2013 Water Main Break Report

MUNICIPAL SERVICES DEPARTMENT

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It is important to understand that water main breaks are common occurrences in every municipality.

Age of Distribution Pipe

Age (yrs)	Miles
>60	24.84
40-59	17.37
20-39	4.60
<20	6.64

Introduction

The Municipal Services Department is aiming to provide residents improved information regarding the water main breaks that occurred in 2013. Water main breaks never occur at an opportune time and at their best provide an inconvenience to residents.

Water main breaks are common occurrences in every municipality and a break can occur without warning due a variety of factors; including the age of the pipe, annual rain fall, annual temperature fluctuations, soil conditions and other seasonal changes.

The Village has a total of 52.5 miles of water main, of which approximately 26 miles or 46% is over 60 years old. An additional 17 miles is more than 40 years old resulting in approximately 77% of the Village water main system that is more than 40 years in age.

Comparison to 2012 Data

The Municipal Services staff evaluated the 2012 water main break information based upon the data available from the annual weather conditions, which included the annual rainfall and the annual temperature information.

The additional data provided from the 2013 calendar year has provided the Village comparative information to test some of the observations from 2012. The most notable difference between the two seasons was the difference in temperature information. The 2012 summer season saw extremely high temperatures, whereas the 2013 season saw more moderate temperatures, but also a slightly lower amount of precipitation during the same period.

In 2013 the total annual rainfall data was similar to that of 2012 with 36.04 inches of precipitation in 2013 and 30.33 inches of precipitation in 2012. Through the summer periods of June through September; the Village's weather station recorded only 8.97 inches of rainfall for 2013. The same period during the 2012 season saw a total of 11.58" or 25% more rainfall.

With this additional data the Village was able to conduct statistical analysis to determine if the precipitation was a significant component in the 2012 breaks.

A Closer Look at Annual Rainfall

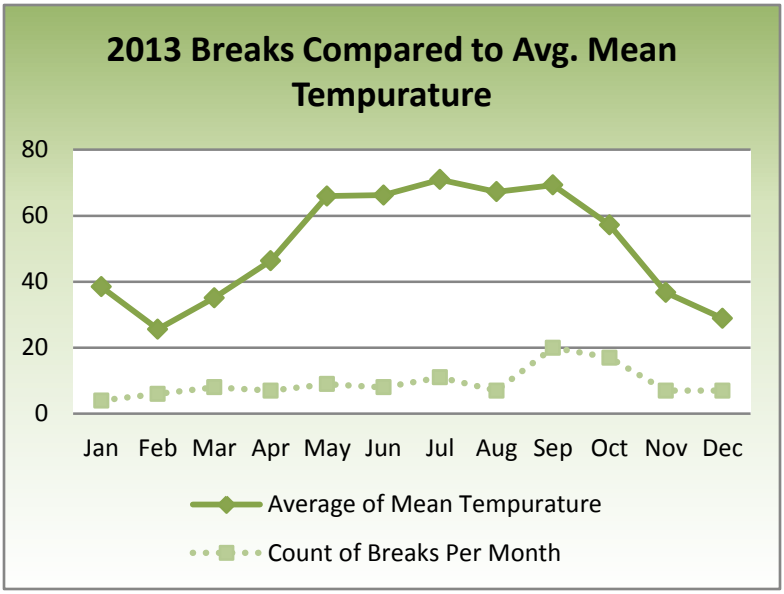
Year	# of Breaks	Annual rainfall (in)	Year	# of Breaks	Annual rainfall (in)
1972	23	41.29	1999	Data Not Avalible	
1973	25	33.51	2000		
1974	15	38.04	2001		
1975	23	32	2002		
1976	14	36.96	2003		
1977	17	46.21	2004		
1978	26	47.27	2005	25	24.83
1979	39	40.37	2006	18	47.55
1980	31	40.57	2007	39	39.74
1981	24	35.5	2008	26	48.45
1982	25	36.67	2009	17	46.08
1983	29	31.89	2010	26	44.75
1984	19	29.57	2011	16	46.62
1985	16	49.44	2012	66	30.33
1986	30	38.19	2013	111	36.04
1987	14	31.23			
1988	28	49.64			
1989	42	31.35			
1990	60	33.73			
1991	45	40.39			
1992	5	33.7			
1993	3	43.71			
1994	23	41.29			
1995	25	33.51			
1996	15	38.04			
1997	23	32			
1998	14	36.96			
1991	17	46.21			

In 2012, the Village explored the possible relationship between decreased rainfall and the increased number of water main breaks. After analyzing the data, the Village determined that there was no such relationship and that the drought conditions were not a significant factor.

