

# Planning for Framingham's Future

An Integrated Approach to Wastewater  
Infrastructure Planning, Operation and Management

## **TOWN OF FRAMINGHAM**

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Assistant Director  
Water and Wastewater



## **STANTEC**

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Senior Associate

January 24, 2017

# Presentation Agenda

- **Community, Infrastructure and DPW Historical Perspectives**
- **Program Status and Accomplishments**
- **Wastewater Master Plan**
- **Next Steps**

January 24, 2017

# OUR COMMUNITY

- Established in 1700
- Mix of Residential, Commercial, Industrial, Institutional, and Land Uses
- Corporate/Recreational HQs - Bose, Staples, Genzyme, TJX
- Framingham State University and Mass. Bay Community College
- Metrowest Hub for Transportation and Commerce



# Who We Are, Our Challenges and Complexities

- **Government**

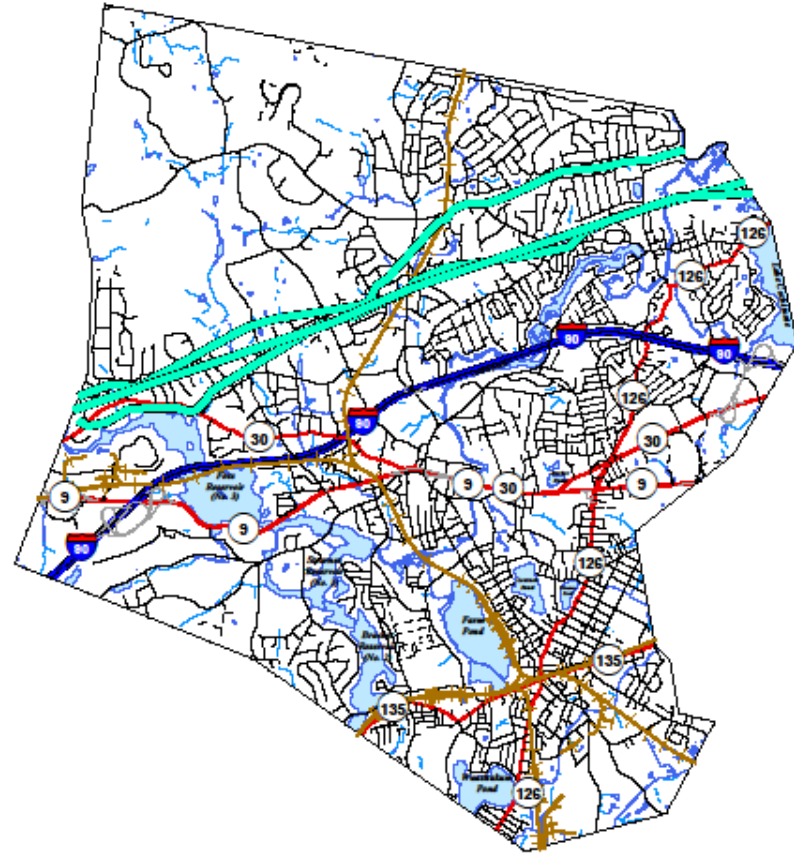
- Representative Town Meeting

- **Population 68,000**

- Tripled since 1945
- 20,000 commercial & residential properties

- **Physical Impediments**

- Crossed by 4 aqueducts
- High Power Electric and Gas Transmission Lir
- Bisected by Sudbury River, reservoirs
- Transportation Hub for Regional Transit
  - MBTA/CSX railway
  - Mass. Pike (Route 90) Exits 12 & 13
  - State roads (Route 9, 30, 126, 135)



