



VILLAGE OF OSSINING

WATER DEMAND MANAGEMENT PLAN

May 2016



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Dear Friends,

Our mission is to provide an adequate supply of safe, potable water for residential, commercial, and fire-fighting purposes to customers of our water system and visitors to the Village of Ossining. As part of our efforts to improve services and to ensure a sustainable water system for decades to come, we have partnered with New York City to produce this Village of Ossining Water Demand Management Plan. As the ninth largest wholesale consumer of water from New York City's water supply system, the Village of Ossining is proud to further its water conservation and demand management efforts.

Effective water demand management strategies are critical to the sustainable management of our water supplies. This report provides a detailed description of the Village of Ossining's water supply system serving both the Village of Ossining and the unincorporated Town of Ossining. The report also includes a demand profile identifying key water use sectors in the system. The water demand management measures suggested in the plan provide a roadmap for private and public entities to partner to achieve the goal of water use efficiency while continuing to provide clean, safe, and reliable drinking water to all residents.

Sincerely,

Victoria Gearity
Mayor, Village of Ossining

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INTRODUCTION

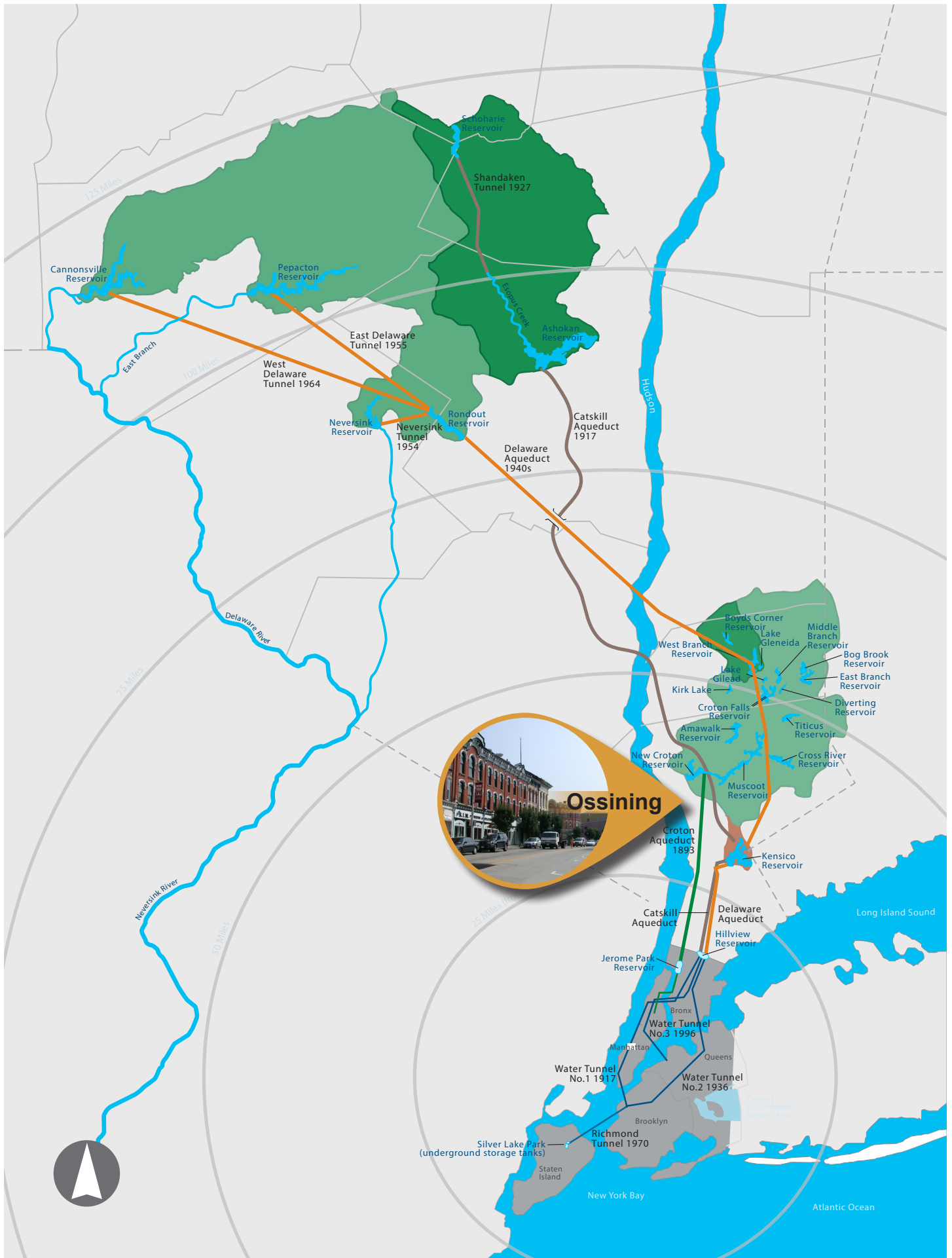
Ashokan Reservoir

The Village of Ossining (Ossining) purchases all of its water from New York City (NYC) through the NYC Department of Environmental Protection (DEP) and the NYC Water Board (Water Board). This high-quality surface water originates in protected watershed areas of the Croton Watershed, which covers an area of more than 300 square miles north and east of Ossining. Water is delivered to Ossining through a 3-mile section of the Old Croton Aqueduct. Overall, the NYC Water Supply System (NYC System) is an integrated network of 19 reservoirs and three controlled lakes in a nearly 2,000 square-mile watershed. The NYC System delivers approximately one billion gallons of water per day to more than 8.5 million users in New York City (NYC), as well as about 110 million gallons a day to wholesale customers north of NYC—nearly one million people living in Westchester, Putnam, Ulster, and Orange counties.

Ossining's Croton source water is supplied from two surface water sources: the Indian Brook Reservoir, located at 25 Fowler Avenue, and the New Croton Reservoir, which is part of the NYC System. For 2013, the average blend ratio was approximately 62 percent from the New Croton Reservoir and 38 percent from the Indian Brook Reservoir. The two waters are blended together and treated at the Indian Brook Water Filtration Plant. The raw water entering the plant undergoes several treatment processes, which include oxidation,

aeration, coagulation and flocculation, sedimentation, filtration, pH and corrosion control, fluoridation, and disinfection. The treated water is then pumped into the distribution system for the public's use.

With the NYC System's service area population expected to rise to 9.1 million by 2030, there are times when water consumption within the NYC System must be curtailed for purposes of aging water infrastructure repairs, potential droughts, or other purposes. It is understood that water conservation and efficiency have an important role in meeting water demand. As NYC wholesale customers' consumption represents 10 percent of the NYC System's total demand, DEP and the Water Board have undertaken a water demand management program that benefits NYC Wholesale Customers by providing support to develop and implement customer water demand management plans. The goals of developing such plans are to equip NYC wholesale customers with the ability to curtail consumption as needed in the short term in the event of a major water shortage and to achieve long-term water demand reductions of at least 5 percent by 2019. **For Ossining, a 5 percent reduction from 2013 consumption levels sets a demand management goal of approximately 46.0 million gallons per year (mgy) and 0.13 million gallons per day (mgd) of savings.**





WATER SYSTEM PROFILE AND CHARACTERIZATION

Delaware Aqueduct

Ossining is located on the Hudson River in western Westchester County, New York. Ossining is bordered by the Village of Briarcliff Manor to the south and the Village of Croton-on-Hudson to the north. The Ossining water system serves the entirety of the Village of Ossining and also includes sections of the Town of Ossining.

According to the U.S. Census Bureau, Ossining has a total area of 6.3 square miles (16.4 km²), of which, 3.2 square miles (8.3 km²) is land and 3.1 square miles (8.1 km²) (49.37 percent) is water.

The Ossining water system served approximately 30,000 people through approximately 6,010 service connections in 2013. The total annual water produced in 2013 was approximately 1.25 billion gallons, according to the Ossining's annual Water Quality Report. The daily average of water treated and pumped into the distribution system was 3.2 mgd. The highest single day was 4.2 million gallons (MG). In 2013, Ossining purchased 920.1 MG (2.52 mgd) from the NYC System.

Water Treatment System

Ossining obtains water from the NYC System, specifically from the Croton watershed in Putnam and Westchester counties. The reservoirs in this mixed land use area are moderately shallow with various degrees of development within the watersheds. Watershed protection efforts regulate municipal and individual wastewater treatment systems as

well as provide for stormwater protection programs.

Ossining's water is supplied via two surface water sources: the Indian Brook Reservoir, located at 25 Fowler Avenue, and the New Croton Reservoir, which is part of the NYC System. The average blend ratio for 2013 was approximately 62 percent from the New Croton Reservoir and 38 percent from the Indian Brook Reservoir. The two waters are blended together and treated at the Indian Brook Water Filtration Plant. The raw water entering the plant undergoes several treatment processes, which include oxidation, aeration, coagulation and flocculation, sedimentation, filtration, pH and corrosion control, fluoridation, and disinfection. The treated water is then pumped into the distribution system for the public's use.