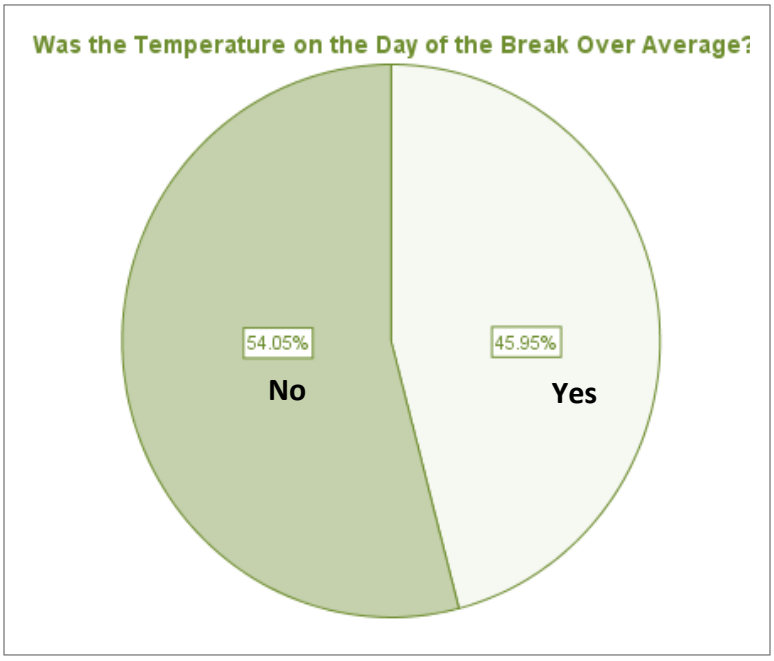
The Village decided to continue researching the theory by using the 2013 water main break data. Analysis was performed using SPSS, a predictive analytics software developed by IBM. Staff ran a t-test to determine if there was statistical siginificance between the water main breaks and rainfall in 2013. The t-test produced a p-value greater than .05, which means that there is no significant relationship present. In order for the data to be statistically significant the data would have had to produce a p-value of less than .05 or less than a 5% margin of error.

A Closer Look at Temperature

During 2012 the Village compared the water main break trend information to the ongoing drought and heat wave that was hitting the northern Illinois area. Thirty-seven of the sixty-six breaks from that year occurred between July and September of 2012. That period was also recorded as being one of the hottest and driest periods on record in the Chicago area. From the data at that time, the Village hypothesized that the current drought and high temperatures may have been a contributing factor to the main breaks experienced that year.

