	-	3,722,300	-	-	-
Lanikai Water System Improvements, Part II	Pipelines	-	-	-	-	2,963,600	-
Lualualei Homestead Rd 16 inch	Pipelines	-	-	-	-	-	-
Lualualei Line Booster Expansion	Pumps-trans	-	-	-	-	-	-
Luluku Road Water System Improvements	Pipelines	-	-	-	-	-	-
Lunalilo Home Road Water System Improvements	Pipelines	-	-	-	-	6,370,300	-
Maakua Well Unit No. 2	Pumps-source	-	-	200,000	-	-	1,320,000
Mailiili Rd 20	Pipelines	0	-	704,800	-	-	-
Makaha Booster No. 2 MCC Replacement	Pumps-trans	-	-	-	-	-	-
Makaha Shaft Renovation	Sources	922,682	-	-	4,620,000	-	-
Makaha Well V Electrical Upgrades	Pumps-source	0	-	-	344,000	-	-
Makakilo Booster No. 1 Electrical Upgrades and Facility Repairs.	Pumps-trans	-	-	-	-	-	-

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Makakilo Water System Improvements, Part III	Pipelines	0	-	6,166,000	-	-	-
Makakilo Well MCC Replacement	Pumps-source	-	-	-	-	-	-
Makiki 180 Reservoir Replace Altitude Valve Assembly	Pumps-source	-	435,000	-	-	-	-
Manoa Estates Water System Improvements	Pipelines	4,059,800	-	-	-	-	-
Manoa Wells II Exploratory Well	Sources	164,765	-	-	650,000	-	-
Manoa Wells II Starter Upgrade	Pumps-source	-	-	-	-	-	89,000
Mapele Place Piping Modification	Pipelines	-	-	-	637,500	1,657,500	-
Mapunapuna Water System Improvements, Part I	Pipelines	0	807,900	-	-	-	-
Mariners Ridge	Pipelines	0	-	-	-	956,400	-
Mariners Ridge Booster No. 2 Renovation	Pumps-trans	263,623	-	-	1,064,800	-	-
Mariners Ridge Water System Improvements	Pipelines	-	-	5,879,500	-	-	-
Mariners Ridge Water System Improvements, Part II	Pipelines	0	-	-	550,000	-	-
Mauna Olu 530 Reservoir Improvements	Facilities	65,906	-	-	-	-	-
Maunawili Booster MCC Replacement	Pumps-trans	-	-	-	-	-	-
McArthur Street 8 inch	Pipelines	-	-	-	-	-	-
McArthur Street 8 inch	Pipelines	254,660	-	-	1,334,000	-	-
McCully St at Date St 16-inch Main	Pipelines	-	-	-	-	-	249,900
Melemanu 808 to Waipio 808 Connection, Phase I	Pipelines	0	-	-	-	-	-
Melemanu 808 to Waipio 808 Connection, Phase II	Pipelines	-	-	-	-	-	-
Metro 180 Reservoir EIS	Storage	-	-	-	-	529,000	-
Mililani 994 Booster Station	Pumps-trans	-	-	4,652,900	-	-	-
Mililani PRV	Pumps-source	-	-	33,300	-	-	230,000
Mililani Wells I GAC Renovation	Pumps-source	790,870	-	-	700,000	-	-
Mililani Wells II Replacement of Pumping Units	Pumps-source	-	-	7,700,000	-	-	-
Moanalua Golf Course 16-in Main	Pipelines	-	-	332,400	-	-	-
Moanalua Road 8-inch Main, Waimalu Neighborhood Park Vicinity	Pipelines	131,812	-	-	1,000,000	-	-
Moanalua Wells Pump No. 1 Replacement	Pumps-trans	2,636,234	-	-	-	-	-
Moiliili Water System Improvements, Part IV	Pipelines	4,613,409	-	-	-	-	-
Monitoring Well Assessment and Repair	Sources	79,087	50,000	50,000	50,000	50,000	50,000
Monsarrat Avenue Water System Improvements	Pipelines	0	-	3,685,000	-	-	-
Monsarrat WSI	Pipelines	-	-	-	718,900	-	-
Monterey Drive 6 inch	Pipelines	0	-	-	210,000	-	-
Nanakuli 242 Zone	Pumps-trans	-	25,400	-	-	230,000	-
Newtown Ridge and Royal Summit Reliability Improvements	Pumps-trans	-	-	-	-	-	-
Nimitz Highway 16-Inch Main	Pipelines	-	-	-	-	-	-
Nimitz Hwy and Waiakamilo Rd Area WSI	Pipelines	-	-	290,000	-	-	-
Niu Valley Booster No. 1 MCC Replacement and Facility Repairs	Pumps-trans	-	-	-	-	-	380,000
North School Street Water System Improvements	Pipelines	0	-	-	-	8,375,200	-

