



PHILADELPHIA WATER DEPARTMENT - WATER REVENUE BUREAU

WATER AUDIT REPORT FOR FISCAL YEAR 2013

July 1, 2012 - June 30, 2013

April 4, 2014

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CITY OF PHILADELPHIA
Philadelphia Water Department - Water Revenue Bureau

WATER AUDIT FOR FISCAL YEAR 2013

July 1, 2012 - June 30, 2013

Introduction

For the 16th consecutive year, Philadelphia's Water Accountability Committee compiled a water audit report of the water supply operations and customer consumption tracking of the City of Philadelphia using the best practice method advocated by the American Water Works Association (AWWA) and the International Water Association (IWA). The method tracks quantities of water supplied and balances these volumes against customer billed consumption and losses categorized as *Apparent Losses*, or non-physical losses, due to customer meter inaccuracies, data/billing error and unauthorized consumption; and *Real Losses*, or actual physical losses, mainly leakage. Apparent losses are valued at higher costs than leakage, and have a substantial financial impact in terms of lost revenue for utilities that bill customers based upon metered consumption. Real losses waste water resources and cause excessive production costs.

The City launched its Basis2 Customer Billing System on January 2, 2008. Fiscal Year 2013 (FY2013) is the fifth full year under the Basis2 system. The Basis2 System has handled routine billing operations well but its functions include a variety necessary financial manipulations such as billing adjustments. While adjusting data is valid for certain billing reasons, it often changes the customer consumption data, making it appear that customers used less water in a given monthly period. In FY2011 a validated master summary report - the TREND Report - was implemented and improved the validity of the billed consumption reporting. For FY2013 average annual billed consumption was equivalent to 152.1 million gallons per day (mgd) which is a record low billed total in the City's history. This continues a trend of declining billings that has occurred for many years. The annual average volume of water delivered to the distribution system has also been in decline in recent years, but not as sharply as the billings.

The FY2013 value of Non-revenue Water, or NRW, (unbilled authorized consumption + apparent losses + real losses) is 31,499 million gallons, or a daily average of 86.3 mgd, an increase of 1.7 mgd from FY2012. The Philadelphia Water Department (PWD) reported an average daily increase of 1.9 mgd in source water withdrawals from the Delaware and Schuylkill Rivers in FY2013 compared to FY2012. Treated water delivery for FY2013 was 238.4 mgd vs. 237.1 in FY2012, an increase of 1.3 mgd. The average daily billed consumption reported by the Water Revenue Bureau (WRB) continues to decline for several reasons. Reduced population and water conserving behavior of customers are factors in this decline, however these are not exclusive impacts on the reduced billing. Additional focus is warranted to audit the customer metering, meter reading and billing processes to better identify and correct apparent losses and define actions to maximize billings and revenue capture. While NRW in FY2013 exceeds 80 mgd, the City's NRW remains roughly one-third lower than the levels prior to the reinstatement of the Water Accountability Committee in 1992. Figure 1 illustrates the long-term During FY2013 the PWD and WRB continued a number of successful loss reduction activities including the Revenue Protection Program and analysis of large customer meters to address apparent losses, and use of the Sahara® inline transmission main leak detection service to control real losses. Work continued to refine and analyze the maintenance and repair work on the water distribution system as tracked in the Cityworks™ computerized maintenance management system. Philadelphia's Water Accountability Committee compiles this annual water audit report and meets quarterly. City personnel have also been active in promoting the best practice methods used in this audit. George Kunkel has been active in AWWA and IWA and coauthored water audit software, the 3rd Edition AWWA M36 manual, *Water Audits and Loss Control Programs (2009)*, and a textbook, *Water Loss Control (2008)*. He has also met with a number of regulatory agencies interested in establishing better accountability in the water industry. As a result, new requirements for water audit data collection by the Delaware River Basin Commission were implemented starting in 2013.

Water Loss in Fiscal Year 2013

Distribution system input again remains low relative to the City's history, in FY2013 at 86,998 mg (238.4 mgd) of treated water, with 81,778 mg (224.1 mgd) distributed to the city and 5,219.5 mg (14.3 mgd) exported to the Bucks County Water & Sewer Authority (BCWSA) and Aqua America's two interconnections. As noted above, the Basis2 system reported aggregate customer billed consumption for FY2013 averaging 55,498 mg (152.1 mgd), a continued trend of decreased water consumption billings over recent years. The long-term trend of supplied volumes and billed consumption is given in the ACCOUNTABILITY TREND worksheet. The monthly summary data now available from the TREND Report from the Basis2 System is the basis for monthly reporting of billed water consumption and billed charges, broken down by customer meter size and by types of accounts (billed, non-billed, fire service, etc.). Summary data for FY2013 has been compiled from the twelve monthly TREND reports and is shown in the "Annual Billing Summary" worksheet.

The WATER AUDIT SUMMARY worksheet shows apparent losses of 7,495 mg (20.5 mgd) in FY2013, representing potentially uncaptured revenue of over \$43 million, a slight volume decrease from the FY2012 levels of 21.4 mgd, and a slight cost decrease from \$43.1 million, respectively. Real losses stand at 22,045 mg (60.4 mgd) with an excess production and liability cost of over \$8.1 million. The Water Audit identifies the category of systematic data handling error as the greatest source of losses, by cost, in FY2013. These losses stem from billing adjustment activity (negative values), consumption at non-billed accounts, estimating errors, unbilled city properties and other data gaps. These types of losses can be reduced by enhanced auditing efforts and implementation of improved accounting procedures. Real loss (leakage) volumes have generally been contained in recent years although a 2011 assessment of the "economic level of leakage" found it to be 45 mgd, thus PWD is cost-justified in seeking a further 15 mgd leakage reduction. Most notably, while leakage losses have decreased over recent years; real loss costs have increased sharply due to rising water treatment and energy costs. The variable water production cost of water has jumped from \$130/mg in FY2005 to \$346/mg in FY2012, a 165% increase in just seven years.

Philadelphia's Water Accountability Committee first issued a comprehensive water audit in FY1998. In FY2000, Philadelphia became the first water utility in the United States to employ the best practice IWA/AWWA Water Audit Method, and has become a recognized water industry leader in water loss control. The water audit is the fundamental accountability tool in water utility operations. While the City employs a robust water audit methodology, the audit results are subject to the level of validity of the input data. With the City changing its billing platform in FY2008, and improved reporting becoming available from this system, the water audit process will continue to increase the validity of its data and performance indicators. Progress achieved in FY2011 in developing and validating new Basis2 System reports helped to reduce data variability in FY2012 and beyond.

Philadelphia Water Department Water System Input, Consumption and Non-Revenue Water

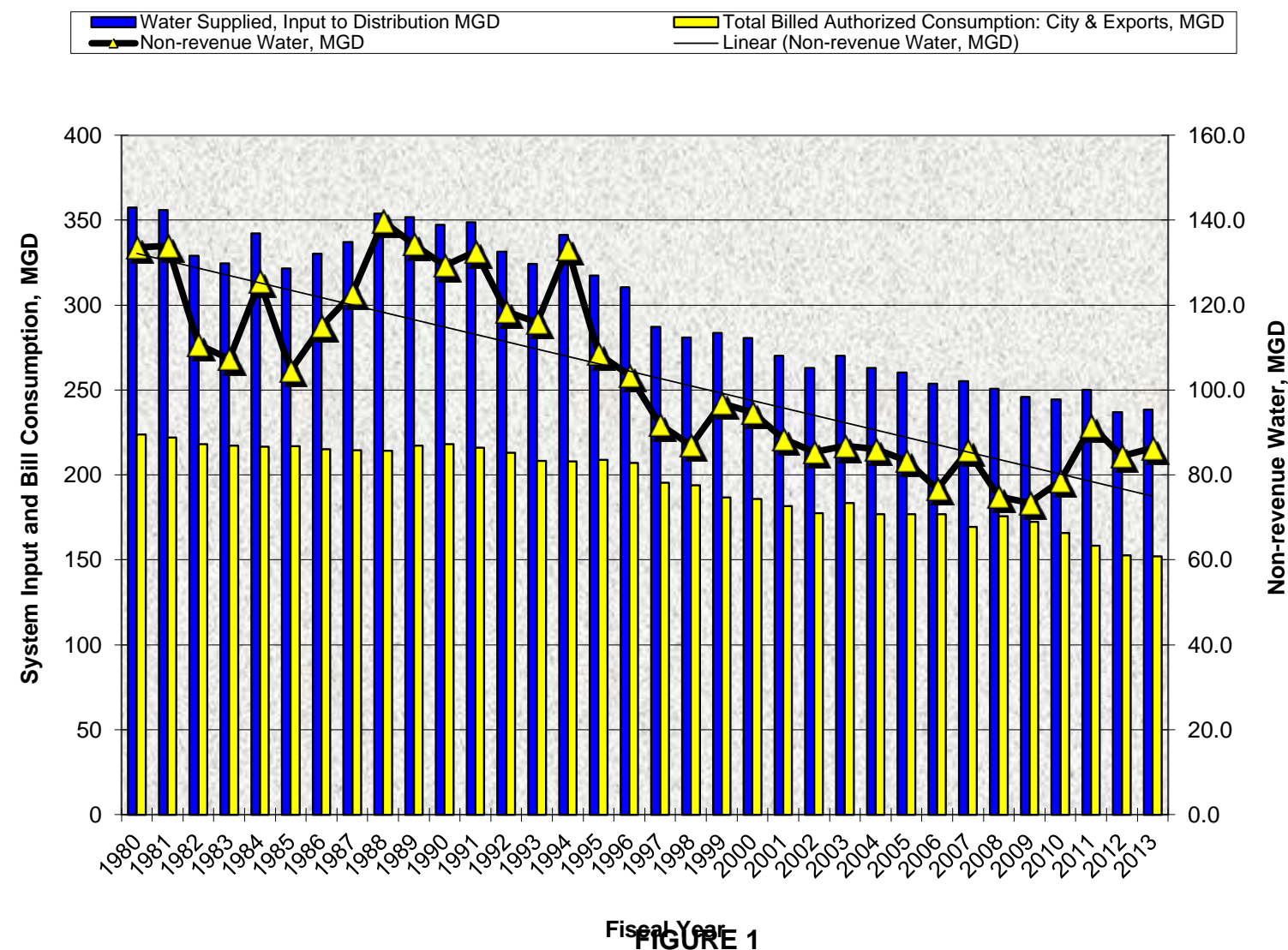


FIGURE 1

Initiatives to Economically Control Water and Revenue Losses

Reducing Apparent Losses

The Revenue Protection Program (PWD) and Reinspection Program (WRB) investigate targeted groups of water-using accounts suspected to be unbilled, or under-billed; and have recovered over \$36 million since FY2000. Table 1 shows almost \$31 million of revenue recovered in the Revenue Protection Program and over \$5 million from the Reinspection Program which conducts follow-up inspections of customer service connections that have been shutoff for payment delinquency (NB3 accounts). The Reinspection Program identifies and corrects the unauthorized consumption that occurs when shutoff customers find a means to reactivate their closed curbstop valves. The potential for recoveries remains high and the City can benefit from expanded revenue recovery efforts. Additional staff was hired in FY2013 to conduct more investigations into accounts with suspicious water consumption patterns.

Philadelphia operates the country's second largest water utility Automatic Meter Reading (AMR) System, with around 475,000 customer meters read monthly by Itron, Inc. via a mobile read system. The AMR contract required battery replacement at all customer endpoints by year 14 (2011) of the 20-year contract. The change-out program reached completion by the end of 2013. The "battery change-out" was actually a swap of the customer end user device with a comparable model with a new battery. For approximately 15,000 accounts PWD purchased higher capability devices that allow for more frequent data collection, and use in a fixed network communication environment. These devices were installed on all large meter accounts and in PWD's District Metered Area 5 (DMA5) and at the former Philadelphia Naval Shipyard site. Fixed network communication equipment was installed in DMA5 in FY2013 and a fixed network pilot

A DMA is a small, discrete zone of the water distribution system which is valved to be isolated from the larger distribution system, and typically supplied via a single water main. DMAs are designed to optimize leakage and pressure management, and DMA5 will also serve as a pilot area for detailed customer consumption assessments. Installing Fixed Network AMR in a portion of the customer population gives PWD a good opportunity to both evaluate innovative AMR technology for widespread use and confirm additional benefits of the DMA approach. Fixed Network AMR technology is known as Advanced Metering Infrastructure (AMI) and is seeing strong growth in the water industry. AMI has the ability to collect meter readings as often as every 15 minutes, allowing precise customer water usage patterns to be defined. AMI also has a number of other innovative end use capabilities. With the installation of over 15,000 AMI units, PWD will have the ability to pilot this technology in advance of specification of the "next generation" system once the current Itron contract

The entire residential customer meter population was replaced from 1997-1999 and these meters are believed to remain very accurate with an expected life of 25 years. Conversely, detailed consumption assessments for over 150 commercial and industrial accounts since FY2007 have found that many large meters are over-sized for their application. Under-registration of low flows often occurs in over-sized meters and significant revenue loss may be occurring in this meter population. PWD started an evaluation of different meter types for these applications and, in FY2011/FY2012, installed over one dozen Single Jet meters in its system. It was viewed that type of meter has the potential to be more accurate over a wider range of flows than the traditional turbine and compound meters typically employed by PWD. An analysis of billing records from before and after the single jet meter installations was conducted in FY2013. Unfortunately, the results were inconclusive, as some of the accounts showed increased billed consumption and others showed decreased consumption using the single jet meters. PWD also looks to install and evaluate a number of magnetic flowmeters.

Unauthorized consumption historically cost the City about \$3 million of lost revenue annually, but jumped to over \$6 million in FY2010 and stands at almost \$6.5 million in FY2013. Losses occur from meter or AMR-device tampering, illegal restores of shutoff service lines, outright theft of water meters and fire hydrant abuse. The AMR System provides detection capabilities but follow-up action is needed once tampering is identified. Not only is revenue lost, but over 2,000 water meters are being stolen and replaced each year at a cost of at least \$100,000. WRB's Reinspection Program identifies illegally restored service connections and the Delinquency & Restoration Unit has piloted remote shutoff valves with moderate success to thwart repeat offenders. Use of the Center Compression Lock (CCL) has greatly curtailed unauthorized fire hydrant openings and contained peak summer flows. Considerable water is still taken sporadically from fire hydrants, both illegally, and legally via a cumbersome permitting process. Fire hydrant policy and enforcement practices could benefit from a comprehensive review and possible overhaul.

| PWD - WRB Revenue Recovery History | | | | | | | |
|------------------------------------|--------------------|----------------------|---------------------|---|---------------------------|--------------------------------|-------------------------|
| PWD Revenue Protection Program | | | | | WRB Reinspection Program* | | Total |
| Fiscal Year | Accounts Recovered | Water Recovered, mgd | Revenue Recovered | Categories of Greatest Recovery** | Reinspection Recoveries | Reinspections Revenue Recovery | Total Recovered Revenue |
| 2013 | 4,667 | 2.56 | \$4,108,889 | Investigation of Zero Consumption accounts: 79% of recovered accounts were "missing meter or ERT" | 1,707 | \$344,218 | \$4,453,107 |
| 2012 | 4,154 | 2.4 | \$3,866,280 | Investigation of Zero Consumption accounts: 65% of recovered accounts were "missing meter or ERT" | 2,040 | \$470,212 | \$4,336,492 |
| 2011 | 3,973 | 2.3 | \$3,683,600 | Investigation of Zero Consumption accounts: 70% of recovered accounts were "missing meter" | 1,620 | \$206,075 | \$3,889,675 |
| 2010 | 2,467 | 1.49 | \$2,384,528 | Investigation of Zero Consumption accounts: 61% of 2,467 recovered accounts were "missing meter" | 1,516 | \$169,733 | \$2,554,261 |
| 2009 | 1,659 | 1 | \$1,603,540 | Investigation of Zero Consumption accounts: 80% of 1,659 recovered accounts were "missing meter" | 1,632 | \$199,732 | \$1,803,272 |
| 2008 | n/a | 0.4 | \$636,250 | n/a | 2,597 | \$390,670 | \$1,026,920 |
| 2007 | 449 | 0.36 | \$531,400 | NB9 (Vacant properties) & NB3 (Shutoff for non-payment) | 2,984 | \$340,380 | \$871,780 |
| 2006 | 1,436 | 1.01 | \$1,413,000 | Estimated Accounts (#1), Non-billed Accounts (#3,#9) and Zero Consumption Accounts | 2,513 | \$209,768 | \$1,622,768 |
| 2005 | 2,397 | 1.74 | \$2,835,000 | NB3 & Zero consumption accounts | 2,553 | \$249,261 | \$3,084,261 |
| 2004 | 1,941 | 1.67 | \$2,003,000 | Zero consumption accounts 0.74 MGD; tampering is most common cause of lost water in this group | 1,991 | \$446,327 | \$2,449,327 |
| 2003 | 1,360 | 1.14 | \$1,782,000 | Zero Consumption Accounts | 2,221 | \$604,379 | \$2,386,379 |
| 2002 | 932 | 0.69 | \$1,037,000 | Zero Consumption Accounts | 2,721 | \$668,932 | \$1,705,932 |
| 2001 | 711 | 5.81 | \$2,900,000 | Missing Accounts, Hand Estimates, NB6 accounts | 3,261 | \$498,952 | \$3,398,952 |
| 2000 | 716 | 1.39 | \$2,100,000 | NB6 accounts | 2,737 | \$393,949 | \$2,493,949 |
| Total | 26,862 | 23.96 | \$30,884,487 | | 32,093 | \$5,192,588 | \$36,077,075 |

*The Reinspection Program inspects customer service connections on accounts that have been shutoff for payment delinquency

**EC-1 & NB-9 - vacant property accounts, NB-3 accounts - shutoff payment delinquency, NB-6 new accounts awaiting occupancy

**Zero Consumption accounts are checked after registering zero consumption (unchanged meter readings) for 4 consecutive cycles

TABLE 1

Controlling Real Losses

The PWD is a recognized United States water industry leader in instituting innovative leakage control techniques. The PWD has operated a traditional acoustic leak detection program for over 30 years. For the seventh consecutive year, PWD continued inline transmission leak detection by using contracted services for the Sahara® technology. PWD continues to operate DMA5 which was installed as part of the industry-sponsored research project "Leakage Management Technologies". The FY2013 Water Audit indicates real (leakage) losses of 22,045 mg (60.4 mgd); a slight increase compared to FY2012's level of 21,928 mg (60.0 mgd). The Infrastructure Leakage Index (ILI) decreased to 8.8 in FY2013 compared to 10.2 in FY2012. The ILI represents the ratio of current leakage to the theoretical low level of leakage known as the Unavoidable Annual Real Losses (UARL). It is important to note that the significant decrease in the ILI value was not due to a reduction in system leakage; but instead is due to a correction in the value of the average system pressure from 55 psi to 65 psi. The average system pressure is a key input variable in the calculation of the ILI. The lower leakage levels occurred, in part, due to the relatively warm winter of 2012-2013. Cold weather exacerbates leakage, and both leakage and main breaks were lower than average for the year.

Leakage target-setting: During FY2010 PWD's water loss consultant, WSO, updated PWD's leakage component analysis and target-setting evaluation in order to determine the current low level of leakage that is economically justified for PWD to seek; i.e. the Economic Level of Leakage (ELL). Taking into account the cost to conduct acoustic leakage surveys and the marginal production cost of water supplied, the economic ILI was determined to be 7.5. Since each integer value of the ILI was equivalent to the value of the Unavoidable Annual Real Losses of 5.8 mgd, the targeted leakage reduction for PWD was determined as $(10.7 - 7.5)(5.8) = 23.2$ mgd. This would mean reducing the real loss level of 66.6 mgd to 43.4 mgd. Since marginal production costs increased from \$240/mg in FY2010 to \$272/mg in FY2011, and then dramatically to \$345/mg in FY2012; the FY2012 ELL and FY2013 ELL (not calculated) will be likely be lower than 43.4 mgd. However, since the current ILI value is 8.8 this would mean the leakage reduction would be slightly less to achieve the ELL. Any leakage reduction below the ELL is not financially justified although other factors (water conservation, resource preservation) might motivate a lower level.

Leak Detection Program: Traditional leak detection and repair efforts continued in FY2013. Using traditional acoustic methods, Leak Detection crews manually surveyed 962 miles of the system's 3,028 miles of pipeline for leaks; utilizing current technology, including leak correlators and leak noise loggers. PWD's Distribution Unit repaired 771 water main breaks and 2,771 leaks were repaired by PWD crews and by contractor repairs arranged by customers. Both the number of breaks and number of leaks increased in FY2013 compared to FY2012; however mild winter conditions experienced in FY2012 led to few leaks during this year. During FY2013 over 500 customers utilized PWD's assistance program to have repairs conducted on their leaking water service lines. The Leak Detection Program canvases the smaller distribution mains of the water distribution system and customer service connection piping. The number of unreported leaks identified and repaired by the Leak Detection Squad has decreased notably in the past several years. Typically finding 200-300 leaks annually, only 35 such leaks were documented in FY2013. Above-ground acoustic methods employed by this group are less effective on large-diameter transmission piping which is better served by the Sahara® system.

Sahara® Transmission Main Leak Detection: PWD continued its successful use of the Sahara® inline transmission main leak detection technology provided by the Pure Technologies in a program that was launched in FY2007. Program results as of the date of this report are shown in Table 2. Large diameter transmission pipelines have historically been difficult to survey for leaks using traditional above-ground acoustic leak detection technology. Access points for sounding on large mains are limited and many leak sounds are subtle and hard to detect. The Sahara® system employs a highly accurate acoustic sensor attached to a tether and inserted into an active water main (see Figure 2). It travels through the pipeline with the flow of water and, being inside the pipeline, is very accurate in pinpointing leaks - including very small

| Sahara® Transmission Main Inline Leak Detection Technology by Pure Technologies | | | | | | | | | |
|---|----------------|---------------------------|---------------------------|----------------------------|---------------|--------------------|------------------|-----------------|--------------------------|
| Period | Number of Days | Total Pipeline Insertions | Total Mileage for Program | Number of Leaks Identified | Miles Per Day | Insertions Per Day | Cost | Cost per Mile | Cost per Leak Identified |
| 6/4/2013 - 6/8/2013 | 5 | 8 | 2.36 | 1 | 0.47 | 1.60 | \$75,000 | \$31,780 | \$75,000 |
| 10/23/2012 - 10/27/2012 | 5 | 7 | 3.78 | 5 | 0.76 | 1.40 | \$75,000 | \$19,841 | \$15,000 |
| 5/8/2012 - 5/18/2012 | 10 | 19 | 6.12 | 12 | 0.61 | 1.90 | \$150,000 | \$24,510 | \$12,500 |
| 10/4/2010 - 10/8/2010 | 5 | 8 | 2.95 | 6 | 0.59 | 1.60 | \$60,000 | \$20,339 | \$10,000 |
| 5/24/2010 - 5/28/2010 | 5 | 8 | 2.76 | 10 | 0.55 | 1.60 | \$60,000 | \$21,739 | \$6,000 |
| 10/19/2009 - 10/23/2009 | 5 | 8 | 1.96 | 3 | 0.39 | 1.60 | \$60,000 | \$30,612 | \$20,000 |
| 6/1/2009-6/5/2009 | 5 | 7 | 2.78 | 3 | 0.56 | 1.40 | \$48,000 | \$17,266 | \$16,000 |
| 11/3/2008-11/14/2008 | 9 | 13 | 5.61 | 14 | 0.62 | 1.44 | \$108,000 | \$19,251 | \$7,714 |
| 4/14/2008-5/1/2008 | 9 | 12 | 7.15 | 8 | 0.79 | 1.33 | \$101,738 | \$14,229 | \$12,717 |
| 10/15/2007-10/19/2007 | 5 | 10 | 3.1 | 15 | 0.62 | 2.00 | \$60,000 | \$19,355 | \$4,000 |
| 6/4/2007-6/8/2007 | 5 | 12 | 3.53 | 3 | 0.71 | 2.40 | \$50,000 | \$14,164 | \$16,667 |
| Program Totals | 68 | 112 | 42.1 | 80 | 0.62 | 1.65 | \$847,738 | \$20,136 | \$10,597 |

TABLE 2

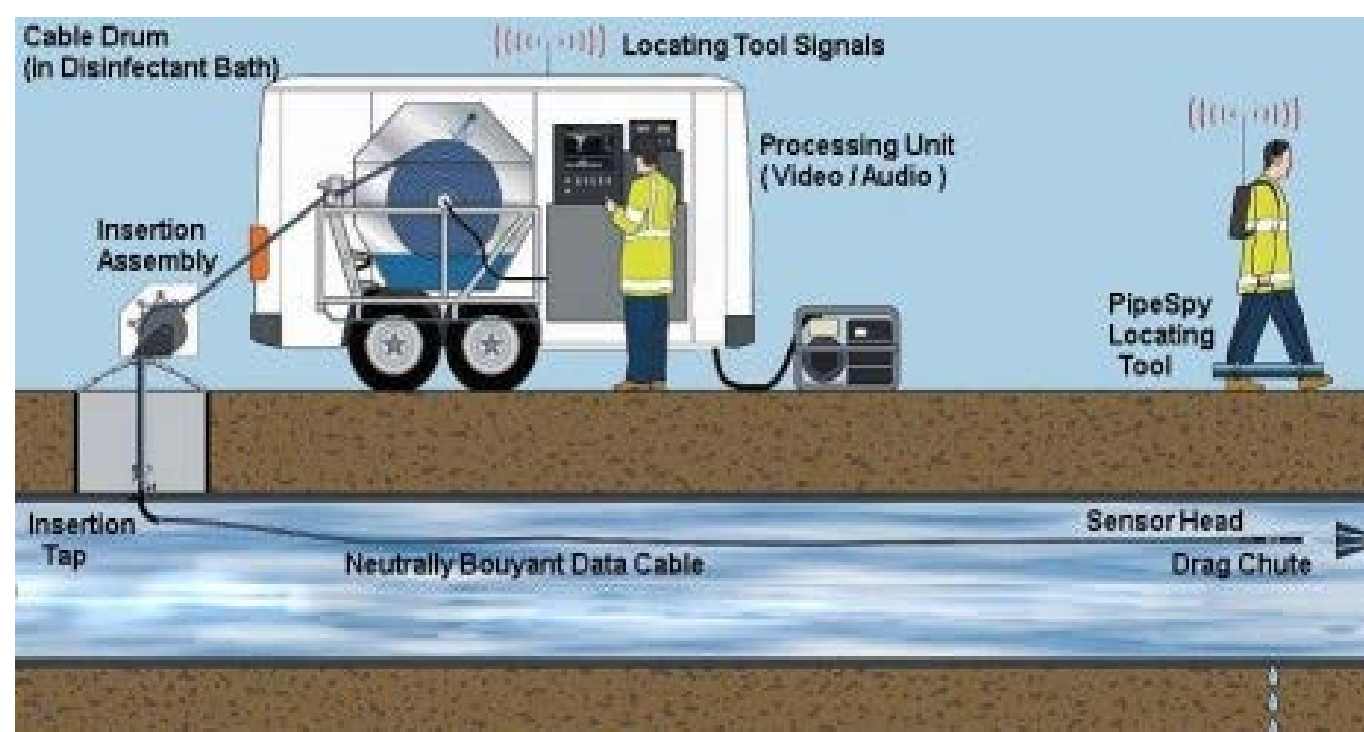


Figure 2 - Schematic of Sahara® inline transmission pipeline leak detection technology

During Fiscal Year 2013, the Sahara® service scanned 6.14 miles of large diameter piping; pinpointing 6 leaks. To date 80 verified leaks have been located and repaired; with no backlog of outstanding repairs. Sahara® is providing PWD a very accurate and reliable service. Almost 40 miles of transmission piping have been scanned to date in this manner, averaging two leaks per mile of pipeline. It is very likely that some of the Sahara® leak repairs have prevented catastrophic ruptures of large piping. This technology is providing PWD with an innovative and effective tool to manage leakage on the most critical supply mains in the city. In FY2012 PWD also entered a contract with Wachs Water Services to pilot an additional transmission main technology. A single test of this technology did not prove to be fruitful.

District Metered Area 5 (DMA5): A DMA is a discrete zone of the water distribution system supplied by one or two metered water mains. Flow and pressure are continuously monitored to assess leakage rates and implement precise controls. Since commissioning in February 2007, DMA5's leakage and main break rates have been reduced and are being monitored for long-term sustainability. Current leakage is approximately 1 mgd less than conditions prior to the DMA. Further analysis will be conducted in DMA5 once fixed network-capable AMR devices are installed on customer accounts and the fixed network system is implemented. In FY2012 PWD also assumed oversight of the water and wastewater infrastructure in the former Philadelphia Naval Shipyard. PWD created a routine computer report similar to that used for DMA5 that is used for monitoring this area as a District Metered Area.

Computerized Maintenance Management System (CMMS): Good leakage management finds and repairs leaks quickly. PWD's leak repair practices often result in known leaks running at length while awaiting repairs. Leak repair records historically have not been fully reliable. The PWD's potential for improved leakage management depends on effective leakage control techniques, and the ability to implement timely and lasting repairs. In FY2012 PWD implemented the Cityworks™ computerized maintenance management software. In June 2012, all of the primary groups that conduct maintenance and repair on the water distribution system switched use to the Cityworks System. Quality control work is occurring is currently ongoing and should witness the beginnings of much more reliable and accurate information on water distribution system failures and repairs.

Leakage on Customer Service Connection Piping: In most water utilities world-wide, leaks on customer service piping are the most frequent leak occurrences, and account for the greatest volume losses. Most water utilities require that customers hold the responsibility to arrange for leak repairs on at least a portion of their service lines. Philadelphia is one of a minority of utilities that assign customers responsibility for the *entire* service line. But customer managed repairs are known to be inefficient leakage control practices. Customer-arranged repair times in the city average 4-5 weeks, whereas efficient practices occur in 1-4 days. In FY2011 PWD launched a Customer Connection Task Force and charged it to investigate the practices around water and sewer connection piping, with the ultimate goal of refining the management of these lines. Additionally, in FY2013, PWD's Planning & Research Section launched an investigation of the best practices for management of repair and replacement of service connections. It is anticipated that PWD will continue to investigate services offered by various providers to warrant customer service lines and to refine the City's assistance programs for homeowners to better maintain their lines.

Looking Ahead

Philadelphia's annual water audit reflects its commitment to water accountability and its long-term reduction of 50-60 mgd of non-revenue water proves its effectiveness in promoting water efficiency. Still, significant loss reduction potential exists and the recommendations given below are viewed as the necessary steps to take the city's loss reduction to the next level:

1. Expand the Revenue Protection Program by enhancing its auditing function. The City has been successful in recovering revenue during its fourteen-year history. However, with an apparent loss financial impact of approximately \$43 million annually, significant revenue recovery potential remains. Due to the volume and complexity of the data managed in the customer billing system, ongoing detailed auditing of billing trends in customer accounts is needed. The Revenue Protection Program should add a routine detailed auditing capability - particularly for large meter customer accounts - and should increase the number of customer inspections that it conducts. PWD hired additional staff for field investigations purposes in FY2012/FY2013. Moving forward, it is recommended that two accounting auditors be hired to routinely audit customer billing records, particularly for large commercial and industrial accounts.

2. Continue to develop Basis2 Customer Billing System water consumption reporting, particularly in order to assist the auditing positions listed above. The Basis2 customer billing system was launched in January 2008 and handles routine water/sewer billing functions well. The development of key reports has continued steadily, but additional reports are needed to conduct the analytical auditing work that is needed to identify systematic data handling error, metering issues and corrupted data.

3. Fully implement the AMR/AMI Fixed Network System pilot in DMA5. Philadelphia gained distinction as perhaps the first water utility in the world to utilize AMR in conjunction with a DMA. Fixed Network AMR capabilities provide customer meter readings at short time increments which can greatly assist a wide range of water efficiency initiatives. A fixed network Advanced Metering Infrastructure (AMI) system has been installed in DMA5. During FY2014 it is anticipated that the AMI pilot system will be fully activated and new Itron software will become available to monitor the system. This pilot will allow PWD to both test further leakage control innovations, and also gain knowledge of new AMI technology.

4. Incorporate District Metered Area approaches at the Philadelphia Navy Yard complex. DMA5 is one of the first such installations in the United States and has successfully demonstrated efficient leakage control and infrastructure management capabilities. With the implementation of DMA5 into PWD's routine operations, efforts can shift to the former Navy Yard site where the piping configuration is well suited to management as a DMA. Monitoring of flow and pressure, and installation of Fixed Network AMR units will give PWD the capability to control leakage and optimize operations in this annexed section of water infrastructure.

