



**DEPARTMENT OF WATER MANAGEMENT**  
**CITY OF CHICAGO**

December 8, 2017

Illinois Department of Natural Resources  
Office of Water Resources  
160 N. LaSalle Street, Suite S-703  
Chicago, Illinois 60601-3117

James P. Casey, Chief  
Lake Michigan Management Section

Mr. Casey:

Enclosed are the completed annual water usage Report LMO-2 and the AWWA Water Loss Audit's Reporting Worksheet and Performance Indicators Sheet for the 2017 water accounting year from October 1, 2016 through September 30, 2017.

A supplemental sheet, attached to the report, details the average daily supply of water transferred to other entities.

A report detailing the activities of the Chicago Water System in regard to water conservation and accountability during the 2017 water accounting year is also attached. If you should have any questions regarding this report, please contact Kwok Ho at 312-742-3609.

Very truly yours,

Randy Conner  
Commissioner



# Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271  
www.dnr.illinois.gov

Bruce Rauner, Governor  
Wayne A. Rosenthal, Director

Office of Water Resources, Michael A. Bilandic Building, 160 N. LaSalle St., S-703, Chicago, IL 60601  
Office: 312/793-5947 Fax: 312/793-5968

## 2017 Annual Water Use Audit Form (LMO-2)

This form must be completed by all Category IA and IB Permittees for the annual water use accounting year running from October 1, 2016 through September 30, 2017. This form must be submitted to the Department by January 8, 2018.

### Section I - General Information

#### Permittee Contact Information:

Permittee: The City of Chicago Department of Water Management  
Address: 1000 East Ohio Street  
Chicago, Illinois 60611  
County: Cook  
Phone: 312-744-7001  
Email: \_\_\_\_\_

#### Contact Person Information:

Name: Randy Conner  
Address: 1000 East Ohio Street  
Chicago, Illinois 60611  
Phone: 312-744-7001  
Email: \_\_\_\_\_

Authorized Official

Randy Conner

Title: Commissioner  
Date: 12/11/17

Service Population: 5,333,545

Service population is the total population the permittee serves with water both inside and outside their corporate limits.

The Illinois Department of Natural Resources is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under Chapter 19, Section 120.2 of the Illinois Revised Statutes. Disclosure of this information is required. Failure to provide any information will result in this form not being processed. This form has been approved by the Forms Management Center, CMS.

**Section II - Water Supplied:**

In order to complete this form you will have to first complete the AWWA Free Water Loss Audit Software. Lines 4, 8, 24 and 26 - 38 (highlighted) must be taken directly from the AWWA Water Loss Audit Reporting Worksheet and Performance Indicator sheet. Both the AWWA Water Loss Audit's Reporting Worksheet and Performance Indicator sheet must be submitted along with this form. All amounts should be rounded to three decimal places.

**Volume from own sources:**

1. Shallow Well	mg/y	0.000 mgd
2. Deep Well	mg/y	0.000 mgd
3. Lake Michigan (Direct Diverters only)	248,521.565 mg/y	680.881 mgd
4. Total Volume From Own Sources	248,521.565 mg/y	680.881 mgd

**Water imported from other sources:**

	<u>Supplier:</u>	<u>Amount:</u>
5	mg/y	0.000 mgd
6	mg/y	0.000 mgd
7	mg/y	0.000 mgd
8. Total Water Imported	0.000 mg/y	0.000 mgd

**Water exported to other systems:**

	<u>System:</u>	<u>Amount:</u>
9	( See Attachment )	95,047.886 mg/y 260.405 mgd
10		mg/y 0.000 mgd
11		mg/y 0.000 mgd
12		mg/y 0.000 mgd
13		mg/y 0.000 mgd
14		mg/y 0.000 mgd
15		mg/y 0.000 mgd
16		mg/y 0.000 mgd
17		mg/y 0.000 mgd
18		mg/y 0.000 mgd
19		mg/y 0.000 mgd
20		mg/y 0.000 mgd
21		mg/y 0.000 mgd
22		mg/y 0.000 mgd
23		mg/y 0.000 mgd

