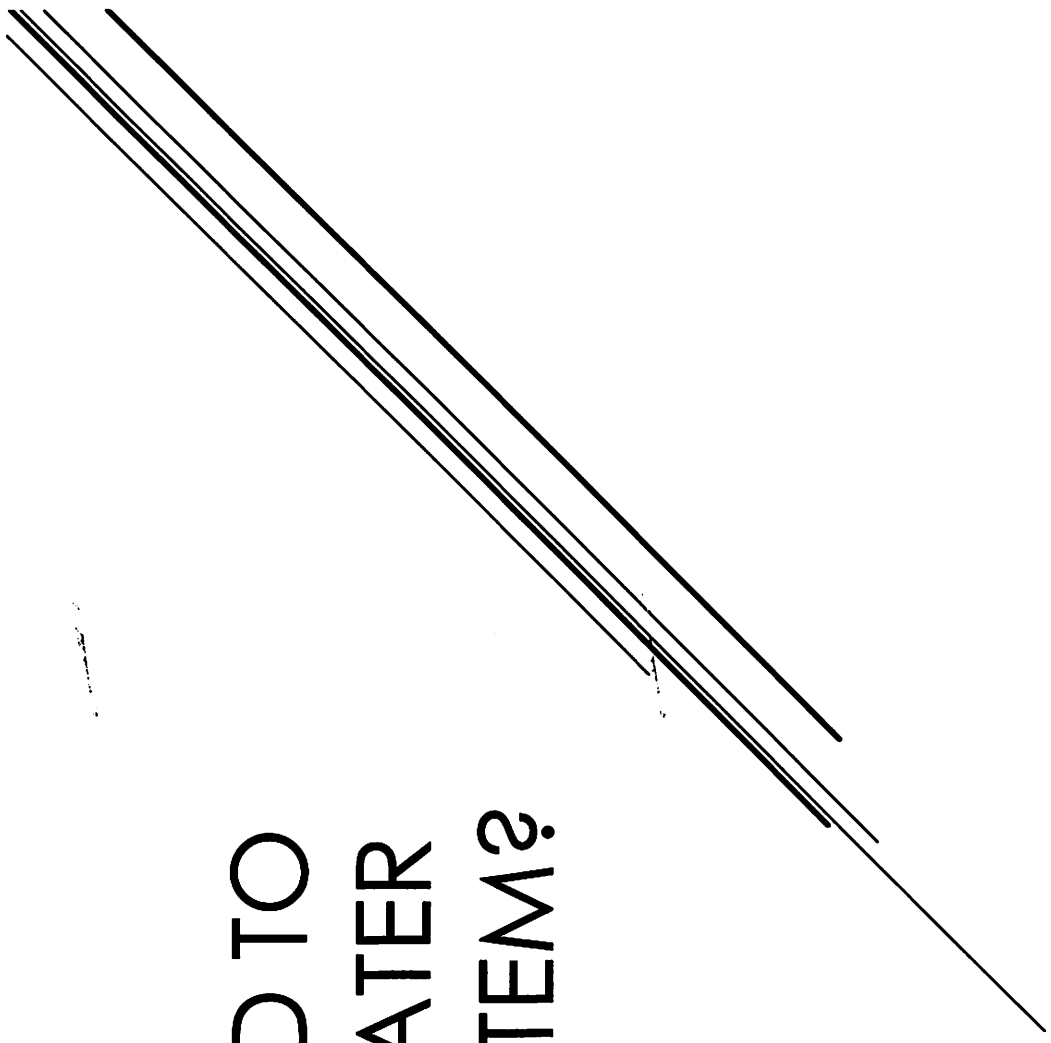
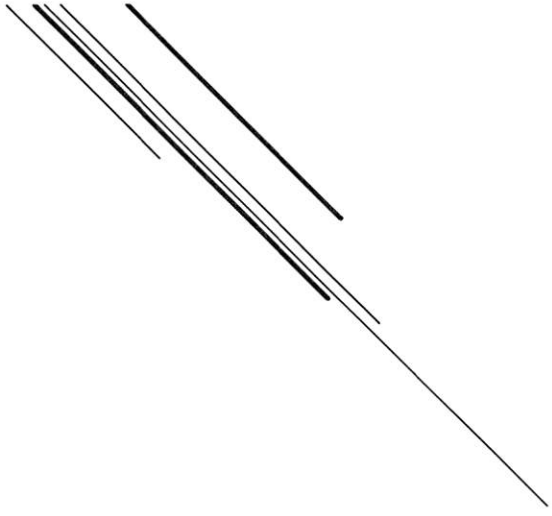


