SUEZ WATER NEW YORK INC.

Water Conservation Plan

BLACK & VEATCH PROJECT NO. 190485

PREPARED FOR

SUEZ Water New York Inc.

APRIL 29, 2016

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Building a world of difference.®

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1 Water Conservation Plan Background

In its November 17, 2014 Order on case 13-W-0303 (Proceeding on Motion of the Commission to Examine United Water New York Inc.'s Development of a New Long-Term Water Supply) the State of New York Public Service Commission (PSC) provided the following order to SUEZ Water New York Inc. (formerly known as United Water New York Inc. and referenced in this document as "SWNY"):

"SWNY shall study what conservation opportunities exist, in collaboration with the Task Force, with the goal of identifying measures that may reduce demand by 2 million gallons per day (mgd) and shall file a report with the Secretary within six months of the issuance of this order identifying the feasibility, cost and estimated demand reductions associated with each identified measure."

In response to this order and an associated order in the same filing concerning the feasibility of development of supply alternatives, SWNY submitted the "Report of Feasibility of Incremental Water Supply Projects and Conservation Opportunities in Rockland County, New York" on June 30, 2015. In this report a framework was provided to achieve approximately 2 mgd of water savings with a combination of demand-side management activities as well as reduction of non-revenue water. SWNY initiated a rate case filing in February of 2016 to address these requirements as well as others. This report pertains only to the demand-side management aspects of the above order. Furthermore, as a private water utility, SWNY cannot impose water use regulations/ordinances to the communities served. For this reason, this study will focus on activities that SWNY is authorized to address. However, SWNY has provided technical support to the Rockland County Task Force on Water Resources Management (Task Force) to address regulatory issues such as irrigation ordinances and building code requirements with the appropriate regulatory authorities. SWNY will assist the Task Force in this endeavor. The Order and the above referenced feasibility report can be found on the PSC's website in www.dps.nys.gov in the Commission Documents section.

This report outlines a plan of action that is designed to contribute to the demand reduction goal outlined above. The report summarizes and describes the data and assumptions that drove the development of the plan.

The plan development process took place between November 2015 and February 2016 and included five PSC-facilitated meetings with stakeholders and separate discussions with representatives from the Task Force, the Rockland Business Association, the Rockland Economic Development Corporation, Orange and Rockland Utilities, and others.

2 History of Water Conservation Actions

SWNY's experience with water conservation spans four decades. Beginning in the early 1980s, SWNY (also formerly known as the Spring Valley Water Company), implemented several water conservation programs in an effort to balance demand against supply. The water conservation and demand-side management programs implemented fall into the following categories:

- A summer / winter rate schedule
- Conservation device distribution programs
- Outreach and education programs
- Survey research activities

The major conservation programs undertaken by SWNY, along with significant external policy influences, are depicted in a timeline in figure 2-1 and are briefly described below.

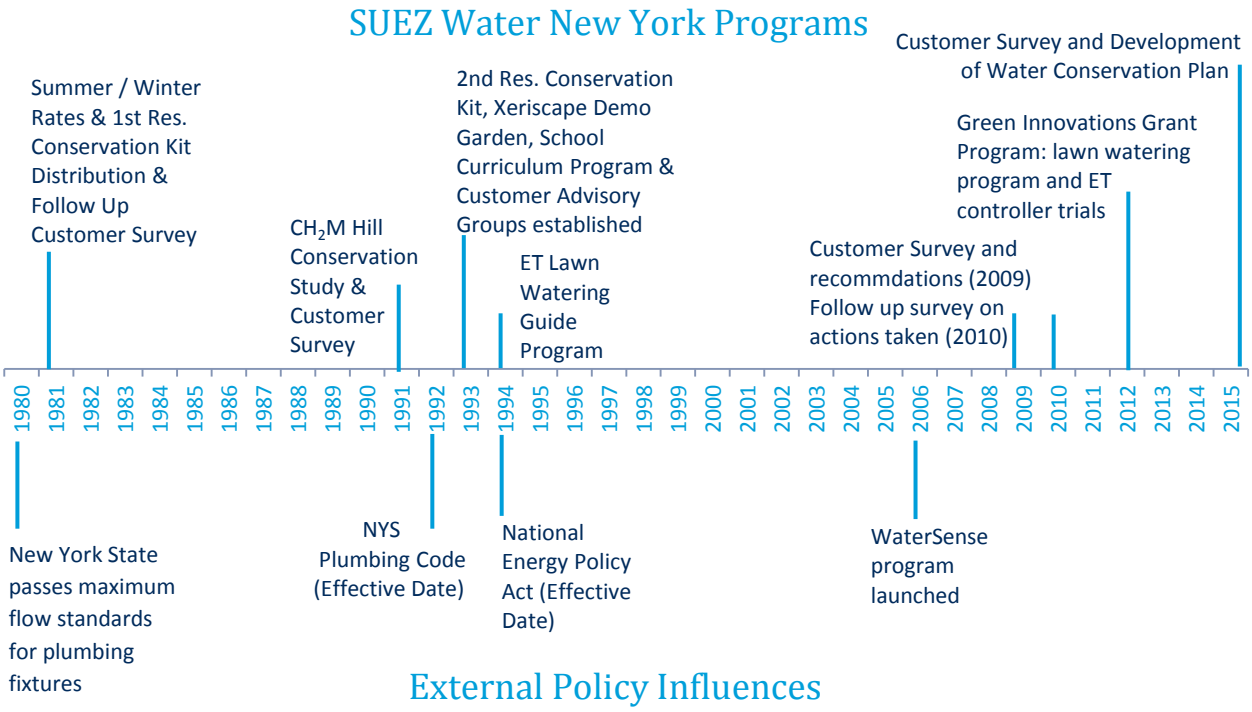

Figure 2-1 A History of Water Conservation Programs and Policy Influences at SWNY

2.1 NEW YORK STATE FLOW STANDARDS

2.1.1 1980 State Plumbing Code

New York State implemented a statewide water conserving plumbing fixtures law in 1980 which mandated that all plumbing fixtures distributed, imported, sold or installed in the state should not exceed maximum flow standards. The standards specified 3.5 gallons per flush for toilets, 1.0 gallon

per flush for urinals, and 3.0 gallons per minute for showers and faucets. An amendment added requirements for self-closing water fountains and self-closing bathroom faucets in public places[1].

2.1.2 1989 State Plumbing Code

A 1989 amendment to the State Plumbing Code requires that, as of January 1, 1992, all toilets meet a standard of 1.6 gallons per flush and, effective January 1, 1991, all bathroom faucets meet a flow standard of 2.0 gallons per minute. The amendment also requires the Department of Environmental Conservation to develop product testing and labeling regulations[2].

2.1.3 2002 State Plumbing Code

The New York State Environmental Conservation Law of 2002 §15-0314 further expanded the previous state code plumbing amendments to align the state plumbing code with the federal standards put in place through the Energy Policy Act of 1992 (see section 2.7).

2.2 SUMMER WINTER RATE SCHEDULE

The Summer/Winter rate schedule was introduced in 1981. Summer months were inclusive of May through August with all other months billed in accordance with the Winter Rate. The initial ratio of summer to winter rates was 3:1 (i.e., a 200% increase in the summer months). However, the intent of the rate structure was to achieve conservation in a way that protected customers that did not use more water during the summer watering season; this was achieved by lowering the winter rates. The rates, and their respective time periods, were structured such that a customer that used the same amount of water year round would not see a change in their total annual bill. To further protect customers that did not use excessive amounts of water in the summer, but who nevertheless would have higher bills in the summer, budget billing was also introduced to allow these customers to even out their payment amounts. After one year – and in response to concerns from customers – this summer to winter rate ratio was reduced by the New York State Public Service Commission to 1.5:1 (i.e., a 50% increase in the summer months).

2.3 FIRST CONSERVATION DEVICE DISTRIBUTION & SURVEY

In 1981, conservation kits were distributed to all residential customers; the kits included:

- Toilet bags – displacement devices to reduce flush volume
- Dye tablets – used to indicate the presence of a toilet valve / flapper leak
- Shower flow restrictors
- Installation instructions and water conservation brochure

A customer survey was conducted following the distribution of the kits to determine the level of acceptance and implementation of the water saving products. The survey was administered by phone and included 200 completed surveys. This allowed SWNY to gain some insight into customer response and reaction; however it should be acknowledged that this level of response did not provide a statistically robust sample of all customers. Based on the survey findings, it was

[1] New York State Department of Environmental Conservation. 1998 (reprint). Water Conservation Manual for Development of a Water Conservation Plan.

[2] Ibid.

concluded that approximately 50% of the respondents indicated that they used the kit in whole, or in part. However, 11% noted that they intended to remove the toilet bags and 40% intended to remove the shower flow restrictors.

2.4 CH2M HILL WATER CONSERVATION STUDY

In 1991, SWNY conducted a comprehensive study to determine the role of enhanced, non-emergency, year round, water conservation in supplementing existing and future water supply sources. The study focused on water use practices and patterns, identified potential water conservation practices and assessed applicability, costs and benefits. In summary, the report estimated an average residential per capita consumption of approximately 78 gallons per capita per day with a trend of increased efficiency in prior years attributable to the summer / winter rates, conservation device distribution program and on-going outreach and education.

Another phone-based survey was conducted generating approximately 400 responses (385 single-family and 33 multi-family customers). The study noted that 90% of respondents practiced water conservation, by engaging in practices such as checking for leaks, reduced lawn watering and taking shorter showers. The study led to the implementation of the evapotranspiration (ET) lawn watering program and the conservation kit program in the early 1990s.

2.5 EARLY 1990S SWNY CONSERVATION PROGRAMS

2.5.1 Xeriscape Demonstration Garden

A 3,600 square foot xeriscape demonstration garden was installed in the garden beds in front of the SWNY headquarters building in West Nyack, NY. The garden included more than 25 varieties of xeriscape and native perennials. A detailed brochure that provided a map of the area and the plants in it, and a guide to xeriscape gardening was created and made available at the headquarters and distributed to local government facilities, schools, and at local trade shows and fairs. This garden is scheduled to be redesigned and redeveloped in 2016 and will be known as the Conservation Garden.

2.5.2 School Curriculum Program

In 1993, SWNY worked with the administrators from 10 school districts, in conjunction with the Rockland County BOCES, to develop a science education module focusing on water resources and conservation. SWNY continues its outreach into Rockland County schools using the curricula developed by the Project Water Education for Teachers program—Project WET.

2.5.3 Second Conservation Device Distribution

In 1993, conservation kits were offered to all 53,500 single family customers via a mail form. This program was designed to be more effective by allowing customers more choice in selecting the products that best matched their needs and acknowledged that customers were already implementing some conservation devices on their own. The kits included stainless steel toilet dams and/or displacement bags, polished chrome-large bezel showerheads (and for a modest extra cost massaging and hand held showerheads), bathroom and kitchen faucet aerators, leak detection dye tablets, along with detailed instructions and a water conservation booklet. A total of 24,000 customers ordered kits including 39,000 toilet dams, 62,000 toilet bags, 42,000 showerheads and 90,000 faucet aerators.

A follow up survey by mail was initiated to all of the 24,000 households that requested a kit. Approximately 3,900 completed survey responses were received to assess customer response and satisfaction. The response indicated that approximately two-thirds of the participants installed the products with 80-90% satisfaction rates. SWNY also implemented a program to monitor a sample of customers' consumption based on billing data using automated meter reading equipment. The monitoring shows that customers that participated in the program reduced water use by 5.2% (approximately 11 gallons per household per day).

2.6 ET LAWN WATERING GUIDE PROGRAM

The purpose of this program was to educate customers on how they could use the evapotranspiration (ET) number to determine lawn watering requirements and reduce unnecessary watering. The program uses weather data to provide recommendations on how much water the average lawn needs. Two sets of numbers were provided: (1) an ET number geared to those that have not watered for three days, and (2) a weekend water number that compiled ET for the prior week. The number was communicated in several ways including a posting on the company web-site, available via a recorder phone message, posted daily in the Rockland County Journal News, and announced during morning drive time weather reports on WRKL. The program was supported by an extensive public education program. In addition, all single family residential customers were mailed a brochure detailing the program and providing education on how to use ET to water lawns. Customers could also request an instructional video and slide chart that enabled conversion of the daily ET number (expressed as inches of watering needed) to the amount of time to run a typical sprinkler.

This program is currently in place, promoted through the use of TV and radio spots as well as social media, bill insert messages and handouts at community events. The program currently uses one ET number based on how much water the typical lawn needs every four days. The ET number is posted daily to the company website.

2.7 ENERGY POLICY ACT

The current federal plumbing efficiency standards were established by the U.S. Energy Policy Act of 1992 (Section 123: Energy Conservation Requirements for Plumbing Products). This legislation set minimum efficiency standards for all toilets, showers, urinals and faucets manufactured in the United States after 1994, with standards specified as follows:

- Toilets: 1.6 gallons per flush (gpf)
- Urinals: 1.0 gpf
- Showerheads: 2.5 gallons per minute (gpm) at 80 psi; 2.2 gpm at 60 psi
- Faucets: 2.5 gpm at 80 psi; 2.2 gpm at 60 psi

Although the Energy Policy Act was passed in 1992, its effective date was 1994. The Energy Policy Act (EPAct) has delivered significant savings in water efficiency relative to homes using fixtures and fittings from the pre-EPAct period[3].

[3] Analysis of Water Use in New Single Family Homes, Prepared by William B. DeOreo of Aquacraft Water Engineering & Management for The Salt Lake City Corporation and the U.S. Environmental Protection Agency, 2011.

2.8 EPA WATERSENSE

In 2006, the U.S. Environmental Protection Agency (EPA) created the WaterSense Program. WaterSense labeled products have been certified to be at least 20% more efficient than standard products without sacrificing performance. WaterSense toilets now operate at or below 1.28 gallons per flush, bathroom faucets can now use 1.5 gallons per minute and new high efficiency flush urinals use 0.5 gallons per flush. When new plumbing fixtures are installed, they are required to meet or exceed the current National Plumbing Efficiency Standards. The SWNY conservation plan will evaluate the potential for promoting and incentivizing the adoption of WaterSense fixtures and appliances, building on previous efforts by SWNY to encourage conservation through device distribution and discount programs. WaterSense products are backed by independent third-party testing and certification so that water efficiency can be achieved without compromising performance. As an indication of the growing acceptance of WaterSense products, the WaterSense specifications have become mandatory in several jurisdictions including in New York City (July 2012)[4], the states of Georgia (January 2012)[5] and Texas[6] and California[7] (both January 2014).

2.9 R&I ALLIANCE SURVEY

A single-family customer survey was conducted in 2009 under the SUEZ Research and Innovation (R&I) program. Approximately 1,700 mail surveys were completed and returned from customers, providing a statistically robust estimation of the implementation of water efficiency products in place within the SWNY service area and customer behavior. Participants in the survey were provided with a water use analysis that contained recommended conservation actions tailored to their specific water using habits and fixtures. A follow-up survey in 2010 gathered information on what recommendations had been acted on and any impediments to action. The responses indicated that approximately 40% of the customers took action based on the recommendations and also suggested that the cost of upgrading to water efficient devices was an impediment to implementation, indicating that a greater financial incentive may increase uptake rates. The R&I survey provided a basis for the development of the 2015 single-family customer survey which has been used to inform development of the SWNY Water Conservation Plan. More details are provided on points of comparison between the two surveys in section 4.

2.10 NEW YORK GIGP LAWN WATERING PROJECT

In 2011, a more in depth customer survey was conducted into lawn watering habits as part of a New York Green Innovation Grant Program study. The survey gathered detailed information on lawn watering habits and identified customers who may wish to participate in a Smart ET controller pilot program. A smart controller can reduce overwatering by applying water only when needed. WaterSense labeled irrigation controllers act like a thermostat for a sprinkler system telling it when to turn on and off, using local weather and landscape conditions to tailor watering

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[4] *See* NYC Local Law 57 of 2010, available at http://www.nyc.gov/html/dob/downloads/pdf/ll57of2010.pdf.

[5] Georgia State Amendments to the International Plumbing Code (Revised Jan. 1, 2012), available at http://www.dca.state.ga.us/development/constructioncodes/programs/documents/2012effective/effective/IPC-2012-effective.pdf; Georgia Code § 8-2-3, available at http://statutes.laws.com/georgia/title-8/chapter-2/article-1/part-1/8-2-3;

[6] California Health and Safety Code § 17921.3, available at http://codes.lp.findlaw.com/cacode/HSC/1/d13/1.5/2/s17921.3

[7] Texas Health and Safety Code, Title 5 Chapter 372, available at http://www.statutes.legis.state.tx.us/Docs/HS/htm/HS.372.htm

schedules. SWNY worked with contractors to install 16 smart controllers on customers' systems in the service area. Based on a preliminary analysis, the test group of customers that had ET smart controllers on their automatic sprinkler systems did not generate savings, compared to a control group and therefore the installation of smart controllers does not appear to represent a significant opportunity to save substantial amounts of water in the SWNY system.

3 Consumption Data Analysis

To help inform development of the conservation plan, trends in SWNY's consumption data were evaluated. This included a review of trends over the past 14 years at the customer class level and a more detailed analysis of individual billing data over the past four years.

3.1 HISTORICAL CONSUMPTION DATA REVIEW

Approximately 14 years of retail customer consumption data were reviewed in order to understand medium to long-term trends within the SWNY system. This data review covered the period of January 2000 through July 2014 during which time residential meters were read on a quarterly basis (other customer classes were read monthly). The transition from quarterly to monthly meter readings occurred in August and September 2014. This change of meter reading and billing cycle causes some discontinuity in the observed trends and for this reason the historical analysis is constrained to the period of consistent quarterly data. However, a more detailed analysis of data covering the period 2012 - 2015, including the transition from quarterly to monthly meter reading is described in section 3.2 and Appendix 1). The data available for the historical time period were aggregated at the following customer class levels:

- Residential
- Commercial
- Industrial
- Wholesale Interconnections (Hillburn and New Jersey Interconnection)

Figure 3-1 shows the historical trends in consumption by these customer classes. Population and per capita consumption estimations are also shown in Figure 3-2. The data are displayed as monthly points and therefore inter-year seasonal trends can be observed. The monthly data reflect billing cycles during which approximately one-third of residential meters are read in each month. In the following sections the term 'usage' is used for simplicity to describe data derived from billed consumption records. The data were obtained from the Oracle CC&B system and may reflect adjustments for credits etc.

3.1.1 Residential Customer Trends

Residential usage accounts for approximately 73% of total system demand and include both single-family customers and multi-family customers. The definition of single family residential (SFR) and multi-family residential (MFR) accounts often varies between different utilities and standardization is not the norm. In the case of SWNY, SFR accounts are defined by having a single meter dedicated to an individual dwelling which may be a detached single-family home or it may be an individually metered dwelling within a larger building unit. MFRs typically have a single meter that provides water to multiple individual dwellings or residential units.

From Figure 3-2, it can be seen that population, (as derived from Census estimates and adjusted to exclude non-SWNY customers), in the period 2000-2014 is estimated to have grown from approximately 252,000 by 13.5%, representing an increase of approximately 34,000 people. Figure 3-1 shows that total residential consumption has remained broadly flat over the 14 year period which means per capita consumption has trended lower over the same period, as can be seen in figure 3-2. Per capita consumption measured in this aggregate way (total residential use divided by total estimated population) is approximately 57 gallons per capita per day on an annualized basis.

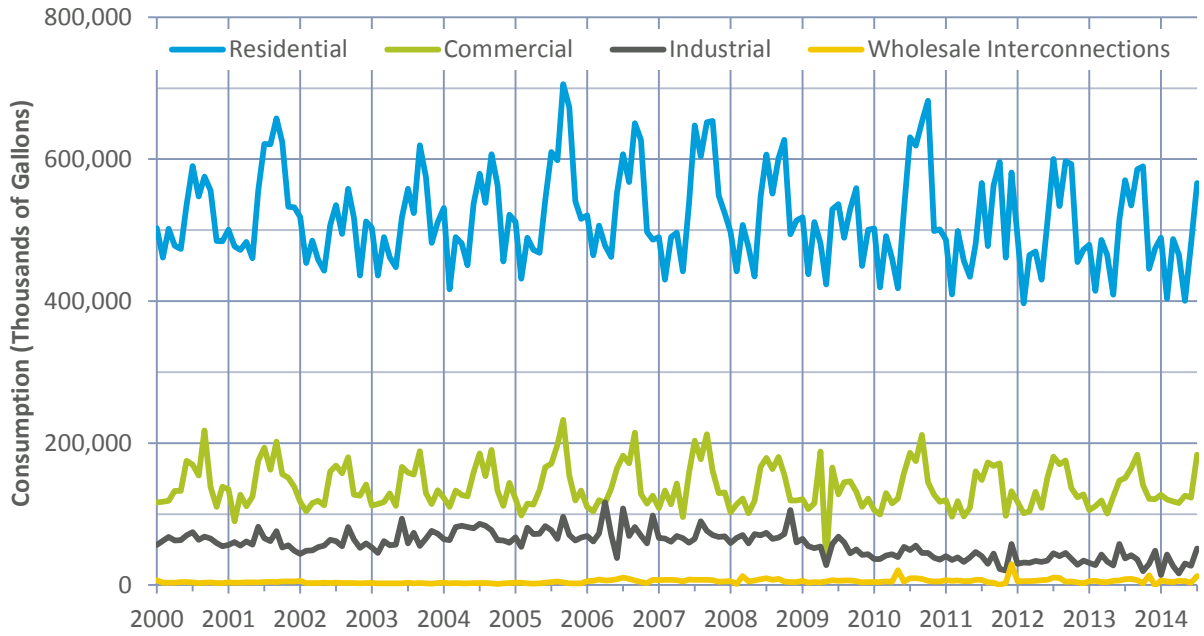


Figure 3-1 Historical Trends in Consumption by Customer Class

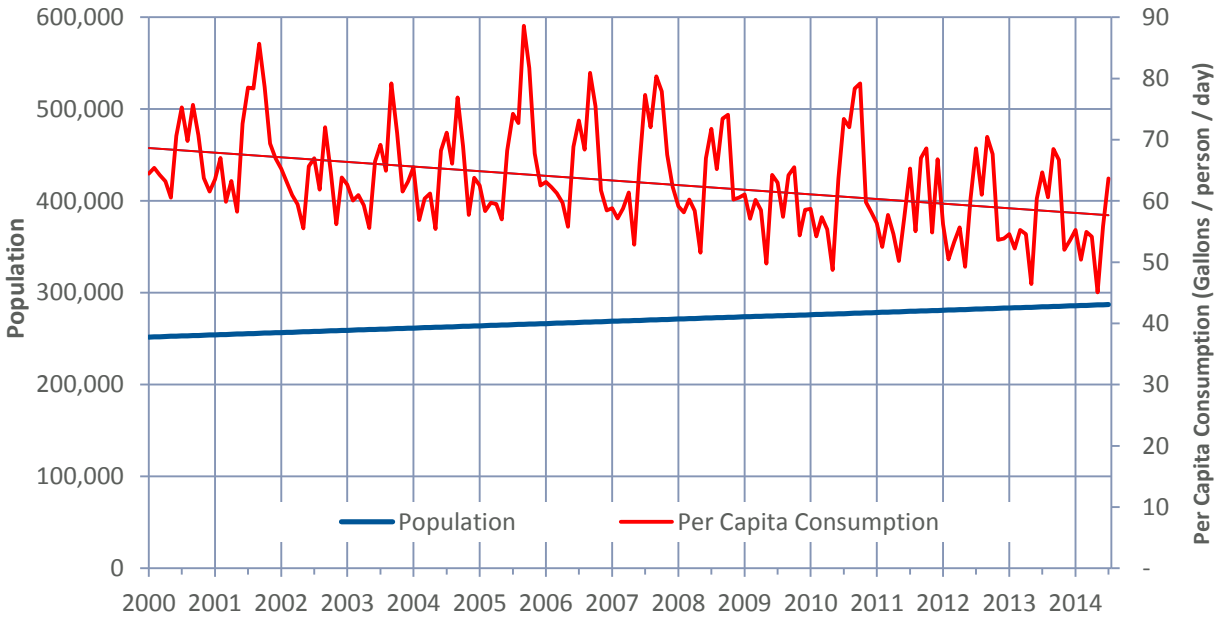


Figure 3-2 Historical Trends in Population Growth and Per Capita Consumption

3.1.2 Commercial Customer Trends

Commercial usage accounts for approximately 21% of system demand. Figure 3-1 shows that aggregate use by SWNY's commercial customers has remained relatively flat over the 14 year period, declining 5.2%. The number of commercial accounts increased between 2000 and 2014 by 7.5%, although the number of accounts peaked in 2012.

3.1.3 Industrial Customer Trends

Industrial usage accounts for approximately 4% of current total system demand and have fallen to less than 50% of their 2000 volume. A significant reduction can be noted beginning in the 2009 timeframe – a time of economic stress - without much recovery evident through 2014. The number of industrial customer accounts has remained relatively stable over the same period. (In August 2009, a large retroactive billing credit was applied to an industrial user. This distorted the profile of actual use, so an adjustment was made to the data shown in Figure 3-1 which interpolated the August 2009 industrial data point to more accurately reflect water use.)

3.1.4 Wholesale Interconnection Customer Trends

There are only two wholesale interconnections on the SWNY system and these account for less than 1% of total system demand. There has been a slight upwards trend in demand of 12% over the 14 year period.

3.2 DETAILED CONSUMPTION DATA REVIEW

Detailed billing data were reviewed for the period 2012-2015. As noted in section 2.1, this included periods of quarterly and monthly meter reading for the residential customer classes (SFR and MFR). Residential meter reading had fully transitioned to a monthly frequency by October 2014 which meant that when the data review for this study began in November 2015, a full year of monthly data was available (October 2014 through September 2015). During the later stages of the project it was possible to repeat the analysis utilizing the full calendar year of data for 2015. The detailed consumption data review included the following aspects not included in the analysis performed in section 3.1:

- Further breakdown of the residential class to differentiate between single family and multi-family accounts.
- Individual account level data was available so differences between users within the same customer classes could be identified (e.g., large and small users).
- Meter read dates were available so more precise seasonal consumption estimates could be derived.

3.2.1 Customer Class Classifications

The SWNY billing data was separated into five main customer classes as shown in Figure 3-3. Some accounts have Fire service associated with them but cumulatively these represent approximately 0.6% of total system demand and for the purposes of the analysis have been combined with wholesale interconnections.

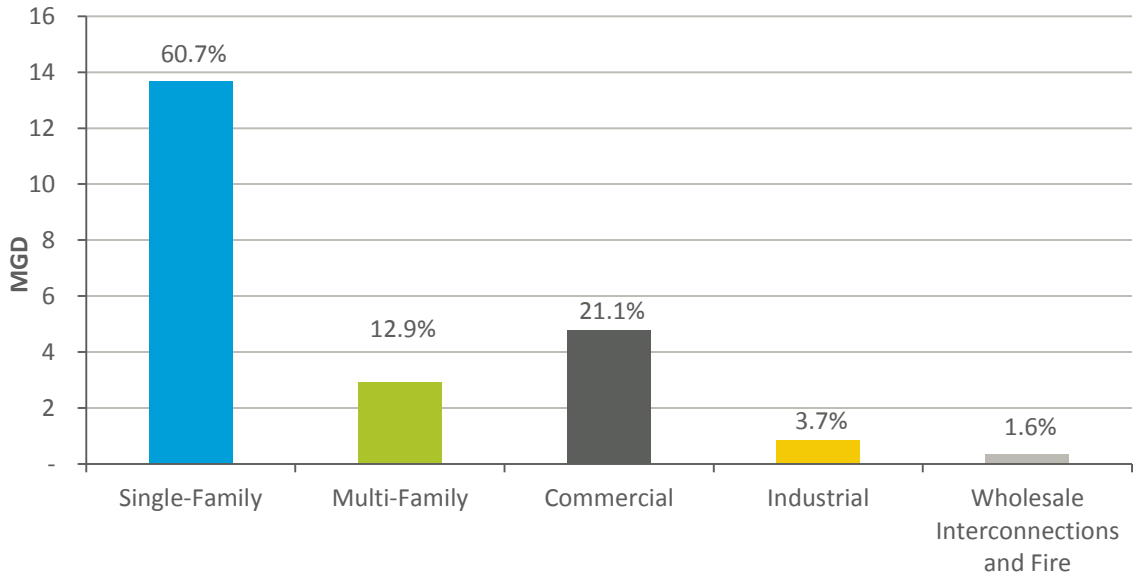


Figure 3-3 Annualized Consumption by Customer Class (2015)

3.2.2 Single-Family Residential Customer Trends

There are approximately 67,500 active single family residential customers in the SWNY system. Although residential end uses of water are more uniform, compared to commercial and industrial sectors, the single-family residential (SFR) sector can still show significant variations in use that are important to consider and understand in the development of a water conservation plan. The following factors can significantly influence water use in the residential sector:

- Persons per household
- Age of water using fixtures and appliances
- Outdoor water use and irrigation
- Swimming pool
- Income
- Price of water
- Education and awareness of the customer
- Willingness to conserve

In Figure 3-4, the green bars indicate that over 50% of customers use between 50 and 200 gallons per household per day. However, the long tail of the distribution indicates that there are large differences in water use, for this sector, within the SWNY service area. Based on a review of the available data is it likely that the tail of the distribution is comprised of a mix of large families, larger properties with significant outdoor water use, businesses run from residential properties and possible non-SFR accounts (i.e., multi-family or commercial units). This variation and the reasons for it are typical of many large water systems and the associated billing systems. The variation in single-family residential water use is described in more detail in section 4 and Appendix 2.

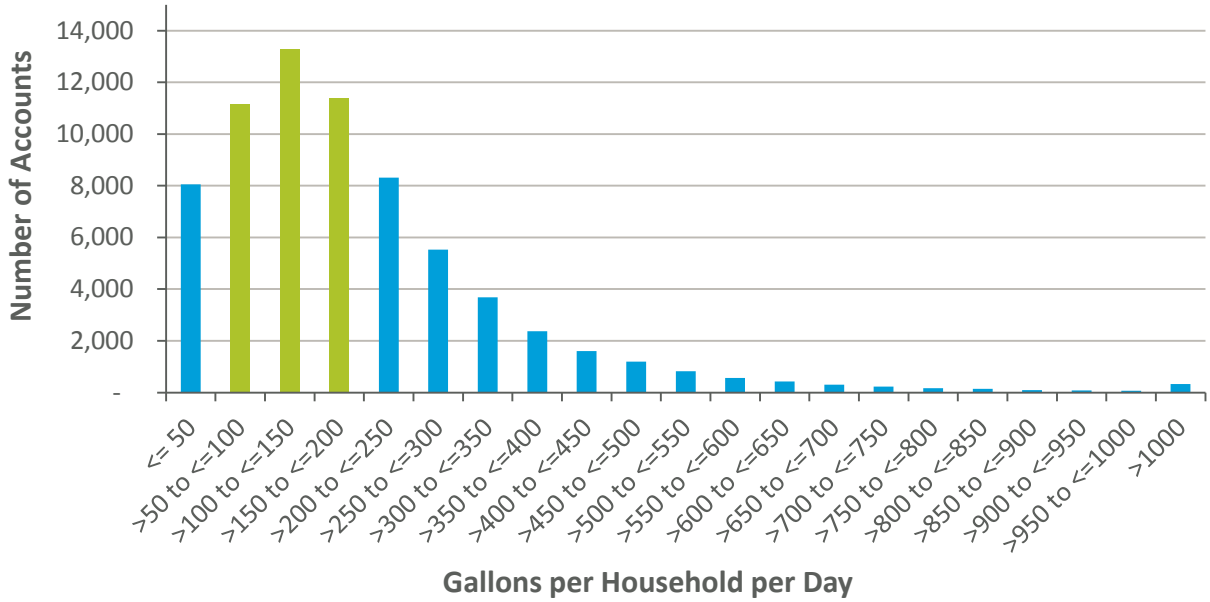


Figure 3-4 Distribution of Single-Family Residential Household use (2015)

3.2.2.1 Temporal Single-Family Residential Trends

Figure 3-5 shows the pattern of water use by SFR households on a monthly basis. As expected, a clear seasonal pattern in water use is evident driven primarily by an increase in outdoor water use during the months of May through September with demand increasing from a base of approximately 12 mgd to a peak around 16 mgd. There is no universally accepted method for estimating outdoor water use from monthly consumption data, as outdoor use will be driven by regional climatic differences[8]. A typical approach is to determine an indoor baseline value, with all usage above that baseline estimated to be outdoor use. Considering the climate for Rockland County, it was determined that the months of January, February and December could be assumed to have negligible outdoor SFR water use in the SWNY service area and therefore these months were used to establish the indoor baseline.

[8] http://www.pacinst.org/wp-content/uploads/sites/21/2013/02/appendix_b3.pdf

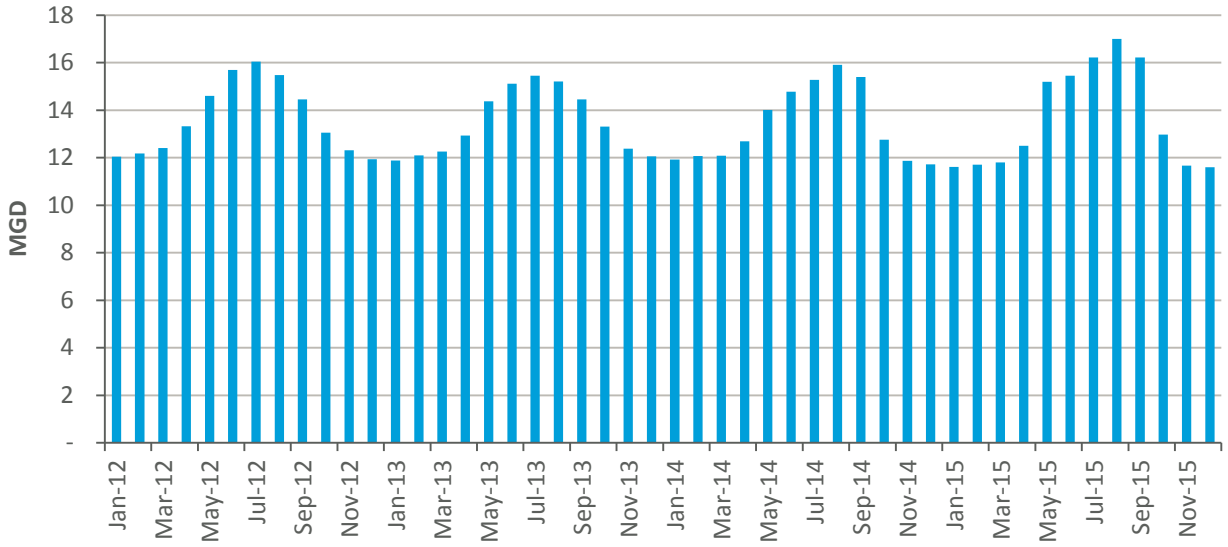


Figure 3-5 Seasonality of Use for Single-Family Residential Households

Table 3-1 shows that estimated outdoor water use in 2015 was approximately 15% of total SFR use. This value is higher than previous years and could be influenced in part by the relatively hot and dry summer (rainfall in August 2015 was 38% of the 5 year average). However, it can also be seen in Table 3-1 that it was a combination of both higher outdoor use *and* lower indoor use that contributed to the higher percentage outdoor use estimation in 2015.