24. Total Water Exported	95,047.886 mg/y	260.405 mgd
25. WATER SUPPLIED (Line 4 + Line 8 - Line 24)		420.476 mgd
26. WATER SUPPLIED (adjusted for master meter error)	147,063.802 mg/y	402.915 mgd

**Section III; Authorized Consumption:**

27. Billed Metered	70,642.465 mg/y	193.541 mgd
28. Billed Unmetered	56,853.860 mg/y	155.764 mgd
29. Unbilled Metered	5,702.760 mg/y	15.624 mgd
30. Unbilled Unmetered	2,717.060 mg/y	7.444 mgd
(If not using the AWWA default of 1.25% of Water Supplied, provide an explanation)		
31. AUTHORIZED CONSUMPTION	135,916.145	372.373 mgd

**Section IV: Water Losses:**

32. Apparent Losses	927.910 mg/y	2.542 mgd
33. Real Losses	10,219.747 mg/y	27.999 mgd
34. Water Losses	11,147.657 mg/y	30.542 mgd

**Section V: Non Revenue Water:**

35. NON REVENUE WATER	19,567.477 mg/y	53.610 mgd
-----------------------	-----------------	------------

**Section VI: Performance Indicators:**

36. Annual cost of Apparent Losses	3,553,895 \$/year
37. Annual cost of Real Losses	1,522,333 \$/year
38. Non-revenue water as percent by volume of Water Supplied	13.3 %

**Section VII - Conversion Table**

Below are conversion calculations to convert the most commonly used units to units of million gallons per day (mgd).

To convert cubic feet per year (cf) to (mgd) use:

$$(cf \times 7.48) / 1,000,000 / 365 = mgd$$

To convert gallons per year (g) to (mgd) use:

$$g / 1,000,000 / 365$$

To convert gallons per day (g/d) to (mgd) use:

$$(g/d) / 1,000,000$$

To convert million gallons per year (mg) to (mgd) use:

$$mg / 365 = mgd$$

CITY OF CHICAGO  
DEPARTMENT OF WATER  
SUPPLEMENT TO FORM LMO-2

WATER METERED AND BILLED DIRECTLY BY CHICAGO WATER DEPARTMENT  
OCTOBER 1, 2016 TO SEPTEMBER 30, 2017

ENTITY	MGD
ALSIP *	5.388
BEDFORD PARK *	21.155
BERWYN	4.827
BLUE ISLAND	2.126
BRIDGEVIEW	1.937
BROOKFIELD-N. RIVERSIDE W.C. *	4.107
BURNHAM	0.092
CALUMET CITY	0.329
CALUMET PARK	0.588
CENT. STICKNEY SD	0.110
CICERO	7.286
DES PLAINES *	1.842
DOLTON	1.962
DUPAGE W.C. *	74.107
ELMWOOD PARK	2.098
EVERGREEN PARK	1.642
FOREST PARK	2.107
FOREST VIEW	0.175
FRANKLIN PARK	2.603
GARDEN HOMES S.D.	0.069
HARVEY *	8.451
HARWOOD HEIGHTS	0.791
HILLSIDE-BERKELEY W.C. *	1.706
HOMETOWN	0.307
JUSTICE-WILLOW SPRINGS W.C. *	2.775
LINCOLNWOOD	1.435
MAYWOOD	2.633
McCOOK *	5.293
MELROSE PARK *	7.848
MERRIONETTE PARK	0.172
MIDLOTHIAN-MARKHAM W.C. *	2.701
MORTON GROVE *	2.653
NILES *	5.668
NORRIDGE	1.352
NORTHWEST SUB JOINT ACTION W. A. *	27.977
AQUA ILLINOIS INC Total	0.006
OAK LAWN *	27.817
OAK PARK	4.848
PARK RIDGE	2.740
RIVER FOREST	1.141
RIVER GROVE	0.989
RIVERDALE	1.311
ROBBINS	1.289
ROSEMONT	1.603
SCHILLER PARK	1.374
SOUTH HOLLAND *	1.981
SOUTH STICKNEY S.D.	2.208
STICKNEY	1.364
SUMMIT	1.139
WESTCHESTER-BROADVIEW W.C. *	3.420
WORTH	0.843
METRO WATER RECLAMATION DIST. Total	0.021
<b>TOTAL</b>	<b>260.405</b>

\* INCLUDES OTHER MUNICIPALITIES  
ALL METERS ARE READ BETWEEN THE 20TH AND 30TH DAY OF EACH MONTH



# AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0  
American Water Works Association  
Copyright © 2014. All Rights Reserved.

