



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

December 31, 2019

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

James F. Kessen, P.E.  
Lake Michigan Management Section

Mr. Kessen:

Enclosed are the completed annual water usage Report LMO-2 and the AWWA Water Loss Audit's Reporting Worksheet, Performance Indicators Sheet and the User Comments Sheet for the 2019 water accounting year from October 1, 2018 through September 30, 2019.

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 2019 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

JB Pritzker, Governor  
Colleen Callahan, Director

Office of Water Resources, Michael A. Bilandic Building, 160 N. LaSalle St., S-703, Chicago, IL 60601

## 2019 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, 2018 through September 30, 2019. This form must be completed and submitted to the Department by January 6, 2020.

### 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: Randy.Conner@cityofchicago.org

Authorized Official

Randy Conner

Title: Commissioner  
Date: 1/6/2020

Service Population: 2,695,598

"Service Population" is the total population the permittee serves with water related to their allocation, both inside and outside their corporate limits. This does not include population associated with water exported/sold to other systems.

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 Audit Software. Lines 4.

8, 24 and 26 - 38 (highlighted below) must be taken directly from the AWWA Free Water Audit Software's "Reporting Worksheet" and "Performance Indicator" worksheets. A completed version of the AWWA Free Water Audit Software must be submitted along with the completed LMO-2 form (submit both as Microsoft Excel files). 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)	242,305.615 mg/y	663.851 mgd
4. Total Volume From Own Sources	242,305.615 mg/y	663.851 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 1 )	91,955.180 mg/y 251.932 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	91,955.180 mg/y	251.932 mgd
25. WATER SUPPLIED (Line 4 + Line 8 - Line 24)		411.919 mgd
26. WATER SUPPLIED (adjusted for master meter error)	147,714.073 mg/y	404.696 mgd

**Section III; Authorized Consumption:**

27. Billed Metered	70,735.175 mg/y	193.795 mgd
28. Billed Unmetered	52,937.045 mg/y	145.033 mgd
29. Unbilled Metered	4,819.825 mg/y	13.205 mgd
30. Unbilled Unmetered	2,302.055 mg/y	6.307 mgd

(If not using the AWWA default of 1.25% of Water Supplied, provide an explanation)

31. AUTHORIZED CONSUMPTION	130,794.100	358.340 mgd
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**Section IV: Water Losses:**

32. Apparent Losses	1,309,305 mg/y	3.587 mgd
33. Real Losses	15,610,668 mg/y	42.769 mgd
34. Water Losses	16,919,973 mg/y	46.356 mgd

**Section V: Non Revenue Water:**

35. NON REVENUE WATER	24,041,853 mg/y	65.868 mgd
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**Section VI: Performance Indicators:**

36. Annual cost of Apparent Losses	5,197,941 \$/year
37. Annual cost of Real Losses	3,951,997 \$/year
38. Non-revenue water as percent by volume of Water Supplied	16.3 %

**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:

$$mg / 365 = mgd$$



## AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0  
American Water Works Association  
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[Click to access definition](#)  
[Click to add a comment](#)

Water Audit Report for: **City of Chicago, Department of Water Management**  
Reporting Year: **2019**      10/2018 - 9/2019

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' ----->

Volume from own sources:	<input type="button" value="+"/> <input type="button" value="9"/>	242,305.615	MG/Yr
Water imported:	<input type="button" value="+"/> <input type="button" value="5"/>	0.000	MG/Yr
Water exported:	<input type="button" value="+"/> <input type="button" value="7"/>	91,955.180	MG/Yr

### Master Meter and Supply Error Adjustments

Pcnt:	Value:		MG/Yr
<input type="button" value="+"/> <input type="button" value="8"/>	1.10%	<input type="radio"/>	
<input type="button" value="+"/> <input type="button" value="7"/>		<input checked="" type="radio"/>	
<input type="button" value="+"/> <input type="button" value="5"/>	0.00%	<input type="radio"/>	

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

**WATER SUPPLIED:**      **147,714.073** MG/Yr

### AUTHORIZED CONSUMPTION

Billed metered:	<input type="button" value="+"/> <input type="button" value="8"/>	70,735.175	MG/Yr
Billed unmetered:	<input type="button" value="+"/> <input type="button" value="5"/>	52,937.045	MG/Yr
Unbilled metered:	<input type="button" value="+"/> <input type="button" value="9"/>	4,819.825	MG/Yr
Unbilled unmetered:	<input type="button" value="+"/> <input type="button" value="8"/>	2,302.055	MG/Yr

