

# Sustainable Maintenance Approaches

Sanitary Sewer Siphons vs. Pump Stations

An analysis of a recent siphon blockage in the Millbury/Vernon Street Area

#### Presentation by:

DPW&P SEWER OPERATIONS

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worcesterma.gov 508-929-1300



Population: approximately 181,000 residents

Miles of Sewers: 377 miles of sewers (8" to 96")

329 miles of drain (8" to 156")

59 miles of combination (8" to 240")



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#### Number of manholes:

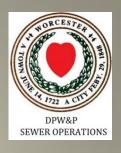
- 2,621 combination manholes
- 13,919 drain manholes
- 14,710 sewer manholes
- 3,213 twin manholes







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Number of catch basins: 15,751

Number of Outfalls: 344 (8" to 72"x74")









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- Number of sewer pump stations: 30 (1,500 GPD to 4 MGD)
- Number of stormwater pump stations: 2
- One CSO treatment facility
- Number of siphons: 19
- Number of regulators: 30

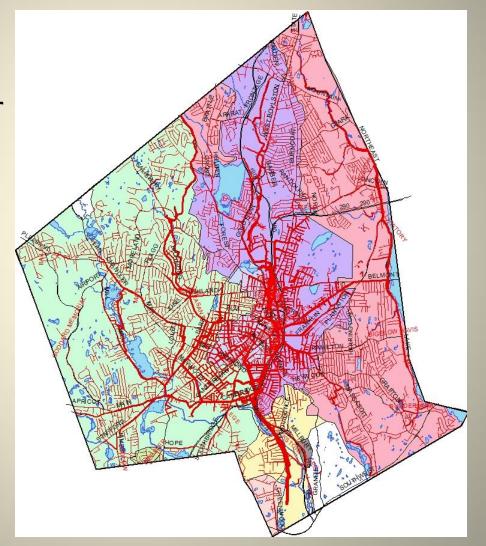




# Major Sewer Service Areas

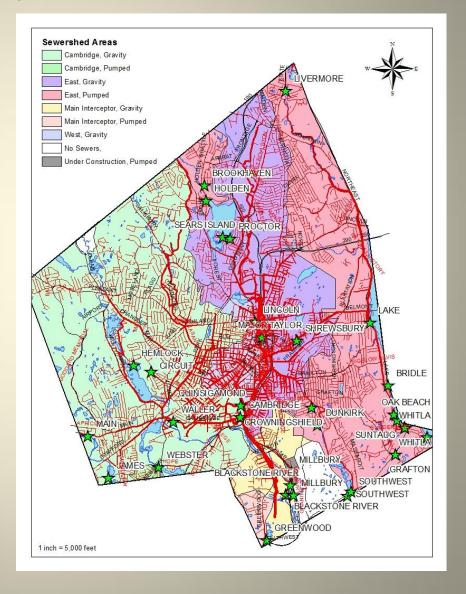
DPW&P SEWER OPERATIONS

- Cambridge Street
- Western Interceptor
- Eastern Interceptor
- Lake Ave Corridor



# 30 Pump Stations

Street Name/PS Name	Service Area Name		
QUINSIGAMOND AVE	Cambridge - Gravity		
GRAFTON ST	East - Pumped		
DUNKIRK AVE	East - Pumped		
MILLBURY ST	Under Construction - Pumped		
HEMLOCK ST	Cambridge - Gravity		
BRIDLE PATH	East - Pumped		
SOUTHWEST CUTOFF	No Sewers		
MAJOR TAYLOR BLVD	East - Gravity		
CROWNINGSHIELD RD	East - Pumped		
LIVERMORE ST	East - Pumped		
OAK BEACH TER	East - Pumped		
PROCTOR ST	East - Gravity		
SHREWSBURY ST	East - Gravity		
SUNTAUG RD	East - Pumped		
BROOKHAVEN RD	East - Pumped		
WHITLA DR	East - Pumped		
PINELAND AVE	East - Pumped		
BROOKHAVEN RD	East - Pumped		
SEARS ISLAND DR	East - Gravity		
JAMES ST	Cambridge - Gravity		
WEBSTER ST	Cambridge - Pumped		
LAKE AVE	East - Pumped		
GREENWOOD ST	Main Interceptor - Pumped		
HOLDEN ST	East - Pumped		
MILLBURY ST	Main Interceptor - Gravity		
CAMBRIDGE ST	Cambridge - Gravity		
MAIN ST	Cambridge - Pumped		
LINCOLN SQ	East - Gravity		
WALLER AVE	Cambridge - Pumped		
WHITLA DR	East - Pumped		