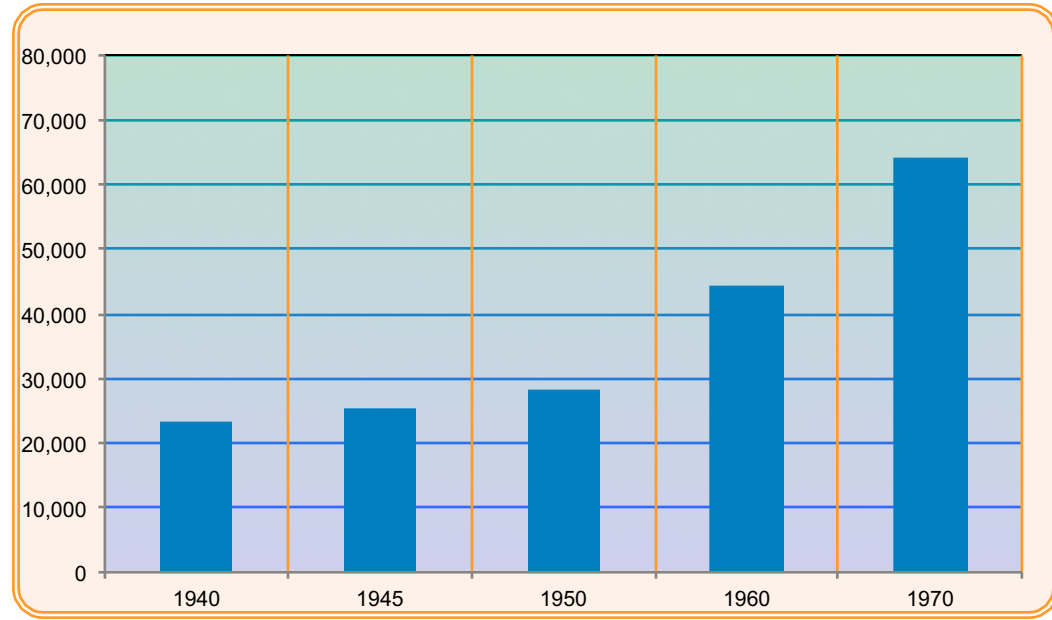
# Population Growth Brings Demand for Infrastructure

## 1890s to 1946

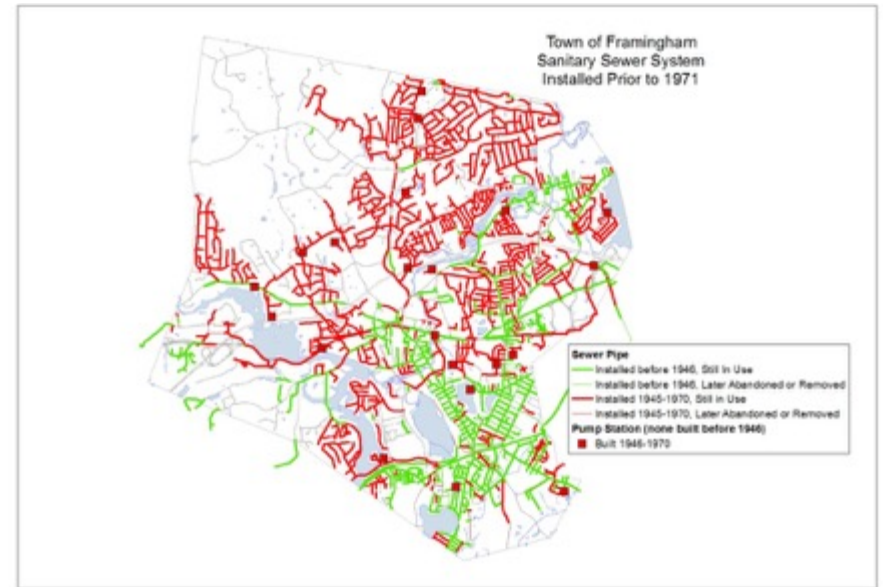
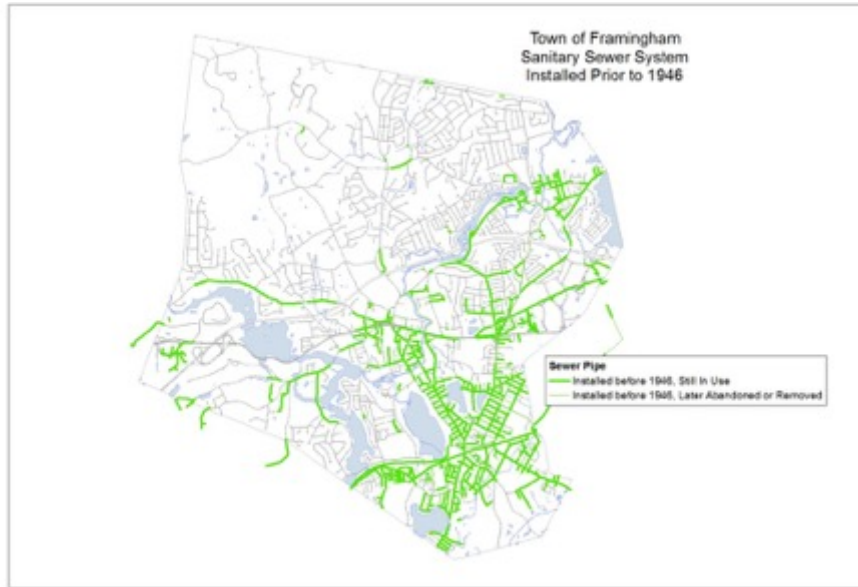
- Construction of wastewater collection systems (and similar for water distribution systems)
- Gravity wastewater system construction (57 miles) matched steady and manageable growth rate