Unbilled Unmetered volume entered is greater than the recommended default value

**AUTHORIZED CONSUMPTION:**      **130,794.100** MG/Yr

Click here:   
for help using option buttons below

Pcnt:	Value:		MG/Yr
<input type="radio"/>	<input type="radio"/>	2,302.055	

Use buttons to select percentage of water supplied OR value

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

**16,919.973** MG/Yr

#### Apparent Losses

Unauthorized consumption:        **369.285** MG/Yr

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

Customer metering inaccuracies:        **763.182** MG/Yr

Systematic data handling errors:        **176.838** MG/Yr

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

**Apparent Losses:**      **1,309.305** MG/Yr

Pcnt:	Value:		MG/Yr
0.25%	<input checked="" type="radio"/>		

1.00%	<input type="radio"/>		MG/Yr
0.25%	<input type="radio"/>		MG/Yr

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

Real Losses = Water Losses - Apparent Losses:      **15,610.668** MG/Yr

**WATER LOSSES:**      **16,919.973** MG/Yr

### NON-REVENUE WATER

**NON-REVENUE WATER:**      **24,041.853** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

### SYSTEM DATA

Length of mains:	<input type="button" value="+"/> <input type="button" value="9"/>	4,419.9	miles
Number of active AND inactive service connections:	<input type="button" value="+"/> <input type="button" value="9"/>	522,428	
Service connection density:	<input type="button" value="9"/>	118	conn./mile main

Are customer meters typically located at the curbside or property line?      No  
Average length of customer service line:        50.0 ft      (length of service line, beyond the property boundary, that is the responsibility of the utility)

Average operating pressure:        45.0 psi

### COST DATA

Total annual cost of operating water system:	<input type="button" value="+"/> <input type="button" value="9"/>	\$833,639,000	\$/Year
Customer retail unit cost (applied to Apparent Losses):	<input type="button" value="+"/> <input type="button" value="10"/>	\$3.97	\$/1000 gallons (US)
Variable production cost (applied to Real Losses):	<input type="button" value="+"/> <input type="button" value="7"/>	\$253.16	\$/Million gallons <input type="checkbox"/> Use Customer Retail Unit Cost to value real losses

### WATER AUDIT DATA VALIDITY SCORE:

\*\*\* YOUR SCORE IS: 76 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: Customer metering inaccuracies

2: Billed unmetered

3: Water exported



# AWWA Free Water Audit Software: System Attributes and Performance Indicators

WAS v5.0  
American Water Works Association

Water Audit Report for: **City of Chicago, Department of Water Management**  
Reporting Year: **2019** **10/2018 - 9/2019**

**\*\*\* YOUR WATER AUDIT DATA VALIDITY SCORE IS: 76 out of 100 \*\*\***

### System Attributes:

Apparent Losses:	1,309,305	MG/yr
+ Real Losses:	15,610,668	MG/yr
= Water Losses:	16,919,973	MG/yr
<b>?</b> Unavoidable Annual Real Losses (UARL):	2,289,32	MG/yr
Annual cost of Apparent Losses:	\$5,197,941	
Annual cost of Real Losses:	\$3,951,997	

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:	16.3%	
	Non-revenue water as percent by cost of operating system:	1.3%	Real Losses valued at Variable Production Cost

Operational Efficiency:	Apparent Losses per service connection per day:	6.87	gallons/connection/day
	Real Losses per service connection per day:	81.87	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.82	gallons/connection/day/psi

From Above, Real Losses = Current Annual Real Losses (CARL): **15,610,67** million gallons/year  
**?** Infrastructure Leakage Index (ILI) [CARL/UARL]: **6.82**

\* 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**

AWAS v5.0  
American Water Works Association  
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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.  
All data used in this report is based on the water year 10/1/18- 9/30/19.