# **Pump Stations Issues**



- Software/SCADA can be a headache.
- Require maintenance & upgrades.
- Expensive. City has \$500,000/year

maintenance budget.

- Mechanical parts break.
- Uses electricity.
- Finite life spans.



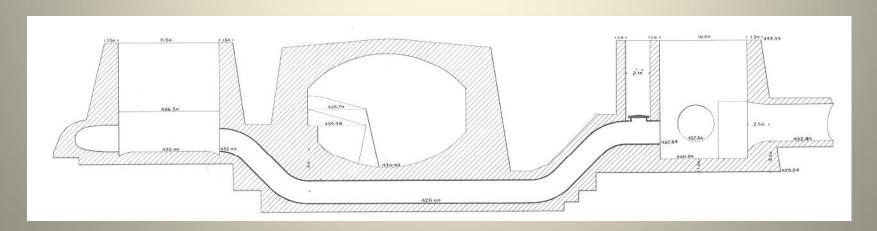
# Siphons in the City of Worcester

Address	Size	Length	Directions
Newton Ave North @ Suburban Rd	15"	27.5	Flush from MH4 to MH5
267 Chandler	8"	52.2	Flush from MH9 to MH12
559 Park Ave	15" and 10"	66.3	Flush from MH8 to MH9 in 10" and 15" sewer
24 Mill St	30" and 18"	57.8	Flush both 30" and 18" sanitary from MH21388
19 Glenine St	Twin 10"	60.4	Flush both barrels from East to West
Glenine St @ Millbrook St	Twin 24"	64.8	Flush both barrels form MH 9 (South) to MH 9 1/2 (North)
151 West Boylston Dr	8" and 12"	38.7	Flush both 8" and 12" from MH 29 1/4 (West) to MH 29 1/2 (East)
Home Depot @ Gold Star Blvd	Twin 24"	48	Flush both barrels from MH 16 1/4 (South) to MH 16 1/2 (North)
160 Gold Star Blvd	Twin 18"	34.1	Flush both barrels from MH 17 (S) to MH 18 (N)
Garden St - A	Twin 10"	68	Flush both barrels from MH 2 1/2 (West) to MH 2 1/4 (East)
Garden St - B	Twin 15"	60.4	Flush both barrels from MH 3 (West) to MH 2 (East)
40 Webster St	18"	72.5 (?)	Flush from MH 6 (North) to MH 7 (South)
241 Grove St	20"	55	Flush from MH near North St (SE) to MH near Sagamore Rd (NW)
51 Summer St	4 x 24"	135	Flush four barrels from MH 13 or closer (SE) to MH 14 (NW)
Southbridge St Under 290 Bridge	24"	200	Flush from MH 7 (N) to MH 8 (S)
1090 Main St	30"	83.6	Flush from MH 1 (East) to MH 8 (W)
Quinsigamond Ave @ Cambridge St	3 x 30"	215	Flush three barrels from Cambridge St side towards Quinsig Ave
Quinsigamond Ave @ 146 on ramp	3 x 30"	65	Flush three barrels from Cambridge St side towards Millbury St
Millbury St Under 146	18"	110'	Flush from MH S-3 to MH S-2 (Millbury St)

# Siphon Issues



- Different designs and applications in the city.
- Lower maintenance than pump stations.
- Blockages can get messy and are tough to resolve.