Table 3-1 Estimated Indoor and Outdoor Single Family Residential Water Use

YEAR	AVERAGE USE (MGD)	INDOOR MONTH AVERAGE (MGD)	OUTDOOR MONTH AVERAGE (MGD)	ESTIMATED OUTDOOR USE %
2012	13.62	12.05	14.15	11.6%
2013	13.46	12.01	13.94	10.8%
2014	13.37	11.90	13.86	11.0%
2015	13.66	11.64	14.33	14.8%

As noted above, 2015 represents the first annual period during which monthly (instead of quarterly) meter reading data were available for SWNY and this may influence the calculation as the greater resolution of meter reads (12 per year versus four per year, for each account) allows consumption to be allocated more closely to the true period of use. By comparison to other utilities, 15 percent of consumption for outdoor water use is below average. Nationwide, approximately 30 percent of water use is devoted to outdoor uses and in dry climates such as the Southwest, a household's outdoor water use can be as high as 60 percent[9].

[9] http://www3.epa.gov/watersense/pubs/outdoor.html

3.2.2.2 Single-Family Residential Trends between Towns

SWNY provides water to approximately 290,000 residents within Rockland County, NY. The service area is comprised primarily of the five towns of Clarkstown, Haverstraw, Orangetown, Ramapo and Stony Point. SWNY also supplies water to a number of small communities within Orange County in the Towns of Tuxedo and Warwick. The service area excludes the villages of Suffern, Nyack and South Nyack. Figure 3-6 shows both a seasonal variation in water use and indicates that there are geographical variations in water use with the SWNY service area. A normalized curve is provided for each town. This means that each town's average monthly water consumption is represented by the unit-less value of 100 on the y-axis. Plotting the data in this way allows the relative peaks between the five towns to be compared. The graphic indicates that, on average, summer water use increases more in Orangetown, Clarkstown and Stony Point, relative to Ramapo and Haverstraw. Additional data analysis provided in Appendix 2 shows the variation in water use within each town.

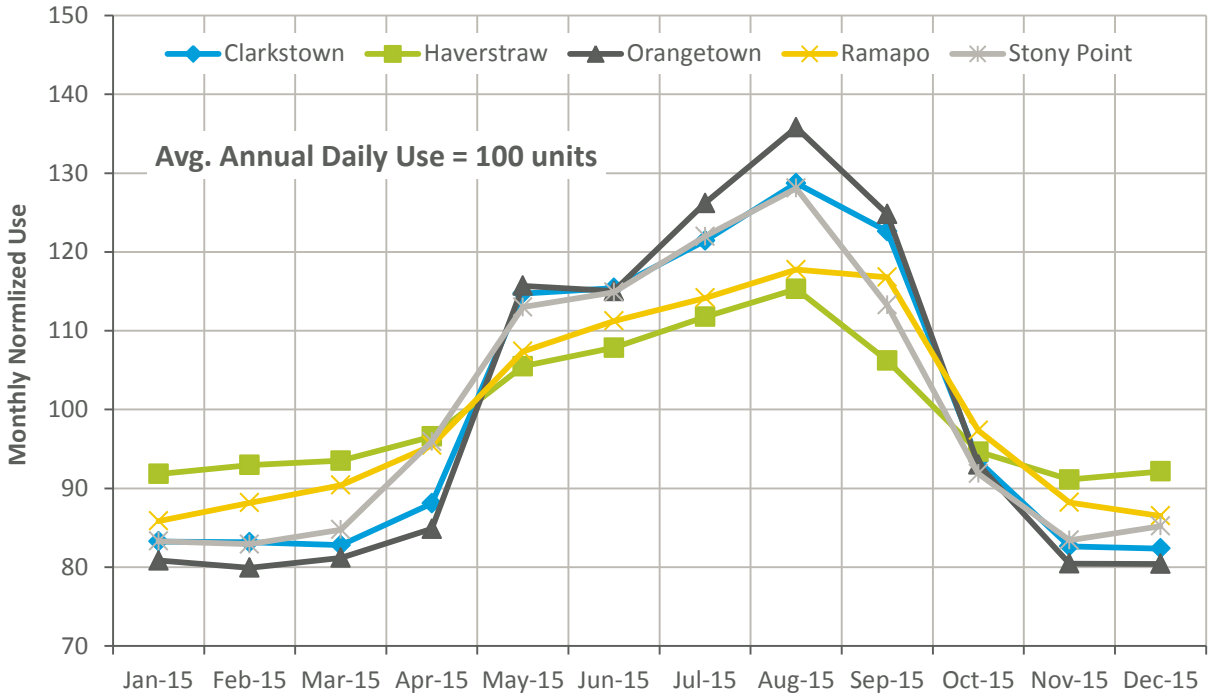


Figure 3-6 Seasonality of Use for Single-Family Residential Households by Town (2015)

3.2.3 Multi-Family Residential Customer Trends

There are approximately 1,600 multi-family residential (MFR) customers in the SWNY system. MFR connections typically have a single meter that provides water to multiple individual dwellings or residential units. These units are often apartments or condominium-style construction. Although there may be a small area of landscaped property that is irrigated, there is almost no potential for outdoor water use by individual residents. The temporal trends shown in Figure 3-7 confirm the relatively flat seasonal use, especially compared to SFR customers.

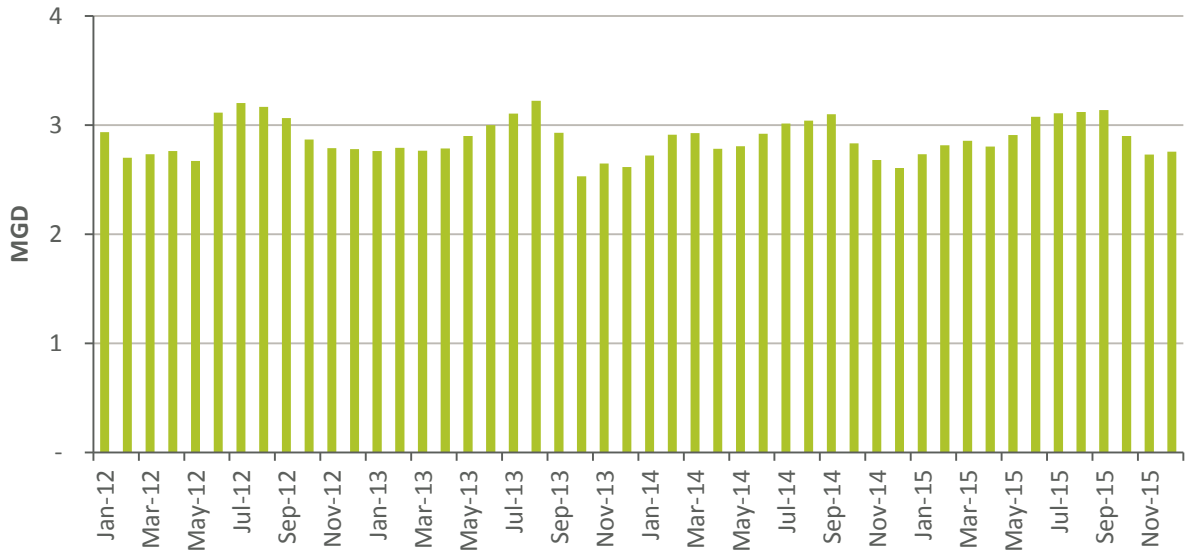


Figure 3-7 Seasonality of Use for Multi-Family Residential Customers

3.2.4 Commercial Customer Trends

There are approximately 4,400 commercial customers in the SWNY system. Figure 3-8 shows the seasonal use profile which shows a pattern of summer peaks. It is notable that use in both July and August 2015 was over 1 mgd greater than in the same months in previous years. Overall commercial use in 2015 was approximately 10% higher than in 2014. The commercial sector includes a wide variety of sub-sectors with varying uses. Institutional uses such as schools and other government buildings are also included in this customer class. Irrigation of sports fields, golf courses and general landscape maintenance also contributes to the summer peak for this category. A general increase in business activity during summer months for some sub-sectors (e.g., hotels and restaurants) may also contribute to the summer peak. Some facilities may also utilize evaporative cooling processes, although the extent to which this occurs is unknown.

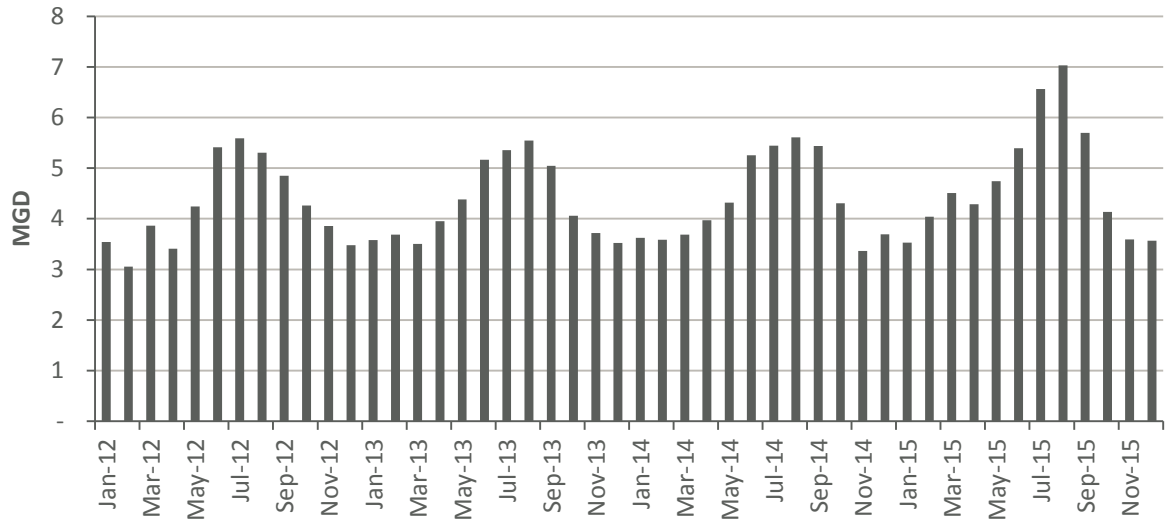


Figure 3-8 Seasonality of Use for Commercial Customers

3.2.5 Industrial Customer Trends

There are approximately 90 industrial customers in the SWNY system. As with the commercial customer class, industrial customers are often highly specialized in their water using processes. Within the industrial class in the SWNY system there are many, varied types of uses such as chemical and pharmaceutical companies, light manufacturing processes and food and beverage processing facilities. Figure 3-9 shows the seasonal profile of water use associated with this sector. The chart is dominated by what appears to be a declining trend over the past three years due to the loss of several large water using customers. Industrial water use shows some seasonal patterns with use often the highest in the summer months, however use appears to be more erratic and less predictable compared to other sectors.

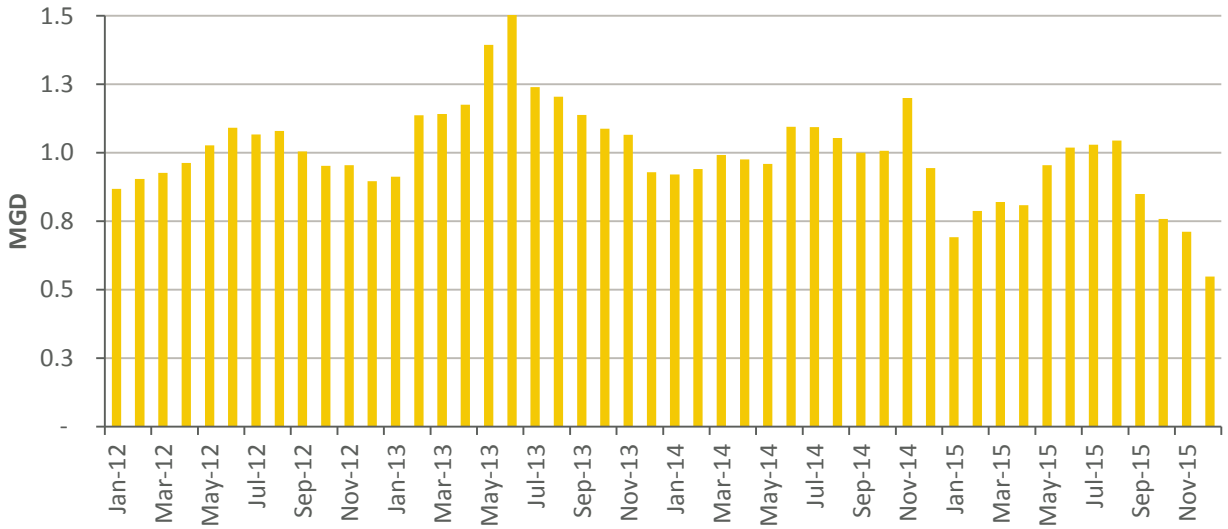


Figure 3-9 Seasonality of Use for Industrial Customers

3.3 DATA QUALITY ASSESSMENT

After reviewing and analyzing the numerous datasets and outputs associated with this study, Black & Veatch found the underlying data to be sound, consistent and comparable to general practices within the industry.

In preparing data for this study, outputs were reviewed for consistency with previously published data. Sometimes the data do not match perfectly. It is not uncommon in data querying and reporting of any large, complex data set (such as a water utility customer level billing data) that apparent anomalies or inconsistencies appear in the outputs. There are several reasons for this, such as:

- **Query definitions**: There are numerous attributes in the underlying SWNY data. For example, a customer may be defined by a Rate Schedule field or a Revenue Class field.
- **Purpose of the query**: A dataset created for analytical purposes may be different from an ostensibly similar dataset created for regulatory reporting requirements. For example, in a given time period, the volume of water billed may not equal the volume of water consumed by the customer due to meter reading lag time.
- **Dynamic data:** Even the exact same query run at two different points in time may return slightly different results. Customer billing data systems are dynamic by nature and are subject to adjustments and corrections at any time.

In reviewing data during this study, issues such as those identified above were reviewed with the SWNY team to ensure that appropriate data were utilized.

SWNY continually reviews and refines the data, where possible, to improve the understanding of customers' water use habits and trends. The transition from quarterly to monthly meter readings for residential customers (in August and September 2014) represents a step towards a greater understanding of seasonal water use patterns and behaviors. SWNY has a longer term plan to transition to an Advanced Metering Infrastructure (AMI) from which even greater insight into customer consumption patterns will be available.

4 Single Family Residential Customer Survey

SWNY has engaged with its customers several times over the past two decades (as shown in Figure 2-1) to develop an understanding of customers' water use patterns and their views and habits regarding water conservation. To support development of the SWNY conservation plan, another survey of SFR customers was performed in December 2015.

Two primary reasons explain why a customer survey was conducted for Single-Family Residential customers and not for other sectors.

- The majority (61%) of SWNY's system demand is from this sector
- The general commonality of single-family residential end uses (bathrooms, clothes washing, kitchens, lawn watering, etc.) provides a basis for developing a single set of generally applicable questions for all customers.

4.1 SURVEY DESIGN

As with previous surveys conducted by SWNY, Pencilbrook LLC, a specialist in the field of water and energy efficiency and related customer research was used to handle survey execution. Pleasant Valley Analytics (PVA) also provided input directly to SWNY and Black & Veatch on survey design, analysis and insight and guidance into the overall conservation plan design. Pencilbrook and PVA have been used by SWNY to conduct previous surveys in New York and other jurisdictions. The questions included in the December 2015 survey were developed based on similar questions used in prior surveys along with additional questions developed by the study team including input from the Task Force. The final survey (see Appendix 3) comprised 71 questions (plus an opportunity for comment) covering the following broad areas:

- Customer demographics and housing data
- Indoor water use fixtures and habits
- Outdoor water use equipment and habits
- Customer views and perceptions

4.2 SURVEY LOGISTICS

The survey sampling plan, preparation and mailing were handled by Pencilbrook LLC and PVA. The SWNY service territory includes the five towns of Clarkstown, Haverstraw, Orangetown, Ramapo and Stony Point. A statistically driven sampling strategy was devised with the objective of being 95% confident that the true value, at the individual town level, lies within ±5% of the reported sample value. To achieve this, the number of single-family homes in each town was used to determine the required number of survey responses based on standard sample size theory[10] (see Table 4-1).

[10] http://www.surveysystem.com/sscalc.htm

Table 4-1 Single Family Residential Customer Survey: Survey Sample Design and Mailings

TOWN	NUMBER OF SINGLE FAMILY HOMES	REQUIRED SAMPLE SIZE*	PLANNED MAILING	ACTUAL MAILING
Clarkstown	22,450	378	3,100	3,098
Haverstraw	8,550	368	3,100	3,098
Orangetown	11,400	372	3,100	3,087
Ramapo	21,350	377	3,100	3,079
Stony Point	3,700	349	3,100	3,085
Total	**67,500**	**1,839**	**15,500**	**15,447**

*** Response required to be 95% confident that true value is ±5% of reported sample value**

The difference between the 3,100 planned mailings for each town and the number of surveys actually sent was due to the inability of the mailing software to properly resolve addresses with certain types of punctuation. In all, 15,447 surveys out of the planned 15,500 were sent. These were distributed randomly amongst the five towns; survey recipients had the option of completing the survey on paper and returning in a pre-paid envelope, or by completing the survey online. Survey recipients were selected at random from the total pool of customers with the only filtering done to ensure that each recipient has a sufficient period of billing history (approximately three years) to support the associated analysis (see Section 4.4). Although the distribution of the surveys was random it is acknowledged that the sampling is based on self-selection, whereby individuals choose whether or not to participate. Although this introduces the potential for self-selection bias, meaning that participants may choose to respond to the survey because they are particularly interested in the topic and may not be representative of the population being studied, it is generally accepted as an effective and practical sampling strategy.

The surveys were mailed out on December 4 and December 7, 2015. Due to the plan development timeline, completed surveys were requested to be mailed (or completed online) by December 21, 2015.

4.3 SURVEY RESPONSES

The survey response included 1,535 surveys completed by the cut-off date, of which 1,465 (95%) were received by mail and 70 (5%) were completed online. The response rate was slightly lower than the expected return rate (based on previous survey experience) and provided confidence intervals for individual towns that ranged from ±5.2% to ±6.4%. For the customer base as a whole, the confidence interval is ± 2.5% as seen Table 4-2.

Table 4-2 Single Family Residential Customer Survey: Responses

TOWN	ACTUAL MAILING	RECEIVED	RESPONSE RATE	PRECISION OR CONFIDENCE INTERVAL*
Clarkstown	3,098	338	10.9%	± 5.3%
Haverstraw	3,098	227	7.3%	± 6.4%
Orangetown	3,087	346	11.2%	± 5.2%
Ramapo	3,079	320	10.4%	± 5.4%
Stony Point	3,085	304	9.9%	± 5.4%
Total	**15,447**	**1,535**	**9.9%**	**± 2.5%**

*** At 95% Confidence Level**

The survey responses provide valuable information to help support the development of a water conservation plan that is specific to the needs of Rockland County customers and is grounded on good data. Figure 4-1 shows the survey recipients (colored dots by town) and the survey respondents indicating the geographic coverage of the survey.

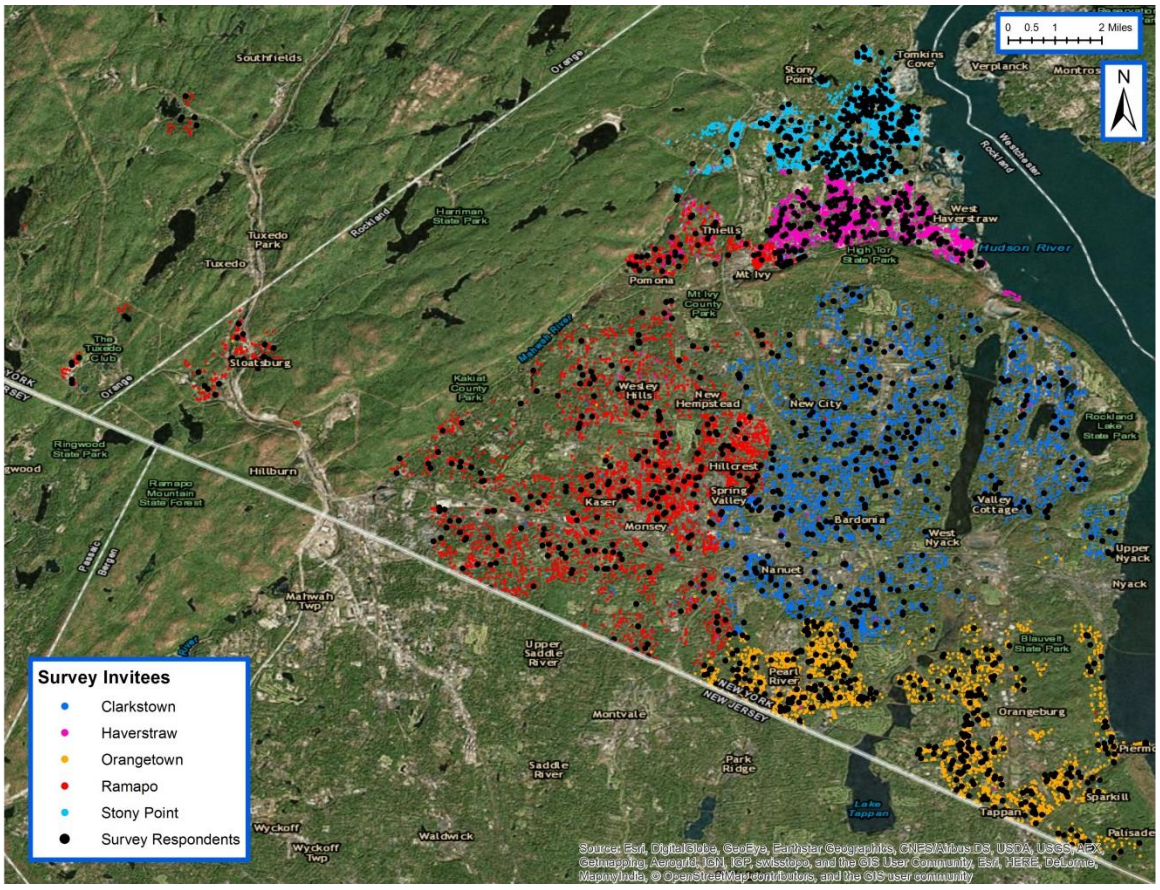


Figure 4-1 Single Family Survey Recipients and Respondents

4.4 SURVEY ANALYTICS (WATERWATCH©)

The survey responses provided by customers were combined with the specific customer's billing data (based on a three-year period) via proprietary analytical software called Waterwatch©. The purpose of Waterwatch© is to generate a quantitative estimate of end-uses within the home (e.g., gallons of water used for flushing the toilet) which cannot be calculated from billing data alone. The following description of the process is taken from Pencilbrook's website[11]:

> Waterwatch© is a software-based service developed for municipal water departments and water utilities. It provides residential customers with accurate, individualized information on how water is used in their homes.
>
> The service uses a copyright-protected computer program to analyze consumption patterns and quantify the amount of water consumed by each end-use. The program "engine" builds a statistically valid model that is derived from water use databases, compiled by Pencilbrook, and from survey data provided by the customer.

A schematic of Pencilbrook's Waterwatch© analytical process is shown in Figure 4-2.

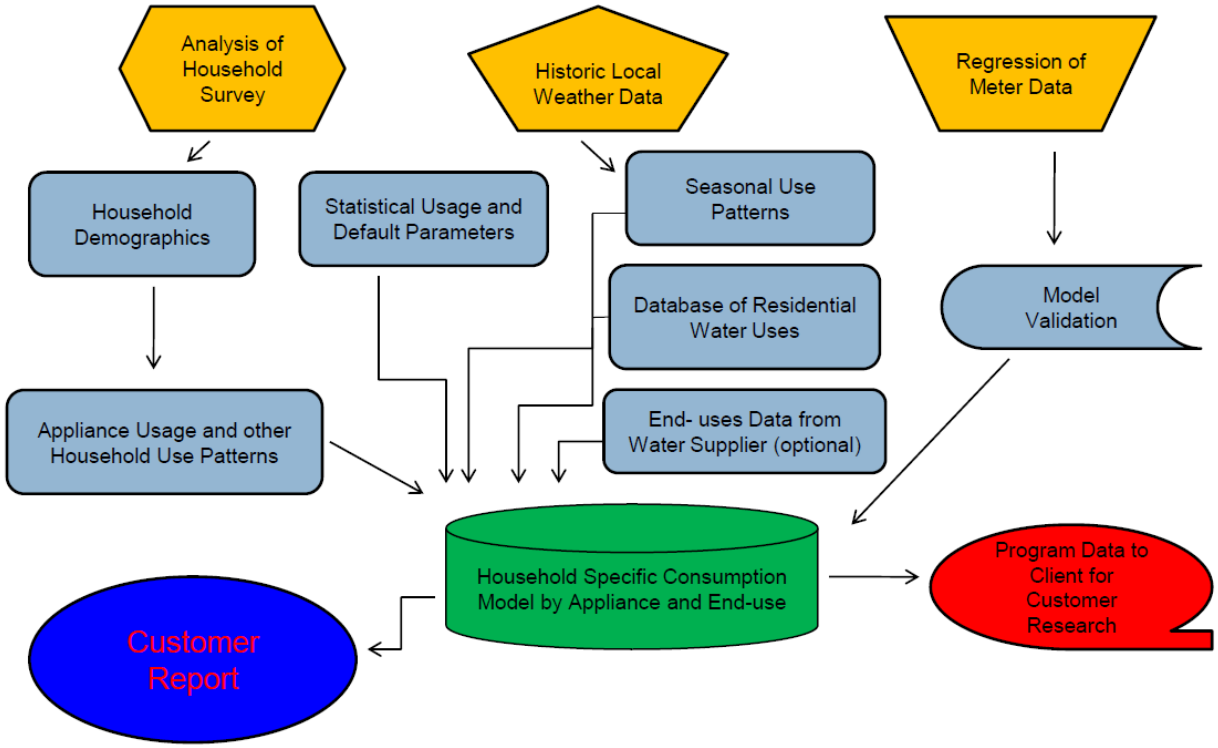


Figure 4-1 Schematic Representation of Pencilbrook's Waterwatch© Analytic Process

SWNY customers responding to the survey within the requested timeframe received a Waterwatch© Report that provides a customized analysis of how the customer uses water for typical indoor end uses and also shows a monthly profile that illustrates seasonal changes in water

[11] http://www.pencilbrook.com/waterwatch%C2%A9-information

use (e.g., outdoor use such as lawn watering). The report also identifies areas of potential water savings for each customer and calculates the associated savings on water utility bills and, if applicable, savings on energy utility bills from reduced water heating. A sample report is included in Appendix 4.

4.5 SURVEY RESULTS AND ANALYSES

Survey results were analyzed by Black & Veatch and PVA and are presented in the following sections. The majority of information presented is based directly on the December 2015 survey. However, where applicable, information from older surveys or other external sources of data is also presented to show trends, or to help validate the survey results.

4.5.1 Customer Demographics & Housing Data

This section describes basic customer demographics beginning with survey respondents by age in figure 4-2. A total of 1,488 respondents answered this question (97%). Figure 4-2 shows that 50% of survey respondents were 65 years of age or older. In light of this, the distribution of age groups responding to the survey was compared to data available from the American Community Survey (ACS), through American FactFinder[12], which is an ongoing statistical survey by the U.S. Census Bureau. Figure 4-2 shows that by comparison to ACS data, the survey responses were over represented by those 65 years or older and underrepresented for those in the 25-44 year age range. This finding was noted and the survey data were investigated further by age cohort (or bin) where it was considered relevant (e.g., clothes washing frequency or lawn watering).

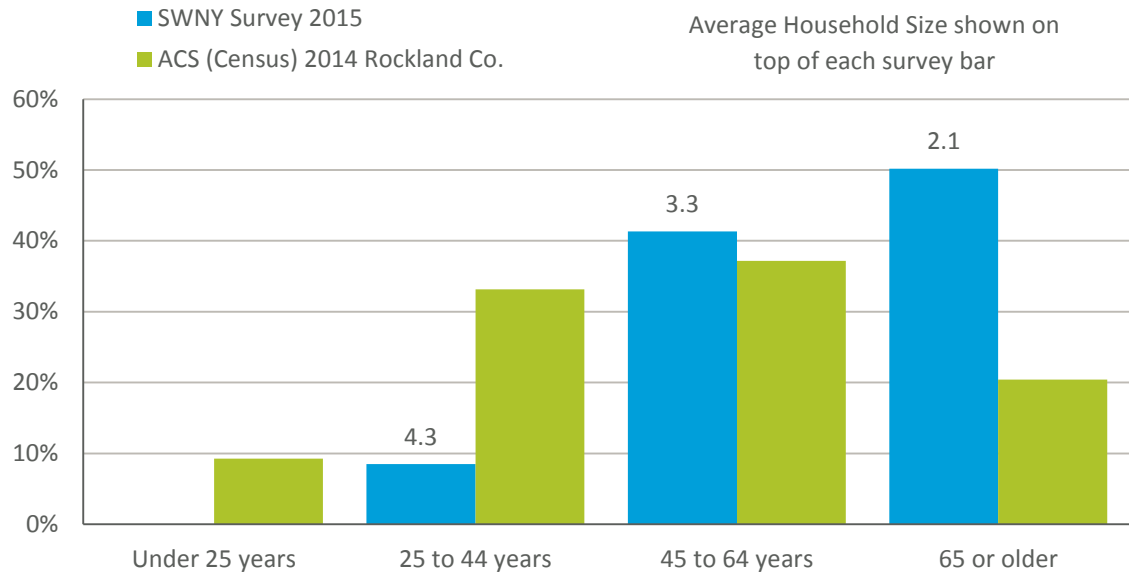


Figure 4-2 Survey Respondents by Age

Table 4-3 shows key demographics for single family customers and associated housing data across the five towns and for the SWNY service area as a whole. Some notable characteristics from the table include:

[12] http://factfinder.census.gov

- According to the 2010 U.S. Census, the average household size for Rockland County is 3.07, which is over 10% higher than the average value of 2.76 reported through the survey;
- Ramapo has a higher number of persons per household compared to the other four towns and overall average;
- The towns with the highest percentage of renters are Ramapo (11%) and Haverstraw (9%);
- Stony Point has the smallest proportion of pre-1992 constructed residences (i.e., Stony Point has newer properties) and Orangetown has the largest proportion of pre-1992 homes;
- Clarkstown and Ramapo have the highest average number of bathrooms.

It is important to understand these characteristics in order to assess the potential for water conservation and where efforts may be targeted to be most effective. For example, it has been well documented that the number of persons per household is the most significant determinant of water use[13]. As noted in Figure 1-1, a statewide plumbing standard was enacted in New York in 1992 meaning that homes constructed, or retrofitted, after this time would have more efficient fixtures. For the purposes of simplifying the analyses in this report, the effective date of the state regulations and the federal Energy Policy Act of 1992 (EPAct) is assumed to be 1994. Understanding where renters are more prevalent will be important in developing strategies for education, communication and implementation of conservation devices. These factors will be discussed in more detail in section 6.

Table 4-3 Key Demographics and Household Data

TOWN	PERSONS PER HOUSEHOLD	% RENTERS	% OF HOMES BUILT BEFORE 1992	NUMBER OF FULL + HALF BATHS	NUMBER OF FULL BATHS
Clarkstown	2.54	2.7%	85.8%	2.53	2.00
Haverstraw	2.66	9.0%	81.0%	2.24	1.77
Orangetown	2.62	2.6%	91.2%	2.42	1.97
Ramapo	3.28	10.9%	77.6%	2.59	2.07
Stony Point	2.70	4.1%	76.0%	2.29	1.95
All Towns	**2.76**	**5.6%**	**82.6%**	**2.43**	**1.96**

4.5.2 Indoor Water Use

Water use data derived from Waterwatch© were used to provide insight into water use volumes by different end use types for the five towns as shown in Figure 4-3. It should be noted that it is not a per person calculation, but instead shows water use at the household scale.

[13] Analysis of Water Use in New Single Family Homes, Prepared by William B. DeOreo of Aquacraft Water Engineering & Management for The Salt Lake City Corporation and the U.S. Environmental Protection Agency, 2011.

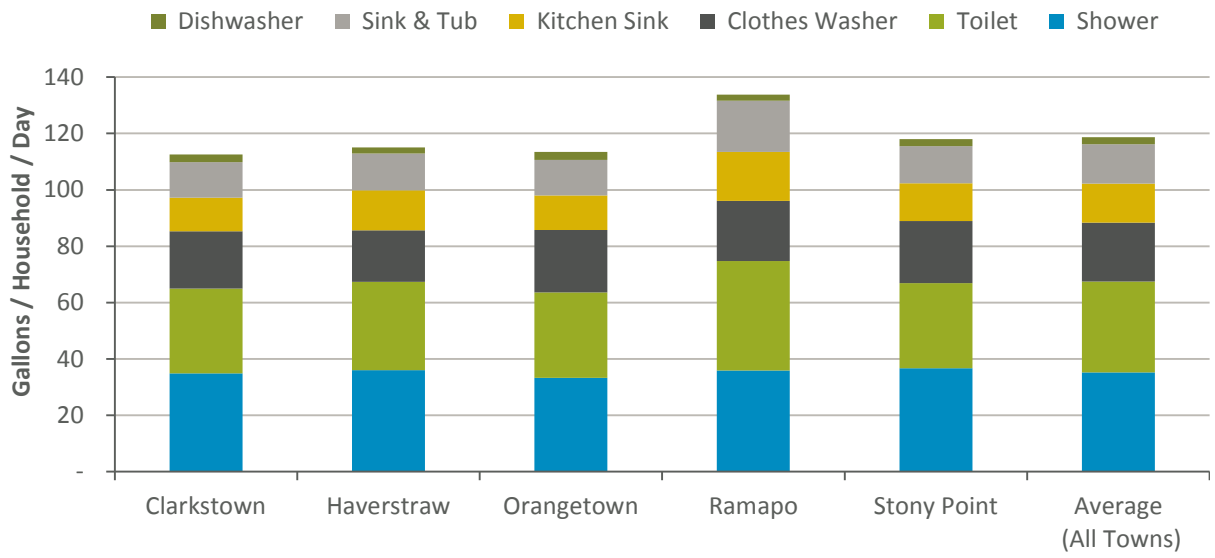


Figure 4-3 Estimated Use of Water by End Use Type

Figure 4-3 shows some uniformity, in indoor water use, between the five towns and overall average, with higher use in Ramapo reflective of the higher persons per household value for this town as shown previously in Table 4-3. The three largest end uses (showers, toilets and clothes washers) collectively account for approximately 75% of total indoor water use. A more detailed view of indoor water use by end-use category can be seen in Figure 4-4. In this analysis, water use is represented on a per capita basis using the median values from all 1,535 Waterwatch© data points; the collective proportion of water use from showers, toilets and clothes washers on a per capita basis is also 75%.

Figure 4-4 Estimated Median Per Capita Water Use by Indoor Category

This is similar to findings from published studies. For example, showers, toilets and clothes washers also represented the three largest components of indoor water use documented in the Residential End Uses of Water Study (REUWS)[14] published in 1999. The 2016 update to the Residential End Uses of Water Study (REUWS 2016)[15] noted that the three largest indoor water uses were toilets, faucets and showers.