5. Create additional output reports from the Cityworks™ Computerized Maintenance Management System (CMMS) to better track water distribution system failures and repairs, and allow more detailed analysis of leakage and main break trends. PWD implemented the majority of this system in FY2013 and should continue to pursue data validation in FY2014. Implementation of this system offers the opportunity to eliminate troublesome gaps in work tracking and will include best practice methods for leak and main break repair tracking, as well as significant improvements in customer responsiveness and work process flow in general.

6. Continue to pursue improvements to the current policy regarding maintenance of customer service line leakage repairs. A majority of the city's unreported leakage occurs on customer service lines. Current city water regulations place the burden of repair on customers and - even with the city's HELP Loan Program - results in an average leak response time in the order of weeks. Best practice response times for repairs are 1-4 days. PWD's Planning & Research Section launched a detailed investigation of options for improved service line management in FY2013. It is anticipated that recommendations will be forthcoming in FY2014. Improvements should include a more timely and effective means to manage service line leakage.

The City of Philadelphia's Water Department and Water Revenue Bureau have taken highly progressive steps to assess their water accountability and loss status on a world scale. Philadelphia has developed a national reputation as a pioneer in this field. It operates one of the largest water utility Automatic Meter Reading Systems in the United States and is pursuing upgraded AMI technology. It has improved its accountability by compiling an annual water audit, cut its non-revenue water significantly and recovered considerable additional revenue in a manner that is cost-effective and fair to rate-payers. Philadelphia's Water Accountability Committee will continue its efforts to address water loss by compiling this annual water audit and coordinate improvements at the local, regional, national and international levels.

Philadelphia Water Department - Water Revenue Bureau
Water Accountability Committee - Fiscal Year 2013

Steering Group

Howard Neukrug, Water Commissioner
Michelle Bethel, WRB Deputy Revenue Commissioner
Mark Harvey, WRB
Debra McCarty, Deputy Commissioner
Joseph Clare, Deputy Commissioner
Stephen Furtek, Deputy Commissioner
Christopher Crockett, Deputy Commissioner
Christine Marjoram
Charles Zitomer
James Brady

Working Group

George Kunkel, Chair
Gary Gehringer
James Aleo
James Gilbert, WRB
Greg Harris, WRB
Geraldine Hawkins, WRB
Stephen Junod
Janusz Kowalski
Jack Meade
Brendan Reilly
Bill Rempfer
Roy Romano
Jesse Thomas, WRB
Barry Williams

City of Philadelphia Annual Water Audit Summary - IWA/AWWA Water Audit Method
Fiscal Year 2013 - July 1, 2012 to June 30, 2013

| Water Supplied | Volume, Million Gallons | Average Volume, MGD | Costs/Year |
|--|----------------------------|------------------------|------------|
| System Input | 87,964.5 | 241.0 | |
| Minus Correction for Master Meter and data handling error | -966.4 | -2.6 | |
| Corrected System Input | 86,998.1 | 238.4 | |
| Minus Exports | 5,219.5 | 14.3 | |
| Water Supplied (City only) | 81,778.6 | 224.1 | |

Authorized Consumption

| | | | |
|--------------------|-----------------|--------------|--------------------|
| Billed Metered | 50,279.4 | 137.8 | |
| Billed Unmetered | 0.0 | 0.0 | |
| Unbilled Metered | 0.0 | 0.0 | |
| Unbilled Unmetered | 1,959.0 | 5.4 | \$1,398,440 |
| | 52,238.5 | 143.1 | \$1,398,440 |

| | | | |
|---------------------|-----------------|-------------|--|
| Water Losses | 29,540.1 | 80.9 | |
|---------------------|-----------------|-------------|--|

Apparent Losses

| | | | |
|--------------------------------|----------------|-------------|---------------------|
| Customer Meter Inaccuracies | 1,490.2 | 4.1 | \$10,660,397 |
| Unauthorized Consumption | 2,425.5 | 6.6 | \$6,481,156 |
| Systematic Data Handling Error | 3,579.3 | 9.8 | \$25,956,064 |
| Apparent Loss totals | 7,494.9 | 20.5 | \$43,097,617 |

Real Losses

| | | | |
|---------------------------------|-----------------|-------------|--------------------|
| Tank Overflows/Operator Error | 0.0 | 0.0 | \$0 |
| Reported & Unreported Leakage** | | | |
| Transmission Main Leaks/Breaks | 4,929.0 | 13.5 | \$1,707,693 |
| Distribution Main Leaks/Breaks | 227.9 | 0.6 | \$78,948 |
| Customer Service Lines | 11,862.7 | 32.5 | \$4,109,953 |
| Hydrant & Valve Leaks | 59.4 | 0.2 | \$20,578 |
| Measured Leakage (DMAs) | 191.8 | 0.5 | \$66,441 |
| Background Leakage | 4,774.5 | 13.1 | \$1,654,170 |
| Leakage Liability Costs | | | \$515,954 |
| Real Loss totals | 22,045.2 | 60.4 | \$8,153,737 |

| | | | |
|---------------------------------|-----------------|-------------|---------------------|
| Water Losses -Total Cost | 29,540.1 | 80.9 | \$51,251,354 |
|---------------------------------|-----------------|-------------|---------------------|

Fiscal Year 2013 Financial Data

| | |
|---------------|---|
| \$7,711 | Apparent Losses per MG-Small Meter Accounts (5/8" & 3/4") |
| \$6,850 | Apparent Losses per MG-Large Meter Accounts (1" and larger) |
| \$6,680 | Apparent Losses per MG for City Property Accounts |
| \$7,313 | Apparent Losses per MG - Overall Average Customer Rate |
| \$346.46 | Real Losses - Marginal Cost per MG |
| \$515,954 | Real Loss Indemnity costs - added to total of Real Losses |
| \$249,101,975 | Water Supply Operating Cost |

Fiscal Year 2013 Infrastructure Data

| | |
|---------|--|
| 12,737 | Number of Large Meter Accounts, 1-inch and larger |
| 460,790 | Number of Small Meter Accounts, 5/8 & 3/4 inch (also includes some large meter accounts) |
| 53,678 | Number of actual connections in Non-billed account population |
| 3,028 | Miles of transmission and distribution pipeline |
| 150 | Miles of piping serving as fire hydrant laterals and large customer connections |
| 12 | Ave. length of service connection: curbstop to customer meter, ft. |
| 65 | Average pressure across the water distribution system, psi |

Notes

**The breakdown of leakage categories is approximate and should not be interpreted literally as most of these components are based on estimates rather than measured from minimum hour flow analysis. It is believed, however, that the overall estimate of leakage is reasonably representative of aggregate system conditions.

City of Philadelphia Annual Water Audit - IWA/AWWA Water Audit Method
Fiscal Year 2013 - July 1, 2012 to June 30, 2013
Performance Indicators for Water Supply System Losses

Water Resources Performance Indicator

Inefficiency of Use of Water as a Resource = Real Losses over system input volume, percent

$$= 22,045.2 \text{ MG divided by } 81,778.6 \text{ MG} \times 100\% = 27.0\%$$

Operational Performance Indicators

| | <u>Million Gallons</u> | <u>MGD</u> |
|--------------------------------|------------------------|---|
| Water Losses | 29,540.1 | 80.9 |
| Apparent Losses | 7,494.9 | 20.5 |
| Real Losses | 22,045.2 | 60.4 |
| Unavoidable Annual Real Losses | 2,496.5 | 6.8 (see next page for calculation - this is a reference value only not an actual leakage quantity) |

Real Losses Normalized 114.6 Gallons/Service Connection/Day

Apparent Losses Normalized 38.9 Gallons/Service Connection/Day

Infrastructure Leakage Index (ILI) = Real Losses over UARL

$$= 22,045 \text{ MG divided by } 2,496.5 \text{ MG} = 8.8$$

Financial Performance Indicators for Non-revenue Water

Non-revenue Water = Unbilled Authorized Consumption + Apparent Losses + Real Losses

$$= 0.0 + 1,959.0 + 7,494.9 + 22,045.2 = 31,499.2 \text{ Million Gallons}$$

$$= 5.4 + 20.5 + 60.4 = 86.3 \text{ MGD}$$

Non-revenue Water by volume = Non Revenue Water over Water Supplied, %

$$= 31,499.2 \text{ MG divided by } 81,778.6 \text{ MG} \times 100\% = 38.5\%$$

Non-revenue Cost Ratio is the annual cost of Non Revenue water over the Annual Running Costs for the water supply system, in %

| | | |
|-------------------------|---------------------|---|
| Non-revenue Water Costs | \$0 | Unbilled Metered |
| | \$1,398,440 | Unbilled Unmetered (Authorized Consumption) |
| | \$43,097,617 | Apparent Losses |
| | \$8,153,737 | Real Losses |
| | <u>\$52,649,794</u> | <u>Total</u> |

$$\text{Non Revenue Cost Ratio} = \$52,649,794 \text{ divided by } \$249,101,975 \times 100\% = 21.1\%$$

Calculation of Unavoidable Annual Real Losses (UARL): IWA/AWWA Water Audit Method

Unavoidable Annual Real Losses (UARL) is a reference value that can be calculated for any water distribution system and is used in calculating certain performance indicators. It is not an actual measure of any leakage component, however. The IWA/AWWA calculation for UARL is powerful since it is determined on a system-specific basis. The UARL is the theoretical minimal level of leakage that would exist in a distribution system after all possible leakage management actions are implemented, using the best of today's available technology.

The IWA/AWWA calculation includes leakage allowances based upon the number of customer service connections, length of service connection piping between the curbstop or property line and the customer meter, and average system pressure; all of which are key factors in the rate of active leakage in a water distribution system.

| Calculation of Unavoidable Annual Real Loss (UARL) for Philadelphia Water Department Fiscal Year 2013, July 1, 2012 - June 30, 2013 | | | | | |
|--|----------------------------------|--|-----------------------|---|-------------------------------------|
| Infrastructure Component | Quantity | Unit Rate for Unavoidable Annual Real Losses | Average Pressure, psi | Unavoidable Annual Real Losses, Million Gallons | Unavoidable Annual Real Losses, MGD |
| Total Pipeline Mileage, including pipeline total & sum of fire hydrant & large connections | 3,178 | 5.40 gals/mile/day/psi | 65 | 407.1 | 1.115 |
| Number of Service Connections (includes active and Non-billed connections that remain in place) | 527,205 | 0.15 gals/service/day/psi | 65 | 1,876.2 | 5.140 |
| Service Connections, curb-stop to meter | 527,205 X 12 ft./5280 ft/mile | 7.5 gals/mile/day/psi | 65 | 213.2 | 0.584 |
| Unavoidable Annual Real Losses | | | | 2,496.5 | 6.8 |

| CATEGORY/COMPONENTS | | VOLUME, Million Gallons | AVERAGE VOLUME, MGD | ANNUAL COSTS | +/-* | QUANTIFICATION MECHANISM | DESCRIPTION |
|--|---|----------------------------|------------------------|------------------|------|--|--|
| I. System Input Volume | | | | | | | |
| I-1 | Uncorrected System Input | 87,964.5 | 241.0 | | | Master Meter Total (See Worksheet #10) | Treated water system input volume from Load Control Center SCADA System data |
| I-2 | Correction for master meter and data handling error | -966.4 | -2.6 | | | Estimate (Inferred, 2004) | Composite average daily adjustment via mass balance method, performed by Load Control Unit; method applied to annual water audit starting in FY2004. |
| I-3 | Corrected System Input | 86,998.1 | 238.4 | | | Line I-1 adjusted by I-2 (See Worksheet #10) | |
| I-4 | Exports | 5,219.5 | 14.3 | | | Master Meter Total (3 interconnections) | Wholesale supply sold to Bucks County Water & Sewer Authority and Aqua Pennsylvania |
| I. System Input Volume | | 81,778.6 | 224.1 | | | Line I-3 minus I-4 | Water supplied to distribution system of Philadelphia city proper |
| II. Authorized Consumption | | | | | | | |
| II-1 | a. Billed Metered | 50,279.4 | 137.8 | | | Customer Billed Consumption from WRB/PWD Billing System. Derived from automatic meter readings (majority) and manual meter readings. | 12,737 Active large meter accounts - estimated from Basis2 Customer Billing System 460,790 Active small meter (residential) accounts - estimated from Basis2 Customer Billing System. Export Volume is NOT included in this amount. |
| II-2 | b. Billed Unmetered | 0.0 | 0.0 | | | | Billed water is typically metered in the city. |
| II-3 | c. Unbilled Metered | 0.0 | 0.0 | | | | Unbilled water is typically unmetered in the city. |
| d. Unbilled Unmetered | | | | | | | |
| <u>-Account Unmetered</u> | | | | | | | |
| II-4 | Scheduled Accounts (temporarily unmetered) | 95.8 | | \$700,662 | | Estimate (Subjective, 1998 revised 2008) | Assume 1,500 accounts with unmetered consumption of 7ccf/month (175 gal/day). |
| II-5 | Unmetered Fire Connections-system testing | 7.5 | | \$54,846 | | Estimate (Subjective, 1998 revised 2008) | Assume 75 fire connections experienced fire flows totaling 100,000 gallons |
| Account Unmetered Sub-total | | 103.3 | 0.3 | \$755,508 | | | |
| <u>-Non-account Unmetered</u> | | | | | | | |
| <u>- Authorized Consumption from fire hydrants</u> | | | | | | | |
| II-6 | Firefighting | 55.0 | | \$19,055 | | Estimate (Inferred, 1980) | Estimated Philadelphia Fire Department consumption for battling fires (1980 study) |
| II-7 | Street Cleaning | 180.0 | | \$62,363 | | Estimate (Inferred, 1980) | Estimated consumption by Streets Department cleaners (1980 study) |
| II-8 | Filling City-owned Swimming Pools | 7.0 | | \$2,425 | | Estimate (Subjective, 1999) | Subjective estimate 100 fillings of City's 80 pools; average pool is 70,000 gal (FY1999). |
| Fire Hydrant Use via Permit | | | | | | | |
| II-9 | Construction Permits | 97.3 | | \$33,717 | | Estimate (Inferred, 1998) | FY2013: 65 weekly Construction Permits issued. Assume 50 gpm for 8 hrs/day for 7 days. Also, 25 6-month permits issued. Assume 50 gpm for 8 hrs/day for 144 work days |
| II-10 | Community Gardens | 77.8 | | \$26,941 | | Estimate (Inferred, 1998) | FY2013: 36 Urban Garden permits issued. Assume 25 gpm for 8 hrs/day for 180 day growing season |
| II-11 | Miscellaneous Fire Hydrant Permits | 0.2 | | \$58 | | Estimate (Inferred, 1998) | FY2013: 2 miscellaneous (Special Event, other) permits issued. Assume 50 gpm for 4 hrs/day for 7 days |
| II-12 | Sewer Flushings, citywide sewer cleaning & root control contracts | 0.0 | | \$3 | | Estimate (Inferred, 1998) | No activity for the citywide contract for sewer flushings in FY2013; Root Control contract activities assumed 10,000 gallons. |
| II-13 | Sprinkler Program | 0.3 | | \$91 | | Estimate (Inferred, 1998) | Assume 5 sprinkler in FY2013, 44 days > 90 degrees F (Assume 2.5 gpm @ 8 hrs) |
| Miscellaneous PWD Usage | | | | | | | |
| II-14 | PWD Treatment Plant flushing operations | 21.8 | | \$7,567 | | Estimate (Subjective, 1999) | Subjective Estimate: One flushing per week for two hours at 500 gpm at seven plants |
| II-15 | Sewer flushings - General Maintenance | 15.6 | | \$5,405 | | Estimate (Subjective, 1999) | Subjective Estimate: 10 flushings/week for 1 hour at 500 gpm |
| II-16 | Cement Truck Water Supply | 0.1 | | \$29 | | Estimate (Inferred, 1998, revised 2008) | Facilities Management Unit works 36 week season: 2 "street" trucks (capacity 350 gal) fill 200 gals each workday. One "plant" truck fills 300 gal 5 times every two weeks. Assume all 3 flush and fill entire 350 gals 9 times per year. |
| -Authorized Cons. - fire hydrants Sub-total | | 455.0 | 1.2 | \$157,655 | | | |
| <u>- Water Distribution System Operations</u> | | | | | | | |
| Disinfection Operations | | | | | | | |
| II-17 | Reservoirs | 0 | | \$0 | | Meters & Water Level Instruments | None in FY2013 |
| II-18 | Transmission Mains | 51.3 | | \$17,778 | | Estimates (Inferred) & portable instruments | Disinfection operations conducted in FY2013 |

| | | | | | | |
|---|--|-----------------|--------------|--------------------|---|---|
| II-19 | Distribution Mains | 16.9 | | \$5,849 | Estimate (Inferred, 1996) | Flushing in 122 operations in FY2013; each operation assumed 96.1 gpm for 24 hrs. |
| | Draining Operations | | | | | |
| II-20 | Reservoirs | 44.0 | | \$15,260 | Water level instruments | FY2013 Operations |
| II-21 | Transmission Mains | 50.8 | | \$17,617 | Estimates (Inferred) & portable instruments | FY2013 Operations |
| II-22 | Transmission Mains Dechlorination Operations | 0.0 | | \$0 | Estimates (Inferred) & portable instruments | None in FY2013 |
| II-23 | Distribution Mains | 3.6 | | \$1,247 | Estimate (Subjective, 1997) | Water from passing valves: assume 10 gpm for 24 hrs on 250 occasions |
| II-24 | Filling new Reservoirs or Basins | 0.0 | | \$0 | Permanent or Portable Meters or estimates | None in FY2013 (filling existing facilities included in drainings) |
| | Flushing Operations | | | | | |
| | Poor Water Quality Investigations | | | | | |
| II-25 | Coordinated by Load Control Unit | 58.9 | | \$20,389 | Estimates (Inferred) & portable instruments | FY2013 recorded flushing volumes during Valve Crew inspections & water quality investigations |
| II-26 | Valve Flushing | 260.2 | | \$90,132 | Estimate (Subjective, 1997) | Documented volumes from valve flushing during FY2013 |
| II-27 | Coordinated by Distribution Unit | 294.3 | | \$101,947 | Estimate (Subjective, 1998) | Undocumented water from routine investigations. (five times the above amount assumed) |
| II-28 | Conducted for Miscellaneous Operations | 130.9 | | \$45,367 | Estimate (Inferred, 2001) | Various flushing activities FY2013 |
| II-29 | Cleaning Floating Covers @ Oak Lane & East Park Reservoirs | 0.0 | | \$0 | Estimate (Inferred, 2002) | FY2013 volume was zero since Oak Lane Reservoir remained out-of-service since February 2009 due to cover failure. Finished water is not used for cover cleaning at East Park Reservoir |
| II-30 | Automatic or systematic flushing of water in the distribution system | 365.0 | | \$126,458 | Estimate (Inferred, 2006) | The water distribution system of the former Philadelphia Naval Shipyard was acquired by PWD in April 2012. An automatic flusher unit was installed in this system to provide flushing to remediate a problem of deteriorating water quality. The flusher unit failed and ongoing flushing was established from a fire hydrant. The volume of water flushed from this fire hydrant was estimated at 1.0 mgd in FY2013. |
| | System Testing | | | | | |
| II-31 | Fire Hydrant Inspection Program | 84.0 | | \$29,103 | Estimate (Inferred, 1997) | Annual Fire Department Inspections: flush 28,000 hydrants 15 minutes @ 200 gpm |
| II-32 | Fire Flow Tests | 1.257 | | \$435 | Portable Instrument | Measured during fire flow tests conducted in FY2013 |
| II-33 | Loss-of-Head Tests | 2.881 | | \$998 | Portable Instrument | Loss-of-head tests conducted in FY2013 |
| II-34 | Special Investigations/other | 36.646 | | \$12,696 | Estimates (Inferred) & portable instruments | Measured during events in FY2013 |
| | -Water Distribution Operations Sub-total | 1400.7 | 3.8 | \$485,277 | | |
| | d. Unbilled Unmetered Sub-total | 1,959.0 | 5.4 | \$1,398,440 | | |
| | II. Authorized Consumption Total | 52,238.5 | 143.1 | \$1,398,440 | Sum | Cost shown is for Unbilled Water only, valued at the marginal production cost |
| III. Water Losses (Item I. minus Item II.) | | 29,540.1 | 80.9 | | | Water Losses consist of Apparent Losses and Real Losses |
| | A. Apparent Losses | | | | | Most Apparent Loss components are valued using the typical monthly residential consumption of 7 ccf (175 gallons per day) each day of the year. Prior to FY2002 average consumption was 9 ccf and average consumption was 8 ccf from FY2002-FY2008. |
| | <u>-Customer Meter Accuracy</u> | | | | | |
| III-1 | Small Meters: 5/8" & 3/4" under-registration | 269.8 | | \$2,080,776 | Estimate (Inferred, 2011) | Most of meter population replaced 1997-1999; with oldest of these meters at 16 years out of expected 25 year life; 30 random meter tests in FY2005 (year 8) found superior accuracy then. Starting in FY2011 assume 1.0% under-registration (99.0% accuracy) for this meter population. |
| III-2 | Defective Small Meters | 147.2 | | \$1,134,788 | Estimate (Inferred, 2010) | Assume 0.50% of 460,790 (2,304) residential meters are defective in any year. 704 confirmed defective small meters during Revenue Protection Program inspections in FY2013. but this is likely a small fraction of the actual number of defective small meters. |
| | Stopped (Frozen) Meters | | | | | |
| III-3 | Small meters, 5/8 inch and 3/4 inch | 108.9 | | \$839,601 | Estimate (Inferred) | FY2013: 1296 Stopped meters confirmed; assume another 500 exist |
| III-4 | Large meters, greater than 3/4 inch | 75.0 | | \$513,893 | Estimate (Inferred) | FY2013: 20 Stopped meters confirmed; assume an additional 15 exist at 5,027 gal/day |
| III-5 | Large Meters: 1" & Larger Under-reg. | 889.2 | | \$6,091,339 | Estimate (Inferred, 2010) | FY2013 -12,737 large meter accounts: Assume 25% under-reg. by 15%. Precise flow dataloggings of over 150 large meter accounts since FY2007 confirms that many large customer meters are oversized. Oversizing can result in failure to register a portion of the customer flow; the low flows that occur. Assumption increased to 15% of accounts in FY2010 and 25% of accounts in FY2011. |
| | <u>Customer Meter Accuracy Sub-total</u> | 1,490.2 | 4.1 | \$10,660,397 | | |

| | | | | | | |
|---|---|----------------|-------------|---------------------|---|--|
| - Unauthorized Consumption | | | | | | |
| III-6 | Heat relief fire hydrant abuse | 857.0 | 2.3 | \$296,923 | Estimate (Inferred, 1997, revised 2003) | FY2013 Estimate for 37 fire hydrant abuse days > 90 degrees F |
| III-7 | Unauthorized consumption by contractors | 328.5 | | \$113,812 | Estimate (Subjective, revised in 1999) | Unauthorized business use: Assumed 50 events per day for 1 hour at 300 gpm |
| III-8 | Random Unauthorized Consumption | 438.0 | | \$151,749 | Estimate (Subjective, revised in 1999) | Unauthorized public use: Assumed 50 events per day for 1 hour at 400 gpm |
| III-9 | Illegal Connections/Fire Connections | 12.8 | | \$93,422 | Estimate (Subjective, 1998, revised in 2011) | Assume 500 illegal connections to water mains or fire service lines (up from 200 to 500 in FY2011) |
| Illegal Restores of Service Lines: NB3 Category | | | | | | |
| III-10 | Reinspection Program, Water Rev Bureau | 109.0 | | \$797,353 | Estimate (Inferred) | FY2013: 1,707 illegal restores found in 18,032 reinspections (9.47%) |
| III-11 | Illegal Restores abated, PWD | 22.2 | | \$162,554 | Estimate (Inferred) | 348 illegally restored accounts found by Delinquency & Restoration in FY2007; assumed same |
| III-12 | Unconfirmed Illegal Restores: NB3 | 119.6 | | \$874,780 | Estimate (Inferred) | 9.47% of the 18,032 reinspected accounts were confirmed reactivated and were shutoff again. Assume the 9.47% of the uninspected accounts (37,815 total shutoffs - 18,032 = 19,783) are also illegally reactivated. |
| Illegal Actions inside Private Premises | | | | | | |
| III-13 | Tampering with meters and AMR ERTs | 332.3 | | \$2,430,362 | Estimate (Subjective, 1998) | 3,703 cases of tampered meters and/or AMR devices (ERTs) confirmed in FY2013. Additional 1,500 assumed to exist, but not yet detected. |
| Confirmed missing meters | | | | | | |
| III-14 | Small meters, 5/8 inch and 3/4 inch | 148.2 | | \$1,142,712 | Estimate (Inferred, 2006) | Meter Shop confirmed 2,496 missing meters in FY2013 |
| III-15 | Large meters, greater than 3/4 inch | 32.2 | | \$220,474 | Estimate (Inferred, FY2006) | Meter Shop confirmed 24 missing meters in FY2013 |
| III-16 | Additional unconfirmed missing meters | 25.6 | | \$197,016 | Estimate (Subjective, 2006) | Assumed 400 additional undiscovered 5/8" accounts are missing meters |
| <u>Unauthorized Consumption Sub-total</u> | | 2,425.5 | 6.6 | \$6,481,156 | | |
| - Systematic Data Handling Error (Meter Reading, Estimating & Billing Error) | | | | | | |
| III-17 | Data Error: SCADA System Program Error | 0 | | \$0 | SCADA System Metered Data | None reported in FY2013 |
| | Manual Meter Reading error: typically only non-AMR accounts are manually read | | | | Estimate (Inferred, Revised in FY2000) | FY2013: 385 manual large meter readings completed in 1,396 attempts (23.8% success rate). Assume 15% of accounts w/o meter readings have estimates that are off by 50% |
| III-18 | 1,754 Small Meter Accounts w/o AMR (2013) | 5.7 | | \$44,319 | | Use 175 gal/day as average billed consumption for small meter accounts |
| III-19 | 385 Large Meter Accounts w/o AMR (2013) | 45.3 | | \$309,966 | | Use 6,277 gal/day as average billed consumption for large meter accounts |
| III-20 | AMR reading device (ERT) failure | 119.1 | | \$870,858 | Estimate (Inferred, established in FY2012) | FY2013 AMR Metering Reading success rate was 98.8% meaning 1.2% accounts did not produce a valid meter reading each month. On average basis this was 5,650 accounts each month. Assume that one-third of these events occurred due to AMR ERT failure |
| III-21 | No Billing/Customers without an Account | 132.0 | | \$965,362 | Estimate (Subjective, 1998) | Assume 0.25% of active connections exist in the city without accounts or billing. |
| III-22 | Non-billed Accounts with active consumption | 514.3 | | \$3,761,012 | | FY2013 53,678 physical NB accounts existed. (Total NB minus NB2 and NB5 accounts). Assume 15% are active water users. |
| Billing Adjustments & Waivers | | | | | | |
| III-23 | Small Meter Accounts | 920.5 | | \$7,097,976 | Billing System Data Mining Analysis (FY2006) increased by subjective 25% (FY2011) | The former WATER1 Customer Billing System awarded financial credits by adjusting consumption to negative values, which distorted consumption totals. Data mining analysis in FY2006 quantified this error as 736.4 MG for small meter accounts and 864.9 MG for large meter accounts. Adjustment impacts in Basis2 System are unknown, but believed to be significant; FY2006 values increased by 25% in FY2011. |
| III-24 | Large Meter Accounts | 1081.1 | | \$7,405,706 | Billing System Data Mining Analysis (FY2006) increased by subjective 25% (FY2011) | |
| City Properties | | | | | Estimate (Subjective, revised in FY1998) | City properties are often given low priority for metering/meter reading/billing functions. Approximately +1,900 accounts exist. PWD accounts register metered consumption but are not "billed". Most facilities have meters/accounts. Assume 12 do not; estimated consumption 30 ccf/month. Assume 250 other City Properties without regular billing at 18 ccf/month. |
| III-25 | PWD accounts lacking billing | 3.2 | | \$0 | | |
| III-26 | Other city accounts lacking billing | 40.4 | | \$269,819 | | |
| III-27 | City properties absent from billing system | 26.9 | | \$179,879 | | Assume 100 active City property connections exist in the city without accounts or billing. |
| III-28 | Miscellaneous adjustments FY2013 | 690.7 | | \$5,051,167 | | Taken as one third of sum of all other billing adjustment error |
| <u>Data Handling Error Sub-total</u> | | 3,579.3 | 9.8 | \$25,956,064 | | |
| A. Apparent Losses Total | | 7,494.9 | 20.5 | \$43,097,617 | Sum | |
| III. Water Losses (Continued) | | | | | | |
| B. Real Losses | | | | | | |
| <i>a. Operator Error</i> | | | | | | |
| III-29 | Documented Reservoir/Tank Overflows | 0 | | \$0 | SCADA System Metered Data | No events reported in FY2013 |
| III-30 | Documented Appurtenances Improperly open | 0 | | \$0 | Estimate (Inferred) | No events reported in FY2013 |