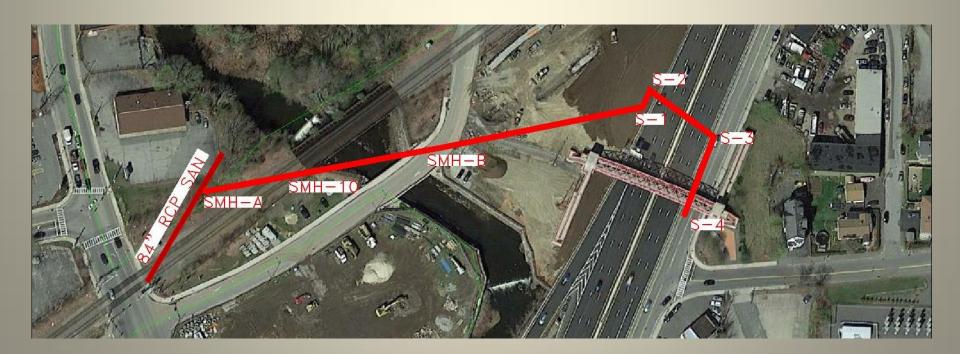


Siphon crossing under the Millbrook Conduit @ Quinsigamond Ave

# Millbury Street Siphon

DPW&P SEWER OPERATIONS

- Approx. 650 feet in length.
- Entire length is under pressure.
- Two cleanouts.
- Enters into 84" RCP sanitary sewer near McKeon Rd.



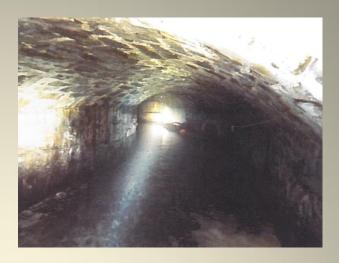
#### Sewer crosses under:

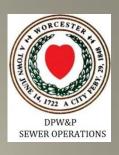
- Rt. 146

- Mill Brook Conduit

P&W Railroad Location

- Middle River



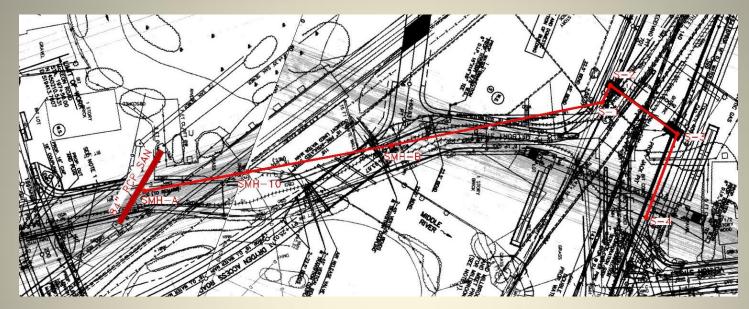


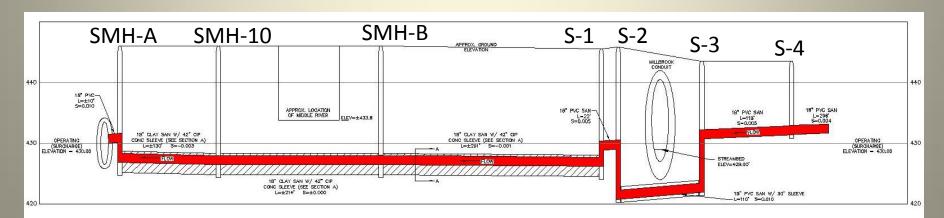




# Millbury Street Siphon



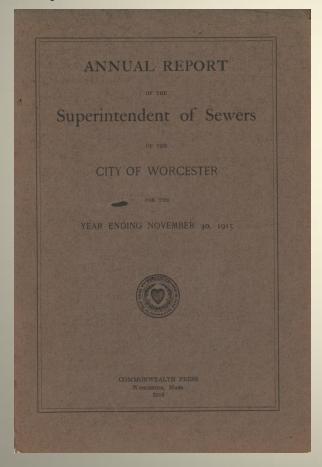


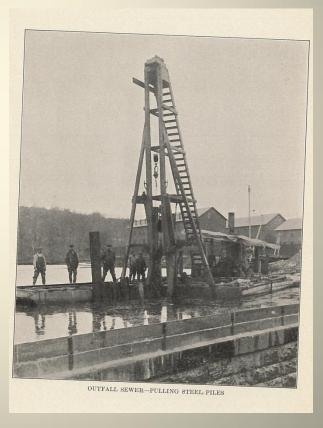


# Siphon Timeline

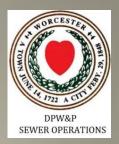
DPW&P SEWER OPERATIONS

 18" sewer first mentioned in 1915 Annual Report.



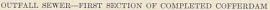


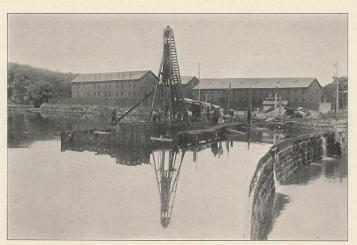
# Siphon Timeline



Intended to flow as a gravity sewer.







OUTFALL SEWER-DRIVING STEEL PILES FOR COFFERDAL

### 1915: Conversion to 18"



Pipe was installed in an existing 42" host pipe.

9] SUPERINTENDENT OF SEWERS. 439
been removed and carted to the nearest available dump at

a cost of 85 cents per yard.
During the year 183 new catch basins have been constructed making the total number on the system 3746.

#### OUTFALL SEWER

The new Outfall Sewer was put into operation Jan. 2, 1915.

The work of the past season has been to change the lateral sewers and house drains from the old to the new outfall, and to remove the walls of the sewage carrier built inside of Mill Brook sewer in 1897. Considerable expense

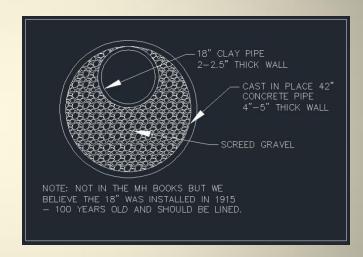
was saved by using in a reinodeled form the ord outlan fettween Middle River Road and Ballard Street. An 18" Akron pipe was placed inside and close to the arch of the old sewer, and the remaining space was completely filled with screened gravel. To flush the 18" pipe which enters the new outland at the bottom, a large tank at the foot of Vernon

brough a 10" Miller Siphon.

With the completion of the new outfall there was no further use for the sewage carrier inside of Mill Brook. In fact the rapid growth of the city demanded its removal, increasing as it did the roof and street area, consequently increasing the volume and intensity of the run-off in time of storm. As a temporary structure it fulfilled the purpose for which it was built; costing \$55,000 to construct and to remove, it saved the expenditure of \$200,000 for a period of 17 years. Extending from Ballard Street to Cambridge Street the carrier contained about 3,000 cubic yards of masonry composed of hard burned brick laid in Portland cement.