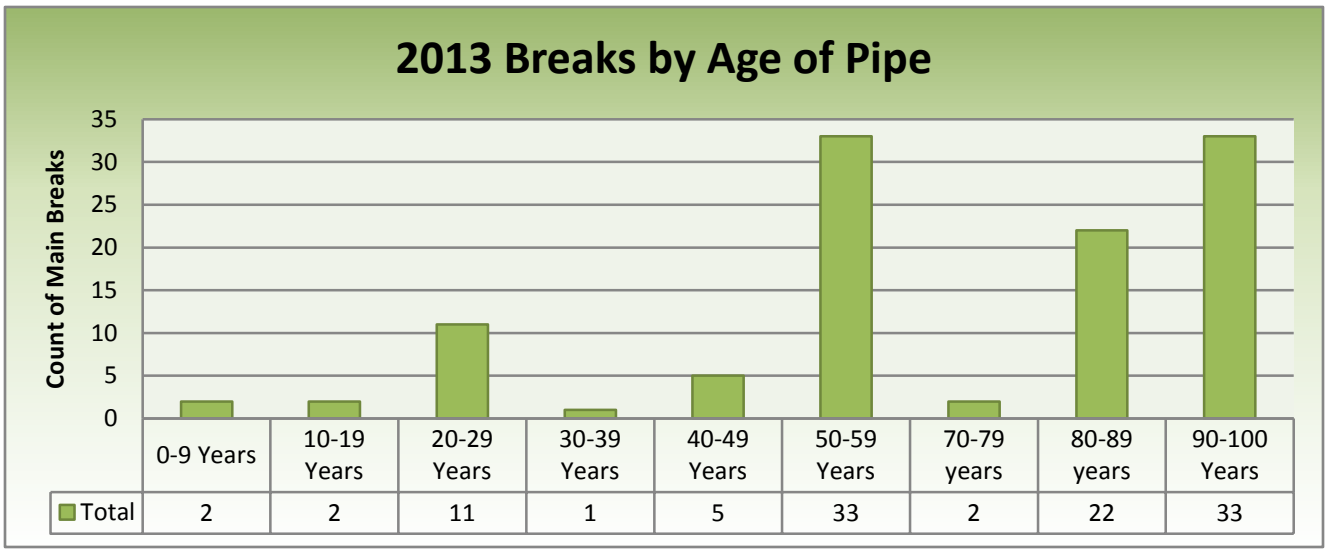


The 2013 summer season demonstrated much milder and more even temperatures throughout the system's high demand periods and the additional data allowed Village staff to compare the main break trend data against additional temperature information. The data for 2013 showed that the number of main breaks per month remained fairly consistent through most of 2013, even when temperatures rose.



Similarly to the rainfall analysis, staff explored the possibility that there could be a correlation between the higher than average summer temperatures and the increased number of water main breaks in 2012. Using SPSS, staff performed a t-test analysis. The p-value for this relationship was much greater than 0.05 which concluded that there was no significant relationship present.

The chart to the left is a portion of the same analysis done on the 2013 water main breaks. The data indicates that the 2013 water main breaks show no direct relationship to higher than average temperatures.



Using the information in the Village's Geographic Information System, staff was able to identify the age of each pipe that had a break occur on it. The distribution from the break data indicated that 55 of the 111 breaks that occurred in 2013 occurred on pipe that was eighty years old or older. There were also 33 breaks on pipe that was aged between 50-59 years in age. Of those 33 breaks, 12 of them occurred in the Ridgewood subdivision and 15 of them occurred in the Springdale subdivision with each grouping of breaks representing the mean age of the total pipe in each subdivision.

Old Town north represented the vast majority of breaks for pipe over 90 years in age with 21 of the 33 total breaks in that cluster.

The Village analyzed the age of the pipe for each break and compared it to the average life of ductile iron pipe at 50 years. Analysis in SPSS showed that there is in fact a significant relationship between the age of the pipe and the amount of water main breaks in 2013.

Subdivisions	Count	Percentage	Avg. Age
Fairview Estates	2	1.80%	59
Field Park	20	18.02%	72
Forest Hills	2	1.80%	90
Old Town North	42	37.84%	73
Old Town South	4	3.60%	61
Ridgeacres	3	2.70%	89
Ridgewood	20	18.02%	56
Springdale	18	16.22%	59
Grand Total	**111**	**100.00%**	**67**

Age of Pipe	Count
0-9	**2**
10-19	**2**
20-29	**11**
30-39	**1**
40-49	**5**
50-59	**33**
Fairview Estates	2
Field Park	2
Old Town North	2
Ridgewood	12
Springdale	15
70-79	**2**
80-89	**22**
90-100	**33**
Field Park	6
Forest Hills	2
Old Town North	21
Ridgeacres	2
Ridgewood	1
Springdale	1
Grand Total	**111**