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Nuuanu 822 0.2 MG Reservoir Replacement and Nuuanu Booster No. 2 Relocation	Storage	-	475,000	-	-	5,830,000	-
Nuuanu 940 0.06 MG Reservoir and Nuuanu Booster No. 4	Storage	-	-	-	375,000	-	-
Nuuanu Hydro-Electric and Managed Aquifer Recharge Study and Environmental Assessment	Sources	790,870	-	-	-	-	-
Nuuanu Reservoir No. 1 Dam Improvements	Facilities	-	951,700	-	-	2,326,400	-
Nuuanu Reservoir No. 2 and 3 Retention Study	Facilities	-	-	-	-	-	200,000
Office and Base Yard Master Plan	Facilities	-	-	-	529,000	-	-
Office and Base Yard Rehabilitation	Facilities	-	-	-	-	-	507,600
Pacific Heights Booster No. 2	Pumps-trans	2,636,234	-	-	-	-	-
Pacific Heights Water System Improvements, Part II	Pipelines	0	2,954,600	-	-	-	-
Paiko Dr 8-inch Main	Pipelines	0	-	205,600	-	-	-
Pakai Pl 16 inch	Pipelines	-	-	-	306,600	-	-
Palolo Tunnel Portal Improvements	Sources	-	1,100,000	-	-	-	-
Palolo Water System Improvements, Part III	Pipelines	-	2,204,300	-	-	-	-
Palolo Water System Improvements, Part IV	Pipelines	-	-	-	5,467,100	-	-
Pauoa Water System Improvements	Pipelines	-	-	4,246,000	-	-	-
Pearl City Booster No. 2 and Pearl City Wells III Starter and Instrumentation Upgrades	Pumps-trans	-	-	-	-	-	-
Pearl City Booster No. 3 MCC Replacement	Pumps-trans	-	-	-	-	319,000	-
Pearl City Water System Improvements	Pipelines	-	-	-	9,154,500	-	-
Pearl City Wells II System Improvements	Pumps-source	4,217,974	-	-	-	-	-
Pensacola St 8-inch Main - Kinau St to Young St	Pipelines	-	850,000	-	-	-	-
Piliuka PRV Replacement	Pumps-trans	263,623	-	-	600,000	-	-
Pipeline Condition Assessment	Pipelines	-	100,000	100,000	750,000	725,000	700,000
Pipeline Tunnel Inspection - 2020	Pipelines	-	-	212,000	-	-	-
Pipeline Tunnel Renovation at Various Locations	Pipelines	0	1,057,500	-	-	-	-
Pipelines Repair and Replacement - 2028	Pipelines	-	-	-	-	-	-
Pipelines Repair and Replacement - 2029	Pipelines	-	-	-	-	-	-
Pipelines Repair and Replacement - 2030	Pipelines	-	-	-	-	-	-
Pipelines Repair and Replacement - 2031	Pipelines	-	-	-	-	-	-
Poola St and Ehupua Pl WSI	Pipelines	0	-	-	272,200	-	-
Poola Street 8-inch Main	Pipelines	-	-	-	-	1,004,600	-
Professional Services for BWS Projects	Tools & Resources	395,435	300,000	300,000	300,000	300,000	300,000
Project Management for Various BWS Construction Projects	Tools & Resources	1,318,117	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Puiwa Road 12-Inch and Dowsett Avenure 8-Inch Mains	Pipelines	276,805	-	-	1,760,900	-	-
Pump Renewal and Replacement	Pumps-trans	4,086,162	3,100,000	3,100,000	3,100,000	3,100,000	3,100,000
Pump Station Corrosion Control	Pumps-trans	120,364	91,315	91,315	91,315	91,315	60,877
Pump Station Hardening - Phase 1	Pumps-trans	-	-	-	-	-	-
Pump Station Instrumentation and Control Upgrade	Pumps-trans	-	485,989	485,989	485,989	485,989	485,989

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Punaluu Wells II Civil	Pumps-source	-	-	-	-	-	-
Punaluu Wells II Renovation	Pumps-source	9,885,876	-	-	-	-	-
Punanani Wells System Improvements	Pumps-source	5,272,467	-	-	-	-	-
Puuohalai Place 6 inch	Pipelines	-	-	-	-	200,600	-
Red Hill Replacement Wells EA	Sources	395,435	-	-	-	-	-
Redundant Control and Security Center	Facilities	-	-	-	-	126,900	-
Rehabilitation of Pipeline Tunnels - Moanalua and Quarry Tunnels	Pipelines	9,885,876	-	-	-	-	-
Reservoir Concrete Repairs	Storage	-	-	82,400	-	-	746,700
Reservoir Condition Assessment Update - 2024	Storage	-	-	-	-	-	-
Reservoir Interior Coating	Storage	-	-	66,700	-	-	604,100
Reservoir Interior Inspection and Cleaning - 2022	Storage	-	-	-	-	1,057,500	-
Reservoir Painting	Storage	-	-	-	-	305,300	-
Reservoir Repair and Rehabilitation - 2030	Storage	-	-	-	-	-	-
Reservoir Repair and Rehabilitation - 2031	Storage	-	-	-	-	-	-
Reservoir Rewrapping	Storage	-	-	261,500	-	-	3,160,100
Reservoir Roofing - Pod 1	Storage	-	522,200	-	-	6,309,700	-
Reservoir Roofing - Pod 2	Storage	-	-	560,400	-	-	6,771,200
Reservoir Roofing - Pod 3	Storage	-	-	-	603,900	-	-
Reservoir Roofing - Pod 4	Storage	-	-	-	-	485,800	-
Reservoir Sealing and Repair	Storage	-	40,300	-	-	365,000	-
Reservoir Seismic Retrofits - Pod 1	Storage	-	-	-	-	-	428,300
Reservoir Seismic Retrofits - Pod 2	Storage	-	-	-	-	-	-
Reservoir Seismic Retrofits - Pod 3	Storage	-	-	-	-	-	-
Reservoir Seismic Retrofits - Pod 4	Storage	-	-	-	-	-	-
Reservoir Site Repairs	Storage	-	-	-	-	-	706,100
Royal Hawaiian Ave WSI	Pipelines	-	-	260,300	-	-	-
RTU Upgrades	Facilities	0	3,384,000	2,200,000	2,400,000	-	-
Salt Lake Boulevard 36-Inch Main - Foster Village to Aliamanu	Pipelines	-	-	-	-	-	5,001,800
Sand Island 16-inch Main [move?]	Pipelines	1,865,135	-	-	-	-	-
SCADA Replacement	Facilities	-	-	528,700	-	-	-
Seaside and Kaiulani Avenue 12-Inch Mains	Pipelines	-	-	-	-	-	116,300
Security Camera Systems	Facilities	771,098	585,000	585,000	-	-	-
Security Enhancements for all BWS Corporation Yards	Facilities	-	1,057,487	1,004,613	-	-	-
Security Fencing at Various Locations	Facilities	1,449,928	2,700,000	2,700,000	-	-	-
Security Improvements at Various Locations	Facilities	1,671,372	5,489,320	5,489,320	5,489,320	5,489,320	5,489,320
Service Lateral Replacement at Various Locations	Pipelines	131,812	1,150,000	1,150,000	1,150,000	1,150,000	1,150,000
Source Tunnel and Shaft Condition Assessment	Sources	-	-	-	-	264,000	-
Source Tunnel and Shaft Rehabilitation	Sources	-	-	-	-	-	-