Water Distribution System

Ossining's water distribution system consists of 44 miles of main.

With the potential substantial development and redevelopment in the coming years, water use in Ossining has become a topic of discussion and concern. Per capita water usage has been growing according to a recent report from Hazen and Sawyer, as have the size of homes and meticulously landscaped lawns. Ossining is actively seeking opportunities to strategically improve, increase, and diversify its water supply capacity.

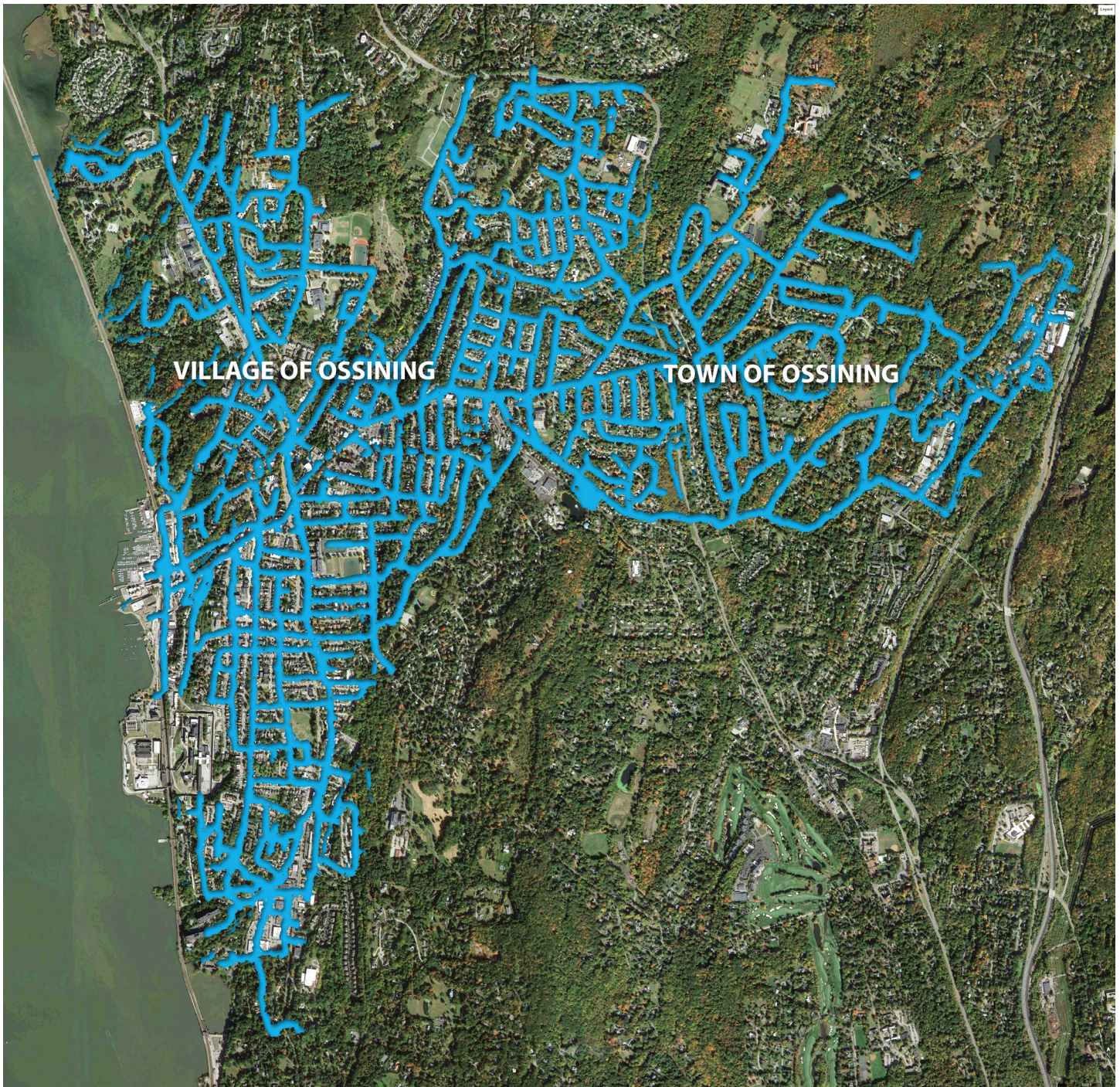


Figure 2.1: Water Distribution Map, Village of Ossining and Town of Ossining

Service Area Characteristics

Ossining is a well-established community and the water service area has experienced limited population changes since 2008 based on changes in the number of water accounts served. Population and per capita water use over the past few years are shown in **Table 2.1** along with annual purchases from NYC and calculated volumes of water produced from Ossining's own sources.

	2008	2009	2010	2011	2012	2013
Village of Ossining (MG)	624.5	593.2	588.8	721.4	647.1	569.6
Town of Ossining Town (MG)	206.5	183.1	193.7	186.6	185.4	183.5
Municipal (MG)*	18.1	98.2	70.0	62.6	79.5	81.5
Prison (MG)	98.8	115.0	90.4	92.6	147.2	177.8
Purchased from NYC (MG)+	922.6	825.8	891.2	715.1	906.5	920.1
Percent from NYC	97.3%	83.5%	94.5%	67.3%	85.6%	90.9%
From Own Sources (MG) - Calculated	195.7	290.9	351.8	536.4	418.4	335.7
Percent from Own Sources	2.7%	16.5%	5.5%	32.7%	14.4%	9.1%
Non-Revenue (MG)	170.4	127.1	300.2	188.3	265.7	243.4
Total Produced All Sources (MG)	1,118.3	1,116.7	1,243.0	1,251.5	1,324.9	1,255.8
Total Produced All Sources (mgd)	3.1	3.1	3.4	3.4	3.6	3.4
Total # of Service Connections**	6,010	6,010	6,010	6,010	6,010	6,010
Gallons/Connection/Day	432.1	451.1	429.8	484.7	482.8	461.5
NYC DEP billing population	30,466	30,466	30,466	30,466	30,466	30,466
Gallons/Capita/day	85.2	89.0	84.8	95.6	95.2	91.0

*Municipal demand from 2011-2013 is an estimated volume due to data discrepancies.

**From Ossining annual Water Quality Report.

+Based on "Upstate Consumption History.xls" spreadsheet.

Table 2.1: Ossining Water Demand, Population, and Per Capita Use 2008-2013

It is noteworthy that water use in the Village of Ossining peaked in 2011 and was lowest in 2013, while use in the Town of Ossining peaked in 2008. Water use at the area prison has increased dramatically in 2012 and 2013 compared to earlier years for which data were provided.

Figure 2.2 shows system and metered per capita use in Ossining from 2008 to 2013. Per capita use has increased slightly based on this estimate, although use remained roughly the same over that time span.

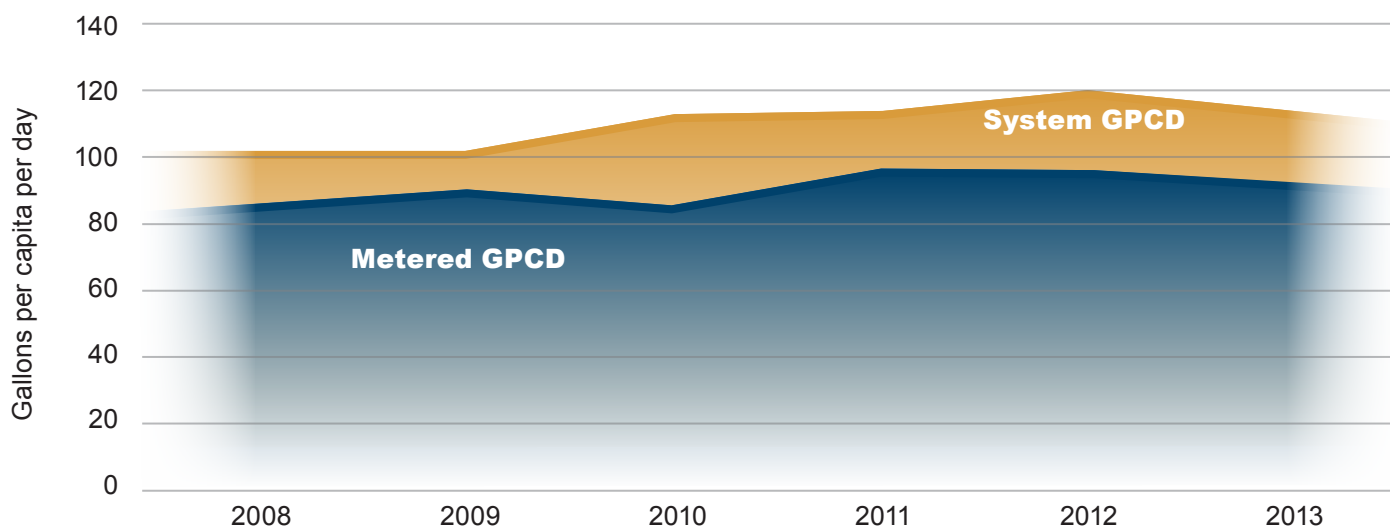


Figure 2.2: Gallons Per Capita Per Day, 2008-13, Ossining



WATER DEMAND AND SAVINGS GOAL

Ossining Downtown

This plan summarizes and analyzes Ossining's water deliveries and demands over the past 5 years to explore the potential for cost-effective water demand management.