4.5.2.1 Toilets

The number of full and half bathrooms is shown in Table 4-3 and can be used as a likely indicator for the number of toilets per household (2.43 on average). It is possible the average number of bathrooms (and therefore toilets) could be slightly greater as the maximum number of bathrooms that could be reported in the survey was three. The SFR survey also asked respondents to indicate the age of up to three toilets in their household and to indicate if the toilet had a retro-fitted water saving device. This information was utilized to determine the proportion of currently installed toilets that could be considered low-flow – where low-flow is defined as 1.6 gpf (as per the EPAct). This also provides a secondary validation of the number of toilets based on reported bathrooms. A total of 3,511 toilets were indicated from the 1,460 respondents that reported one or more toilets. One explanation of the 5% of non-respondents to this question is that they did not know the age of their toilet. Calculated from this information, the average number of toilets per household is 2.40, which is close to the value derived from the number of full and half bathrooms.

Based on the survey results as a whole, the age and proportion of toilets in the SWNY service area as a whole, as of December 2015, is shown in Table 4-4.

Table 4-4 Proportion of Toilets by Age (and Efficiency)

AGE OF TOILET WSD = WATER SAVING DEVICE INDICATED	ASSUMED FLUSH VOLUME (GALLONS)	NUMBER OF TOILETS				WEIGHTED AVERAGE FLUSH VOLUME (GALLONS)	PROPORTION CURRENTLY EXISTING
		TOILET 1	TOILET 2	TOILET 3	ALL TOILETS		
Before 1980	4.0	154	130	80	364	**3.66**	**25.7%**
Before 1980 (WSD)	3.5	36	33	15	84		
1981 - 1992	3.5	146	143	94	383		
1981 – 1992 (WSD)	3.0	27	30	15	72		
After 1992	1.6	1,081	974	553	2,608	**1.6**	**74.3%**
Total		**1,444**	**1,310**	**757**	**3,511**		**100%**

A significant finding from Table 4-4 is that the majority of toilets (74%) are already at the current standard level of efficiency as per the EPAct (1.6 gpf). This finding is significant because it helps determine the potential savings from additional replacement of non-efficient toilets and it also provides some insight on the natural (or passive) rate of conservation savings that have occurred in

[14] Residential End Uses of Water Study (1999) Water Research Foundation

[15] Residential End Uses of Water, Version 2 (REU2016) (DeOreo et al. 2016),

the SWNY service area over time – conservation related savings that help to explain the decline in residential per capita use as shown in Section 3. In Table 4-4 a distinction is made between toilets that are pre-and-post EPAct standards. This distinction is important in considering a potential toilet rebate program which would need to consider which toilets could cost-effectively be replaced with more efficient models.

Table 4-4 shows the overall proportion of pre-and-post EPAct toilets. Within the data, it was observed that the proportion of first, second, and third toilets meeting the post-EPAct standard was within a fairly tight range (between 73.1% and 74.9%).

The same analysis was performed at the individual town level (see Appendix 5). The summary findings for the overall proportion of post-EPAct toilets are as follows:

- Clarkstown: 71.3%
- Haverstraw: 73.4%
- Orangetown: 74.5%
- Ramapo: 73.1%
- Stony Point: 79.8%

Stony Point has the largest existing penetration rate of low-flow toilets, consistent with having the lowest rate of pre-EPAct homes among the five towns, as shown in Table 4-3. Based on the above findings, there are likely to be more opportunities for cost-effective toilet replacements in Clarkstown. These findings can help to prioritize and target rebate programs at the individual town level as discussed in Section 6.

4.5.2.2 Shower Use

Water use associated with showering was the highest volume of indoor water use identified in the SWNY Waterwatch© analysis. Over the years, plumbing standards have defined specifications for showerhead efficiency as measured by flow rates in gallons per minute (at a specified pressure). However, in addition to the specific efficiency of showerhead equipment, personal habits and behavior, such as the frequency and duration of showering, also influence the total volume of water used for showering. To some degree, water pressure in the household will also influence the total volume of use. In the SWNY survey, customers were asked about the water efficiency status of showerheads and questions on the frequency and duration of showering. As with the question on toilets, the customer was asked to provide information for up to three shower units in the household. Based on the information from the 1,523 respondents who provided an answer to the shower-related questions, a total of 2,975 shower units are reported; this produces an estimate of 1.95 shower units per household, which is almost exactly the same ratio as the number of full bathrooms per household reported in Table 4-3 (1.96) and helps to validate the original estimate.

Customers were asked to identify if the showerhead unit was a low-flow device and the responses are shown in Table 4-5.

Of note in Table 4-5 is the relatively high proportion of showerheads of unknown efficiency status. Low-flow showerheads, as defined in this study, are those that meet the EPAct standard (i.e., 2.5 gpm flow rate). Showerheads are generally less expensive and easier to retrofit compared to toilets so it would be surprising to see fewer EPAct specification showerheads compared to toilets, which

Table 4-5 Indicated Efficiency Status of Showerheads

EFFICIENCY STATUS	SHOWERHEAD 1	SHOWERHEAD 2	SHOWERHEAD 3	AVERAGE ALL SHOWERHEADS
Low-Flow	50.8%	49.6%	35.5%	**48.9%**
Non Low-Flow	22.9%	24.3%	29.9%	**24.1%**
Unknown	26.3%	26.0%	34.7%	**27.0%**

is what the data shows as reported. However, if the majority of those declaring an unknown efficiency status are actually low-flow units, the overall proportion of low-flow units would be comparable to the proportion of low-flush volume toilets (approximately 75%). When viewed at the individual town level the findings are generally similar; with overall reported low-flow shower units in the range of 45-52% (see Appendix 6 for additional details).

Another finding from Table 4-5 is that Showerhead 3 (for those homes having three showers) is less likely to be a low-flow unit and there is greater uncertainty regarding its efficiency status. This may imply that the third shower is typically used less frequently, perhaps located in a guest bathroom. When estimating the potential savings associated with showerhead retrofits (or any water saving device) it is important to understand the potential use rates associated with the retrofitted device as this will help determine cost effectiveness of replacement. Table 4-6 shows additional information that supports the assertion that third showers are used less than first and second showers.

Table 4-6 Frequency of Shower Use

	NUMBER OF SHOWERS PER WEEK REPORTED		
	Shower 1	Shower 2	Shower 3
All survey responses reporting one or more shower unit(s) (n = 1,523) in the household	13,573	4,630	763
Survey responses reporting three (3) shower units (n = 375) in the household	3,352	1,717	717

In light of this information, it is clear that the realized water saving benefit from replacing Shower 1 (most frequently used shower) will be much greater compared to a replacement of Shower 3 (least frequently used shower).

The survey also inquired into the duration of showers (Question 11), with responses falling into one of the three following categories:

- 5 minutes or less
- 5 to 10 minutes
- 10 minutes or more

Figure 4-6 shows that 55% of all respondents indicated that the average duration of each shower was 5 to 10 minutes. A closer look at those customers who indicated that they have only low-flow showerheads reveals that they are more likely to take shorter showers. Those respondents who noted they only have non low-flow showerheads are more likely to take longer showers. These data may indicate some behavioral characteristics that could influence the uptake rates of low-flow showerheads.

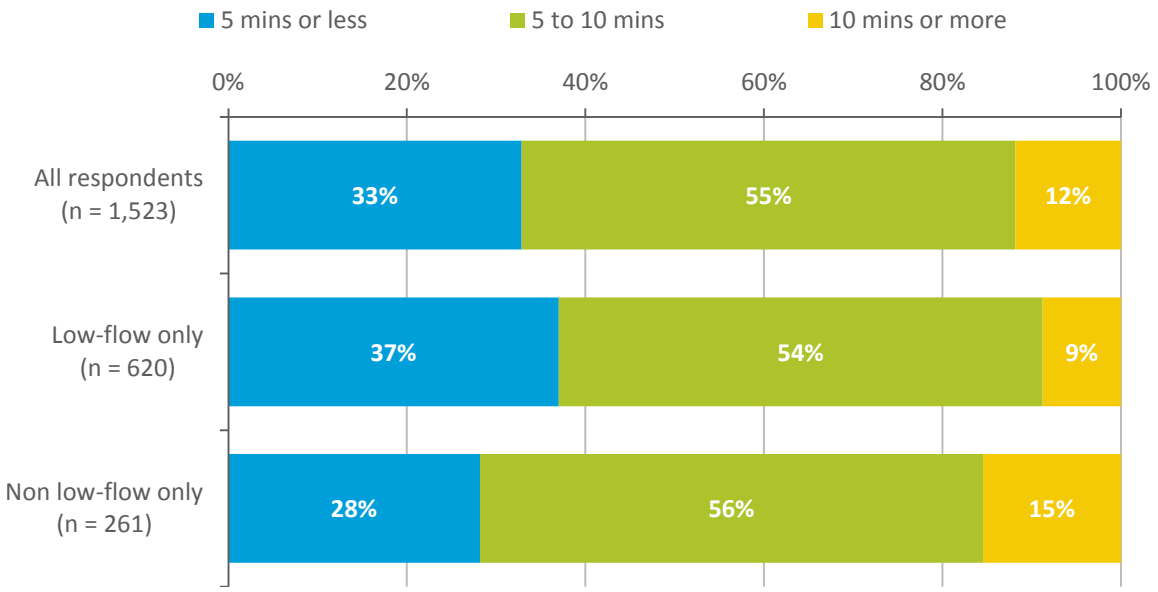


Figure 4-5 Shower Duration

4.5.2.3 Clothes Washers

Clothes washers represent the third largest component of indoor water use reported through the Waterwatch© analysis. Survey questions 13 and 14 asked about the type of clothes washer and the number of loads of laundry washed per week. This information is summarized in Figure 4-7.

In order to keep the survey simple for the customer, question 13 asked customers to report on whether they had front-load versus top-load clothes washers. Generally, clothes washers with a front-load design are more efficient washers, although the market for these appliances is continually evolving, as discussed further in section 5. The December 2015 survey revealed that approximately 26% of households owned a clothes washer with a front-load design. A previous survey conducted by SWNY in 2009 noted that 16% of households had a front-load style clothes washer, so these results indicate a naturally growing market penetration for this style of clothes washer. The survey used a distinction between front-load and top-load washers as a benchmark of efficiency to keep this question straight-forward for respondents. However, it should be noted that the classification of front-load clothes washers as efficient and top-load washers as non-efficient is a simplifying assumption and the current clothes washer market offers some highly efficient top-load clothes washers. The 2016 update to the Residential End Uses of Water Study (REUWS 2016)[16]

[16] Residential End Uses of Water, Version 2 (REU2016) (DeOreo et al. 2016),

indicated that 46% of households in that study had efficient washers. Considering the simplified definition used in the survey and the REUWS 2016 findings, it is probably that the actual existing efficiency of clothes washers within SWNY single-family households is higher than the baseline figure of 26% suggests.

Survey question 14 asked customers about the number of laundry loads washed per week. It can be seen from Figure 4-7 that the average number of loads is higher for those owning a front-load washer. This may signify that those households that wash a higher number of loads may have purchased a more efficient machine to realize the water and cost savings.

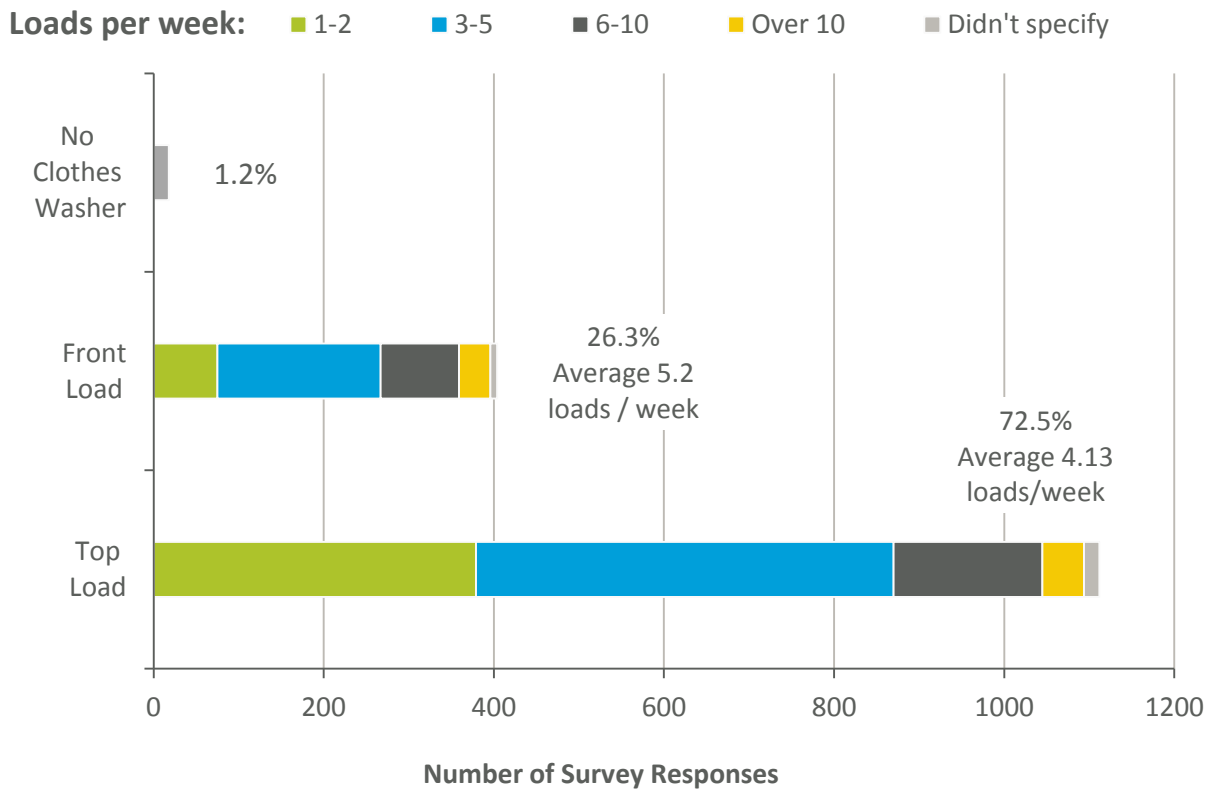


Figure 4-6 Clothes Washers by Type and Loads of Laundry Washed per Week

Table 4-7 explores some potential factors that could drive the use rates of clothes washers by looking at the type of clothes washers owned and the number of laundry loads washed per week, by age cohort. A logical correlation is seen in which younger households (as indicated by the age of the survey respondent) tend to have a higher number of residents, equating to a higher number of laundry loads per week and a higher proportion of front-load washers.

Table 4-7 Front-Load Clothes Washer Ownership and Use by Age Cohort

	25 TO 44 YEARS N = 124	45 TO 64 YEARS N = 610	65 OR OLDER N = 738
Average Persons / Household	4.3	3.2	2.1
Average Loads / Week	6.2	5.2	3.5
Front-Load Washers (%)	46.8%	32.2%	18.4%

4.5.3 Outdoor Water Use

Water may be used outdoors for a number of purpose including lawn watering and other landscape irrigation, filling of pools and hot tubs, washing vehicles and other miscellaneous uses. The customer survey included a number of questions on outdoor water use beginning with question 17 that asked the customer if they watered their lawn during the summer months (Table 4-8).

Table 4-8 Lawn Watering in the Summer Months (2009 and 2015)

Q17. DO YOU WATER YOUR LAWN IN THE SUMMER MONTHS?	2009 SURVEY	2015 SURVEY
Yes	41%	**37%**
No	59%	**63%**

Approximately 37% of customers indicated that they watered their lawn during the summer. This is a slightly lower percentage compared to the response to the same question asked in the 2009 survey, although the difference is within the confidence interval of the surveys so the change is not statistically significant.

When viewed by age cohort (Figure 4-8) it can be seen that less than one-third of younger families indicate that they water their lawn in the summer months.

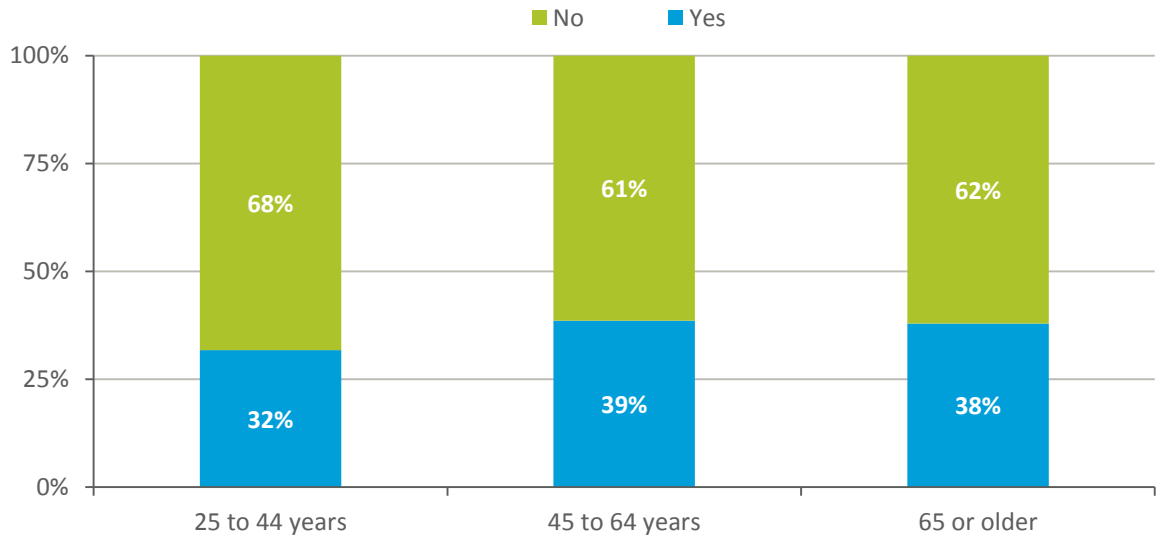


Figure 4-7 Lawn Watering in the Summer Months by Age Cohort

The responses to question 17 were also examined at the individual town level. At this high level of question regarding lawn watering (either a yes or no response) there is not a statistically significant level of difference, given the survey confidence intervals at the individual town level, between the proportions of households that water their lawn, as shown in Figure 4-9

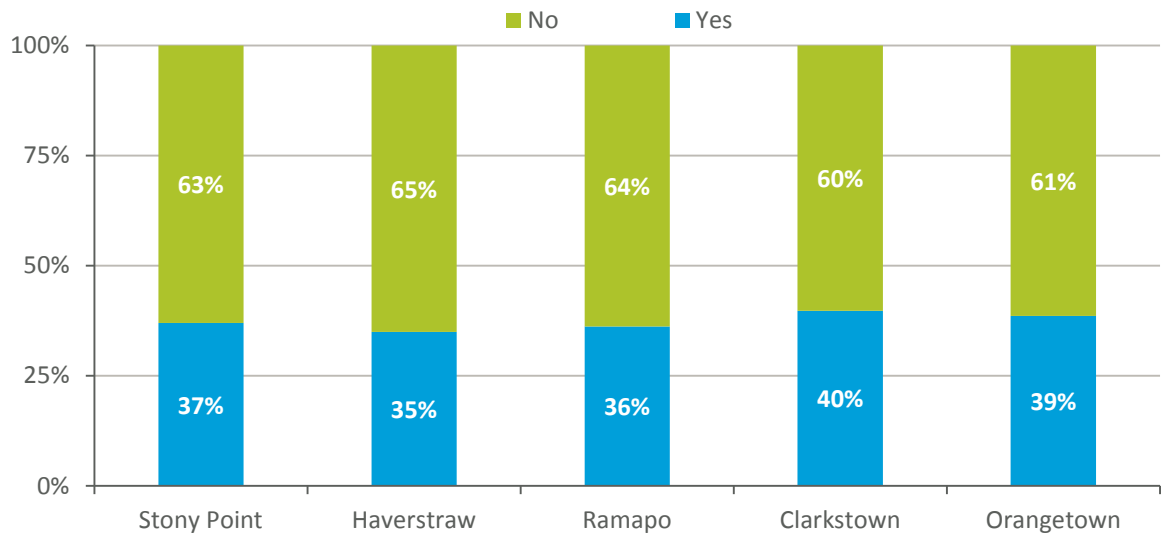


Figure 4-8 Lawn Watering in the Summer Months by Town

There are a number of factors that can influence the amount of water associated with lawn watering such as the frequency of watering (number of times per week), the amount of lawn irrigated, the irrigation equipment and associated application rates. Although these factors are determined primarily by customer behavior and preferences, they may be influenced through education and promotion of best practices. Some jurisdictions have passed local ordinances that place restrictions on residents outdoor water use practices. The purpose of the survey questions was to ascertain existing outdoor water use practices in order to determine potentially effective strategies that would result in more efficient use.

The reported frequency of lawn watering is shown in Figure 4-9. It should be noted that the confidence interval for this subset of survey data is lower than for the overall survey results as there are fewer respondents (569 in total) able to answer detailed questions on lawn watering, due to the fact that the majority of customers indicated that they do not water their lawn. The data were also reviewed at the individual town level, although no significant differences from the aggregate data were evident (see Appendix 7).

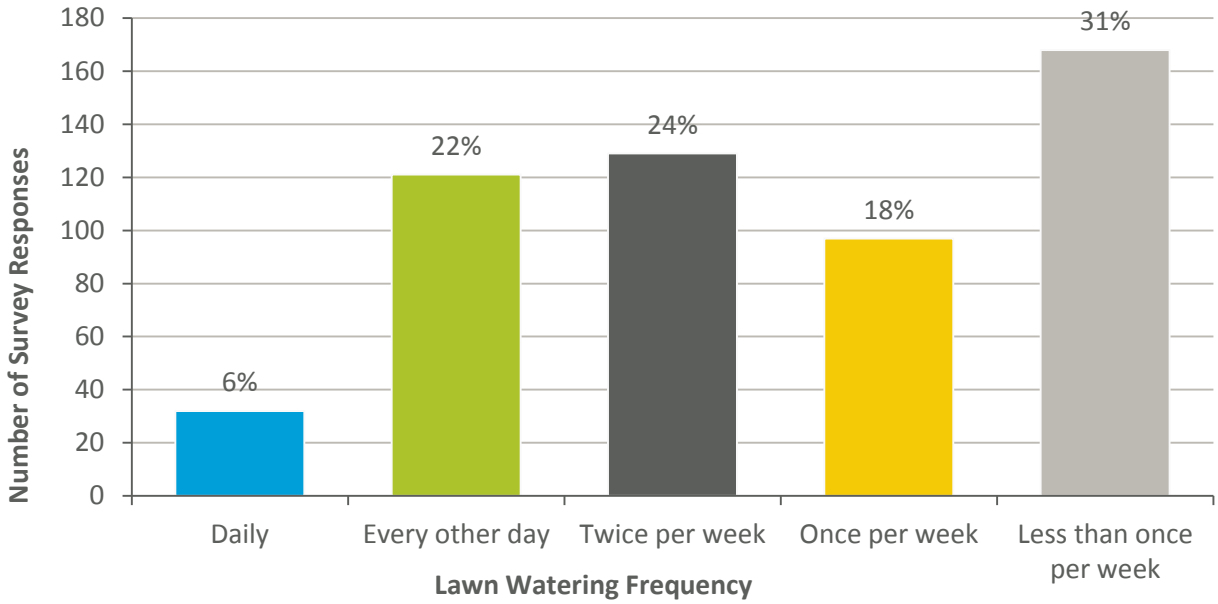


Figure 4-9 Reported Lawn Watering Frequency

In reviewing responses at the individual town level, some differences were noted in factors related to area irrigated (Question 22) and the type of watering equipment used (Question 24); these survey results are shown in Figure 4-11 and Figure 4-12 respectively.

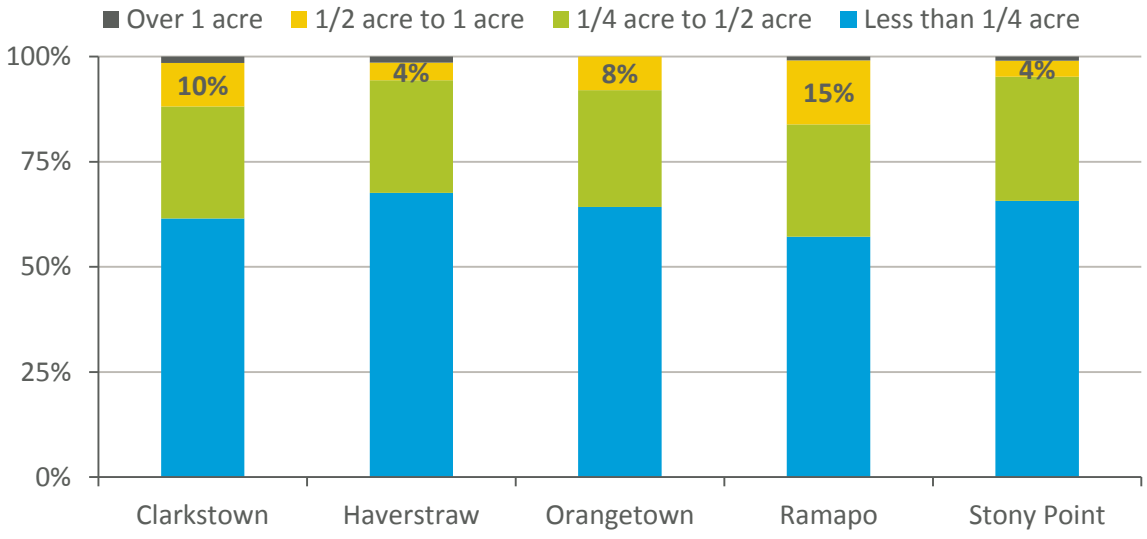


Figure 4-10 Reported Irrigated Acreage by Town

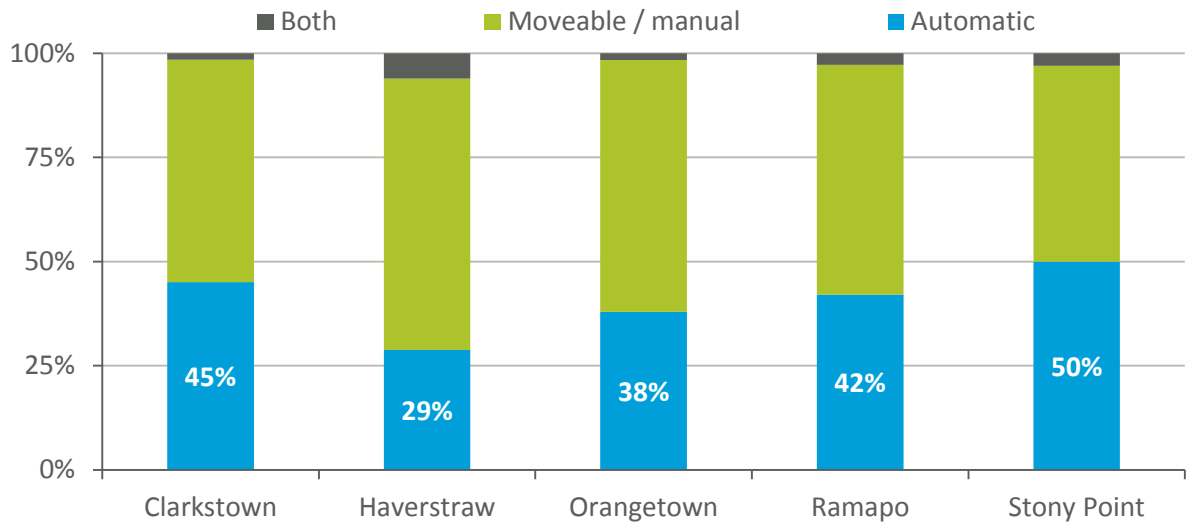


Figure 4-11 Reported Irrigation Equipment by Town

Survey question 27 asked whether it was the homeowner or a contractor who had the responsibility for setting the schedule on automatic sprinkler systems. Table 4-12 shows the answer to this question for both the recent survey and the 2009 survey that asked a similar question.

Table 4-9 Setting of Automatic Sprinkler Systems (2009 and 2015)

Q27. WHO SETS THE WATERING SCHEDULE FOR YOUR AUTOMATIC SPRINKLER SYSTEM?	2009 SURVEY	2015 SURVEY
Contractor	17%	38%
Self	83%	62%

It can be seen that between 2009 and 2015 more irrigation contractors have been given the responsibility for setting the schedule for automated sprinkler systems. It should be noted that as this question referenced a specific irrigation issue, only a relatively small subset (14%) of the total customers responding to the survey were able to answer this question, reducing the overall confidence interval for the findings. However, it does indicate that educational activities to support landscapers and irrigation contractors could prove effective.

SWNY implemented a lawn water guidance program in the early 1990s. Evapotranspiration is a program that uses scientific weather data to determine how much water the average lawn actually needs on any given day. Survey question 20 asked customers if they were aware of the ET notification program. Only 9% of respondents indicated that they were aware of the program which presents opportunities for enhanced communication and promotion, especially considering the response to question 19, in which 42% of respondents indicated that they would be interested in having the ET number emailed or sent to them via text message on a daily basis.

In addition to water used for lawn watering, swimming pools can require a significant quantity of water, depending on their size and how they are refilled each year. For example, a 21' (diameter) round pool of 4' depth will contain approximately 10,500 gallons of water.

Approximately 18% of respondents to the survey indicated that they had a pool (this included both in-ground and above-ground pools). Between the five towns, this value ranged from a low of 16% for both Clarkstown and Ramapo, to a high of 22% in Stony Point, although these differences are not statistically significant given the confidence intervals of the survey data.

In answer to question 43 regarding the refilling of swimming pools, only 5% of customers indicated that they drained the pool completely and refilled it in the spring, as shown in Table 4-10.

Table 4-10 Draining and Refilling Pools

Q43. DO YOU DRAIN THE POOL IN FALL AND REFILL IT IN THE SPRING?	2015 SURVEY
Yes, completely	5%
Yes, partially	31%
No	64%

Customers were asked about the frequency of other outdoor water uses and a summary of the results is shown in Figure 4-13. Given the generally infrequent rates of use indicated and relatively small volumes of water associated with these uses they will not be a focal area of the water conservation plan. In addition, it was reported through the survey that approximately 5% of customers have a rain barrel and 7% indicated that they had converted a portion of their lawn or garden area to xeriscape (drought tolerant) plantings.

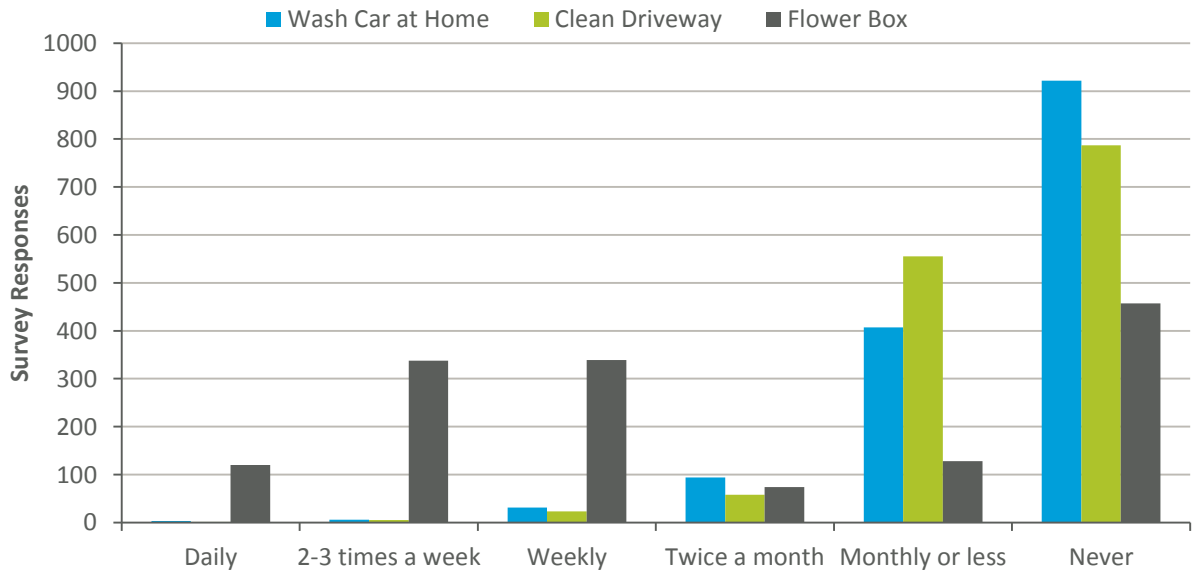


Figure 4-12 Frequency of Various Outdoor Water using Activities

4.5.4 Behavior and Perceptions

The December 2015 survey went beyond the scope of previous SWNY surveys by asking several questions about customer behavior, actions and perceptions related to water conservation. These questions were asked in order to help provide background and direction to the water conservation plan.

4.5.4.1 Customer Views on Rebates and Existing Water Rates

Customers were asked their opinion on SWNY's current summer / winter rate structure. The rates were designed to encourage water conservation in the summer months as rates are 1.5 times higher than during winter months. As shown in Figure 4-14, 50% of customers have an unfavorable or very unfavorable opinion of the current rate structure.

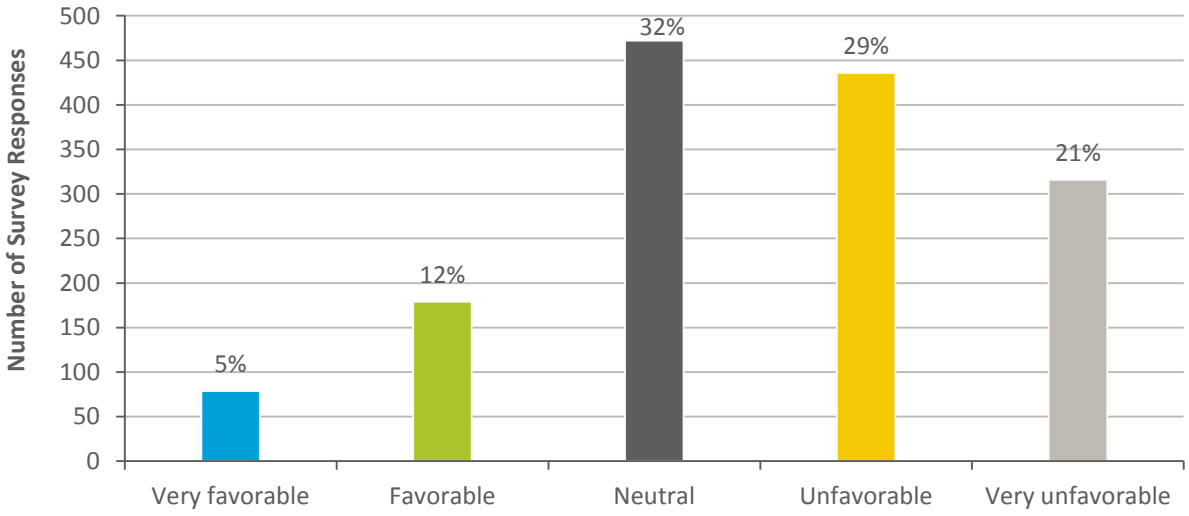


Figure 4-13 Opinion on Summer / Winter Rate Schedule

When asked how their behavior had changed in response to the summer / winter rate schedule only 11% of customers responded that they had changed their behavior quite a lot (Figure 4-15). However, because the rate schedule has been in place for over three decades the price signal may have become part of the 'background'. When implemented in 1980, a key feature of the rate design was a very high winter to summer rate differential; the intention was to achieve meaningful changes in water use quickly. The initial rate differential was 3:1, that is, water used during the summer period, defined as May 1 to August 31 was three times as expensive as water used during the winter period (October through April). The implementation of the rate structure at a 3:1 ratio appeared to reduce the summer peak, but generated complaints from customers and in the following year the ratio was reduced to 1.5:1 and has remained at that level since.