**WHY DO WE NEED TO  
MAINTAIN THE WATER  
DISTRIBUTION SYSTEM?**





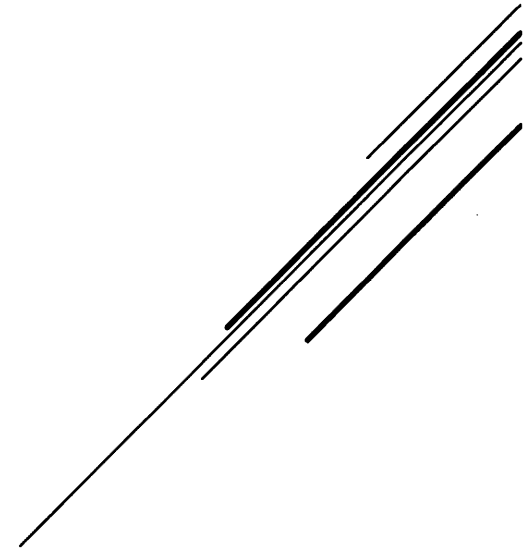
# **WHAT IS WATER DISTRIBUTION**

Water distribution is the process of bringing clean water to the consumer.

Municipal water distribution systems typically supply all the water for residential, commercial and industrial use. Also, they provide water for fire protection through hydrants and fire service connections.

A water distribution system is a network of buried pipes connected together that allows the transfer of water from the water treatment plant to all the homes, businesses, fire hydrants, schools, parks and gardens etc...

The Pipe size, length and material type can vary depending on system age, demand, pressure required and area covered.



## The Cambridge Water Distribution System

Consists of approximately 185 miles of pipe ranging from 4" – 42"

Active Pipe Age ranges from, 1864-Present

### Pipe materials include,

(Pit) Cast Iron	(1800's – 1920's)
(Rolled riveted) Steel	(1800's – 1920's)
(Spun) Cast Iron	(1930's – 1960's)
(Pre-stressed) Concrete	(1950's – Present)
Ductile Iron	(1950's – Present)
HDPE	(1990's – Present)

## PIPE RELIABILITY AND ASSESSMENT

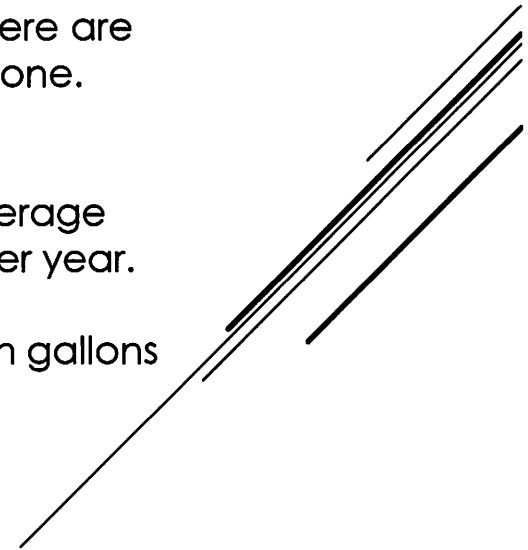
It is a fact that in every water system throughout the world eventually your water mains will leak and/or break!

Regardless of pipe material, soil type, age, or climate, eventually water will find it's way out of the pipe.

Currently the American Society of Civil Engineers (ASCE) estimates that there are approximately 240,000 water main leaks each year in the United States alone. (Which I believe is a low estimate)

The Water Research Foundation estimates that most water systems on average have approximately 0.25 leaks per foot of water main within the system per year.

When you add up the numbers ASCE estimates that in the US over 2 Trillion gallons of water are lost through leaks each year.