## 1946 to 1970

- Post WW II Boom  
Population tripled
- Demand for wastewater infrastructure  
136 miles of mains  
40+ pump stations
- Construction of Massachusetts Turnpike in late 1950s
- Demand negated the community's ability to effectively and efficiently plan and construct infrastructure systems



# Wastewater System Expansion 1946 -1971

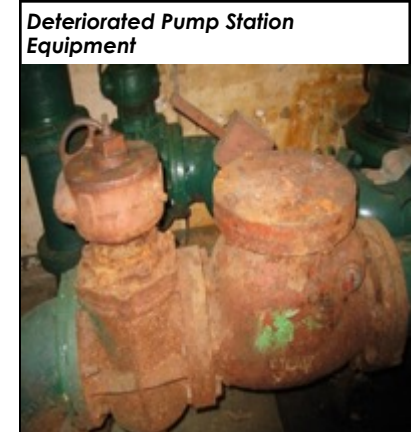


# Growth Brings Challenges and Problems 1960 to Early 2000s

- Philosophy: keep rates down, lowest in the state
- No documentation of assets, only anecdotal information
- No mapping
- Minimal engineering or support staff
- Little accountability or authority



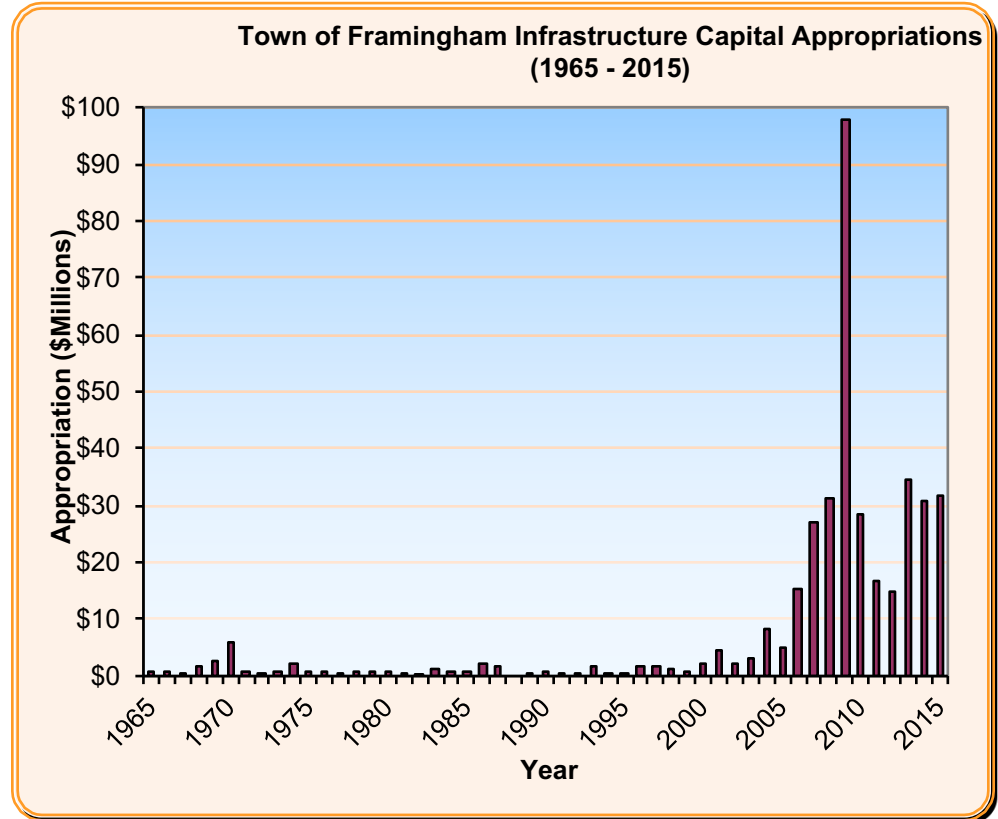
**Hydrant—Out of Service**



# Result: Minimal Capital Investment for Over 40 Years...

But they saw it coming...

From a 1973 Annual Report:  
“Unless we provide a methodical program of maintenance and repair for our facilities we may one day be faced with a need for total replacement of all facilities. The cost would be too burdensome for the taxpayers to afford.”





# Problems Require Action - 2003 to 2007

- **Development of Master Plans**