| Definitions: | | Reported Leaks: visible leaks identified by complaints | | | Volumes of leakage losses are a function of the type of leak and the duration that it runs. Reported leaks and breaks evidence quickly, which results in shorter run times than unreported leaks, which often run undetected for lengthy periods of time, with mounting loss. | |
|--|---|--|------|-------------|---|--|
| | | Unreported Leaks: hidden leaks identified by active leakage control (leak surveys, Sahara, DMA flow, sewer CCTV) | | | | |
| | | Background Leakage: collective volume from numerous undetectable weeps and seeps at joints & service connections | | | | |
| | | Transmission Water Mains: diameter 16-inch & larger. Distribution Water Mains: diameter 12-inch & smaller | | | | |
| b. Leakage | | | | | | |
| III-31 | Transmission Main Breaks - Reported | 0.6 | | \$221 | Component Analysis (FY2005) | 17 events in FY2013 |
| III-32 | Transmission Main Breaks - Unreported | 0.0 | | \$0 | Component Analysis (FY2005) | No events in FY2013 |
| III-33 | Transmission Main Leaks - Reported | 300.1 | | \$103,974 | Component Analysis (FY2005) | 24 events in FY2013 |
| III-34 | Trans. Main Leaks - Unreported (Detected) | 11.1 | | \$3,828 | Implementation of Inline Leak Detection (FY2007) | 14 repaired leaks identified by SAHARA Technology (Pure Technologies) in FY2013 |
| III-35 | Trans. Main Leaks - Unreported (Undetected) | 3910.5 | | \$1,354,818 | Inferred Estimate (FY2009) | Use of the Sahara® service for almost 40 miles of pipeline found 72 leaks from FY2006-FY2013 or 2 leaks per mile. Assume 2 leaks per mile of remaining 372 miles at leakage rate of 14 gpm (small/medium size leaks). |
| III-36 | Distribution Main Breaks - Reported | 29.6 | | \$10,271 | Component Analysis (FY2005) | 754 events in FY2013 (typical break events average 27.25 hours from awareness to repair) |
| III-37 | Distribution Main Breaks - Unreported | 0.0 | | \$0 | Component Analysis (FY2005) | No events in FY2013 |
| III-38 | Distribution Main Leaks - Reported | 25.7 | | \$8,900 | Component Analysis (FY2005) | FY2013: 104 main leaks abated (.013 MGD/ leak taken as 19 day event) |
| III-39 | Distribution Main Leaks - Unreported | 172.5 | | \$59,777 | Component Analysis (FY2005) | FY2013: 24 main leaks abated (.013 MGD/ leak taken as 553 day event) |
| III-40 | Service Line Leaks - PWD Repair: Reported | 363.0 | | \$125,779 | Component Analysis (FY2005) | FY2013: 747 leaks abated by Distribution Unit (0.009 MGD/leak taken as a 54 day event) |
| III-41 | Service Line Leaks - PWD Repair: Unreported | 26.4 | | \$9,152 | Component Analysis (FY2005) | FY2013: 5 leaks abated by Distribution Unit (0.009 MGD/leak taken as a 587 day event) |
| III-42 | Service Line Leaks - Customer arranged repairs: Reported | 948.0 | | \$328,452 | Component Analysis (FY2005) | 1,254 leaks, including 850 abated via customer assistance (HELP) program loans and 404 abated by customer arranged repairs at customer cost; assume all are 5/8" at 0.009 MGD 84 days. |
| III-43 | Service Line Leaks - Customer arranged repairs: Unreported | 328.5 | | \$113,812 | Component Analysis (FY2005) | Breakdown of reported vs unreported not known for this year, assume 100 unreported leaks repaired by customers; all are 5/8" at .009 MGD 618 days |
| III-44 | Abandoned Service Line Leaks - Reported | 9.0 | | \$3,118 | Component Analysis (FY2005) | FY2013: 2 leaks abated (0.018 MGD) @ 250 days |
| III-45 | Abandoned Service Line Leaks - Unreported | 33.4 | | \$11,562 | Component Analysis (FY2005) | FY2013: 3 1 leak abated by LD Crew & Dist. (0.018 MGD) @ 618 days |
| III-46 | Service Leaks (all types) undetected/hidden | 8453.5 | | \$2,928,786 | Inferred Estimate (FY2011) | Assume 1% of 460,790 customer lines leak at rate of 7 gpm for 182 days. |
| III-47 | Hydrant Leaks - Reported | 7.0 | | \$2,439 | Component Analysis (FY2005) | FY2013: 80 leaks abated (.004 MGD per leak @ 22 days) |
| III-48 | Hydrant Leaks - Unreported | 6.8 | | \$2,361 | Component Analysis (FY2005) | FY2013: 3 leaks abated (.004 MGD per leak @ 568 days) |
| III-49 | Valve Leaks - Reported | 45.5 | | \$15,778 | Component Analysis (FY2005) | FY2013: 230 leaks abated (.009 MGD per leak @ 22 days) |
| III-50 | Valve Leaks - Unreported | 0.0 | | \$0 | Component Analysis (FY2005) | FY2013: 0 leaks abated (.009 MGD per leak @ 568 days) |
| Reported & Unreported Leakage sub-total | | 14,671.3 | 40.2 | \$5,083,028 | | |
| Measured leakage in District Metered Areas (DMA) and several known sites | | | | | | The PWD piloted DMAs since 2000 and commissioned its first permanent DMA (DMA5) in FY2007 under AWWA Research Foundation Project "Leakage Management Technologies" |
| III-51 | DMA1- Lower Roxborough Gravity Dist. | 3.7 | | \$1,265 | Metered - derived from Nightflow Analysis | FY2003: Measured at 7 gallons per min. (0.010 MGD) 8/6/2003; taken as current level |
| III-52 | DMA2 - Upper Roxborough Gravity Dist. | 8.8 | | \$3,035 | Metered - derived from Nightflow Analysis | FY2003: Measured at 17gpm (0.024 MGD) 6/26/2003; taken as current level |
| III-53 | DMA3 - Chestnut Hill District | 31.4 | | \$10,875 | Metered - derived from Nightflow Analysis | FY2003: Measured at 60 gpm (0.086 MGD) 7/25/2003; taken as current level |
| III-54 | DMA4 - Belmont Gravity District | 32.1 | | \$11,128 | Metered - derived from Nightflow Analysis | FY2004: Measured at 61 gpm (0.088 MGD) 7/11/2003, also used night AMR readings |
| III-55 | DMA5 - Roxborough High Service District | 105.9 | | \$36,673 | Metered - derived from Nightflow Analysis | FY2013: DMA5 established as part of Water Research Foundation Research Project 2928 (2003-2007); flows are continuously monitored and leakage is derived from minimum hour flow analysis. Volume entered is yearly average of minimum night flow. |
| III-56 | Reported Active Large Ongoing Leaks Awaiting Repair or Capital Program long-term rehabilitation | 10.0 | | \$3,465 | Subjective Estimate | Lardner's Point Pump Station Piping - previously reported longstanding leakage of 1.5 Mgd. Piping rehab contract W3153D initiated in July 2009. Pipe lining and joint repairs are complete. Leakage now believed to not stem from water downstream of production metering point. Nominal value retained to represent minor leakage a several sites awaiting a Capital Program project to replace infrastructure and eliminate the leakage. |
| Measured Leakage sub-total | | 191.8 | 0.5 | \$66,441 | | |
| Background Leakage | | | | | | |
| III-57 | Unlined Underground Reservoirs | 184.0 | | \$63,735 | Component Analysis (FY2005) | Assumed 350 gpm seepage at 3 Roxborough Reservoirs and Monument Road Basin |
| III-58 | Booster Pumping Station Piping | 184.0 | | \$63,735 | Estimate (Subjective, Revised in FY2005) | Assumed year round 350 gpm leakage: Foxchase, East Oak Lane, West Oak Lane, Chestnut Hill, Roxborough and East Park |
| III-59 | Transmission Mains | 64.0 | | \$22,173 | Component Analysis (FY2005) | |
| III-60 | Distribution Mains | 418.0 | | \$144,820 | Component Analysis (FY2005) | |
| III-61 | Customer Service Lines | 3240.0 | | \$1,122,529 | Component Analysis (FY2005) | |
| III-62 | Hydrants & Valves | 0.0 | | \$0 | Component Analysis (FY2005) | |
| Background Leakage sub-total | | 4,089.9 | 11.2 | \$1,416,992 | | |
| Leakage total | | 18,953.0 | 51.9 | \$6,566,460 | | |
| B. Real Losses Total | | 18,953.0 | 51.9 | \$6,566,460 | Sum | |
| | | | | \$515,954 | Indemnity Costs for damage incidents from water leakage (FY2012 data) | |
| | | | | \$7,082,414 | Total Cost of Real Losses | |

City of Philadelphia - Preliminary Water Audit Summary Fiscal Year 2013 July 1, 2012 - June 30, 2013

| Water Supplied | Million Gallons | Mgd | Annual Cost |
|-----------------------------------|-----------------|--------------|-------------|
| System Input | 87,964.5 | 241.0 | |
| Master Meter Correction | -966.4 | -2.6 | |
| Corrected System Input | 86,998.1 | 238.4 | |
| Minus Exports | 5,219.5 | 14.3 | |
| Water Supplied (City only) | 81,778.6 | 224.1 | |

| Authorized Consumption | Million Gallons | Mgd | Annual Cost |
|-------------------------------|-----------------|--------------|--------------------|
| Billed Metered | 50,279.4 | 137.8 | |
| Billed Unmetered | 0.0 | 0.0 | |
| Unbilled Metered | 0.0 | 0.0 | |
| Unbilled Unmetered | 1,959.0 | 5.4 | \$1,398,440 |
| Authorized Consumption | 52,238.5 | 143.1 | \$1,398,440 |

| | | | |
|---------------------|-----------------|-------------|--|
| Water Losses | 29,540.1 | 80.9 | |
|---------------------|-----------------|-------------|--|

| Apparent Losses | Million Gallons | Mgd | Annual Cost |
|--------------------------------|-----------------|-------------|---------------------|
| Customer Meter Inaccuracies | 1,490.2 | 4.1 | \$10,660,397 |
| Unauthorized Consumption | 2,425.5 | 6.6 | \$6,481,156 |
| Systematic Data Handling Error | 3,579.3 | 9.8 | \$25,956,064 |
| Apparent Loss Total | 7,494.9 | 20.5 | \$43,097,617 |

| Real Losses | Million Gallons | Mgd | Annual Cost |
|-----------------------------------|-----------------|-------------|--------------------|
| Tank Overflows/Operator Error | 0.0 | 0.0 | \$0 |
| Reported & Unreported Leakage | | | |
| Transmission Main Breaks & Leaks | 4,222.3 | 11.6 | \$1,462,841 |
| Distribution Mains Leaks & Breaks | 227.9 | 0.6 | \$78,948 |
| Customer Service Lines | 10,161.8 | 27.8 | \$3,520,661 |
| Hydrant & Valve Leaks | 59.4 | 0.2 | \$20,578 |
| Measured Leakage (DMAs) | 191.8 | 0.5 | \$66,441 |
| Background Leakage | 4,089.9 | 11.2 | \$1,416,992 |
| Leakage Liability Costs | | | \$515,954 |
| Real Loss Total | 18,953.0 | 51.9 | \$7,082,414 |

Fiscal Year 2013 Financial Data

| | |
|-----------------|--|
| \$7,711 | Apparent Costs per MG-Small Meter Accounts (5/8" & 3/4") |
| \$6,850 | Apparent Costs per MG-Large Meter Accounts (1" and larger) |
| \$6,680 | Apparent Costs per MG for City Property Accounts |
| \$7,313 | Overall Average Customer Rate |
| \$346.46 | Marginal Cost per MG for Real Losses |
| 365 | Number of days in the Fiscal Year |
| 12,737 | Number of Large Meter Accounts, 1-inch and greater |
| 460,790 | Number of Small Meter Accounts, 5/8 & 3/4 inch (also includes some large meter accounts) |

| | | | |
|---|-----------------|-------------|---------------------|
| Water Loss Total - Preliminary Audit | 26,447.9 | 72.5 | \$50,180,031 |
|---|-----------------|-------------|---------------------|

\$249,101,975 Water Supply Operating Cost

Hidden Leakage = Water Losses - (Apparent + Real Losses)

3,092.2
8.5

The Hidden Leakage quantity reflects the fact that not all components of loss, particularly leakage are quantified in detail in the water audit. Since the majority of the distribution system is not monitored for leakage continuously, a large portion of leakage is not captured in the preliminary audit.

City of Philadelphia - Water Audit Fiscal Year 2013 - Hidden Leakage Adjustment

While the source of the water loss represented by the quantity of Hidden Leakage is not specifically known, the City of Philadelphia applies this quantity to three major leakage categories in an apportioned manner.

Adding the quantities of estimated and measured leakage into the Water Audit gives a final summary and allows for an approximation of losses that equal the audited total of 72.5 MGD. The Hidden Leakage quantity in FY2013 is 8.5. In the 11-year IWA/AWWA water audit history of the PWD-WRB, the lowest Hidden Leakage quantity was 6.90 MGD in FY2011 and the highest value was 36.0 MGD in FY2005.

District Metered Areas provide actual leakage measurements and establishment of additional DMAs in the distribution system would improve the validity of the leakage quantity in the water audit and should gradually reduce the magnitude of the Hidden Leakage quantity, giving a more reliable water audit.

It is possible that some of the amount of the Hidden Leakage quantity is actually Apparent Loss.

Assigning the Hidden Leakage quantity to Real Losses: from the Preliminary Water Audit

| | Million Gallons | Mgd | % of Total | Multiply % by Hid. Leak. = Million Gallons |
|---|-----------------|------|------------|--|
| Transmission Main Breaks and Leaks | 4,222.3 | 11.6 | 22.9% | 706.7 |
| Unreported Leakage on Active and Abandoned Customer Service Lines | 10,161.8 | 27.8 | 55.0% | 1,700.9 |
| Background Leakage | 4,089.9 | 11.2 | 22.1% | 684.6 |
| Total | 18,474.0 | 50.6 | 100% | 3,092.2 |

| | Category Assigned to Hidden Leakage | Million Gallons | Mgd | Annual Cost | Quantification Mechanism | Description |
|--------|---|-----------------|-------------|--------------------|------------------------------------|---|
| Adj. 1 | Transmission Main Breaks and Leaks | 4,929.0 | 13.5 | \$1,707,693 | Hidden Leakage Adjustment (FY2010) | Transmission main leaks and breaks adjusted by apportioned Hidden Leakage quantity. |
| Adj. 2 | Unreported Leakage on Active and Abandoned Customer Service Lines | 11,862.7 | 32.5 | \$4,109,953 | Hidden Leakage Adjustment (FY2004) | Service line leakage adjusted by apportioned Hidden Leakage quantity. |
| Adj. 3 | Background Leakage | 4,774.5 | 13.1 | \$1,654,170 | Hidden Leakage Adjustment (FY2004) | Background leakage adjusted by apportioned Hidden Leakage quantity. |
| | | 21,566.2 | 59.1 | \$7,471,816 | | |

City of Philadelphia - Complete Water Audit Summary Fiscal Year 2013 July 1, 2012 - June 30, 2013

| Water Supplied | Million Gallons | Mgd | Annual Cost |
|---|-----------------|--------------|-------------|
| System Input | 87,964.5 | 241.0 | |
| Correction for Master Meter & data handling error | -966.4 | -2.6 | |
| Corrected System Input | 86,998.1 | 238.4 | |
| Minus Exports | 5,220 | 14.3 | |
| Water Supplied (City only) | 81,778.6 | 224.1 | |

| Authorized Consumption | Million Gallons | Mgd | Annual Cost |
|-------------------------------|-----------------|--------------|--------------------|
| Billed Metered | 50,279.4 | 137.8 | |
| Billed Unmetered | 0.0 | 0.0 | |
| Unbilled Metered | 0.0 | 0.0 | |
| Unbilled Unmetered | 1959.0 | 5.4 | \$1,398,440 |
| Authorized Consumption | 52,238.5 | 143.1 | \$1,398,440 |

| | | | |
|---------------------|-----------------|-------------|--|
| Water Losses | 29,540.1 | 80.9 | |
|---------------------|-----------------|-------------|--|

| Apparent Losses | Million Gallons | Mgd | Annual Cost |
|--------------------------------|-----------------|-------------|---------------------|
| Customer Meter Inaccuracies | 1,490.2 | 4.1 | \$10,660,397 |
| Unauthorized Consumption | 2,425.5 | 6.6 | \$6,481,156 |
| Systematic Data Handling Error | 3,579.3 | 9.8 | \$25,956,064 |
| Apparent Loss Total | 7,494.9 | 20.5 | \$43,097,617 |

| Real Losses | Million Gallons | Mgd | Annual Cost |
|-----------------------------------|-----------------|-------------|--------------------|
| Tank Overflows/Operator Error | 0.0 | 0.0 | \$0 |
| Reported & Unreported Leakage | | | |
| Transmission Main Breaks & Leaks | 4,929.0 | 13.5 | \$1,707,693 |
| Distribution Mains Leaks & Breaks | 227.9 | 0.6 | \$78,948 |
| Customer Service Lines | 11,862.7 | 32.5 | \$4,109,953 |
| Hydrant & Valve Leaks | 59.4 | 0.2 | \$20,578 |
| Measured Leakage (DMAs) | 191.8 | 0.5 | \$66,441 |
| Background Leakage | 4,774.5 | 13.1 | \$1,654,170 |
| Leakage Liability Costs | | | \$515,954 |
| Real Loss Total | 22,045.2 | 60.4 | \$8,153,737 |

Fiscal Year 2013 Financial Data

| | |
|------------------|---|
| \$7,711 | Apparent Costs per MG-Small Meter Accounts (5/8" & 3/4") |
| \$6,850 | Apparent Costs per MG-Large Meter Accounts (1" and larger) |
| \$6,680 | Apparent Costs per MG for City Property Accounts |
| \$7,313 | Overall Average Customer Rate |
| \$515,954 | Real loss indemnity cost - added to total of Real Loss costs |
| \$346.46 | Marginal Cost per MG for Real Losses |
| 365 | Number of days in the Fiscal Year |
| 12,737 | Number of Large Meter Accounts, 1-inch and greater |
| 460,790 | Number of Small Meter Accounts, 5/8 & 3/4 inch (includes some large meter accounts) |

| | | | |
|-------------------------|-----------------|-------------|---------------------|
| Water Loss Total | 29,540.1 | 80.9 | \$51,251,354 |
|-------------------------|-----------------|-------------|---------------------|

| | |
|----------------------|-----------------------------|
| \$249,101,975 | Water Supply Operating Cost |
|----------------------|-----------------------------|

**International Water Association - American Water Works Association Standard Water Balance for the
Philadelphia Water Department - Fiscal Year 2013**

Volumes reported in million gallons for the reporting year; and average million gallons per day, mgd in italic

| | | | | | | | | | |
|--------------------------------------|---------------------------------------|---|---|--|-----------------------------------|--|---|--|--|
| Own Sources 87,964.5 241.0 | System Input 86,998.1 238.4 | Water Exported 5,219.5 14.3 | Water Exported 5,219.5 14.3 | Water Exported 5,219.5 14.3 | Water Exported 5,219.5 14.3 | Billed Water Exported 5,219.5 14.3 | | | |
| | | Water Supplied 81,778.6 224.1 | Authorized Consumption 52,238.5 143.1 | Billed Authorized Consumption 50,279.4 137.8 | | Revenue Water 50,279.4 137.8 | Billed Metered Consumption 50,279.4 137.8 | | |
| | | | | Unbilled Authorized Consumption 1,959.0 5.4 | | Non-revenue Water 31,499.2 86.3 | Billed Unmetered Consumption 0.0 0.0 | | |
| | | | | | | | Unbilled Metered Consumption 0.0 0.0 | | |
| | | | | | | | Unbilled Unmetered Consumption 1,959.0 5.4 | | |
| | | | Water Losses 29,540.1 80.9 | Apparent Losses 7,494.9 20.5 | | | | Customer Metering Inaccuracies 1,490.2 4.1 | |
| | | | | Real Losses 22,045.2 60.4 | | Unauthorized Consumption 2,425.5 6.6 | | | |
| | | | | | | Systematic Data Handling Error 3,579.3 9.8 | | | |
| | | | | | | Leakage on Mains 10,182.5 27.9 | | | |
| | | | | | | Leakage and Overflows at Storages 0.0 0.0 | | | |
| | | | Leakage on Service Connections up to the point of customer metering 11,862.7 32.5 | | | | | | |
| | | | - Correction -966.4 -2.6 | Water Imported 0 | | | | | |

Definitions of Terms

OWN SOURCES: the volume of water input to a water distribution system from the water supplier's own sources

WATER IMPORTED OR EXPORTED: the volumes of bulk transfers across operational boundaries

SYSTEM INPUT : the volume input to that part of the water supply system to which the water balance calculation relates, allowing for known errors. Equal to OWN SOURCES + WATER IMPORTED +/- CORRECTION for production meter error

WATER SUPPLIED: SYSTEM INPUT minus WATER EXPORTED

AUTHORIZED CONSUMPTION: volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are implicitly or explicitly authorized to do so by the water supplier, for residential, commercial and industrial purposes.

Note: Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water, etc. These may be billed or unbilled, metered or unmetered

WATER LOSSES: the difference between SYSTEM INPUT and AUTHORIZED CONSUMPTION. Water losses can be considered as a total volume for the whole system, or for partial systems such as raw water mains, transmission or distribution systems, or individual zones

APPARENT LOSSES: includes all types of inaccuracies associated with customer metering, systematic error or manipulation of consumption data in billing and accounting systems, plus unauthorized consumption (theft or illegal consumption).

Note: Authorized consumption may include items such as fire fighting and training, flushing of mains and sewers, street cleaning, watering of municipal gardens, public fountains, frost protection, building water, etc. These may be billed or unbilled, metered or unmetered

REAL LOSSES: physical water losses from the pressurized system, up to the point of measurement of customer consumption. The annual volume lost through all types of leaks, breaks and overflows depends on frequencies, flow rates, and average duration of individual leaks, breaks and overflows

Note: Although physical losses after the point of customer flow measurement or assumed consumption are excluded from the assessment of REAL LOSSES, this does not necessarily mean that they are insignificant or unworthy of attention for demand management purposes

REVENUE WATER: those components of SYSTEM INPUT which are billed and produce revenue (also known as BILLED AUTHORIZED CONSUMPTION). Equal to BILLED WATER EXPORTED, BILLED METERED CONSUMPTION and BILLED UNMETERED CONSUMPTION

NON- REVENUE WATER: those components of SYSTEM INPUT which are not billed and do not produce revenue. Equal to UNBILLED AUTHORIZED CONSUMPTION, APPARENT LOSSES and REAL LOSSES

UNBILLED AUTHORIZED CONSUMPTION: those components of AUTHORIZED CONSUMPTION which are not billed and do not produce revenue. Equal to UNBILLED METERED CONSUMPTION and UNBILLED UNMETERED CONSUMPTION

City of Philadelphia - Water Efficiency Trend - Fiscal Years 2000-2013

| | Fiscal Year | | | | | | | | | | | | | |
|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 | 2000 |
| Water Supplied | | | | | | | | | | | | | | |
| Water Supplied from Rivers, mgd (minus treatment plant usage) | 259.8 | 257.9 | 271.7 | 266.9 | 268.0 | 273.6 | 278.7 | 276.9 | 283.0 | 286.0 | 294.3 | 286.5 | 294.3 | 308.7 |
| Water System Input Volume, mgd | 238.4 | 237.1 | 250 | 244.4 | 245.8 | 250.7 | 255.3 | 253.8 | 260.3 | 263.0 | 270.2 | 263.0 | 267.5 | 277.7 |
| Service Area Population | 1,758,507 | 1,747,371 | 1,736,906 | 1,736,906 | 1,660,900 | 1,660,534 | 1,642,634 | 1,656,212 | 1,653,301 | 1,622,740 | 1,629,400 | 1,640,771 | 1,653,262 | 1,671,550 |
| Per capita water supplied, gpcd | 147.7 | 147.6 | 156.4 | 153.7 | 161.4 | 164.8 | 169.7 | 167.2 | 171.2 | 176.2 | 180.6 | 174.6 | 178.0 | 184.7 |
| Authorized Consumption | | | | | | | | | | | | | | |
| Billed Consumption, mgd | 152.1 | 152.6 | 158.4 | 165.8 | 172.4 | 175.8 | 169.5 | 177.0 | 176.9 | 176.9 | 183.4 | 178.2 | 181.7 | 185.8 |
| Unbilled Unmetered (firefighting, etc.), mgd | 5.4 | 3.3 | 2.1 | 2.0 | 2.1 | 2.1 | 2.3 | 2.4 | 2.3 | 2.4 | 3.1 | 2.4 | 2.3 | 3.0 |
| Unbilled Unmetered water cost | \$1,398,440 | \$1,051,979 | \$866,917 | \$779,394 | \$713,802 | \$717,246 | \$214,310 | \$192,260 | \$155,165 | \$159,715 | \$180,376 | \$145,984 | \$134,517 | \$148,991 |
| Authorized Consumption, mgd | 157.4 | 155.9 | 160.5 | 167.8 | 174.5 | 177.9 | 171.8 | 179.4 | 179.2 | 179.3 | 186.4 | 180.6 | 184.0 | 188.8 |
| Per capita water billed, gpcd | 86.5 | 87.3 | 91.2 | 95.5 | 103.8 | 105.9 | 103.2 | 106.9 | 107.0 | 109.0 | 112.6 | 108.6 | 109.9 | 111.2 |
| Water Losses | | | | | | | | | | | | | | |
| Apparent Losses (billing data error, unauthorized consumption, customer metering inaccuracies), mgd | 20.5 | 21.4 | 23.1 | 17.0 | 15.0 | 19.0 | 21.8 | 15.1 | 14.1 | 11.1 | 13.3 | 13.1 | 14.5 | 18.6 |
| Apparent Loss unit retail cost/mg | \$7,313 | \$6,983 | \$6,503 | \$6,071 | \$5,429 | \$4,971 | \$4,799 | \$4,500 | \$4,132 | \$3,945 | \$3,671 | \$3,285 | \$3,103 | \$3,120 |
| Apparent Loss Cost | \$43,097,617 | \$43,076,304 | \$43,544,119 | \$30,034,457 | \$22,255,068 | \$27,328,369 | \$30,844,309 | \$20,276,611 | \$19,093,984 | \$10,937,852 | \$10,013,610 | \$9,036,037 | \$11,588,741 | \$13,750,895 |
| Real Losses (Leakage), mgd | 60.4 | 60.0 | 66.3 | 59.6 | 56.2 | 53.8 | 61.6 | 59.2 | 66.9 | 72.6 | 70.5 | 69.2 | 68.9 | 70.1 |
| Variable Production Cost, per mg | \$346.46 | \$345.86 | \$272.56 | \$235.00 | \$229.41 | \$215.50 | \$193.82 | \$160.48 | \$130.54 | \$133.58 | \$126.60 | \$121.70 | \$116.12 | \$110.25 |
| Real Loss (leakage) Cost | \$8,153,737 | \$8,099,949 | \$7,357,751 | \$5,867,776 | \$4,843,686 | \$4,960,676 | \$5,117,778 | \$4,228,646 | \$3,948,821 | \$4,074,864 | \$3,682,258 | \$3,369,029 | \$2,499,146 | \$2,965,128 |
| Non-revenue Water Volume, mgd = Unbilled, Unmetered Consumption + Apparent Loss + Real Loss | 86.3 | 84.6 | 91.6 | 78.6 | 73.4 | 74.9 | 85.7 | 76.7 | 83.3 | 86.1 | 86.9 | 84.7 | 85.7 | 91.8 |
| Non-revenue Water Cost Total | \$52,649,794 | \$51,390,813 | \$50,901,870 | \$36,681,627 | \$27,098,754 | \$33,006,291 | \$36,176,397 | \$24,697,517 | \$23,197,970 | \$15,172,431 | \$13,876,244 | \$12,551,050 | \$14,222,404 | \$16,865,014 |
| Key Performance Indicators | | | | | | | | | | | | | | |
| Apparent Losses per connection, gal/service connection/day | 38.9 | 39.8 | 44.4 | 30.8 | 25.8 | 35.2 | 39.6 | 27.4 | 25.5 | 22.8 | 24.2 | 23.9 | 26.3 | 33.9 |
| Real Losses (leakage) per connection, gal/service connection/day | 114.6 | 111.9 | 126.2 | 107.7 | 96.6 | 96.7 | 112 | 107.3 | 121.2 | 132.5 | 154.6 | 149.8 | 125.1 | 127.7 |
| Infrastructure Leakage Index (ILI) | 8.8 | 10.2 | 11.5 | 9.9 | 8.9 | 9.0 | 10.3 | 8.9 | 11.0 | 12.1 | 11.9 | 13.1 | 12.7 | 12.3 |
| Non-revenue Water by Volume, % | 38.5% | 38.4% | 39.7% | 34.9% | 32.3% | 32.4% | 36.3% | 32.2% | 34.6% | 35.4% | 32.1% | 32.2% | 32.1% | 33.1% |
| Non-revenue Water by Cost, % | 21.1% | 22.2% | 23.2% | 16.3% | 12.5% | 15.2% | 17.5% | 13.0% | 12.4% | 9.05% | 8.28% | 8.09% | 9.18% | 11.50% |

Annual Water System Input volume peaked at 370 mgd in 1955
Historic annual Non-revenue Water Volumes exceeded 100 mgd until being reduced
below this level starting in FY1996

PHILADELPHIA WATER DEPARTMENT - WATER REVENUE BUREAU
WATER SUPPLY AND LOSS COST QUANTIFICATION

FISCAL YEAR 2013 FINANCIAL DATA APPLIED TO FISCAL YEAR 2013 WATER QUANTITIES (except as noted)

I. REAL LOSSES (EXCESS PRODUCTION COST)

Totals are derived from the marginal cost of the excess water incurred due to real losses

A. Electrical Costs

| | | |
|---|------------------|--|
| Total Annual Power Consumption for Water Supply Operations (excluding BLS and 29th Street) | 131,541,400 kwh | FY2013 data |
| Total Water Produced (MG) | 87,016 MG | FY2013 data |
| Average Kwh per MG | 1,511.7 /MG | |
| Cost per Kwh: (generation, transmission & distribution costs) | \$ 0.06900 | |
| Avg. Electric Cost / MG | \$ 104.31 | Average Electrical Cost Per MG = \$0.06900 x 1,511.7 kwh |

B. Chemical Costs

| | | |
|---------------------------|------------------|-------------|
| Baxter Treatment Plant | \$ 9,597,497 | |
| Queen Lane Treat. Plant | \$ 5,173,322 | |
| Belmont Treatment Plant | \$ 3,476,145 | |
| Total Costs | \$ 18,246,964 | FY2013 data |
| Chemical Costs/ MG | \$ 209.70 | |

C. Treatment Costs of Water Treatment Plant Sludge

In November 2008 sludge processing and disposal was privatized and taken over by the Philadelphia Municipal Authority (PMA)/Synagro. The costs for this service were generally fixed for approximately the first 3 to 4 years of the contract. After the new facility was completed, the contract entered the next phase in February 2012 (i.e. the Class A phase), a variable operating charge went into effect that is based on a "per ton" rate based upon the amount of sludge that is delivered to the processing facility. Until February 2012, the charges were a flat annual amount as long as PWD's sludge deliveries did not fall below 57,000 dry tons or exceed 63,000 dry tons. The variable operating charge for FY2012 was \$87.50 per dry ton of dewatered sludge that was processed into product.

Ratio of Water Treatment Plant to Wastewater Plant Sludge Production (FY2012 figures)

| | Water Treatment Plant Sludge # | Total Wastewater Plant Sludge Production # | Ratio |
|----------------------|-----------------------------------|---|--------|
| Baxter | 7,133 | 29,568 (NEWPC) | |
| Queen Lane & Belmont | 6,860 | 29,342 (SWWPC) | |
| | 13,993 | 58,910 | 23.75% |

Sludge production calculated in dry tons; figures taken from the Residuals Management Report

Sludge Cake Production at Biosolids Recycling Center attributable to Wastewater Plants *

| | | |
|---|--------|--------------------------------------|
| Northeast Water Pollution Control Plant | 24,671 | *Source: Residuals Management Report |
| Southwest Water Pollution Control Plant | 28,357 | |
| Total | 53,028 | |

Allocation of Water Treatment Plants' Share of Sludge Cake (dry tons)

Water Plant's % of sludge production applied to Sludge Cake Total
 23.75% * 53,028 = 12,594 tons attributable to water treatment

Dry Ton Sludge Cake Produced Per Million Gallons

Water Treatment Plant Sludge Cake/ Total Water Produced
 12,594 / 87,016 = 0.14473 dry tons per MG

Costs Per Dry Ton of Sludge Processing

| | | |
|-------------------------|--------------|------------------------------------|
| Annual Production Costs | | |
| Wood chips | \$ - | (composting has been discontinued) |
| Polymer | 1,373,309 | |
| Total | \$ 1,373,309 | |

Annual Dry Ton Production - 53,028

Electrical Cost Calculation

| | | | |
|---|-----------------------|-------------------|-------------------|
| Annual electrical consumption | at BRC/ Synagro - | 15,339,365 Kwh | |
| Avg. Kwh/ dry ton of sludge = | 15,339,365 / 53,028 = | 289.27 Kwh | |
| Elec. Cost/ Ton = 289.27 kwh @ \$0.06900/ kwh = | | \$ | 19.96 / dry ton |
| Variable Operating Charge - | | \$ | 87.91 per dry ton |
| Electrical Costs - | | | 19.96 " |
| | Total | \$ | 107.87 |
| Number of dry tons per MG x cost per dry ton - | | 0.1447 * \$107.87 | \$ 15.61 |

Cost of Sludge Processing per Million Gallons \$ 15.61

D. Wastewater Treatment Plant Costs of Water Treatment Plant Direct Discharges into the Sewer System

It is assumed that 25% of real (leakage) losses reach the Collector System and require wastewater treatment

Wastewater Treatment Marginal Costs

| | | |
|---|-----------------|-------------|
| Total Annual Approx. Wastewater System Electrical Consumption - | 123,089,342 kwh | FY2013 data |
| Total Annual Wastewater Treated - | 143,963 MG | FY2013 data |
| Average kwh / million gallons - | 855.01 kwh / MG | FY2013 data |
| Average electrical cost per MG - 855.01 * \$0.069 | \$ 59.00 MG | FY2013 data |
| <i>Average Chemical Cost Per Million Gallons of Treated Wastewater-</i> | | |
| Annual Chemical Costs * - | \$ 1,206,479 | FY2013 data |
| Total Annual Wastewater Treated - | 143,963 MG | |
| Average chemical cost per MG - \$1,206,479 / 143,963 MG | \$ 8.38 /MG | |

Total Electrical and Chemical Costs per MG = \$59.00 + \$8.38 = \$ 67.38

E. Total of all Marginal Production Costs for Real Losses

| Costs Per Million Gallons Of Water Produced | | Change from FY2012 |
|---|-----------|--------------------|
| Electrical | \$ 104.31 | -7.1% |
| Chemical | \$ 209.70 | 4.1% |
| Water Treatment Plant Sludge Processing | \$ 15.61 | 7.8% |
| Total | \$ 329.62 | 0.4% |
| Wastewater Treatment | \$ 67.38 | -4.6% |

Total Production Cost = \$329.62 + (0.25 * \$67.38) = \$346.46 0.2%

Total Marginal Cost per MG of Delivery Loss- \$ 346.46

INDEMNITIES- WATER MAIN RELATED - Fiscal Year 2013 Data (Add to total Real Loss cost total in Water Audit)

| | |
|-------------------------------|------------------|
| Water Customer Service Claims | |
| Payments (estimated) | \$ 170,954 |
| Risk Management Payments | \$ 345,000 |
| (includes lawsuits) | Total \$ 515,954 |

II. APPARENT LOSSES (LOST REVENUE)

Totals are derived from the various retail rates charged to consumers. Note: The City of Philadelphia employs a declining block water rate structure.