An additional view point gathered on this issue during the discussions with stakeholders was that the rate structure could be communicated more effectively through the customers' bills so that

customers are more aware of the higher per gallon price of water in the summer months.

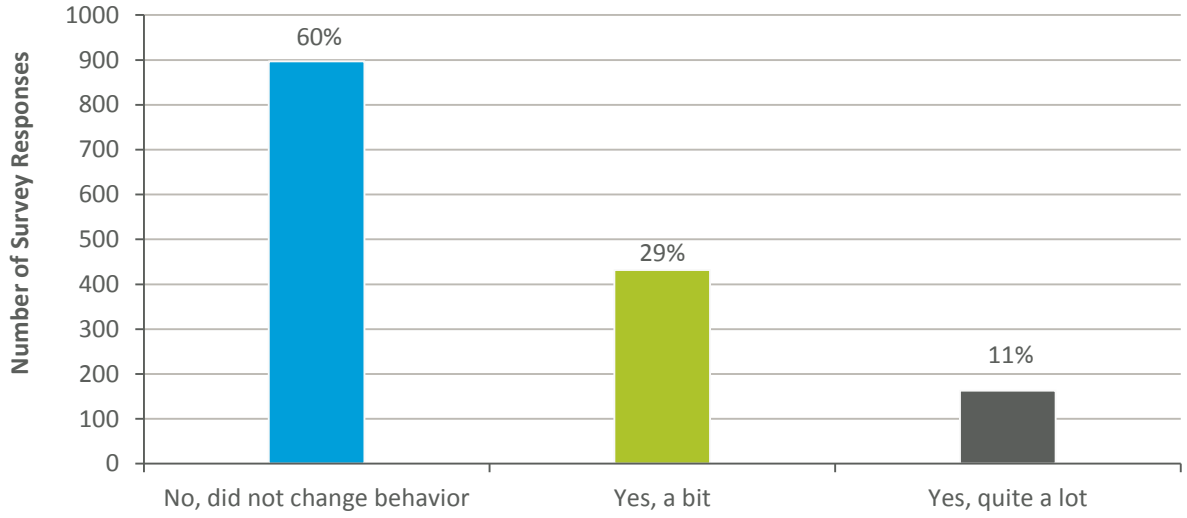


Figure 4-14 Have You Changed Behavior due to Summer / Winter Rates?

In looking ahead to potential implementation strategies for the water conservation plan, customers were asked how likely they would be to participate in a rebate program (Figure 4-16).

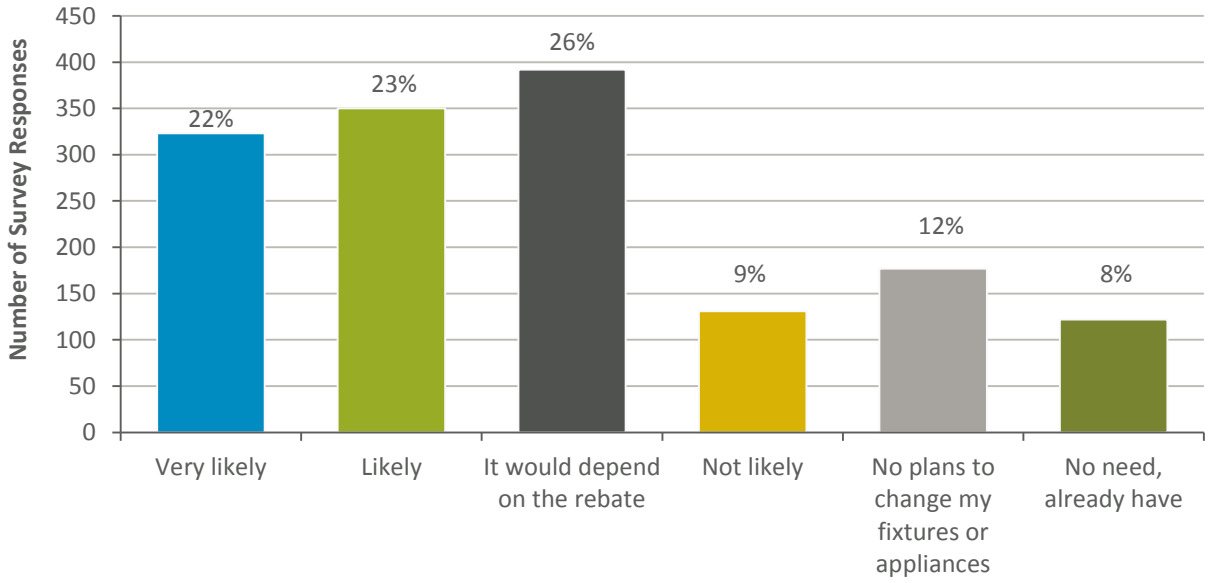


Figure 4-15 How Likely Would You Be to Participate in a Rebate Program?

The survey results indicate that 71% of customers have some level of interest in a rebate program. This finding is consistent with a review of previous surveys conducted for SWNY in which cost has been identified as an impediment to installation of more water efficient devices. The actual level of participation will be contingent upon the products offered, the dollar value of the rebates and any qualifying conditions for the rebate.

4.5.4.2 Customer Views on Conservation

To gain further insight into drivers of water conservation that could help shape the water conservation plan, customers were asked to provide the reasons why they conserve water (Figure 4-16).

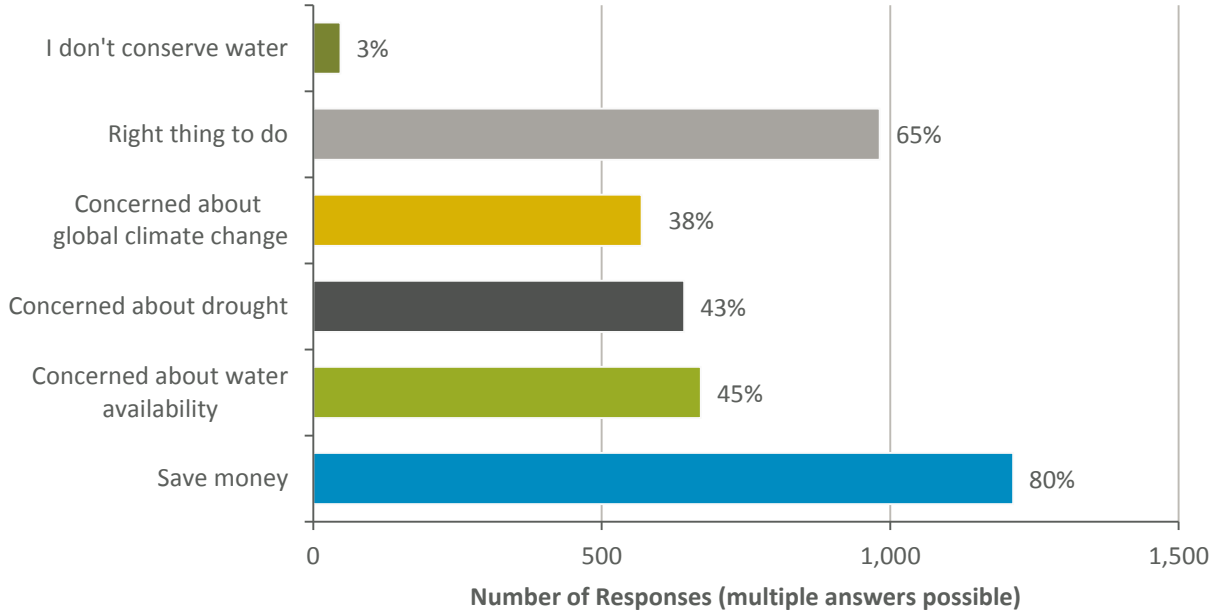


Figure 4-16 Why Do You Conserve Water in Your Home?

The most common reason for conserving water was to save money, with 80% of respondents listing this as one of their reasons. This suggests that a rate structure that provides customers with an incentive, and opportunity, to save water could be effective. Approximately two-thirds of customers responded that conserving water was the *right thing to do*. In light of this, a water conservation plan that promotes best practices and provides education to customers on how to save water, along with water saving case studies, may be well received by SWNY customers.

Customers were asked about actions they have taken to support water conservation as this helps to determine the level of engagement of SWNY customers. Customers were asked what actions they had taken in the past three years to conserve water; the results are shown in Figure 4-17

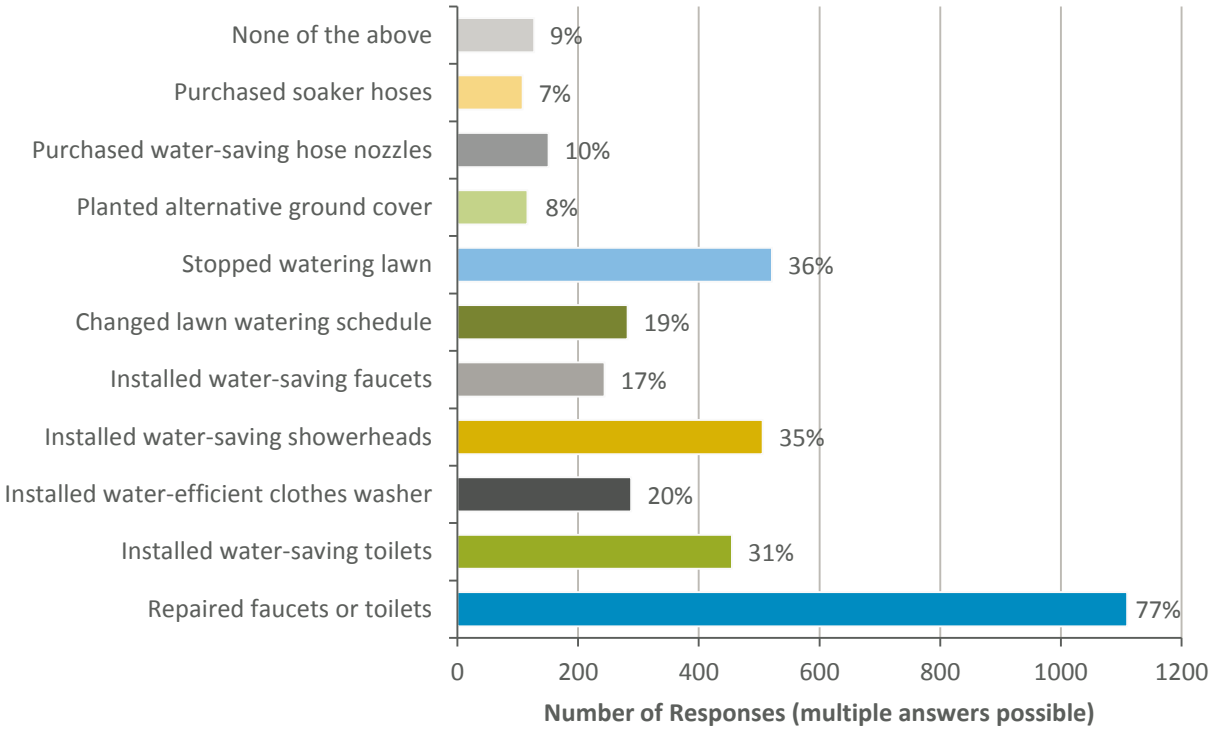


Figure 4-17 What Have You Done in the Past Three Years To Conserve Water?

The response rates reported in Figure 4-17 appear to be higher than expected. For example, if 35% of customers had installed a water-saving shower-head within the past three years this would represent a very high turnover rate, especially as the overall reported rate of low-flow shower head implementation is less than 50% (Table 4-5). A factor explaining the high response rates could be that it indicates that those responding to the survey were more interested in conservation and may have taken more actions in support of this, compared to the SWNY customer base as a whole, although this would not explain the showerhead data inconsistency as both data points come from the same set of respondents. Another explanation is that respondents did not limit their answers to actions taken within the past three years, but instead included any actions that they could remember taking at some point in time.

In order to gage potential acceptance of future water conservation actions and incentives, customers were asked to indicate if they thought they could do more to conserve water (Figure 4-18). Almost 50% of respondents indicated that they thought they could do a little more to conserve water. This opinion seems consistent with the findings in section 5 which indicate that overall per capita consumption is reflective of a level that suggests SWNY customers have already taken a number of steps towards increasing their water efficiency. Eleven percent of households indicated that they believe they could do a lot more and may be reflective of those in older homes (which are prevalent in the SWNY service area) which have not yet had their fixtures and fittings upgraded to more water efficient models. Thirteen percent indicated that they are not sure if they could do more to conserve and this suggests that more information could be provided to help them benchmark their water use against their peers, neighbors and good practice standards, such as through the

development of case studies. Approximately 30% of customers believe they are already doing what they can to conserve water.

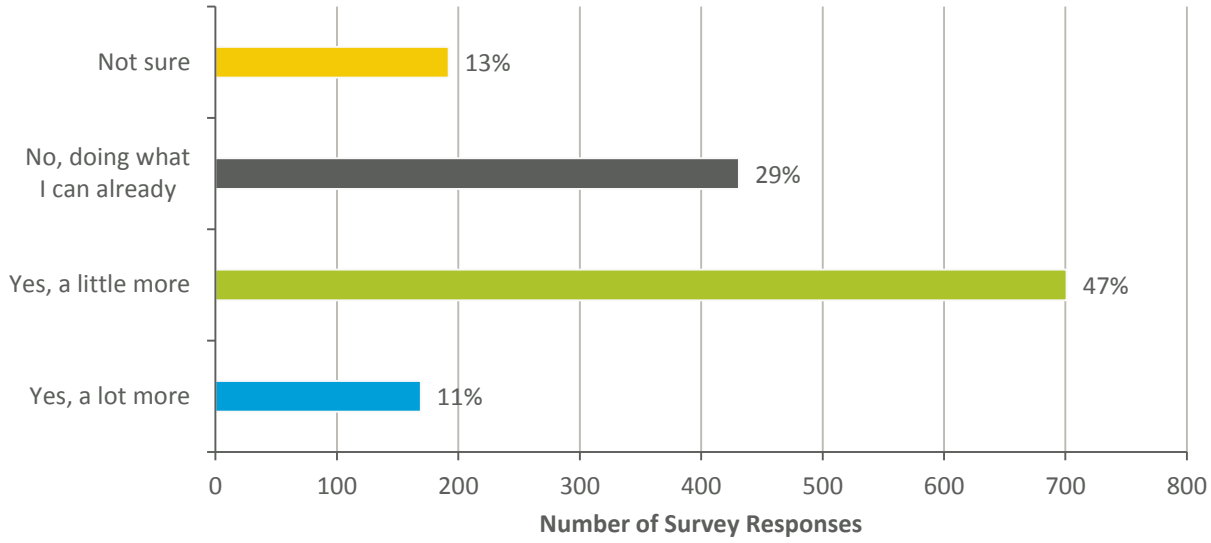


Figure 4-18 Do You Think You Can Do More to Conserve Water in Your Home?

4.5.5 Customer Comments

Over 350 respondents to the survey (23 percent) provided a written comment. These comments were reviewed and categorized for their relevance to water conservation planning. A summary of the nature of comments is listed below:

- Many customers provided specific examples of how they conserve water (e.g., take shorter showers);
- Many customers expressed discontent over the summer / winter rate schedule questioning why they should pay more if they don't use more. Many customers agreed with the principle that those who try to conserve should pay less and large users should be penalized;
- Many customers asked for educational materials on how to conserve water;
- Some positive comments on the customer survey as a tool to help understand customer water use and to support conservation in general;
- Some customers asked for more clarity in their bills so they can improve their understanding of their water use;
- There were concerns over bill amounts and several customers noted a preference for quarterly billing, noting that monthly billing requires more frequent postage etc.;
- Several customers noted that they do not have a computer (relevant for use of website and email versus bill inserts for communications).

4.6 SURVEY SUMMARY

The survey has provided greater insight into the characteristics of water use for SWNY single-family customers. It has provided valuable information on the existing efficiency of fixtures and appliances and customers' habits and perception of water conservation issues. Key survey findings are summarized below:

- Nearly three-quarters of toilets meet EPAct standards meaning that there remains some opportunity for replacing older units and increasing efficiency, however, to be most cost-effective, replacement programs would need to be targeted to customers with older toilets;
- Replacement of showerheads with more efficient models has the potential to generate significant savings if customers are receptive to lower-flow units;
- An increase in efficient clothes washers has been identified with efficiency levels possibly greater than the raw survey data suggests. Larger families appear to be choosing front-load devices at greater rates as larger families have greater potential for water and monetary savings;
- Lawn watering is practiced by less than 40% of SWNY customers according to the survey responses, although the specific patterns and approaches to lawn watering vary significantly;
- Customers believe that water conservation will save them money and that it is the right things to do and the majority report taking some form of action to increase their water conservation in the last three years;
- Customers are interested in rebate programs.

5 Benchmarking SWNY Residential Water Use

The single-family residential survey collected specific data at the individual household level to provide further insight into the current level of water use efficiency for SWNY customers. Water usage data from customers responding to the survey was combined with data on persons per household in order to generate a metric of water use efficiency. As noted in section 3, the metric of *gallons per capita per day (gpcd)* is an approach that is commonly used to make assessments of the level of water efficiency achieved by customers. However, it can be difficult to calculate accurately and meaningful comparisons are often difficult to make as the calculations may use assumptions or varying definitions.

Using the survey information it is possible to calculate reliable per capita consumption estimates for the 1,535 households that provided responses. Using the customer survey data, in conjunction with monthly water usage data an estimate of indoor and total water use in gallons per capita per day was calculated. Although the Waterwatch© analysis program allows the calculation of indoor water use, its primary benefit is to disaggregate water consumption into the individual end uses. However this does not include an estimate of leakage so this may under-estimate per capita use. To determine indoor water use, the winter baseline method was used, taking consumption data for January, February, and December of 2015, derived from monthly meter reads, as representative of exclusive indoor use. Separating indoor and outdoor water use makes the benchmarking of efficiency more meaningful, as outdoor water use varies regionally. Table 5-1 shows the calculated per capita values for SWNY and the five towns individually.

Table 5-1 Per Capita Consumption (Gallons per Capita per Day)

TOWN	INDOOR USE (GPCD)		TOTAL USE (GPCD)	
	AVG.	MEDIAN	AVG.	MEDIAN
Clarkstown	57.8	51.6	70.7	58.9
Haverstraw	54.4	49.9	59.8	54.4
Orangetown	54.8	50.4	66.3	55.2
Ramapo	54.1	48.0	62.6	55.5
Stony Point	54.6	48.1	69.6	58.1
All Survey Data	**55.2**	**49.6**	**66.2**	**56.3**

From Table 5-1 it can be seen that Clarkstown has the highest average per capita water use values for both indoor and total use. Stony Point also has a higher outdoor use. However, a more complex story underlies these measurements of central tendency, as within each town there can be significant variation in water use between customers. This is presented in more detail in Appendix 2 that shows variations in water use per capita through box and whisker plots. A key finding based on this analysis is that efforts to increase water efficiency will need to be targeted, perhaps at the neighborhood scale, as the level of variability is greater within each town than it is between towns. The data from the survey also provide a starting point for SWNY to investigate outlier water use data points. This can take the form of further data analysis and review, outreach to individual customers through customer service calls, and, if customers are willing, a more detailed review of

individual customer consumption patterns. These activities will increase the Company's understanding of water use by customers and provide an increased level of customer service.

The SWNY per capita data were compared to data published in 2011 in *Analysis of Water Use in New Single Family Homes*[17] in order to benchmark overall efficiency of SWNY customers. This publication examined water use from three categories of homes:

- Homes built in the early-to-mid 1990s
- Homes built after January 2001 and
- High-efficiency homes built to equal or exceed water use efficiency specifications very similar to those of the WaterSense program. This group also included a number of homes that were retro-fitted with similar high-efficiency fixtures and appliances.

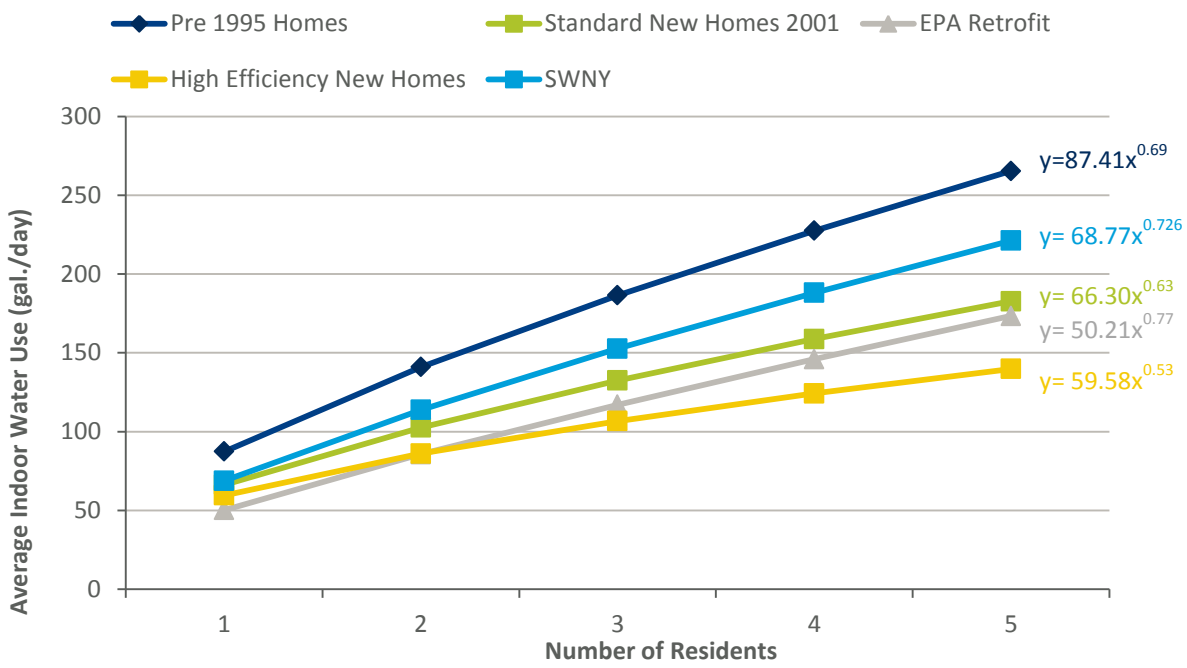
Although it is important to normalize indoor water use for single family residences on the basis of the number of persons living in the home it can also be instructive to view the nature of the relationship between indoor water use and the number of persons in the home as the relationship is not linear[18]. This information was published in the above referenced study and has been recreated in Figure 5-1 in order to allow a direct comparison against SWNY data. This graphic supports one of the key findings of the Single Family Homes report that states *there are clear and significant improvements in household water use in the newer and more efficient homes, compared to the baseline homes from pre-1995 period*.

Based on the high proportion of pre-1992 housing stock in the SWNY service area, it is notable that the SWNY curve has moved away from this benchmark and towards benchmarks associated with more efficient housing stock. A likely explanation is that individual customers have switched their fixtures and appliances to more efficient models as seen in the survey results presented in Section 4.

One interesting feature of the SWNY curve is that it appears to be more linear than the other curves. The data points suggest that SWNY homes with one or two residents are very efficient, approaching best practice standards. However, as the number of residents increase the efficiency levels appear to decrease which is somewhat unusual as, from a cost-effectiveness point of view, it generally benefits homes with higher occupancy to retrofit more efficient devices and it could be expected that these homes would be the ones with higher efficiency.

[17] Analysis of Water Use in New Single Family Homes, Prepared by William B. DeOreo of Aquacraft Water Engineering & Management for The Salt Lake City Corporation and the U.S. Environmental Protection Agency, 2011.

[18] Ibid.



All data (except SWNY) from: Analysis of Water Use in New Single Family Homes, Prepared by William B. DeOreo of Aquacraft Water Engineering & Management for The Salt Lake City Corporation and the U.S. Environmental Protection Agency, 2011

Figure 5-1 Indoor Water Use versus Number of Residents for Various Housing Stock

6 Conservation Program Evaluation & Development

Based on the analytical work described in Sections 3, 4 and 5, a Water Conservation Plan (hereinafter referred to as WCP, or the Plan) for SWNY will be developed based on the following findings and understanding:

- Per capita water use has declined, reflecting the increased water efficiency that has been achieved and can be furthered through more water efficient fixtures and appliances.
- Although it appears that water efficient products have penetrated the housing stock substantially and per capita use is comparatively low, there are targeted opportunities to increase the prevalence of water saving products.
- There appears to be a willingness and track record of customers embracing water conservation, both in terms of adopting water saving products and through education and best practice behaviors.
- Incentives, such as rebates for purchasing water saving products and price signals that encourage responsible water use could be effective for increasing water conservation.
- Single-family residential water use is the largest demand on the SWNY system but water conservation should and will be promoted and incentivized to all customer classes.

Based on this understanding, the proposed conservation program will be structured around the following interrelated components:

- Rebates and Incentives
- Outreach, education and audits
- Conservation-oriented rates
- Municipal ordinances
- Monitoring, reporting and plan adjustments as needed

6.1 REBATE PROGRAMS

Many water utilities have used rebate programs to incentivize the adoption of more water efficient products. This is also true of energy utilities with many having advanced customer engagement and incentive programs.

6.1.1 Example Rebate Programs

A rebate program can be an effective means of encouraging customers to replace older, less efficient water using products with newer, more efficient models. It also helps engage the company with its customers and gain a greater understanding of customer needs. Many water utilities have implemented rebate programs and numerous programs were reviewed as part of this study. A listing of water utilities and details of their rebate programs is shown in Appendix 8. As noted in section 4, the three largest areas of indoor residential water use are showers, toilets and clothes washers. It is therefore not surprising to see that these are among the qualifying products offered through many water utility rebate programs. There is also potential overlap beyond the single family residential sector as these products are found in many multi-family, commercial, institutional and industrial facilities, although the particular models may vary depending on the end use application. Based on a review of other rebate programs, the SWNY customer survey data and

general knowledge of the customer base, the products (by sector) identified in Table 6-1 were evaluated for potential inclusion in a SWNY rebate program.

Table 6-1 Rebate Programs Evaluated

ITEM	SECTOR		
	SINGLE-FAMILY	MULTI-FAMILY	COMMERCIAL / INSTITUTIONAL / INDUSTRIAL
Toilets	X	X	X
Showerheads	X	X	
Clothes Washers	X	X	
Urinals			X
Pre Rinse Spray Valves			X

6.1.2 Water Conservation Measures Studied and Not Recommended

A provisional analysis removed the measures that were inappropriate for further evaluation. For example, grey water usage requires specified treatment, storage, and specific types of irrigation to be used for landscape irrigation. This alternative incurs possible environmental health and regulatory issues and safety risks and also would be cost prohibitive. For these reasons, this measure was ruled out as an option.

Based on a preliminary review of potential costs and savings and the information available for SWNY customers, the following measures were deemed inappropriate for inclusion within the timescale of this Plan. However, this does not mean that they are not cost-effective or appropriate for specific customers. This assessment relates to the unique details of the overall SWNY system.

- Gray Water Recycling
- Rainwater Harvesting
- Turf replacement
- Geothermal Cooling

During the analysis of rain barrels (typically a 55 gallon capacity), it was determined that these items have limited potential to offset irrigation demand and compared to other water saving options they do not represent a cost effective approach to reducing water use. However, as part of an overall education and outreach program a small pilot program for distribution of rain barrels has been included as part of the conservation program.

6.1.3 Rebate Program Goals

Rebate programs are designed to incentivize customers to take an action that they would not otherwise have taken. In regard to water conservation incentives, rebates can work in the following ways:

- Accelerate the penetration rates of water efficient devices. For example, a customer uses the rebate to purchase a WaterSense toilet – something that they were not planning to do prior to the

rebate becoming available. Essentially this encourages the customer to 'act now', accelerating water conservation.

- Incentivize customers to purchase a more efficient version of a product. A customer may have been planning to purchase a clothes washer, but a rebate available for only the most efficient machines may encourage the customer to purchase a more water efficient model.
- Overcome reluctance to water efficiency. It should be acknowledged that there is an element of skepticism regarding water saving devices such as low flow shower heads. The low cost of shower heads and the performance improvements associated with the WaterSense-labeled products provides an opportunity for customers to try these products at little to no cost.

6.1.4 Rebate Program Evaluation

As part of this study the market penetration and potential for these products to reduce water demand was reviewed across all customer classes. In addition to customized modeling, a water conservation modeling framework developed for the Alliance for Water Efficiency, known as the Water Conservation Tracking Tool (v2.0), was used to support the program development. In order to evaluate the potential impact of a rebate program, a number of assumptions have to be made to drive the model. Some of the primary assumptions and important factors that drive the analysis are shown in Figure 6-1. The specific assumptions used in the analysis are documented in the report sections below and in the corresponding appendices. For each water saving product that was evaluated the key assumptions listed below were evaluated for each sector, as many of the assumptions varied by sector.

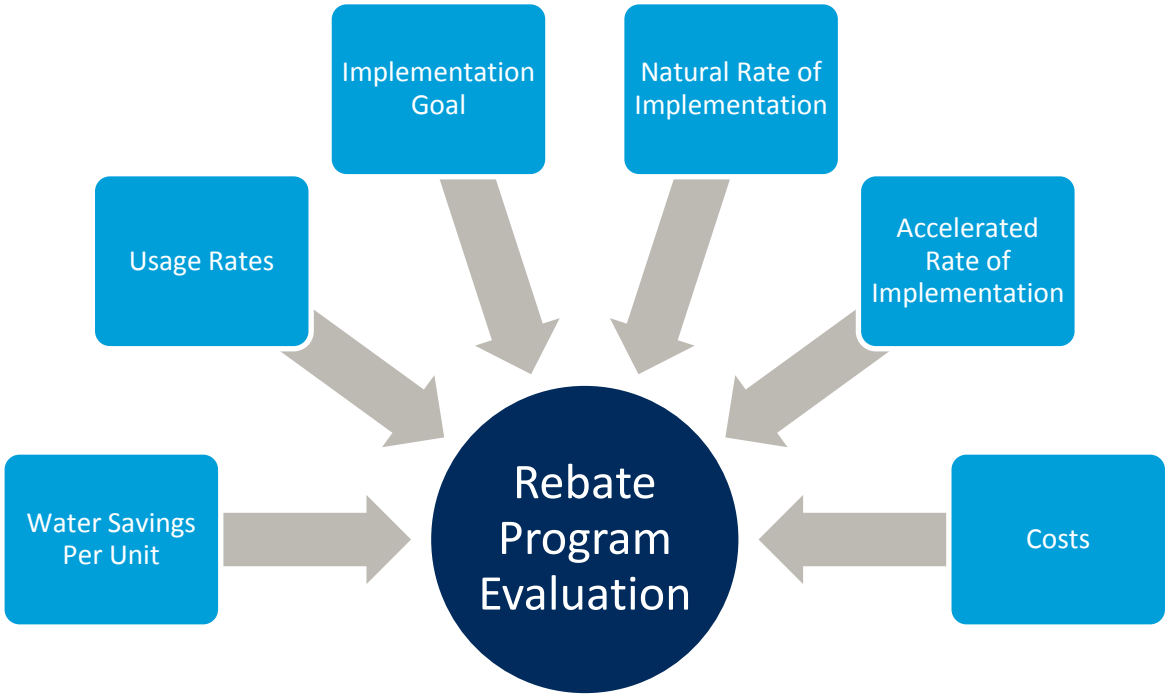


Figure 6-1 Key Assumptions Considered for each Rebate Program

6.1.5 Water Savings per Unit

For each proposed rebate item it was necessary to estimate the water savings per unit, for example, the water saved per toilet flush. In making these calculations it was necessary to consider criteria regarding qualifying conditions for the rebate. For example, the rebate may only be available for the purchase of a WaterSense-labeled toilet that replaces a pre-EPAct toilet, as this ensures a certain level of water savings per flush (replacing a post-EPAct toilet would decrease the saving potential).

6.1.6 Usage Rates

For the rebate evaluation a water savings per year was calculated for each item, by sector. This required estimating the usage rates associated with the rebate item. For toilets, this means calculating the estimated number of toilet flushes per year. This will vary by sector, as the usage rates are a function of (amongst other variables) the number of people in a home, or a commercial, institutional or industrial facility.

6.1.7 Implementation Goal

To quantify the overall water-saving impact of a rebate program it is necessary to forecast the number of products that will be implemented in a given time period. For the purposes of the conservation program development, a five-year forecast period was considered; with plan implementation and activity expected to begin in 2017 and continuing through 2021. In comparison to estimating water savings per unit and usage rates, there is a higher level of uncertainty associated with projecting estimations of the number of units that will be installed. This is because of the following factors:

- It is a forecast of future activity which implies inherent uncertainty
- It requires a prediction of a behavioral response to a financial incentive (i.e., the rebate)

As is common with many rebate incentive programs, upper limits will need to be established for the number of rebates available in order to constrain program costs. The number of units installed will be a function of both the natural and accelerated rates of implementation and it is important to understand both aspects.

6.1.7.1 Natural Rate of Implementation

It is widely acknowledged that water efficiency has improved as older, less efficient water using products are replaced with newer, more-efficient versions. Plumbing codes and the marketplace in general are driving this trend. One of the challenges in developing a rebate program is to understand the natural rate of these trends in order to determine how these rates can be increased in order to stimulate additional water conservation. The results of the customer survey help to establish estimated natural rates of implementation for single-family customers. In the absence of more specific data, these rates can be applied to, and / or adjusted, for other sectors. Water savings attributable to the natural rate of implementation are also known as *passive savings*.

6.1.7.2 Accelerated Rate of Implementation

Once the expected natural rates of implementation have been calculated, the accelerated rate of implementation attributable to the rebate program incentive can be estimated. The purpose of a rebate is to prompt an action by a customer that would not otherwise have been taken in the

timeframe being evaluated. Water savings from a rebate program in excess of passive savings are known as *active savings*. Differentiating between passive and active savings is necessary to accurately assess the cost-effectiveness of a rebate program. By acknowledging there is a natural rate of implementation, it implies that some customers would have purchased the water-saving product anyway and if they also take advantage of the financial incentive provided via the rebate, then then the program has incurred a cost (the value of the rebate), without providing an additional water savings (as the action would have been taken anyway). In the AWE Conservation Tracking Tool and other studies[19], these customers are known as *free riders*.

6.1.8 Costs

The rebate program costs are primarily driven by individual rebate values (e.g., $75 per toilet) and the level of expected rebate redemption. For the purposes of program evaluation it has been assumed that if a customer makes a qualifying purchase then they will take advantage of the rebate offer, although it is possible that some will implement changes and choose not to participate in the rebate program. Administrative costs for rebate redemption and processing has also been considered as part of the overall rebate (and conservation) program costs. However, for the purpose of comparing the cost-effectiveness of individual rebate programs against one another, administrative costs have not been included.

6.1.9 Rebate Program Overview

Detailed rebate program assumptions are documented in Appendix 9. These assumptions support the development of the proposed rebate programs that are summarized in Table 6-2.