Audit Item	Comment
<u>Volume from own sources:</u>	The total Volume is metered pumpage from our twelve pumping stations from 10/1/18 to 9/30/19. A lag time correction has not been applied
<u>Vol. from own sources: Master meter error adjustment:</u>	The total Volume from own sources is measured by 56 venturi tube flowmeters in twelve pumping stations over the City. The flowmeters were calibrated routinely through the year. The average of accuracy for the 56 venturi tube flowmeters is +1.10% based on flowmeters calibration reports. The meter error adjustment is +1.10%.
<u>Water imported:</u>	NONE
<u>Water imported: master meter error adjustment:</u>	N/A
<u>Water exported:</u>	The total volume of water is metered and billed to the direct connected 52 suburban consumers from 10/1/18 to 9/30/19. A lag time correction has not been applied.
<u>Water exported: master meter error adjustment:</u>	DuPage Water Commission (DWC) and Northwest Suburban Municipal Joint Action Water Agency (JAWA) calibrate their flowmeters routinely. The rest of 52 suburban customers have no flowmeter calibration reports, therefore the water exported meter error adjustment is 0.00%.
<u>Billed metered:</u>	70,735.175 MG/Yr is the summation of 330,721 metered accounts from 10/1/18 to 9/30/19. All meters are read between the 20th and 30th day of every two months. The billing frequency is also for two months. Even some meter readings were not taken at the beginning and end of the audit year (off few days), but the water usages were accumulated for 365 days. Furthermore, all meter readings were taken continually following previous LMO-2 Report year. Lag time correction has not been applied.
<u>Billed unmetered:</u>	52,937.045 MG/Yr is the summation of 191,707 accounts from 10/1/18 to 9/30/19. All accounts are categorized in to about 28 Service Classes based on the properties type and size. Each Service Class has a flat rate determined from a practical manner.
<u>Unbilled metered:</u>	It is the total volume of water exemption for the schools, universities, churches, hospitals, nonprofit organizations and public facilities. The unbilled value of 4,819,825 MG/Yr is the summation of about 6187 metered accounts from 10/1/18 to 9/30/19. All meters are read monthly or bimonthly. Lag time correction has no been applied.

Audit Item	Comment
<u>Unbilled unmetered:</u>	It is the summation of Fire Hydrant water usages for firefighting, new water main flushing, sewer cleaning, street cleaning, public construction, and water quality request flushing. The water usage from new Water Main Flushing and Water Quality Purposes were calculated based on the data. The water usage from other five categories were estimated based on the traditional method.
<u>Unauthorized consumption:</u>	Unauthorized consumption is due to unauthorized and illegal open fire hydrants.
<u>Customer metering inaccuracies:</u>	There are 330,721 water meters for customer accounts. All meters comply with AWWA Standards. There are no routine meters calibration program, City will calibrate or replace the faulty meters when the reading appears abnormal or customers requested. Considering the huge number of water meters and the age of the meters, the percentage of 1.00% was used for the customer metering inaccuracy.
<u>Systematic data handling errors:</u>	The default errors percentage 0.25% was used.
<u>Length of mains:</u>	The Length of mains is the total length of transmission and distribution pipelines. It included Fire Hydrants lead. It doesn't include the service connection lines which belong to private.
<u>Number of active AND inactive service connections:</u>	522,428 of Active & inactive service connections is the same number of total accounts. The only difference is that the inactive service connection's accounts have no bills.
<u>Average length of customer service line:</u>	The average length of customer service line is 50 feet measuring from the City's water main to the customer's building.
<u>Average operating pressure:</u>	The average operating pressure is 45 psi. The pressure is measured at pumping station discharge with pressure transmitter sending the signal to the SCADA system.
<u>Total annual cost of operating water system:</u>	The total annual cost of operating water system is from the City of Chicago 2018 Financial Statement (Water Fund). It included Source of supply, Power and pumping, Purification, Transmission and distribution, Customer accounting, Administrative, General Fund/reimbursements, and Construction of capital assets.
<u>Customer retail unit cost (Applied to Apparent Losses):</u>	\$3.97 per 1000 gal. is the water rate of 2019 for the city customers and the suburban wholesale accounts.
<u>Variable production cost (Applied to Real Losses):</u>	The variable production cost came from City of Chicago 2019 Budget Recommendation for Department of Water Management. It included Water pumping, water distribution, Engineering Services, and Administration Support. It doesn't include labor costs.