Small Meter Customers (5/8" and 3/4" meter size)

Mcf = 1,000 cubic feet
MG = million gallons

Usage Charge = water charge + sewer charge
Usage Charge - \$34.24 + \$23.24 = \$57.68/ Mcf

133,690 cf = 1,000,000 gallons;

| | |
|--------------------|---------------|
| 133.69 Mcf * 57.68 | \$ 7,711 / MG |
|--------------------|---------------|

1" and Larger (water usage) Rate-

Usage Charge - $\$27.80 + \$23.44 = \$51.24/\text{Mcf}$

| | |
|------------------------|---------------|
| 133.69 Mcf * \$51.24 = | \$ 6,850 / MG |
|------------------------|---------------|

Lower cost because high volume users consume water at high levels of the 2nd and 3rd block, which are lower rates

City-owned building Accounts -

Usage Charge - $\$26.53 + \$23.44 = \$49.97/\text{Mcf}$

| | | |
|----------------------|----|------------|
| 133.69 Mcf * \$49.97 | \$ | 6,680 / MG |
|----------------------|----|------------|

Lower cost due to very high consumption in a number of City-owned properties

Overall Average Customer Rates -

Usage Charge - $\$31.26 + \$23.44 = \$54.70 / \text{Mcf}$

| | |
|------------------------|---------------|
| 133.69 Mcf * \$54.70 = | \$ 7,313 / MG |
|------------------------|---------------|

Arrived by looking at all customers collectively; and determining the number of accounts consuming high volumes of water, into the 2nd and 3rd billing blocks or tiers

Note: these unit costs are an increase of approximately 4.7% compared to FY2012 costs

CITY OF PHILADELPHIA - LONG-TERM WATER ACCOUNTABILITY STATISTICS

| | Source Water Withdrawal | | | Water Supplied, Wholesale Exports & City | Wholesale Export Sales to Other Water Suppliers | | | | | | | | Water Supplied, City only | Billed Authorized Consumption - City of Philadelphia | | | | | | | | Non-revenue Water | | Water Resources Utilization | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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* Transition year from Quarterly to Monthly Billing method, 1993

**The term "control days" refer to meter reading routes. This term was used in the WATER1 Customer Billing System until January 1, 2008, when this system was replaced with the Basis2 Billing System.

*** Non-revenue Water is the difference between water supplied and Billed Authorized Consumption. The percentage indicator Non-revenue Water by Volume is a basic financial performance indicator only, and not a reliable technical performance indicator. See Water Audit Summary for calculation of all IWA/AWWA Method performance indicators.

*Transition to Basis2 Customer Billing System, January 2, 2008 City Property consumption and Sewer Only consumption are included in large meter consumption total. The number of accounts is estimated.

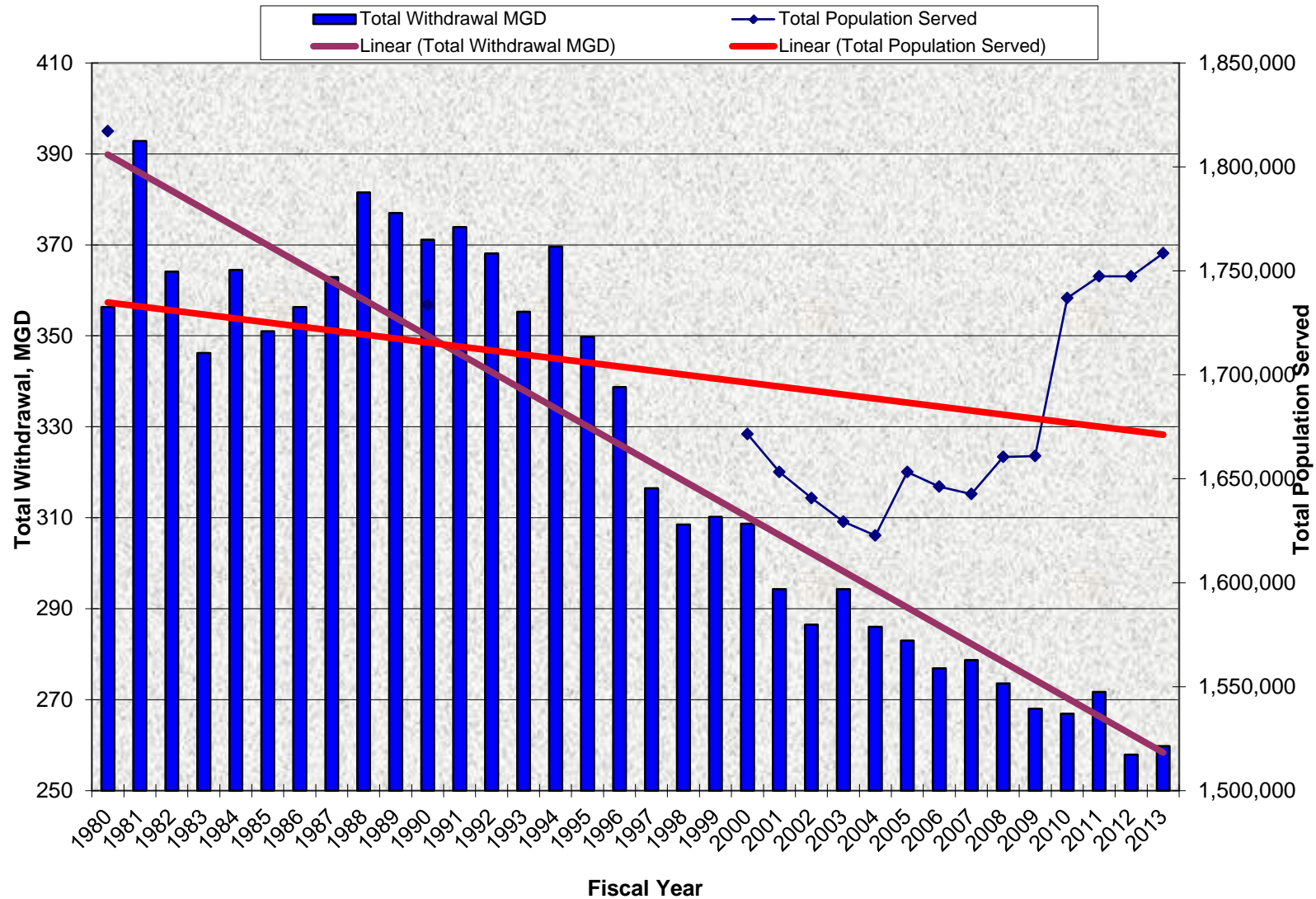
Fiscal Years 2008 and 2009 include an adjustment reduction of 6 mgd and 15 mgd, respectively, due to perceived over-stating of the billed consumption volume in the new Basis2 Customer Billing System

Fiscal Year 2010 includes an adjustment increase of 12.26 mgd due to perceived under-stating of the billed consumption volume in the Basis2 Customer Billing System. Better validated billing data became available in FY2011.

The proportion of large meter vs. small meter consumption for fiscal years 1997-2005 is skewed, erroneously showing large meters reducing as a percentage of the total consumption. This occurred since large meter accounts, once outfitted with AMR, were moved into small meter control day (meter reading) routes. Resuming in FY2006 a realistic breakdown of large meter billed consumption vs. small meter billed consumption is given.

Population Data for 1980, 1990, 2000 and 2010 are actual US Census Bureau data; 2005 is the US Census Bureau mid-term projection, others are US Census Bureau annual population estimates
Population for 2008-2011 for BCWSA & Aqua America taken from PWD Bond Statements. Philadelphia's census year population peaked at 2,071,000 in 1950. The annual volume of water supplied peaked at 370.1 MGD in 1955.

Philadelphia Water Department **Water Withdrawals from the Delaware and Schuylkill Rivers vs. Population** (population increase in 2003/2004 due to new suburban supply interconnections)



| MASTER METER VERIFICATION - FISCAL YEAR 2013 | | | | | | | | | |
|--|---------------|--------------|--|-----------|--------------|-------------|--|--------------------------|-----------------|
| METER NAME | SCADA ACRONYM | METER TYPE | METER CLASSIFICATION | PIPE SIZE | RANGE in MGD | 2% of RANGE | FY2013 VERIFICATION | | |
| | | | | | | | DATE | RESULT | FREQUENCY |
| 3rd & Spring Garden Rate | 3SG-RATE | Transit time | Distribution System | 30" | 45 | 0.9 | 9/27/2012 | -5% | once/year |
| Baxter W.T. Plant Effluent Rate | BAX-FW-R | Venturi | Treatment | 120" | 400 | 6 | | | not done |
| Belmont W.T. Plant North Pretreat Rate | BF-PRET-N | Venturi | Treatment | 48" | 60 | 0.8 | | | not done |
| Belmont W.T. Plant South Pretreat Rate | BF-PRET-S | Venturi | Treatment | 48" | 80 | 1.1 | | | not done |
| Belmont WT Plant East Gravity Rate | BFE-GR | Venturi | Distribution System | 48" | 60 | 1.2 | 5/14/2013 | -2% | once/year |
| Belmont WT Plant West Gravity Rate | BFW-GR | Venturi | Distribution System | 48" | 60 | 1.2 | 5/14/2013 | -2% | once/year |
| Belmont High Service (new) East Pump Rate | BHSD-BAE-R | Magnetic | Distribution | 24" | 24 | 0.5 | 9/13/2012 | -2% | once/year |
| Belmont High Service (new) West Pump Rate | BHSD-BAW-R | Magnetic | Distribution | 24" | 24 | 0.48 | 9/13/2012 | -1% | once/year |
| Belmont High Service (new) Monument Pump Rate | BHSD-MR-R | Magnetic | Distribution | 20" | 12 | 0.2 | 9/24/2012 | -53% | once/year |
| Belmont Raw Water PS North Pump Rate | BRW-NVP-R | Venturi | Raw Water | 48" | 75 | 1.6 | 4/4/2013 | 1% | once/year |
| Belmont Raw Water PS South Pump Rate | BRW-SVP-R | Venturi | Raw Water | 48" | 75 | 1.6 | 2/11/2013 | -4% | once/year |
| Bucks County Water & Sewer Authority Export Supply Meter | BUCK-SR | Magnetic | Large Customer | 48" | 30 | 0.6 | 9/11/2012 3/17/2013 | -2% -1% | twice/year |
| Aqua PA, Cheltenham Interconnection Export Supply Meter | CHE-PSW-R | Magnetic | Large Customer | 12" | 5 | 0.1 | 9/6/2012 12/4/2012 3/13/2013 6/5/2013 | -4% -1% -4% -6% | four times/year |
| Aqua PA, Tinicum Interconnection Export Supply Meter | TIN-PSW-R | Magnetic | Large Customer | 16" | 28 | 0.3 | 9/6/2012 12/6/2012 3/11/2013 6/4/2013 | -2% 3% 1% 3% | four times/year |
| Chestnut Hill Booster PS Pump Rate | CH-VP-R | Venturi | Distribution System | 12" | 5 | 0.1 | 5/31/2013 | 12% | once/year |
| Chew & Walnut: DMA5 Inflow | CAW-DMA-R | Magnetic | Distribution System/DMA | 8" | 5 | 0.1 | 9/26/2012 | 0% | once/year |
| East Park Reservoir #12 Valve Rate Out | CV12-R | Venturi | Distribution System | 48" | 50 | 1.0 | 9/17/2012 | -3% | once/year |
| East Oak Lane PS Pump Rate A (NW) | EOL-NVP-R | Venturi | Distribution System | 24" | 15 | 0.3 | 10/9/2012 | -4% | once/year |
| East Oak Lane PS Pump Rate B (SE) | EOL-SEVP-R | Venturi | Distribution System | 24" | 15 | 0.3 | 10/4/2012 | 0% | once/year |
| East Oak Lane PS Pump Rate C (SW) | EOL-SWVP-R | Venturi | Distribution System | 36" | 30 | 0.6 | 10/4/2012 | -4% | once/year |
| East Park Reservoir North Rate In | EPR-NIV-RIN | Magnetic | Distribution System | 48" | 45 | 0.9 | 2/1/2013 | 1% | once/year |
| East Park Reservoir South Rate In | EPR-SIV-RIN | Magnetic | Distribution System | 48" | 45 | 0.9 | 2/1/2013 | -5% | once/year |
| East Park Booster PS East Pump Rate | EPB-EVP-R | Venturi | Distribution System | 48" | 75 | 1.5 | | | not done |
| East Park Booster PS West Pump Rate | EPB-WVP-R | Venturi | Distribution System | 48" | 75 | 1.5 | 12/6/2012 | -3% | once/year |
| East Park Reservoir #11 Valve Rate Out | EPR-ROUT | Venturi | Distribution System | 54" | 50 | 1.2 | 9/17/2012 | 2% | once/year |
| Fox Chase Booster PS West Pump Rate (N) | FC-NVP-R | Venturi | Distribution System | 20" | 10 | 0.2 | 2/25/2013 | 10% | once/year |
| Fox Chase Booster PS East Pump Rate (S) | FC-SVP-R | Venturi | Distribution System | 20" | 15 | 0.3 | 2/25/2013 | 0% | once/year |
| Fox Chase Tank Rate In | FC-TK-RIN | Gentile | Distribution System | 20" | 5 | 0.1 | 9/24/2012 | -1% | once/year |
| Fox Chase Tank Rate Out | FC-TK-ROUT | Gentile | Distribution System | 20" | 5 | 0.1 | 9/24/2012 | 11% | once/year |
| Lardners Point PS Header 48 inch Rate | LPPS-48P-R | Venturi | Distribution System | 48" | 50 | 1 | | | not done |
| Lardners Point PS Header 60 inch Rate | LPPS-60P-R | Venturi | Distribution System | 60" | 100 | 2.0 | 1/15/2013 | 0% | once/year |
| Lardners Point PS Header A Rate | LPPS-AP-R | Venturi | Distribution System | 48" | 50 | 1.0 | 4/19/2013 | -16% | once/year |
| Lardners Point PS Header B Rate | LPPS-BP-R | Venturi | Distribution System | 48" | 50 | 1.0 | 4/18/2013 | -2% | once/year |
| Lardners Point PS Header C Rate | LPPS-CP-R | Venturi | Distribution System | 48" | 50 | 1.0 | 4/25/2013 | 0% | once/year |
| Lardners Point PS Header D Rate | LPPS-DP-R | Orifice | Distribution System | 48" | 50 | 1.0 | 4/12/2013 | -2% | once/year |
| Lardners Point PS Header 104V Rate | LP-104V-R | Magnetic | Distribution System | 20" | 30 | 0.6 | 5/10/2013 | 4% | once/year |
| | | | Meter: Endress & Hauser, Model 50W5H-PLHAIRK5BAAA - installed 2011 | | | | | | |
| Oak Lane Reservoir North Basin Effluent Rate | OLNB-ROUT | Venturi | Distribution System | 48" | 45 | 0.9 | 5/29/2013 | 2% | once/year |
| Oak Lane Reservoir South Basin Influent Rate | OLSB-RIN | Venturi | Distribution System | 48" | 45 | 0.9 | 5/2/2013 | -4% | once/year |
| Philadelphia Naval Business Center Rate | PNBC-GATE-RIN | Magnetic | Large Customer | 12" | 5 | 0.1 | 9/10/2012 3/19/2013 | -5% -16% | twice/year |
| Queen Lane W.T. Plant Pretreatment Rate # 1 | QL-PRET-R1 | Venturi | Treatment | 48" | 60 | 1.2 | | | not done |
| Queen Lane W.T. Plant Pretreatment Rate # 2 | QL-PRET-R2 | Venturi | Treatment | 48" | 60 | 1.2 | | | not done |
| Queen Lane W.T. Plant Pretreatment Rate # 3 | QL-PRET-R3 | Venturi | Treatment | 48" | 60 | 1.2 | | | not done |
| Queen Lane W.T. Plant Pretreatment Rate # 4 | QL-PRET-R4 | Venturi | Treatment | 48" | 60 | 1.2 | | | not done |
| Queen Lane Gravity Rate # 1 | QLF1-G-R | Magnetic | Distribution System | 48" | 60 | 1.2 | 5/3/2013 | -13% | once/year |
| Queen Lane Gravity Rate # 2 | QLF2-G-R | Magnetic | Distribution System | 48" | 60 | 1.2 | 5/3/2013 | -13% | once/year |
| Queen Lane Gravity Rate # 3 | QLF3-G-R | Pitot Rod | Distribution System | 48" | 60 | 1.2 | 5/17/2013 | -17% | once/year |
| Queen Lane Gravity Rate # 4 | QLF4-G-R | Magnetic | Distribution System | 48" | 60 | 1.2 | 5/22/2013 | -8% | once/year |
| Queen Lane High Service Pump Rate | QLH-P-R | Venturi | Distribution System | 36" | 40 | 0.8 | 9/19/2012 | -2% | once/year |
| Queen Lane Raw Water PS North Pump Rate | QLRW-NMP-R | Magnetic | Raw Water | 60" | 160 | 3.2 | 5/16/2013 | 1% | once/year |
| Queen Lane Raw Water PS South Pump Rate | QLRW-SMP-R | Magnetic | Raw Water | 60" | 160 | 3.2 | 5/16/2013 | 7% | once/year |
| Queen Lane Raw Water PS West Pump Rate | QLRW-VP-R | Venturi | Raw Water | 48" | 40 | 0.8 | O.O.S. | | once/year |
| Roxborough Express Pump Rate | QLRX-P-R | Venturi | Distribution System | 36" | 40 | 0.8 | 9/19/2012 | 2% | once/year |
| Roxborough High Service PS Pump Rate "B" (N) | RHS-NVP-R | Venturi | Distribution System | 24" | 20 | 0.4 | 3/21/2013 | -7% | once/year |
| Roxborough High Service PS Pump Rate "A" (S) | RHS-SVP-R | Venturi | Distribution System | 24" | 20 | 0.4 | 3/20/2013 | 5% | once/year |
| Somerton Standpipes Rate In | SM-SP-RIN | Gentile | Distribution System | 30" | 15 | 0.3 | 12/13/2012 | 8% | once/year |
| Somerton Standpipes Rate Out | SM-SP-ROUT | Gentile | Distribution System | 30" | 15 | 0.3 | 12/13/2012 | 3% | once/year |

| | | | | | | | | | |
|--|------------|----------|---------------------|-----|-----|-----|------------|-----------|-----------|
| Torresdale High Duty PS Pump Rate E (#3A)(Penny) | THS-EVP-R | Venturi | Distribution System | 24" | 10 | 0.2 | 11/19/2012 | 1% | once/year |
| Torresdale High Duty PS Pump Rate 36" (#13) | THS-V13P-R | Venturi | Distribution System | 36" | 30 | 0.6 | 10/1/2012 | -2% | once/year |
| Torresdale High Duty PS Pump Rate W (#3B)(Grant) | THS-WVP-R | Venturi | Distribution System | 24" | 10 | 0.2 | 11/19/2012 | 6% | once/year |
| PSW Tinicum Interconnection | TIN-PSW-R | Magnetic | Customer | 16" | 28 | 15 | 0.3 | 9/6/2012 | -2% |
| | | | | | | | | 12/6/2012 | 3% |
| | | | | | | | | 3/11/2013 | 1% |
| | | | | | | | | 6/4/2013 | 3% |
| Torresdale Low Duty PS Pump Rate (Venturi # 1) | TLD-V1P-R | Venturi | Distribution System | 60" | 80 | 1.6 | | | not done |
| Torresdale Low Duty PS Pump Rate (Venturi # 5) | TLD-V5P-R | Venturi | Distribution System | 42" | 60 | 1.2 | | | not done |
| Torresdale Low Duty PS Pump Rate (Venturi #6) | TLD-V6P-R | Venturi | Distribution System | 60" | 80 | 1.6 | 11/20/2012 | 3% | once/year |
| Torresdale Raw Water PS North East Pump Rate | TRW-EVP-R | Venturi | Raw Water | 96" | 210 | 4.2 | | | not done |
| Torresdale Raw Water PS South West Pump Rate | TRW-WVP-R | Venturi | Raw Water | 96" | 210 | 4.2 | | | not done |
| Roxborough Standpipes Rate In | UR-SP-RIN | Gentile | Distribution System | 36" | 15 | 0.3 | 12/17/2012 | -16% | once/year |
| Roxborough Standpipes Rate Out | UR-SP-ROUT | Gentile | Distribution System | 36" | 20 | 0.4 | 12/17/2012 | -13% | once/year |
| West Oak Lane PS Pump Rate | WOL-P-R | Venturi | Distribution System | 30" | 30 | 0.6 | 5/6/2013 | 1% | not done |
| Cells shown in dotted shading identify flowmeters that cannot be physically verified via pitot rod instrumentation | | | | | | | | | |

| Philadelphia Water Department | | | | | | |
|---|----------------|---|---|---|--|------------|
| Composite Water System Input Adjustments - Fiscal Year 2013 | | | | | | |
| Month | Number of days | Original SCADA System data: unedited daily average water system input based on SCADA A history | Monthly total system input volume based on original (unedited) total delivery - MG | Average daily system input volume based on edited SCADA B history report- MGD* | Monthly total system input volume based on edited SCADA B history report- MG | Difference |
| July'12 | 31 | 266.9 | 8273.9 | 263.7 | 8174.7 | -3.2 |
| Aug'12 | 31 | 243.8 | 7557.8 | 247.6 | 7675.6 | 3.8 |
| Sep'12 | 30 | 239.9 | 7197.0 | 238.5 | 7155.0 | -1.4 |
| Oct'12 | 31 | 231.9 | 7188.9 | 233.5 | 7238.5 | 1.6 |
| Nov'12 | 30 | 231.9 | 6957.0 | 233.1 | 6993.0 | 1.2 |
| Dec'12 | 31 | 233.3 | 7232.3 | 233.0 | 7223.0 | -0.3 |
| Jan'13 | 31 | 246.0 | 7626.0 | 239.4 | 7421.4 | -6.6 |
| Feb'13 | 28 | 252.6 | 7072.8 | 241.8 | 6770.4 | -10.8 |
| Mar'13 | 31 | 242.4 | 7514.4 | 235.3 | 7294.3 | -7.1 |
| Apr'13 | 30 | 232.3 | 6969.0 | 229.7 | 6891.0 | -2.6 |
| May'13 | 31 | 230.4 | 7142.4 | 229.2 | 7105.2 | -1.2 |
| Jun'13 | 30 | 241.1 | 7233.0 | 235.2 | 7056.0 | -5.9 |
| Sum | 365 | | 87964.5 | | 86998.1 | 966.4 |
| Average | | | 241.0 | | 238.4 | -2.6 |

*Adjustments are based upon several factors including regular master meter verification testing, mass balance comparisons of flows into and out of water treatment plants, operational histories at facilities and instrumentation outage/maintenance histories.

City of Philadelphia Water Billing Account Codes

| Customer Type Code | | Size Code, inches | |
|--------------------|---|-------------------|-------|
| 4 | Regular | R | 5/8 |
| A | Philadelphia Housing Authority (PHA) | Z | 3/4 |
| C | Charity/Non-public school | Q | 1 |
| D | Senior Citizen | Y | 1-1/4 |
| E | Board of Education (Public Schools) | P | 1-1/2 |
| G | Federal Government | X | 2 |
| H | Hand Bill (special handling) | O | 3 |
| L | City Leased | W | 4 |
| N | Hospital/University | N | 6 |
| P | State Government | V | 8 |
| S | Scheduled | E | 10 |
| W | Well service | T | 12 |
| Y | Fire Service | H | 14 |
| Z | City Government | | |
| 1 | Water, Sewer and Stormwater | | |
| 2 | Water Only | | |
| 3 | Stormwater Only | | |
| 4 | Sewer and Stormwater | | |
| 5 | Water and Stormwater, and bills to accounts outside City limits | | |
| 6 | Sewer Only | | |
| 7 | Water and Sewer | | |
| Installation Code | | | |
| 09 | Condominium/Fraternity | | |
| 10 | Single Family - Tenant Occupied | | |
| 11 | Single Family - Owner Occupied | | |
| 12 | Multi-family less than 4 units | | |
| 13 | Commercial and Residential | | |
| 14 | Hotels, Motels, Boarding Houses | | |
| 15 | Office Buildings | | |
| 16 | Commercial, General Property | | |
| 17 | Gas Stations | | |
| 18 | Laundries | | |
| 20 | Industry/Industries | | |
| 21 | Churches, Charity Rate Accounts | | |
| 22 | Two or more Tenant Occupied Apartments | | |
| 23 | Hospital, Nursing Home Boarding | | |
| 24 | Vacant Lots, Torn Down | | |
| 25 | Schools without Charity Rate | | |
| 26 | Commercial/Residential, 4 or more units | | |
| 27 | Commercial and Residential, tenanted | | |
| Account Code | Account Description | Type | |
| 41N | Regular Water and Sewer 6 inch meter | Commercial | |
| 41O | Regular Water and Sewer 3 inch meter | Residential | |
| 41P | Regular Water and Sewer 1-1/2 inch meter | Residential | |
| 41Q | Regular Water and Sewer 1 inch meter | Residential | |
| 41R | Regular Water and Sewer 5/8 inch meter | Residential | |
| 41V | Regular Water and Sewer 8 inch meter | Commercial | |
| 41W | Regular Water and Sewer 4 inch meter | Commercial | |
| 41X | Regular Water and Sewer 2 inch meter | Residential | |
| 41Z | Regular Water and Sewer 3/4 inch meter | Residential | |

City of Philadelphia Water Billing Account Codes

| | | | |
|-----|---|-------------|--|
| 42O | Regular Water Only 3 inch meter | Residential | |
| 42P | Regular Water Only 1-1/2 inch meter | Residential | |
| 42Q | Regular Water Only 1 inch meter | Residential | |
| 42R | Regular Water Only 5/8 inch meter | Residential | |
| 42X | Regular Water Only 2 inch meter | Residential | |
| 42Z | Regular Water Only 3/4 inch meter | Residential | |
| 45Q | Regular Water Only Bill Outside of City 1 inch meter | Residential | |
| 45R | Regular Water Only Bill Outside of City 5/8 inch meter | Residential | |
| 45Z | Regular Water Only Bill Outside of City 3/4 inch meter | Residential | |
| A1Q | Philadelphia Housing Authority Water and Sewer 1 inch meter | Residential | |
| A1R | Philadelphia Housing Authority Water and Sewer 5/8 inch meter | Residential | |
| A1W | Philadelphia Housing Authority Water and Sewer 4 inch meter | Residential | |
| A1X | Philadelphia Housing Authority Water and Sewer 2 inch meter | Residential | |
| C1N | Charity Water and Sewer 6 inch meter | Commercial | |
| C1O | Charity Water and Sewer 3 inch meter | Commercial | |
| C1P | Charity Water and Sewer 1-1/2 inch meter | Commercial | |
| C1Q | Charity Water and Sewer 1 inch meter | Commercial | |
| C1R | Charity Water and Sewer 5/8 inch meter | Commercial | |
| C1W | Charity Water and Sewer 4 inch meter | Commercial | |
| C1X | Charity Water and Sewer 2 inch meter | Commercial | |
| C1Z | Charity Water and Sewer 3/4 inch meter | Commercial | |
| C2O | Charity Water Only 3 inch meter | Commercial | |
| C2Q | Charity Water Only 1 inch meter | Commercial | |
| C2R | Charity Water Only 5/8 inch meter | Commercial | |
| C2X | Charity Water Only 2 inch meter | Commercial | |
| D1Q | Senior Citizen Water and Sewer 1 inch meter | Residential | |
| D1R | Senior Citizen Water and Sewer 5/8 inch meter | Residential | |
| D1Z | Senior Citizen Water and Sewer 3/4 inch meter | Residential | |
| D2Q | Senior Citizen Water Only 1 inch meter | Residential | |
| D2R | Senior Citizen Water Only 5/8 inch meter | Residential | |
| E1N | Board of Education Water and Sewer 6 inch meter | Commercial | |
| E1O | Board of Education Water and Sewer 3 inch meter | Commercial | |
| E1W | Board of Education Water and Sewer 4 inch meter | Commercial | |
| E1X | Board of Education Water and Sewer 2 inch meter | Commercial | |
| H1O | Special Handling Water and Sewer 3 inch meter | Commercial | |
| H1X | Special Handling Water and Sewer 2 inch meter | Commercial | |
| H2B | Special Handling Water Only - Bucks Co. Water/Sewer Authority | Commercial | |
| N1N | Hospitals and Universities Water and Sewer 6 inch meter | Commercial | |
| N1W | Hospitals and Universities Water and Sewer 4 inch meter | Commercial | |
| N2R | Hospitals and Universities Water Only 5/8 inch meter | Commercial | |
| Y1N | Fire Meter Water and Sewer 6 inch meter | Commercial | |
| Y1V | Fire Meter Water and Sewer 8 inch meter | Commercial | |
| Y2N | Fire Meter Water Only 6 inch meter | Commercial | |
| Y2V | Fire Meter Water Only 8 inch meter | Commercial | |
| Y2W | Fire Meter Water Only 4 inch meter | Commercial | |
| Y2X | Fire Meter Water Only 2 inch meter | Commercial | |
| Z1O | City of Philadelphia Water and Sewer 3 inch meter | Commercial | |
| Z1P | City of Philadelphia Water and Sewer 1-1/2 inch meter | Commercial | |
| Z1Q | City of Philadelphia Water and Sewer 1 inch meter | Commercial | |
| Z1R | City of Philadelphia Water and Sewer 5/8 inch meter | Commercial | |
| Z1W | City of Philadelphia Water and Sewer 4 inch meter | Commercial | |
| Z1X | City of Philadelphia Water and Sewer 2 inch meter | Commercial | |
| Z2R | City of Philadelphia Water Only 5/8 inch meter | Commercial | |

CITY OF PHILADELPHIA - BILLED WATER CONSUMPTION FOR FISCAL YEAR 2013
July 1, 2012 - June 30, 2013 (ccf = 100 cubic feet)

| Meter Size, inches | Number | 5/8 CCF | Billings | Number | 3/4 CCF | Billings | Number | 1 CCF | Billings | Number | 1 1/4 CCF | Billings | Number | 1 1/2 CCF | Billings | Number | 2 CCF | Billings |
|-----------------------|-----------|------------|---------------|--------|------------|---------------|--------|------------|---------------|--------|--------------|---------------|--------|--------------|---------------|--------|------------|---------------|
| Jul-12 | 460,290 | 3,141,242 | 12,959,869 | 26 | 800 | 2,519 | 5,304 | 166,554 | 522,601 | 1 | 119 | 339 | 2,011 | 148,392 | 411,989 | 2,581 | 377,162 | 990,442 |
| Aug-12 | 460,780 | 3,111,304 | 12,867,360 | 24 | 466 | 1,530 | 5,308 | 169,406 | 532,136 | 1 | 141 | 397 | 2,012 | 145,510 | 407,370 | 2,589 | 404,557 | 1,045,643 |
| Sep-12 | 460,370 | 3,227,510 | 13,013,564 | 26 | 511 | 1,682 | 5,340 | 180,262 | 557,986 | 1 | 124 | 352 | 2,015 | 152,472 | 420,990 | 2,594 | 470,964 | 1,138,533 |
| Oct-12 | 459,892 | 3,197,479 | 13,356,285 | 23 | 390 | 1,362 | 5,362 | 187,811 | 588,207 | 1 | 124 | 352 | 2,024 | 157,324 | 442,196 | 2,596 | 367,878 | 968,511 |
| Nov-12 | 458,671 | 3,147,860 | 12,977,734 | 22 | 270 | 954 | 5,376 | 163,589 | 515,670 | 1 | - | - | 2,034 | 147,892 | 414,296 | 2,596 | 361,825 | 940,681 |
| Dec-12 | 460,542 | 2,627,142 | 11,197,974 | 22 | 273 | 977 | 5,396 | 121,139 | 391,494 | 1 | 179 | 494 | 2,039 | 97,100 | 277,452 | 2,598 | 257,256 | 652,640 |
| Jan-13 | 462,357 | 3,171,203 | 13,429,227 | 23 | 934 | 2,913 | 5,430 | 215,034 | 689,497 | 1 | 532 | 1,531 | 2,041 | 201,767 | 578,847 | 2,609 | 483,784 | 1,324,664 |
| Feb-13 | 463,553 | 2,824,935 | 12,432,203 | 25 | 418 | 1,487 | 5,447 | 148,518 | 504,101 | 1 | 132 | 402 | 2,047 | 131,025 | 395,023 | 2,621 | 337,357 | 934,404 |
| Mar-13 | 464,032 | 2,899,777 | 12,842,169 | 27 | 418 | 1,618 | 5,522 | 147,801 | 507,135 | 1 | 153 | 456 | 2,065 | 141,969 | 423,602 | 2,634 | 346,522 | 952,414 |
| Apr-13 | 461,820 | 2,864,546 | 12,918,076 | 31 | 599 | 2,669 | 5,582 | 161,719 | 555,967 | 1 | 247 | 754 | 2,080 | 137,682 | 418,200 | 2,659 | 340,041 | 938,478 |
| May-13 | 458,158 | 2,758,735 | 12,407,581 | 31 | 520 | 1,861 | 5,613 | 145,065 | 503,373 | 1 | 124 | 379 | 2,080 | 146,604 | 434,046 | 2,681 | 340,370 | 936,954 |
| Jun-13 | 458,704 | 3,097,794 | 13,559,236 | 31 | 424 | 1,567 | 5,659 | 162,391 | 556,772 | 1 | 141 | 429 | 2,089 | 147,975 | 439,915 | 2,692 | 401,133 | 1,090,751 |
| Total CCF, \$ | | 36,069,527 | \$153,961,278 | | 6,023 | \$21,139 | | 1,969,289 | \$6,424,939 | | 2,016 | \$5,885 | | 1,755,712 | \$5,063,926 | | 4,488,849 | \$11,914,115 |
| MGD | | 73.9 | | | 0.01 | | | 4.04 | | | 0.00 | | | 3.60 | | | 9.20 | |
| Total Accts | 5,529,169 | | | 311 | | | 65,339 | | | 12 | | | 24,537 | | | 31,450 | | |
| Ave CCF | | 7 | | | 19 | | | 30 | | | 168 | | | 72 | | | 143 | |
| Cum. CCF | | 36,069,527 | \$153,961,278 | | 36,075,550 | \$153,982,417 | | 38,044,839 | \$160,407,356 | | 38,046,855 | \$160,413,241 | | 39,800,551 | \$165,471,282 | | 44,289,400 | \$177,385,397 |
| % of total | | 53.66% | 65.89% | | 0.01% | 0.01% | | 2.93% | 2.75% | | 0.00% | 0.00% | | 2.61% | 2.17% | | 6.68% | 5.10% |
| Cum. % >> | | 53.66% | 65.89% | | 53.67% | 65.90% | | 56.60% | 68.65% | | 56.60% | 68.65% | | 59.21% | 70.82% | | 65.89% | 75.92% |
| Cum. % << | | 100.00% | 100.00% | | 46.34% | 34.11% | | 46.33% | 34.10% | | 43.40% | 31.35% | | 43.40% | 31.35% | | 40.79% | 29.18% |
| Averages | 460,764 | 3,005,794 | \$12,830,107 | 26 | 502 | \$1,762 | | 5,445 | \$535,412 | | 1 | \$490 | | 2,045 | \$421,994 | | 2,621 | \$992,843 |