- 
- 

**Water Audit Report for:** City of Chicago, Department of Water Management  
**Reporting Year:** 2017 10/2016 - 9/2017

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

**All volumes to be entered as: MILLION GALLONS (US) PER YEAR**

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

### WATER SUPPLIED

		----- Enter grading in column 'E' and 'J' ----->				Master Meter and Supply Error Adjustments	
		Pcnt:	Value:			Pcnt:	Value:
Volume from own sources:	<input type="button" value="7"/>	<input type="button" value="7"/>	248,521.565	MG/Yr	<input type="button" value="7"/>	1.91%	<input type="radio"/>
Water imported:	<input type="button" value="5"/>	<input type="button" value="5"/>	0.000	MG/Yr	<input type="button" value="5"/>		<input type="radio"/>
Water exported:	<input type="button" value="9"/>	<input type="button" value="9"/>	95,047.886	MG/Yr	<input type="button" value="5"/>	-1.81%	<input type="radio"/>

**WATER SUPPLIED:** 147,063.802 MG/Yr

Enter negative % or value for under-registration  
Enter positive % or value for over-registration

### AUTHORIZED CONSUMPTION

Billed metered:	<input type="button" value="8"/>	<input type="button" value="8"/>	70,642.465	MG/Yr	<input type="button" value="8"/>		<input type="radio"/>
Billed unmetered:	<input type="button" value="5"/>	<input type="button" value="5"/>	56,853.860	MG/Yr	<input type="button" value="5"/>		<input type="radio"/>
Unbilled metered:	<input type="button" value="9"/>	<input type="button" value="9"/>	5,702.760	MG/Yr	<input type="button" value="9"/>		<input type="radio"/>
Unbilled unmetered:	<input type="button" value="6"/>	<input type="button" value="6"/>	2,717.060	MG/Yr	<input type="button" value="6"/>		<input type="radio"/>

Unbilled Unmetered volume entered is greater than the recommended default value

**AUTHORIZED CONSUMPTION:** 135,916.145 MG/Yr

Click here:   
for help using option buttons below

Pcnt:   Value: 2,717.060 MG/Yr

Use buttons to select percentage of water supplied  
OR  
value

Pcnt:   Value: 0.25% MG/Yr

0.50%   MG/Yr  
 0.25%   MG/Yr

### WATER LOSSES (Water Supplied - Authorized Consumption)

11,147.657 MG/Yr

#### Apparent Losses

Unauthorized consumption:  367.660 MG/Yr

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:  383.644 MG/Yr

Systematic data handling errors:  176.606 MG/Yr

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

**Apparent Losses:** 927.910 MG/Yr

#### Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:  10,219.747 MG/Yr

**WATER LOSSES:** 11,147.657 MG/Yr

### NON-REVENUE WATER

**NON-REVENUE WATER:**  19,567.477 MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

### SYSTEM DATA

Length of mains:  4,236.7 miles  
 Number of active AND inactive service connections:  520,254  
 Service connection density:  123 conn./mile main

Are customer meters typically located at the curbstop or property line?  (length of service line, beyond the property boundary, that is the responsibility of the utility)  
Average length of customer service line:  50.0 ft

Average operating pressure:  45.0 psi

### COST DATA

Total annual cost of operating water system:  \$959,599,000 \$/Year  
 Customer retail unit cost (applied to Apparent Losses):  \$3.83 \$/1000 gallons (US)  
 Variable production cost (applied to Real Losses):  \$148.96 \$/Million gallons  Use Customer Retail Unit Cost to value real losses