Table 6-2 Rebate Program Summary

	SINGLE-FAMILY RESIDENTIAL			MULTI-FAMILY RESIDENTIAL			COMMERCIAL, INSTITUTIONAL & INDUSTRIAL		
	$ Rebate	Number of Units	MGD saving 2021	$ Rebate	Number of Units	MGD saving 2021	$ Rebate	Number of Units	MGD saving 2021
Toilets	$ 75.00	15,000	0.23	$ 75.00	5,000	0.17	$ 75.00	3,750	0.29
Shower-heads	$ 15.00	15,000	0.08	$ 15.00	7,500	0.08			
Clothes Washers	$ 100.00	2,250	0.03	$ 100.00	500	0.03			
Urinals	N/A			N/A			$ 75.00	1,500	0.05
Pre Rinse Spray Valves							$ 50.00	1,000	0.08

[19] Chandra, Ambarish and Gulati, Sumeet and Kandlikar, Milind, Green Drivers or Free Riders? An Analysis of Tax Rebates for Hybrid Vehicles (January 20, 2010). Journal of Environmental Economics and Management, Vol. 60, No. 2, 2010. Available at SSRN: http://ssrn.com/abstract=1348808

6.2 CONSERVATION PROGRAM IMPLEMENTATION

The SWNY conservation program is driven in large part by the rebate incentive component, but there are a number of other aspects that are important for the success of the overall program.

6.2.1 Toilets

The SWNY survey data indicated that approximately 26% of currently installed toilets in single-family residential homes are pre EPAct standards and have an average flush volume of 3.66 gallons. Considering the single-family customer base as a whole, this indicates that there are approximately 43,000 toilets that could potentially be replaced with WaterSense toilets which have an average flush of 1.28 gallons, or less[20]. Although the survey data indicate that the majority of toilets are already EPAct compliant, replacing the remaining non EPAct toilets with WaterSense-labeled toilets could reduce the volume per flush by over 60%. A rebate program for toilets was evaluated for all sectors of SWNY customers. It is expected that rebates on WaterSense toilets will be attractive to residential customers as a review of previous SWNY survey data noted that almost 50% of residents indicated that cost was a factor that prevented them from installing a more water efficient toilet. The effectiveness of lower flush volume toilets has increased since their introduction over two decades ago, in addition to meeting efficiency standards, WaterSense labeled products also have to meet minimal performance standards, so customer satisfaction with these devices is expected to be high.

A review of the current market for toilets as sold in large retail home improvement outlets and online, indicates that WaterSense labeled toilets currently dominate the market with more WaterSense labeled models available compared to non-WaterSense labeled models.

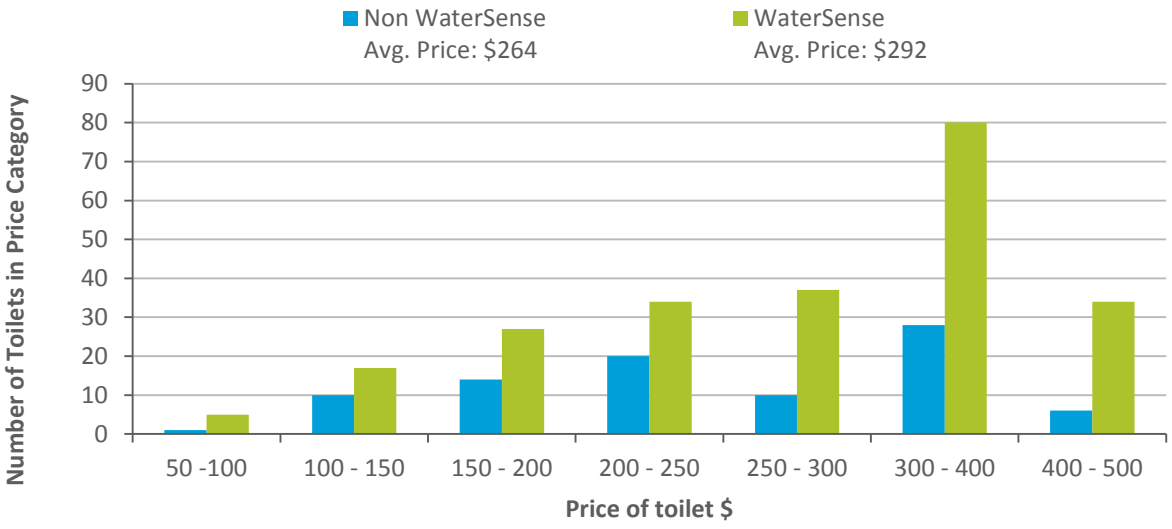


Figure 6-2 Pricing and Availability of Residential Toilets Sold at a Large Home Improvement Store (Jan 2016)

Market-based research carried out for this study found that, according to popular retail websites and evidenced in stores, WaterSense toilets were often the best-selling units, indicating that these

[20] http://www3.epa.gov/watersense/docs/Revised%20HET%20specification_V1%202_060214_final508d.pdf

are popular products among consumers. Both single flush and dual flush WaterSense toilets are available and both will be eligible for rebates. Over 200 WaterSense toilet models were available (not including color variations) with an average price premium of less than $30. Based on market research the lowest price of a WaterSense labeled toilet was $74. The proposed rebate value for the purchase of a WaterSense labeled toilet is $75. Other toilet rebate programs were reviewed and this level of rebate was found to be common (with rebate values ranging from $50 - $100 per toilet). A limit of up to two WaterSense toilets per customer account would apply to the single-family toilet rebate program.

Due to the relatively high penetration rates of EPAct compliant toilets, rebate eligibility will need to be restricted to those customers replacing a non-EPAct compliant toilet. This will ensure that significant savings will be achieved and that the overall program will meet benefit/cost expectations. Other rebate programs reviewed for this study recognize and require the same constraint. Measures available to ensure this condition is met include self-certification through the rebate redemption process and in some cases the customer also has to consent to an inspection of the property to verify purchase and installation of the qualifying fixture. For the SWNY program additional steps are proposed to help with implementation such as obtaining real estate data to help identify homes that are most likely to be eligible for rebates. This includes obtaining data on the following:

- **The year a property was built.** Customers in homes built after 1994 would not be eligible for the rebate.
- **Date the property was last sold.** On the basis that bathroom renovations often shortly occur before or after a home is sold, identifying homes that have not sold since 1994 may be a way to focus in on homes more likely to still have inefficient fixtures.

This type of data is generally available through public records, although it may be easier to obtain (purchase) via a third-party company such as First American and CoreLogic. These companies, amongst others, are aggregators and resellers of the data. As part of the education and outreach effort that is planned within the conservation program, SWNY will look to work with realtors to make them aware of the rebate for replacement of older fixtures and fittings as this incentive could be attractive for the buyer or seller of the property, as new fixtures raise the overall appeal of the property. Another approach under consideration is to provide additional support to low-income customers. Customers applying for SWNY's existing low-income support program could be provided with promotional material on the rebate program. In some cases, it could be cost-effective to provide additional incentives for these customers. For example, scenarios where the number of residents per household is high and the number of bathrooms is low provide highly cost effective conditions for water efficient fixture replacement; this information could be gathered during the low-income qualification process. The SUEZ Cares program provides up to $100 of relief for qualifying residential customers and since 2014, SUEZ Cares has helped approximately 200 low income families. SUEZ also partnered with HomeServe, beginning in March 2016, to provide low income customers with assistance to fix broken water fixtures in their homes. Both these programs could potentially be adapted to include rebates or other incentives to implement water efficient devices which would have the added benefit of providing ongoing savings to the customer through reduced water bills.

SWNY currently offers dye tablets to customers as an inexpensive and effective way to help them identify a leaking toilet. Toilets may leak when the flapper valve fails to form a tight seal against the valve seat, which allows water to leak from the tank into the bowl. The rate of leakage may be too small to notice with the naked eye so coloring the water in the toilet tank with the dye provides a means of indicating a leak as colored water will trickle into the toilet bowl. In order to stimulate uptake of the rebates, SWNY will raise awareness of leaking toilets and will actively promote and distribute dye tablets that help customers identify a leaking toilet. Where older toilets are found to be leaking, customers will be encouraged to take advantage of the rebate offer and replace the toilet. Those customers with a leaking toilet that do not take advantage of the rebate offer will be provided with advice on how to repair their toilet.

6.2.2 Showerheads

The SWNY survey data indicated that approximately 49% of showerheads are low-flow units, 24% are not low-flow units and 27% of showerheads were of unknown efficiency standards. For the purposes of this study, a low-flow showerhead is assumed to have a flow rate of 2.5gpm. WaterSense units are available on the market and to qualify for a WaterSense label they must demonstrate that they use no more than 2.0gpm. The WaterSense label also ensures that these products provide a satisfactory shower that is equal to or better than conventional showerheads on the market[21].

A review of the current market for showerheads as sold in large retail home improvement outlets and online, indicates that WaterSense branded shower-heads are available but are not market leaders with an estimated 10-20% of readily available showerheads carrying the WaterSense label. This marks a contrast with WaterSense toilets which currently dominate the market. There is therefore an opportunity for increased water efficiency through incentivizing consumers to adopt these products. Based on a review of the current market for WaterSense showerheads, a typical price of a unit is in the $25-40 range but models are available for as little as $15. A rebate will be offered for a WaterSense labeled shower-head with the proposed value of the rebate at $15. This provides SWNY with an opportunity to source showerheads directly from a manufacturer in bulk and provide them as a direct give away to customers, although this would limit the choice of available models to customers. For customers that prefer to select their own WaterSense showerhead, a rebate application would be required with up to $15 available towards the cost. A limit of up to two WaterSense showerheads per customer account would apply to the single-family showerhead rebate program.

In addition to water saving benefits, low-flow showerheads also provide energy saving benefits as less water has to be heated. This makes low-flow showerheads a particularly compelling item to promote through a SWNY and Orange and Rockland (O&R) energy utility collaboration (see section X). If both companies promote the water and energy saving potential this will help send a unified message of efficiency to utility customers.

Showerheads are easy to install and work on a universal fitting. As such, it is expected that most residential consumers will not require a plumber to install the showerhead and this lessens the

[21] http://www3.epa.gov/watersense/products/showerheads.html

barriers to implementation. SWNY also plans to use its website to direct customers towards 'how-to' guides that will provide guidance for consumers on how to install a showerhead. This could be through collaboration with local stakeholders, developing specific content, or it could direct customers to existing resources from established content providers such as www.thisoldhouse.com or other readily available online installation guides.

In addition to incentivizing low-flow showerhead uptake via rebates, SWNY will also be developing educational content on cost savings for the consumer associated with switching to more efficient showerheads and also more efficient shower habits.

6.2.3 Clothes Washers

The SWNY Survey data indicates that approximately 26% of clothes washers are front-load washers, 73% are top-load washers and 1% of single-family residential customers do not have a clothes washer. A prior SWNY survey in 2009 indicated that 16% of residents had a front-load washer at that time, which provides an overall indication of the increased market penetration of the typically more efficient front-load washers.

A review of the current market for clothes washers indicates that there are currently no WaterSense labeled models available. However the ENERGY STAR program features a water use component that is measured through a Water Factor (WF) that specifies the gallons of water use per cubic foot of laundry and so allows a comparison between washers of different sizes. The most water efficient models on the market are Consortium for Energy Efficiency (CEE) Tier 2 and Tier 3 washers which have WFs of 4.5 gallons and 4.0 gallons respectively (Table 6-3).

Table 6-3 Rebate Program Summary

SPECIFICATION	WATER FACTOR	GALLONS PER 4CU FT LAUNDRY LOAD
Federal Standard	9.5	38
ENERGY STAR®	6	24
CEE Tier I	6	24
CEE TIER II	4.5	18
CEE TIER III	4	16

A review of available clothes washers as sold in large retail home improvement outlets and online noted approximately 50 washer models with a Tier 2/Tier 3 rating and 50 models with a Tier 1 rating (or not CEE rated). Excluding washers over $1,000, there is an average price premium of $200 for the Tier2/Tier3 machines (figure 6-3).

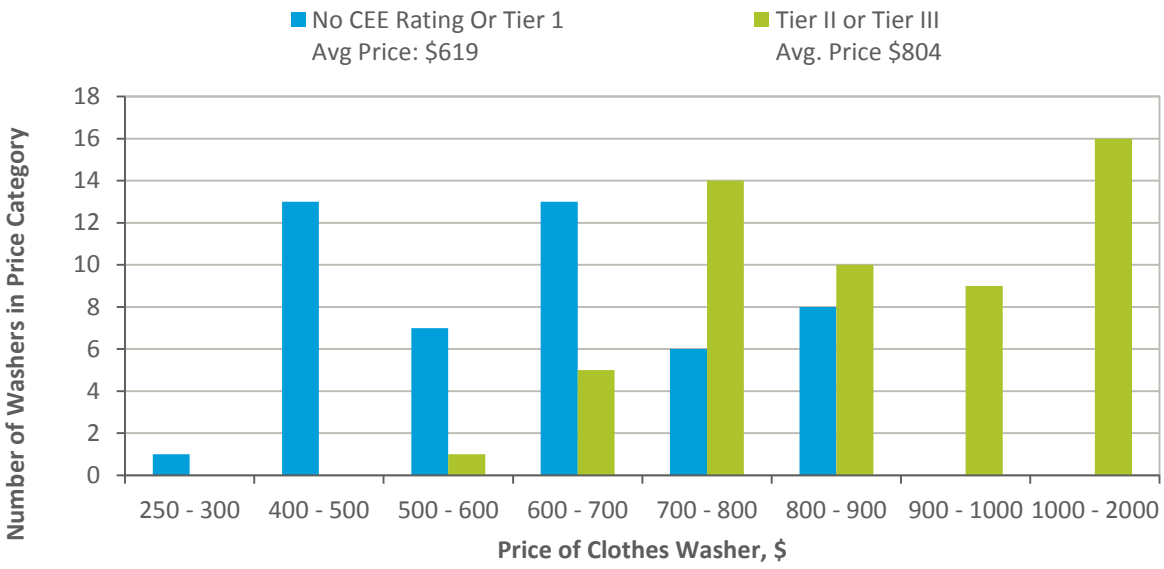


Figure 6-3 Pricing and Availability of Clothes Washers sold at a Large Home Improvement Store (Jan 2016)

Although clothes washers are significant water using appliances and the most efficient models have substantial water saving potential, the benefit/cost (B/C) ratio is not as attractive as other water efficiency options when considering the average household. For households that do have a higher than average number of laundry loads the B/C ratio will improve but accurately identifying and verifying these households is expected to be a challenge. For this reason a limited number of clothes washer rebates are proposed within the overall plan. Recognizing that water saved by switching to more efficient clothes washer will also result in energy savings, SWNY plans to work with O&R to fully evaluate the joint water and energy saving potential which may result in a joint rebate offering and reevaluation of the B/C ratio for clothes washers.

6.2.4 Urinals

WaterSense labeled urinals offer potential for water savings in commercial, institutional and industrial facilities as they use no more than 0.5 gallons per flush (gpf). While the current EPAct standard for urinals is 1.0 gpf, some older urinals may use up to 5.0 gpf[22]. A review of water efficiency rebate programs run by other utilities shows that rebates for WaterSense urinals are a part of many CII (Commercial, Institutional, and Industrial) focused programs. Due to the high variability of water use at CII facilities, eligibility for urinal rebates will be assessed on a case-by-case basis. Specifically for urinals, the number of male staff and visitors at a CII facility will be a key consideration that will drive the cost benefit assessment.

6.2.5 Pre-Rinse Spray Heads

Pre-rinse spray heads are ubiquitous in restaurants and other food-service establishments. They are used by kitchen staff to remove food particles prior to the cookware or dishes being washed by hand or in a dishwasher. Typically, both hot and cold water supply lines feed the spray head, and the user can adjust the mixed water temperature exiting the spray head. Low-flow, high efficiency

[22] http://www3.epa.gov/watersense/products/urinals.html

pre-rinse spray heads are available, including WaterSense labeled models. These produce a fan-like spray pattern that removes the food particles just as effectively as standard heads. These high-efficiency heads generally have a much lower flow rate than standard models. Replacing old heads with this type saves water and energy by reducing the gas or electric energy required to heat the water.

Water and energy saving data from a California study[23] is shown below in Table 6-4.

Table 6-4 Water and Energy Savings from Retrofitted Pre-Rinse Spray Valves

ESTABLISHMENT SIZE	HOURS USED PER DAY	WATER SAVINGS/ SPRAY HEAD (GAL/DAY)	GAS SAVINGS/ SPRAY HEAD* (THERMS/DAY)
Medium	6	300	2.0
Small	4	200	1.3
Very Small	2	100	0.7

6.2.6 Rebate Administration

Rebate administration is an important element of the rebate program and overall plan implementation. It includes the process through which the customer applies for and redeems the rebate and the process in which the company verifies and processes the rebate application. The rebate administration process is a point of engagement between the company and the customer. The customer will be looking for a process that is straight-forward and transparent and the company will want an efficient process that provides sufficient assurance that the rebate eligibility requirements have been met.

A review of water conservation rebate programs indicates that the majority of programs use a paper-based application process. Typically, a rebate application form is downloaded from the utility website, completed by the customer and sent back to the utility along with any documentation such as a receipt confirming the purchase of an eligible product. Listed below are some of the typical criteria and conditions that are noted in water efficiency rebate programs:

- Only utility customers with an account in good standing are eligible
- Eligibility criteria for the product (e.g., toilet being replaced must have a minimum of 3.5gpf).
- Rebate is offered on a first-come, first-served basis and subject to availability of funds
- If you are installing fixtures yourself, please remember the utility is not responsible for the condition of the plumbing on the customer's side of the meter
- Rebates may appear as a credit on the customer's utility bill, or as a rebate check issued to the customer
- Rebates may be limited per customer (per account)

[23] Evaluation, Measurement & Verification Report for the CUWCC Pre-Rinse Spray Head Distribution Program, May 2004.

- Submit a dated and itemized original receipt along with the appropriate completed rebate application form.
- Participants may need to verify purchase and installation of qualifying fixture(s)
- Utility reserves the right to alter this program at any time.
- Utility is not responsible for any damage that may occur to applicant's property as a result of removing the old fixture or installing the new fixture under this offer.
- Utility is not responsible for any local permits that may be required. .

6.2.6.1 Orange & Rockland Collaboration

In February 2016, O&R rolled out a new website (www.myorustore.com) that is focused on incentivizing customers to purchase energy efficient products. The website serves as an eCommerce platform (or Marketplace) and currently offers smart thermostats for sale to O&R customers; customers who purchase a smart thermostat through the website can get an instant rebate that lowers the cost of the device.

This program is currently being run as a demonstration project through the New York PSC's Reforming the Energy Vision (REV) program. There are many appealing aspects of this energy focused program that are applicable for water efficiency and could be replicated for SWNY. However, SWNY and O&R have collaborated on several outreach programs previously and are investigating a potential collaboration through the Marketplace concept. There are several aspects of a collaborative program that would be compelling:

- Strengthens the water-energy connection in the minds of customers
- Sends a unified message of efficiency to utility customers
- Creates potential for home efficiency kit (showerhead, LED bulbs etc.)
- Potential model for other utility collaborations

An advantage of an online Marketplace for water efficient products would be a simplified process for rebate redemption for the customer through a web-based interface. Customers would be able to choose from a selection of approved water-efficient devices and will be able to apply a rebate at the point of sale. This makes rebate redemption simpler and less cumbersome for the customer.

The web-based rebate administration program will also provide a robust means of tracking and accounting for rebate redemption. Customers will go through a process of validation to ensure that they are SWNY customers; the Marketplace will also be able to appropriately limit the number of rebates per customer. Such a process would also obviate the need for the customer to mail a copy of their receipt and rebate application and wait for the reimbursement. The online transaction would confirm the purchase of the water efficient device directly. The process may also eliminate the possibility of fraud that exists with mail-in rebate programs, such as the duplication of receipts.

However, recognizing that this is a novel and innovative approach, there are also challenges to be addressed. As noted in section 6.2.1, the single-family toilet rebate program will need to be restricted to eligible customers (i.e., those replacing a pre EPAct standard toilet) and it is planned to reach out to potentially eligible customers directly (based on housing age etc.,). Therefore, a

Marketplace approach would require some pre-screening of customers to determine eligibility. Alternatively, as is common with many water utility rebate programs, a good faith approach could be adopted whereby customers declare that their purchase meets the eligibility requirements.

For multi-family and CII sectors, SWNY plans to work directly with these customers and determine eligibility for rebates on a case-by-case basis by working directly with the property owner and, if applicable, the facility manager. Site visits and individualized water audits will be performed to establish rebate eligibility (see sections 7.7.1 and 7.7.2). When working with multi-family and CII customers, it is likely that multiple fixtures will be replaced and therefore there will be no specific limit set for rebate quantities for these customers (other than the overall maximum established for the sector); the number of eligible fixtures per facility will be determined by the audit process.

Working with building managers offers some economies of scale and will help to ensure that water efficient devices are effectively installed. These accounts also offer significant potential for water use monitoring and case study development. For example, if 25-50 toilets and shower-heads are replaced at one-time in a multi-family property, this should provide a significant water saving that can be monitored through water consumption data and should provide valuable information for a case study that could be documented, publicized and promoted to provide an incentive for others to participate in the rebate offering.

7 Outreach, Education & Audits

In addition to a significant rebate component, the SWNY water conservation plan will enhance outreach and education efforts and include water audits for some customers. This section of the report describes some of the specific outreach and educational materials that will be developed for each target audience. Listed below are communication mechanisms that will be used to help disseminate the messages:

- **Bill Inserts.** Bill inserts are a good way to reach all customers and the transition to monthly billing for all customers allows for timely messages to be communicated, such as specific advice and reminders as customers enter the irrigation season
- **SUEZ Website (www.mysuezwater.com).** A new website launched in 2015 allows for more targeted and relevant content to be provided to customers. For example, the website technology will be able to identify the general region that the visitor is from and serve applicable content.
- **Email.** Email can provide a flexible and low cost means of communication to customers and will be used to provide timely updates on water conservation. However, SWNY is typical within the water industry in only having 10-20% of its customers' email addresses.
- **Social Media.** Social media accounts such as Twitter and Facebook will be used to publicize and promote the water conservation plan. As with email, not all SWNY customers have these accounts, but the flexibility of social media means timely messages and updates can be communicated quickly and at low cost and these messages are likely to reach more customers over time.

7.1 WATER CONSERVATION COORDINATOR

As part of the Plan, a SWNY will be developing a Water Conservation Coordinator position that will be dedicated to the overall administration of the conservation program. This position will have responsibility for the implementation of the various components of the plan and would be the main point of contact for stakeholders in the program. This position would also be involved in education and outreach efforts, case study development and program evaluation and reporting. This position will also be involved in developing recommendations for program modifications.

7.2 REBATE PROGRAM OUTREACH

Customers may be notified of the rebate program via bill inserts and through digital media including the SUEZ website. The full conditions of the rebate programs, including eligibility criteria will be provided on the SUEZ website along with a link to the online Marketplace, or a link to rebate application forms (if this approach is used instead of the Marketplace). The type of promotional material that would be developed for SWNY is included in Appendix 10 using an example from another water utility rebate program.

Annual monitoring of the rebate redemption volume will be conducted and more aggressive programs can be developed to promote the rebates if needed. For example, housing data can be used to identify customers that are more likely to have older fixtures and targeted promotions can be directed to those customers. This could also include distribution of dye tablets to help customers test for leaking toilets that could be replaced using the rebate.

7.3 CUSTOMER BEST PRACTICES & EDUCATION

The single-family customer survey indicated that, after monetary savings, customers conserved water because it was the right thing to do. Therefore, providing customers with educational information and water conservation tips may be effective as there appears to be a strong stewardship ethic amongst customers and an interest in following best practices.

7.3.1 Landscape Irrigation

As part of the Plan, the existing SWNY evapotranspiration (ET) notification program will be revised and relaunched. SWNY will work with local experts, for example the Cornell Cooperative Extension, to develop a best practice approach and educational materials for outdoor irrigation, with an emphasis on lawn watering practices. The approach will be designed to balance lawn care with responsible water use. The program is likely to transition from daily notifications to weekly notifications and use the SUEZ website, social media and other electronic communication to reach customers. The program will be designed specifically for SWNY customers and will utilize local and timely data to provide information to SWNY customers and other county residents. Factors that will be considered within the revised program will include the following:

- **Native Landscaping.** The program will consider native plants and grasses for Rockland County.
- **Conservation Gardens.** Previously known as xeriscape landscaping, this can replace turf grasses with low-water-use grasses, wildflowers and both native and drought tolerant plants.
- **Drip Irrigation.** Also called micro-irrigation, uses tubing to apply a slow trickle of water directly to the soil. Gravity and capillary action pull water to the plants roots reducing water lost to evaporation. Drip can be a more efficient way to water trees, shrubs, flower beds, ground cover and borders and can also reduce run off and plant disease resulting from over-watering[24].
- **Rain Sensors.** These devices shut off a system during a rainstorm, preventing unnecessary watering.
- **Moisture Sensors / Smart Irrigation Controllers.** The WaterSense program has endorsed some irrigation controllers which act like a thermostat for your sprinkler system telling it when to turn on and off and may use local weather conditions to tailor water schedules to actual conditions on the site[25]. SWNY has investigated and undertaken a pilot program using these types of units.
- **Landscape Water Budgets.** Landscape water audits can help develop appropriate water budgets for individual customers.
- **Landscape Contractors.** Training and certification program are available for landscape professionals through organizations such as the Irrigation Association (www.irrigation.org). The irrigation Association (IA) offers certifications that allow irrigation contractors, landscape / turf irrigation designers and golf and landscape irrigation auditor to become EPA WaterSense Partners. SWNY will work with landscape contractors to promote and encourage certification

[24] http://www.rainbird.com/documents/corporate/iuow/iuow_homeownerwhitepaper.pdf

[25] https://www3.epa.gov/watersense/products/controltech.html

and educate customers that they may want to consider using a landscape contractor with these credentials.

7.3.1.1 Water Wise Landscaping (BOCES)

The Task Force is launching an educational course on Water Wise Landscaping at Rockland BOCES. The course is modeled after Westchester County Community College's "Go Native U" program, adapted to promote water conservation efforts for Rockland County residents. SWNY is providing a free outdoor water conservation kit for attendees as well as a tour of the Lake DeForest Water Treatment Plant facilities. The class will show participants how to design and use water saving projects around their homes and businesses. Projects to be studied include: rain gardens, rain barrels, disconnected downspouts, pervious pavement, drip irrigation, native plants and sustainable landscaping methods that promote soil and water conservation. Students will learn how to plant and maintain ecological landscapes which not only help conserve water and provide food and habitat for wildlife, but also increase the aesthetic beauty of a property.

7.4 CASE STUDIES

As the conservation program proceeds, it is anticipated that case studies will be developed for all customer classes based on real data obtained from SWNY customers who have replaced fixtures through the rebate program. These case studies will publicize the water and monetary savings that have been achieved, including a calculation of the payback period. The case studies will be promoted to help customers make an informed decision on whether the switch to more water efficient products makes sense for them. It is anticipated that the case study data and verification will be developed through the annual monitoring and additional customer surveys that are planned as part of the conservation program. Customers will be invited to contribute to the case study development, but all data used will be anonymous.

7.5 COLLABORATION WITH ORANGE & ROCKLAND

In addition to developing a shared Marketplace to promote and sell water and energy efficient products, SWNY and O&R will continue to expand and develop partnerships in following areas to drive the water-energy nexus message:

- **Social Media.** Cross promote residential conservation tips on social media sites such as Facebook and Twitter (and bill inserts as appropriate).
- **Water Audits.** Explore ways to collaboratively reach out to commercial, institutional and industrial customers to provide education and audits to improve water and energy efficiency. Partnering on audits will be more efficient than providing a separate water and energy audit.
- **Small Business Education.** Small businesses often don't have the internal resources to stay informed on the latest approaches in water and energy efficiency. SWNY and O&R will continue to partner with RBA and REDC to provide assistance to small businesses.
- **School Outreach.** SUEZ currently conducts free educational programs for schools by providing curricula for Kindergarten through 8th grade students. These outreach efforts are based upon the lesson plans developed by Project Water Education for Teachers (WET) Foundation. There may be opportunities to include an energy component or establish joint educational sessions with contributions from O&R (water-energy nexus). In collaboration with the NY Department of Environmental Conservation, the company recently sponsored a workshop designed to help

teachers develop water-related lesson plans. More workshops will be planned as part of this outreach effort.

7.6 SUEZ WEBSITE.

The SUEZ website was relaunched in 2015 and has the capability to provide relevant local content to customers. This means that visitors originating from the SWNY service area can be reminded of the water conservation resources, such as the rebate program, available specific to their region. As part of the water conservation program a number of website resources will be developed:

- **Water Conservation Tips.** Water conservation tips will be added to the SUEZ website. This type of content can be frequently updated to keep it fresh and relevant to the time of year.
- **Water Conservation Resources.** Many water conservation resources exist online and can be linked from the SUEZ website. Examples include the WaterSense program and links to water use calculators that would help customers develop a basic estimate of their use or potential ways to save water, for example:
  - http://www.home-water-works.org/calculator
  - http://wateruseitwisely.com/100-ways-to-conserve/home-water-audit/
  - http://www.h2ouse.org/
- **Case Studies.** Case studies developed from actual SWNY customer data will be promoted on the website. The website can also be used to invite customers to contribute their data or share their experience
- **Water Use Information.** The analysis performed during the development of the water conservation plan and presented in this report has provided more insight into customer water use. As appropriate, this information can be shared via the website to help customers benchmark their use against their peers and benchmarks of efficient water use.

In the longer term, outside of the scope of the water conservation plan, the website will continue to be developed to provide a fully customized experience through the customer portal. The full scope of this upgrade has not been finalized yet but it is expected to include a more interactive customer experience such as capability to view water usage profiles, compare to benchmarks and to allow calculations of potential water conservation savings. Furthermore, the implementation of AMI will allow the Company to receive alerts on unusual water use and to report information to the customer (e.g., to address a leak).

7.7 CUSTOMER AUDITS

Customer audits can be an effective means of identifying opportunities for water efficiency improvements and providing customers with education on this topic. It is also an opportunity for SWNY to gain a better understanding of how customers use water and to become familiar with issues important to them. Individual water audits can be costly, but a targeted approach can make them cost-effective.

7.7.1 Multi-Family Audits

Although the planned rebate program for multi-family customers offers the same fixtures and appliances as the program for single-family customers, there will be a difference in the approach

recognizing that many residents of multi-family properties are renters and property owners and building managers will typically be involved in the decision to retrofit multi-family units.

SWNY plans to develop a simple contact form that will be directed to multi-family account contacts with the purpose of establishing interest and potential eligibility for participation in the program. This contact form will be sent out with multi-family bills in the initial year of the program and will include the following general questions:

- Number of units / dwellings
- Occupancy rates
- Building Age (if not already obtained from other data sources)
- Plumbing age / remodel status and year
- Laundry set up (common area versus in unit)
- Interest in rebates
- Appropriate contact for follow up

For multi-family units with common area laundry facilities there may be high potential for a cost effective replacement of clothes washers. Estimated savings, provided in further detail in the Appendix 9, have been developed using a published case study[26]. Water savings related to commercial laundries, often referred to as "On Premise Laundries" (OPLs), or industrial laundries, may also be identified during CII audits (see section 7.7.2). A study conducted in 2006, noted that many OPLs are operated much the same today as 50 years ago, with little change, and virtually no conservation innovation[27]. Without more detailed information from the multi-family and CII sector in this area, it is hard to estimate the full potential from this area of water use, but it is anticipated that numerous multi-family and CII customers, such as dedicated laundromats facilities and hotels, nursing homes and other care related facilities, will have high volume laundry equipment that could be replaced with more efficient equipment. Some facilities may use washer-extractor and tunnel washers which are very high volume washing units. These units are often highly specialized and very expensive and a replacement incentive is likely to be beyond the budget of the proposed rebate program, however the audits within these facilities will likely increase the knowledge regarding these units which may be applicable for future studies and programs.

7.7.2 CII Audits

It is widely recognized that benchmarking commercial, institutional and industrial (CII) water use efficiency is extremely difficult because there are few metrics that can be used consistently to analyze and compare water demand[28]. This provides a challenge for implementing CII audits as without a benchmark of efficiency it is not clear how to prioritize effort. As part of the Plan, SWNY will provide water audits to CII customers with a preliminary budget designed to accommodate up to 125 two-day audits. This is an approximate figure as audits may vary depending on the size of the facility being audited. The planned approach assumes that generally larger facilities will be prioritized, in the absence of other information, on the basis that this is where opportunities for

[26] https://www.energystar.gov/ia/products/appliances/clotheswash/508_ColesvilleTowers.pdf

[27] Riesenberger, James. "PBMP – Commercial Laundry Facilities" (Koeller and Company, 2006)

[28] Frost, D., Sversvold, D., Wilcut, E,. & Keen, D.J. Journal AWWA 108:3:64 March 2016

water savings may be found. Although there are approximately 4,500 CII facilities in the SWNY service area, an audit of the largest 125 water using facilities would account for over 60% of the total water use by CII customers.

The CII water audit program will focus on common water using fixtures that are expected to be found in the majority of CII facilities such as toilets, urinals, showerheads and pre-rinse spray valves. As such the program is expected to have a broad appeal and relevance for a wide variety of customers in the CII category. The audits will also provide an opportunity to engage with facility owners, gain a better understanding of water use within the sector and look for water saving opportunities in areas beyond the current scope of the Plan. Rebate eligibility will be determined on a case-by-case basis for this sector. It is important to note that water consumption evaluations for toilets and urinals should consider not just the fixtures themselves, but include a usage calculation based on occupancy of the building and the amount of visitor traffic. For example in some settings (where the frequency of use is high driven by employees or visitors), it may make sense to replace a 1.0 gpf urinal with a WaterSense model that uses 0.5 gpf. In other cases it may not make sense to replace a 1.5 gpf urinal, because the frequency of use is low, and water and cost savings do not justify the replacement.

Other water using fixtures and appliances, beyond those specifically identified in the Plan, could be justified for replacement through the audit program. For example, in some settings, commercial dishwashers, clothes washers, aerators and ice makers may warrant replacement; if a reasonable benefit/cost ratio is estimated for the customer and SWNY (in line with overall program goals), then it would make sense to offer an incentive to replace these items. In a joint collaboration with O&R, cooling systems that use both water and energy could also be investigated for replacement.

Within the CII water audit process, the following aspects will be included:

- **Water Use Analysis.** Major water uses within the facility will be identified in coordination with building owners and facility managers. This will also include assessment of rates of use for the common water using fixtures identified as eligible for rebates. In many cases this will be driven by the number of employees and visitors within a facility.
- **Water Balance.** Where possible, estimated end uses of water within the facility can be compared to metered consumption. This will check the overall understanding of water uses within the facility and can also be used to identify possible unidentified leaks.
- **Equipment and fixture inventory.** This will help to identify potential equipment and fixtures that are below current high efficiency standards (e.g., WaterSense specification) and can be used to assess potential for replacement.
- **Summary of Savings Potential.** An evaluation will be made on water use at the facility and the identification of potential water-saving changes to fixtures or processes.
- **Development of Case Studies.** If the audit shows water saving potential and the customer wishes to move ahead with installation of water efficient equipment, there may be an opportunity to turn the project into a case study, subject to the customer's willingness to participate.

It is anticipated that the CII audit program will expand on an initiative already under development by SWNY. At the request of the Task Force, SWNY conducted an audit of fixtures of Rockland County's government offices in Pomona, New City and at the Rockland County Community College. The audit involved testing of toilets, urinals, sinks and showers to estimate their performance relative to WaterSense standards. Company personnel are continuing to review the results of this work with Rockland County Facilities Management Division. The results will be provided to the County to help them develop their conservation plan and will be used as input to development of the final SWNY audit program.