AVERAGE BILLED WATER CONSUMPTION PER CUSTOMER ACCOUNT (CCF PER ACCOUNT)

| Meter Size | 5/8 | | 3/4 | | 1 | | 1 1/4 | | 1-1/2 | | 2 | |
|----------------|-----|---------|-----|----------|-----|----------|-------|------------|-------|----------|------|----------|
| Jul-12 | 7 | \$28.16 | 31 | \$96.88 | 31 | \$98.53 | 119 | \$339.00 | 74 | \$204.87 | 146 | \$383.74 |
| Aug-12 | 7 | \$27.93 | 19 | \$63.75 | 32 | \$100.25 | 141 | \$397.00 | 72 | \$202.47 | 156 | \$403.88 |
| Sep-12 | 7 | \$28.27 | 20 | \$64.69 | 34 | \$104.49 | 124 | \$352.00 | 76 | \$208.93 | 182 | \$438.91 |
| Oct-12 | 7 | \$29.04 | 17 | \$59.22 | 35 | \$109.70 | 124 | \$352.00 | 78 | \$218.48 | 142 | \$373.08 |
| Nov-12 | 7 | \$28.29 | 12 | \$43.36 | 30 | \$95.92 | 0 | \$0.00 | 73 | \$203.69 | 139 | \$362.36 |
| Dec-12 | 6 | \$24.31 | 12 | \$44.41 | 22 | \$72.55 | 179 | \$494.00 | 48 | \$136.07 | 99 | \$251.21 |
| Jan-13 | 7 | \$29.05 | 41 | \$126.65 | 40 | \$126.98 | 532 | \$1,531.00 | 99 | \$283.61 | 185 | \$507.73 |
| Feb-13 | 6 | \$26.82 | 17 | \$59.48 | 27 | \$92.55 | 132 | \$402.00 | 64 | \$192.98 | 129 | \$356.51 |
| Mar-13 | 6 | \$27.68 | 15 | \$59.93 | 27 | \$91.84 | 153 | \$456.00 | 69 | \$205.13 | 132 | \$361.58 |
| Apr-13 | 6 | \$27.97 | 19 | \$86.10 | 29 | \$99.60 | 247 | \$754.00 | 66 | \$201.06 | 128 | \$352.94 |
| May-13 | 6 | \$27.08 | 17 | \$60.03 | 26 | \$89.68 | 124 | \$379.00 | 70 | \$208.68 | 127 | \$349.48 |
| Jun-13 | 7 | \$29.56 | 14 | \$50.55 | 29 | \$98.39 | 141 | \$429.00 | 71 | \$210.59 | 149 | \$405.18 |
| Average | 7 | \$27.85 | 20 | \$67.92 | 30 | \$98.37 | 168 | \$490.42 | 72 | \$206.38 | 143 | \$378.88 |
| Maximum | 7 | \$29.56 | 41 | \$126.65 | 40 | \$126.98 | 532 | \$1,531.00 | 99 | \$283.61 | 185 | \$507.73 |
| Minimum | 6 | \$24.31 | 12 | \$43.36 | 22 | \$72.55 | 0 | \$0.00 | 48 | \$136.07 | 99 | \$251.21 |
| Std. Deviation | 0.4 | \$1.31 | 7.9 | \$23.05 | 4.4 | \$12.30 | 121.9 | \$352.13 | 11.1 | \$30.71 | 22.9 | \$58.09 |

In Fiscal Year 1999 meter size 1-1/4 inch accounts were phased-out. However, the Basis2 Billing System reports one such account existing with minimal consumption in FY2010; this account is not believed to incur actual water consumption and this size is not included above

Note: Billed Consumption represents data that is output from the Customer Billing System and, due to billing adjustment activities, may differ from Customer Metered Consumption, which is the input data to the Customer Billing System.

CITY OF PHILADELPHIA - BILLED WATER CONSUMPTION FOR FISCAL YEAR 2013
July 1, 2012 - June 30, 2013 (ccf = 100 cubic feet)

| 3 | | | 4 | | | 6 | | | 8 | | | 10 | | |
|---------------|---------|-----------|---------------|---------|-----------|---------------|---------|-----------|---------------|---------|----------|---------------|-----------|-----------|
| Number | CCF | Billings | Number | CCF | Billings | Number | CCF | Billings | Number | CCF | Billings | Number | CCF | Billings |
| 1,308 | 456,705 | 1,160,742 | 917 | 624,339 | 1,529,044 | 296 | 494,459 | 1,138,102 | 61 | 190,151 | 423,109 | 34 | 303,381 | 676,839 |
| 1,310 | 486,690 | 1,233,366 | 918 | 611,616 | 1,501,971 | 296 | 504,906 | 1,176,917 | 61 | 175,552 | 386,562 | 34 | 302,383 | 671,112 |
| 1,310 | 424,089 | 1,081,040 | 919 | 609,477 | 1,492,044 | 295 | 522,481 | 1,206,071 | 60 | 186,667 | 413,124 | 34 | 291,517 | 647,783 |
| 1,309 | 429,483 | 1,100,462 | 918 | 626,076 | 1,501,444 | 295 | 455,028 | 1,059,255 | 60 | 178,039 | 392,886 | 34 | 357,660 | 823,824 |
| 1,310 | 392,823 | 986,521 | 916 | 513,779 | 1,262,335 | 295 | 417,334 | 972,397 | 61 | 150,326 | 333,983 | 34 | 276,573 | 609,987 |
| 1,309 | 257,601 | 650,805 | 915 | 345,419 | 845,997 | 295 | 283,777 | 652,843 | 61 | 103,432 | 230,155 | 34 | 287,643 | 626,359 |
| 1,310 | 477,724 | 1,280,786 | 913 | 558,728 | 1,465,241 | 295 | 475,616 | 1,140,311 | 62 | 200,756 | 476,522 | 36 | 319,440 | 712,461 |
| 1,313 | 331,202 | 907,458 | 914 | 419,931 | 1,119,636 | 296 | 386,908 | 963,545 | 62 | 152,058 | 375,141 | 37 | 322,513 | 743,443 |
| 1,316 | 344,419 | 941,114 | 917 | 440,540 | 1,178,238 | 296 | 368,709 | 923,320 | 62 | 136,951 | 343,081 | 37 | 297,345 | 703,271 |
| 1,319 | 363,016 | 995,489 | 918 | 459,600 | 1,236,842 | 299 | 370,448 | 934,039 | 62 | 150,459 | 363,906 | 37 | 304,669 | 711,227 |
| 1,322 | 427,744 | 1,137,032 | 918 | 498,619 | 1,333,285 | 302 | 392,863 | 984,708 | 64 | 151,087 | 364,398 | 37 | 497,750 | 1,094,193 |
| 1,326 | 445,235 | 1,186,614 | 921 | 527,753 | 1,425,098 | 303 | 485,715 | 1,182,800 | 64 | 184,021 | 432,220 | 38 | 1,117,145 | 2,672,268 |
| 4,836,731 | | | 6,235,877 | | | 5,158,244 | | | 1,959,499 | | | 4,678,019 | | |
| 9.91 | | | 12.78 | | | 10.57 | | | 4.02 | | | 9.59 | | |
| 15,762 | | | 11,004 | | | 3,563 | | | 740 | | | 426 | | |
| 307 | | | 567 | | | 1,448 | | | 2,648 | | | 10,981 | | |
| 49,126,131 | | | 55,362,008 | | | 60,520,252 | | | 62,479,751 | | | 67,157,770 | | |
| \$190,046,826 | | | \$205,938,001 | | | \$218,272,309 | | | \$222,807,396 | | | \$233,500,163 | | |
| 7.20% | | | 9.28% | | | 7.67% | | | 2.92% | | | 6.96% | | |
| 5.42% | | | 6.80% | | | 5.28% | | | 1.94% | | | 4.58% | | |
| 73.09% | | | 82.36% | | | 90.04% | | | 92.95% | | | 99.91% | | |
| 81.34% | | | 88.14% | | | 93.42% | | | 95.36% | | | 99.93% | | |
| 34.11% | | | 26.91% | | | 17.64% | | | 11.86% | | | 7.05% | | |
| 24.08% | | | 18.66% | | | 9.96% | | | 6.58% | | | 4.64% | | |
| 1,314 | | | 917 | | | 297 | | | 62 | | | 36 | | |
| \$1,055,119 | | | \$1,324,265 | | | \$1,027,859 | | | \$377,924 | | | \$891,064 | | |

AVERAGE BILLED WATER CONSUMPTION PER CUSTOMER ACCOUNT (CCF PER ACCOUNT)

| 3 | | | 4 | | | 6 | | | 8 | | | 10 | | |
|------|----------|--|------|------------|--|-------|------------|--|-------|------------|--|---------|-------------|--|
| 349 | \$887.42 | | 681 | \$1,667.44 | | 1,670 | \$3,844.94 | | 3,117 | \$6,936.21 | | 8,923 | \$19,907.03 | |
| 372 | \$941.50 | | 666 | \$1,636.13 | | 1,706 | \$3,976.07 | | 2,878 | \$6,337.08 | | 8,894 | \$19,738.59 | |
| 324 | \$825.22 | | 663 | \$1,623.55 | | 1,771 | \$4,088.38 | | 3,111 | \$6,885.40 | | 8,574 | \$19,052.44 | |
| 328 | \$840.69 | | 682 | \$1,635.56 | | 1,542 | \$3,590.69 | | 2,967 | \$6,548.10 | | 10,519 | \$24,230.12 | |
| 300 | \$753.07 | | 561 | \$1,378.09 | | 1,415 | \$3,296.26 | | 2,464 | \$5,475.13 | | 8,135 | \$17,940.79 | |
| 197 | \$497.18 | | 378 | \$924.59 | | 962 | \$2,213.03 | | 1,696 | \$3,773.03 | | 8,460 | \$18,422.32 | |
| 365 | \$977.70 | | 612 | \$1,604.86 | | 1,612 | \$3,865.46 | | 3,238 | \$7,685.84 | | 8,873 | \$19,790.58 | |
| 252 | \$691.13 | | 459 | \$1,224.98 | | 1,307 | \$3,255.22 | | 2,453 | \$6,050.66 | | 8,717 | \$20,093.05 | |
| 262 | \$715.13 | | 480 | \$1,284.88 | | 1,246 | \$3,119.32 | | 2,209 | \$5,533.56 | | 8,036 | \$19,007.32 | |
| 275 | \$754.73 | | 501 | \$1,347.32 | | 1,239 | \$3,123.88 | | 2,427 | \$5,869.45 | | 8,234 | \$19,222.35 | |
| 324 | \$860.08 | | 543 | \$1,452.38 | | 1,301 | \$3,260.62 | | 2,361 | \$5,693.72 | | 13,453 | \$29,572.78 | |
| 336 | \$894.88 | | 573 | \$1,547.34 | | 1,603 | \$3,903.63 | | 2,875 | \$6,753.44 | | 29,399 | \$70,322.84 | |
| 307 | \$803.23 | | 567 | \$1,443.93 | | 1,448 | \$3,461.46 | | 2,650 | \$6,128.47 | | 10,851 | \$24,775.02 | |
| 372 | \$977.70 | | 682 | \$1,667.44 | | 1,771 | \$4,088.38 | | 3,238 | \$7,685.84 | | 29,399 | \$70,322.84 | |
| 197 | \$497.18 | | 378 | \$924.59 | | 962 | \$2,213.03 | | 1,696 | \$3,773.03 | | 8,036 | \$17,940.79 | |
| 49.5 | \$125.51 | | 94.6 | \$213.93 | | 231.6 | \$506.63 | | 437.1 | \$950.96 | | 5,773.2 | \$14,076.16 | |

Note: Billed Consumption represents data that is output from the Customer Billing System and, due to billing adjustment activities, may differ from Customer Metered Usage, which is the input data to the Customer Billing System. Data from the "Accountability Trend" worksheet through FY2005 includes adjustments.

CITY OF PHILADELPHIA - BILLED WATER CONSUMPTION FOR FISCAL YEAR 2013
July 1, 2012 - June 30, 2013 (ccf = 100 cubic feet)

| 12 | | | | | | Monthly | | | | |
|------------|-------|---------------|------------|------------|---------------|----------------|-------------|-----------|--------|--|
| Number | CCF | Billings | Total # | Total CCF | Ave CCF | Total Billings | Ave Billing | % of Year | Month | |
| 1 | 6,389 | 16,374 | 472,830 | 5,909,693 | 12 | \$19,831,630 | 42 | 8.8% | Jul-12 | |
| 1 | 6,051 | 15,553 | 473,334 | 5,918,582 | 13 | \$19,839,520 | 42 | 8.8% | Aug-12 | |
| 1 | 5,524 | 14,262 | 472,965 | 6,071,598 | 13 | \$19,987,079 | 42 | 9.0% | Sep-12 | |
| 1 | 5,274 | 13,651 | 472,515 | 5,962,566 | 13 | \$20,248,083 | 43 | 8.9% | Oct-12 | |
| 1 | 3,890 | 9,735 | 471,317 | 5,576,161 | 12 | \$19,024,293 | 40 | 8.3% | Nov-12 | |
| 1 | 4,270 | 10,663 | 473,213 | 4,385,231 | 9 | \$15,537,359 | 33 | 6.5% | Dec-12 | |
| 1 | 4,326 | 12,495 | 475,078 | 6,109,844 | 13 | \$21,112,964 | 44 | 9.1% | Jan-13 | |
| 1 | 3,802 | 10,802 | 476,317 | 5,058,799 | 11 | \$18,387,243 | 39 | 7.5% | Feb-13 | |
| 1 | 3,900 | 10,505 | 476,910 | 5,128,504 | 11 | \$18,826,467 | 39 | 7.6% | Mar-13 | |
| 1 | 5,437 | 15,653 | 474,809 | 5,158,463 | 11 | \$19,090,546 | 40 | 7.7% | Apr-13 | |
| 1 | 4,544 | 12,752 | 471,208 | 5,364,025 | 11 | \$19,210,183 | 41 | 8.0% | May-13 | |
| 1 | 5,291 | 14,723 | 471,829 | 6,575,018 | 14 | \$22,561,964 | 48 | 9.8% | Jun-13 | |
| 58,698 | | \$157,168 | 67,218,484 | | \$233,657,331 | | Total CCF | | | |
| 0.12 | | | 137.75 | | | | MGD | | | |
| 12 | | | 5,682,325 | | | | | | | |
| 4,892 | | | | 12 | Ave CCF | | | | | |
| 67,216,468 | | \$233,657,331 | | | | | | | | |
| 0.09% | | 0.07% | | % of total | | | | | | |
| 100.00% | | 100.00% | | | | | | | | |
| 0.09% | | 0.07% | | | | | | | | |
| 1 | | \$13,097 | 473,527 | | | | | | | |

AVERAGE BILLED WATER CONSUMPTION PER CUSTOMER ACCOUNT (CCF PER ACCOUNT)

| 12 | Total |
|-------|-------------|
| 6,389 | \$16,374.00 |
| 6,051 | \$15,553.00 |
| 5,524 | \$14,262.00 |
| 5,274 | \$13,651.00 |
| 3,890 | \$9,735.00 |
| 4,270 | \$10,663.00 |
| 4,326 | \$12,495.00 |
| 3,802 | \$10,802.00 |
| 3,900 | \$10,505.00 |
| 5,437 | \$15,653.00 |
| 4,544 | \$12,752.00 |
| 5,291 | \$14,723.00 |
| 4,892 | \$13,097.33 |
| 6,389 | \$16,374.00 |
| 3,802 | \$9,735.00 |
| 846.1 | \$2,185.29 |

203 ccf equals 5,073 gal/day Average Large Meter Consumption

Note: Billed Consumption represents data that is output from the Customer Billing System and, due to billing adjustment activities, may differ from Customer Metered Usage, which is the input data to the Customer Billing System. Data from the "Accountability Trend" worksheet through FY2005 includes adjustments.

| Large Meters, 1-inch & | |
|------------------------|-----------|
| Total # | Total CCF |
| 12,514 | 2,767,651 |
| 12,530 | 2,806,812 |
| 12,569 | 2,843,577 |
| 12,600 | 2,764,697 |
| 12,624 | 2,428,031 |
| 12,649 | 1,757,816 |
| 12,698 | 2,937,707 |
| 12,739 | 2,233,446 |
| 12,851 | 2,228,309 |
| 12,958 | 2,293,318 |
| 13,019 | 2,604,770 |
| 13,094 | 3,476,800 |
| 31,142,934 | |
| 63.8 | |
| 152,845 | |
| | 204 |
| | 46.33% |
| | |
| | 12,737 |
| | |
| | Total |
| | 221 |
| | 224 |
| | 226 |
| | 219 |
| | 192 |
| | 139 |
| | 231 |
| | 175 |
| | 173 |
| | 177 |
| | 200 |
| | 266 |
| | 204 |
| | 266 |
| | 139 |
| | 32.7 |

City of Philadelphia-Summary of Billed Water ConsumptionTrend For Fiscal Years 1998-2013

Average Monthly Billed Retail Water Consumption Per Customer Account In Hundred Cubic Feet (CCF)

| Meter Size, In. | 5/8 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 3 | 4 | 6 | 8 | 10 | 12 | Billed Consumption for Year, mgd* |
|------------------|-----|-----|----|-------|-------|-----|-----|-----|-------|-------|--------|--------|-----------------------------------|
| Fiscal Year 2013 | 7 | 20 | 30 | 168 | 72 | 143 | 307 | 567 | 1,448 | 2,650 | 10,851 | 4,892 | 137.8 |
| Fiscal Year 2012 | 7 | 20 | 31 | | 72 | 135 | 311 | 566 | 1,470 | 2,507 | 9,297 | 4,246 | 135.5 |
| Fiscal Year 2011 | 7 | 24 | 32 | | 75 | 141 | 327 | 605 | 1,541 | 2,595 | 7,939 | 132 | 139.0 |
| Fiscal Year 2010 | 6 | 21 | 30 | | 72 | 134 | 300 | 587 | 1,498 | 2,865 | 8,100 | 129 | 134.3 |
| Fiscal Year 2009 | 7 | 18 | 38 | | 81 | 161 | 415 | 783 | 1,927 | 4,215 | 14,619 | 132 | 168.9 |
| Fiscal Year 2008 | 8 | 19 | 35 | | 81 | 156 | 378 | 700 | 1,727 | 3,463 | 15,834 | 30,962 | 169.0 |
| Fiscal Year 2007 | 8 | 15 | 32 | | 75 | 140 | 332 | 583 | 1,562 | 2,910 | 13,323 | 60,912 | 163.3 |
| Fiscal Year 2006 | 8 | 12 | 33 | | 76 | 152 | 343 | 592 | 1,755 | 3,696 | 12,685 | 53,802 | 163.3 |
| Fiscal Year 2005 | 8 | 16 | 33 | | 77 | 143 | 301 | 527 | 1,524 | 3,282 | 13,917 | 39,687 | 161.6 |
| Fiscal Year 2004 | 8 | 15 | 34 | | 77 | 138 | 319 | 548 | 1,579 | 2,577 | 11,490 | 43,811 | 176.9 |
| Fiscal Year 2003 | 8 | 13 | 36 | | 79 | 148 | 278 | 560 | 1,590 | 2,850 | 11,937 | 65,983 | 183.4 |
| Fiscal Year 2002 | 8 | 16 | 37 | | 83 | 149 | 269 | 577 | 1,620 | 2,662 | 12,900 | 189 | 177.6 |
| Fiscal Year 2001 | 8 | 16 | 38 | | 87 | 154 | 312 | 620 | 1,920 | 2,399 | 10,862 | 2,038 | 181.7 |
| Fiscal Year 2000 | 9 | 18 | 39 | | 96 | 160 | 362 | 731 | 1,776 | 3,365 | 13,165 | 320 | 185.8 |
| Fiscal Year 1999 | 9 | 18 | 38 | 65 | 85 | 174 | 365 | 656 | 1,727 | 2,911 | 5,886 | 13,995 | 186.7 |
| Fiscal Year 1998 | 9 | 18 | 41 | 45 | 85 | 163 | 393 | 683 | 1,693 | 2,903 | 10,972 | | 193.9 |

Fiscal Year: July 1 of the previous year-June 30th of the current year

*Does not include adjustment for sewer only accounts thru FY2008 - see ACCOUNTABILITY TREND worksheet

Basis2 Customer Billing System launched January 2, 2008

City of Philadelphia-Summary of Billed Water ConsumptionTrend For Fiscal Years 1998-2013

Number Of Accounts (Average Of Twelve Monthly Counts)

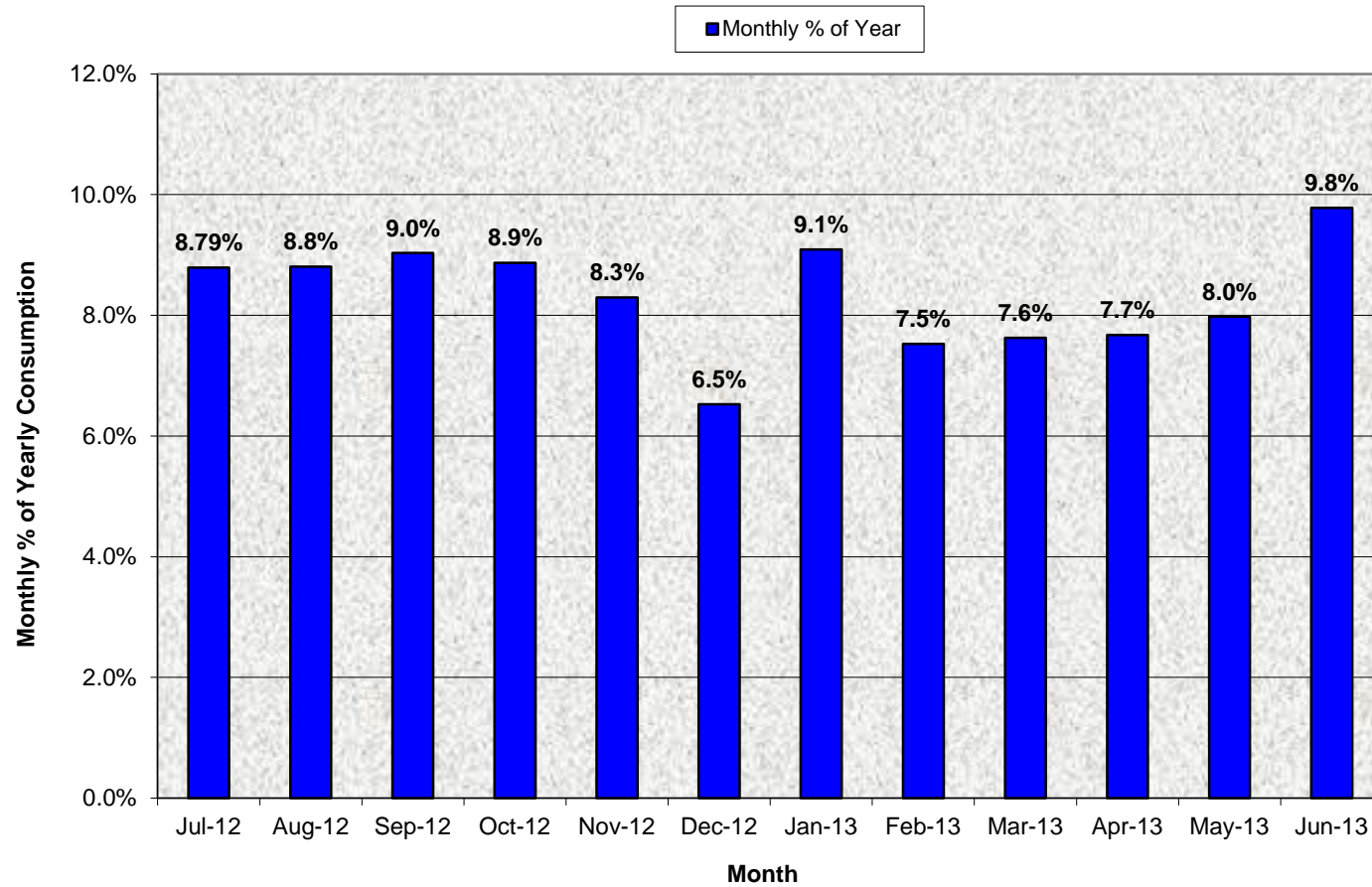
| Meter Size, In. | 5/8 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 3 | 4 | 6 | 8 | 10 | 12 | Total Accounts, Fiscal Year End |
|------------------|---------|-------|-------|-------|-------|-------|-------|-----|-----|----|----|----|------------------------------------|
| Fiscal Year 2013 | 460,764 | 26 | 5,445 | 1 | 2,045 | 2,621 | 1,314 | 917 | 297 | 62 | 36 | 1 | 473,527 |
| Fiscal Year 2012 | 461,392 | 30 | 5,277 | | 1,994 | 2,550 | 1,292 | 911 | 291 | 62 | 37 | 1 | 473,837 |
| Fiscal Year 2011 | 462,093 | 31 | 5,264 | | 1,971 | 2,524 | 1,275 | 904 | 287 | 61 | 41 | 1 | 474,452 |
| Fiscal Year 2010 | 463,019 | 58 | 5,465 | | 2,017 | 2,594 | 1,256 | 922 | 321 | 74 | 34 | 1 | 504,231 |
| Fiscal Year 2009 | 491,490 | 58 | 5,464 | | 2,017 | 2,594 | 1,256 | 922 | 321 | 74 | 34 | 1 | 504,231 |
| Fiscal Year 2008 | 473,904 | 71 | 5,526 | | 2,026 | 2,562 | 1,227 | 920 | 331 | 66 | 29 | 2 | 486,664 |
| Fiscal Year 2007 | 457,246 | 137 | 5,602 | | 2,044 | 2,533 | 1,185 | 930 | 326 | 67 | 28 | 3 | 470,101 |
| Fiscal Year 2006 | 457,845 | 197 | 5,787 | | 2,073 | 2,517 | 1,166 | 955 | 338 | 69 | 30 | 3 | 470,980 |
| Fiscal Year 2005 | 457,944 | 254 | 5,990 | | 2,098 | 2,519 | 1,154 | 953 | 361 | 66 | 30 | 4 | 471,373 |
| Fiscal Year 2004 | 458,639 | 322 | 6,261 | | 2,111 | 2,535 | 1,134 | 959 | 390 | 67 | 30 | 5 | 472,453 |
| Fiscal Year 2003 | 459,236 | 377 | 6,617 | | 2,136 | 2,538 | 1,138 | 968 | 403 | 70 | 29 | 3 | 473,973 |
| Fiscal Year 2002 | 459,881 | 684 | 6,776 | | 2,140 | 2,518 | 1,140 | 947 | 404 | 69 | 27 | 3 | 474,657 |
| Fiscal Year 2001 | 460,572 | 978 | 6,882 | | 2,125 | 2,470 | 1,129 | 955 | 405 | 70 | 26 | 3 | 475,818 |
| Fiscal Year 2000 | 459,952 | 1,222 | 6,841 | | 2,090 | 2,358 | 1,098 | 935 | 402 | 69 | 22 | 1 | 475,142 |
| Fiscal Year 1999 | 460,534 | 2,980 | 6,860 | 28 | 2,106 | 2,344 | 1,085 | 933 | 404 | 72 | 19 | 1 | 477,582 |
| Fiscal Year 1998 | 459,940 | 5,405 | 6,986 | 35 | 2,125 | 2,362 | 1,080 | 932 | 404 | 77 | 19 | | 478,609 |

City of Philadelphia-Summary of Billed Water ConsumptionTrend For Fiscal Years 1998-2013

Percent of Total Billed Water Consumption

| Meter Size, In. | 5/8 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 3 | 4 | 6 | 8 | 10 | 12 |
|------------------|--------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|-------|
| Fiscal Year 2013 | 53.66% | 0.01% | 2.93% | 0.00% | 2.61% | 6.68% | 7.20% | 9.28% | 7.67% | 2.92% | 6.96% | 0.09% |
| Fiscal Year 2012 | 54.67% | 0.01% | 2.95% | | 2.61% | 6.26% | 7.30% | 9.35% | 7.75% | 2.80% | 6.22% | 0.08% |
| Fiscal Year 2011 | 54.68% | 0.01% | 2.94% | | 2.63% | 6.29% | 7.37% | 9.67% | 7.84% | 2.80% | 5.78% | 0.00% |
| Fiscal Year 2010 | 54.57% | 0.01% | 2.91% | | 2.59% | 6.19% | 7.01% | 9.71% | 7.82% | 3.25% | 5.93% | 0.00% |
| Fiscal Year 2009 | 49.68% | 0.02% | 3.02% | | 2.38% | 6.07% | 7.60% | 10.50% | 9.02% | 4.50% | 7.21% | 0.00% |
| Fiscal Year 2008 | 52.95% | 0.02% | 2.80% | | 2.39% | 5.81% | 6.76% | 9.36% | 8.30% | 3.36% | 6.68% | 1.56% |
| Fiscal Year 2007 | 54.27% | 0.03% | 2.81% | | 2.43% | 5.62% | 6.22% | 8.58% | 8.07% | 3.10% | 5.97% | 2.89% |
| Fiscal Year 2006 | 53.42% | 0.04% | 2.91% | | 2.36% | 5.78% | 6.03% | 8.52% | 8.95% | 3.80% | 5.75% | 2.43% |
| Fiscal Year 2005 | 55.65% | 0.06% | 3.02% | | 2.40% | 5.48% | 5.28% | 7.64% | 8.37% | 3.28% | 6.27% | 2.55% |
| Fiscal Year 2004 | 55.80% | 0.07% | 3.16% | | 2.45% | 5.27% | 5.43% | 7.90% | 9.25% | 2.61% | 5.09% | 2.96% |
| Fiscal Year 2003 | 55.67% | 0.07% | 3.51% | | 2.47% | 5.48% | 4.62% | 7.92% | 9.36% | 2.90% | 5.10% | 2.89% |
| Fiscal Year 2002 | 57.09% | 0.16% | 3.77% | | 2.69% | 5.66% | 4.62% | 8.14% | 9.87% | 2.76% | 5.22% | 0.01% |
| Fiscal Year 2001 | 53.08% | 0.21% | 3.63% | | 2.55% | 5.27% | 4.88% | 8.19% | 10.77% | 2.32% | 3.97% | 0.09% |
| Fiscal Year 2000 | 54.49% | 0.31% | 3.67% | | 2.77% | 5.23% | 5.51% | 9.47% | 9.87% | 3.20% | 3.92% | 0.00% |
| Fiscal Year 1999 | 56.89% | 0.73% | 3.62% | 0.02% | 2.49% | 5.64% | 5.48% | 8.46% | 9.65% | 2.91% | 1.51% | 0.16% |
| Fiscal Year 1998 | 56.72% | 1.34% | 3.93% | 0.02% | 2.50% | 5.32% | 5.87% | 8.81% | 9.46% | 3.10% | 2.92% | |