Summary Information

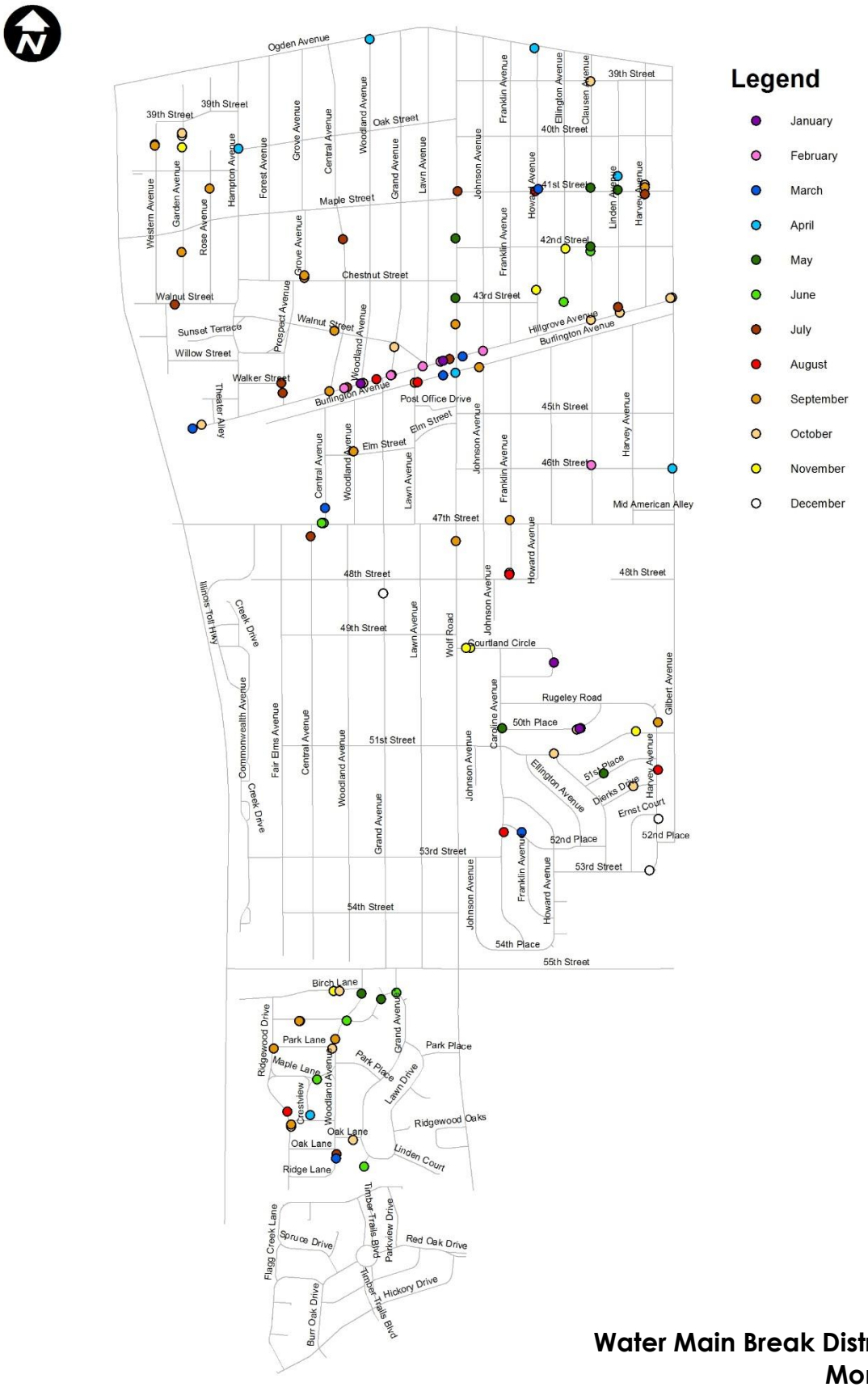
Month	2012	2013
January	1	4
February	1	6
March	1	8
April	2	7
May	9	9
June	6	8
July	19	11
August	7	7
September	5	20
October	5	17
November	6	7
December	4	7

The Village for this year has developed two maps to highlight the locations of the water main breaks within the Community. The first map shows the locations of the breaks and has color coded each break to the corresponding month that the break occurred. This can be used with the table to the left to illustrate the distribution of breaks throughout the year and how they compared to the 2012 main breaks.