The CII audit program does not include a promotion of sensor activated (touchless) flushing mechanisms. In recent years, the devices have become more prevalent in common area restrooms, primarily driven by the concern for health and hygiene, as fixtures do not need to be touched to initiate a flush. There has been debate over the impact of these controls and one study[29] concluded that the installation of sensor-activated flushing mechanisms resulted in a significant increase in water use. This issue will be investigated further as opportunities arise during the CII audit process.

A preliminary review of SWNY CII customer data, in conjunction with discussions with the Rockland Business Association (RBA) and the Rockland Economic Development Corporation (REDC), has identified the following potential sub-sectors that may be prioritized in the CII audit program. The estimation of the number of accounts in the sections 7.7.2.1 – 7.7.2.3 should be considered preliminary as there is no clear attribute within the SWNY customer data to identify these facilities. A text-based matching approach within the customer name field was used to develop these preliminary findings.

7.7.2.1 Schools

A preliminary data review estimates the SWNY billing data contains approximately 80 schools (of varying sizes). These facilities use water and could be good candidates for water efficiency audits. It is anticipated that the audits will identify water saving potential which could be incentivized through the planned rebate offerings. In addition, this program will connect to educational aspects of the overall Plan by expanding the current SWNY schools program that has been established in conjunction with the Project WET Foundation (Water Education for Teachers). One example could be to develop material to support a math curriculum that has students estimate and calculate water savings associated with the change out to efficient fixtures and fittings retrofitted to their school building. This program could be expanded further through collaboration with O&R to associate the energy efficiency opportunities that exist within school facilities and to highlight the combined water and energy savings of some equipment changes (e.g., showerheads).

7.7.2.2 Hospitals, Healthcare and Assisted Living Facilities

A preliminary data review estimates the SWNY billing data contains approximately 100 facilities in this category. A review of the Top 100 Employers in Rockland County also identified several facilities in this category[30] although further scrutiny will be needed to confirm they are SWNY customers. If water efficiency audits for these types of facilities identify common water use issues

[29] http://www.map-testing.com/assets/files/Sensor-operated%20Fixtures%20Final%20Report%20March%202010.pdf

[30] http://www.redc.org/new/images/photos/Top_Employers_in_Rockland_County_Feb_2012.pdf

and potential for savings, information will be developed (such as fact sheets) containing sector-specific and regionally relevant information.

7.7.2.3 Hotels and Restaurants

A preliminary data review estimates the SWNY billing data contains approximately 75 hotels and / or restaurants (of varying sizes), although this is likely to be an under-estimation due to the limits of identifying these types of facilities using text matching. This sector has already been well studied with regard to water efficiency savings potential and a number of resources are available. For example, New York City recently published water efficiency guides for restaurant managers[31] and hotel managers[32] and other similar guidance is readily available. It is anticipated that developing and publishing case studies for these facilities using Rockland County data will help promote best practice and encourage water conservation.

7.7.3 Water Efficiency Stewardship

Many businesses, especially larger ones, have a sustainability strategy that includes water management. Typically, the goal of these strategies is to increase water efficiency and reduce operational water use. Cost savings may drive the strategy, but some companies have embraced the concept of water stewardship which involves managing a company's own water use in the context of the broader needs of the community.

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings. It promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health, including water savings. While this practice is not currently developed within most water conservation plans, it is considered best practice in the green-building industry. To help raise awareness of best practices, SWNY will work with the RBA Green Council to consider giving out annual awards to recognize exceptional achievement in water conservation.

7.7.4 Residential Outdoor Water Audits

The data analysis indicates that although system-wide SWNY outdoor water use appears to be below the national average, use is high for some customers. Water audits can be used to help customers better understand their use and identify areas for potential savings. The SWNY Plan includes a phased approach for helping customers complete a water audit.

- Provide a printed (or online) audit for customers to complete on their own
- Hire an outside contractor to conduct the onsite surveys

The options above are listed in order of increasing cost and SWNY will begin with the self-completed survey and evaluate its effectiveness before moving to more costly approaches. Key goals of outdoor water audits are to determine reasonable use and educate the customer on best

[31] http://www.nyc.gov/html/dep/pdf/conservation/restaurant-managers-guide-to-water-efficiency.pdf

[32] http://www.nyc.gov/html/dep/pdf/conservation/housekeeping-booklet.pdf

practices, such as the setting of an irrigation controller so that the lawn is efficiently watered and not overwatered.

Customers may be selected by reviewing consumption data to identify significant outdoor water use. One of the most important factors in selecting whom to audit is finding the highest-use residences within a community and to work with these customers first. Customer-use databases are sufficient to identify these users and enable the service to be targeted to provide the largest savings to the customer and the utility. The customer survey data collected several points of information regarding lawn watering, such as area irrigated, watering equipment, presence of rain sensors etc. This information has been reviewed and can also be used to help prioritize and customize outreach efforts and potential lawn watering audits.

At the level of individual onsite landscape audits, the auditor will also be able to advise these customers on how to utilize their sprinkler systems more efficiently, how to repair them, and how better to apply the sprinkler heads for the specific needs of their individual landscapes. Distribution uniformity could also be analyzed and reviewed in order to evaluate the amount of water needed as well as the sprinkler setting efficiency to provide an even distribution of water across the landscape. This program calculates the water balance for a specific landscape setup and will estimate the uniformity to allow the landscape to be watered properly and to stay healthy. As water use is decreased from overuse to efficient use, this service will become more and more critical to ensure that customers keep their landscape healthy. In some cases, it will be found that overwatering has adversely affected the health of the landscape. In those instances, it will be necessary to convert the lawn slowly from overwatering to efficient watering in order to reduce any negative impact on the plants.

Landscape professionals may be concerned that they will be negatively affected by this program. In fact, the opposite will be true. This program promotes increased use of technology and professional irrigation services to complement the services provided by SWNY. SWNY may also contract some of the outdoor audits to professional irrigators. An outdoor residential water audit would consist of the following:

- Check irrigation system and timers
- Measure currently landscaped area
- Measure total irrigable area
- Review or develop customer irrigation schedule in minutes of watering time per week for spring, summer, and fall
- Provide a rain shut-off device (optional)

Customers will be provided with survey evaluation results and water savings recommendations and will be given an information packet. SWNY will track surveys offered, surveys completed, survey results, and survey costs.

8 Ordinances

As a private water utility, SWNY cannot impose water use regulations and ordinances on the community served. However, in developing this Plan, SWNY has provided support to the Task Force to identify potential municipal or county level regulations and ordinances that may reduce water use.

8.1 POTENTIAL ORDINANCES

A number of potential ordinances were reviewed that apply to both indoor and outdoor water uses. There are many different types of potential water ordinances and four were reviewed in detail:

- **Water Waste Ordinances:** Typically these ordinances address poor practices such as allowing water to escape from the owner's property due to broken sprinkler heads or automatic sprinkler systems that are not set up correctly. They may also restrict or prohibit washing of driveways, sidewalks and other impervious surfaces. Some water waste ordinances require a rain sensor on automated sprinkler systems to ensure that watering does not occur during rain events.
- **Irrigation Ordinances.** These typically dictate the time of day and frequency per week of watering. These types of ordinances often have variances for establishing new lawns. One important aspect of these ordinances is that if lawn watering is restricted to certain days of the week it should be implemented so as not to exacerbate peak water use. In some cases, lawn irrigation is allowed on the same day as trash pickup, which balances demand across the system and also helps residents remember the watering schedule and reduces confusion.
- **Retrofit on Resale Ordinances.** These direct property owners to replace inefficient fixtures and fittings at the time of sale.
- **New Construction Standards.** Require highly water efficient fixtures and fittings – above and beyond standard plumbing codes. For example, Texas, Georgia and Colorado have passed statewide building codes that restrict the sale of plumbing products to WaterSense certified products. New York City, Miami-Dade County, Chicago and other jurisdictions have modified local plumbing codes to require that fixtures and fittings meet WaterSense specifications.

8.1.1 Irrigation Ordinance

A review of the potential types of ordinances indicated that irrigation related ordinances may complement the SWNY rebate program that is focused on indoor water use. As many irrigation ordinances limit the frequency of watering (number of times per week) an analysis of outdoor water use, using data provided by the single-family customer surveys, was performed to provide an indication of how frequency of watering correlated with the quantity of water used for SWNY customers. The results of this analysis are shown in figure 8-1.

This indicates that, based on the median data point for each watering frequency, the volume of water used outdoors decreases as the frequency of watering decreases. This is a logical relationship, however it should be noted that in addition to frequency of watering, there are several other variables that may influence the volume of water used such as:

- Irrigated area
- Type of watering equipment (automatic vs manual sprinklers)

- Duration of watering (minutes per zone or area)

However, these factors are generally not addressed in most irrigation ordinances and so the analysis focused on factors that could be influenced by an ordinance.

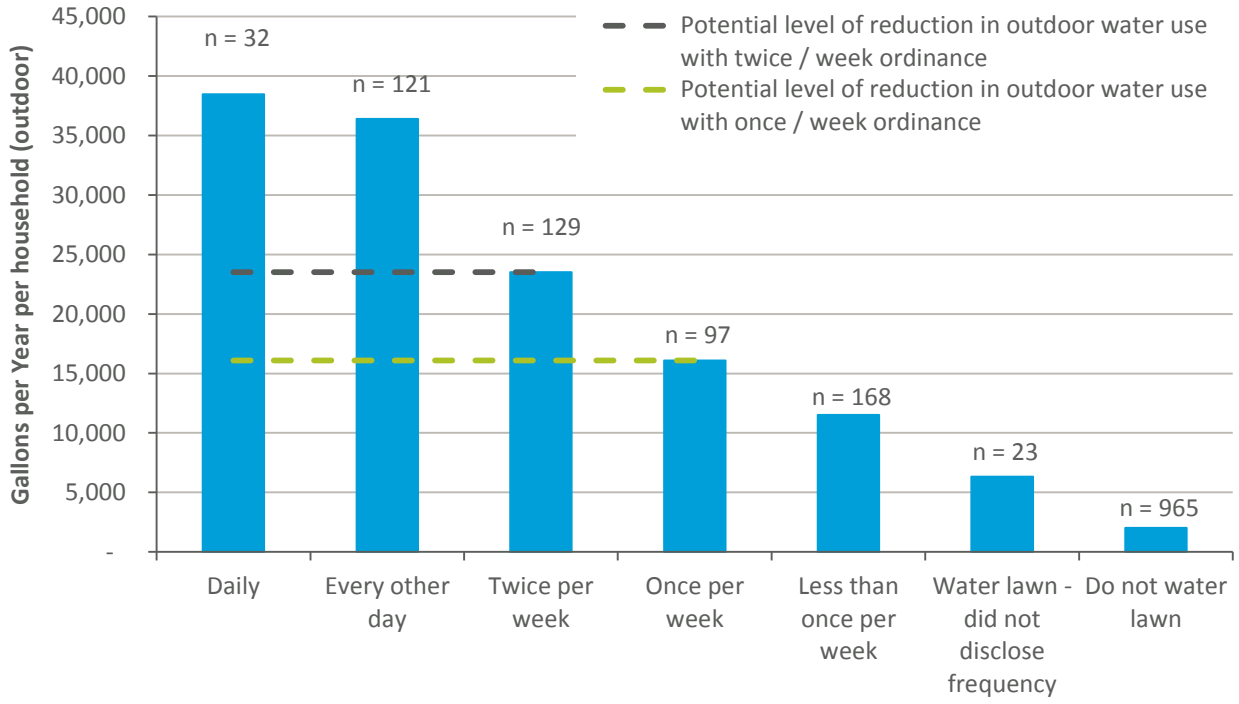


Figure 8-1 Median Outdoor Water Use and Lawn Watering Frequency

The potential savings in outdoor water use were calculated under two scenarios:

- Limit lawn water frequency to twice / week
- Limit lawn water frequency to once / week (more stringent)

This analysis was performed by adjusting the number of households at the twice per week or once per week level. For example, to model the new level of water use under a twice per week scenario, the number of daily and every other day lawn waterers drop to zero and the number of twice per week waterers increase by 153.

The potential water saving impact of the two ordinance scenarios described above are shown in Table 8-1. The water savings have been extrapolated from the customer survey dataset to the full single-family residential customer base.

Table 8-1 Potential Water Savings Attributable to Irrigation Ordinance Restrictions

ORDINANCE	CALCULATION BASIS	POTENTIAL WATER SAVINGS	
		MGD	PERCENT
Limit Lawn Watering to Twice / week	Annualized Savings (365 days)	0.25 mgd	13.1%
	May to September Savings (153 days)	0.59 mgd	
Limit Lawn Watering to Once / week	Annualized Savings (365 days)	0.5 mgd	26.5%
	May to September Savings (153 days)	1.19 mgd	

It is important to consider two simplifying assumptions that may result in an over-estimate of potential water savings in Table 8-1:

- All outdoor water is associated with lawn watering.
- Lawn watering habits will not change, i.e., if the frequency of watering is reduced, households do not compensate by increasing the duration of watering.

However, if an ordinance was passed it would also apply to the irrigation activities of many CII sector facilities and the impact of potential savings does not include an estimate for this sector. Several types of commercial activities may be excluded from the ordinance, or may be treated differently, such as nurseries, golf courses and other businesses that are heavily dependent on irrigation.

The Rockland County Department of Health currently has a well-established set of water use restrictions established in its Sanitary Code which are enacted in response to drought conditions. Local ordinances could be implemented that would establish permanent restrictions on lawn watering regardless of hydrologic conditions.

8.1.2 New Construction Standards Ordinance

The New York Department of State Division of Building Standards and Codes recently considered a proposal to modify the New York State Uniform Codes to include an updated standard for high-efficiency toilets, urinals, faucets, and showerheads, based on the water-efficiency criteria of the WaterSense program. The outcome of the decision, in 2016, was to not include WaterSense specifications at this time.

This leaves open the opportunity for local ordinances to be developed to specify inclusion of WaterSense fixtures and fittings in new construction or rehabilitated buildings. Local building inspectors would provide the means of enforcement for these ordinances.

Under the SWNY Plan, rebates would not generally be available for subsidizing WaterSense implementation in new construction. This is because the SWNY program is focused on replacing older (pre-EPAct) fixtures in order to generate a favorable cost / benefit ratio. WaterSense-labeled

products still provide water savings above and beyond current plumbing standards, but the magnitude of the savings is significantly smaller compared to targeting and replacing older fixtures.

8.1.3 Mandatory Maximum Two-Day-Per-Week Watering

Data from a Colorado-based study[33] shows the potential mandatory restrictions to provide water savings during drought. The study found that during periods of mandatory restrictions savings in per capita use range from 15 – 55 percent, compared to 4 to 12 percent during periods of voluntary restrictions. Although this study is based in a region where outdoor irrigation is very large component of summer water use - much larger than SWNY - it provides a reference point to show how ordinances can affect irrigation practices in the community. A summary of the reported savings from the Colorado study is shown in Table 8-2.

Table 8-2 Impact of Mandatory Water Restrictions in Colorado Communities

WATERING RESTRICTIONS	VOLUNTARY PERIOD		MANDATORY PERIOD	
	NET SAVINGS	PER CAPITA SAVINGS	NET SAVINGS	PER CAPITA SAVINGS
Every three days	0%	4%	14%	17%
Twice a week	0%	2%	30%	31%
Once a week	N/A	N/A	53%	55%

8.2 ORDINANCE IMPLEMENTATION

It is recommended that prior to adoption of ordinances that include water use conservation measures, local government should embark on a 1-2 year public information campaign to promote awareness and empower residents with knowledge of specific actions to be taken for insuring reduction in water demand. The public information campaign will be most successful if it continues even after the ordinance has been adopted to increase compliance and to maintain a presence of the need for water conservation in the community. It is important that local governments inform the public about the enforcement program that will be employed[34].

One of the key findings of the Colorado study was that water managers noted that many customers were confused by the diversity of water restriction programs implemented at the municipal level. Having multiple local programs makes it difficult to use broad media to remind customers of water restrictions. For these reasons, a consortium of cities was established to devise a consistent program of restrictions. This could provide an important lesson for the implementation of a program in Rockland County.

[33] Kenney, D.S., Klein, R.A., and Clark, M.P. Use and Effectiveness of Municipal Watering Restrictions During Drought in Colorado. Journal of the American Water Resources Association, February 2004, pp. 77-87

[34] Chicago Metropolitan Agency for Planning. 2010. Model Water Use Conservation Ordinance.

9 Water Savings and Program Cost Analysis

The development of the SWNY water conservation plan has required an estimation of water savings and associated costs. If the water conservation program is implemented as proposed and the customer response is in line with expectations, customer demand will be reduced by approximately 1 MGD by 2021. This may be considered a conservative estimate as this does not include any savings that may arise explicitly from the educational and outreach aspects of the plan such as customers developing a greater awareness of water conservation and responding with best practice behavior and implementing water conservation habits. Nor does the 1 MGD value include explicit savings that may arise from the proposed three-tier rate structure or impact of any ordinances that may get approved. The estimated total cost of the five-year program is approximately $4.8M with an average annual cost of $0.96M. Table 9-1 presents the estimated total costs of the program by the main program areas.

These costs reflect the best available estimates of projected program costs at this time, recognizing that it may be necessary to shift costs between programs during implementation in order to achieve the maximum benefit from the program.

9.1 SUPPLY-SIDE COSTS

The benefits and costs of the SWNY water conservation program can be put into context against other measures to balance supply and demand. In the *Report of Feasibility of Incremental Water Supply Projects and Conservation Opportunities in Rockland County, New York*, the company concluded that, assuming 1 mgd can be found through additional well development, the average estimated cost would be approximately $12 million per mgd. Although the water conservation plan outlines a set of actions to achieve an approximate 1 mgd reduction within five years, it is acknowledged that this will be comprised of passive and active (natural and accelerated) water conservation activity. Therefore, only the estimated active portion of the conservation savings is credited to be a benefit for the program. This returns an estimated cost of $4.8m for 0.68 mgd of active conservation savings which equates to approximately $7 million per mgd.

Table 9-1 Total Program Costs and Estimated Water Savings

PROGRAM		FIVE-YEAR COST ESTIMATE		2021 SAVINGS ESTIMATE (MILLION GALLONS / DAY)		
				Active	Baseline (Passive)	Total
Admin, Education & Evaluation	Program Administration (rebate admin)	$319,786	$1,425,913	N/A	N/A	N/A
	Public Information and Outreach	$480,938				
	Res. Conservation Evaluation Studies	$127,825				
	CI Conservation Evaluation Study	$92,385				
	Contractor admin / Implementation	$311,560				
	Lawn Watering Best Practices Program	$93,419				
Single Family Residential	SFR - H.E. Toilets Rebate	$1,211,426	$1,797,066	0.076	0.154	0.335
	SFR - H.E. Showerheads Rebate	$242,285		0.052	0.026	
	SFR - H.E. Washers Rebate	$247,437		0.013	0.014	
	SFR - H.E. Washer / Rain barrel Promotion	$95,918		0.000	0.000	
Multi-Family Residential	MFR - H.E. Toilets Rebate	$404,273	$579,458	0.062	0.109	0.279
	MFR - H.E. Showerheads Rebate	$121,282		0.057	0.019	
	MFR - H.E. Washers Rebate	$53,903		0.029	0.003	
Commercial, Institutional Industrial	CII - Audit Program Rebate	$510,314	$988,635	0.017	0.000	0.430
	CII - Urinal Rebate	$121,282		0.043	0.005	
	CII - H.E. Toilets Rebate	$303,135		0.258	0.029	
	CII - Spray Rinse Valve / Rebate	$53,903		0.070	0.008	
Totals:		$4,791,072	$4,791,072	0.677	0.367	1.044

9.2 CUSTOMER-SIDE SAVINGS

Although the rebate offering will mean a reduced cost for customers purchasing water efficient devices, the individual water savings, and therefore monetary savings resulting from a lower water bill, will vary for each customer. For single-family customers, the survey data indicated that the number of residents in a household was a likely influence on decisions to purchase a water efficient fixture or appliance. For example (as was shown in Table 4-7), larger families typically washed more loads of laundry per week and were more likely to own a more efficient front-load style clothes washer.

Table 9-2 shows three scenarios for water and cost savings for a single-family household replacing one existing toilet with a WaterSense model. The scenarios include an average saving and both a

high and low saving potential based on actual customer data provided within the customer survey results.

Table 9-2 Savings Scenarios for a Single-Family Household Replacing a Toilet with a WaterSense Model

	AVERAGE DATA*	HIGH SAVINGS POTENTIAL EXAMPLE DATA	LOW SAVINGS POTENTIAL EXAMPLE DATA
Residents in the home (a)	3.07	6	2
Number of Toilets in the home (b)	2.43	1	3
Toilet Age	N/A*	Pre 1980	1980 - 1992
Toilet Flush Volume (gallons)	3.66	4.0	3.5
Savings / Flush (gallons) (c)	2.38	2.72	2.22
Flushes / person / day (d)	5.1	5.1	5.1
Savings / Day /per toilet replaced (gallons) = (a x c x d) / b	15.33	83.23	7.55
Est. Water Savings / Year	5,597	30,380	2,755
Est. Cost Savings / Year ($7.4/1000gal)	$41.59	$225.72	$20.47

***Average values used to develop program estimated water savings. Detailed assumptions referenced in Appendix 9**

Table 9-2 shows that water and cost savings will vary significantly between individual households. It also indicates that SWNY's goals and customers' goals are aligned in that the installation of water saving devices is more compelling for customers that will save the most water and this may drive the overall water savings higher than the average estimates used to predict the water savings. Providing case studies and education to customers will help them understand the potential savings and may encourage more customers to take advantage of the rebate offer.

10 Conservation Oriented Rates

Conservation oriented rates were included within the 2016 rate case and are designed to incentivize all forms of conservation within the overall Plan. Sending a price signal to encourage conservation can encourage customers to invest in more water efficient fixtures and appliances (further incentivized by the rebate component of the Plan) and the price signal may also lead to behavioral changes, such as reduced irrigation and other outdoor water uses, as customers look for ways to save money on their water bill.

10.1 CONSERVATION ORIENTED RATES

In the 2016 rate filing, the summer / winter rate schedule was proposed to be eliminated in response to general customer feedback over the past several years. Many customers have provided feedback that the current rates are not equitable for those who do not irrigate in the summer, which is the majority of SWNY customers. When introduced, the summer / winter rate schedule was designed to promote conservation and to prevent this inequity, as it also lowered winter rates. However over time rates have risen and customer perceptions on this issue are strong, as noted through comments submitted as part of the single family customer survey in December 2015. The proposed rate structures for each customer (revenue) class are shown in Table 10-1.

Table 10-1 Proposed Rate Structure for 2016 Rate Filing

RATE CLASS	TIER 1		TIER 2		TIER 3	
	USEAGE CCF	$ / CCF	USEAGE CCF	$ / CCF	USEAGE CCF	$ / CCF
Single-Family Residential	First 5	$ 4.300	Next 7	$ 8.360	Over 12	$ 10.000
Multi-Family Residential	First 20	$ 4.500	Next 380	$ 4.950	Over 400	$ 5.850
Non Residential	First 900	$ 5.272	Over 900	$ 5.802	N/A	
Resale	First 900	$ 5.272	Over 900	$ 5.802	N/A	

Black & Veatch worked with Gannet Fleming, the principal rate consultant, to set the usage tiers for the single-family residential customers. A three tier inclining block rate was chosen. The goal of a conservation tier design is to set the first tier at a level that reflects reasonable consumption levels for a typical household. The second tier of consumption recognizes the variability in household sizes and should accommodate the majority of single-family households, most of the time. Water usage in the third tier should generally reflect discretionary use and is likely to spike in the summer months, although the goal of the price signal is to discourage water use in the third tier associated with lawn irrigation, or at least promote efficient irrigation practices.

With the variation in single-family use noted in the analysis in Section 4 there is no single conservation rate structure that will work for all households. In addition, the cost of service allocation objectives need to be met as part of overall rate design and this will drive decisions regarding the setting of tiers and rates. However the setting of the tiers for the single-family revenue class has been influenced by data developed in this study. Based on U.S. Census data, the average household size is 3.07. Figure 5-1 shows that for a family of three, indoor water use in single-family homes is approximately 125 gallons per person per day. This equates to 3,750 gallons per month (using a 30 day month), or 5.01 CCF. Therefore, 5 CCF per month has been chosen for the upper limit of tier 1. It has been estimated that approximately 50% of total single-family

consumption would be included in the first tier. The second tier consists of consumption between 5 and 12 CCF; using the same data described in the development of tier 1, consumption through tier 2 (up to 12 CCF) is approximately equivalent to the indoor use of a family of 7. Overall, it is estimated that 30% of total usage will be in the second tier. Consumption in tier 3 is any amount in excess of 12 CCF per month and is expected to capture a significant component of outdoor water usage sending the appropriate price signal; approximately 20% of single-family consumption is anticipated to be in the third tier. Single-family residential consumption for 2015 was modeled using the proposed three tier rates structure. Figure 10-1 shows the proportion of overall consumption for this revenue class that falls within each tier and shows that the majority of tier 3 consumption occurs during the irrigation season.

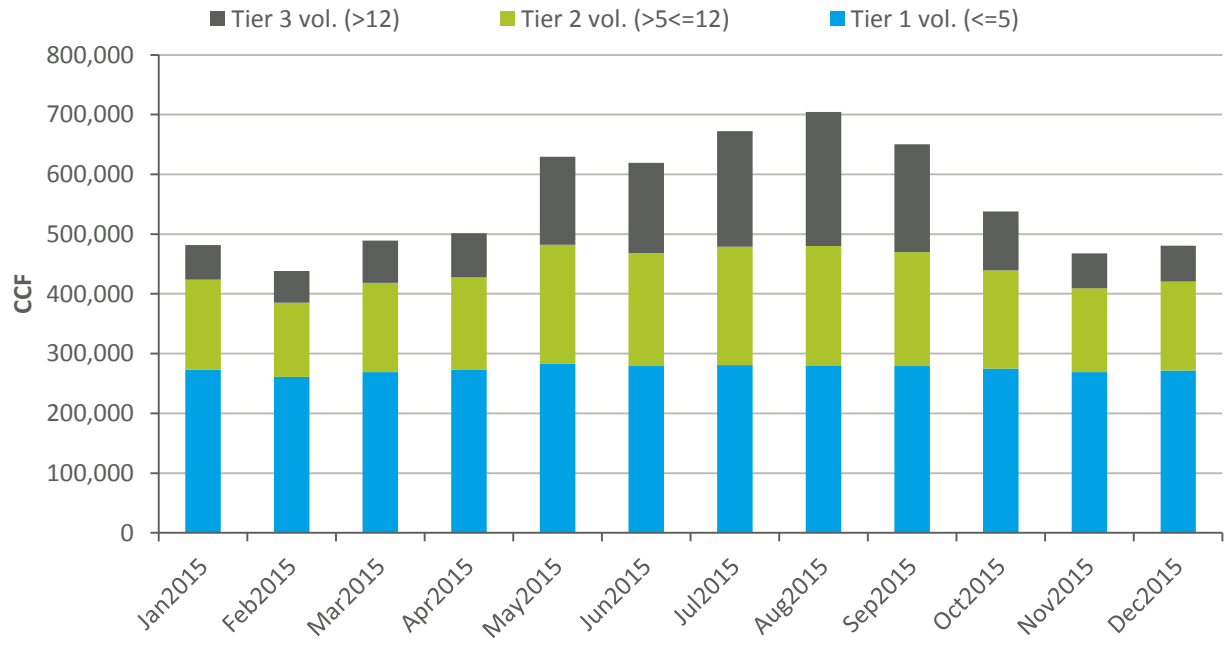


Figure 10-1 Estimated Consumption in each Tier of the Proposed Three Tier Single Family Rate Structure (using 2015 consumption data)

10.1.1 Single-Family and Multi-Family Classifications

Within the SWNY billing system, the single-family account classification includes primarily traditional single-family homes; however it also includes some customers living in multi-family structures where the dwelling unit is individually metered. The sub-metering of multi-family units is generally recognized as a best practice approach as the bill that the customer receives will be directly influenced by the customer's water use, compared to multi-family structures without sub-metering where the total water bill is shared across all residents, often as a flat fee. As such, sub-metering is recommended to encourage water conservation through a price-signal.

Based on a review of the single-family residential account data, it is estimated that there may be approximately 100-150 accounts that are multi-family units without sub-metering (i.e., one meter serves multiple individual end units). These accounts were identified by dividing each account's baseline winter use volume by typical per capita consumption levels. Accounts for which the

calculation resulted in greater than 20 occupants were identified as possibly being associated with multi-family structures.

This may occur if structures are renovated or replaced with higher occupancy buildings and SWNY is not notified of the zoning or customer classification change. During review of the billing data, single-family accounts with exceptionally high use were identified and were flagged for further review to determine if they are appropriately assigned in the SWNY customer billing system.

10.2 PRICE ELASTICITY OF DEMAND

Economic theory states that if price goes up, the quantity demanded will go down and this is one of the principles behind setting conservation oriented rates. The amount of demand change expected from a given price increase is determined by the price elasticity of demand, where:

$$Price\ Elasticity = \frac{\%\ Change\ in\ Quantity\ Demanded}{\%\ Change\ in\ Price}$$

Many studies have been performed to estimate the price elasticity for water although consensus is hard to find. Water is often referred to as inelastic, meaning that consumption does not change much when price goes up. Dalhuisen et al.[35] reviewed multiple studies and found an average price elasticity of -0.41, however this does not mean this is an appropriate value for the unique characteristics of SWNY, as there are numerous factors that will influence the demand response to a price increase such as household income, seasonal factors and the extent to which use is discretionary or non-discretionary. For example, outdoor water use will be more elastic than indoor water use, especially in the short term as outdoor water can be more easily curtailed. Over the longer term, indoor water use may be reduced in response to price through the purchase of more efficient fixtures and appliances. In this regard, the conservation oriented rates may help to incentivize participation in the SWNY rebate program.

10.3 IMPACT OF CONSERVATION PROGRAM ON REVENUES

The primary impact of the conservation program on revenues is the anticipated reduction in water sales attributable to a decreased demand of approximately 1 mgd by 2021, as detailed in section 9. However, this reduction will take place in the context of other influences on water sales such as a growing customer base, economic conditions and weather trends. A complete forecast of future water demand accounting for the multiple potential influences has not been undertaken as part of the Plan development. As data on the uptake of rebates and the impact of the other components of the conservation program is obtained, it can be used to improve forecasts of future demand.

An additional impact of the overall conservation program could be a demand reduction influenced by the price elasticity effect described in 10.2. As part of this study, the impact of price elasticity in response to the proposed single-family rate structure was estimated using conservative assumptions. An elasticity value of -0.1 was applied in summer months (May through September) and a lower elasticity value of -0.05 was applied in the other months of the year. This reflects the higher probability of a demand response in summer months as customers are likely to have some

[35] Dalhuisen, J. M., R.J.G.M. Florax, H.L.F. de Groot and P. Nijkamp. (2003). Price and Income Elasticities of Residential Water Demand: A Meta-analysis. Land Economics, 79 (2), pp. 292-308.

opportunity to reduce outdoor water use relative to indoor water use. The impact of this elasticity assumption is an overall reduction in water demand of 0.20 MGD on an annualized basis for the single-family revenue class. Due to the lag time in response between customers receiving a price signal and changing their behavior no significant impact on demand is expected in 2017. Furthermore, the magnitude of the projected demand response means that it will be very difficult to measure against other background demand changes due to population growth, water conservation and particularly weather influences. Due to these uncertainties, the potential decreased demand as a result of price elasticity is not included as part of the overall targeted 1 mgd reduction (i.e., any decrease due to price elasticity would be additional to the 1 mgd reduction).

11 Monitoring, Evaluation and Reporting

One of the key features of the plan is an emphasis on monitoring, evaluation and feedback to ensure the plan is effective and meeting expectations. Levels of implementation have been estimated for each of the five years with recognition that in year one (2017) the program will be developing and the level of implementation will be lower than in subsequent years.

11.1 REBATE MONITORING

To ensure the rebate program is meeting the anticipated goals and staying within budget, rebate redemption will be closely monitored. The online Marketplace will provide a single location for rebate redemption and is designed to support monitoring, analysis and adjustment to rebate programs in order to optimize participation and cost-effectiveness.

Monitoring and frequent evaluation of the program's water savings will be essential to documenting the impact of the program. Water savings can be estimated based on adoption rates of water efficient products and can be validated by examining water use records (i.e., billing data) to help verify savings. Such an approach is likely to be particularly effective for multi-family and CII facilities, especially where a large number of fixtures are changed out simultaneously, as this may result in a significant reduction in consumption. This information will also provide valuable information for the development of case studies.

11.2 FOLLOW UP SURVEYS

11.2.1 Single-family Residential Survey Follow Up (2017)

A follow up to the December 2015 customer survey is planned for 2017. This survey will be smaller in scope and will focus on the approximately 1,200 customers who received recommendations for water savings (the remainder of recipients did not receive recommendations as their water use patterns and reported fixtures did not reveal opportunities for water savings using the Waterwatch© program). The survey will be structured to gain insight into which customers acted on recommendations and to understand the reasons why some customers may not have acted on recommendations. This information is expected to be valuable as implementation gets underway, for both the rebate component and educational aspects of the Plan. Within the survey, customers will be invited to participate in more in-depth studies of their water use with the purpose of identifying good candidates for case study development that document savings from water efficiency upgrades.

11.2.2 Single-family Residential Survey (2019)

At around the mid-point of the five year program, another broad survey of the single-family residential customer base will be undertaken. This will be similar in scale to the December 2015 survey; however the survey and the distribution approach will be designed to ensure that the process captures customers who have participated in the rebate program. Although customer consumption data can be reviewed to determine the impact of replacement fixtures, it will be important to gather qualitative data and customer perceptions regarding all aspects of the program.

11.2.3 CII Surveys

Two surveys of CII customers are planned and scheduled for the middle and end of the program. This recognizes that these customers are highly varied in their water use and specialized. The audit program that is part of the overall Plan is expected to yield valuable information on the current level of water efficiency within this customer class and to provide insight into customer needs and priorities. This information will help inform the development of a survey, which may be conducted separately for individual sub-sectors, such as schools, restaurants and government facilities. Alternatively, if the information gathered through the audits leads us to believe that a survey is not a practical approach the resources can be directed to developing workshops for specific CII sub-sectors where an exchange of information can take place. This approach provides a balance between a broad survey and the individualized audit approach. It is anticipated that workshops would provide a good opportunity for dialog and the dissemination of relevant case studies developed using SWNY customer data.

11.2.4 Stakeholder Engagement

The Plan has been developed using a collaborative approach with input gathered from many stakeholders. This collaborative approach is expected to continue through the duration of the Plan. The existing customer-advisory panel will provide regular updates on Plan implementation progress and will provide an opportunity to gather feedback from customers. In addition, biannual updates with a broader group of key stakeholders are planned to review overall Plan progress.

11.3 PROGRAM REPORTING

On an annual basis, a report will be developed and submitted to the PSC describing the following aspects:

- **Implementation Progress.** This will describe progress establishing individual components of the Plan such as the rebate program, education, audits and surveys.
- **Rebate Redemption.** This will detail the overall level of rebate redemption by customer class and compare to program goals. Based on the findings, this may present an opportunity to adjust the rebate levels or product focus.
- **Education and Audits.** This will detail the level of activity in these areas, document general results of the audits and report any key findings that may influence the program.
- **Survey.** Several surveys are planned during the program and summary reports will be provided on their findings.