**Philadelphia Water Department - Water Revenue Bureau
FY2013 - Monthly Frequency Distribution of Customer Billed Consumption**



| City of Philadelphia Retail Customer Billing Summary Data for Fiscal Year 2013 <i>(Note: Billings (\$) data presented has not been confirmed by a standard financial audit)</i> | | | | | | | | | | | | | | | | |
|--|-----------------------|-------------------|----------------------|------------------|----------------------|----------------------|----------------------|----------------------|---------------------|---------------------|----------------------|-------------------|----------------------|-----------------------|-------------------|--|
| Meter Size | 5/8 | 3/4 | 1 | 1 1/4 | 1 1/2 | 2 | 3 | 4 | 6 | 8 | 10 | 12 | Stormwater | Total Metered | Total Unmetered | Grand Total (Stormwater +Metered +Unmetered) |
| Ave. Number of Monthly Billed Accounts | 460,764 | 26 | 5,445 | 1 | 2,045 | 2,621 | 1,314 | 917 | 297 | 62 | 36 | 1 | 51,631 | 473,527 | 365 | 525,523 |
| Total Billed Water Consumption (CCF) Billed & non-billed accounts | 36,069,527 | 6,023 | 1,969,289 | 2,016 | 1,755,712 | 4,488,849 | 4,836,731 | 6,235,877 | 5,158,244 | 1,959,499 | 4,678,019 | 58,698 | 4,512 | 67,218,484 | 886 | 67,223,882 |
| Total Billed Water Consumption (MG) Billed & non-billed accounts | 26,980 | 5 | 1,473 | 2 | 1,313 | 3,358 | 3,618 | 4,664 | 3,858 | 1,466 | 3,499 | 44 | 3 | 50,279 | 1 | 50,283 |
| Total Average Daily Water Consumption (MGD) Billed & non-billed accounts | 73.7 | 0.0 | 4.0 | 0.0 | 3.6 | 9.2 | 9.9 | 12.7 | 10.5 | 4.0 | 9.6 | 0.1 | 0.0 | 137.4 | 0.0 | 137.39 |
| Annual Water Billings (\$) | \$153,961,278 | \$21,139 | \$6,424,939 | \$5,885 | \$5,063,926 | \$11,914,115 | \$12,661,429 | \$15,891,175 | \$12,334,308 | \$4,535,087 | \$10,692,767 | \$157,168 | \$12,434 | \$233,663,216 | \$15,805 | \$233,691,455 |
| Annual Sewer Billings (\$) | \$111,629,283 | \$23,638 | \$5,513,596 | \$4,918 | \$4,557,255 | \$10,631,042 | \$11,120,490 | \$13,469,238 | \$10,518,867 | \$3,993,904 | \$9,162,120 | \$18,309 | \$10,936 | \$180,642,660 | \$23,247 | \$180,676,843 |
| Annual Storm Water Billing (\$) | \$84,913,713 | \$55,898 | \$8,496,884 | \$3,643 | \$5,681,384 | \$12,162,037 | \$9,641,880 | \$9,057,181 | \$6,537,934 | \$1,895,513 | \$1,639,557 | \$46,719 | \$14,274,751 | \$140,132,343 | \$199,937 | \$154,607,031 |
| Total W/S/Storm Water Billing (\$) | \$ 350,504,274 | \$ 100,675 | \$ 20,435,419 | \$ 14,446 | \$ 15,302,565 | \$ 34,707,194 | \$ 33,423,799 | \$ 38,417,594 | \$29,391,109 | \$10,424,504 | \$ 21,494,444 | \$ 222,196 | \$ 14,298,121 | \$ 554,438,219 | \$ 238,989 | \$ 568,975,329 |

| Automatic Meter Reading Results for Fiscal Year 2013 | | | | | | |
|---|--|----------------------------|------------------|--------------|-----------------------------|--------------------------|
| Month | Total Meters Scheduled for Automatic Reading | Meter Reading Success Rate | Meters Read | Missed Reads | Unit Cost per Meter Reading | Total Meter Reading Cost |
| Jul-12 | 475,850 | 98.2% | 467,068 | 8,782 | \$0.305 | \$142,455.74 |
| Aug-12 | 474,957 | 98.1% | 465,852 | 9,105 | \$0.305 | \$142,084.86 |
| Sep-12 | 475,703 | 98.7% | 469,506 | 6,197 | \$0.305 | \$143,199.33 |
| Oct-12 | 477,672 | 98.8% | 472,009 | 5,663 | \$0.305 | \$143,962.75 |
| Nov-12 | 477,672 | 98.8% | 472,009 | 5,663 | \$0.305 | \$143,962.75 |
| Dec-12 | 477,672 | 98.8% | 472,009 | 5,663 | \$0.305 | \$143,962.75 |
| Jan-13 | 477,839 | 99.0% | 472,948 | 4,891 | \$0.305 | \$144,249.14 |
| Feb-13 | 476,676 | 99.1% | 472,579 | 4,097 | \$0.305 | \$144,136.60 |
| Mar-13 | 477,576 | 99.1% | 473,379 | 4,197 | \$0.305 | \$144,380.60 |
| Apr-13 | 478,137 | 99.1% | 474,021 | 4,116 | \$0.305 | \$144,576.41 |
| May-13 | 478,861 | 99.0% | 474,270 | 4,591 | \$0.305 | \$144,652.35 |
| Jun-13 | 480,030 | 99.0% | 475,200 | 4,830 | \$0.305 | \$144,936.00 |
| Totals | 5,728,645 | 98.8% | 5,660,850 | 5,650 | \$ 0.305 | \$1,726,559.25 |
| Automatic Meter Reading System Battery/ERT Changeout Project Results for Fiscal Year 2013 | | | | | | |
| In 1997 PWD entered into a 20-year contract with Itron, Inc. for Automatic Meter Reading equipment installation and regular monthly customer meter readings. Battery change-out of the meter reading devices (ERTs) was required by contract at Year 14 and launched in 2011. The project was successfully completed in calendar year 2013. | | | | | | |

Water Revenue Bureau - Customer Meter Reading Technical Operations Report for Fiscal Year 2013

Customer Meters are read monthly via the Automatic Meter Reading (AMR) System for the vast majority of billed accounts. A small number of accounts await AMR installation and these are read manually.

| | Fiscal Year Backlog | Routes Scheduled | Routes Completed | Routes Deleted | Total Readings | Read Percent | Total No Response | No Response Percent | Can't Read | Can't Read Percent | Vacant | Vacant Percent | Total Accounts | Completed Backlog | Explain all backlog items |
|------------------------|---------------------|------------------|------------------|----------------|----------------|--------------|-------------------|---------------------|------------|--------------------|--------|----------------|----------------|-------------------|--|
| Commercial Itron (AMR) | 0 | 0 | 0 | 0 | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% | 0 | 0 | |
| Commercial Manual | 0 | 396 | 396 | 0 | 302 | 29.2% | 532 | 51.4% | 202 | 19.5% | 0 | 0.0% | 1,036 | 0 | |
| Combined Total | | 396 | 396 | 0 | 302 | 29.2% | 532 | 51.4% | 202 | 19.5% | - | 0.0% | 1,036 | 0 | |
| Phone in Readings | 0 | 0 | | | 0 | 0.0% | | | | | | | 0 | 0 | Reads received outside of billing window |

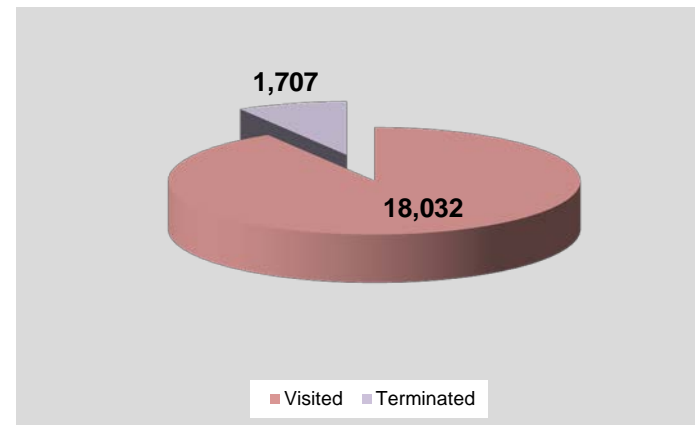
| | | | | | | | | |
|---|--|------------|--------------|---------|--------------|--|--|--|
| Reinspections of curbstops of accounts shutoff for payment delinquency (to detect unauthorized consumption) | | # Visited | # Terminated | % Term. | \$ Collected | | Shutoff procedures require that the customer service connection be closed at the curbstops valve in the footway. Some customers are able to reopen the curbstops on their own to illegally restore their water service. The Reinspection Program is conducted by WRB and reinspects a portion of the accounts that have been shutoff. Listed is the number of reinspections (# visited) and number of accounts shutoff a second time (# Terminated). | |
| | | 18,032 | 1,707 | 9.5% | \$344,217.89 | | | |
| Return Mail | | # Received | # Completed | % Comp | \$ Collected | | | |
| | | 303,855 | 21,354 | 7.0% | \$183,339.66 | | | |

| | Reads | Read Percent | No Response | No Resp Percent | Non-Billed | NB Percent | Can't Read | Can't Read Percent | Total Accounts |
|---------------------------------------|----------------|--------------|-------------------|---------------------|------------|--------------------|------------|--------------------|----------------|
| Itron Reads (Automatic Meter Reading) | 5,656,786 | 97.94% | 115,590 | 2.00% | 3,397 | 0.06% | - | 0.00% | 5,775,773 |
| | Total Readings | Read Percent | Total No Response | No Response Percent | Can't Read | Can't Read Percent | Non-Billed | NB Percent | Total Accounts |
| Combined Totals Itron & Manual | 5,657,088 | 97.93% | 116,122 | 2.01% | 202 | 0.00% | 3,397 | 0.06% | 5,776,809 |

Reinspection Program - Inspection of Accounts Shutoff for Payment Delinquency: Accounts visited - 18,032 terminated - 1,707

Backlog
Scheduled
Completed
Total Readings
Can't Read

Total number of routes not completed FY2013
Routes scheduled for FY2013
Routes completed for FY2013
Total readings commercial & manual
Non-billed, blocked, no access, flooded etc.



Technical Operations, Meter Reading & Investigation Division, Water Revenue Bureau

Philadelphia Water Department - Water Revenue Bureau Revenue Protection Program Fiscal Year 2013

In Fiscal Year 2013 the Revenue Protection Program continued to lead investigations into suspect billing accounts. Since the launch of the Basis2 Customer Billing System in January 2008, the primary focus of this initiative has been the investigation of billing accounts registering zero consumption for several consecutive months. Causes of zero consumption are varied. Many vacant properties exist in Philadelphia and, for these accounts, zero consumption validly reflects no water usage at these buildings. However, investigations have found that the registering of zero consumption in many properties is due to tampering with metering and/or AMR equipment. This constitutes unauthorized consumption. Meter and/or AMR equipment malfunction can also cause zero consumption reports. These two instances represent apparent loss.

| Results of Zero Consumption Investigations for Fiscal Year 2013 | | | | | | |
|---|-------------------------------|------------------|-----------------|------------------|--------------------------|--|
| Finding | Addressed by PWD | RECOVERED CCF | RECOVERED MG | RECOVERED MGD | BILLED - USAGE CHARGE | Comments |
| Damaged ERT | 260 | 76,440 | 57.18 | 0.16 | \$251,308 | AMR Defect |
| Defective Meter Register | 416 | 122,304 | | | | Meter Defect |
| Damaged Meter | 288 | 84,672 | 63.33 | 0.17 | \$278,372 | Tampering |
| ERT Missing | 164 | 48,216 | 36.07 | 0.10 | \$158,517 | Tampering |
| ERT Offline | 143 | 42,042 | 31.45 | 0.09 | \$138,220 | Tampering |
| ERT Tampered | 107 | 31,458 | 23.53 | 0.06 | \$103,423 | Tampering |
| Meter Backwards | 603 | 177,282 | 132.61 | 0.36 | \$582,842 | Tampering |
| Meter & ERT missing | 2,383 | 700,602 | 524.05 | 1.44 | \$2,303,336 | Tampering |
| Meter & ERT off | 147 | 43,218 | 32.33 | 0.09 | \$142,086 | Tampering |
| Meter Missing | 136 | 39,984 | 29.91 | 0.08 | \$131,454 | Tampering |
| Meter Offline | 12 | 3,528 | 2.64 | 0.01 | \$11,599 | Tampering |
| Meter Tampered | 8 | 2,352 | 1.76 | 0.00 | \$7,733 | Tampering |
| Good PMA Match | Not Reported | | | | | No lost water - property is vacant |
| Vacant | | | | | | No lost water - property is vacant |
| Change ERT | | | | | | No lost water - Routine ERT Change |
| Totals | 4,667 | 1,372,098 | 934.85 | 2.56 | \$4,108,889 | |
| Totals by Category | 676 AMR & Meter Defects | | | | | |
| | 3,703 Tampering | | | | | |
| | (None Reported) No Lost Water | | | | | |

Note: Data tracking has found that roughly 12,000 accounts meet the Zero Consumption criteria of 4 consecutive months with a valid AMR meter reading reported as the same value as the prior monthly readings. ITRON is PWD's meter reading provider. ERT is the automatic meter reading device.

| Non-billed Accounts (NB) | No. of non-billed accounts on 7/1/2012 ^[1] |
|---|---|
| (Note: many NB accounts are "paper entries") | |
| NB1: Discontinued service with another service to the property | 39 |
| NB2: Deactivated Account (deleted) | 8,607 |
| NB3: Suspended due to shutoff for non-payment | 22,411 |
| NB4: Water from Another Source | 0 |
| NB5: No Water Service (Discontinued Property) | 42,432 |
| NB6: Service & Meter Permit (New property to be billed when occupied) | 5,472 |
| NB8: Suspended Billing: fire and meter remaining | 799 |
| NB9: Vacant property with no activity for one year. | 24,957 |
| Total Non-Billed Accounts | 104,717 |

Physical NB Accounts = total NB accounts minus NB2 and NB5= 53,678

[1]Data for FY2013 is not available

**City of Philadelphia - Delinquency and Restoration Services
Record of Nonpayment Shutoffs and Restored Accounts**

| | Totals FY2013 | Totals FY2012 | Totals FY2011 | Totals FY2010 | Totals FY2009 | Totals FY2008 | Totals FY2007 | Totals FY2006 | Totals FY2005 | Totals FY2004 | Totals FY2003 | Totals FY2002 | Difference FY2013 vs. FY2012 |
|------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------------------------|
| Accounts Received | 83,541 | 79,230 | 74,986 | 68,588 | 72,218 | 69,140 | 71,846 | 68,424 | 79,162 | 79,573 | 74,356 | 78,799 | 4,311 |
| Accounts Serviced | 83,461 | 79,735 | 74,376 | 68,090 | 71,020 | 68,744 | 71,034 | 67,976 | 78,443 | 78,528 | 71,783 | 75,979 | 3,726 |
| Accounts Shutoff | 37,815 | 36,237 | 31,435 | 30,450 | 30,343 | 31,058 | 31,403 | 28,362 | 31,299 | 31,263 | 28,833 | 28,074 | 1,578 |
| Accounts Shutoff and Locked | | | | | | | | | 7,966 | | | | 0 |
| Accounts Found Off | 7,191 | 6,080 | 5,156 | 5,070 | 7,324 | 3,774 | 7,905 | 8,149 | 12,036 | 10,916 | 10,531 | | 1,111 |
| Accounts Restored: Shutoff Crews | 37,687 | 34,088 | 27,118 | 23,100 | 22,936 | 23,257 | 21,930 | 20,122 | 20,959 | 21,111 | 21,414 | 18,723 | 3,599 |
| Accounts Restored: Emergency Crews | 8 | 33 | 108 | 513 | 2,175 | 1,488 | 1,959 | 2,377 | 2,117 | 2,463 | 2,895 | 3,993 | (25) |
| Accounts Cancelled: WRB | 40,893 | 43,729 | 36,988 | 27,679 | 16,069 | 35,186 | 14,083 | 7,321 | 8,518 | 8,514 | 9,532 | 7,921 | (2,836) |
| Accounts Made Ready For Shutoff | 26 | 35 | 1,565 | 3,132 | 5,274 | 5,516 | 5,303 | 3,705 | 6,331 | 5,696 | 5,946 | 5,305 | (9) |
| Checks Collected: Number | 17,780 | 17,537 | 17,036 | 16,522 | 16,439 | 16,795 | 16,096 | 14,774 | 14,943 | 15,491 | 15,404 | 14,766 | 243 |
| Checks Collected: Amount | \$6,225,807 | \$6,050,739 | \$5,615,400 | \$5,304,854 | \$4,422,471 | \$5,570,697 | \$4,985,974 | \$4,407,606 | \$4,384,465 | \$3,852,277 | \$3,837,151 | \$3,415,596 | \$175,068 |
| Digup Accounts Received | 9,253 | 4,204 | 6,655 | 5,519 | 5,274 | 5,517 | 5,302 | 3,704 | 6,333 | 5,697 | 6,188 | 6,755 | 5,049 |
| Regular Shutoff Crews | 3,467 | 3,606 | 3,347 | 2,819 | 3,005 | 2,752 | 3,031 | 2,936 | 3,295 | 3,359 | 3,078 | 3,340 | (139) |
| Digup Crews | 1,278 | 888 | 894 | 1,054 | 1,081 | 1,131 | 1,082 | 855 | 1,110 | 996 | 1,289 | 1,248 | 390 |
| USTRA Inspection Crews | 0 | 0 | 3 | 1 | 33 | 3 | 1 | 2 | 21 | 23 | 86 | 115 | 0 |
| USTRA Shutoff Crews | 187 | 398 | 0 | 0 | 19 | 2 | | | 12 | 23 | 58 | 69 | (211) |
| AMR Digup/Shutoff Crews | 7,774 | 2,438 | 836 | 1,366 | 66 | 93 | 74 | 13 | 14 | 33 | 38 | 66 | 5,336 |
| Days Computer System Unavailable | 7 | 2 | 2 | 1 | 4 | 7 | 1 | 2 | 2 | 1 | 3 | | 5 |
| Heat Emergency Days | 3 | 6 | 5 | 4 | 14 | 7 | 5 | 10 | 0 | 0 | 19 | 7 | (3) |
| Snow Days | 0 | 0 | 2 | 5 | 4 | 1 | 3 | 6 | 4 | 2 | 3 | 1 | 0 |
| Illegal Restores Addressed | | | | | | | 348 | | | | | | |

In Fiscal Year 2008 the Delinquency & Restoration Unit investigated the use of automatic shutoff valves which are installed on customer service connection piping and can be operated remotely by a handheld transmitter. These devices were piloted on a number of repeat illegal restoration violators and their feasibility was evaluated. Ultimately these devices were installed on 86 customer service connections; resulting in payments roughly one-half of these stubborn accounts. The maximum single repayment was \$21,000. While providing a strong enforcement capability, these devices also require additional cost to purchase, install and maintain; and are not feasible to implement on a widespread basis. It was planned to purchase an additional 650 additional automatic shutoff valves, starting in FY2011; however, a slower pace is now envisioned for this program. Current policy is to install an automatic shutoff valve where damaged curbstops are identified and/or illegal restores are confirmed and the outstanding balance is in excess of \$1,500. A \$750 installation fee is added to these accounts.

| AMR Meter Monthly Statistics Report | | | | | | | | | | | | | | | | |
|---|------------|----------|---------------|--------|-----|-----|-------|-------|------|-----|-----|----|---|----|----|---------------------|
| Customer Meter Population Demographics as of 7/4/2013 | | | | | | | | | | | | | | | | |
| | Meter Size | Mfg | Meter Type | 5/8 | 3/4 | 1 | 1-1/4 | 1-1/2 | 2 | 3 | 4 | 6 | 8 | 10 | 12 | Total By Meter Type |
| Meters on Billed Accounts | | | | | | | | | | | | | | | | |
| A10 | 10-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| A12 | 1.5-inch | ABB | Displacement | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| A17 | 2-inch | ABB | Displacement | 0 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| A30 | 3-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 86 | 0 | 0 | 0 | 0 | 0 | 86 |
| A40 | 4-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| A60 | 6-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| A80 | 8-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| C30 | 3-inch | Actaris | Single Jet | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 9 |
| C40 | 4-inch | Actaris | Single Jet | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| C60 | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| D12 | 1.5-inch | ABB | Displacement | 0 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 45 |
| D17 | 2-inch | ABB | Displacement | 0 | 0 | 0 | 0 | 0 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| D30 | 3-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 809 | 0 | 0 | 0 | 0 | 0 | 809 |
| F01 | 1-inch | Metron | Single Jet | 0 | 0 | 119 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 119 |
| F15 | 1.5-inch | Metron | Single Jet | 0 | 0 | 0 | 0 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 |
| F20 | 2-inch | Metron | Single Jet | 0 | 0 | 0 | 0 | 0 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 61 |
| F34 | 3/4-inch | Metron | Single Jet | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| GAL-MTR | | | | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| H30 | 3-inch | Hersey | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| I10 | 10-inch | Invensus | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 |
| I30 | 3-inch | Invensus | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 242 | 0 | 0 | 0 | 0 | 0 | 242 |
| I31 | 3-inch | Invensus | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 79 | 0 | 0 | 0 | 0 | 0 | 79 |
| I40 | 4-inch | Invensus | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| I41 | 4-inch | Invensus | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 294 | 0 | 0 | 0 | 0 | 294 |
| I60 | 6-inch | Invensus | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 18 |
| I61 | 6-inch | Invensus | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 82 | 0 | 0 | 0 | 82 |
| I80 | 8-inch | Invensus | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 |
| M01 | 1-inch | Badger | Fire/Domestic | 0 | 0 | 222 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 222 |
| M02 | 2-inch | Badger | Fire/Domestic | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| M10 | 10-inch | Badger | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 21 |
| M12 | 1.5-inch | Badger | Displacement | 0 | 0 | 0 | 0 | 1905 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1905 |
| M15 | 1.5-inch | Badger | Fire/Domestic | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| M17 | 2-inch | Badger | Displacement | 0 | 0 | 0 | 0 | 0 | 2499 | 0 | 0 | 0 | 0 | 0 | 0 | 2499 |
| M25 | 5/8-inch | Badger | Displacement | 457001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 457001 |
| M30 | 3-inch | Badger | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 0 | 0 | 0 | 0 | 0 | 67 |
| M34 | 3/4-inch | Badger | Fire/Domestic | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| M40 | 4-inch | Badger | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 249 | 0 | 0 | 0 | 0 | 249 |
| M41 | 4-inch | Badger | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 334 | 0 | 0 | 0 | 0 | 334 |
| M60 | 6-inch | Badger | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 77 | 0 | 0 | 0 | 77 |

| | | | | | | | | | | | | | | | | |
|---|----------|----------|---------------|---------|----|-------|---|-------|-------|-------|-----|-----|-----|----|---|---------|
| M61 | 6-inch | Badger | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 107 | 0 | 0 | 0 | 107 |
| M70 | 1-inch | Badger | Displacement | 0 | 0 | 5249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5249 |
| M80 | 8-inch | Badger | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 57 |
| NAB | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| NAE | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 12 |
| NAN | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 0 | 0 | 0 | 56 |
| NAO | | | | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| NAP | | | | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| NAQ | | | | 0 | 0 | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 79 |
| NAR | | | | 1734 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1734 |
| NAT | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| NAV | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 58 | 0 | 0 | 58 |
| NAW | | | | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 | 0 | 0 | 39 |
| NAX | | | | 0 | 0 | 0 | 0 | 0 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| NAY | | | | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| NAZ | | | | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| S30 | | | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| SEW | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 |
| VIR | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 |
| | | | | | | | | | | | | | | | | |
| Sub-Total Billed Account AMR Meters | | | | 457,003 | 12 | 5,590 | 0 | 2,055 | 2,645 | 1,295 | 893 | 288 | 64 | 37 | 0 | 469,882 |
| | | | | | | | | | | | | | | | | |
| Sub-Total Billed Account Non-AMR Meters | | | | 1,734 | 20 | 79 | 2 | 35 | 62 | 40 | 39 | 56 | 58 | 12 | 2 | 2,140 |
| | | | | | | | | | | | | | | | | |
| Total Billed Accounts by Meter Size | | | | 458,737 | 32 | 5,669 | 2 | 2,090 | 2,707 | 1,335 | 932 | 344 | 122 | 49 | 2 | 472,022 |
| | | | | | | | | | | | | | | | | |
| Meters on Non - Billed Accounts | | | | | | | | | | | | | | | | |
| A17 | 2-inch | ABB | Displacement | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| A40 | 4-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| D17 | 2-inch | ABB | Displacement | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| D30 | 3-inch | ABB | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| F01 | 1-inch | Metron | Single Jet | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| F15 | 1.5-inch | Metron | Single Jet | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| I30 | 3-inch | Invensus | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| I41 | 4-inch | Invensus | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| M01 | 1-inch | Badger | Fire/Domestic | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| M12 | 1.5-inch | Badger | Displacement | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| M17 | 2-inch | Badger | Displacement | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| M25 | 5/8-inch | Badger | Displacement | 25300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25365 |
| M30 | 3-inch | Badger | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| M34 | 3/4-inch | Badger | Fire/Domestic | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| M40 | 4-inch | Badger | Turbine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| M41 | 4-inch | Badger | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 3 |
| M61 | 6-inch | Badger | Compound | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| M70 | 1-inch | Badger | Displacement | 0 | 0 | 56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |

| | | | | | | | | | | | | | | | | |
|--|--|--|--|---------|-----|-----|----|-----|-----|----|----|----|----|---|---|--------|
| NAE | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 5 |
| NAN | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 32 |
| NAO | | | | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 61 |
| NAP | | | | 0 | 0 | 0 | 0 | 156 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 173 |
| NAQ | | | | 0 | 0 | 457 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 474 |
| NAR | | | | 22216 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22766 |
| NAT | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| NAV | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 13 |
| NAW | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 0 | 0 | 53 |
| NAX | | | | 0 | 0 | 0 | 0 | 0 | 148 | 0 | 0 | 0 | 0 | 0 | 0 | 177 |
| NAY | | | | 0 | 0 | 0 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 74 |
| NAZ | | | | 0 | 450 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 459 |
| | | | | | | | | | | | | | | | | |
| Sub-Total Non-billed Account AMR Meters | | | | 25,300 | 0 | 57 | 0 | 9 | 18 | 7 | 7 | 0 | 0 | 0 | 0 | 25,398 |
| | | | | | | | | | | | | | | | | |
| Sub-Total Non-billed Account Non-AMR Meters | | | | 22,216 | 450 | 457 | 73 | 156 | 148 | 40 | 36 | 23 | 12 | 4 | 2 | 23,617 |
| | | | | | | | | | | | | | | | | |
| Total Non-billed Accounts by Meter Size | | | | 47,516 | 450 | 514 | 73 | 165 | 166 | 47 | 43 | 23 | 12 | 4 | 2 | 49,015 |
| | | | | | | | | | | | | | | | | |
| Total Unmetered Accounts (Mostly Storm Water Only Accounts) | | | | 61,675 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Grand TOTAL | | | | 582,712 | | | | | | | | | | | | |

| Apparent Loss Due to Missing or Malfunctioning Customer Meters During Fiscal Year 2013 | | | | | |
|---|-------------------------------|---------------------------------|-------------------------------|--|---|
| Water Lost Through Missing Meters Uncovered during Fiscal Year 2013 | | | | | |
| Meter Category | Meter Size | # Identified | Typical Use per Size, gal/day | Unmetered Water, gallons | Average Daily Unmetered Water, mgd |
| Small Meters | 5/8" | 2496 | 163 | 148,192,437 | 0.406 |
| Large Meters | 1" | 11 | 752 | 3,020,942 | 0.008 |
| | 1-1/2" | 4 | 1,785 | 2,605,724 | 0.007 |
| | 2" | 6 | 3,560 | 7,797,475 | 0.021 |
| | 3" | 2 | 7,651 | 5,585,326 | 0.015 |
| | 4" | 0 | 14,128 | 0 | 0.000 |
| | 6" | 1 | 36,100 | 13,176,503 | 0.036 |
| | 8" | 0 | 80,734 | 0 | 0.000 |
| | 10" | 0 | 733003.9123 | 0 | 0 |
| Large Meters Total | | 24 | - | 32,185,970 | 0.088 |
| All Meters Total | | 2,520 | - | 180,378,406 | 0.494 |
| Water Lost Through Non-registering (Frozen or Stopped) Meters Uncovered during Fiscal Year 2013 | | | | | |
| Small Meters | 5/8" | 1296 | 163 | 76,946,073 | 0.211 |
| Large Meters | 1" | 12 | 752 | 3,295,573 | 0.009 |
| | 1-1/2" | 1 | 1,785 | 651,431 | 0.002 |
| | 2" | 1 | 3,560 | 1,299,579 | 0.004 |
| | 3" | 2 | 7,651 | 5,585,326 | 0.015 |
| | 4" | 2 | 14,128 | 10,313,111 | 0.028 |
| | 6" | 2 | 36,100 | 26,353,006 | 0.072 |
| | 8" | 0 | 66,065 | 0 | 0.000 |
| Large Meters Total | | 20 | - | 47,498,025 | 0.130 |
| All Meters Total | | 1,316 | | 124,444,098 | 0.341 |
| Water Lost Through Under-registration of Large Meters - Fiscal Year 2013* | | | | | |
| Taken that 25% of large meter population under-registers by 15%. Precise flow dataloggings of over 150 large meter accounts since FY2007 confirm that many large customer meters are likely under-registering low flows. | | | | | |
| Meter Size | Typical Use per Size, gal/day | 15% Under-registration, gal/day | Ave. # of Accounts | # of Accounts Under-registering, taken as 25% except for 12" | Water Under-registered, 25% of accounts multiplied by the 15% error amount, gal/day |
| 1" | 752 | 113 | 5,445 | 1,361 | 153,631 |
| 1-1/2" | 1,785 | 268 | 2,045 | 511 | 136,851 |
| 2" | 3,560 | 534 | 2,621 | 655 | 349,930 |
| 3" | 7,651 | 1,148 | 1,314 | 328 | 376,866 |
| 4" | 14,128 | 2,119 | 917 | 229 | 485,811 |
| 6" | 36,100 | 5,415 | 297 | 74 | 401,951 |
| 8" | 66,065 | 9,910 | 62 | 15 | 152,774 |
| 10" | 270,561 | 40,584 | 36 | 9 | 360,184 |
| 12" | 121,961 | 18,294 | 1 | 1 | 18,294 |
| | | Totals | 12,736 | 3,185 | 2,436,292 |
| | | | | Gallons per year | 889,246,625 |
| | | | | mgd | 2.436 |
| *Under-registration of small meters is taken as a nominal 0.15% of small meter consumption since most of the small meter population was replaced with new meters as part of the AMR installation from 1997-1999. Random testing of 30 small meters in FY2005 confirmed high accuracy. | | | | | |

Fiscal Year 2013 Customer Meter Size Changes

Meter size changes historically occurred from customer requests; which were often motivated by customer desire to lower their monthly service charge by utilizing a smaller meter. Water regulation changes in 2009 require that a size change from 3-inch and larger to 2-inch and smaller requires a new service line with a ferrule connection to the water main. The water rate structure was modified on July 1, 2010 to incorporate separate stormwater charges into the bill. This removed the former stormwater charge from the monthly service charge, thereby reducing the service charge and making it much less attractive as a motivator to reduce meter size. Meter downsizings dropped from 216 in FY2009 to 33 in FY2010, likely because of these changes. Meter downsizings increased to 70 in FY2011, but declined to 38 in FY2012, with 26 in FY2013.

| FROM | | TO | | NUMBER | SIZE CHANGE |
|------|--------|------|------------|--------------------------|-------------|
| CODE | SIZE | CODE | SIZE | | |
| Q | 1 inch | R | 5/8 inch | 17 | Downsize |
| Q | 1 inch | P | 1-1/2 inch | 2 | Downsize |
| Q | 1 inch | X | 2 inch | 4 | Upsize |
| X | 2 inch | Q | 1 inch | 3 | Downsize |
| O | 3 inch | W | 4 inch | 1 | Upsize |
| W | 4 inch | O | 3 inch | 1 | Downsize |
| W | 4 inch | N | 6 inch | 2 | Upsize |
| N | 6 inch | O | 3 inch | 2 | Downsize |
| N | 6 inch | W | 4 inch | 1 | Downsize |
| | | | | Total Downsizings | 26 |
| | | | | Total Upsizings | 7 |
| | | | | Grand Total | 33 |

Meter type changes typically occur for a small number of meters sized 3-inch and larger. The primary types of meters used in these size ranges are turbine and compound meters serving commercial, industrial, institutional and large multi-unit residential buildings. Generally, where water consumption in a building has decreased over time, better meter accuracy can be achieved by conversion from a turbine meter to a compound meter.