In 2013, Ossining purchased 920.1 MG (2.52 mgd) from the NYC System. Annual water demands for 2008-2013 are presented on **Figure 3.1**. From 2008 to 2013, Ossining purchased an average of 864 MG per year from the NYC System.

The annual consumption from all of the Ossining's metered accounts from 2008 to 2013 and calculated system water

loss are shown on **Figure 3.2**. Non-revenue water in Ossining's distribution system ranged from 127 to 300 MG over the past 6 years and averaged 17.5 percent of deliveries. A more detailed analysis of non-revenue water loss in 2013 is presented later in this section.

Ossining's 2013 demand is shown as a pie chart on **Figure 3.3**. Water demand is divided into key categories including the Village of Ossining (45 percent), non-revenue (19 percent), the Town of Ossining (15 percent), prison (14 percent), and municipal (8 percent).

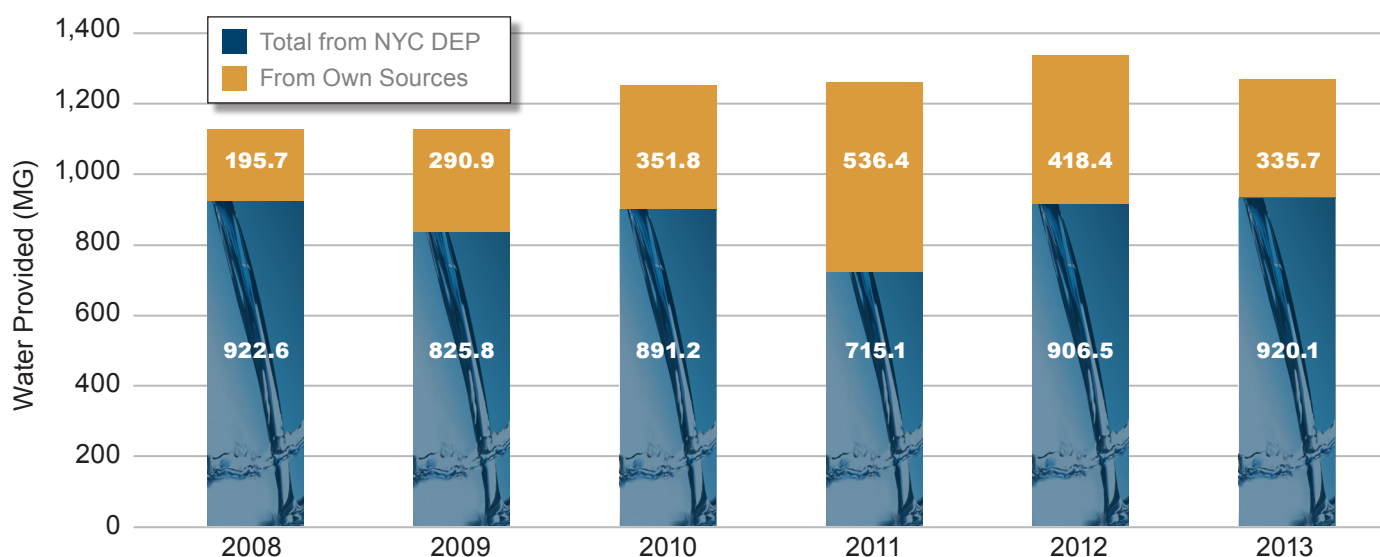


Figure 3.1: Ossining Water Demand, 2008-2013

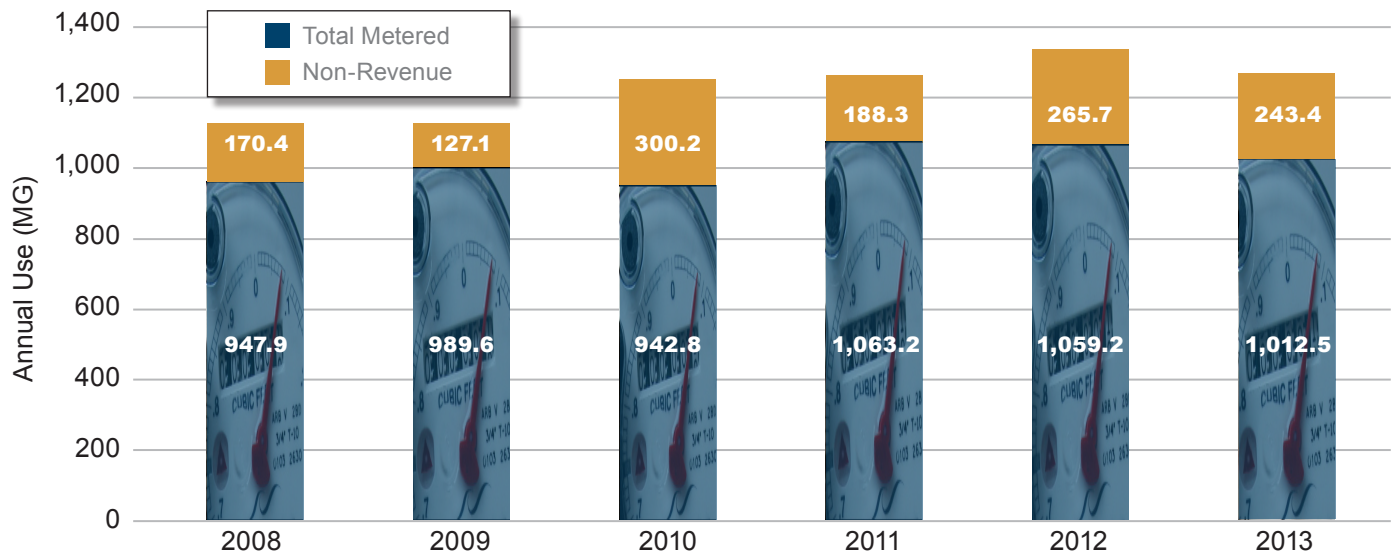


Figure 3.2: Total Metered Demand and Non-revenue Water, Ossining

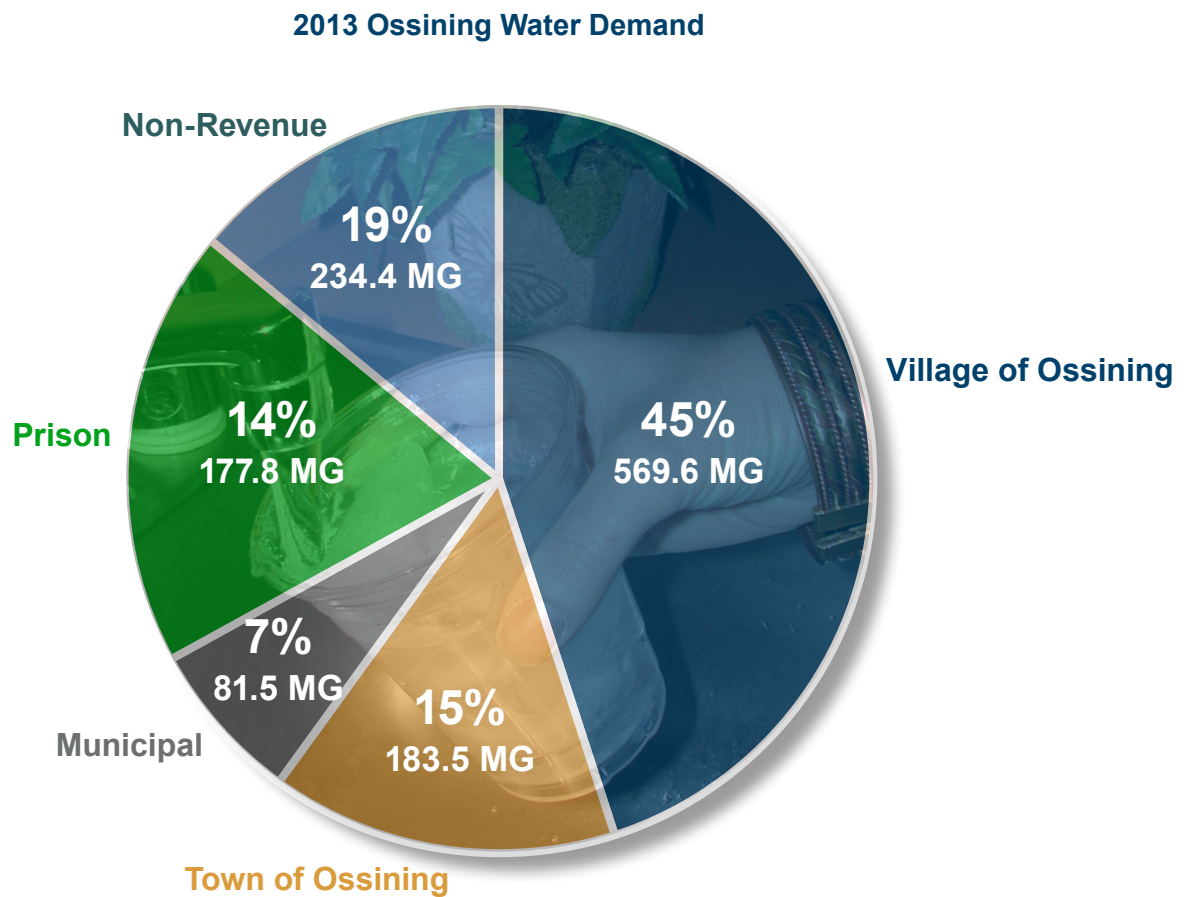


Figure 3.3: 2013 Water Use, Ossining, (MG and Percent)

A summary of historic metered water demands, purchases from NYC, non-revenue water, and population for Ossining is presented in **Table 3.1**. Included in **Table 3.1** are calculations of metered per capita consumption and production per capita consumption in Ossining. Consumption by meter size and the demand by each category over the past 5 years is shown on **Figure 3.4**.