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

Attachment 1

WATER METERED AND BILLED DIRECTLY BY CHICAGO WATER DEPARTMENT  
OCTOBER 1, 2018 TO SEPTEMBER 30, 2019

ENTITY	MGD
ALSIP *	5.377
BEDFORD PARK *	20.540
BERWYN	4.757
BLUE ISLAND	1.994
BRIDGEVIEW	2.169
BROOKFIELD-N. RIVERSIDE W.C. *	3.697
BURNHAM	0.068
CALUMET CITY	0.289
CALUMET PARK	0.643
CENT. STICKNEY SD	0.096
CICERO	6.564
DES PLAINES *	1.706
DOLTON	2.296
DUPAGE W.C. *	71.114
ELMWOOD PARK	2.270
EVERGREEN PARK	1.597
FOREST PARK	1.678
FOREST VIEW	0.112
FRANKLIN PARK	2.402
GARDEN HOMES S.D.	0.067
HARVEY *	7.682
HARWOOD HEIGHTS	0.786
HILLSIDE-BERKELEY W.C. *	1.581
HOMETOWN	0.317
WEST SUBURBAN W.C. * (JUSTICE-WILLOW SPRINGS W.C. )	2.562
LINCOLNWOOD	1.459
MAYWOOD	2.700
McCOOK *	5.388
MELROSE PARK *	7.885
MERRIONETTE PARK	0.167
MIDLOTHIAN-MARKHAM W.C. *	2.474
MORTON GROVE *	2.409
NILES *	3.237
NORRIDGE	1.350
NORTHWEST SUB JOINT ACTION W. A. *	27.438
AQUA ILLINOIS INC Total	0.005
OAK LAWN *	27.301
OAK PARK	4.920
PARK RIDGE	3.878
RIVER FOREST	1.034
RIVER GROVE	0.995
RIVERDALE	1.670
ROBBINS	1.206
ROSEMONT	1.661
SCHILLER PARK	1.380
SOUTH HOLLAND *	1.963
SOUTH STICKNEY S.D.	1.971
STICKNEY	1.437
SUMMIT	1.066
WESTCHESTER-BROADVIEW W.C. *	3.741
WORTH	0.816
METRO WATER RECLAMATION DIST. Total	0.022
TOTAL	251.932

\* INCLUDES OTHER MUNICIPALITIES

ALL METERS ARE READ BETWEEN THE 20TH AND 30TH DAY OF EACH MONTH

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:

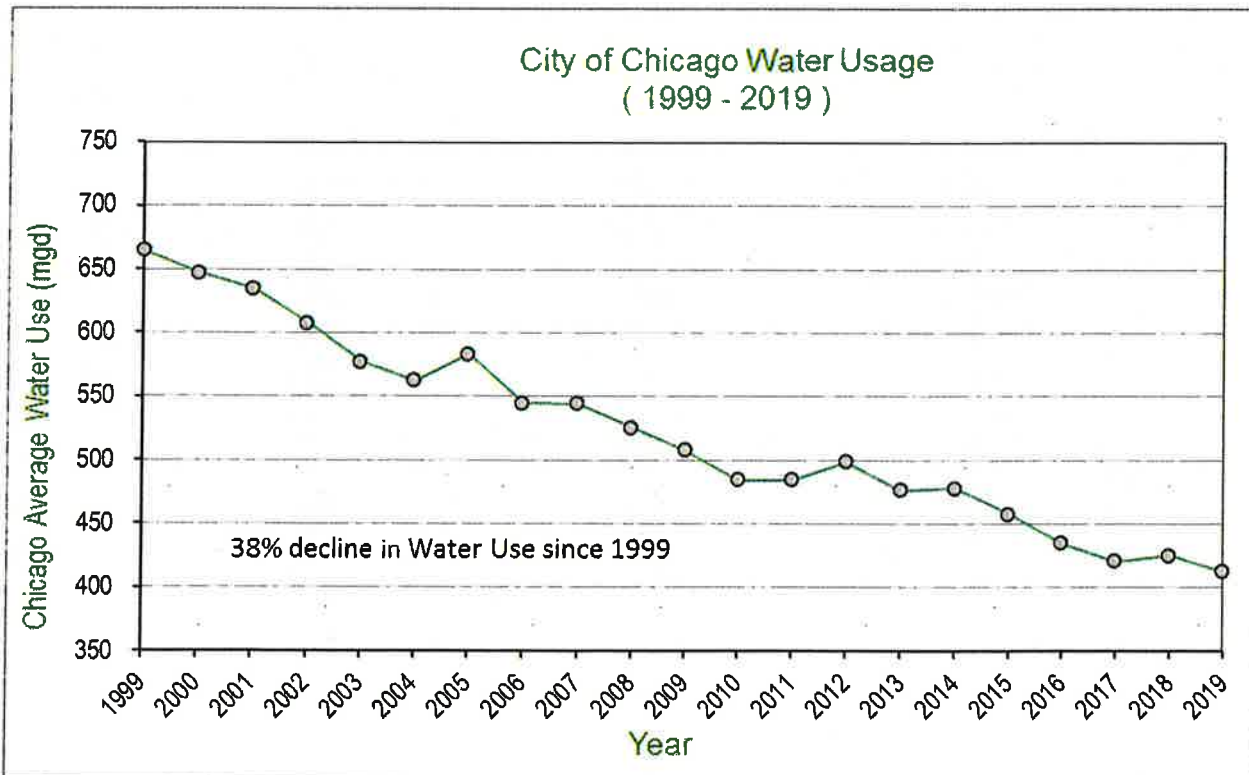
	<u>Estimated Usage</u>	<u>Percentage of water supplied</u>
1. NEW WATER MAIN FLUSHING. An accelerated water main replacement program is in progress. More hydrant flow is needed for water main flushing.	2.221 mgd	0.54%
2. FIREFIGHTING & TRAINING	2.060 mgd	0.50%
3. SEWER CLEANING	0.100 mgd	0.02%
4. STREET CLEANING	0.100 mgd	0.02%
5. PUBLIC FACILITIES CONSTRUCTION	0.412 mgd	0.10%
6. WATER MAIN FLUSHING FOR WATER QUALITY PURPOSES	0.878 mgd	0.21%
7. EXEMPTED UNMETERED ACCOUNTS	0.536 mgd	0.13%
<hr/>		
TOTAL UNBILLED UNMETERED WATER USAGE	6.307 mgd	1.53%
	<b>2,302.055 MG/Yr</b>	