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
St. Louis Heights Booster No. 3 Facility Repairs	Pumps-trans	-	-	-	182,000	-	-
Temporary Pumping Connections	Pumps-trans	0	-	368,200	-	-	4,892,200
Time and Attendance System	Tools & Resources	0	-	-	-	-	132,000
Treatment Repair and Rehabilitation - 2028	Treatment	-	-	-	-	-	-
Treatment Repair and Rehabilitation - 2029	Treatment	0	-	-	-	-	-
Treatment Repair and Rehabilitation - 2030	Treatment	0	-	-	-	-	-
Treatment Repair and Rehabilitation - 2031	Treatment	-	-	-	-	-	-
University Ave WSI	Pipelines	0	-	-	338,400	-	-
WAHIAWA 1180 Reservoir Improvements	Storage	-	-	-	-	-	-
WAHIAWA 1361 NO. 1 and 2 Reservoir Improvements	Storage	-	-	429,900	-	-	5,194,900
Wahiawa Water System Improvements, Part IA	Pipelines	14,499,284	-	-	-	-	-
Wahiawa Water System Improvements, Part IB	Pipelines	-	-	-	-	-	-
Wahiawa Water System Improvements, Part III	Pipelines	3,822,539	-	-	-	-	-
Wahiawa Water System Improvements, Part IV	Pipelines	-	-	-	-	11,028,800	-
Waialae 180 3.0 MG Reservoir Replacement	Storage	-	-	-	-	-	-
Waialae Iki 180 Reservoir Improvements	Storage	-	224,000	-	-	2,706,300	-
Waialae Iki Booster No. 1 Relocation	Pumps-trans	-	-	2,640,000	-	-	-
Waialae Iki Booster No. 3 MCC Replacement	Pumps-trans	-	-	-	-	-	-
Waialae Nui Well	Sources	-	-	150,000	-	-	-
Waialae Nui Well Test	Sources	329,529	-	-	-	-	-
Waialae West Well	Pumps-source	-	4,510,000	-	-	-	-
Waialua Beach Dr and Goodale Ave 16 and 8 inch	Pipelines	-	-	-	-	603,800	-
Waianae Water System Improvements, Part III	Pipelines	-	-	-	5,350,800	-	-
Waianae Well III Facility Repairs	Pumps-source	-	-	-	99,000	-	-
Waiapo Pl, Waihua Pl and Waimomona Pl	Pipelines	-	-	236,200	-	-	-
Waiau Booster No. 2 Electrical Upgrades	Pumps-trans	-	-	555,000	-	-	1,356,300
Waiau Water System Improvements, Part II	Pipelines	-	1,628,600	-	-	-	-
Waiau Wells and Booster Roof Repairs	Pumps-source	-	51,000	-	-	124,300	-
Waihee Booster No. 1 Facility Repairs	Pumps-trans	-	-	-	57,000	-	-
Waihee Chlorinator Electrical Upgrades and Facility Repairs	Pumps-source	-	-	124,000	-	-	-
Waihee Line Booster Renovation	Pumps-trans	-	-	-	4,000,000	-	-
Waihee Road Water System Improvements	Pipelines	-	-	160,000	-	-	-
Waihee Tunnel and Inclined Wells Chlorinator	Pumps-source	-	-	136,400	-	-	-
Waihee Wells Capping	Sources	-	151,300	-	-	-	-
Waikalua Rd 6 inch	Pipelines	0	-	450,600	-	-	-
Waikele Gulch Exploratory Well Testing	Sources	0	1,500,000	-	-	-	-
Waikele Gulch Wells	Sources	-	-	-	-	-	-
Wailupe Line Booster Pump and MCC Replacement	Pumps-trans	-	217,000	-	-	530,200	-
Waimalu Wells I Site Drainage Improvements	Sources	2,899,857	-	-	-	-	-