Metered demand by the Village of Ossining, the Town of Ossining, and other key categories from 2008 to 2013 is shown on **Figure 3.4**. With the exception of 2011, water use in Ossining fluctuated very little, indicating a steady customer base.

Year	2008-2013 Ossining - Demand Summary (MG)												
	Village of Ossining	Town of Ossining	Municipal*	Prison	Total Metered	Total from DEP**	From Own Sources - Calculated	Plant Production - All Sources	Non-Revenue	Percent Non-Revenue	Population	Meter GPCD	Prod. GPCD
2008	624.5	206.5	18.1	98.8	947.9	922.58	195.72	1,118.3	170.4	15.2%	30,466	85.2	100.6
2009	593.2	183.1	98.2	115.0	989.6	825.81	290.89	1,116.7	127.1	11.4%	30,466	89.0	100.4
2010	588.8	193.7	70.0	90.4	942.8	891.21	351.79	1,243.0	300.2	24.1%	30,466	84.8	111.8
2011	721.4	186.6	62.6	92.6	1,063.2	715.09	536.41	1,251.5	188.3	15.0%	30,466	95.6	112.5
2012	647.1	185.4	79.5	147.2	1,059.2	906.48	418.40	1,324.9	265.7	20.1%	30,466	95.2	119.1
2013	569.6	183.5	81.5	177.8	1,012.5	920.09	335.75	1,255.8	243.4	19.4%	30,466	91.0	112.9

*Municipal demand in 2011 – 2013 is an estimated volume due to data discrepancies.

**Based on "Upstate Consumption History.xls" spreadsheets.

Table 3.1: Village of Ossining Metered Water Demand Summary

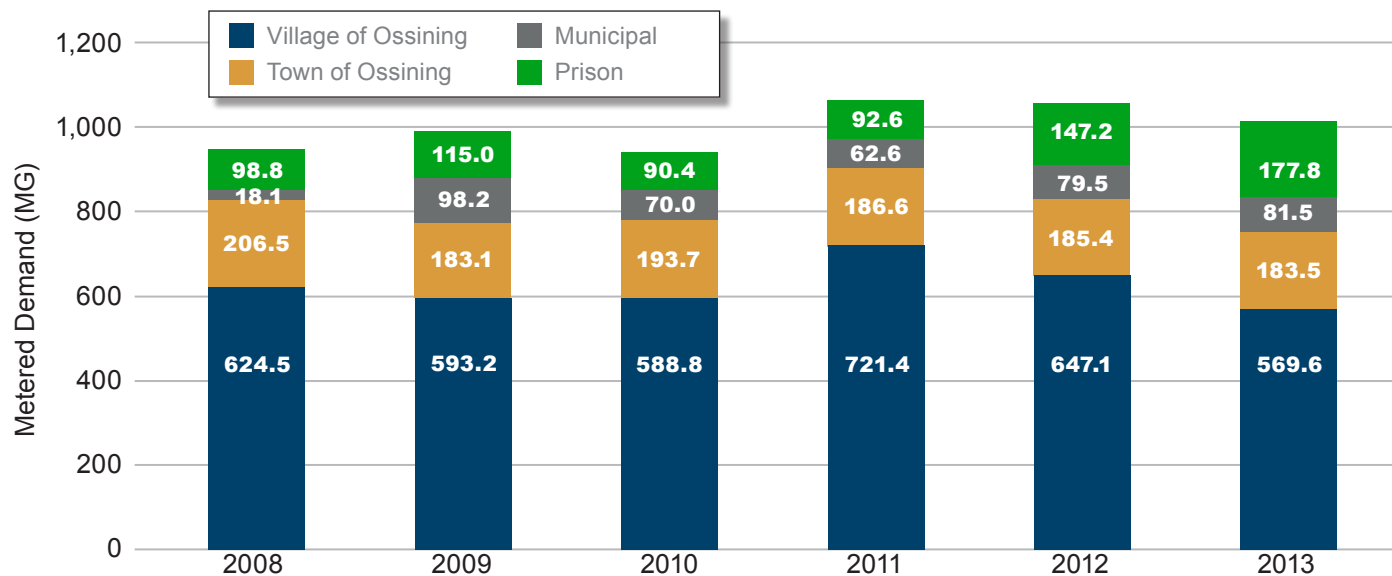


Figure 3.4: Metered Demand by Customer Category 2008-13, Ossining

Water Loss Analysis

As part of the preparation of this water demand management plan, WaterDM prepared a basic desktop water loss audit for calendar year 2013 for the Ossining water system, using the American Water Works Association (AWWA) M36 approach and Microsoft Excel software. Utilities incur real losses from pipeline leakage and apparent losses when customer water consumption is not properly measured or billed. The water audit method used for Ossining was developed jointly by the International Water Association and AWWA and provides the best management practice tools water utilities need to efficiently manage their supplies.

While overall non-revenue water in 2013 was 243.4 MG, the 2013 water loss control audit for Ossining found that approximately 228 MG of that non-revenue volume are lost from the system over the year. About 26 MG are apparent losses and 201 MG are real losses. It is estimated that in Ossining about 69 mgy of loss are unavoidable under the best of circumstances, suggesting that about 159 mgy of loss per year could be addressed through future action.

Real water losses in Ossining amounted to 91 gallons per connection per day in 2013. This could probably be brought down to 25 gallons per connection per day over time through a systematic water loss control program. It is calculated that in 2013, the annual cost to Ossining of the apparent losses in the system was \$263,710 and the annual cost of real losses to the system was \$316,780.

2013 Ossining Water Loss Control Performance Indicators

Financial Indicators

- \$263,710 – Annual cost of Apparent losses
- \$316,780 – Annual cost of Real losses (valued at the variable production cost – \$1,573.61 per MG)
- 19.4 percent – Non-revenue water as percent of volume of water supplied.

Operational Efficiency

- Apparent losses per service connection – 11.9 gallon (gal)/connect/day
- Real losses per service connection per day – 91.0 gal/connect/day
- Current Annual Real Losses – 201.3 mgy
- Infrastructure Leakage Index (ILI) – 2.91

The ILI is a performance indicator for comparing utilities operational management of real losses. An ILI score in the range of 1 to 3 is a general indication that water loss is being successfully addressed and these efforts should be continued and expanded. Operating with system leakage above this level is expensive and not desirable and proactive measures are necessary to further reduce water loss in the future.

Water Audit Data Validity Score

Ossining earned a 47 out of 100 Water Audit Data Validity Score for this water audit. A score of 47 is a poor level of overall water accountability, even for a first audit. This score can be improved by reviewing the data-validating requirements in the AWWA software (v5.0) and by implementing as many of the recommendations indicated as possible.



¹ The AWWA M36 Manual (3rd ed. 2009) defines apparent losses as unauthorized consumption, customer metering inaccuracies, and systematic data handling errors. Real losses are defined as leakage in transmission and distribution lines, leakage and overflows at storage tanks, and leakage on service connections up to the customer meter.

Village of Ossining 2013 Water Loss Control Audit Summary

A summary of the data input and outputs from the 2013 Ossining water loss control audit is presented here.