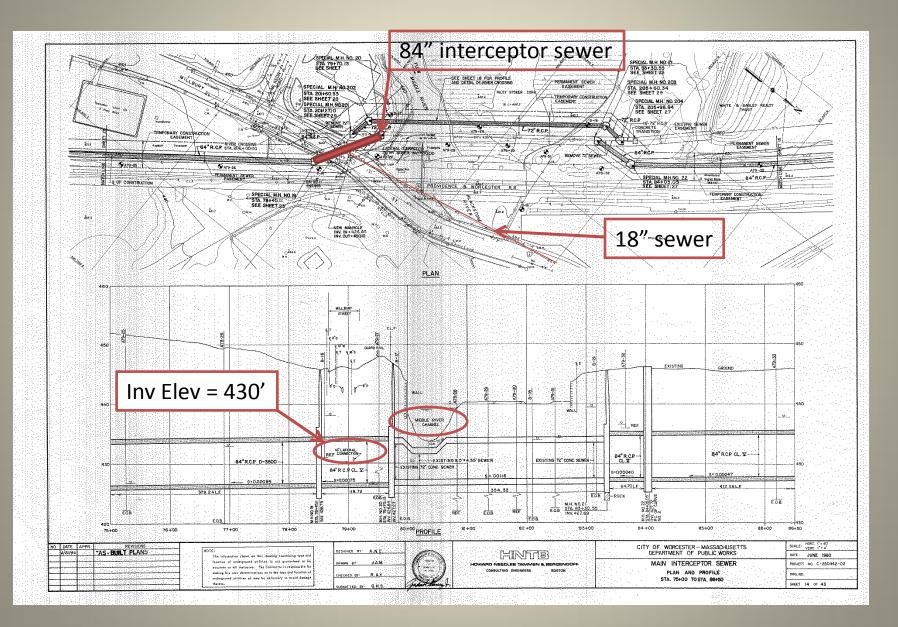
To facilitate the work of removal a shaft leading to Mill Brook was sunk at Fifth Avenue. A derrick was also set up and a small compressor plant established. The masonry was drilled by the use of compressed air and blasted with dynamite, small charges being used to guard against injury to the main structure.

A dam, easily removed, was thrown across the 18' channel, thus furnishing a depth of water sufficient to operate three boats each 5½ feet wide and 18 feet long. Evinrude 3½ H. P. gasoline motors were used for moving the boats, and made good headway even against the current which at times was strong.

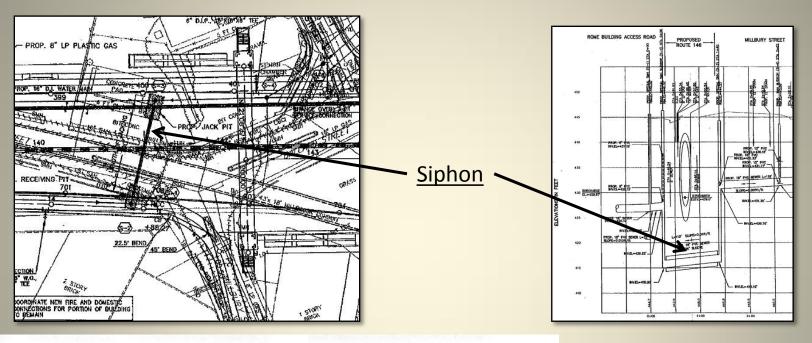


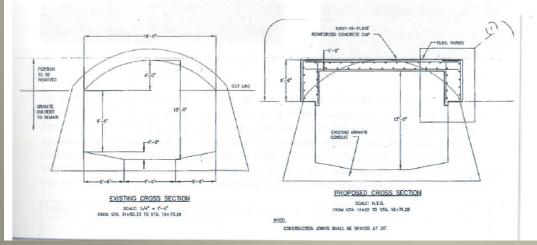
"An 18" Akron pipe was placed inside and close to the arch of the old sewer, and the remaining space was completely filled with screened gravel."

#### 1980s: Contract 19



# 2002: Rt. 146/Hurley Sq. Contract



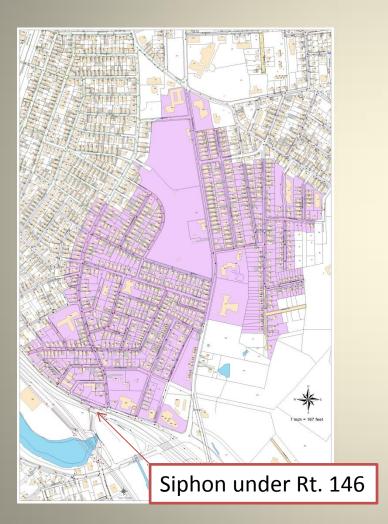


Mill Brook Conduit work included removing top 4' of granite arch and replacing it with a cast-in-place reinforced concrete cap.