PROJECT NAME	PROJECT CATEGORY	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
WAIMANALO 230 Reservoir Improvements	Storage	-	-	-	355,800	-	-
Waimanalo Tunnel I and II and Waianae Plantation Tunnel III Renovation	Sources	-	232,700	-	211,500	-	-
Waiomao Homestead Rd 8-inch Main	Pipelines	144,993	-	-	759,500	-	-
Waipahu 36-Inch Main Relocation	Pipelines	-	-	-	-	-	355,900
Waipahu Wells I Renovation	Pumps-source	-	-	1,406,900	-	-	-
Waipahu-Waiawa Exploratory Wells Environmental Assessment	Sources	131,812	-	-	-	-	-
Waipio Heights Wells and Waipio Heights Wells I	Pumps-source	-	148,000	-	-	363,000	-
Waipio Heights Wells II Pump Replacement and Electrical Upgrades	Pumps-source	-	-	-	511,000	-	-
Water Main Installation and Replacement	Pipelines	263,623	200,000	200,000	200,000	200,000	200,000
Water Master Plan Update - 2026	Tools & Resources	-	-	-	-	-	-
Water Meter Transponders Replacement - Phase I	Facilities	23,330,667	18,000,000	-	-	-	-
WiFi Network Deployment	Facilities	197,718	-	-	1,420,400	-	-
Wikao Street 8-Inch Water Main	Pipelines	-	837,500	-	-	-	-
Wilder Wells Starter Upgrades and Facility Repairs	Pumps-source	-	-	417,000	-	-	1,019,700
Wilhelmina Rise 811 Reservoir Replacement	Storage	659,058	-	-	-	4,400,000	-
Wilhelmina Rise Booster No. 3 MCC Replacment	Pumps-trans	-	-	-	-	-	518,000
Wireless and Security Camera System Upgrades	Facilities	-	211,000	-	-	-	-
Kahuku Storage	Storage	-	-	-	-	-	-
Kalawahine Well - Exploratory	Sources	-	-	-	-	-	-
Pipelines Repair and Replacement - 2032	Pipelines	-	-	-	-	-	-
Pump Station Hardening - Phase 2	Pumps-trans	-	-	-	-	-	-
Reservoir Repair and Rehabilitation - 2032	Storage	-	-	-	-	-	-
Treatment Repair and Rehabilitation - 2032	Treatment	-	-	-	-	-	-
Capital Improvement Program TOTALS, FY 2017$ (except for FY2018, which is budgeted FY 2018$)		**144,340,000**	**137,901,239**	**160,209,591**	**140,566,865**	**182,827,755**	**159,329,003**

Appendix D

O&M Allocations

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O&M: Functional Allocation Factors

Division/ Staff Office														
Code	Name	Source	Treatment	Storage	T&D	Customer Accounts	Meters	Public Fire Protection	Non-Potable Water	RO Water	R-1 Water	Ocean Cooling	Total	Allocation Method
5100	Office of the Manager & Chief Engineer	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5105	ESO Admin	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5110	Risk Management	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5120	Security	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5125	Management & Budget Section	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5140	Procurement Section	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5130	Communications Office	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5201	Ocean Cooling											100.0%	100.0%	100% Ocean Cooling
5220	Human Resources	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5250	Water Quality Admin	50.0%	20.0%		30.0%								100.0%	Directly Assigned per Water Res Prog. Admin
5251	Chemical Lab	50.0%	20.0%		30.0%								100.0%	Directly Assigned per Water Res Prog. Admin
5252	Micro Bio Lab	50.0%	20.0%		30.0%								100.0%	Directly Assigned per Water Res Prog. Admin
5300	Customer Care: Admin				14.5%	59.8%	25.7%						100.0%	Directly Assigned: aggregate of DA customer care
5310	Customer Care: Collection & Credit					100.0%							100.0%	100% Customer Accounts
5320	Customer Care: Service Engineering				15.0%	25.0%	60.0%						100.0%	15% T&D, 25% Customer Accounts, 60% meters
5325	Customer Care: Cross Connection & Backflow Prevent					30.0%	70.0%						100.0%	30% Customer Accounts, 70% Meters
5330	Customer Care: Customer Service & Records Section					100.0%							100.0%	100% Customer Accounts
5350	Customer Care: Investigative Section				50.0%		50.0%						100.0%	50% T&D, 50% Meter
5400	Land	69.2%	1.3%	5.7%	20.8%	0.2%	0.8%	0.7%	0.5%	0.6%	0.1%	0.1%	100.0%	Net Plant - Asset Class = 1 (land and land rights)
5450	Water Resources: Admin	15.8%	15.8%	15.8%	15.8%			5.0%	15.8%	6.5%	9.3%		100.0%	Directly Assigned per Water Res Prog. Admin
5470	Water System Planning	18.0%	5.0%	8.0%	50.0%		5.0%	10.0%	2.0%	0.8%	1.2%		100.0%	Directly Assigned per Water Res Prog. Admin
5472	Conservation	50.0%			5.0%		5.0%			16.4%	23.6%		100.0%	Directly Assigned per Water Res Prog. Admin
5475	Recycled Water									41.0%	59.0%		100.0%	41% to RO and 59% to R1 Based on Analysis of Bills
5480	Hydrology/ Geology	100.0%											100.0%	100% source
5490	Project Review	23.0%		8.0%	20.0%		5.0%	40.0%	2.0%	0.8%	1.2%		100.0%	Directly Assigned per Water Res Prog. Admin
5495	Long Range Planning	35.0%	4.0%	15.0%	30.0%		3.0%	3.0%	5.0%	2.1%	3.0%		100.0%	Directly Assigned per Water Res Prog. Admin
5500	Field Ops: Admin				94.6%			4.0%	1.4%				100.0%	Net Plant - T&D/ Fire Protection / Non Potable