### WATER AUDIT DATA VALIDITY SCORE:

**\*\*\* YOUR SCORE IS: 75 out of 100 \*\*\***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

### PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

**1: Volume from own sources**

**2: Billed unmetered**

**3: Unauthorized consumption**



Water Audit Report for: **City of Chicago, Department of Water Management**  
Reporting Year: **2017** **10/2016 - 9/2017**

**\*\*\* YOUR WATER AUDIT DATA VALIDITY SCORE IS: 75 out of 100 \*\*\***

**System Attributes:**

Apparent Losses:	927,910	MG/yr
+ Real Losses:	10,219,747	MG/yr
= <b>Water Losses:</b>	<b>11,147,657</b>	MG/yr
<b>Unavoidable Annual Real Losses (UARL):</b>	<b>2,265,151</b>	MG/yr
Annual cost of Apparent Losses:	\$3,563,895	
Annual cost of Real Losses:	\$1,522,333	

Valued at **Variable Production Cost**  
Return to Reporting Worksheet to change this assumption

**Performance Indicators:**

Financial:	Non-revenue water as percent by volume of Water Supplied:	13.3%
	Non-revenue water as percent by cost of operating system:	0.7%

Real Losses valued at Variable Production Cost

Operational Efficiency:	Apparent Losses per service connection per day:	4.89	gallons/connection/day
	Real Losses per service connection per day:	53.82	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.20	gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL):	10,219,751	million gallons/year
<b>Infrastructure Leakage Index (ILI) [CARL/UARL]:</b>	<b>4.51</b>	

\* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline



## AWWA Free Water Audit Software: User Comments

WAS v5.0

American Water Works Association.  
Copyright © 2014, All Rights Reserved.

Use this worksheet to add comments or notes to explain how an input value was calculated, or to document the sources of the information used.

<b>General Comment:</b>	
Audit Item	Comment
<a href="#">Volume from own sources:</a>	
<a href="#">Vol. from own sources: Master meter error adjustment:</a>	In the Chicago water system, the total discharge flow measurements are accomplished with 58 venturi tube flowmeters. Their sizes are from 36"X22" to 60"X45". Their ages are from 1920 to 1997. The error tolerance of venturi tubes is +/-2% from the manufacture's specifications. In addition, the flowmeter devices (transmitters) have an accuracy of +/-0.25%. The total error tolerance of a discharge flow measuring system would be +/-2.25%. We believe that estimated +1.91% accuracy is reasonable and practical.
<a href="#">Water imported:</a>	
<a href="#">Water imported: master meter error adjustment:</a>	
<a href="#">Water exported:</a>	
<a href="#">Water exported: master meter error adjustment:</a>	Our two biggest suburban consumers are DuPage Water Commission (DWC) and Northwest Suburban Municipal Joint Action Water Agency (JAWA). Their combined water usage is more than 40% of the total amount of water exported. They are using the venturi tube flowmeters to measure water flow to their system. Those venturi tubes also have a +/-2% accuracy. the flow transmitters have an accuracy of +/-0.25% . The total accuracy for the flow measuring system would be +/-2.25%. The -1.81% accuracy for water exported is an estimated number.
<a href="#">Billed metered:</a>	
<a href="#">Billed unmetered:</a>	
<a href="#">Unbilled metered:</a>	



Audit Item	Comment
<a href="#">Unbilled unmetered:</a>	
<a href="#">Unauthorized consumption:</a>	
<a href="#">Customer metering inaccuracies:</a>	We used Default Option of 0.5% from AWWA Audit Worksheet for customer metering inaccuracy because we have a huge number of service meters (314,842) with various sizes, ages and models. It is not practical to calculate an average accuracy for all service meters.
<a href="#">Systematic data handling errors:</a>	
<a href="#">Length of mains:</a>	
<a href="#">Number of active AND inactive service connections:</a>	
<a href="#">Average length of customer service line:</a>	
<a href="#">Average operating pressure:</a>	
<a href="#">Total annual cost of operating water system:</a>	
<a href="#">Customer retail unit cost (applied to Apparent Losses):</a>	
<a href="#">Variable production cost (applied to Real Losses):</a>	The variable production cost (\$148.96/MG) was calculated by subtracting the total operating personnel cost (fixed cost) from the total operating budget for the Bureau of Water Supply and dividing the resulting number by total water pumpage of the system.