Water Supplied (MG)	
Volume from own sources	335.750
Water purchased from NYC	920.090
Water exported (included with Billed Metered)	
Water Supplied	1,255.840
Authorized Consumption (MG)	
Billed metered	1,012.500
Billed unmetered	
Unbilled metered	
Unbilled unmetered	15.698
Authorized Consumption	1,028.198
Water Losses (Water Supplied - Authorized Consumption)	227.642
Apparent Losses (MG)	
Unauthorized consumption	3.140
Customer metering inaccuracies	20.663
Systematic data handling errors	2.531
Apparent Losses	26.334
Real Losses = Water Losses - Apparent Losses	201.308
Water Losses	227.642

Table 3.2: Ossining 2013 AWWA Water Audit Summary

Current and Historic Demand Management

Ossining has begun implementing a number of relevant demand management measures. These measures are described briefly below:

Inclining Block Rate Billing Structure

In Ossining, most residential customers are billed quarterly and some non-residential customers are billed monthly. Ossining has recently adopted an inclining block rate structure with substantially higher rates for out-of-Village customers. For 2016, water rates for the Village and Town of Ossining are as follows with specific consumption charges in bold:

Village of Ossining Customers

- First 100 cubic feet (CF) per billing cycle, **\$25.00 minimum**
- Over 100 CF/billing cycle, **\$7.491 per 100 CF** (+5.5 percent)

- Over 100 CF/billing cycle to 249,999 CF/quarter, or 83,333 CF/month, or 166,666 CF/bi-month, **\$7.491 per 100 CF**, (effective April 1, 2016).
- Over 250,000 CF/quarter, or 83,334 CF/month, or 166,667 CF/bi-month, **\$11.236 per 100 CF**, (effective April 1, 2016).
- Owners and related customers will be grouped together for purposes of determining billing consumption thresholds.

Town of Ossining Customers

- First 100 CF per billing cycle, **\$37.50 minimum**
- Over 100 CF/billing cycle, **\$11.236 per 100 CF** (+5.5 percent)
- Over 100 CF/billing cycle to 249,999 CF/quarter, or 83,333 CF/month, or 166,666 CF/bi-month, **\$11.236 per 100 CF**, (effective April 1, 2016).

- Over 250,000 CF/quarter, or 83,334 CF/month, or 166,667 CF/bi-month, **\$14.982 per 100 CF**, (effective April 1, 2016).
- Owners and related customers will be grouped together for purposes of determining billing consumption thresholds.

Comments on Rate Structure

While Ossining's rate structure provides a price incentive for conservation, the quarterly billing cycle makes it difficult for customers to make rational economic decisions on their water use. Quarterly billing is not considered a demand management best practice by AWWA, monthly is best and bi-monthly is acceptable.

Water Loss Control Measures

Ossining has recently taken important proactive steps to reduce water loss, but it is a long and difficult process. Ossining utilizes a 12-year water meter replacement cycle, which is considered an industry best practice. More than 50 percent of the current replacement cycle has now been completed.

Ossining conducts annual leak detection surveys and uses its SCADA system to conduct night flow studies in District Metered Areas (DMAs). These are also considered industry best practices. Even with these measures in place, staff report it took 20 days to find a particularly vexing leak in 2014. Ossining staff estimated that \$100,000 per year is invested in water loss control measures, including leak detection and monitoring.

Additional leak detection and water loss control measures are something that Ossining is interested in pursuing through the DEP planning process.

Water Conservation Ordinances

The Village of Ossining Municipal Code includes two important water conservation ordinance listed below.

Chapter 259-15 Waste of water prohibited

All waste of water at all times is prohibited. A consumer shall maintain his or her faucets, toilets, and service lines and all appurtenances in good order and condition and free of all leaks at his or her own expense.

Chapter 259-16 Emergency curtailments on use

A. Whenever it shall be determined by the Board of Trustees that a state of emergency exists by reason of drought or damage to the public water supply system or that there is an insufficient supply of water or that the water supply system is endangered by any

other cause, then upon resolution of the Board, and after publication once in a local newspaper, it shall be unlawful to use water from the Village's water supply system for any of the following uses:

- (1) *Lawn sprinkling, etc. Lawn sprinkling and sprinkling of shrubs, flower gardens and vegetable gardens with a hose or sprinkler; however, watering of shrubs, flower gardens and vegetable gardens with a watering can or bucket is permitted.*
- (2) *Washing automobiles. The washing of automobiles in any form, except the commercial washing of automobiles, with the exception that windshields and glasses necessary for the proper operation of the vehicle may be washed or cleansed only.*
- (3) *Water supply lines with constant flow bleeds. The maintenance of water supply lines with bleeds on any dock, structure or in any building for the purpose of maintaining a constant flow to prevent freezing.*
- (4) *Filling pools, etc. The filling of pools of all sizes, or the operation of pools of any size which do not recirculate water.*
- (5) *Automatic plumbing fixtures, etc. The maintenance or operation of automatic plumbing flush fixtures or apparatus using a constant or fixed periodic flow. The flow from such apparatus shall only be by manual operation when the fixture or apparatus is in actual use.*
- (6) *Cleaning of buildings, etc. The cleaning or washing of the outside of buildings or any structures, involving the use of water or steam in any form, until further notice.*
- (7) *Hoses, spouts, etc. The use of a hose, spout and similar pressure bathing apparatus or the maintenance of a constant flow from showers or similar apparatus. Operation of such apparatus shall be manual and only when the apparatus is in actual use.*
- (8) *Refrigerating and air-conditioning systems. The operation of any system of refrigeration or air conditioning having an individual or collective capacity of six tons or greater unless it shall be equipped with a water conserving device such as an economizer, evaporative condenser, water cooling tower or similar apparatus, which device shall not consume for makeup purposes in excess of 5 per-*

cent of the consumption that would normally be used without any such device.

- B. Any person violating this section shall be subject to punishment as provided in Article III, General Penalty, of Chapter 1, General Provisions and, in addition, water service to violators may be discontinued.

Drought Response and Emergency Curtailment

Additionally, Westchester County has developed a drought response and emergency curtailment plan as part of Local Law 9 – 1996, titled Chapter 693 – Water Conservation. The Westchester County law also created a Drought Emergency Task Force to establish administrative procedures and to monitor compliance with Westchester County’s Water Conservation Program.

Westchester County’s drought emergency contingency plan includes these drought condition phases:

Drought Watch

The initial step, a “Drought Watch,” may be announced by the county executive when the depletion of reservoir storage and the current meteorological forecast suggest that normal consumption rates will result in a more serious shortage.

The object of the “Drought Watch” announcement is to reduce consumption by encouraging voluntary conservation and to create public awareness of depleted storage levels and anticipated adverse water supply developments. At this point, it is important to raise the consciousness level of the area’s water users.

Drought Warning

If storage levels continue to decrease and conditions deteriorate, but the capacity of the reservoirs to recover within a short period of time exists, a “Drought Warning” may be announced.

During the “Drought Warning”, the County Executive would initiate an outreach program to the public for voluntary water conservation. Also, during this stage, public awareness programs are intensified, the County takes a lead role in encouraging conservation, and planning activities commence in the event that a Drought Emergency is declared.

Drought Emergency

If the drought continues and/or voluntary conservation measures are ineffective, the county executive may assume emergency powers by declaring a “Drought Emergency” under Local Law 9-1996.

Normally, the county executive declares the existence of a drought in Westchester County following the receipt of a report or recommendation from the Westchester County Water Agency.

Local Law 9-1996 empowers the county executive to restrict the wasteful, inefficient or non-essential use of water, establish penalties for violations, and provide for the enforcement of water conservation measures.

The current water supply status, actual precipitation levels, success of conservation measures, and long- and short-range meteorological forecasts allow the county executive to declare a drought emergency in three distinct phases, which require progressively more stringent restrictions and regulations.

- Phase I is the Declaration of a Drought.
- Phase II is the Declaration of a Severe Drought.
- Phase III is the Declaration of an Extreme Drought.

Water Savings Goal

The water savings goal for this plan is to achieve water demand reductions of at least 5 percent of the volume purchased from NYC in 2013 over the next 5 to 7 years². For Ossining, a 5 percent reduction from 2013 consumption levels sets a demand management goal of approximately 46.0 mgd (0.13 mgd) of savings by 2020. A summary of Ossining’s water demand in 2013 and the calculated savings goal are presented in **Table 3.4**.

	2013 (mgd)	2013 (MG)
Water Purchased from NYC	2.52	920.1
Metered Demand	2.77	1,012.5
Water loss (real + apparent losses)	0.67	243.4
5% Savings Goal	0.13	46.0

Table 3.4: Ossining 2013 Water Use Summary and 2020 Savings Goal

² 2013 consumption is used as the basis for the water savings goal for all agencies participating in the NYC upstate water demand management planning effort.



EVALUATION AND PROPOSAL OF WATER DEMAND MANAGEMENT MEASURES

The Water Board developed a water demand management planning program to assist its 10 largest customers, including Ossining, to reduce water consumption by a minimum of 5 percent from the baseline water usage recorded in fiscal year 2013 and maintaining lower water demand levels thereafter. A broad series of water demand options were evaluated for this plan and are included in Section 5. However, not all of the options discussed in this section meet the Water Board's criteria for receiving funding support because some do not achieve a 5 percent reduction, some do not offer durable demand reductions, and some are not cost-effective.