Philadelphia Water Department

Estimated Leakage Flowrates Derived from the 2000/2001 Leakage Management Assessment Project

| Type of Leak or Break | Diameter | PWD Leakage Flow Rates @ 70 Psi | | | | PWD Leakage Flow Rates @65 Psi | | | |
|--------------------------------------|------------|---------------------------------|-------|----------|-------|--------------------------------|-------|----------|-------|
| | | Unreported | | Reported | | Unreported | | Reported | |
| | | gpm | mgd | gpm | mgd | gpm | mgd | gpm | mgd |
| Fire Hydrant | | 3.5 | 0.005 | 3.5 | 0.005 | 3.4 | 0.005 | 3.4 | 0.005 |
| Valve | | 6.9 | 0.010 | 6.9 | 0.010 | 6.6 | 0.010 | 6.6 | 0.010 |
| <u>Customer Service Lines</u> | | | | | | | | | |
| Active | 5/8" | 6.9 | 0.010 | 6.9 | 0.010 | 6.6 | 0.010 | 6.6 | 0.010 |
| Active | 3/4" | 6.9 | 0.010 | 6.9 | 0.010 | 6.6 | 0.010 | 6.6 | 0.010 |
| Active | 1" | 6.9 | 0.010 | 6.9 | 0.010 | 6.6 | 0.010 | 6.6 | 0.010 |
| Active | 2" to 4" | 13.9 | 0.020 | 13.9 | 0.020 | 13.4 | 0.019 | 13.4 | 0.019 |
| Abandoned or Vacant Building | 5/8" | 13.9 | 0.020 | 13.9 | 0.020 | 13.4 | 0.019 | 13.4 | 0.019 |
| Abandoned or Vacant Building | 1" | 13.9 | 0.020 | 13.9 | 0.020 | 13.4 | 0.019 | 13.4 | 0.019 |
| Abandoned or Vacant Building | 2" to 4" | 13.9 | 0.020 | 13.9 | 0.020 | 13.4 | 0.019 | 13.4 | 0.019 |
| <u>Water Mains</u> | | | | | | | | | |
| Joint Leak or Repair Band Leak | 6" | 10.4 | 0.015 | 10.4 | 0.015 | 10.0 | 0.014 | 10.0 | 0.014 |
| Joint Leak or Repair Band Leak | 8" | 17.3 | 0.025 | 17.3 | 0.025 | 16.7 | 0.024 | 16.7 | 0.024 |
| Joint Leak or Repair Band Leak | 10" to 48" | 27.8 | 0.040 | 27.8 | 0.040 | 26.8 | 0.039 | 26.8 | 0.039 |
| Round (circumferential) crack | 4" | 34.7 | 0.050 | 69.4 | 0.100 | 33.4 | 0.048 | 66.9 | 0.096 |
| Round (circumferential) crack | 6" | 55.5 | 0.080 | 111.1 | 0.160 | 53.5 | 0.077 | 107.1 | 0.154 |
| Round (circumferential) crack | 8" | 76.3 | 0.110 | 152.6 | 0.220 | 73.5 | 0.106 | 147.0 | 0.212 |
| Round (circumferential) crack | 10" | 93.8 | 0.135 | 187.6 | 0.270 | 90.4 | 0.130 | 180.8 | 0.260 |
| Round (circumferential) crack | 12" | 111.1 | 0.160 | 222.2 | 0.320 | 107.1 | 0.154 | 214.1 | 0.308 |
| Longitudinal crack or split bell | 6" | 69.4 | 0.100 | 138.9 | 0.200 | 66.9 | 0.096 | 133.8 | 0.193 |
| Longitudinal crack or split bell | 8" | 93.8 | 0.135 | 187.6 | 0.270 | 90.4 | 0.130 | 180.8 | 0.260 |
| Longitudinal crack or split bell | 10" | 111.1 | 0.160 | 222.2 | 0.320 | 107.1 | 0.154 | 214.1 | 0.308 |
| Longitudinal crack or split bell | 12" | 138.9 | 0.200 | 277.8 | 0.400 | 133.8 | 0.193 | 267.7 | 0.385 |

Note: Quantities do not include the effects of different pipe materials

International Leakage Management practices reference leakage rates at 70 Psi

Leakage rate at actual pressure $P_a = (\text{leakage rate @ 70 psi})[(P_a/70)^{0.5}]$ (AWWA M36 3rd Ed., Eq 5-12)

Average system pressure was taken as 55 psi for all audits thru FY2012, but PWD's hydraulic model found average was 65 psi in FY 2013.

Unreported Leaks - discovered during leak survey work

Reported Leaks - visible leaks; originated by complaint

**ESTIMATE OF WATER LOSSES DUE TO REPORTED WATER MAIN BREAKS AND TRANSMISSION LEAKS
FISCAL YEAR 2013**

| MAIN BREAK OCCURRENCES | | | WATER LOSS - AWARENESS, LOCATION & RESPONSE ASSESSMENTS | | | | | |
|-------------------------|------------|------------------|---|--------------------------------|---------------------------|---|---|----------------------|
| WATER MAIN SIZE (In) | BREAK TYPE | NUMBER OF BREAKS | AWARENESS PERIOD (24 Hr) | | | LOCATION PERIOD (.25 Hr) | RESPONSE PERIOD (3 Hr) | |
| | | | PRE-BREAK LOSS RATE (gal/day) | LOSS UNTIL AWARENESS (gallons) | BREAK LOSS RATE (gal/day) | LOSS DURING LOCATION ACTIVITY (gallons) | LOSS DURING RESPONSE ACTIVITIES (gallons) | TOTAL LOSS (gallons) |
| 3 | Joint/Hole | 0 | 1,800 | 0 | 18,000 | 0 | 0 | 0 |
| 3 | Circ. | 4 | 1,800 | 7,200 | 18,000 | 750 | 9,000 | 16,950 |
| 3 | Long/SB/BO | 3 | 1,800 | 5,400 | 18,000 | 563 | 6,750 | 12,713 |
| 4 | Joint/Hole | 5 | 1,800 | 9,000 | 18,000 | 938 | 11,250 | 21,188 |
| 4 | Circ. | 4 | 8,900 | 35,600 | 89,000 | 3,708 | 44,500 | 83,808 |
| 4 | Long/SB/BO | 1 | 8,900 | 8,900 | 89,000 | 927 | 11,125 | 20,952 |
| 6 | Joint/Hole | 37 | 1,300 | 48,100 | 13,000 | 5,010 | 60,125 | 113,235 |
| 6 | Circ. | 295 | 14,200 | 4,189,000 | 142,000 | 436,354 | 5,236,250 | 9,861,604 |
| 6 | Long/SB/BO | 150 | 17,700 | 2,655,000 | 177,000 | 276,563 | 3,318,750 | 6,250,313 |
| 8 | Joint/Hole | 12 | 2,200 | 26,400 | 22,000 | 2,750 | 33,000 | 62,150 |
| 8 | Circ. | 70 | 19,500 | 1,365,000 | 195,000 | 142,188 | 1,706,250 | 3,213,438 |
| 8 | Long/SB/BO | 100 | 23,900 | 2,390,000 | 239,000 | 248,958 | 2,987,500 | 5,626,458 |
| 10 | Joint/Hole | 5 | 3,500 | 17,500 | 35,000 | 1,823 | 21,875 | 41,198 |
| 10 | Circ. | 9 | 23,900 | 215,100 | 239,000 | 22,406 | 268,875 | 506,381 |
| 10 | Long/SB/BO | 8 | 28,300 | 226,400 | 283,000 | 23,583 | 283,000 | 532,983 |
| 12 | Joint/Hole | 10 | 3,500 | 35,000 | 35,000 | 3,646 | 43,750 | 82,396 |
| 12 | Circ. | 13 | 28,300 | 367,900 | 283,000 | 38,323 | 459,875 | 866,098 |
| 12 | Long/SB/BO | 28 | 35,400 | 991,200 | 354,000 | 103,250 | 1,239,000 | 2,333,450 |
| Dist Main Total | | 754 | 12,592,700 | | | 1,311,740 | 15,740,875 | 29,645,315 |
| | | | | | | | Average, MGD | 0.081 |
| 16 | Joint/Hole | 1 | 3500 | 3,500 | 35,000 | 365 | 4,375 | 8,240 |
| 16 | Circ. | 0 | 33000 | 0 | 330,000 | 0 | 0 | 0 |
| 16 | Long/SB/BO | 2 | 45000 | 90,000 | 450,000 | 9,375 | 112,500 | 211,875 |
| 20 | Joint/Hole | 2 | 3500 | 7,000 | 35,000 | 729 | 8,750 | 16,479 |
| 20 | Circ. | 0 | 39000 | 0 | 390,000 | 0 | 0 | 0 |
| 20 | Long/SB/BO | 0 | 49000 | 0 | 490,000 | 0 | 0 | 0 |
| 24 | Joint/Hole | 1 | 3500 | 3,500 | 35,000 | 365 | 4,375 | 8,240 |
| 24 | Circ. | 0 | 46000 | 0 | 460,000 | 0 | 0 | 0 |
| 24 | Long/SB/BO | 1 | 54000 | 54,000 | 540,000 | 5,625 | 67,500 | 127,125 |
| 30 | Joint/Hole | 3 | 3500 | 10,500 | 35,000 | 1,094 | 13,125 | 24,719 |
| 30 | Circ. | 0 | 54000 | 0 | 540,000 | 0 | 0 | 0 |
| 30 | Long/SB/BO | 0 | 61000 | 0 | 610,000 | 0 | 0 | 0 |
| 36 | Joint/Hole | 3 | 3500 | 10,500 | 35,000 | 1,094 | 13,125 | 24,719 |
| 36 | Circ. | 0 | 54000 | 0 | 630,000 | 0 | 0 | 0 |
| 36 | Long/SB/BO | 0 | 61000 | 0 | 730,000 | 0 | 0 | 0 |
| 42 | Joint/Hole | 0 | 3500 | 0 | 35,000 | 0 | 0 | 0 |
| 48 | Joint/Hole | 2 | 3500 | 7,000 | 35,000 | 729 | 8,750 | 16,479 |
| 48 | Circ. | 0 | 54000 | 0 | 750,000 | 0 | 0 | 0 |
| 48 | Long/SB/BO | 1 | 61000 | 61,000 | 1,000,000 | 10,417 | 125,000 | 196,417 |
| 54 | Joint/Hole | 1 | 3500 | 3,500 | 0 | 0 | 0 | 3,500 |
| 60 | Joint/Hole | 0 | 3500 | 0 | 0 | 0 | 0 | 0 |
| Transmission Main Total | | 17 | 250,500 | | | 29,792 | 357,500 | 637,792 |
| | | | | | | | Average, MGD | 0.002 |
| | TOTAL | 771 | 12,843,200 | | | 1,341,531 | 16,098,375 | 30,283,106 |
| | | | | | | | Average, MGD | 0.083 |

| TRANSMISSION MAIN REPORTED LEAK OCCURRENCES | | | WATER LOSS - AWARENESS, LOCATION & RESPONSE ASSESSMENTS | | | | | |
|---|------------|-----------------|---|--------------------------------|--------------------------|---|---|----------------------|
| WATER MAIN SIZE (In) | LEAK TYPE | NUMBER OF LEAKS | AWARENESS PERIOD (547 Days) | | | LOCATION PERIOD (.25 Hr) | RESPONSE PERIOD (3 Hr) | |
| | | | LEAK LOSS RATE (gal/day) | LOSS UNTIL AWARENESS (gallons) | LEAK LOSS RATE (gal/day) | LOSS DURING LOCATION ACTIVITY (gallons) | LOSS DURING RESPONSE ACTIVITIES (gallons) | TOTAL LOSS (gallons) |
| 16 | Joint/Hole | 3 | 3,500 | 5,743,500 | 3,500 | 109 | 1,313 | 5,744,922 |
| 16 | Circ. | 0 | 33,000 | 0 | 33,000 | 0 | 0 | 0 |
| 16 | Long/SB/BO | 2 | 45,000 | 49,230,000 | 45,000 | 938 | 11,250 | 49,242,188 |

ESTIMATE OF WATER LOSSES DUE TO REPORTED WATER MAIN BREAKS AND TRANSMISSION LEAKS

FISCAL YEAR 2013

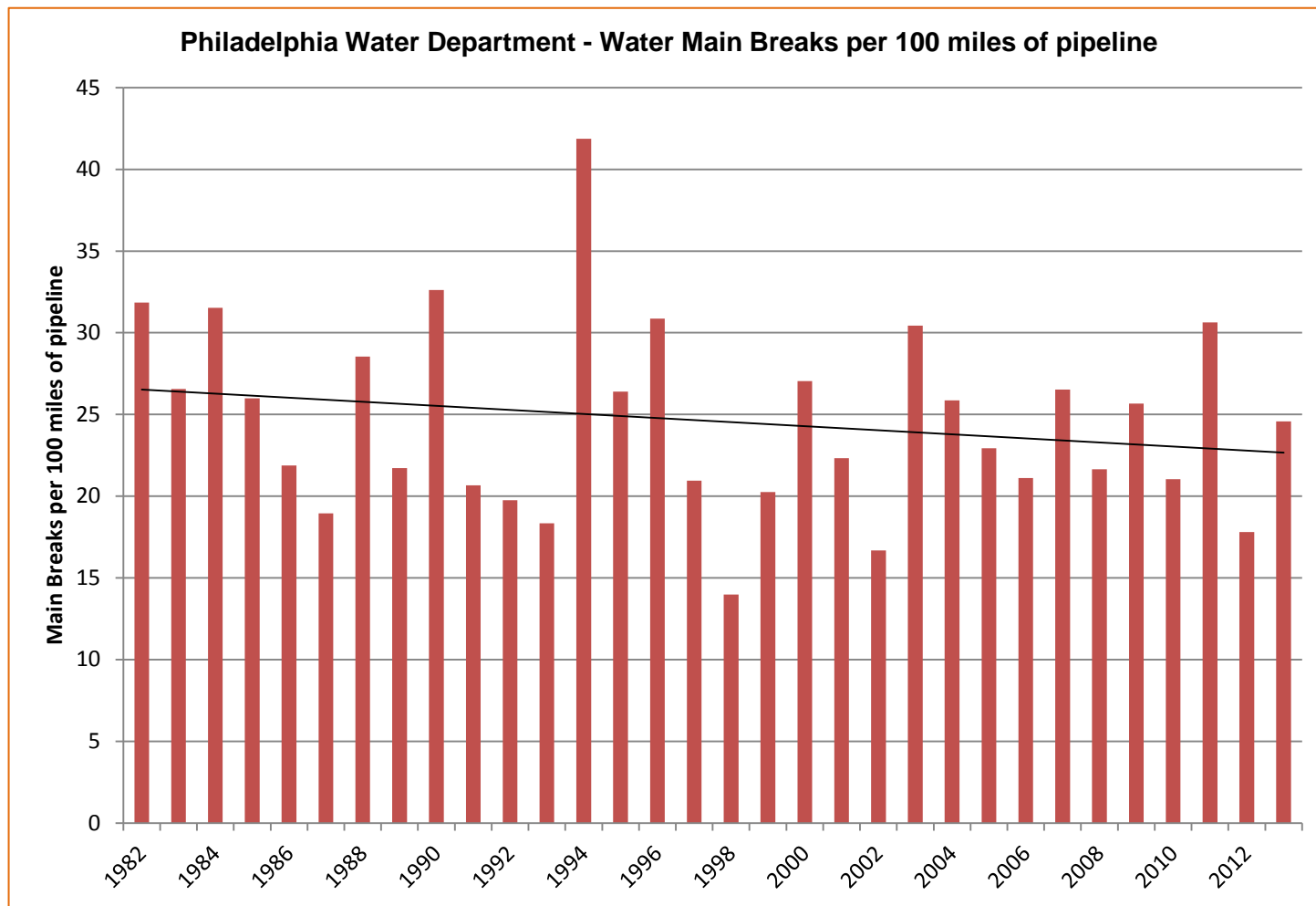
| | | | | | | | | |
|--------------------------|------------|----|-------------|------------|--------|-------|------------------------|----------------------|
| 20 | Joint/Hole | 2 | 3,500 | 3,829,000 | 3,500 | 73 | 875 | 3,829,948 |
| 20 | Circ. | 0 | 39,000 | 0 | 39,000 | 0 | 0 | 0 |
| 20 | Long/SB/BO | 0 | 49,000 | 0 | 49,000 | 0 | 0 | 0 |
| 24 | Joint/Hole | 0 | 3,500 | 0 | 3,500 | 0 | 0 | 0 |
| 24 | Circ. | 0 | 46,000 | 0 | 46,000 | 0 | 0 | 0 |
| 24 | Long/SB/BO | 3 | 54,000 | 88,614,000 | 54,000 | 1,688 | 20,250 | 88,635,938 |
| 30 | Joint/Hole | 4 | 3,500 | 7,658,000 | 3,500 | 146 | 1,750 | 7,659,896 |
| 30 | Circ. | 0 | 54,000 | 0 | 54,000 | 0 | 0 | 0 |
| 30 | Long/SB/BO | 2 | 61,000 | 66,734,000 | 61,000 | 1,271 | 15,250 | 66,750,521 |
| 36 | Joint/Hole | 2 | 3,500 | 3,829,000 | 3,500 | 73 | 875 | 3,829,948 |
| 36 | Circ. | 0 | 54,000 | 0 | 54,000 | 0 | 0 | 0 |
| 36 | Long/SB/BO | 0 | 61,000 | 0 | 61,000 | 0 | 0 | 0 |
| 42 | Joint/Hole | 0 | 3,500 | 0 | 3,500 | 0 | 0 | 0 |
| 48 | Joint/Hole | 2 | 3,500 | 3,829,000 | 3,500 | 73 | 875 | 3,829,948 |
| 48 | Circ. | 0 | 54,000 | 0 | 54,000 | 0 | 0 | 0 |
| 48 | Long/SB/BO | 1 | 61,000 | 33,367,000 | 61,000 | 635 | 7,625 | 33,375,260 |
| 54 | Joint/Hole | 1 | 3,500 | 1,914,500 | 3,500 | 36 | 438 | 1,914,974 |
| 54 | Long/SB/BO | 1 | 61,000 | 33,367,000 | 61,000 | 635 | 7,625 | 33,375,260 |
| 60 | Joint/Hole | 1 | 3,500 | 1,914,500 | 3,500 | 36 | 438 | 1,914,974 |
| 72 | Joint/Hole | 0 | 3,500 | 0 | 3,500 | 0 | 0 | 0 |
| Transmission Leaks Total | | 24 | 300,029,500 | | 5,714 | | 68,563 Average, MGD | 300,103,776 0.822 |

Fiscal Year 2013 Reported Transmission Main Leak Repairs (16-inch diameter & Larger)

| Job Number | Completed | Complaint Location | Repair Action | Size | Defect |
|------------|------------|---|------------------------|------|------------|
| 1 | 7/6/2012 | CHRISTOPHER COLUMBUS BLVD @ OREGON | Recaulked Joint | 16 | Joint/Hole |
| 2 | 7/30/2012 | SNYDER AVE & S MILDRED ST | Recaulked Joint | 30 | Joint/Hole |
| 3 | 8/12/2012 | RICHMOND & DYOTT ST | installed Pipe Section | 24 | Long/SB/BO |
| 4 | 8/15/2012 | DELAWARE & RICHMOND | installed Pipe Section | 24 | Long/SB/BO |
| 5 | 9/14/2012 | 21ST & BAINBRIDGE | installed Pipe Section | 48 | Long/SB/BO |
| 6 | 9/25/2012 | Columbus Blvd. & Oregon Ave | Recaulked Joint | 16 | Joint/Hole |
| 7 | 11/6/2012 | 1500 CALLOWHILL ST | Welded Main | 54 | Joint/Hole |
| 8 | 11/20/2012 | 11800 ACADEMY RD | Recaulked Joint | 20 | Joint/Hole |
| 9 | 11/27/2012 | 38th & S. Brown | Recaulked Joint | 30 | Joint/Hole |
| 10 | 12/18/2012 | FRONT & TIOGA ST | Recaulked Joint | 36 | Joint/Hole |
| 11 | 12/20/2012 | OREGON AVE & S CHRISTOPHER COLUMBUS BLV | Recaulked Joint | 16 | Joint/Hole |
| 12 | 12/28/2012 | 38TH @ BROWN | Recaulked Joint | 30 | Joint/Hole |
| 13 | 1/4/2013 | 21ST @ LUDLOW | Recaulked Joint | 48 | Joint/Hole |
| 14 | 1/31/2013 | 600 W HARTWELL LN | installed Pipe Section | 30 | Long/SB/BO |
| 15 | 2/1/2013 | 21ST @ NAUDAIN | Recaulked Joint | 48 | Joint/Hole |
| 16 | 2/1/2013 | STENTON AVE & MURDOCH RD | installed Pipe Section | 16 | Long/SB/BO |
| 17 | 2/6/2013 | 3946 GRANT AVE | installed Pipe Section | 24 | Long/SB/BO |
| 18 | 3/8/2013 | 05TH & GODFREY | Recaulked Joint | 36 | Joint/Hole |
| 19 | 3/18/2013 | 52ND STREET @ WHITBY AVENUE | installed Pipe Section | 30 | Long/SB/BO |
| 20 | 4/25/2013 | 921 E WADSWORTH AV | installed Pipe Section | 16 | Long/SB/BO |
| 21 | 4/28/2013 | 800 N MYRTLEWOOD ST | installed Pipe Section | 54 | Long/SB/BO |
| 22 | 5/14/2013 | 4700 PENN STREET | Recaulked Joint | 20 | Joint/Hole |
| 23 | 6/26/2013 | 04TH @ NORRIS | Recaulked Joint | 30 | Joint/Hole |

Fiscal Year 2013 Unreported Transmission Main Leak Repairs (16-inch diameter & Larger) Hidden Leaks Identified via Sahara Technology (service by Pure Technologies)

| Job Number | Completed | Location | Leak Size | Repair Action | Size | Leakage Quantity |
|--|------------|---|------------|---|-------|------------------|
| The below leak was identified by Sahara on 10/8/2007 and the repair was deferred due to access difficulties. This event has been presumed leaking since that time. However, maintenance records reviewed in FY2013 found that a work order dated 7/16/2011 confirmed that no leak exists at this location. | | | | | | |
| 1 | | 21st & Winter Sts (West main) | Very Small | No leak existed | 48 | 0 |
| The below leaks were identified in FY2011 or FY2012, and repaired in FY2013 (volume listed is the leakage loss for days occurring in FY2012 only) | | | | | | |
| 1 | 4/11/2013 | Hartwell Lane, east of Wissahickon Creek in parkland; leak at a blow-off | Very Small | additional valve installed to halt | 30 | 4.56 |
| 2 | 6/30/2013 | 5 ft East of the west curb line of 3rd St. and 16 ft. north of the north curbline of South St. | Medium | Leak was on a 1-inch abandoned lead | 48 | 0.34 |
| 3 | 1/3/2013 | 9 ft. west of the east curb line of 21st St., 13 ft. south of the south curbline of Ludlow St. | Medium | Recaulked leaking lead joint | 48 | 1.04 |
| 4 | 1/30/2013 | 8 ft. west of the east curb line of 21st St., 18 ft. south of the south curb line of Naudain St. | Small | Recaulked leaking lead joint | 48 | 0.72 |
| 5 | 11/27/2012 | 10 ft. west of the east curb line of 38th St., 28 ft. south of the south curb line of Brown St. | Small | Recaulked leaking lead joint | 30 | 0.28 |
| 6 | 12/28/2012 | 4 ft. west of the east curb line of 38th St., 6 ft. north of the north curb line of Brown St. | Small | Recaulked leaking lead joint | 30 | 0.55 |
| 7 | 11/24/2012 | 4 ft. west of the east curb line of 13th St., 40 ft. north of the north curb line of Somerset St. | Medium | Installed repair band on leaking | 48 | 0.55 |
| 8 | 9/21/2012 | 20 ft. west of the east curb line of Delaware Ave., 1,137 ft. south of the south curb line of Oregon Ave. | Small | Recaulked leaking lead joint | 16 | 0.24 |
| 9 | 9/7/2012 | 20 ft. west of the east curb line of Delaware Ave., 919 ft. south of the south curb line of Oregon Ave. | Medium | Recaulked leaking lead joint | 16 | 1.15 |
| 10 | 7/30/2012 | 11 ft. south of the north curb line of Snyder Ave., 1 ft west of the east curb line of Mildred St. | Small | Recaulked leaking lead joint | 30 | 0.24 |
| 11 | 9/18/2012 | 6 ft. north of the south curb line of Snyder Ave., 54 ft. west of the west curb line of Juniper St. | Small | Leak was on 6-inch Tee fitting off of 30- | 30 | 0.65 |
| 12 | 7/17/2012 | 7 ft. west of the east curb line of Mascher St., 29 ft. south of south curb line of the Gurney St. | Small | Recaulked leaking lead joint | 48 | 0.17 |
| 13 | 8/3/2014 | 9 ft. north of the south curb line of Clearfield St., 22 west of the west curb line of Hurley St. | Small | inch service connection adjacent | 48 | 0.34 |
| 14 | 7/11/2012 | 8 ft. south of the north curb line of Clearfield St., 4 ft. east of the west curb line of Reach St. | Medium | inch round connection piping | 48 | 0.22 |
| Sahara Leak Repairs Total | | 14 | | | Total | 11.05 |



| Philadelphia Water Department - Reported Water Main Breaks by Month | | | | | | | | | | | | | | |
|---|------|------|------|------|------|-------|-------|-------|------|------|------|------|------|--------|
| | Jul | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Avg. | Total |
| 1965 | 49 | 37 | 29 | 35 | 41 | 96 | 189 | 119 | 43 | 43 | 36 | 33 | 63 | 750 |
| 1966 | 29 | 29 | 29 | 33 | 53 | 78 | 174 | 188 | 65 | 43 | 27 | 40 | 66 | 788 |
| 1967 | 49 | 33 | 34 | 29 | 35 | 123 | 127 | 64 | 58 | 40 | 23 | 64 | 57 | 679 |
| 1968 | 31 | 44 | 22 | 41 | 59 | 98 | 338 | 139 | 68 | 36 | 36 | 46 | 80 | 958 |
| 1969 | 58 | 54 | 39 | 45 | 68 | 189 | 170 | 62 | 48 | 53 | 34 | 51 | 73 | 871 |
| 1970 | 49 | 33 | 42 | 36 | 28 | 174 | 287 | 163 | 59 | 48 | 71 | 42 | 86 | 1,032 |
| 1971 | 61 | 36 | 27 | 44 | 64 | 88 | 168 | 146 | 56 | 44 | 40 | 54 | 69 | 828 |
| 1972 | 49 | 49 | 30 | 53 | 63 | 87 | 71 | 112 | 51 | 33 | 33 | 26 | 55 | 657 |
| 1973 | 55 | 41 | 29 | 46 | 73 | 95 | 165 | 79 | 36 | 28 | 32 | 71 | 63 | 750 |
| 1974 | 51 | 52 | 56 | 35 | 57 | 105 | 120 | 73 | 36 | 34 | 33 | 46 | 58 | 698 |
| 1975 | 59 | 43 | 44 | 62 | 72 | 81 | 93 | 91 | 42 | 49 | 50 | 77 | 64 | 763 |
| 1976 | 47 | 43 | 30 | 47 | 49 | 135 | 289 | 106 | 81 | 41 | 27 | 69 | 80 | 964 |
| 1977 | 26 | 44 | 34 | 45 | 105 | 154 | 439 | 435 | 149 | 69 | 64 | 68 | 136 | 1,632 |
| 1978 | 55 | 57 | 37 | 68 | 83 | 211 | 169 | 181 | 127 | 36 | 65 | 69 | 97 | 1,158 |
| 1979 | 42 | 56 | 40 | 55 | 58 | 95 | 164 | 184 | 172 | 87 | 71 | 46 | 89 | 1,070 |
| 1980 | 55 | 62 | 49 | 63 | 43 | 98 | 85 | 148 | 74 | 42 | 37 | 46 | 67 | 802 |
| 1981 | 59 | 54 | 69 | 51 | 61 | 180 | 273 | 160 | 77 | 33 | 54 | 59 | 94 | 1,130 |
| 1982 | 67 | 36 | 37 | 35 | 63 | 189 | 154 | 178 | 83 | 75 | 46 | 37 | 83 | 1,000 |
| 1983 | 66 | 65 | 58 | 53 | 64 | 86 | 149 | 84 | 50 | 52 | 39 | 68 | 70 | 834 |
| 1984 | 78 | 55 | 35 | 67 | 56 | 150 | 259 | 109 | 49 | 27 | 49 | 56 | 83 | 990 |
| 1985 | 45 | 33 | 33 | 39 | 63 | 66 | 221 | 153 | 56 | 33 | 27 | 47 | 68 | 816 |
| 1986 | 40 | 39 | 29 | 50 | 69 | 139 | 147 | 64 | 43 | 31 | 14 | 22 | 57 | 687 |
| 1987 | 22 | 38 | 37 | 36 | 55 | 77 | 92 | 106 | 45 | 26 | 24 | 37 | 50 | 595 |
| 1988 | 39 | 40 | 41 | 46 | 57 | 84 | 253 | 121 | 67 | 40 | 43 | 65 | 75 | 896 |
| 1989 | 75 | 77 | 18 | 56 | 37 | 111 | 98 | 50 | 37 | 33 | 35 | 55 | 57 | 682 |
| 1990 | 43 | 44 | 38 | 53 | 74 | 245 | 227 | 90 | 85 | 43 | 31 | 51 | 85 | 1,024 |
| 1991 | 51 | 50 | 32 | 29 | 79 | 61 | 134 | 44 | 35 | 39 | 51 | 44 | 54 | 649 |
| 1992 | 35 | 37 | 25 | 42 | 46 | 87 | 139 | 84 | 29 | 34 | 28 | 34 | 52 | 620 |
| 1993 | 51 | 16 | 15 | 24 | 44 | 70 | 74 | 86 | 62 | 47 | 34 | 54 | 48 | 577 |
| 1994 | 58 | 37 | 32 | 43 | 49 | 112 | 419 | 229 | 117 | 61 | 76 | 84 | 110 | 1,317 |
| 1995 | 65 | 65 | 30 | 50 | 57 | 94 | 134 | 143 | 75 | 38 | 30 | 48 | 69 | 829 |
| 1996 | 70 | 66 | 47 | 30 | 75 | 199 | 218 | 96 | 48 | 41 | 37 | 42 | 81 | 969 |
| 1997 | 41 | 35 | 29 | 42 | 82 | 61 | 180 | 46 | 33 | 39 | 26 | 44 | 55 | 658 |
| 1998 | 40 | 18 | 22 | 27 | 54 | 66 | 50 | 26 | 37 | 30 | 31 | 38 | 37 | 439 |
| 1999 | 46 | 33 | 32 | 27 | 48 | 66 | 226 | 38 | 39 | 32 | 22 | 27 | 53 | 636 |
| 2000 | 55 | 38 | 27 | 32 | 49 | 95 | 202 | 191 | 64 | 22 | 47 | 27 | 71 | 849 |
| 2001 | 32 | 25 | 23 | 33 | 61 | 165 | 178 | 43 | 47 | 39 | 30 | 30 | 59 | 706 |
| 2002 | 54 | 43 | 30 | 41 | 52 | 36 | 128 | 38 | 31 | 24 | 13 | 35 | 44 | 525 |
| 2003 | 50 | 50 | 19 | 47 | 50 | 160 | 217 | 172 | 84 | 42 | 26 | 39 | 80 | 956 |
| 2004 | 50 | 27 | 27 | 41 | 35 | 91 | 200 | 178 | 62 | 36 | 34 | 36 | 68 | 817 |
| 2005 | 33 | 26 | 32 | 39 | 54 | 107 | 129 | 119 | 62 | 36 | 41 | 42 | 60 | 720 |
| 2006 | 60 | 61 | 40 | 47 | 54 | 127 | 67 | 47 | 46 | 28 | 46 | 37 | 55 | 660 |
| 2007 | 32 | 54 | 37 | 35 | 67 | 81 | 90 | 231 | 58 | 49 | 49 | 49 | 69 | 832 |
| 2008 | 44 | 45 | 29 | 39 | 107 | 99 | 90 | 60 | 39 | 40 | 31 | 56 | 57 | 679 |
| 2009 | 58 | 29 | 28 | 48 | 71 | 112 | 223 | 107 | 46 | 31 | 29 | 26 | 67 | 808 |
| 2010 | 45 | 33 | 33 | 40 | 37 | 99 | 138 | 75 | 50 | 29 | 33 | 50 | 55 | 662 |
| 2011 | 56 | 43 | 41 | 51 | 53 | 198 | 234 | 90 | 60 | 44 | 39 | 54 | 80.3 | 963 |
| 2012 | 77 | 43 | 22 | 36 | 55 | 75 | 92 | 46 | 25 | 20 | 32 | 36 | 47 | 559 |
| 2013 | 54 | 42 | 24 | 36 | 74 | 51 | 198 | 129 | 64 | 32 | 31 | 36 | 64.3 | 771 |
| Min | 22 | 16 | 15 | 24 | 28 | 36 | 50 | 26 | 25 | 20 | 13 | 22 | 37 | 439 |
| Max | 78 | 77 | 69 | 68 | 107 | 245 | 439 | 435 | 172 | 87 | 76 | 84 | 136 | 1,632 |
| Avg. | 50 | 43 | 34 | 43 | 59 | 113 | 177 | 117 | 61 | 40 | 38 | 47 | 68 | 822 |
| % of Total | 6.1% | 5.2% | 4.1% | 5.2% | 7.2% | 13.8% | 21.6% | 14.2% | 7.4% | 4.8% | 4.6% | 5.7% | | 100.0% |