Explanation for the Report (LMO-2) Line No. 30.  
 (not using the AWWA default of 1.25% of Water Supplied.)

Excessive unbilled unmetered water usage was due to the following factors:

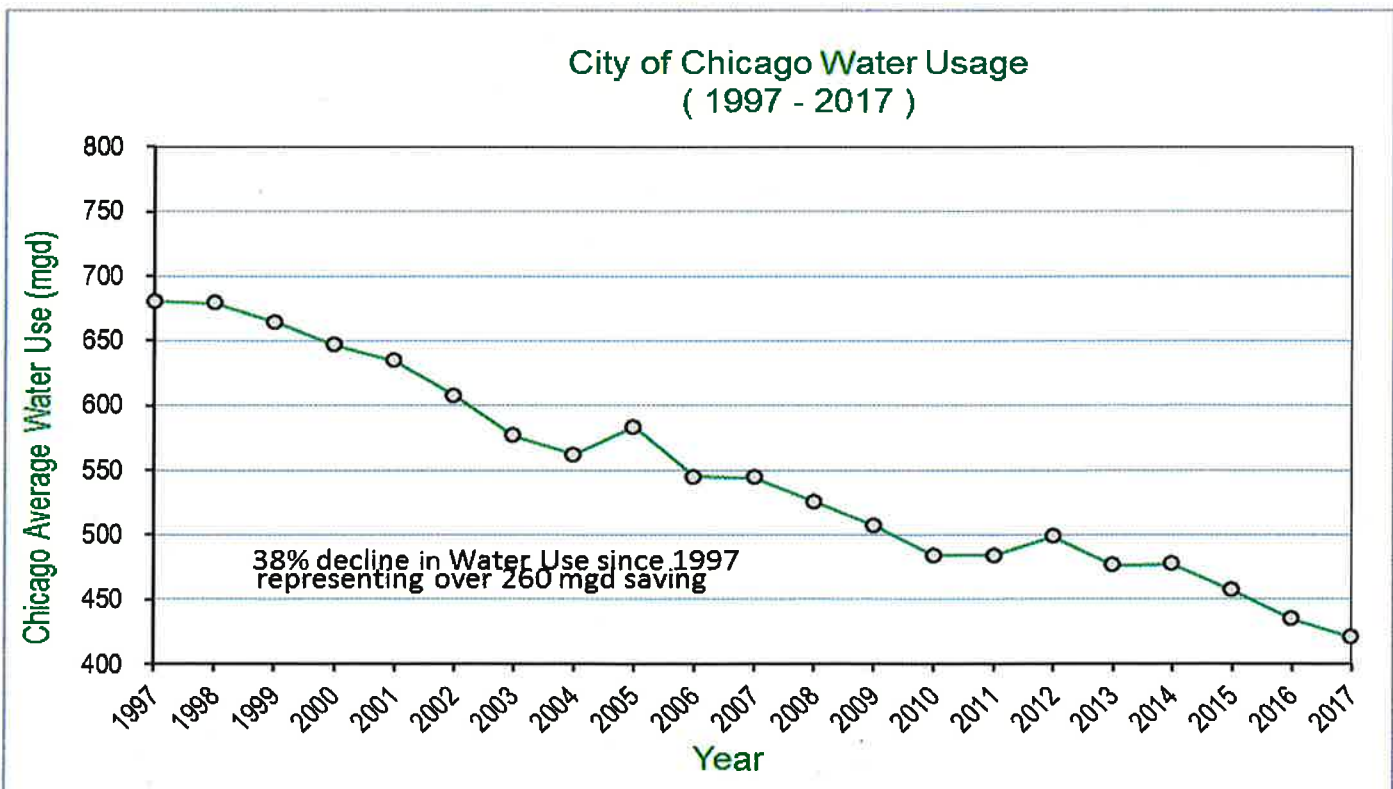
	<u>Estimated Usage</u>	<u>Percentage of water supplied</u>
1. NEW WATER MAIN FLUSHING. An accelerated water main replacement program is in progress. More hydrant flow is needed for water main flushing.	3.507 mgd	0.83%
2. FIREFIGHTING & TRAINING	2.102 mgd	0.50%
3. SEWER CLEANING	0.100 mgd	0.02%
4. STREET CLEANING	0.100 mgd	0.02%
5. PUBLIC FACILITIES CONSTRUCTION	0.420 mgd	0.10%
6. WATER MAIN FLUSHING FOR WATER QUALITY PURPOSES	0.568 mgd	0.14%
7. EXEMPTED UNMETERED ACCOUNTS	0.647 mgd	0.15%
<hr/>		
TOTAL UNBILLED UNMETERED WATER USAGE	7.444 mgd	1.76%
	<b>2,717.060 MG/Yr</b>	