Water Demand Management Program Measures and Options

The analysis of water demand management program options for Ossining identified six areas that appear promising for implementation and have the potential of achieving the desired 5 percent demand reduction of 0.13 mgd. The areas are:

1. Water loss control, including additional leak detection and line repair.
2. Increased prison water efficiency.
3. Indoor upgrade voucher program for residential retrofits, including toilet, shower, and faucet replacement.
4. Commercial and institutional customer audits and upgrades.
5. Customer engagement and leakage alerts—continue and expand advanced metering infrastructure (AMI) leak detection, night polling, and customer leak alerts.
 - A. Offer leak repair assistance (free or subsidized).
6. Transition to monthly billing for all customers.

Each measure is briefly described below and a summary of the preliminary water savings and cost analysis is presented in **Table 4.1**. The cost estimates presented here are “reconnaissance level” estimates that are intended to provide information on the relative costs of different demand management measures.

Potential Water Demand Management Measures, Village and Town of Ossining

Description	Basis for Savings Estimate	Units/ Customers	Expected Savings (gpd)	Percent of 0.13 mgd Savings Goal	Expected Cost (\$)	1 year Cost Per GPD Saved (\$)	Net Annual Revenue Loss/Gain
1. Water Loss Control							
Line Listening	Entire system, 44 miles, \$300/mile	44	-	-	\$ 13,200	-	-
Line Repair	8% - 12% of annual water loss	-	66,679	56.0%	TBD	TBD	\$43,264
Pressure Management	7% - 10% of annual water loss	-	33,340	28.0%	TBD	TBD	\$36,774
2. Increased Prison Water Efficiency	5% of annual demand	1	24,353	20.5%	\$ 500,000	\$20.53	(\$75,020)
3. Indoor upgrade voucher program	10,000 gal. savings/ intervention	2,000	43,836	36.8%	\$400,000	\$9.13	(\$135,036)
4. Commercial and institutional customer audits and upgrades	75,000 gal./ participant	100	20,548	17.3%	\$750,000	\$36.50	(\$63,298)
5. Customer engagement and leak alerts	5% reduction in residential demand	4,000	67,062	56.3%	\$200,000	\$2.98	(\$206,584)
6. Transition to monthly billing for all customers	6% reduction in residential demand	4,000	80,474	67.6%	\$40,000	\$0.50	(\$247,901)

Table 4.1: Ossining Demand Management Options Preliminary Cost and Savings Analysis

Measure 1: Water Loss Control Including Meter Replacements, Leak Detection, and Line Repair, and Pressure Management

Improved water loss control measures have the potential to achieve more than 50 percent of Ossining's demand reduction goal. In 2013, non-revenue water was 19.4 percent of water supplied, which is similar to neighboring water providers participating in this overall planning effort. However, the annual cost of real losses in 2013 was \$316,780 when valued at NYC's purchase rate of \$1,574 per MG. Ossining occasionally purchases water at the excess rate of \$4,500 per MG. If water loss were to be valued at that rate it would be \$905,885 in 2013.

Ossining has recently taken important proactive steps to reduce water loss, but it is a long and difficult process. Ossining utilizes a 12-year water meter replacement cycle, which is considered an industry best practice. More than 50 percent of the current replacement cycle has been completed.

Ossining also conducts annual leak detection surveys and uses its supervisory control and data acquisition (SCADA) system to conduct night flow studies in DMAs. These are also considered industry best practices. However, even with these measures in place, staff report it took 20 days to find an undetermined leak in 2014. Ossining staff estimated that an annual operating budget of \$100,000 is invested in water loss control measures, including \$60,000 to \$70,000 per year for a Connecticut company to conduct leak detection and monitoring.

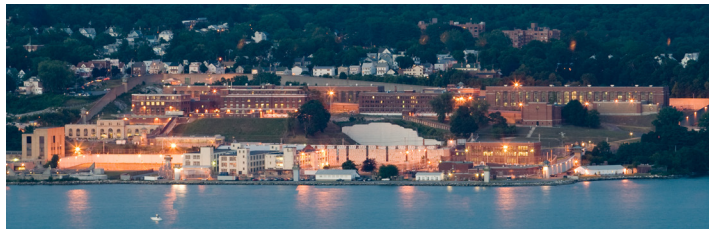
Ossining is already implementing a number of best practices for water loss control. Ossining should continue to implement an annual M36 water audit. Audits for 2014 and 2015 would require a minimal amount of additional data and could be done as part of this demand management planning project. Ossining's best practice metering program should reduce apparent water losses. DEP funding could be used to augment and improve Ossining's current efforts with an emphasis on reducing real losses.

\$ Water savings potential:
0.07 mgd (60 percent of goal)

Measure 2: Increased Prison Water Efficiency

In 2013, water use at the Sing Sing Correctional Facility in Ossining accounted for 14 percent of the total demand of the system. Furthermore, it appears water use has increased substantially at the prison over the past six years starting from 98.8 MG in 2008 and reaching 177.8 MG in 2013, from the data provided by Ossining for this analysis. The reason for this increase in water use is not known, but given the history of water use at this facility, it appears that there might be substantial opportunities for water efficiency if funding were available.

Increasing efficiency at the prison by 5 percent would help Ossining achieve 20 percent of the savings goal. This is an option worth exploring further with prison officials.



\$ Water savings potential:
0.02 mgd (20.5 percent of goal)

Measure 3: Residential Indoor Efficiency Vouchers

The goal of this measure is to reduce indoor consumption in up to 2,000 residences in Ossining by incentivizing replacement of old toilets and faucet aerators. Replacing old, high volume toilets and high flow bathroom faucet aerators with high-efficiency fixtures has been shown to reduce water use by 9,000 to 11,000 gal per household per day. Ossining would create a voucher program working with local plumbers and suppliers. Each participating customer would receive a voucher reducing the cost, either partially or fully, of the pur-

chase of a new EPA WaterSense labeled high-efficiency toilet (HET). Vouchers could also be offered for showerheads and bathroom faucet aerators or these products could be provided for free along with a voucher purchase. The value of the voucher can change over time.

Completing 2,000 indoor upgrades is expected to achieve 37 percent of the water savings goal. A higher level of implementation could achieve more savings, but none of these measures alone can achieve the water saving goal.

\$ Water savings potential:
0.04 mgd (36.8 percent of goal)

Measure 4: CII Audits and Upgrades

Commercial, institutional, and industrial (CII) customers in Ossining were estimated to use about 30 percent of the total metered demand in 2013, based on the typical breakdown of water use in Westchester communities. Under this program, Ossining would implement aggressive water efficiency upgrades across 100 of the largest CII water users with the goal of reducing their consumption by an average of 75,000 gal per year per participant. These upgrades would likely include: toilet and urinal replacement, faucet and clothes washer replacement, irrigation efficiency upgrades, elimination of single-pass cooling, and possibly other measures. Such a program would require Ossining to hire staff or contract out the job to qualified professionals.

\$ Water savings potential:
0.02 mgd (17.3 percent of goal)

Measure 5: Expand Customer Information and Engagement Including AMI Leak Alerts

Provide customers with better information about their water use and "normative" comparisons was shown to reduce water use by up to 5 percent in a study conducted in California in 2013 (Mitchell, D. et al., 2013).

Figure 4.1 shows an example of a home water use report developed by WaterSmart software.

If Ossining is interested in continuing a quarterly billing cycle for some customers, more frequent, enhanced information on water use could be provided through an in-home device, a web portal/app, or customer alerts via email and text. Ossining's residential customers could receive customized messaging and information based on their metered consumption in addition to their water bill. Consumption reports could be sent periodically to provide a clear message based