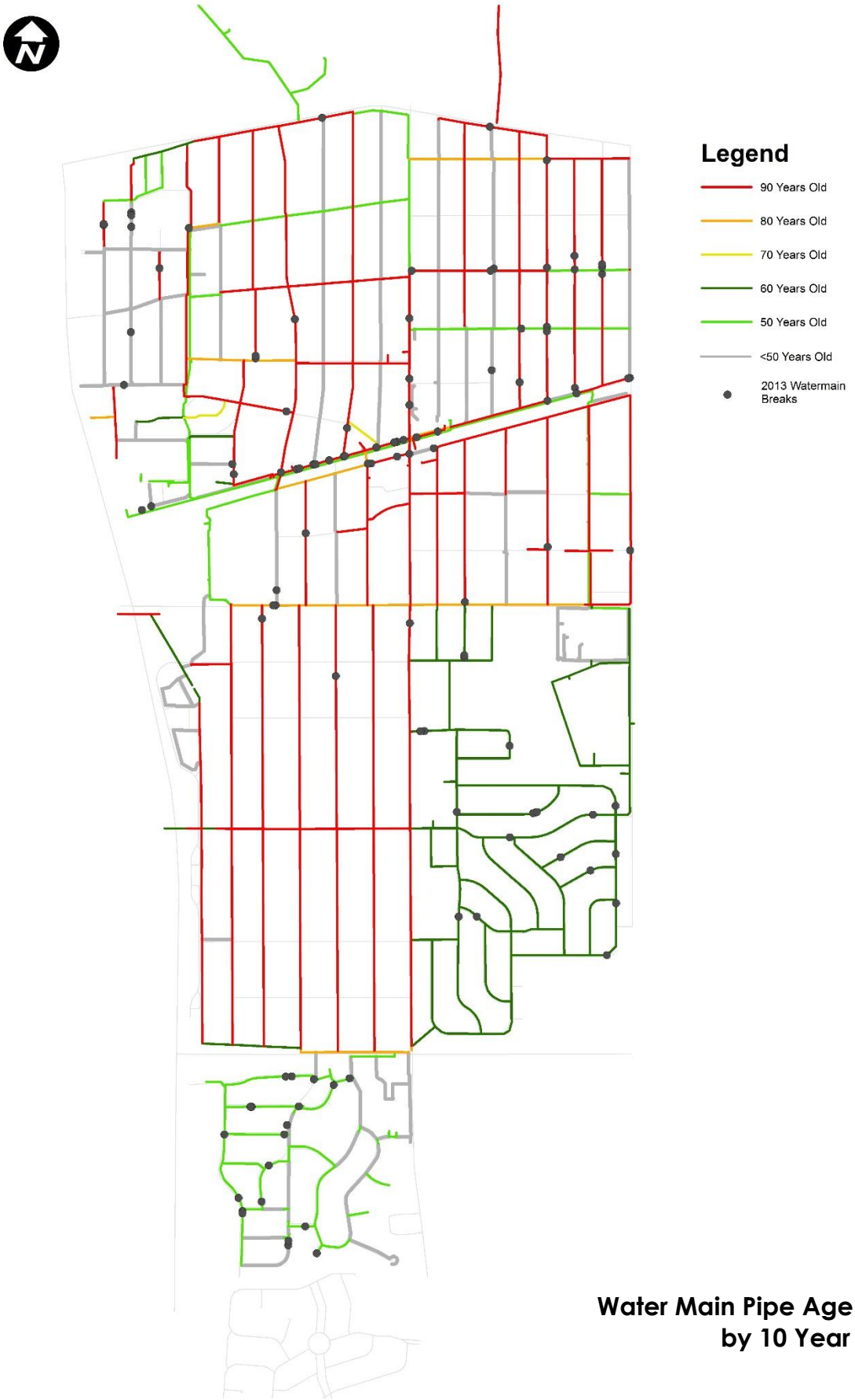
The second map shows the same water main breaks for the 2013 calendar year, but has highlighted the water main in each section of town to illustrate the ages of the entire distribution pipe. Residents can then see a distribution of the breaks based upon the pipe age and also see a distribution of the pipe age for each subdivision. The pipe classifications have been grouped in ten year increments.

The compiled data from 2012 and 2013 clearly demonstrates that the Village has experienced an increased amount of water main breaks over the past two years. The initial analysis from the 2012 data pointed to the extreme drought and heat conditions of 2012 as being possible factors for the breaks since the escalation of the breaks coincided with the heat wave during July of that year. With the additional data from 2013, the statistical information indicates that the heat and drought conditions may be contributing factors, but are unlikely the primary factors of the escalation of main breaks.

During both the 2012 and the 2013 calendar years the Village was in the process of reconstructing its water treatment plant, changing the treatment process from lime softening to reverse osmosis. Residents who have lived in the Village for years are likely familiar with the calcium that was deposited in pipes and water heaters from the lime softening. An example of a service line that has been plugged by calcium deposits is shown to the side. Anecdotal evidence from the 2013 calendar year from resident communication and inspections of the Village's water main after repairs seems to indicate that the new R.O. treated water is scouring the distribution mains. Since the data indicates that the pipes that are breaking within the Village are predominately older than 50 years in age, the hypothesis currently is that the removal of the decade's worth of calcium deposits in the distribution mains is exposing weaknesses in the distribution pipes that were previously masked by the calcium deposits. Further investigation by Village still will be required to determine if there is evidence to support this hypothesis.



Water Main Break Distribution by Month in 2013



Water Main Pipe Age Distribution by 10 Year Increments