**REPORT BY THE CITY OF CHICAGO  
DEPARTMENT OF WATER MANAGEMENT  
TO  
THE ILLINOIS DEPARTMENT OF NATURAL RESOURCES  
FOR THE 2017 WATER ACCOUNTING YEAR**

During Water Year 2017, the City of Chicago has continued to promote water conservation through a number of initiatives and policies to better conserve our fresh water and to wisely manage storm water. Our water conservation plan is a partnership among public and private sectors, and each resident of Chicago. It includes investing in infrastructure upgrades, working with our sister agencies and large industrial customers to promote conservation, and developing a plan to meter all residential water users. With the exception of drought years, the Department continues to see declining water usage due to its continued efforts to reduce water waste by investing in the following programs:

- 1.) Water Main Replacement
- 2.) Hydrant Custodian Installation
- 3.) Education and Public Awareness
- 4.) Volunteer Metering Program
- 5.) Meter Repair and Replacement
- 6.) Elimination of Unused Services
- 7.) Underground Leak Detection and Repair
- 8.) SCADA System Upgrade
- 9.) Installation of Variable Speed Pumps

The chart below demonstrates our progress with a plan that has had significant results in reducing water usage for the City of Chicago.



## WATER MAIN REPLACEMENT

The Water Main Replacement Program was designed to address the City's aging water mains which were installed over 100 years ago at the height of Chicago's exponential growth rate. The selection of water mains to be replaced is based primarily from analyzing break history records to determine where replacement would most benefit the water system. The City has placed a high priority on this key component of the Water Conservation Program, and believes it has had a large impact on the reduction of unaccounted for water, and a significant impact on the decline in water pumpage. Prior to 2012, the program had targeted a replacement rate of approximately 1% of the system's 4,350 miles of pipe each year. We are now on a path to target over 2% per year allowing us to mirror the installation rates over 100 years ago. The following table shows the past and current miles of main replaced per year.

We are pleased to report that through the leadership and support of Mayor Rahm Emanuel, the funding to address the needs of our aging infrastructure has become available through a series of water rate increases starting in 2012 with 25% and continuing the next 3 years with 15% each year. Water mains are critical assets to deliver safe potable water to not just Chicago but to its wholesale customers. These unprecedented water rate increases were based on the fact that over 25% of our water mains are over 100 years old and demonstrate our Mayor's vision and commitment to focus on the long term needs of this aging water system. The rate increases will allow us to continue this successful program to reduce water waste as well as fund critical treatment plant and pumping station upgrades. Our long term goals have been set to replace nearly 900 miles of water mains in the 10 year period, from 2012 through 2021

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Miles of Pipe Laid	38.7	35.9	23.0	33.7	20.7	34.0	32.0	30.0	30.0	70.0	75.0	85.0	90.0	90.0	90.0

## HYDRANT CUSTODIANS

The City has historically experienced difficulty in deterring people from opening hydrants during hot summer days. The opening of hydrants creates hazardous traffic situations, may damage adjacent property, and wastes water. In addition, open hydrants reduce the pressure and amount of water available for fire fighting.