O&M: Functional Allocation Factors

Division/ Staff Office														
Code	Name	Source	Treatment	Storage	T&D	Customer Accounts	Meters	Public Fire Protection	Non-Potable Water	RO Water	R-1 Water	Ocean Cooling	Total	Allocation Method
5510	Field Ops: Admin Support - Distribution Branch Admin				94.6%			4.0%	1.4%				100.0%	Net Plant - T&D/ Fire Protection / Non Potable
5520	Fields Ops: Admin Unit				94.6%			4.0%	1.4%				100.0%	Net Plant - T&D/ Fire Protection / Non Potable
5521	Field Ops: Hydrants & Valves				94.6%			4.0%	1.4%				100.0%	Net Plant - T&D/ Fire Protection / Non Potable
5522	Field Ops: Grounds & Landscaping	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant
5530	Field Ops: Construction Section	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant
5540	Field Ops: Suburban Field Services Branch - Admin	6.9%	4.9%	8.0%	71.0%	0.9%	3.7%	3.0%	1.1%			0.6%	100.0%	Net Plant Less Reclaimed Water
5541	Field Ops: Suburban Field Services Branch - manana	6.9%	4.9%	8.0%	71.0%	0.9%	3.7%	3.0%	1.1%			0.6%	100.0%	Net Plant Less Reclaimed Water
5542	Field Ops: Suburban Field Services Branch - wahiawa	6.9%	4.9%	8.0%	71.0%	0.9%	3.7%	3.0%	1.1%			0.6%	100.0%	Net Plant Less Reclaimed Water
5543	Field Ops: Suburban Field Services Branch - waianae	6.9%	4.9%	8.0%	71.0%	0.9%	3.7%	3.0%	1.1%			0.6%	100.0%	Net Plant Less Reclaimed Water
5550	Field Ops: District Services	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5551	Field Ops: Service Connections	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5552	Field Ops: Meter Shop/ Meter Maintenance						100.0%						100.0%	100% Meter
5553	Field Ops: Building Maintenance	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5560	Windward Branch	6.9%	4.9%	8.0%	71.0%	0.9%	3.7%	3.0%	1.1%			0.6%	100.0%	Net Plant Less Reclaimed Water
5585	Admin Support: Supply	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5565	Capital Projects: admin	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant
5570	Capital Projects: Design & Plans Review	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant
5575	Capital Projects: Construction	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant
5580	Capital Projects: Support	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant
5582	Capital Projects: Mechanical & Electrical	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant
5600	Water System Operations: Admin	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Directly Assigned: Aggregate of Water System Ops 561x Items.
5610	Water System Operations: Plant Ops	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable
5611	Water System Operations: Plant Ops - District 1 Leeward West Sec.	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable
5612	Water System Operations: Plant Ops - District 2 Central/ Windward Sec.	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable
5613	Water System Operations: Plant Ops - District 3 Metropolitan Sec	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable
5614	Water System Operations: Plant Ops - District 4 Leeward East Sec	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable
5615	Water System Operations: Plant Ops - Tech Svr & Contorl Center - Control Center Unit	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable

O&M: Functional Allocation Factors

Division/ Staff Office														
Code	Name	Source	Treatment	Storage	T&D	Customer Accounts	Meters	Public Fire Protection	Non-Potable Water	RO Water	R-1 Water	Ocean Cooling	Total	Allocation Method
5616	Water System Operations: Plant Ops - Tech Svr & Contorl Center - Tech Srv	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable
5620	Water System Operations: Telecomunications	7.5%	5.3%	8.7%	77.3%				1.2%				100.0%	Net Plant - Source, Treatment, Storage, T&D, Non-Potable
5660	Water System Operations: Automotive	5.0%	5.0%	5.0%	40.0%	5.0%	30.0%	5.0%	2.5%	1.0%	1.5%		100.0%	Per Automotive Manager
5805	IT: Admin	31.8%	1.6%	2.4%	41.1%	14.1%	7.8%	0.6%	0.3%	0.1%	0.2%		100.0%	Directly Assigned: Aggregate of IT Costs
5820	IT: Application System Dev	35.0%			40.0%	10.0%	15.0%						100.0%	Per IT Manager
5830	IT: Operations Support	35.0%	3.0%	2.0%	35.0%	20.0%	5.0%						100.0%	Per IT Manager
5835	IT: Technical Engineering Projects	10.0%		10.0%	70.0%		1.0%	5.0%	2.0%	0.8%	1.2%		100.0%	Per IT Manager
5900	Fin: Admin	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5910	Fin: Treasury	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5915	Fin: Treasury - Revenue & Customer Accounting					100.0%							100.0%	100% Customer Accounts
5930	Fin: General Accounting	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5940	Fin: Fiscal Services	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
5950	Fin: Systems Accounting	25.1%	2.9%	3.0%	43.6%	7.0%	9.5%	1.4%	0.8%	2.6%	3.4%	0.6%	100.0%	Aggregate of Directly Assigned Costs
Fixed Charges														
5990-4610	Electric Power - Plants	75.0%			25.0%								100.0%	75% source, 25% T&D
5990-4620	Electricity	17.9%	3.3%	2.6%	42.8%	6.3%	12.9%	1.4%	0.9%	4.7%	6.5%	0.8%	100.0%	Subtotal Materials, Supplies & Equipment
5990-4660	Sewer Service Charge	17.9%	3.3%	2.6%	42.8%	6.3%	12.9%	1.4%	0.9%	4.7%	6.5%	0.8%	100.0%	Subtotal Materials, Supplies & Equipment
5990-5600	CASE Fees	13.2%	3.7%	4.8%	52.2%	10.9%	9.5%	2.0%	1.0%	1.1%	1.0%	0.7%	100.0%	Subtotal Personnel Services
5990-6010	Retirement System - Normal	13.2%	3.7%	4.8%	52.2%	10.9%	9.5%	2.0%	1.0%	1.1%	1.0%	0.7%	100.0%	Subtotal Personnel Services
5990-6020	FICA Contributions	13.2%	3.7%	4.8%	52.2%	10.9%	9.5%	2.0%	1.0%	1.1%	1.0%	0.7%	100.0%	Subtotal Personnel Services
5990-6100	Health Benefits - Employees	13.2%	3.7%	4.8%	52.2%	10.9%	9.5%	2.0%	1.0%	1.1%	1.0%	0.7%	100.0%	Subtotal Personnel Services
5990-6200	Health Benefits - Retirees	13.2%	3.7%	4.8%	52.2%	10.9%	9.5%	2.0%	1.0%	1.1%	1.0%	0.7%	100.0%	Subtotal Personnel Services
5990-6250	Health Fund Post-Employment Costs	13.2%	3.7%	4.8%	52.2%	10.9%	9.5%	2.0%	1.0%	1.1%	1.0%	0.7%	100.0%	Subtotal Personnel Services
5990-6320	Unemployment Insurance Benefits	13.2%	3.7%	4.8%	52.2%	10.9%	9.5%	2.0%	1.0%	1.1%	1.0%	0.7%	100.0%	Subtotal Personnel Services
	Staffing Allowance	6.7%	4.8%	7.8%	69.2%	0.8%	3.6%	2.9%	1.0%	2.1%	0.5%	0.6%	100.0%	Total Net Plant

Non-Rate Revenue: Functional Allocation Method

	Allocation Method
Bad Debt Expense	Allocated Like O&M
ENV Billing	100% to Customer
Installations	100% to Equivalent Meter
Other Water Revenues	Allocated Like O&M

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Appendix E

Development of Average Useful Lives

The model estimates the original cost less depreciation of the estimated net plant at the test year. As part of that calculation, average useful lives are used for the construction work in progress and capital improvement projects categories of source, pumps, treatment, storage, pipelines, non-potable, facilities, and tools & resources. The average useful life is used because this information is at the project grouping level, not the asset level.

Source: 50 years
Source assets are captured in accounting classes 10, 11, 12, 14, 15, 24, and 25, which have estimated useful lives ranging from 20 to 100 years. Propose using 50 years for source-related projects.

Pumps: 30 years
Pumps assets are captured in accounting class 5, which has an estimated 20-year useful life. Pumping projects also include structure and other equipment, which may be accounting class 3 (30 years), accounting class 2 (50 years), or accounting classes 4-9 (5 to 30 years). Propose using 30 years for pumping-related projects.

Treatment: 25 years
Treatment assets are captured in accounting classes 3 and 5, with estimated useful lives of 30 and 20 years, respectfully. Propose using 25 years for treatment-related projects.

Storage: 30 years
The BWS system's storage assets consist predominately of distribution reservoirs, which is accounting class 15. Propose using 30 years for storage-related projects.

Pipelines: 50 years
Pipeline assets are captured in accounting classes 16, 17, and 18, which have estimated useful lives ranging from 13.34 to 50 years. The majority of pipeline assets are classes 16 and 17, which have 50-year lives. Future projects are likely to be predominately these longer-lived pipelines. Propose using 50 years for pipeline-related projects.

Non-Potable: 25 years
Non-Potable assets are captured in many accounting classes. Propose 25 years for Non-Potable-related projects, similar to treatment.

Facilities: 25 years
Facilities projects include things like corporation yards. Corporation yard type assets are captured in accounting classes 2, 7 and 9, representing a range of estimated useful lives of 5 – 50 years. Propose using 25 years for facilities projects.