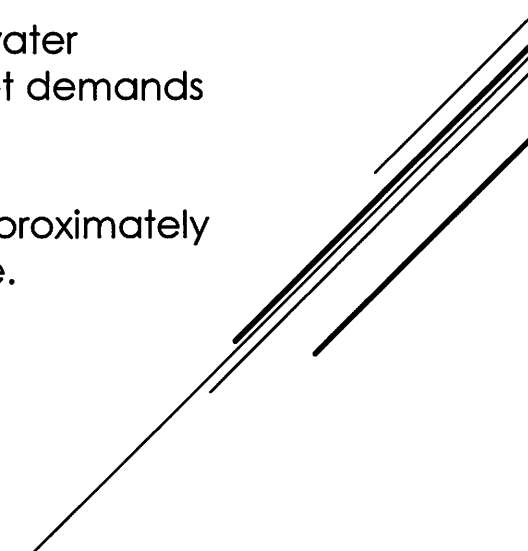


In March of 2001 ASCE released their "Report Card" for their assessment of the condition of America's infrastructure and gave it an overall "POOR" rating which included public water distribution systems.

This prompted the USEPA, the American Water Works Association (AWWA) and other national associations to look into the aging water infrastructure across the country and develop cost estimates for addressing the issue.

The estimates went as high as \$1 Trillion that would need to be spent on water infrastructure over the next 20 years to just maintain water service to meet demands which 55% of that was for distribution systems.

It was also estimated that Massachusetts alone would need to spend approximately over \$12 Billion Dollars in the next 20 years on Drinking Water Infrastructure.

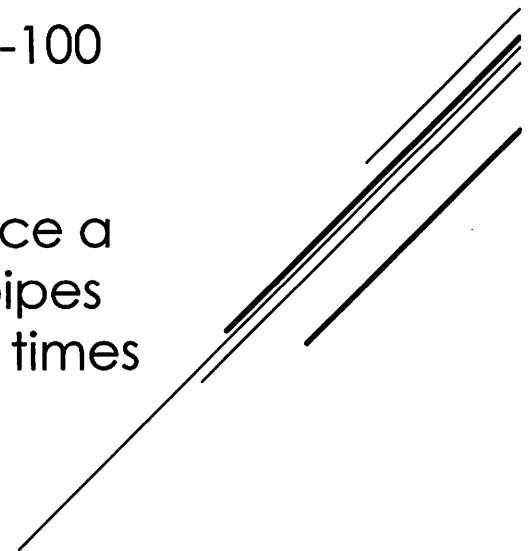


What does this mean for Cambridge?

Currently Cambridge has over 124 miles of water main that is either cast iron, Riveted Steel or concrete. Which indicates because of pipe material that the pipes are a minimum of 70 years old and some are more than 150 years old!

Original estimates for useful life for these materials was 50 -100 in the ground.

Using age of material as the only deciding factor to replace a pipe. The estimated cost to dig and replace all of those pipes would be **\$250 Million Dollars!** Which is approximately 175 times our current annual Capital Improvement Budget for Distribution.



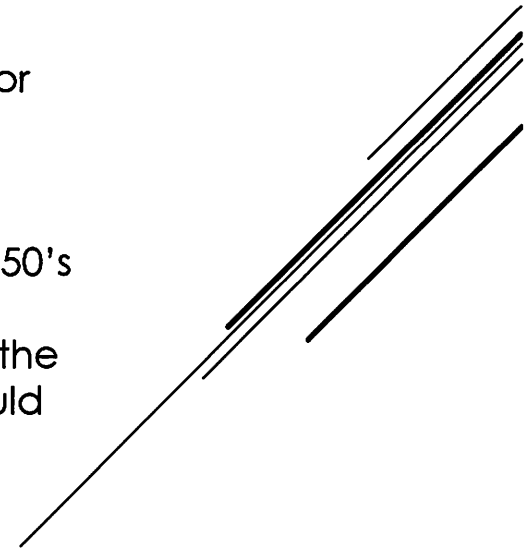
When we look at pipe replacement in this way it becomes clear that it would be impractical to try and replace pipe based on age alone. Especially in a place like Cambridge where our water infrastructure dates back over a century and a half.

So what basis do we use to determine when a water main should be replaced instead of just maintained and repaired?

The guideline stated by the USEPA is "The appropriate time to replace or rehabilitate a main is when it **stops providing the level of service that is expected of it!**"

Fortunately that has been the approach of the CWD since the early 1950's

In the early 50's instead of replacing all of the large transmission mains the CWD had them all cleaned and lined with cement knowing that it would extend the useful life of the pipes by preventing internal corrosion.