In order to minimize this problem, the City began installing hydrant custodians in areas where previous experience indicated that open hydrants may be a problem. This program had to be coordinated with the Fire Department to insure that the hydrants would always be available for fighting fires. The installation of hydrant custodians is a repetitive and evolutionary process. The City develops a locking mechanism and the water thieves develop methods of removal. This has occurred multiple times with the City attempting to stay one lock ahead of the thieves.

The City has experimented with various locking devices throughout the years and has developed two types of technologically advanced custodians that are fairly effective. In addition, the City has developed a stem design that makes it difficult to turn the hydrant valve by reaching through the ports and manually turning the stem. In the 1990's, the City investigated and tried many other deterrents and have found them to be readily defeatable by determined vandals. Over 20,000 of the City's 48,000 hydrants now have custodians. A total of 8,400 of these 19,000 are the newer "NEO" version which operates with a stronger magnet. In areas where repeated open hydrants occur, the City is retrofitting the custodian with an additional spider guard deterrent to prevent damage to the operating mechanism. These retrofits installed since 1998, have demonstrated their effectiveness by a reduction in their frequency of opening. The City has found that the newer "NEO" version of the custodian has had a very significant impact on illegal hydrant openings. The City will still install the additional spider guard retrofits, but only in the areas where the "NEO" has not been successful.

## EDUCATION AND PUBLIC AWARENESS

The Department of Water Management engages in public education and awareness on a continuing basis. Conservation messages are conveyed through a variety of channels, including community meetings, literature distribution, and extensive use of the World Wide Web. Over the past years, we have included themes from the Chicago Water Agenda. This is a gathering of local initiatives, policies, programs and proposals that address issues of conservation, water quality and storm water management in a coordinated way. The Agenda applies not just to the City of Chicago, but to suburban communities and other cities across the Great Lakes region. We have also ramped up efforts in a promotional campaign to get conservation messages out to the public through various transportation ads and street signage advertising. Our metersave program message is quite visible throughout the city.

Coordinating with other City departments, the Department of Water Management has been including Agenda messages in the annual Consumer Confidence Report, in development of an educational program for schools, in grass roots presentations to community groups and Chambers of Commerce, and in other appropriate settings. Topics range from techniques of conservation to fire hydrant usages to the prospect of universal customer metering.

## VOLUNTEER METERING PROGRAM

The City has continued to make great strides with its volunteer metering program. Accounts which are currently unmetered can have a meter installed free of charge. By the end of 2017, the City has installed over 118,000 meters, under this program, since its inception in 2009, and plan to install additional 15,000 meters in 2018. To keep up with the program, we have continued to engage in a contract to allow a private contractor to install meters from the volunteer program and supplement our in-house work force. As this program is continuously promoted and more customers realize the financial and water resource benefits, we anticipate a stronger participation, in the years to come, from our unmetered customer base. The Department of Water Management is fully committed to making this a successful program. Also, additional highlights of this program are presented on our promotional website at [www.metersave.org](http://www.metersave.org).

## METER REPAIR AND REPLACEMENT

The City continued to service those meters presently installed on suburban, commercial, industrial, and municipal accounts. The total installed meter base in Chicago is in excess of 314,000 units. As new housing is erected and rehabilitation continues, the number of meters is increasing. Maintenance of this large installed meter base requires a considerable commitment of manpower and equipment. The City is committed to maintaining its meters in conformance with the recommendation of the meter manufacturers and the AWWA.

## ELIMINATION OF UNUSED SERVICES

The City continued its efforts to cut and seal unused services. The following table shows the data for termination of unused services since 2004.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of Services Terminated	820	620	422	297	488	510	692	342	476	635	1540	1521	2256	1892

A major effort has been made to eliminate these potential sources of leakage. These water services were terminated by both City forces and by private contractors. Although the termination of unused water services is very expensive, the continued reduction in the number of unused services should help reduce the amount of unaccounted for water.