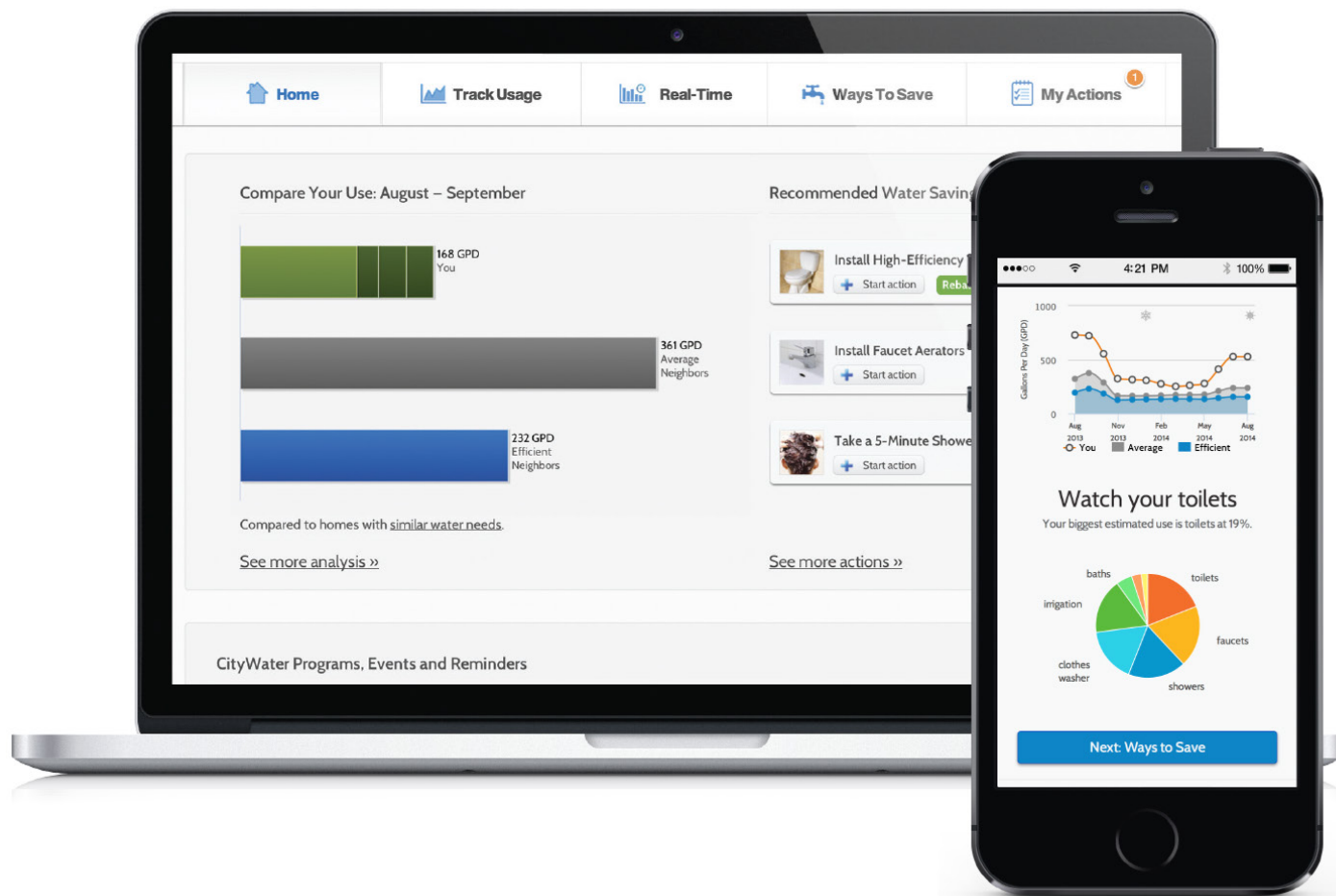


Figure 4.1: Example of a Customer Information and Engagement Message (WaterSmart software).

on actual use in each home, compared to an established water budget.

Additionally, once Ossining has completed installation of an AMI, this alert system can be used to provide high-resolution consumption data that would identify customer consumption patterns which deviate from typical conditions, possibly indicating leaks or damaged, or removed meters.

Ossining's implementation of this new metering technology can assist in achieving the 5 percent demand reduction goal. However, replacing water meters, even with the latest and greatest technology, does not automatically result in demand where customers are already fully metered, like in Ossining.

In order to achieve significant demand reductions through advanced metering, additional customer engagement through billing practices or other methods (as described above) are required.

Measure 6: Transition to Monthly Billing for All Customers

As a demand management measure, it is recommended that Ossining transition all customers to monthly billing. This change will provide Ossining's metered residential customers with three times more feedback than they are currently receiving, as well as additional financial incentive to reduce water waste. When monthly bills are sent promptly, customers are provided with useful information on recent consumption patterns that will help identify excessive consumption. A full transition to monthly billing could help achieve about 67.6 percent of the 2020 water savings goal.

Monthly billing is considered an industry best practice and is already implemented for the commercial sector in Ossining.



Water savings potential:

0.08 mgd (67.6 percent of goal)



Water savings potential:

0.07 mgd (56.3 percent of goal)



IMPLEMENTATION PLAN

After reviewing the proposed demand management measures proposed in this plan, Ossining identified three measures to actively pursue to achieve the desired 5 percent demand reduction – 0.13 mgd (119.1 mgy). The three selected areas are:

1. Water loss control including additional analysis, leak detection, and line repair.
2. Increased prison water efficiency.
3. Indoor upgrade voucher program – residential and small commercial retrofits including: toilet, shower, and faucet replacement.

DEP has \$280,000 in partnership funding available to Ossining for implementation of conservation measures to achieve a 5 percent reduction. An implementation plan for each measure and a DEP partnership budget is presented below.

Water Loss Control

In 2013, 19.4 percent of water supplied in Ossining was non-revenue water, which is similar to neighboring water

providers participating in this planning effort. As a direct result of this planning effort and the 2013 water loss audit conducted in conjunction with this plan, Ossining has recently taken important proactive steps to reduce water loss. This included conducting leak surveys and finding and repairing a 0.4 mgd leak on a 12-inch water main (**Figure 5.1**). This action alone should result in savings more than triple the goal of 0.13 mgd.

Additionally, as a result of the analysis developed in this water demand management plan the following actions were taken by Ossining:

- Signed an agreement with a leak detection company.
- Started placing noise loggers throughout the Ossining water system
- Developed baseline consumption metered water vs. pumped water for all 3 pressure zones, to determine which area to focus on for the fastest return on investment.
 - Showed focus should be on the Lakeville System.
- Swiftly moved noise loggers to the Lakeville System and immediately found and temporarily repaired a leak on a 12-inch main estimated at 0.4 mgd (**Figure 5.1**).
- Saved more than \$300,000 in raw water purchases annually from permanent repair.



- Fully repairing the leaking 12-inch main, including relining the bedding and restoring the line is estimated to cost \$150,000 to \$200,000.³
- Fully repairing this leak alone is estimated to exceed the 5 percent, 0.13 mgd savings threefold.

Ossining is continuing with its water loss control efforts, including using its SCADA system to conduct night flow studies in DMAs. Ossining would like to continue and improve upon these efforts in the coming years as outlined below.

A 4-year, strategic water loss control program for Ossining is outlined in **Table 5.1** below.

	Program Element	Estimated Time	Goals
ASSESSMENT PHASE	1. Water Loss Assessment Building on the desktop audit produced by WaterDM, work closely with water loss specialist to produce 2015 audit and component analysis. Ossining staff will learn process for conducting future audits.	3 months	<ul style="list-style-type: none"> • Produce a reliable 2015 AWWA water audit, which will serve as the baseline from which to calculate savings in future interventions. • Highlight procedural and data improvements required for better water loss assessment.
	2. Component Analysis of Real Losses	~ 3 months	<ul style="list-style-type: none"> • Produce a component analysis of real losses. • Recommend improvements on repair record documentation. • Highlight biggest leakage reduction opportunities.
SAVINGS PHASE	3. Leak Detection Intervention Conduct recommended level of comprehensive leak detection.	Years 1 to 4	<ul style="list-style-type: none"> • Reduce the backlog of leakage in Round 1. • Identify leaks masked by those found in Round 1 and new leaks that developed after repair of leaks identified in Round 1.
	4. Pressure Management Intervention Identify opportunities for pressure reduction and implement pressure management plans.	Years 1 and 3	<ul style="list-style-type: none"> • Inventory actual operating pressures. • Reduce leakage through optimized pressure regimes.

Table 5.1: Outline of Ossining Water Loss Control Program

Water Loss Control Funding Request

- \$40,000 for additional water loss assessment, consulting, component analysis, planning, and leak detection.
- \$140,000 for as needed leak repair and line replacement, including the relining work needed on the 12-inch main leak described above.

A more detailed budget is presented in **Table 5.2**.

Item	Hours	Cost
1. 2015 Water Loss Assessment	30	\$5,000
2. Component Analysis and Loss Control Planning	30	\$5,000
3. Leak Detection and Pressure Management	-	\$30,000
4. Leak Repair and Line Replacement	-	\$140,000
Total Water Loss Control Funding Request		\$180,000

Table 5.2: Ossining Water Loss Control Funding Request

³Information provided by Superintendent of Water, Andrew Tiess, on April 4, 2016.