# Siphon Blockage and SSO



# Millbury St Siphon Service Area



- Approximately 600 parcels.
- An estimated 6,600
   gallons of sewage
   entered the Blackstone
   due to blockage.



# Saturday 9/24/16



 Passerby see sewage coming out of manhole on Millbury St and calls customer service.





\*This is not the actual SSO

# Saturday



- Flusher responds and frees blocked sewer.
- We believe debris was flushed downstream and blocked up the siphon.



# Saturday night into Sunday

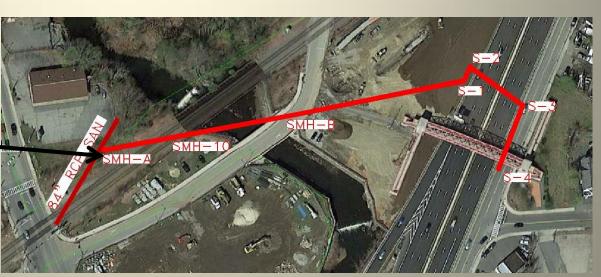
- Flow is managed by three hired septic haulers.
- No loss of service reported in the area.
- Dumped sewage into a local gravity sewer.



# Monday Morning

- Septic haulers continue to work around the clock.
- A pump is set up on the downstream side of the second siphon to lower the operating elevation of the system.





# Monday – Siphon is blocked

- Catch basin machine set up on Rt. 146 due to limited access to downstream MH.
- Dredger removes 6-10 yards of rags, flushable wipes and grease from MH.



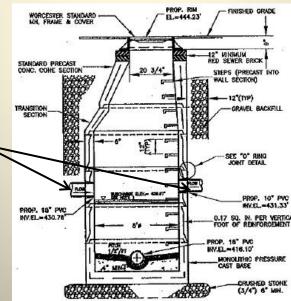


# Tuesday

- DPW&P SEWER OPERATIONS
- Dredger work shuts down at 4 PM due to safety concerns.
- Two legs coming into the siphon became exposed overnight on Tuesday due to the low flow conditions and increased capacity

downstream.

Flow into the siphon was plugged overnight on Tuesday



<u>Upsteam MH S-3</u>

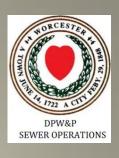
# Wednesday

- DPW&P SEWER OPERATIONS
- 3" submersible pump brought in to expose invert of outgoing siphon pipe.
- Hired vac-flusher brought in to clean 18" siphon from upstream MH.
- One yard of gravel removed from siphon.





#### Cost

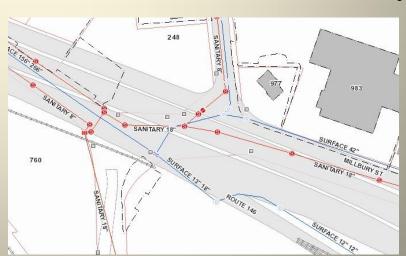


- 10 Sewer Operations personnel dedicated to this location over a three day span.
- Overnight supervision of job site.
- Three large septic haulers: three straight days.
- Hired vac-flusher for 15 hours.
- Police detail for Rt. 146 two officers for three eight-hour shifts.
- Still much cheaper than designing, building and maintaining a pump station to service this area.

# Lessons learned/conclusions

- DPW&P SEWER OPERATIONS
- Improve monitoring of pre-1900 sewers.
- Schedule & document inspections and cleanings when necessary.
- Record drawings need to be readily available and properly catalogued.
- GIS needs to be updated to ensure accuracy.

# LIST OF REFERENCE DRAWINGS 1915 Annual Report Worcester Sewer Dept. 40-Scales Book 10 - Sheets 14 and 15 Rt.146 - Hurley Sq Contract Utility Plan Sheet 3 and 6 Contract 19 Sheet 14



# Lessons learned/conclusions



 Targeted public outreach/education associated with flushable wipes, grease, etc. to entire service area.





@TweetWorcester

## Questions?

DPW&P SEWER OPERATIONS

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Thanks!