## LEAK DETECTION AND REPAIR

The Department has maintained a high level of effort in its leak detection program over the past years. The Department employs one TriCorr TM 2001 correlator and in 2009 purchased some of the newer Digicorr correlators from FCS which is considered the product of choice by most professional leak detection firms and consultants, particularly in North America. These models are more sensitive in detecting leaks and have better noise filtering capabilities. In addition to our in house forces, the Department also contracts out services for leak detection. The services include not only an ongoing systematic coverage for leak detection of our distribution system every 3-4 years, but also the monitoring for leak noises while performing an ongoing valve inspection program. Through our leak detection consultant, we have been able to employ various technologies to detect and pinpoint underground leakage. One of these technologies: the “Radcom SoundSens” leak noise correlator system combines sound logging and correlation by installing three or more correlating pods within an area. The units pick up sound during the night and are then analyzed the next day by downloading the sounds to a central correlator. A multipoint correlation can then be performed between the units resulting in higher degrees of accuracy and allowing nighttime sounding without the need to work during the nighttime.

The Department is also employing the latest technology in the leak detection field for feeder mains. During 2005 and 2006, we started to survey sections of 36-inch and 60-inch mains with the Sahara® leak detection technology, where a tether-controlled Sahara® sensor is deployed inside a pipeline without any disruption to pipeline service. It moves through the pipeline with the flow and pinpoints even the smallest leaks in water mains. More documentation on this technology can be found at [http://www.puretechltd.com/products/sahara/sahara\\_leak\\_gas\\_pocket.shtml](http://www.puretechltd.com/products/sahara/sahara_leak_gas_pocket.shtml) . In 2007 we started using another newer technology for large diameter pipeline leak detection. This technology is Echologics and it differs from traditional leak correlators in that it uses the water column inside the pipeline to transmit the sound wave generated from a leak. This technology allows greater distances to between transmitters and has proven to be worthwhile. More documentation on this technology can be found at [http://www.echologics.com/leakfinder\\_overview.html](http://www.echologics.com/leakfinder_overview.html). Since then, we have been using a similar product, the Primayer leak correlator system and have made an effort to systematically survey our older trunk main systems to assure no leaks are occurring on these mains which could cause catastrophic failures and extensive damage. More documentation on this technology can be found at [http://www.primayer.co.uk/wlc\\_leak\\_location\\_eureka\\_digital.htm](http://www.primayer.co.uk/wlc_leak_location_eureka_digital.htm)

The following table demonstrates the Department’s efforts toward leak detection.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Miles of Pipe Surveyed	2200	700	734	1220	1700	1460	1220	1600	1900	1760	1162	1179	1501	1820
Number of Underground Leaks Located	938	400	320	356	590	477	402	300	660	637	380	611	702	833

## SCADA SYSTEM

The SCADA system was upgraded during 1996-97. At that time new well gauges, discharge pressure gauges, and flow meters were installed. In 2006, the SCADA system was upgraded again with new equipment and software to improve the operations and allow even better pressure management. Today there are 84 remote pressure sensors installed in the distribution system. The sensors are continuously monitoring water pressure in real time for the entire service area of the City of Chicago. Also, there are eight additional continuously monitored points located mainly in the outlying areas to monitor supply pressure and suburban flow demand patterns. These pressure sensors have proven to be a great aid with pumping station

operation, by avoiding over pressurizing the system that in turn is believed to contribute to significant savings in water usage. The upgraded SCADA system provided a more complete monitoring and control of pressures and flows in the distribution system on a real time basis.

### **VARIABLE SPEED ELECTRIC DRIVES**

The Chicago water system has 12 pumping stations. Nine of the pumping stations have pumps that are driven by electric motors, and four of these electric stations are equipped with electronically controlled variable speed drives. The variable speed drives allow the operating staff to efficiently adjust water pumpage without over pressurizing the water distribution system, which reduces water main breaks and wasting of water. The remaining three stations are steam powered with manually controlled pumps. The plan is to convert these stations to electrical power with variable speed drives. The Department has just completed the conversion of Springfield Pumping Station in 2015. The design plans have been completed for the conversion of the Central Park Pumping Station, this project will go into construction in 2018. The next steam powered station, Western Ave. Pumping station, will follow soon after the start of construction of the Central Park Station construction. And the design for the conversion of the final steam pumping station, Mayfair Ave. Pumping Station, is slated to begin in 2022.