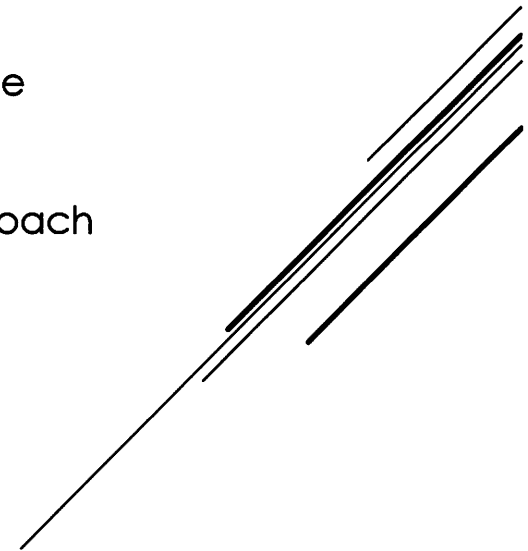


In the early 90's the CWD commissioned CDM to perform a Distribution Study to assess the condition of our distribution system and make recommendations for needed repairs or replacement.

From those recommendations CWD has developed, maintained and routinely updated a list of priority watermain replacement strategy and Capital Improvement Plan.

Each pipe segment throughout the City is given a priority number for replacement based on set of criteria which gives us the best chance to be proactive instead of reactive to distribution issues.

Because water main breaks and leaks are impossible to predict, this approach is the best known way to at least minimize these issues.



**The criteria used is as follow:**

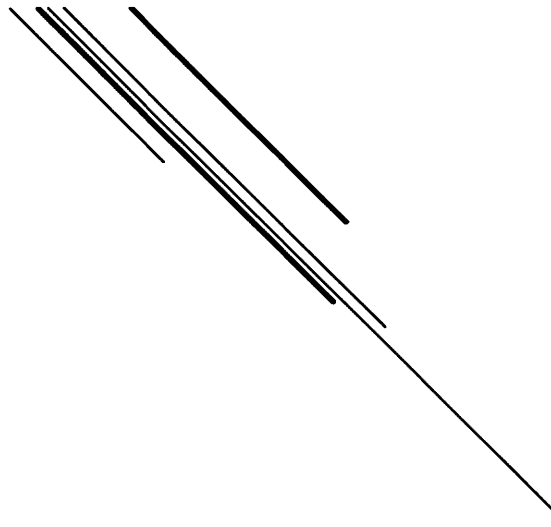
Fire flow capacity

Leak History

Water Quality Issues and complaints

Age and pipe material

DPW Street restoration project schedule



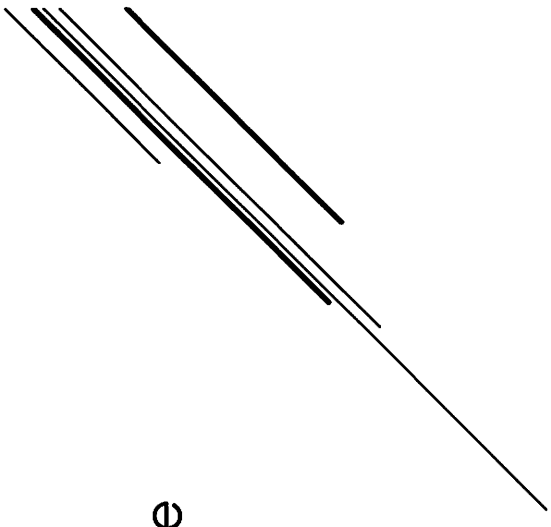
Using this methodology along with having