Water Loss Control Program Considerations

The following are important water loss program considerations for Ossining:

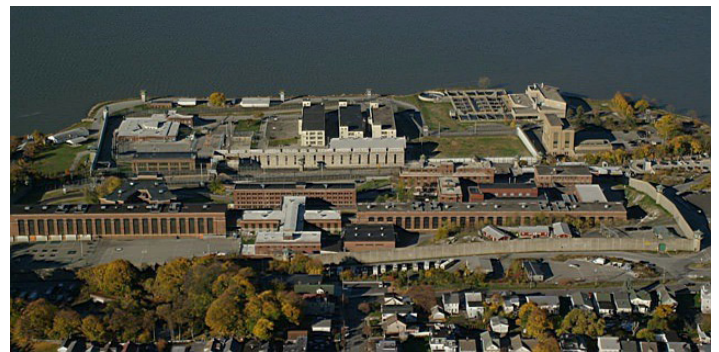
- **Funding:** DEP is considering a regional water loss control initiative, which Ossining could participate in. This could help defray part of the \$40,000 assigned to water loss assessment, component analysis, and planning. However, Ossining has immediate need to begin implementation given the significant leak already found. Depending upon the timing of the regional initiative, Ossining may wish to move forward more rapidly.
- **Repair commitment:** In the implementation phase, the process of leak detection only identifies failures that have not yet surfaced. ***In order to realize water savings, Ossining must promptly repair the failures identified in each leak detection survey.*** For this effort to be a success, Ossining must commit to repairing leaks found through the detection survey process. Ossining is requesting a \$140,000 contribution to the leak repair fund to ensure this commitment can be maintained during the NYC infrastructure outage period.
- **Savings tracking:** The impact of water loss control interventions must be measured. There are a number of approaches to do this, depending on the situation and metering. Options include:
 - Estimation of flow rate for each leak found and repaired.
 - Systemwide audit prepared before and after leak detection survey.
- **Timing:** Ossining has already begun the leak detection and repair effort and seeks DEP funding as soon as possible to help defray costs associated with the relining and repair of the 12-inch main leak described above.
- **Continuation of water loss control:** Ossining must carry this effort forward. Leak detection is not a one-time fix; it is meant to be a tool deployed intermittently to contain a continuously accumulating leakage volume in the system. Knowledge transfer and capacity building is key and Ossining should seek to integrate training and education throughout the water loss control program.

Prison Water Efficiency

The Sing Sing Correctional Facility in Ossining houses approximately 1,700 inmates and in 2013 accounted for 14 percent of the total demand of the water system. Furthermore, it appears water use has increased substantially at the prison

over the past six years starting from 98.8 MG in 2008 and reaching 177.8 MG in 2013. The reason for this increase in water use is not known, but given the history of water use at this facility it appears that there might be substantial opportunities for water efficiency if funding were available.

Increasing efficiency at the prison by 5 percent would help Ossining achieve 20 percent of the savings goal. Andy Tiess, Superintendent of Water and Sewer for Ossining has already approached prison leadership and requested that testing be performed on the water meters serving the Sing Sing facility. Pending these results, Ossining staff plans to encourage the prison to implement increased water efficiency under the assumption that the on-site staff are in the best position to determine what measures are feasible.



Ossining is prepared to work with the Sing Sing Correctional Facility to contract with a professional water auditor to conduct a thorough evaluation of the facility to look for water efficiency opportunities. Ossining expects the prison will implement the selected measures itself for its own budget.



No funding from DEP is being sought for the prison water efficiency effort.

Indoor Upgrade Voucher Program

Ossining plans to offer water customers a voucher of up to \$200 for the purchase and installation of HETs and bathroom faucet aerators. The goal of this program is to reduce indoor consumption in up to 500 residential and/or small commercial properties in Ossining by incentivizing replacement of old toilets and faucet aerators. For a single-family residence (home or apartment), replacing old, high-volume toilets and high-flow bathroom faucet aerators with high-efficiency fixtures has



been shown to reduce water use by 9,000 to 11,000 gal per household per day (DeOreo, et al., 2011). The total annual savings from this effort are estimated to be 5 mgd.

In this program, Ossining will create a customized voucher program working with local plumbers and plumbing suppliers. Ossining should set up an online application for the voucher and limit the number of vouchers to 500 total and one voucher per customer. Once the application process is complete and approved, the customers can use the voucher to reduce the purchase cost or the installation cost of the HETs and faucet aerators. The suggested maximum value of the voucher is \$200 per voucher, but this can be adapted as warranted.

The following steps are recommended for Ossining to follow to implement the indoor efficiency voucher program.

1 Create the voucher program.

Ossining must make a formal decision to create the voucher program and to establish all necessary rules and requirements. As envisioned, up to 500 residential and small commercial customers in Ossining may apply for a voucher of \$20. The voucher can be used to defray the cost of purchasing or installing a high-performance HET and low-flow bathroom faucet aerators.

It is recommended that Ossining only provide vouchers for the purchase of EPA WaterSense®-certified toilets and faucet aerators, to ensure great performance and reduce water consumption. Each participating customer (or their plumbing contractor) is responsible for purchasing the toilet(s) and aerators, having them installed, and disposing of the old toilet(s) and faucets so they are not reused.

Who qualifies? Only current Ossining water customers are eligible to participate in the voucher program. Ossining can require a water account number and address as part of the application process.

Who does not qualify? Customers who are already equipped with HETs and low-flow faucet aerators.

Enlist retail partners. Ossining will work with designated plumbing suppliers (including Home Depot, Loews, or another local “big-box” retailer) to establish an approved list of supply partners. These partners must be informed about what products can and cannot be purchased using an “Ossining voucher.”

Enlist plumbing contractor partners. Ossining can invite local plumbing contractors to participate in the voucher program. These contractors can receive the voucher as partial

payment for services or use the voucher to purchase an approved toilet and faucet fixtures on behalf of an approved customer.

2 Create an online voucher application.

The easiest way to implement and manage a voucher program is to create an online application that includes all information customers will need to participate.

There are several examples of online applications Ossining can refer to including:

- The DEP website, which includes a downloadable application – <http://www1.nyc.gov/nyc-resources/service/2619/toilet-replacement-program>;
- Dallas Water Utilities's toilet rebate application - <https://savedallaswater.com/toilet-replacement-application-form/>.

Other examples can be easily found through an online search.

The voucher program should be open to homeowners and renters alike. For renters, Ossining should develop a Landlord Consent letter agreeing to the installation of the new toilet fixtures under the voucher program.

3 Application approval process.

A member of the Ossining staff will review and approve each application and inform the applicant of the decision via email or phone. Once approved an official “Ossining Voucher” will be mailed or emailed to the customer.

4 Using the voucher.

When a voucher application has been approved, Ossining will mail or email the approved applicant a voucher along with a listing of available purchase locations and approved plumbing contractors within 10 business days of receipt of the application.

The customer can then present the voucher to the plumbing retailer or approved plumbing contractor to defray purchase and installation costs.

5 Redeeming vouchers.

At regular intervals (weekly or monthly), participating retailers and plumbing contractors will submit all vouchers collected from customers to Ossining for payment. Ossining can tailor this aspect of the program to meet specific requirements and conditions.

Indoor Upgrade Voucher Funding Request

Ossining's funding request for the indoor upgrade program is shown in **Table 5.3**.

WDM Program	Implementation Level	Per Unit Cost (\$)	Total
WaterSense toilet and aerators voucher	500	\$200	\$100,000
Total Voucher Program Funding Request			\$100,000

Table 5.3: Ossining Toilet Voucher Funding Request

WDM Program	Implementation Level	Per Unit Cost (\$)	Total
2015 water loss assessment	30 hours	\$165 per hour	\$5,000
Component analysis of real losses and loss control planning	30 hours	\$165 per hour	\$5,000
Leak detection and pressure management	Whatever is needed	NYC \$ will defray	\$30,000
Leak repair and line replacement	Whatever is needed	NYC \$ will defray	\$140,000
WaterSense toilet and aerators voucher	500 customers	\$200 per voucher	\$100,000
Total Funding Request From DEP			\$280,000

Table 5.4: Ossining Water Demand Management Funding Request Summary

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APPENDIX A

Analysis of Potential Water Demand management Options for Ossining, N.Y.

Description	Current Use (gal/yr)	Savings Range (per unit)	Units	Expected Savings (gpd)	Expected 1 year Cost	1Year Cost Per gpd Saved (\$)	Annual Revenue Recovery	Annual Revenue Loss	Expected 10 Year Cost	10 Year Cost Per gpd Saved (\$)
Indoor Upgrade - toilet, faucet, shower		9000 - 11000 gal/participant	5,500	120,548	\$1,237,500	\$10.27	\$69,239	\$440,588	\$5,088,494	\$42.21
Indoor Upgrade - toilet, faucet, shower - Voucher		9000 - 11000 gal/participant	2,000	43,836	\$400,000	\$9.13	\$25,178	\$160,214	\$1,850,361	\$42.21
Water Loss Control	243,378,915	3% to 2%	-	-	-	-	-	-	-	-
Pressure Management	-	3% to 7%	-	33,340	\$750,000	\$22.50	\$19,149	-	\$808,508	\$24.25
Line Repair	-	8% to 12%	-	66,679	\$750,000	\$11.25	\$38,298	-	\$617,017	\$5.50
Customer Engagement - Residential Sector	489,550,404	4% to 5%	4,000	67,062	\$200,000	\$2.98	\$38,518	\$245,102	\$2,365,844	\$35.28
Commercial Audits and Upgrades	263,604,064	50,000 - 100,000 gal/intervention	100	20,548	\$750,000	\$36.50	\$11,802	\$75,100	\$1,632,982	\$79.47
Monthly billing	489,550,404	5% to 7%	4,000	80,474	\$40,000	\$0.50	\$46,222	\$294,123	\$2,519,012	\$31.30
Prison Efficiency	177,777,908	5% savings	1	24,353	\$500,000	\$20.53	\$13,988	\$89,008	\$1,500,201	\$61.60

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