The SWNY Conservation Coordinator position will have the primary responsibility for assembling the data to support the program reporting, but will be supported by a third party (e.g., consultant assistance) as needed, and has been budgeted within the program. This Conservation Coordinator will also be involved in developing recommendations for program modifications based on the evaluation of data.

11.4 PROGRAM FLEXIBILITY

Within the overall program budget it may be necessary to have flexibility in rebate pricing (i.e., to adjust the dollar value of the rebates). It is anticipated that rebate value will be reevaluated no more frequently than once per year, following a review of annual implementation rates and rebate

redemption. The flexible approach will need to be balanced against any perception that some customers are getting a better deal than others.

It is also anticipated that during water audit work with CII customers, other water using processes (e.g., high volume dishwashers, ice makers) will be reviewed and evaluated. Although these items are not specified in the current rebate program, a flexible approach would allow water conservation opportunities to be realized when they are identified. A guiding principle for the flexible approach would be that any alternate proposed water efficiency improvements would need to meet, or improve on, the cost / benefit ratio anticipated for the CII program (2.3M$/MGD). This type of approach will increase the overall value of the program as it will be responsive to customers' needs and will also provide greater insight into the water using processes within the diverse CII sector.

12 Summary and Conclusions.

The water conservation plan developed for SWNY is based on an innovative, collaborative and flexible approach that comprises multiple strategies across all sectors. The plan includes individual programs that fall into the following broad areas:

- Rebates for Highly Water Efficient Fixtures and Fittings
- Outreach, Education and Audit Programs
- Conservation Oriented Rates
- Municipal Collaboration / Ordinances
- Monitoring, Evaluation and Reporting

The data driven approach behind the Plan has revealed generally prudent indoor and outdoor water use by the majority of single-family customers. However, opportunities for additional water savings for some customers have been identified and quantified. These savings can be realized through the installation of more efficient fixtures and appliances – resulting in savings that are likely to be sustained through the life of the equipment, and potentially through behavioral changes. The Plan also anticipates finding and acting on opportunities for water savings in the multi-family and CII sectors, however the confidence in the assumptions for the scope of savings is less than for the single-family sector due to the lack of data and more varied nature of water use, particularly in the CII sector. However, the plan will address the lack of currently available data through planned surveys and audits focused on these sectors. This, combined with a flexible approach, may identify further opportunities for water conservation.

Within this plan, the primary focus for the estimation of water savings has been on the more quantifiable aspects of upgrading the efficiency of fixtures and fittings through rebate incentives. If the rebates programs are implemented and customer response is in line with the anticipated rates, water conservation savings of approximately 1 mgd can be expected. However, additional water savings may be generated through other components of the plan such as price elasticity impacts from the conservation oriented rates, municipal ordinances, if implemented, and from educational outreach and customer surveys that reinforce conservation messages. However, these components of the plan are less quantifiable and are not relied upon in order to achieve the 1 mgd target savings.

This Plan recognizes the impact that water conservation has had in increasing the efficiency of water use and the role that it can continue to play as part of a broader strategy to manage supply and demand. Other efforts include supply evaluation, interconnections and the reduction of physical water losses as part of a non-revenue water management strategy. The development of this Water Conservation Plan has been driven by data to estimate the water savings and cost impact for the proposed level of activity and has used new approaches to further the understanding of water use by SWNY. Conservative assumptions have been applied, recognizing that overly optimistic forecasts of water savings could result in a supply-demand deficit if those savings are not realized. The implementation of the Plan will result in further data collection that will be analyzed and reported and used to evolve and improve the Plan.

13 Appendices

APPENDIX 1. USING METER READ DATES TO DEVELOP CUSTOMER CONSUMPTION BY MONTH

An algorithm was applied to the 2012 – 2015 individual account level detail to normalize meter reads to the calendar month. This process was applied to the quarterly and monthly data using the same approach. This approach had the following goals:

- Provide more consistency between consumption data points, by adjusting use for the number of days between reads
- Assigning use to the appropriate month by pro-rating the reads amounts

For example, without the above approach, a three day difference in consecutive monthly reads (which is typical for monthly meter reads) is the equivalent of a 10% difference in consumption. Table 13-1 outlines an example adjustment referencing real account data.

Table 13-1 Example Calculation for Meter Read Normalization to Calendar Month

	METER READ MONTH			
	JULY	AUGUST	SEPTEMBER	OCTOBER
Read Date	7/2/2015	8/4/2015	9/8/2015	10/6/2015
Use Amount (Thousand Gallons)	11.968	15.708	16.456	8.228
Days In Month		31	30	31
Days between Reads		33	35	28
Use per Day*		0.476	0.470	0.294
Read Day in Month		4	8	6
Use Pro-rated 1		1.904 (4days x 0.476)	3.761 (8days x 0.470)	
Use Pro-rated 2		12.695 (27days x 0.470)	6.465 (22days x 0.294)	
Use in Calendar Month		14.599	10.226	

*** Use divided by number of days between reads**

The overall impact of the adjustments can be seen in Figure 13-1. This has two main impacts:

- It smooths consumption patterns during the period of quarterly meter readings. This is because the algorithm includes consumption from each customer during each month, whereas the unequal number of meters reads in each monthly cycle results in more variability in the use profile (because the number of accounts read in each cycle is not consistent)
- It corrects for the lag in meter reading, this can be seen most clearly in the period of monthly meter readings (August 2014 onwards). As can be seen in Table 13-1, although the read with the September date is higher, the algorithm assigns much of the use volume to August (based on the pro-rating on consumption by date) and in the final outcome August has the higher consumption value.

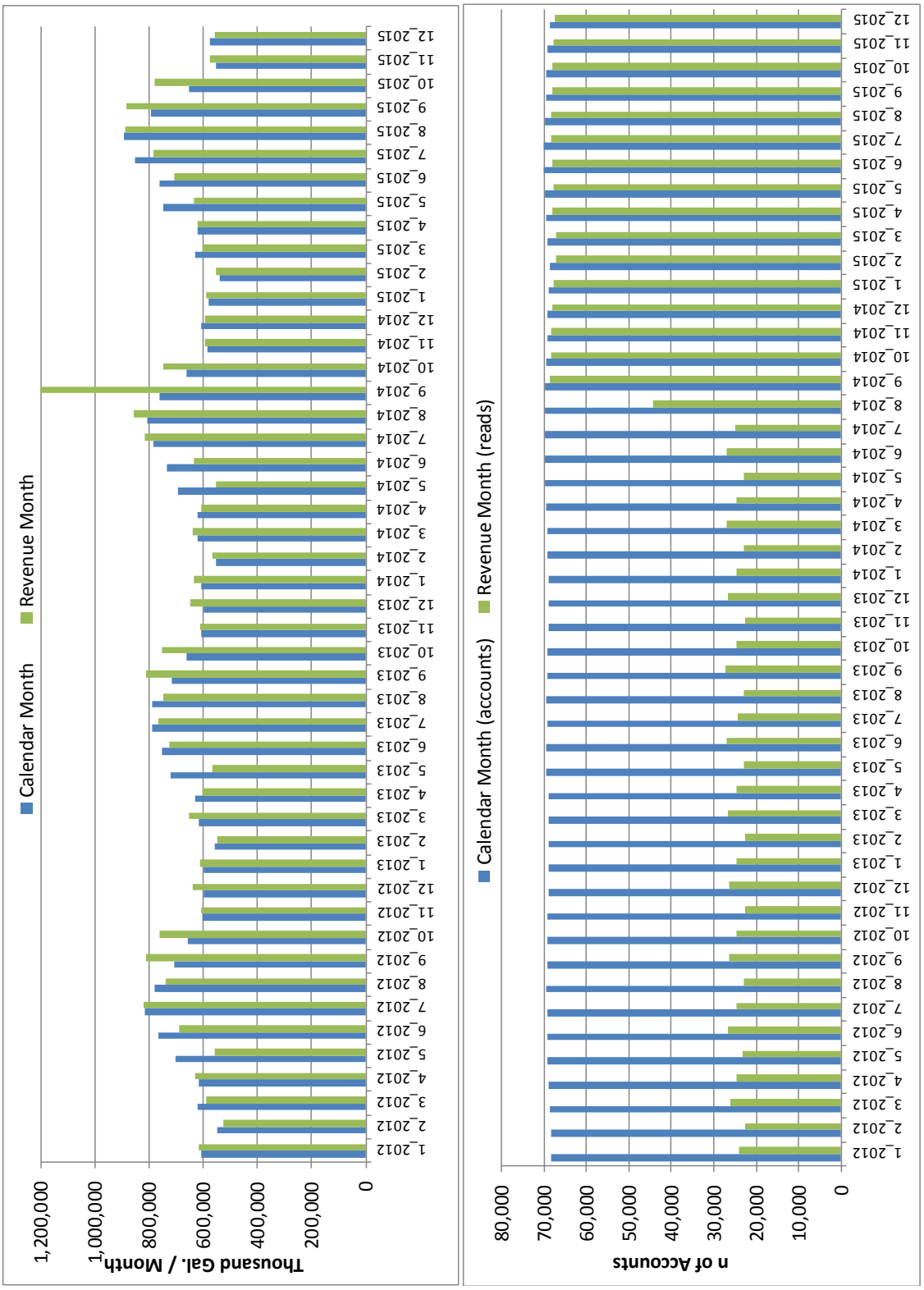


Figure 13-1 Comparison of Billing Month versus Calendar Month Consumption Data

APPENDIX 2 GALLONS PER CAPITA PER DAY BY TOWN

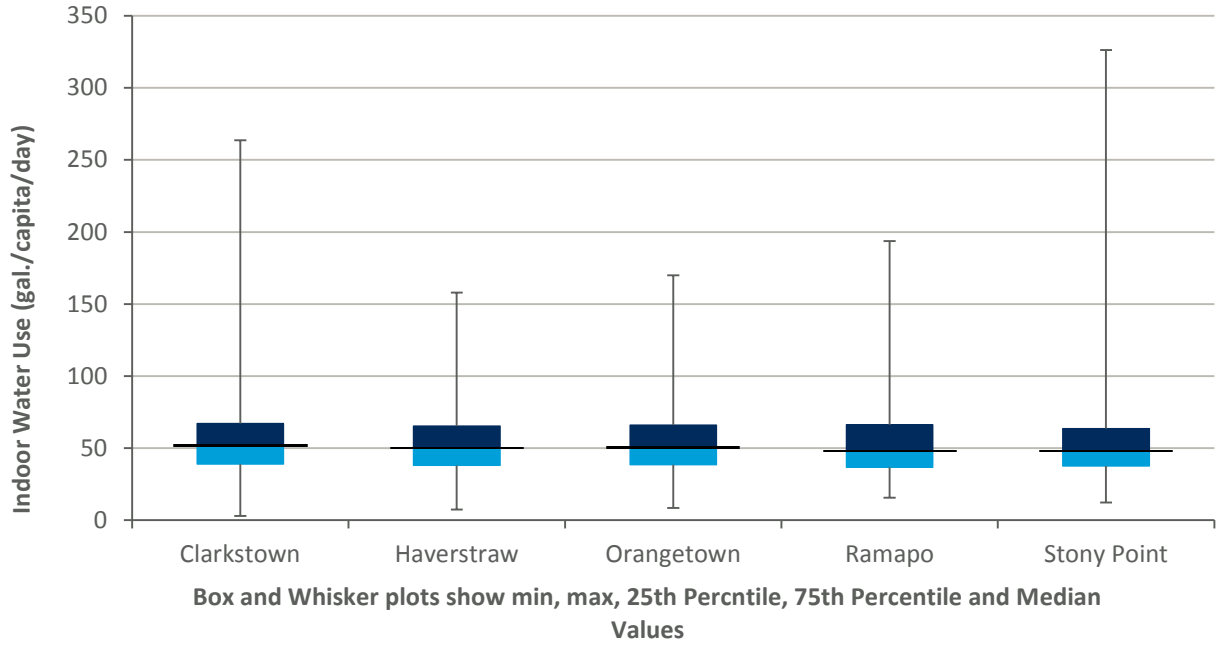


Figure 13-2 Indoor Water Use (gpcd) of Survey Respondents (Estimated from Winter Baseline)

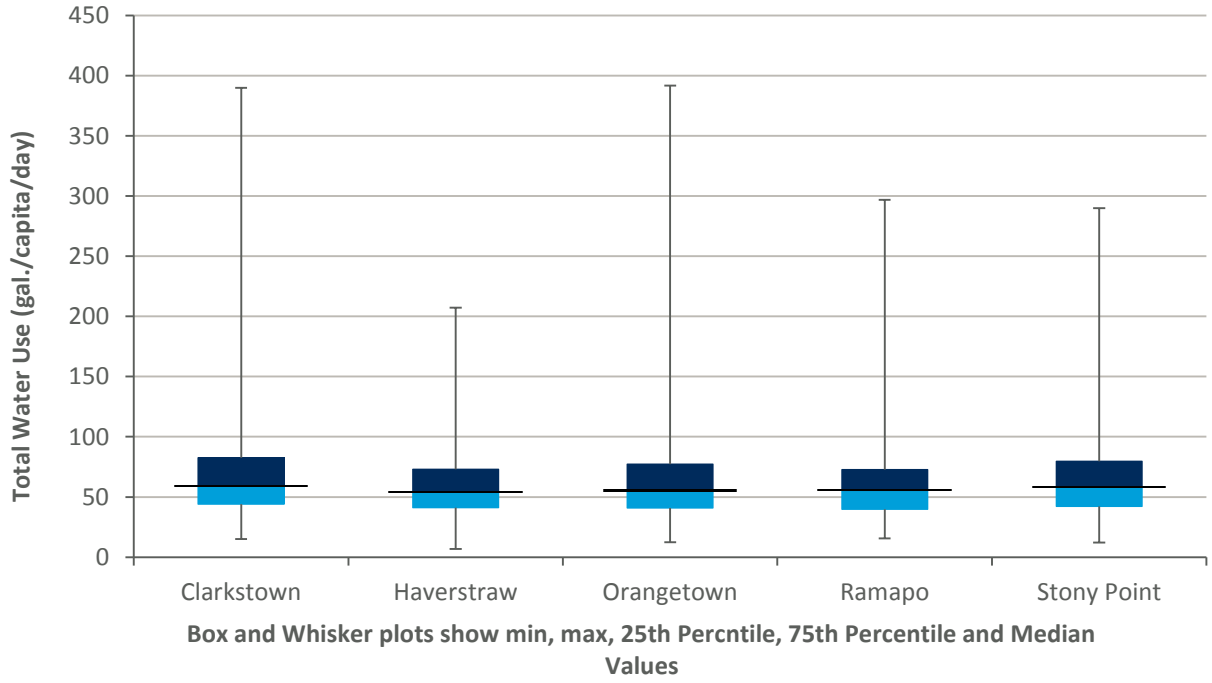


Figure 13-3 Total Water Use (gpcd) of Survey Respondents

APPENDIX 3. SINGLE FAMILY RESIDENTIAL SURVEY

Customer Research Program Conservation Survey Form

Your Account Number:

Your Contact Information

John Doe
132 Main Street
Mytown, NY 01234

Please make any corrections to your contact information here:

Name:_____
Address: _____
City:_____ State:____ Zip: _____
Phone: _____
E-mail: _____

Basic Household Info

1. Number of people living in your household: _____
2. Number of children: Aged 10 and under _____
   Over 10 _____
3. Number of people at home weekdays: _____
4. Do you own or rent your home? ☐1 Own ☐2 Rent
5. When was your home built? ☐1 Before 1992 ☐2 1992 or after ☐3 Don't know

Indoor Water Use

BATHROOMS

6. How many bathrooms do you have in your home?
   ☐1 One ☐2 One and 1/2 ☐3 Two ☐4 Two and 1/2 ☐5 Three or more
7. Have you remodeled any bathrooms since 1992?
   ☐1 Yes ☐2 No SKIP TO 9
8. If yes, how many bathrooms have you remodeled? _____
9. For each toilet, give the approximate age, and whether it has a toilet dam or other water saving device. If you have more than three toilets, please answer for the three toilets that are used most often.

	Age of toilet	Water-saving device?
Toilet 1	☐1 Before 1980 ☐2 1981-1992 ☐3 After 1992	☐1 Yes ☐2 No ☐3 I don't know
Toilet 2	☐1 Before 1980 ☐2 1981-1992 ☐3 After 1992	☐1 Yes ☐2 No ☐3 I don't know
Toilet 3	☐1 Before 1980 ☐2 1981-1992 ☐3 After 1992	☐1 Yes ☐2 No ☐3 I don't know

10. For each shower in your home, indicate the number of times it's used each week, and whether the shower has a low-flow showerhead. If you have more than three showers, please answer for the three showers that are used most often.

	Number of showers taken per week	Low-flow Showerhead?
Shower 1	☐1 None ☐2 1-4 ☐3 5-7 ☐4 8-12 ☐5 13-18 ☐6 Over 18	☐1 Yes ☐2 No ☐3 I don't know
Shower 2	☐1 None ☐2 1-4 ☐3 5-7 ☐4 8-12 ☐5 13-18 ☐6 Over 18	☐1 Yes ☐2 No ☐3 I don't know
Shower 3	☐1 None ☐2 1-4 ☐3 5-7 ☐4 8-12 ☐5 13-18 ☐6 Over 18	☐1 Yes ☐2 No ☐3 I don't know

11. Indicate the average time of each shower:
    ☐1 5 minutes or less ☐2 5 to10 minutes ☐3 10 minutes or more
12. Number of baths taken each week in the household:
    ☐1 None ☐2 1-2 ☐3 3-5 ☐4 6 or more

LAUNDRY & KITCHEN

13. Do you have a clothes washer?
    ☐1 Yes, top load ☐2 Yes, front load ☐3 No SKIP TO 15
14. How many clothes washer loads per week?
    ☐1 None ☐2 1-2 ☐3 3-5 ☐4 6-10 ☐5 Over 10

LAUNDRY & KITCHEN (cont.)

15. Do you have a dishwasher? ☐1 Yes ☐2 No SKIP TO 17

16. How many cycles (dish washing loads) do you run per week?
☐1 None
☐2 1-2
☐3 3-5
☐4 6-10
☐5 Over 10

Outdoor Water Use

LAWN WATERING

17. Do you water your lawn during the summer months?
☐1 Yes
☐2 No SKIP TO 34

18. How often do you water your lawn?
☐1 Daily
☐2 Every other day
☐3 Twice per week
☐4 Once per week
☐5 Less than once per week

19. Would you be interested in having the ET number (which would tell you exactly how much water your lawn needs based on daily weather conditions) emailed or texted to you each day?
☐1 Yes
☐2 No

20. Are you aware of the company's ET lawn watering program? ☐1 Yes ☐2 No

21. Do you use ET as a guide to water your lawn?
☐1 Yes
☐2 No

22. How much lawn area do you water?
☐1 < 1/4 acre (1/4 acre is about 100'X100' or 10,000 sq ft)
☐2 1/4 - 1/2 acre (1/2 acre is about 100'X200' or 20,000 sq ft)
☐3 1/2 -1 acre (1 acre is about 200'X200' or 40,000 sq ft)
☐4 Over 1 acre

23. Which water source do you primarily use to water your lawn?
☐1 SUEZ (formerly United Water) exclusively
☐2 Alternate supply or well exclusively
☐3 Both SUEZ and alternate supply

24. What type of watering equipment do you use?
☐1 Automatic sprinkler system
☐2 Movable/manual sprinklers SKIP TO 30
☐3 Both automatic and movable sprinklers

AUTOMATIC SPRINKLER SYSTEMS (please answer these questions if you have an automatic sprinkler system)

25. When was the system installed?
☐1 Within the past 5 years
☐2 5-10 years ago
☐3 Over 10 years ago

26. Do you have a functioning rain sensor on your system? ☐1 Yes ☐2 No

27. Does your irrigation contractor set the watering schedule for your automatic sprinkler system or do you set it yourself? ☐1 Contractor ☐2 Self

28. Number of zones in the system: _____

29. On average, how many minutes do you water per zone?
☐1 Less than 10
☐2 11-20
☐3 21-30
☐4 Over 30

MOVABLE SPRINKLERS (please answer these questions if you use movable sprinklers)

30. What type of manual sprinkler(s) do you use?
☐1 Oscillating
☐2 Rotary
☐3 Moving / crawler
☐4 Soaker or drip hose
☐5 Other_____

31. If it rains how long do you typically wait before you start watering again?
_____ days

32. Number of areas you water, that is, how many times you move your sprinklers to water all the areas you water.
_____ areas

33. On average, how many minutes do you water per area?
☐1 Less than 10
☐2 11-20
☐3 21-30
☐4 Over 30

GARDENING & ORNAMENTAL

34. Do you water a flower or vegetable garden?
☐1 Yes
☐2 No SKIP TO 36

35. If yes, please estimate the size of your garden:
_____ square feet

GARDENING & ORNAMENTAL (cont.)

36. Do you have a fountain, pond or other outdoor water feature? ☐1 Yes ☐2 No SKIP TO 38
37. If yes, please estimate the size of your feature: _____ square feet
38. Do you have a rain barrel? ☐1 Yes ☐2 No
39. Have you converted any of your lawn or garden areas to xeriscape (drought tolerant) plantings? ☐1 Yes ☐2 No

POOLS AND SPAS

40. Do you have a swimming pool? ☐1 Yes ☐2 No SKIP TO 44
41. If yes, please estimate the size of the pool:
    Rectangular - length _____ ft x width _____ ft
    Round – diameter _____ feet

POOLS AND SPAS (cont.)

42. Do you cover your pool when not in use? ☐1 Yes ☐2 No
43. Do you drain the pool in the fall and refill it in the spring? ☐1 Yes, completely ☐2 Yes, partially ☐3 No
44. Do you have a hot tub or spa? ☐1 Yes ☐2 No SKIP TO 47
45. If yes, what is its capacity (either the number of persons or gallons)?
    Persons: _____
    Gallons: _____
46. Do you cover your hot tub when not in use? ☐1 Yes ☐2 No

OTHER OUTDOOR USES

Please estimate the frequency of any of these outdoor water uses during the summer:

	Daily	2-3 times a week	Weekly	Twice a month	Monthly or less	Never
47. Wash car or other vehicle	☐1	☐2	☐3	☐4	☐5	☐6
48. Clean driveway, sidewalk, patio furniture, etc.	☐1	☐2	☐3	☐4	☐5	☐6
49. Water flower box, potted plants, etc.	☐1	☐2	☐3	☐4	☐5	☐6

Other Questions

SUMMER/WINTER RATES

50. The company's rate schedule is designed to encourage water conservation in the summer. Summer water rates are 1.5 times higher than winter rates. What is your opinion of this?
    ☐1 Very favorable
    ☐2 Favorable
    ☐3 Neutral
    ☐4 Unfavorable
    ☐5 Very unfavorable
51. Have you changed your behavior or water use because of summer/winter rates?
    ☐1 Yes, quite a lot
    ☐2 Yes, a bit
    ☐3 No, did not change behavior

REBATE & CONSERVATION PROGRAMS

52. If SUEZ offered a rebate to help you switch to water-conserving products such as water-conserving toilets or high-efficiency washing machines, how likely would you be to participate?
    ☐1 Very likely
    ☐2 Likely
    ☐3 Not likely
    ☐4 It would depend on the rebate
    ☐5 No plans to change fixtures or appliances
    ☐6 No need, already have
53. Are you aware that the company previously sponsored a program to provide water-conserving devices at discounted prices? ☐1 Yes ☐2 No SKIP TO 55
54. Did you purchase any of the water conserving kits from the company (check all that apply):
    ☐1 Standard kit
    ☐2 Deluxe kit
    ☐3 Outdoor kit

If SUEZ restarted and expanded the conservation kit offering on its website, how likely would you be to visit the site and purchase items priced at a discount to retail?

	Definitely	Probably	Maybe	Not interested
55. Indoor kit (showerheads, toilet devices, faucet aerators)	☐1	☐2	☐3	☐4
56. Outdoor kit (nozzle, timers, soil moisture sensor, rain gauge)	☐1	☐2	☐3	☐4
57. Rain barrel	☐1	☐2	☐3	☐4
58. Automatic sprinklers (rain cut-off switches, smart controllers)	☐1	☐2	☐3	☐4

BEHAVIOR

59. Why do you conserve water in your home (check all that apply)

- ☐1 To save money on my water bill.
- ☐2 I am concerned about water availability.
- ☐3 I am concerned about a drought or water restrictions.
- ☐4 I am concerned about global climate change and how it may affect water supplies.
- ☐5 It is the right thing to do.
- ☐6 I don't conserve water.

60. What have you done in the past three years to conserve water in your home (check all that apply)

- ☐1 Repaired leaking faucets and/or toilets
- ☐2 Installed water-saving toilets or retrofitted existing toilets with water-saving devices
- ☐3 Installed water-efficient front-load clothes washer
- ☐4 Installed water-saving shower heads
- ☐5 Installed water-saving faucets or water-saving aerators on existing faucets
- ☐6 Changed lawn watering schedule
- ☐7 Stopped watering some or all of an existing lawn
- ☐8 Planted alternative ground covers/trees/shrubs to replace grass
- ☐9 Purchased water-saving hose nozzles
- ☐10 Purchased soaker hoses for outside watering
- ☐11 None of the above

How often do you perform any of these activities?

	All of the time	Most of the time	Some of the time	Rarely	Never
61. Mow grass no less than 3 inches high to reduce evaporation from the soil and help the grass hold more water in each blade	☐1	☐2	☐3	☐4	☐5
62. Take a shorter shower or time my shower	☐1	☐2	☐3	☐4	☐5
63. Check toilet and faucets for leaks	☐1	☐2	☐3	☐4	☐5
64. Track water usage monthly using my water bill	☐1	☐2	☐3	☐4	☐5
65. Do not water my lawn if it has rained	☐1	☐2	☐3	☐4	☐5
66. Use water-wise gardening techniques and/or technology (e.g., rain barrels, mulch, native plants)	☐1	☐2	☐3	☐4	☐5
67. Make sure irrigation water doesn't run off my landscape	☐1	☐2	☐3	☐4	☐5

68. Do you think you can do more to conserve water in your home?

- ☐1 Yes, a lot more
- ☐2 Yes, a little more
- ☐3 No, doing what I can already
- ☐4 Not sure

DEMOGRAPHICS (optional)

69. What is your age?
- ☐1 Under 25 years
- ☐2 25 to 44 years
- ☐3 45 to 64 years
- ☐4 65 or older

70. What was your total household income during the past 12 months?
- ☐1 Under $50,000
- ☐2 $50,000 to $99,999
- ☐3 $100,000 or more

71. What is your highest education level?
- ☐1 Some high school
- ☐2 High school graduate
- ☐3 Associate degree
- ☐4 Bachelor's degree
- ☐5 Postgraduate degree

Do you have any other comments that would help us understand your water use better or suggestions on what SUEZ could do to help you conserve water?_____

APPENDIX 4. EXAMPLE OF A WATERWATCH© REPORT

December 26, 2015

Dear SUEZ Customer:

Thank you for taking part in our recent water conservation study. Enclosed is your Customer Report based on the water usage in your home.

The Conservation Survey was sponsored by SUEZ (formerly United Water New York) to help us understand how our customers use water at home and, most importantly, to help customers find ways to reduce water use and save money.

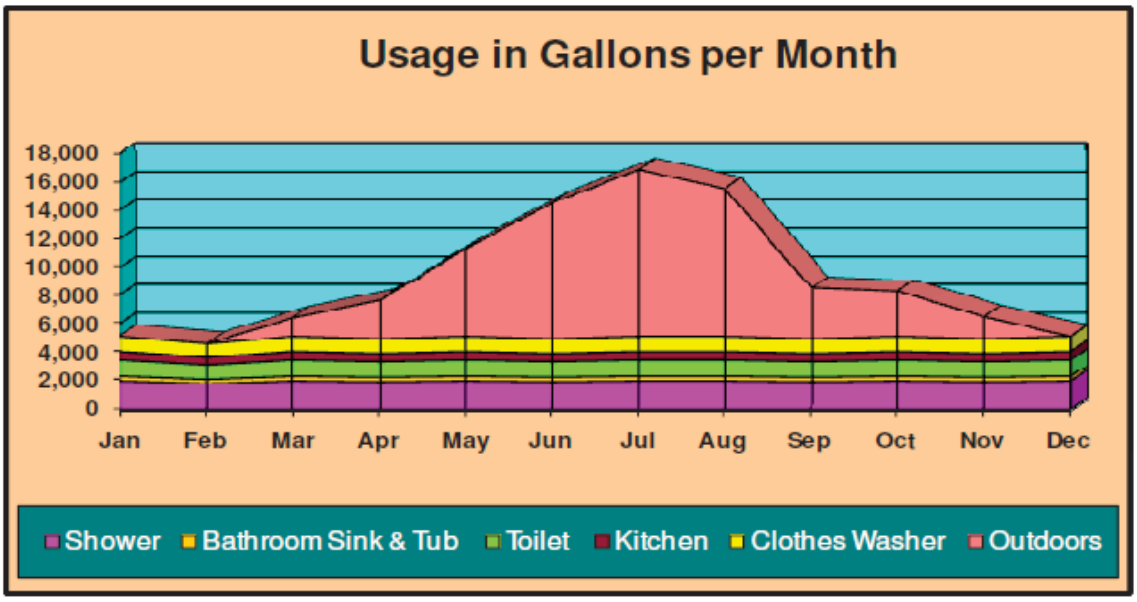
This report is the result of a computer analysis of your water bills and the survey you recently completed about water use in your home. It shows how you use water each day, and explains the daily and annual water consumption for each use. Your report will also show any seasonal variations in water use caused by lawn watering, filling pools and washing cars. Outdoor watering activities may cause usage to increase by 50% or more in summer months.

Please note that your report indicates that you may have opportunities to conserve water in your household and save up to $268 each year in water and water heating costs.

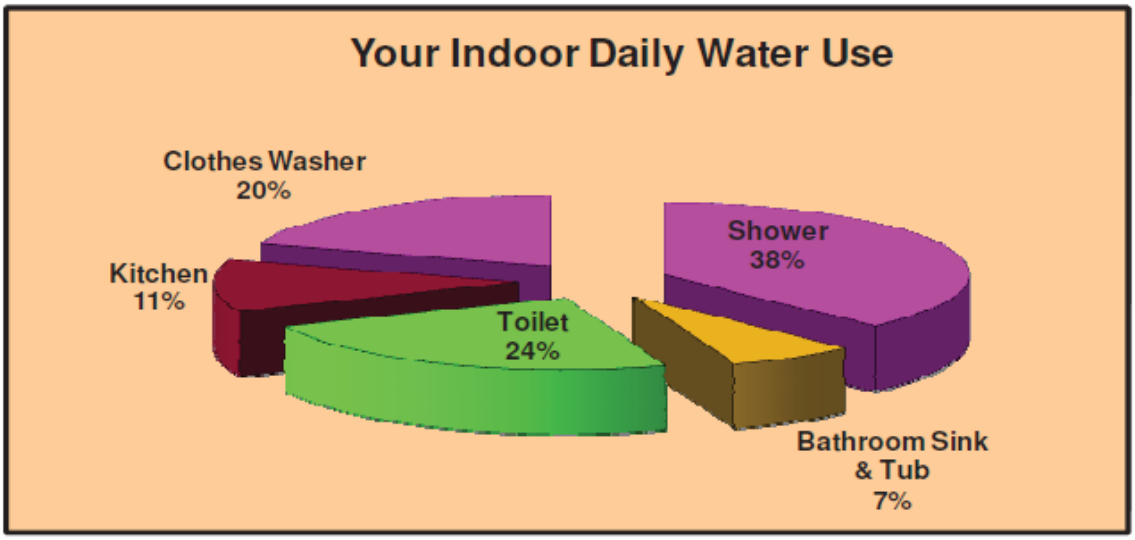
Thank you for your interest in water conservation and for participating in this important survey.

Sincerely,

SUEZ



If your seasonal analysis shows higher water consumption in the warm months, it is usually caused by outdoor uses such as watering lawns and gardens and washing cars. The next chart shows how you use water inside your home each day.



The average American uses about 60 gals per person day indoors, so for an average household with 3 people that's 180 gallons per day. Bathroom usage accounts for 75% of that total, clothes washing 15% and kitchen use 10%. Please refer to the table on the next page to see how much water you actually use.

Water Use Category	Your Daily Use	Your Annual Use	Your Water Use Rating
Shower	63 gal	23,000 gal	high
Bathroom Sink & Tub	11 gal	4,080 gal	low
Toilet	39 gal	14,400 gal	average
Kitchen	19 gal	7,090 gal	average
Clothes Washer	33 gal	12,200 gal	average
Indoor Total	**166 gal**	**60,770 gal**	average
Outdoors	138 gal	50,200 gal	high
Total Water Use	**304 gal**	**110,970 gal**	average

SPECIFIC RECOMMENDATIONS FOR YOUR HOUSEHOLD

The water use rating in the table above compares your use to the national average for similar households. The following water saving opportunities have been identified based upon a computer analysis of your water bills and the questionnaire you submitted for your household.

Shower - A high performance, water-efficient showerhead uses less than 2½ gallons per minute. It will give you a good shower and cut your water use. Also fix any leaks in the tub diverter valve. These measures could save about 11,500 gallons or $90 per year for water and $111 for the energy used to heat water. If you heat water with electricity, your energy savings will be greater.

Toilet - You indicated that your toilet was installed before 1992. If you replace it with a new water conserving model that meets federal standards, you could save about 8,600 gallons or $67 per year.

Irrigation - There are many ways to reduce irrigation water use while ensuring that plants get the water they need. Fix leaks and maintain hoses, sprinkler heads and valves. Install automated controls, such as soil moisture sensors, to prevent irrigation when unneeded. Only water after sundown, and convert to drought-resistant grasses and plants.

APPENDIX 5. SFR CUSTOMER SURVEY Q 9. TOILET AGE AND WATER SAVING DEVICE (WSD) STATUS.