A robust water main replacement program,

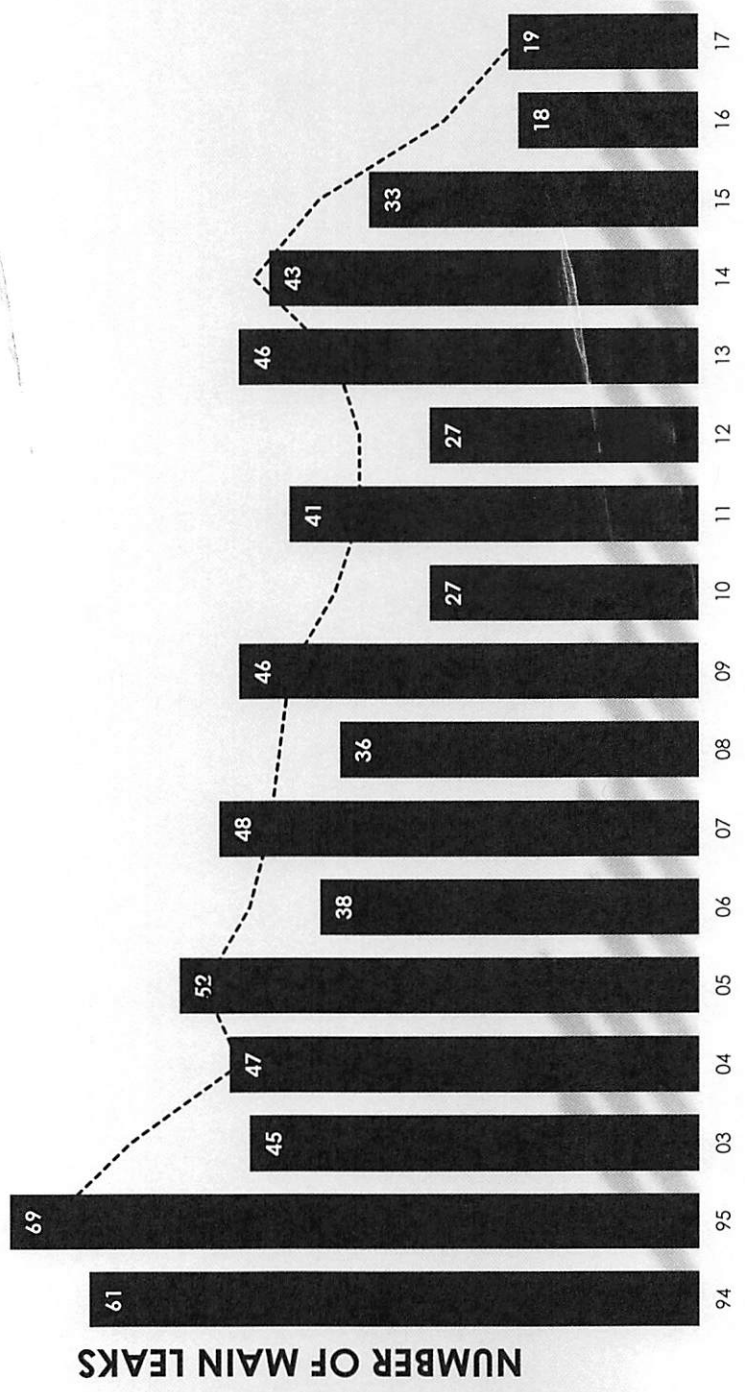
And establishing an annual leak detection program

CWD has been able to reduce the amount of annual leaks by approximately 50% since the early 90's

In the past couple of years CWD has been well below the Average of .25 leaks per foot of pipe established by The Water Resources Association



# MAIN LEAKS COMPARISON BY YEAR



MILES OF NEW WATER MAIN INSTALLED 1992 - 2017

SIZE	FT OF MAIN	MILES
4	1370.34	0.26
6	14107.9	2.67
8	106987.85	20.26
10	15705.55	2.97
12	68045.34	12.89
16	8336.73	1.58
20	483.18	0.09
24	897.69	0.17
30	2534.31	0.48
36	2241.88	0.42
40	2904.31	0.55
42	4259.78	0.81
48	533.25	0.10
TOTALS	228408.11	43.26

Since the early 1990's the CWD has

Replaced over 43 miles of old cast iron water main,

Started a lead service replacement program which has eliminated over 9000 old lead services from the system which also reduces service leaks

Replaced or repaired over 2700 valves to help maintain system control

Replaced or repaired over 1000 hydrants, which helps the city maintain it's triple A fire rating

And continued working with the DPW and other City departments in coordinating water main replacement along with other city projects which helps reduce cost and repeat work.

Overall I feel our distribution system is in pretty good shape compared to other municipalities which was reiterated by our leak detection contractor after his last city wide audit he quoted "I found the system to be in excellent condition with only five leaks throughout"