Tools & resources: 15 years
Projects categorized as tools & resources capture smaller equipment items. Equipment assets are

captured in accounting classes 4-9 with estimated useful lives ranging from 5 to 30 years. Propose using 15 years for Tools & Resources-related projects.

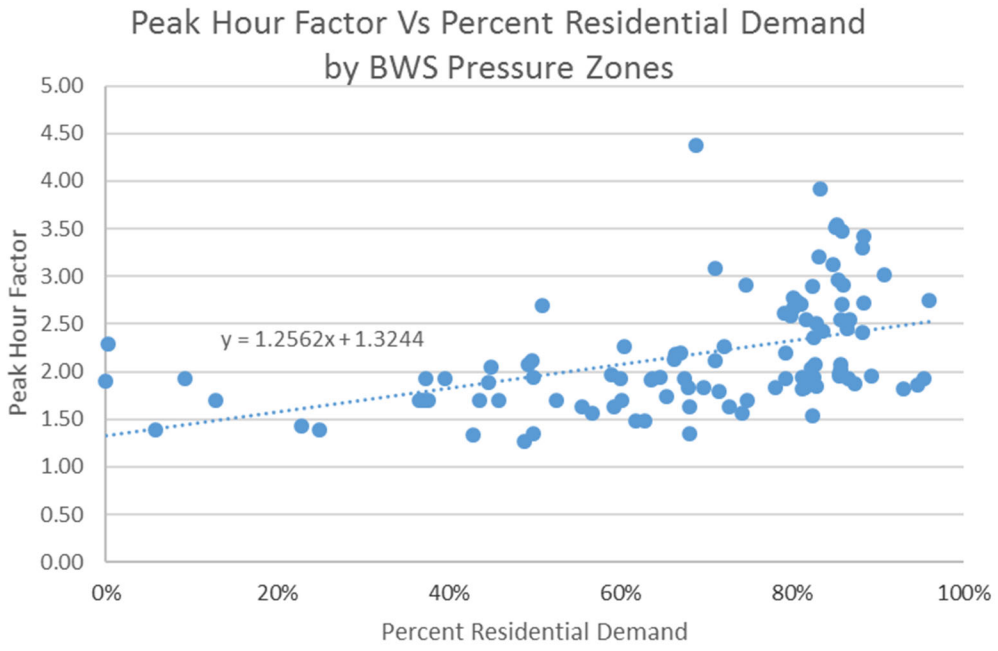
Appendix F

Customer Class Peaking Factors

	2016 Maximum Month Demand, mgd	2016 Average Day Demand, mgd	Max Month over Average Day Peaking Factor	Class Factor	Max Day over Max Month Peaking Factor	Max Day over Average Day Peaking Factor	Max Day over Average Day Peaking Factor Round for Study
	A	B	C	D	E	F	G
Calculation			A/B	C/C'	D*F'/C'	C*E	
Single Family	54.0	46.7	1.16	1.03	1.12	1.29	130%
Multi-unit	28.3	27.0	1.05	0.93	1.01	1.06	105%
Non-Residential	52.0	45.4	1.15	1.02	1.11	1.27	125%
Agricultural	3.6	3.2	1.12	0.99	1.08	1.21	120%
Sum	**137.9**	**122.2**			**1.09**		
Weighted Average (')			**1.13**			**1.23**	

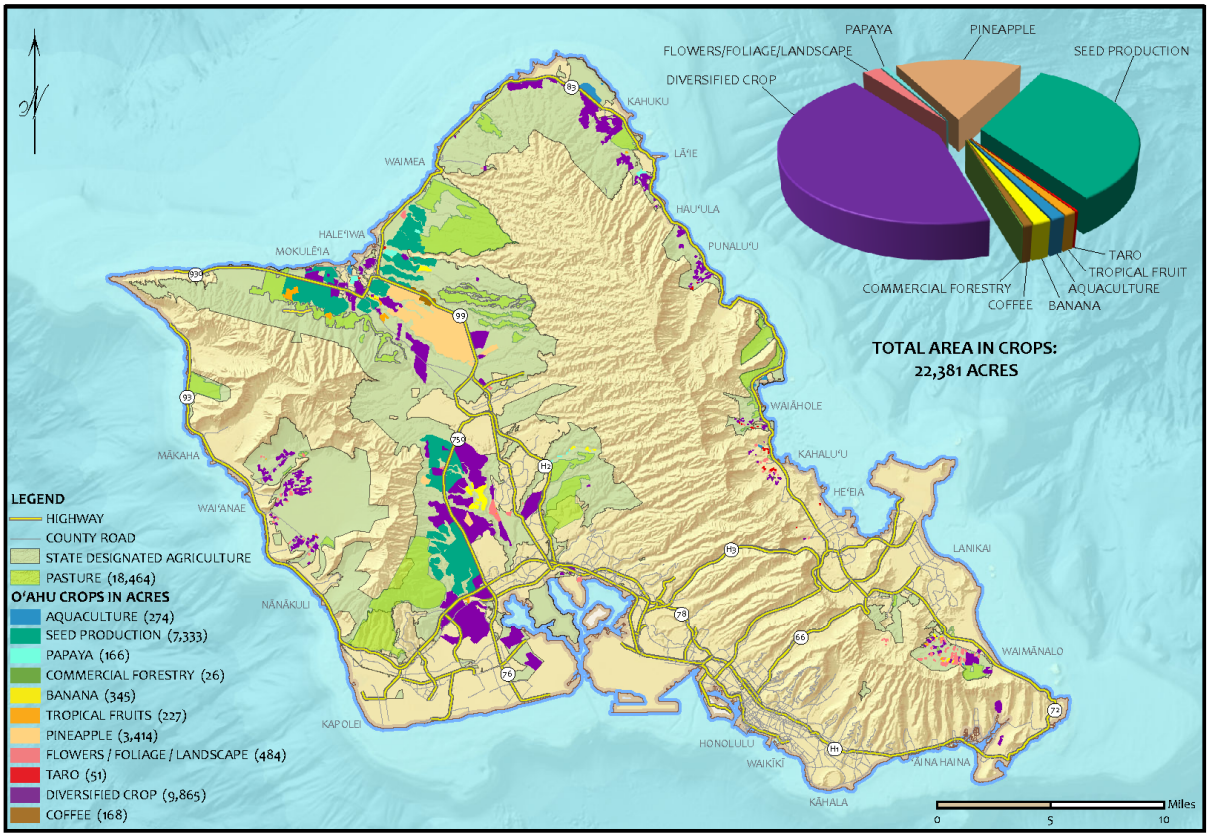
	Peak Hour over Max Day Peaking Factor	Peak Hour over Average Day Peaking Factor	Peak Hour over Average Day Peaking Factor Round for Study
	I	J	K
Calculation		F*I	
Single Family	2.00	2.58	260%
Multi-unit	2.00	2.13	210%
Non-Residential	1.29	1.64	165%
Agricultural	1.00	1.21	120%
Weighted Average (')	**1.71**	**2.09**	