Clarkstown					
Age of Toilet	Toilet 1	Toilet 2	Toilet 3	All	Pre / Post 1992
Before 1980	39	34	19	92	
Before 1980_WSD	8	9	3	20	**28.7%**
1981 - 1992	34	35	25	94	
1981 - 1992_WSD	8	11	7	26	
After 1992	95	100	63	258	**71.3%**
After 1992_WSD	134	117	67	318	
	318	**306**	**184**	**808**	**100%**
Haverstraw					
Age of Toilet	Toilet 1	Toilet 2	Toilet 3	All	Pre / Post 1992
Before 1980	22	19	11	52	
Before 1980_WSD	6	2	2	10	**26.6%**
1981 - 1992	20	19	7	46	
1981 - 1992_WSD	7	5	3	15	
After 1992	90	67	37	194	**73.4%**
After 1992_WSD	62	58	26	146	
	207	**170**	**86**	**463**	**100%**
Orangetown					
Age of Toilet	Toilet 1	Toilet 2	Toilet 3	All	Pre / Post 1992
Before 1980	40	29	20	89	
Before 1980_WSD	6	7	4	17	**25.5%**
1981 - 1992	35	39	19	93	
1981 - 1992_WSD	1	4	1	6	
After 1992	124	116	61	301	**74.5%**
After 1992_WSD	126	113	58	297	
	332	**308**	**163**	**803**	**100%**
Ramapo					
Age of Toilet	Toilet 1	Toilet 2	Toilet 3	All	Pre / Post 1992
Before 1980	39	32	28	99	
Before 1980_WSD	13	11	6	30	**26.9%**
1981 - 1992	30	25	21	76	
1981 - 1992_WSD	4	3	0	7	
After 1992	119	121	95	335	**73.1%**
After 1992_WSD	97	91	54	242	
	302	**283**	**204**	**789**	**100%**
Stony Point					
Age of Toilet	Toilet 1	Toilet 2	Toilet 3	All	Pre / Post 1992
Before 1980	14	16	2	32	
Before 1980_WSD	3	4	0	7	**20.2%**
1981 - 1992	27	25	22	74	
1981 - 1992_WSD	7	7	4	18	
After 1992	117	100	56	273	**79.8%**
After 1992_WSD	117	91	36	244	
	285	**243**	**120**	**648**	**100%**

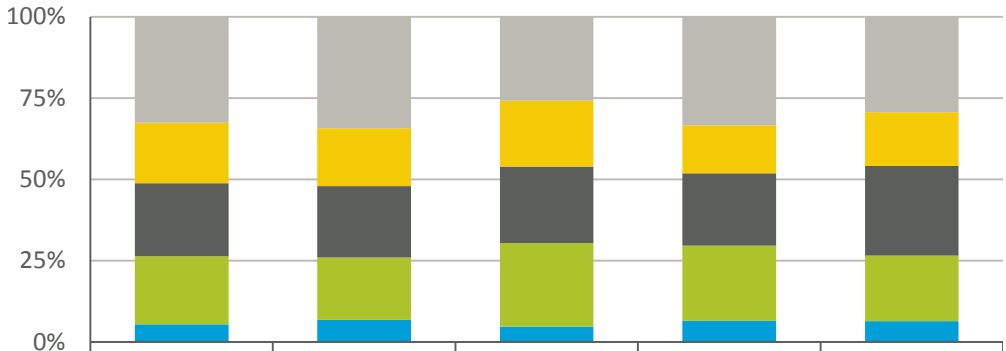
Figure 13-4 Efficiency Status of Single-Family Toilets by Town

APPENDIX 6. SFR CUSTOMER SURVEY Q 10-11. SHOWERHEAD EFFICIENCY STATUS

Clarkstown				
	Shower 1 Low Flow	Shower 2 Low Flow	Shower 3 Low Flow	All Showers
Yes	167	99	21	**52%**
No	65	40	18	**22%**
Don't know	75	50	19	**26%**
	307	**189**	**58**	
Haverstraw				
	Shower 1 Low Flow	Shower 2 Low Flow	Shower 3 Low Flow	All Showers
Yes	103	36	6	**46%**
No	45	28	13	**27%**
Don't know	52	26	8	**27%**
	200	**90**	**27**	
Orangetown				
	Shower 1 Low Flow	Shower 2 Low Flow	Shower 3 Low Flow	All Showers
Yes	151	102	23	**48%**
No	81	56	22	**28%**
Don't know	79	45	13	**24%**
	311	**203**	**58**	
Ramapo				
	Shower 1 Low Flow	Shower 2 Low Flow	Shower 3 Low Flow	All Showers
Yes	129	86	22	**45%**
No	65	39	12	**22%**
Don't know	85	59	27	**33%**
	279	**184**	**61**	
Stony Point				
	Shower 1 Low Flow	Shower 2 Low Flow	Shower 3 Low Flow	All Showers
Yes	149	89	17	**52%**
No	59	39	10	**22%**
Don't know	70	36	20	**26%**
	278	**164**	**47**	

Figure 13-5 Efficiency Status of Showerheads by Town

APPENDIX 7. FREQUENCY OF LAWN WATERING BY TOWN



	Clarkstown	Haverstraw	Orangetown	Ramapo	Stony Point
Less than once per week	33%	34%	26%	33%	29%
Once per week	19%	18%	20%	15%	17%
Twice per week	22%	22%	23%	22%	28%
Every other day	21%	19%	26%	23%	20%
Daily	5%	7%	5%	6%	6%

Figure 13-6 Frequency of Lawn Watering by Town

APPENDIX 8. WATER CONSERVATION REBATE PROGRAMS REVIEWED

Table 13-2 Summary of Rebate Items and Rebate Values from a Review of Water Utility Rebate Programs

CITY/UTILITY	SECTOR / ITEMS	DESCRIPTION
San Antonio Water System, TX	Toilets	"Kick the Can" toilet rebate program (original program offered $75 rebate for residential customers, later phase of program offered free WaterSense toilet).
	Showerheads	Free High-efficiency shower heads & aerators
	Outdoor	$100 or $200 coupons toward patioscaping, landscaping and irrigation design
	Commercial	Rebates for SAWS commercial customers who institute new water-saving processes or install new water-saving equipment, up to 100% of installed water saving equipment cost
	Restaurants	Free pre-rinse kitchen spray valve, free Ultra-low flow toilets (1.6 gpf) , 50% rebate for air-cooled ice machine
	http://www.saws.org/Conservation	
Albuquerque Water utility Authority, NM	Showerheads	$10 for WaterSense approved showerhead
	Toilets	$100 for 1.6 gpf, $50 for 1.6 gpf to 1.28 gpf or lower, residential and commercial
	Urinals	$75 for conversion to one pint or less, also available for new construction
	Clothes Washers	$100
	Hot water recirculator	$100
	Evaporative Cooler Thermostat	$25
	Xeriscape rebates	Water bill credit of $1.00 for every square foot of qualifying landscape. You must convert a minimum of 500 square feet to participate
	Free Audits	Residential includes free installation of 2.5 gpm showerheads, HE faucets and auto-shutoff hose nozzles. Commercial audits: review of usage and recommendations for savings
	http://www.abcwua.org/Conservation_and_Rebates.aspx	
Cary, NC	Outdoor	Free residential irrigation consultation
	https://www.townofcary.org/Departments/waterresources/waterconservation/Incentive_Programs.htm	
The Metropolitan Water District of Southern California	Clothes Washers	Start at $85, as of July 2015 must meet CEE Tier 1 standard
	Toilets	Premium High Efficiency Toilets using 1.1gpf or less, $40 per toilet.
	Irrigation	Weather based irrigation controllers ($35), rotating sprinkler nozzles, soil moisture systems ($85)

CITY/UTILITY	SECTOR / ITEMS	DESCRIPTION
	Rain Barrel	$75
	http://socalwatersmart.com/?page_id=2954	
NYC DEP, NY	Toilets	$125 rebate but only for multifamily conservation program participants
	http://www.nyc.gov/html/dep/html/ways_to_save_water/toilet_replacement_program_faq.shtml	
Seattle Public Utilities / Saving Water Partnership, WA	Toilets	$100 rebate for 1.06 gpf or less toilets, limited offer through March 2016
	Toilets (low income)	Free water saving toilets to low-income homeowners and low-incoming housing properties
	Irrigation systems	On-site assessment and up to 50% of the cost of high efficiency upgrades
	CII	$150 for replacing 3.0gpf or greater with flushometer, $150 for urinal, $75(1.28gpf) and $150(1.1.gpf) for tank type. Plus other case-by-case rebates.
	Commercial Laundry	$300 for Tier III coin operated washers
	Outdoor	$100 for WaterSense Irrigation controller
	http://savingwater.org/Rebates/index.htm	
Tampa Water Department, FL	Showerheads & aerators	Free Plumbing Retrofit Kit - Low flow showerhead, bathroom aerators, kitchen aerator, Teflon tape, toilet leak detection dye tablets, installation instructions, and informational brochures
	Rain sensor irrigation controller	Free
	Commercial Pre-rinse spray valve	Free
	http://www.tampagov.net/water/info/saving-water	
Pleasanton, CA	Irrigation rebates	Up to $50 for a rain sensor
	Toilet	$100 for WaterSense toilet replacing a (min) 3.5gpf
	Clothes Washers	$50 - $150 depending on washer model
	http://www.cityofpleasantonca.gov/gov/depts/os/env/water/rebates.asp	
Austin, TX	Showerheads & faucet aerators	Free
	Irrigation / outdoor	Free soil moisture meters, treegators, digital garden hose meters or sunlight calculators
		Compost ($50 for 2 cubic yards), mulch ($40 for 2 cu yards) and lawn aeration ($30)
		Irrigation system evaluations and rebates
	Commercial kitchen equipment	Extensive program, multiple rebates, up to $2,500 for specific dishwasher models (see website for full details)

CITY/UTILITY	SECTOR / ITEMS	DESCRIPTION
	https://www.austintexas.gov/department/water-conservation-rebates	
Denver Water, CO	Toilets	$150 rebate for 1.1 gpf toilets, $75 for 1.28 gpf toilets, WaterSense certified for residential and commercial
	Irrigation system	Sprinkler nozzles - $3 per head, Water Sense smart sprinkler system controller up to $100 rebate
	Commercial	Urinal - $100, Flushometer bowl & valve - $125, coin/card op laundry - $150, irrigation - 25% of smart controller and $3 nozzles
	Audits	Free for residential and commercial customers
	http://www.denverwater.org/Conservation/Rebates/	
City of Raleigh, NC	Showerhead exchange	Free - 1.5 gpm HE showers in exchange for old showerhead
	Conservation kit	Free - 2 HE bathroom aerators, 1 kitchen aerator, 2 toilet leak detection tablets
	https://www.raleighnc.gov/home/content/PubUtilAdmin/Articles/WaterConservationAndEfficiency.html	
James City Service Authority, VA	Clothes washer	$75 for an EnergyStar qualified HE dishwasher
	Dishwasher	$50 for an EnergyStar qualified HE dishwasher
	Toilet	up to $40 per WaterSense high-efficiency toilet
	Hot Water recirculator	JCSA will refund up to $50, not exceeding the cost of one hot water recirculator.
	Rain Barrel	$25 per barrel up to 4 barrels
	Cisterns	JCSA will rebate 1/4 of your JCSA Lawn Irrigation System Fee, not exceeding the cost of the rain cistern, if you remain connected to JCSA water for irrigation. JCSA will rebate half of your JCSA Lawn Irrigation System Fee, not exceeding the cost of the rain cistern, if you do not connect to or disconnect from JCSA water for irrigation.
	Rain sensor	$25, one sensor per residential customer
	Landscape / irrigation system	$150 or $250
	http://www.jamescitycountyva.gov/648/Lets-Be-Water-Smart	
California DWR, State-wide SaveOurWater Campaign	Toilet	Up to $100 for a 1.28 gallon toilet to replace a 1.6 gallon or greater toilet
	Turf replacement	Up to $2 per square foot of removed and replaced turf will be rebated per eligible household.
	http://www.saveourwaterrebates.com/toilet-rebates.html	
Citrus County Utilities, FL	Toilet	WaterSense® labeled only - 1.28 gallons per flush or less - $100
	Irrigation Controller with rain sensor	WaterSense® labeled only - $150

CITY/UTILITY	SECTOR / ITEMS	DESCRIPTION
	High-efficiency Clothes Washer	Energy Star® labeled or CEE approved only - $ 75
	Rain Sensor	$50
	Shower heads and aerators	Free available for pickup at the utility (WaterSense shower heads, bathroom and kitchen aerators)
	http://www.citrusbocc.com/waterres/conservation/conservation.htm	
Charlottesville and Albemarle County, VA	Indoor conservation kit	Free includes WaterSense shower head and faucet aerator, Teflon tape, 2 toilet leak detection dye tablets and conservation info
	Toilets	$100 rebate for WaterSense labeled
	Rain barrels	$30
	http://www.charlottesville.org/departments-and-services/departments-h-z/public-works/public-utilities/water/water-conservation/water-rebates-programs	
Hillsborough County, FL	Residential toilets	ULF toilets, tiered rebate for multiple installations, 1st - $125+$25, 2nd - $65+$15, 3rd- $40, installation allowance
	Commercial toilets	ULF toilets $100 per no limit, no installation allowance
	Community associations	Incentives of up to $2500 to promote the installation of efficient low volume irrigation systems in community maintained areas
	http://www.hillsboroughcounty.org/index.aspx?NID=1339	
Fresno, CA	Clothes Washer	$50 for a qualified HECW
	Evaporative Cooler	$100
	Rain Sensor	$50
	Rainwater Harvesting	$50
	Recalculating Hot Water Pump	$100
	Smart Irrigation Controller	$50
	Soil Moisture Sensor	$50
	Sprinkler Nozzles	up to $4 per nozzle
	Swimming Pool Cover	$50
	Toilets	$50 on up to 3 WaterSense
	Commercial Toilets	$50 WaterSense
	Commercial Urinal	$100 WaterSense
	http://www.fresno.gov/Government/DepartmentDirectory/PublicUtilities/Watermanagement/rebatespermits.htm	
Miami Dade W&S, FL	Showerheads (single-family)	Residents may exchange a pre 1996 shower head for a WaterSense shower head (free)
	Showerheads (multi-	Multifamily property owners encouraged to participate

CITY/UTILITY	SECTOR / ITEMS	DESCRIPTION
	family)	in the exchange program and exchange in bulk
	Toilets	$50 for WaterSense toilet
	Shower heads	$25 for WaterSense certified 1.5 gpm HE showerhead or faucet
	Landscape evaluations/rebates	free evaluations and up to $500 per year in rebates toward approved retrofits
	http://www.miamidade.gov/waterconservation/home-savings.asp	
Sacramento Suburban Water District, CA	Clothes Washer	$75 rebate with the purchase of an approved Tier III clothes washers listed on the ENERGY STAR Most Efficient list.
	Recirculating hot water pump	$150 rebate for a recirculating hot water pump.
	Outdoor	High efficiency irrigation heads (up to $300), pool covers, weather based irrigation controllers and rain sensors ($100 each)
	http://www.sswd.org/index.aspx?page=488	
Tucson, AZ	Single-Family Toilet	$75 for WaterSense (replacing 3.5gpf or greater). Maximum of two per customer
	Clothes Washer	$200 for specified models
	Rainwater harvesting	$300 for passive system, up to $2,000 for active system
	Gray water system	Up to $1,000
	Multi-Family / Commercial Toilet	$75 for WaterSense tank type, $150 for WaterSense flushometer / valve type
	Commercial / Industrial Urinals	$200 / urinal
	https://www.tucsonaz.gov/water/rebate	

APPENDIX 9. REBATE PROGRAM ASSUMPTION AND CALCULATIONS

The proposed rebate program is summarized in Section 6 of the main report. This appendix provides supporting information for the program. A table is provided for each rebate program outlining key assumptions, references used and methods of calculation.

Single Family Residential Rebate Programs

Toilets

Table 13-3 Assumptions for the Single-Family Residential Toilet Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION		SOURCE
Qualifying Rebate / Incentive Item	Single flush or dual flush design WaterSense labeled Toilet (1.28 gallons per average flush volume). WaterSense toilet must replace a pre-1994 standard toilet		
Savings Calculations	3.66 gallons per flush is the assumed weighted average of pre-1994 standard toilets		Survey Data
	a	3.66 - 1.28 = 2.38 gallons per flush saving	Survey Data; note 1
	b	5.1 Flushes / person / day	Reference 1
	c	3.07 persons / household	U.S. Census 2010
	d	2.43 Toilets / household	Survey Data
Est. Unit Savings	5,597 gallons / toilet / year (a*b*c/d)*365		
Five Year Implementation Goal	15,000 units		See Figure 1; note 2
Total Program Savings	0.23 MGD		
Active Savings (rebate driven)	0.076 MGD		
Passive Savings (background)	0.154 MGD		

Notes:
1. No distinction has been made between savings from dual-flush versus singe flush toilets.
2. Estimated implementation goal represents an increase of 50% over expected passive savings

References:
1. Peter W. Mayer and William B, DeOreo. Residential End Uses of Water. Aquacraft, Inc. Water Engineering and Management. American Water Works Association. 1998. p. 96.

The five-year implementation goal for the single family toilet rebate program was developed by modeling a toilet change out trend that defines a possible historical rate of toilet replacements that explain the current penetration rate of low-flow toilets. Figure 13-1 show this trend, which can be extrapolated to estimate future implementation rates; Figure 13-1 represents the follow assumptions and influences:

- 1994 was the effective date of the Energy Policy Act of 1992 which set new plumbing standards (e.g., 1.6 gallon / flush toilets)
- All toilets in 1994 were non-low flow models.

- All new homes built after 1994 had low flow toilets installed
- Toilets in existing (pre-1994) homes are replaced over time at a specific natural rate of replacement (nrr)
- The AWE Water Conservation Tracking Tool provides the following approach as a means for estimating remaining pre-1994 toilets:

$$S_y = H_{1994}(FB + HB)(1 - nrr)^{(y-1994)}$$ where:

S_y = number of pre-1994 toilets in year y
H_{1994} = number of single family homes in 1994
FB = Full bathrooms
HB = Half bathrooms
nrr = annual rate of toilet replacement

- The single-family residential survey defines the existing (2015) penetration rate of low flow toilets and therefore the above referenced equation could be solved for nrr.
- Solving for nrr, using the available information for SWNY, gives a value of 5.5%. In other words, the current level of market penetration of low flow toilets can be explained assuming 5.5% of non-low flow toilets were replaced each year, beginning in 1994.

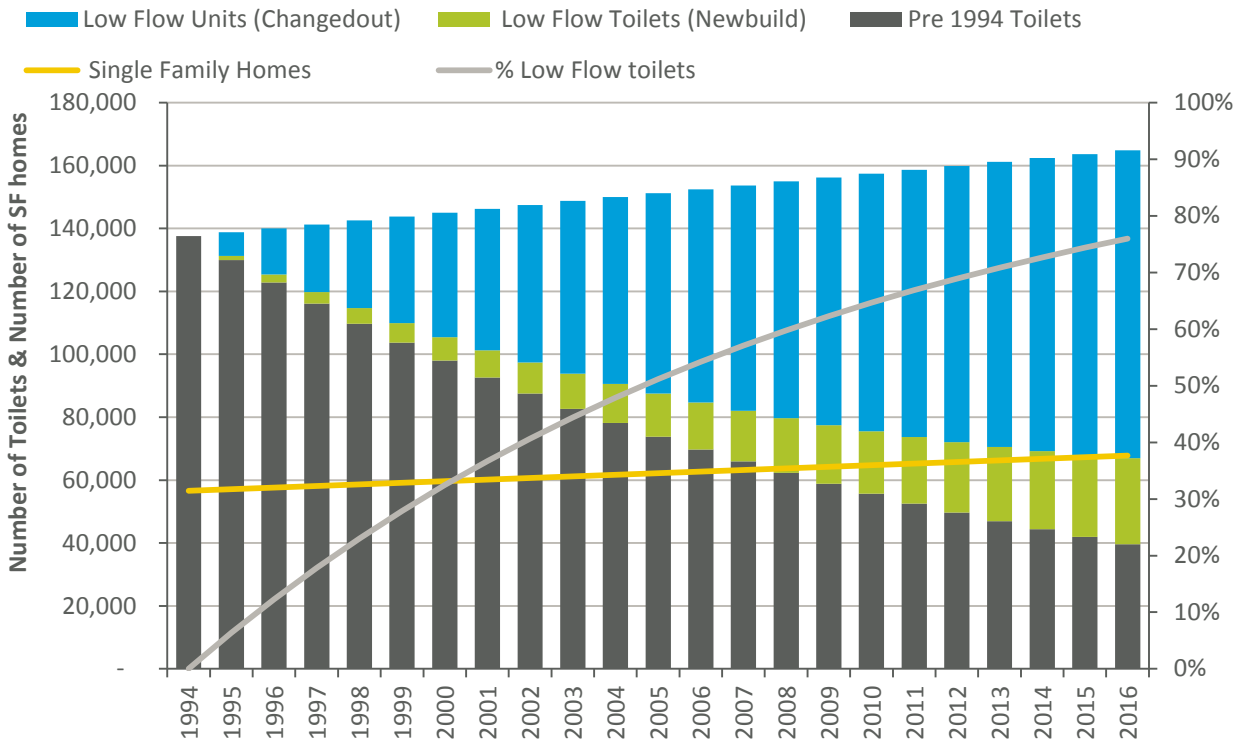


Figure 13-7 Estimation of Single-Family Residential Toilet Replacement Rate

The trends defined above can be extrapolated through future years to help set implementation goals for the rebate programs. Based on the data above for single family residential customers, extrapolating through the period 2017-2021 inclusive gives an estimated change out rate of approximately 10,000 additional toilets. This can be considered an approximation of the natural

rate of replacement. It was estimated that a rebate incentive program could accelerate the natural (passive) rate of replacement by 50% and this was used to define the implementation goal of 15,000 toilets by 2021. It should be understood that the above approach is simply a model of potential past and future implementation rates used to inform the rebate program development. For example, periods of economic growth and decline may influence the rate of change as residents increase and decrease investment in their homes. The path of actual implementation is likely to be more erratic than the smooth modeled curve suggests. The example for single family low flow toilets is built on data provided by the customer survey and referenced approaches. In developing goals for other rebate programs it was not always possible to model future implementation rates with a high level of confidence, due to a lack of data, especially for multi-family and CII sectors.

Showerheads

Table 13-4 Assumptions for the Single-Family Residential Showerhead Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION		SOURCE/NOTES
Qualifying Rebate / Incentive Item	WaterSense labeled showerhead (maximum of 2.0 gallons per minute (gpm) flow rate at 80psi).		
Savings Calculations	a	Average shower use: 4,700 gal. per person / year	Survey Data
	b	Average flow rate of existing shower: 2.7 gpm	See note 1
	c	Flow rate of WaterSense Shower: 2.0 gpm	WaterSense specification
	d	3.07 persons / household	U.S. Census 2010
	e	1.96 Showerheads / household	Survey Data
Est. Unit Savings	1,909 gallons / showerhead / year =(a-(a/b*c))*d/e		
Five Year Implementation Goal	15,000 showerheads		See note 2
Total Program Savings	0.078 MGD		
Active Savings (rebate driven)	0.052 MGD		
Passive Savings (background)	0.026 MGD		

Notes:

1. Survey Data: Weighted average flow rate based on survey Q10. Assumes 3.0 gpm flow (1980 standard) for non-low flow showers, 2.5 gpm (EPAct) for low-flow showerheads. 'Don't know' response is split 50%/50% between low-flow and non-low-flow.

2. The number of showerheads in single-family homes is estimated to be 67,500 homes x 1.96 full bathrooms = 132,300. Indicated percentage of non-low flow showerheads is approximately 24%, or 32,000. This is a conservative estimate of the potential for change as it does not include showerheads of unknown efficiency status. Implementation goal of 15,000 units is equivalent to approximately 50% of existing non-low flow showerheads.

Clothes Washers

Table 13-5 Assumptions for the Single-Family Residential Clothes Washer Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION	SOURCE/NOTES
Qualifying Rebate / Incentive Item	ENERGY STAR CEE Tier 2 or Tier 3 clothes washer replacing Top Load washer	See note 1
Savings Calculations	Top Load Washer: 8,470 gallons / year / household (39.4 gallons / load)	Survey Data
	Tier 2, Tier 3 Average Water Factor: 4.25 gallons / cubic foot of laundry	See note 2
	Average laundry load: 4 cubic feet (17 gallons / load)	See note 3
	Average laundry loads / household / year: 233	Survey Data
	Savings Calculation: 8,470-(4.25*4*233)	
Est. Unit Savings	4,509 gallons / clothes washer / year	
Five Year Implementation Goal	2,250 clothes washers	See note 4
Total Program Savings	0.028 MGD	
Active Savings (rebate driven)	0.013 MGD	
Passive Savings (background)	0.014 MGD	

Notes:

1. The WaterSense program does not currently include clothes washers. The EPA ENERGY STAR program includes a Water Factor, which specifies the maximum gallons per cubic foot of laundry load and has been used as a basis to determine eligible clothes washers.
2. Average of Water Factors for Tier 2 (4.5gal./cuft) and Tier 3 (4.0gal./cuft). See Reference 1
3. Most common capacity of washer sold at large retail store: 4.0 cubic feet
4. Due to uncertainty over the natural rate of adoption of efficient washers (front-load versus top-load is no longer a reliable means of estimating efficiency in an evolving market), an upper limit of 2,250 units has been established for this program.

References:

1. http://www.allianceforwaterefficiency.org/uploadedFiles/Resource_Center/Library/products/Clothes_Washers/Residential-Washer-Specifications.pdf

Multi-Family Residential Rebate Programs

Many of the SWNY multi-family residential rebate programs have been developed using assumptions derived from the single-family residential survey data. Where information relevant to multi-family customers was available it was used as noted in the tables below. The scale of each rebate program was also adjusted to reflect the estimated number of multi-family end units (which is different from the number of multi-family accounts).

Table 13-6 Assumptions for the Multi-Family Residential Toilet Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION	SOURCE/NOTES
Qualifying Rebate / Incentive Item	Single flush or dual flush design WaterSense labeled Toilet (maximum of 1.28 gallons per average flush volume). WaterSense toilet must replace a pre-EPAct standard toilet	
Savings Calculations	3.66 gallons per flush is the assumed weighted average of pre-EPAct standard toilets 3.66 - 1.28 = 2.38 gallons per flush saving	Survey Data. See note 1
	5.1 Flushes / person / day	See Reference 1
	3.07 persons / household	U.S. Census 2010. See note 2
	1.1 Toilets / household	See Reference 2
Est. Unit Savings	12,478 gallons / toilet / year	
Five Year Implementation Goal	5,000 toilets	See note 3
Total Program Savings	0.171 MGD	
Active Savings (rebate driven)	0.062 MGD	
Passive Savings (background)	0.109 MGD	

Notes:

1. No distinction has been made between savings from dual-flush versus singe flush toilets.
2. No specific data available for multi-family units. U.S. Census 2010 data for Rockland County lists average household size of renter-occupied units as 3.07 (identical to owner-occupied units).
3. Multi-family consumption is 2.9 mgd, assuming a per capita consumption of approximately 55 gal./capita/day this gives a population equivalent of approximately 52,700 in multi-family buildings. Using 3.07 persons per end unit, as per note 2, equates to approximately 17,000 total multi-family end units. The estimate of 1.09 toilets per end unit, as per reference 2, results in an overall estimate of 19,000 toilets. Based on this information, a program goal of 5,000 WaterSense toilets was established.

References:

1. Peter W. Mayer and William B, DeOreo. Residential End Uses of Water. Aquacraft, Inc. Water Engineering and Management. American Water Works Association. 1998. p. 95.
2. American Housing Survey (AHS) data. Recommended default value for NY, as per Alliance for Water Efficiency Conservation Tracking Tool.

Table 13-7 Assumptions for the Multi-Family Residential Showerhead Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION	SOURCE/NOTES
Qualifying Rebate / Incentive Item	WaterSense labeled showerhead (maximum of 2.0 gallons per minute (gpm) flow rate at 80psi).	
Savings Calculations	Average shower use: 4,700 gal. per person / year	Survey Data
	Average flow rate of existing shower: 2.7 gpm	See note 1
	Flow rate of WaterSense Shower: 2.0 gpm	WaterSense specification
	3.07 persons / household	U.S. Census 2010. See note 2
	1.0 Showerheads / household	See Reference 1
Est. Unit Savings	3,741 gallons / showerhead / year	
Five Year Implementation Goal	7,500 showerheads	See note 3
Total Program Savings	0.076 MGD	
Active Savings (rebate driven)	0.057 MGD	
Passive Savings (background)	0.019 MGD	

Notes:

1. Survey Data: Weighted average flow rate based on survey Q10. Assumes 3.0 gpm flow (1980 standard) for non-low flow showers, 2.5 gpm (EPAct standard) for low-flow showerheads. 'Don't know' response is split 50%/50% between low-flow and non-low-flow.

2. No specific data available for multi-family units. U.S. Census 2010 data for Rockland County lists average household size of renter-occupied units as 3.07 (identical to owner-occupied units).

3. Multi-family consumption is 2.9 mgd, assuming a per capita consumption of approximately 55 gal./capita/day this gives a population equivalent of approximately 52,700 in multi-family buildings. Using 3.07 persons per end unit, as per note 2, equates to approximately 17,000 total multi-family end units. The estimate of 1.0 showerhead per end unit means this is also the estimated number of total showerheads. A program goal of 7,500 WaterSense showerheads was established.

References:

1. American Housing Survey (AHS) data. Recommended default value for NY, as per Alliance for Water Efficiency Conservation Tracking Tool.

Table 13-8 Assumptions for the Multi-Family Residential Clothes Washer Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION	SOURCE/NOTES
Qualifying Rebate / Incentive Item	Program will focus on common-area laundry facilities within MFR facilities. Rebate eligibility will be reviewed on a case-by-case basis during water / energy audit	See note 1
Savings Calculations	Existing Washers: 33.5 gallons / load	See Reference 1
	High Efficiency Washers: 12.9 gallons / load	
	Loads / year / washer: 1,138	
Est. Unit Savings	23,443 gallons / clothes washer / year	
Five Year Implementation Goal	500 clothes washers	See note 2
Total Program Savings	0.032 MGD	
Active Savings (rebate driven)	0.029 MGD	
Passive Savings (background)	0.003 MGD	

Notes:
1. Audit program is anticipated to include collaboration with Orange & Rockland energy utility.
2. Will require working with property owners, route operators (owners of laundry equipment) and building owners

References:
1. https://www.energystar.gov/ia/products/appliances/clotheswash/508_ColesvilleTowers.pdf

CII Rebate Programs

The CII rebate programs have been developed around water using fixtures that are likely to be common to many commercial, institutional and industrial facilities. This has been done to create a program with a broad appeal and applicability. The eligibility for rebates will be determined on a case-by-case basis during the audit process that is a component of the overall water conservation program.

Table 13-9 Assumptions for the CII Toilet Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION	SOURCE/NOTES
Qualifying Rebate / Incentive Item	Program will focus on replacing toilets found in common-area restrooms in Commercial, Institutional and Industrial facilities with WaterSense specification toilets. Rebate eligibility will be reviewed on a case-by-case basis during water audit	
Savings Calculations	3.66 gallons per flush is the assumed weighted average of pre-EPAct standard toilets 3.66 - 1.28 = 2.38 gallons per flush saving	Survey Data. See note 1
	16 - 35 employees in permanent place of employment require minimum of 2 water closets	Reference 1
	Facility operational 313 days / year	See note 2
	3 flushes per employee per 8 hour shift	Reference 2
	37.5 Flushes / toilet / day	See note 3
Est. Unit Savings	27,935 gallons / toilet / year	
Five Year Implementation Goal	3,750 toilets	
Total Program Savings	0.287 MGD	
Active Savings (rebate driven)	0.258 MGD	
Passive Savings (background)	0.029 MGD	

Notes:

1. Assumes toilet being replaced has same average flush as found in residential survey
2. Assumes 1 day closed per week
3. This example calculation assumes 25 employees x 3 flushes per day / 2 toilets = 37.5 flushes / toilet / day. Facilities with visitors will increase the number of flushes and therefore potential savings.

References:

1. U.S. Department of Labor Occupational Safety and Health Administration Interpretation of 29 CFR 1910.141(c)(1)(i): Toilet Facilities (http://www.americanrestroom.org/gov/ohsa/) Determines number of water closets per number of employees
2. http://www.allianceforwaterefficiency.org/commercial_restroom_audit.aspx

Table 13-10 Assumptions for the CII Urinal Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION	SOURCE/NOTES
Qualifying Rebate / Incentive Item	Program will focus on replacing urinals found in common-area restrooms in Commercial, Institutional and Industrial facilities with WaterSense specification urinals. Rebate eligibility will be reviewed on a case-by-case basis during water audit	
Savings Calculations	2.5 - 0.5 = 2.0 gallons per urinal flush saving	Reference 1
	16 - 35 employees in permanent place of employment require minimum of 2 water closets / urinals	Reference 2
	Facility operational 313 days / year	See note 2
	1.5 urinal flushes per employee per 8 hour shift	Reference 2
	18.8 Urinal flushes / urinal / day	See note 3
Est. Unit Savings	11,738 gallons / urinal / year	
Five Year Implementation Goal	1,500 urinals	
Total Program Savings	0.048 MGD	
Active Savings (rebate driven)	0.043 MGD	
Passive Savings (background)	0.005 MGD	

Notes:
1. http://www3.epa.gov/watersense/products/urinals.html
2. Assumes 1 day closed per week
3. This example calculation assumes 25 employees x 1.5 urinal flushes per day / 2 urinals = 18.8 flushes / urinal / day. Facilities with visitors will increase the number of flushes and therefore potential savings

References:
1. http://www3.epa.gov/watersense/products/urinals.html (average of urinal flush volumes)
2. http://www.allianceforwaterefficiency.org/commercial_restroom_audit.aspx.

Table 13-11 Assumptions for the CII Pre-Rinse Spray Valves Rebate Program

ASSUMPTION	DETAILS / DESCRIPTION	SOURCE/NOTES
Qualifying Rebate / Incentive Item	Program will focus on replacing pre-rinse spray valves found in commercial and institutional kitchens with WaterSense specification units. Rebate eligibility will be reviewed on a case-by-case basis during water audit	
Savings Calculations		See note 1 and Reference 1
Est. Unit Savings	28,285 gallons / spray valve / year	See Reference 2
Five Year Implementation Goal	1,000 Pre rinse spray valves	
Total Program Savings	0.077 MGD	
Active Savings (rebate driven)	0.070 MGD	
Passive Savings (background)	0.008 MGD	

Notes:
1. As documented in Reference 1, savings of 50,000 gallons per year per valve were estimated based on 19 metered sites that were mostly small restaurants. A more conservative estimate was used for the SWNY study which uses the reference value provided in the AWE Water Conservation Tracking Tool (reference 2)

References:
1. CUWCC (2004b), —Evaluation, Measurement & Verification Report for the CUWCC Pre-Rinse Spray Head Distribution Program, prepared for the California Urban Water Conservation Council by SBW Consulting, Inc., May. See also letter to CPUC from SBW Consulting, Inc. with minor revisions to program savings results (June, 11, 2004). As reported in AWE Water Conservation Tracking Tool_v2.0 User Guide, July 2011

2. AWE Water Conservation Tracking Tool_v2.0 Activity Library CII Spray Rinse default savings value

APPENDIX 10. EXAMPLE OF PROMOTIONAL MATERIAL FOR REBATE PROGRAMS (TUSCON WATER)


How Much Water Can You Save?
Toilet flushing accounts for nearly one-quarter of indoor water use. On average, Tucson Water customers save 7,500 gallons of water per year when they install a high-efficiency toilet.
Do You Qualify?
The toilet rebate program is for Tucson Water residential customers whose homes were built prior to 1991 with a toilet that uses 3.5 gallons per flush or more. For additional requirements, please review the Rebate Program Policy on the back of the rebate application.
Low-income customers may qualify for free toilet replacements. Call Community Home Repair at (520) 745-2055 to inquire.
What Toilets Qualify?
Only WaterSense certified high-efficiency toilets (HETs) qualify for the rebate.
Look for the Logo
Look for the WaterSense logo to select a toilet that qualifies for the rebate and meets water efficiency and performance standards. A list of qualifying HETs can be found on the EPA's website at epa.gov/WaterSense/product_search.html
How Much Is the Rebate?
Tucson Water customers can receive $75 per HET. There is a two toilet maximum allowed at each property for a rebate up to $150.
INDOOR WATER USE
Toilet 24%
Clothes Washer 17%
Shower 20%
Faucets 19%
Leaks 16%
Bathtub – 3%
Dishwasher – 1%
Did You Know?
Technological advancements allow toilets to use 1.28 gallons per flush or less while still providing equal or superior performance. This is 20% less water than the current federal standard of 1.6 gallons per flush. The WaterSense label is used on toilets that are independently certified to meet rigorous criteria for both performance and efficiency. Only water-saving toilets that complete the certification process can earn the WaterSense label.

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