CITY OF PHILADELPHIA - WATER DEPARTMENT

WATER MAIN BREAKS & CAPITAL PROGRAM MAIN REPLACEMENT DATA

| Fiscal Year | Water Main Breaks* | | | Miles of Pipeline Replaced | | |
|----------------|--------------------|-----------|----------|----------------------------|--------|---------|
| | Total | Leadite** | %Leadite | Funding*** | Total | Leadite |
| 1980 | 861 | 102 | 11.8% | \$6,557,000 | 13.14 | 0.41 |
| 1981 | 1,086 | 101 | 9.3% | \$6,625,000 | 13.83 | 0.00 |
| 1982 | 932 | 108 | 11.6% | \$7,243,000 | 12.06 | 0.61 |
| 1983 | 778 | 146 | 18.8% | \$9,945,000 | 9.00 | 0.61 |
| 1984 | 798 | 105 | 13.2% | \$6,500,000 | 18.89 | 0.65 |
| 1985 | 816 | 115 | 14.1% | \$9,975,000 | 16.09 | 1.34 |
| 1986 | 685 | 121 | 17.7% | \$7,100,000 | 13.97 | 2.02 |
| 1987 | 590 | 119 | 20.2% | \$8,400,000 | 14.22 | 2.22 |
| 1988 | 892 | 105 | 11.8% | \$13,900,000 | 17.58 | 4.59 |
| 1989 | 680 | 90 | 13.2% | \$13,700,000 | 20.24 | 4.13 |
| 1990 | 1,018 | 76 | 7.5% | \$13,000,000 | 18.67 | 6.25 |
| 1991 | 648 | 62 | 9.6% | \$3,800,000 | 4.74 | 0.00 |
| 1992 | 617 | 59 | 9.6% | \$15,600,000 | 18.07 | 3.86 |
| 1993 | 577 | 60 | 10.4% | \$18,200,000 | 16.88 | 1.06 |
| 1994 | 1,316 | 105 | 8.0% | \$14,800,000 | 14.26 | 3.44 |
| 1995 | 829 | 74 | 8.9% | \$11,800,000 | 13.99 | 2.23 |
| 1996 | 968 | 66 | 6.8% | \$20,000,000 | 22.10 | 4.43 |
| 1997 | 661 | 50 | 7.6% | \$21,000,000 | 22.21 | 4.65 |
| 1998 | 440 | 38 | 8.6% | \$21,990,000 | 26.23 | 4.32 |
| 1999 | 616 | 55 | 8.9% | \$22,200,000 | 25.07 | 3.04 |
| 2000 | 848 | 95 | 11.2% | \$23,150,000 | 25.60 | 3.25 |
| 2001 | 701 | 59 | 8.4% | \$16,500,000 | 20.10 | 3.30 |
| 2002 | 521 | 69 | 13.2% | \$20,850,000 | 22.00 | 2.60 |
| 2003 | 955 | 88 | 9.2% | \$24,100,000 | 21.90 | 1.73 |
| 2004 | 802 | 79 | 9.9% | \$22,300,000 | 18.80 | 1.00 |
| 2005 | 716 | 67 | 9.4% | \$9,250,000 | 7.80 | 0.67 |
| 2006 | 660 | 77 | 11.7% | \$16,980,000 | 14.30 | 2.80 |
| 2007 | 816 | 79 | 9.7% | \$16,610,000 | 14.30 | 1.00 |
| 2008 | 682 | 78 | 11.4% | \$22,400,000 | 17.30 | 1.94 |
| 2009 | 806 | 79 | 9.8% | \$11,700,000 | 10.00 | 0.60 |
| 2010 | 660 | 75 | 11.4% | \$20,800,000 | 16.00 | 0.90 |
| 2011 | 965 | 98 | 10.2% | \$14,700,000 | 11.00 | 0.88 |
| 2012 | 559 | 60 | 10.7% | \$22,500,000 | 16.10 | 2.40 |
| 2013 | 771 | 62 | 8.0% | \$22,600,000 | 16.20 | 1.64 |
| Total | 26,270 | 2,822 | | | 562.64 | 74.57 |
| Ave. | 773 | 83 | 10.7% | | 16.55 | 2.19 |
| Max. | 1,316 | 146 | 20.2% | | 26.23 | 6.25 |

*Years 1980-1984 are calendar year main break data

** Roughly 300 miles of rupture-prone leadite joint pipeline were installed from 1946-1955

*** Funding figures include budgeted amounts for 1980-1985; expenditures for all other years

Philadelphia Water Department - Leak Detection and Repair Program

Quantity of Leakage Abated through the Leak Detection Program

All quantities in million gallons per day, mgd

| Fiscal Year | Crews Assisted by ADS - Pitometer Pipeline Services | | | | Leak Detection Crews | | | Grand Total | Leak Survey Mileage* |
|-------------|---|---------------------|--------------------|--------|----------------------|---------------------|--------|-------------|----------------------|
| | Survey (Unreported) | Referral (Reported) | Sewer Infiltration | Total | Survey (Unreported) | Referral (Reported) | Total | | |
| 1980 | 2.435 | 2.098 | 0 | 4.533 | | | 0 | 4.533 | |
| 1981 | 1.729 | 2.541 | 0.908 | 5.178 | | | 0 | 5.178 | |
| 1982 | 5.628 | 2.414 | 5.728 | 13.77 | | | 0 | 13.77 | |
| 1983 | 16.047 | 1.922 | 0.013 | 17.982 | 0.833 | 0.585 | 1.418 | 19.4 | |
| 1984 | 4.474 | 2.241 | 0 | 6.715 | 2.59 | 0.51 | 3.1 | 9.815 | |
| 1985 | 8.54 | 3.954 | 0 | 12.494 | 1.86 | 0.64 | 2.5 | 14.994 | |
| 1986 | 7.393 | 6.639 | 0 | 14.032 | 6.421 | 1.684 | 8.105 | 22.137 | |
| 1987 | 3.013 | 5.01 | 0 | 8.023 | 5.03 | 0.47 | 5.5 | 13.523 | |
| 1988 | 6.123 | 8.137 | 0 | 14.26 | 4.345 | 1.665 | 6.01 | 20.27 | |
| 1989 | 9.232 | 4.012 | 0 | 13.244 | 5.66 | 8.245 | 13.905 | 27.149 | 1,240 |
| 1990 | 3.935 | 2.865 | 0 | 6.8 | 7.835 | 9.115 | 16.95 | 23.75 | 1,204 |
| 1991 | 5.594 | 1.338 | 0 | 6.932 | 10.42 | 12.705 | 23.125 | 30.057 | 1,106 |
| 1992 | 4.614 | 1.53 | 0 | 6.144 | 6.27 | 13.705 | 19.975 | 26.119 | 977 |
| 1993 | 3.883 | 1.333 | 0 | 5.216 | 7.56 | 10.91 | 18.47 | 23.686 | 1,003 |
| 1994 | 1.643 | 2.363 | 0 | 4.006 | 4.93 | 14.146 | 19.076 | 23.082 | 616 |
| 1995 | 1.02 | 2.236 | 0 | 3.256 | 13.93 | 24.96 | 38.89 | 42.146 | 1,126 |
| 1996 | 1.233 | 1.082 | 0 | 2.315 | 9.52 | 9.605 | 19.125 | 21.44 | 1,146 |
| 1997 | 1.371 | 1.983 | 0 | 3.354 | 4.71 | 5.135 | 9.845 | 13.199 | 1,402 |
| 1998 | 0.912 | 0.812 | 0 | 1.724 | 3.68 | 7.295 | 10.975 | 12.699 | 1,072 |
| 1999 | 1.07 | 0 | 0 | 1.07 | 3.145 | 16.535 | 19.68 | 20.75 | 1,396 |
| 2000 | 0.04 | 0 | 0 | 0.04 | 6.075 | 19.35 | 25.425 | 25.465 | 1,371 |
| 2001 | 0 | 0 | 0 | 0 | 9.175 | 17.945 | 27.12 | 27.12 | 1,690 |
| 2002 | 0 | 0 | 0 | 0 | 4.616 | 23.055 | 27.671 | 27.671 | 1,313 |
| 2003 | 0 | 0 | 0 | 0 | 6.023 | 32.413 | 38.436 | 38.436 | 1,421 |
| 2004 | 0 | 0 | 0 | 0 | 8.167 | 27.766 | 35.933 | 35.933 | 1,160 |
| 2005 | 0 | 0 | 0 | 0 | 10.913 | 25.171 | 36.084 | 36.084 | 1,278 |
| 2006 | 0 | 0 | 0 | 0 | 5.031 | 24.121 | 29.152 | 29.152 | 1,113 |
| 2007 | 0 | 0 | 0 | 0 | 2.011 | 25.653 | 27.664 | 27.664 | 1,024 |
| 2008 | 0 | 0 | 0 | 0 | 2.414 | 33.654 | 36.068 | 36.068 | 1,113 |
| 2009 | 0 | 0 | 0 | 0 | 1.592 | 29.793 | 31.385 | 31.385 | 953 |
| 2010 | 0 | 0 | 0 | 0 | 0.782 | 27.725 | 28.507 | 28.507 | 1,133 |
| 2011 | 0 | 0 | 0 | 0 | 3.251 | 33.118 | 36.369 | 36.369 | 995 |
| 2012 | 0 | 0 | 0 | 0 | 4.342 | 21.847 | 26.189 | 26.189 | 1,137 |
| 2013 | 0 | 0 | 0 | 0 | 4.866 | 15.596 | 20.462 | 20.462 | 962 |

Average 1,158

*PWD's water distribution system includes 3,028 miles of pipeline

Average time to survey entire distribution system 2.61 years

| PROACTIVE LEAKAGE SURVEY INVESTIGATIONS | | | | | | | |
|---|----------|------------------------|-------------------------|-------------|---------------|--------|-------|
| PIPELINE MILEAGE & NUMBER OF UNREPORTED (SURVEY) LEAKS REPAIRED** | | | | | | | |
| Fiscal Year | Mileage* | Customer Service Lines | Abandoned Service Lines | Water Mains | Fire Hydrants | Valves | Total |
| 1987 | N/A | 198 | 109 | 37 | 36 | 22 | 402 |
| 1988 | N/A | 234 | 84 | 47 | 81 | 16 | 462 |
| 1989 | 1240 | 412 | 146 | 47 | 78 | 29 | 712 |
| 1990 | 1204 | 243 | 108 | 38 | 163 | 9 | 561 |
| 1991 | 1106 | 327 | 228 | 27 | 41 | 12 | 635 |
| 1992 | 977 | 237 | 137 | 27 | 52 | 9 | 462 |
| 1993 | 1003 | 400 | 60 | 20 | 40 | 6 | 526 |
| 1994 | 616 | 139 | 60 | 25 | 34 | 9 | 267 |
| 1995 | 1126 | 169 | 90 | 84 | 162 | 20 | 525 |
| 1996 | 1146 | 132 | 80 | 72 | 5 | 5 | 294 |
| 1997 | 1402 | 117 | 32 | 34 | 12 | 0 | 195 |
| 1998 | 1072 | 98 | 26 | 19 | 14 | 2 | 159 |
| 1999 | 1396 | 78 | 47 | 17 | 35 | 12 | 189 |
| 2000 | 1371 | 92 | 32 | 37 | 105 | 21 | 287 |
| 2001 | 1690 | 109 | 40 | 57 | 146 | 15 | 367 |
| 2002 | 1313 | 86 | 31 | 28 | 117 | 20 | 282 |
| 2003 | 1421 | 64 | 25 | 64 | 39 | 16 | 208 |
| 2004 | 1160 | 83 | 24 | 54 | 48 | 7 | 216 |
| 2005 | 1278 | 70 | 25 | 61 | 143 | 17 | 316 |
| 2006 | 1113 | 82 | 28 | 31 | 76 | 11 | 228 |
| 2007 | 1024 | 83 | 10 | 17 | 52 | 11 | 173 |
| 2008 | 1113 | 54 | 24 | 15 | 59 | 7 | 159 |
| 2009 | 953 | 57 | 36 | 2 | 41 | 8 | 144 |
| 2010 | 1133 | 53 | 3 | 6 | 22 | 2 | 86 |
| 2011 | 995 | 51 | 16 | 33 | 12 | 7 | 119 |
| 2012 | 1137 | 55 | 1 | 57 | 2 | 13 | 128 |
| 2013 | 962 | 5 | 3 | 24 | 3 | 0 | 35 |

*PWD's water distribution system includes 3,028 miles of pipeline

| REPORTED (REFERRAL) LEAKS: DEPLOYMENT & REPAIRS** | | | | | | | | | |
|---|-------------------------------|-------------------------------|--------------------------------|------------------------|-------------------------|-------------|---------------|--------|-------|
| Fiscal Year | Unreported (Survey) Crew days | Reported (Referral) Crew days | Time dedicated to Leak Surveys | Customer Service Lines | Abandoned Service Lines | Water Mains | Fire Hydrants | Valves | Total |
| 1987 | | 145.3 | | 59 | 57 | 43 | 3 | 0 | 162 |
| 1988 | | 300.3 | | 71 | 93 | 84 | 5 | 2 | 255 |
| 1989 | | 407.8 | | 80 | 125 | 103 | 3 | 4 | 315 |
| 1990 | | 393 | | 66 | 130 | 73 | 17 | 23 | 309 |
| 1991 | | 389.8 | | 87 | 145 | 73 | 8 | 23 | 336 |
| 1992 | | 538.2 | | 122 | 132 | 85 | 9 | 14 | 362 |
| 1993 | | 578.5 | | 168 | 104 | 69 | 22 | 11 | 374 |
| 1994 | | 686.3 | | 118 | 85 | 147 | 26 | 17 | 393 |
| 1995 | | 774.3 | | 218 | 129 | 211 | 88 | 11 | 657 |
| 1996 | | 648.5 | | 114 | 69 | 76 | 6 | 3 | 268 |
| 1997 | | 425.7 | | 92 | 31 | 38 | 20 | 2 | 183 |
| 1998 | | 370.1 | | 65 | 78 | 64 | 16 | 2 | 225 |
| 1999 | | 413.1 | | 112 | 141 | 133 | 21 | 14 | 421 |
| 2000 | | 414 | | 160 | 73 | 150 | 46 | 19 | 448 |
| 2001 | 852 | 452.5 | 65.3% | 148 | 77 | 147 | 36 | 12 | 420 |
| 2002 | 751.3 | 606.7 | 55.3% | 136 | 82 | 131 | 32 | 19 | 400 |
| 2003 | 821.3 | 752.4 | 52.2% | 152 | 78 | 199 | 32 | 20 | 481 |
| 2004 | 776.3 | 844.2 | 47.9% | 208 | 78 | 151 | 33 | 11 | 481 |
| 2005 | 862.2 | 755.6 | 53.3% | 231 | 59 | 161 | 52 | 11 | 514 |
| 2006 | 885.9 | 701.2 | 55.8% | 197 | 29 | 124 | 39 | 3 | 392 |
| 2007 | 836 | 729.1 | 53.4% | 219 | 33 | 168 | 31 | 10 | 461 |
| 2008 | 897.8 | 649.1 | 58.0% | 282 | 71 | 194 | 20 | 4 | 571 |
| 2009 | 618.9 | 845.7 | 42.3% | 214 | 50 | 164 | 28 | 4 | 460 |
| 2010 | 744.46 | 854.52 | 46.6% | 244 | 15 | 160 | 16 | 5 | 440 |
| 2011 | 623.15 | 930.41 | 40.1% | 336 | 45 | 268 | 48 | 7 | 704 |
| 2012 | 667.78 | 807.77 | 45.3% | 296 | 2 | 164 | 2 | 10 | 474 |
| 2013 | 715.77 | 767.72 | 48.2% | 185 | 170 | 207 | 4 | 2 | 568 |

** Does not represent all leaks repaired by the Philadelphia Water Department

City of Philadelphia Water Audit Fiscal Year 2013 - July 1, 2012 to June 30, 2013
Estimated Water Loss Due to Leakage Incidents

Section 1: The Nature of Leaks and Leak Repairs in Philadelphia

A. Leaks in Philadelphia's water distribution network occur primarily on customer service piping (over 60% of all leak incidents occur on these lines), water main joints and points of corrosion, valves and fire hydrants.

Since many vacant and/or abandoned properties exist in the city, customer service pipe leaks are usually categorized as "active" or "abandoned". The term Vacant Broken Pipe, or VBP, is also used casually to define leaks on customer service piping on an apparently unoccupied residence. VBPs are considered part of the "abandoned" customer service pipe leaks.

B. Leaks in the city garner a response from PWD personnel in two primary manners: *Reported Leaks* originate via reports or complaints of leakage or leak-related symptoms, usually by customers. *Unreported Leaks* are those discovered by the PWD in their routine Leak Detection Surveys, periodic use of the Sahara Leak Detection technology for large pipelines, or occasionally via video sewer inspections which finds drinking water infiltrating joints in brick sewers.

The Leak Detection Squad performs leak surveys or searches for unreported leaks. While the Leak Detection Squad identifies leaks they do not repair them. The refer virtually all of their findings to designated PWD repair crews or customers (via violation notices) for action to effect repairs.

The Leak Detection Squad also performs work to pinpoint certain Reported Leaks which have been referred to them (referrals) by repair crews who encounter difficulty in making repairs. By using leak correlators, the Leak Detection Squad can usually pinpoint the exact leak location for the repair crew.

C. Leakage Repair Data is gathered from complaint and work order tracking systems. Leak repairs are conducted by: Customers - who arrange for repairs conducted by private plumbers on service pipes that have been identified as leaking by the PWD; and the PWD - who handle all other leaks and intercede on customer service pipe leaks if customers are not timely or an emergency condition occurs.

Customers can apply for funding assistance via loans or grants to pay for service line leak repairs and the PWD operates an assistance program to this end. While providing a reasonable estimate of the number of leak repairs occurring in the city, PWD's leakage information tracking has many gaps. Improvements in the leakage control business process, documentation and tracking are expected as PWD completes its implementation of the Cityworks computerized maintenance management system in Fiscal Year 2013.

Section 2: Summary Data on Repaired Leaks - FY2013*

| | Active Customer Service Pipe Leaks | Abandoned Customer Service Pipe Leaks | Valve Leaks | Hydrant Leaks | Dist. Main Leaks | Trans. Main Leaks*** | Total |
|--|---|--|-------------|---------------|---------------------|----------------------------|--------------|
| Reported Leak Repairs | | | | | | | |
| Service Leaks Repaired via arrangements of customers** | 850 | | | | | | 850 |
| Service leaks Repaired by customers via funding assistance of Plumbing Repair Program (HELP Loans) Utilized FY2012, FY2013 data not available. | 404 | | | | | | 404 |
| Leak repairs by the Distribution Unit, with no Leak Detection Squad involvement* | 511 | 182 | 66 | 78 | 94 | 23 | 954 |
| Other Distribution Unit repairs - referred from LD Squad | 236 | 2 | 164 | 2 | 10 | | 414 |
| Unreported Leak Repairs | | | | | | | |
| Leaks repaired by the Distribution Unit as reported and pinpointed by the Leak Detection Squad (Included in above data - excess numbers added to below total). Trans Main leaks detected by Sahara Technology. | 5 | 3 | 0 | 3 | 24 | 14 | 35 |
| Totals | 2,006 | 187 | 230 | 83 | 128 | 37 | 2,671 |

*The breakdown between active and abandoned customer service line leaks is not known for this category

**Used same number as FY2006; FY2007 - FY2013 data are not available

***Unreported leaks on large transmission mains were located using the SAHARA Technology by Pure Technologies, Inc.

ESTIMATE OF DELIVERED WATER LOST DUE TO UNAUTHORIZED FIRE HYDRANT USE FOR HEAT RELIEF DURING THE SUMMER PERIOD

METHOD

Philadelphia allows certain uses of water taken from fire hydrants (with meter and backflow preventer attached) but also experiences unauthorized consumption from fire hydrants. Prior to the year 2000, widespread unauthorized openings of fire hydrants on hot summer days for heat relief was an extremely problematic occurrence. Fortunately this situation has greatly improved.

Philadelphia has largely regained control over the problem of mass fire hydrant openings by employing the use of Center Compression Locks (CCL) installed on fire hydrants. The CCL is a spring-loaded device installed inside the bonnet of the fire hydrant. The hydrant can only be opened by use of a special adapter, which requires the coil to be compressed. The adapter and hydrant wrench must stay on the hydrant in order to keep the hydrant open. Even in cases where the adapter is replicated illegally, the unauthorized user closes the hydrant when finished using the hydrant, halting the unauthorized flow of water and limiting the event to a temporary one.

Traditionally, the Philadelphia Water Department viewed unauthorized, heat-relief fire hydrant consumption occurring on days of peak temperature at or above 84 degrees F. Water delivered to distribution on these days was compared to the delivery on the summer days that were less than 84 degrees. The difference was taken as unauthorized fire hydrant consumption. Starting in FY2003, this method was modified to use 90 degrees F as the defining peak temperature. This reflects the better control that the CCL has exerted on this type of unauthorized hydrant consumption and has been verified by the analysis of peak water delivery volumes.

Because the City's fiscal year starts on July 1, an apportionment over two summer periods must be made to obtain an estimate of hydrant losses for the fiscal year.

STEP 1

"Average +90 Degree F Day Delivery of 7/1/2012 - 9/15/2012 period" minus "Average <90 Degree F Day Delivery of 5/15/2012 - 9/15/2012 period." This equals "Average Delivery lost on +90 Days from 7/1/2012 - 9/15/2012."

$$(6,814.9 \text{ MG/25 Days}) - ((9,535.6 + 12,802.3)/(39 + 52)) = 272.596 - 245.471 = 27.125 \text{ MG for 25 days}$$

STEP 2

"Average +90 Day Degree F Delivery of 5/15/2012 - 6/30/2012 period" minus "Average <90 Day Delivery of 5/15/2012 - 9/15/2012 period." This equals "Average Delivery lost on +90 Degree F Days from 5/15/2012 - 6/30/2012."

$$(1,740.802 \text{ MG/7 Days}) - ((9,233.8 + 15,313.7)/(40 + 64)) = 248.686 - 236.034 = 12.652 \text{ MG for 7 days}$$

STEP 3

Water Delivery lost from 7/1/2012 - 9/15/2012 plus Water Delivery lost from 5/15/2012 to 6/30/2012 represents the total estimated volume of water lost to unauthorized hydrant use due to hot weather. Dividing this amount by 365 gives it in MGD.

$$((25.611 \text{ MG/day} \times 30 \text{ days}) + (12.652 \text{ MG/day} \times 7 \text{ days}))/365 = 2.348 \text{ MGD}$$

ESTIMATE OF DELIVERED WATER LOST DUE TO UNAUTHORIZED FIRE HYDRANT USE FOR HEAT RELIEF DURING THE SUMMER PERIOD

YEARLY PROFILE OF UNAUTHORIZED HYDRANT CONSUMPTION

| | Less than 84 deg. F | | Equal or Greater than 84 deg. F | | | | |
|-------------|---------------------|--------------------|---------------------------------|--------------------|------------------------|------------------|---------------------------------------|
| Fiscal Year | Number of days | Ave. Delivery, mgd | Number of days | Ave. Delivery, mgd | Difference of Ave. mgd | Fraction of Year | Unauthorized Hydrant Consumption, mgd |
| 2001 | 79 | 277.43 | 29 | 290.09 | 12.66 | 29/365 | |
| | 55 | 265.99 | 18 | 283.58 | 17.59 | 18/365 | 1.873 |
| | | | | | | | |
| 2002 | 55 | 265.985 | 51 | 284.908 | 18.923 | 51/365 | |
| | 47 | 259.436 | 21 | 269.576 | 10.14 | 21/365 | 3.227 |
| | | | | | | | |
| | Less than 90 deg. F | | Equal or Greater than 90 deg. F | | | | |
| 2003 | 83 | 264.478 | 35 | 295.617 | 31.139 | 35/365 | |
| | 101 | 261.313 | 6 | 287.783 | 26.470 | 6/365 | 3.421 |
| | | | | | | | |
| 2004 | 101 | 261.324 | 17 | 279.753 | 18.429 | 17/366 | |
| | 115 | 263.890 | 4 | 279.050 | 15.160 | 4/366 | 1.022 |
| | | | | | | | |
| 2005 | 115 | 263.890 | 5 | 277.020 | 13.130 | 5/365 | |
| | 96 | 262.294 | 5 | 278.960 | 16.666 | 5/365 | 0.408 |
| | | | | | | | |
| 2006 | 96 | 262.294 | 23 | 285.591 | 23.297 | 23/365 | |
| | 97 | 260.128 | 6 | 279.033 | 18.905 | 6/365 | 1.779 |
| | | | | | | | |
| 2007 | 97 | 260.128 | 21 | 287.167 | 27.039 | 21/365 | |
| | 101 | 257.627 | 6 | 279.833 | 22.206 | 6/365 | 1.921 |
| | | | | | | | |
| 2008 | 101 | 257.627 | 17 | 280.506 | 22.879 | 17/365 | |
| | 101 | 253.627 | 8 | 282.038 | 28.354 | 8/365 | 1.687 |
| | | | | | | | |
| 2009 | 101 | 253.627 | 15 | 275.033 | 21.349 | 15/365 | |
| | 112 | 242.598 | 1 | 249.600 | 7.002 | 1/365 | 0.897 |
| | | | | | | | |
| 2010 | 112 | 242.598 | 11 | 257.900 | 15.302 | 11/365 | |
| | 72 | 249.447 | 17 | 268.900 | 19.453 | 17/365 | 1.367 |
| | | | | | | | |
| 2011 | 71 | 252.961 | 36 | 276.292 | 23.331 | 36/365 | |
| | 91 | 245.471 | 8 | 264.763 | 19.292 | 8/365 | 2.724 |
| | | | | | | | |
| 2012 | 91 | 245.471 | 36 | 272.596 | 27.125 | 25/366 | |
| | 85 | 239.056 | 9 | 263.578 | 24.522 | 9/366 | 2.456 |
| | | | | | | | |
| 2013 | 85 | 239.054 | 30 | 264.667 | 25.611 | 30/365 | |
| | 104 | 236.034 | 7 | 248.686 | 12.652 | 7/365 | 2.348 |

PHILADELPHIA WATER DEPARTMENT
REDUCTION OF WATER LOSS FROM HEAT RELIEF FIRE HYDRANT ABUSE
(As indicated by reduced peak water demand during summer months)

| Summer | Temperature (°F) | | | | Total Precipitation | Number of days with measurable precipitation | Summer Delivery- MGD | | | 8 AM minimum useable water storage | | # of Shutoff Fire Hydrant Customer Complaints |
|--------|------------------|-----|----------------|---------------------|------------------------|---|----------------------|--------------|----------------------------|---------------------------------------|-------------------|--|
| | Avg. | Max | # > 90 °F days | # = or > 93 °F days | | | Daily Avg. | Daily Max | 30 min peak rate Max | Raw + Treated % | Treated only % | |
| 1993 | 78.2 | 101 | 38 | 26 | 8.7 | 22 | 359.4 | 463 | 696 | 54.4 | | 10,402 |
| 1994 | 78.3 | 100 | 34 | 19 | 16.7 | 28 | 349.4 | 468 | 704 | 69.8 | | 12,665 |
| 1995 | 78.5 | 103 | 45 | 23 | 4.7 | 22 | 339.2 | 470 | 653 | 61.3 | | 16,881 |
| 1996 | 74 | 91 | 3 | 0 | 17.2 | 39 | 307.4 | 330 | 483 | 69.6 | | 2,384 |
| 1997 | 74.1 | 98 | 20 | 14 | 8.4 | 19 | 306.8 | 400 | 562 | 61.5 | | 4,587 |
| 1998 | 75.7 | 95 | 23 | 3 | 8.0 | 26 | 298.9 | 344 | 467 | 68.1 | 55.1 | 3,820 |
| 1999 | 77.1 | 100 | 34 | 22 | 7.7 | 18 | 303.3 | 399 | 541 | 68.2 | 55.3 | 4,650 |
| 2000 | 73.5 | 94 | 8 | 3 | 12.2 | 40 | 285.5 | 318 | 450 | 71.6 | 64.6 | 1,541 |
| 2001 | 76.8 | 101 | 21 | 11 | 8.2 | 24 | 280.6 | 334 | 457 | 66.4 | 47.3 | 2,245 |
| 2002 | 77.7 | 99 | 39 | 28 | 8.3 | 24 | 279.4 | 315 | 419 | 61.6 | 63.9 | 2,115 |
| 2003 | 76.2 | 97 | 23 | 9 | 13.4 | 45 | 268.8 | 303 | 391 | 76.1 | 75.7 | 673 |
| 2004 | 74.4 | 93 | 7 | 1 | 16.7 | 35 | 265.9 | 286 | 422 | 79.6 | 79.6 | N/A |
| 2005 | 77.8 | 98 | 21 | 14 | 10.2 | 30 | 271.7 | 300 | 441 | 65.6 | 75.9 | N/A |
| 2006 | 76.8 | 98 | 19 | 9 | 16.2 | 34 | 270.2 | 319 | 403 | 70.6 | 63.7 | N/A |
| 2007 | 76.1 | 97 | 18 | 11 | 10.4 | 31 | 264.7 | 301 | 397 | 75.6 | 70.5 | N/A |
| 2008 | 76.7 | 98 | 14 | 8 | 8.6 | 22 | 262.5 | 302 | 407 | 70.7 | 69.0 | N/A |
| 2009 | N/A | 95 | 9 | 3 | N/A | N/A | 245.1 | 269 | 341 | N/A | N/A | N/A |
| 2010 | N/A | 103 | 38 | 26 | N/A | N/A | 266.6 | 314 | 415 | N/A | N/A | N/A |
| 2011 | N/A | 103 | 22 | 17 | N/A | N/A | 256.2 | 317 | 371 | N/A | N/A | N/A |
| 2012 | N/A | 101 | 31 | 19 | N/A | N/A | 250.8 | 293 | 387 | N/A | N/A | N/A |
| 2013 | N/A | 98 | 15 | 9 | N/A | N/A | 242.7 | 290 | 404 | N/A | N/A | N/A |

Note: All values are for 6/1 to 8/31 summer period. (Ex: 2008 data from 6/1/2008 to 8/31/2008; some data from FY 2008 & some for FY 2009 since the fiscal year starts 7/1)