Notes:
Columns A and B are per billing database and do not include non-revenue water.
Column F average, 1.23 is the system-wide max day over average day peaking factor (Water Master Plan Table 5-2).
Column I, Residential class peak hour factor estimated using regression analysis as discussed on page F-2. Non-residential and Agricultural class peak hour factors estimated based on discussions with the BWS stuff, review of available data, and adjusted so that system-wide peak hour to max day average equals 1.7.
Column J average, 2.09 per hydraulic model estimate.



Regression for Peak Hour Factor of each zone is based on percent of residential demand. A hypothetical zone with 100 percent residential demand would have an estimated Peak Hour over Average Day Peaking Factor of 1.2562 x 100 % + 1.3244 = 2.58 and should be similar to Column J Single-Family Peaking Factor. Regression for other classes was not possible due to a lack of zones with high percentages of non-residential or agricultural demand.

Appendix G
O‘ahu Crop Summary



Source: Melrose, J. et. al. (2016). *Statewide Agricultural Land Use Baseline 2015*. Hawaii State Department of Agriculture. Retrieved from Hawaii State Department of Agriculture website: https://hdoa.hawaii.gov/wp-content/uploads/2016/02/StateAgLandUseBaseline2015.pdf, (p. 55). Reprinted with permission.

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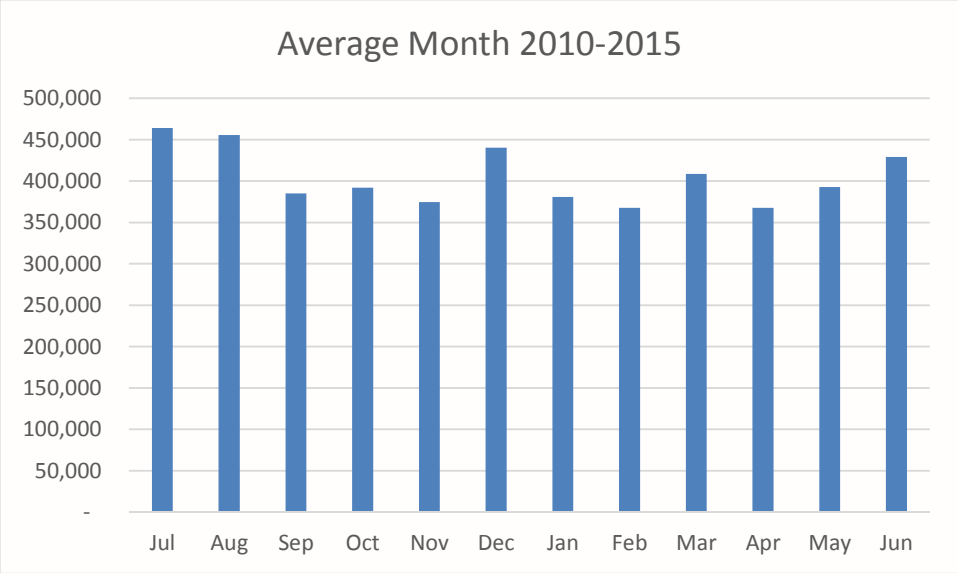
Appendix H

Average Visitor Arrivals to O‘ahu

Figure B-1. Average Visitor Arrivals via Air to O‘ahu by Month



Data used in Figure B-1 is available from the Hawaii Tourism Authority, *2015 Historical Visitors.xls*, “Table 6 Visitor Arrivals by Island and Month: 1990-2015”. [Microsoft Excel file]. Retrieved from http://www.hawaiitourismauthority.org/research/reports/historical-visitor-statistics/

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