## WATER CONSERVATION PROGRAM

During Water Year 2019, 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. The Department of Water Management 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.) Meter Installation and Maintenance
- 5.) Elimination of Unused Services
- 6.) Underground Leak Detection and Repair
- 7.) SCADA System
- 8.) 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. Since 2012, the program had targeted a replacement rate of approximately 1% to 2% of the system's 4,419 miles of pipe each year. For the last five years, (2014 to 2018), the water main replacement rates have been over 2% per year. The following table shows the past and current miles of main replaced per year.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Miles of Pipe Laid	30.0	30.0	70.0	75.0	85.0	90.0	90.0	90.0	90.0	56.9

## **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 City has installed over 20,000 hydrant custodians on the City's 48,141 hydrants. The City has found that the hydrant custodians have had a very significant impact on illegal hydrant openings.

## **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.

## METER INSTALLATION AND MAINTENANCE

In the City, the number of metered accounts is increasing. In the end of 2018, the number of metered accounts was 326,624. During water year 2019, there were 2,751 new water meters installed. The water metering is the most effective way to conserve water. The City continued to service those meters presently installed on residential, commercial, industrial, and suburban municipal accounts. 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 unused service connections are the potential sources of water leakage. The City continued its efforts to cut and seal unused services. 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.

The following table shows the data for termination of unused services since 2009.

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Number of Services Terminated	510	692	342	476	635	1540	1521	2256	1892	2510	163

## LEAK DETECTION AND REPAIR

The Department has maintained a high level of effort in its leak detection program over the past years. By using the latest leak detection technology the Department can effectively locate the underground leaks.

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

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Miles of Pipe Surveyed	1460	1220	1600	1900	1760	1162	1179	1501	1820	1773	1869
Number of Underground Leaks Located	477	402	300	660	637	380	611	702	833	656	600

## SCADA SYSTEM

The Supervisory Control and Data Acquisition (SCADA) system provides automation of water pumping and the better pressure management for the water distribution system. 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.

## **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 five of these electric powered 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 conversion of the Central Park Pumping Station is going into construction in 2019. The next steam powered station, Western Ave. Pumping Station, will follow soon after the start of the Central Park Pumping Station construction. The design for the conversion of the final steam pumping station, Mayfair Ave. Pumping Station, is slated to begin in 2022.