- **MWRA Coordination**
  - Sulfides: Identify Sources and Establish Limits
  - I&I Reduction and SSES
  - 2003 MWRA Settlement Agreement
- **MassDEP Coordination**
  - Noted high SSOs in 2005
  - DPW proactively met with MassDEP, providing them with master plans
  - 2007 Administrative Consent Order – but no fines

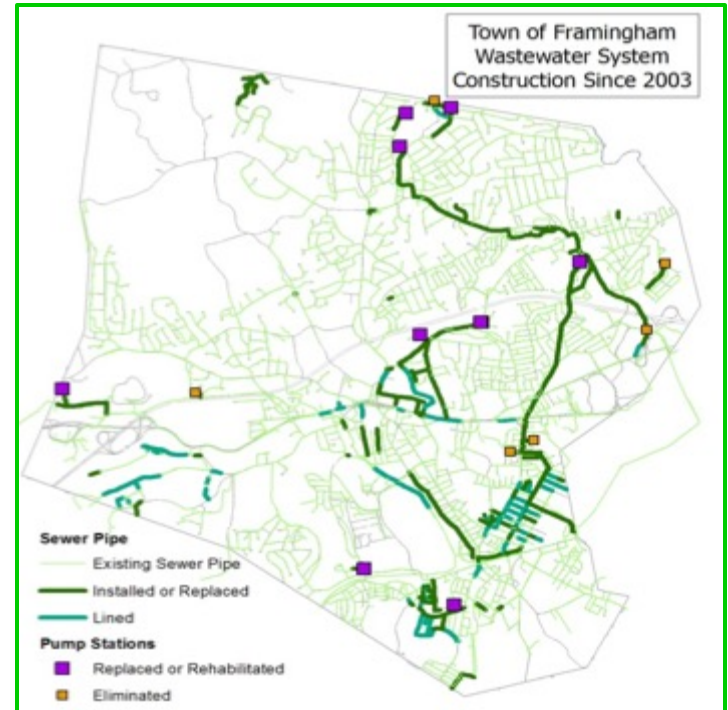


# Reversing The Trend - A Typical Year in Framingham!



# Accomplishments and Results 2005 to 2015

- Collections System - 17 Miles of Sewer Replaced, 11 Miles Rehabilitated (10% of System), ~1,000 Manholes
- Wastewater Pump Stations (42)
  - Eliminated - 7
  - Rehab./Repl. - 8
  - R/R in Process - 7
- Operations Efficiency - Eliminating SSOs, Reducing Inflow/Infiltration, Reducing Energy Usage
- Necessity for Infrastructure Investment Part of the Town Government and Community's Culture
- Level of Work Completed Dictated Need to Revisit and Update our CWMP



# System Components - 2016

- **Average Daily Flow = 7 MGD**
- **240 Miles of Mains**
  - **50 Miles - 75 to 100 Years Old**
- **7 Siphons**
- **6,900 Manholes**
- **42 Pump Stations**
- **40 Miles of Cross Country Easements**



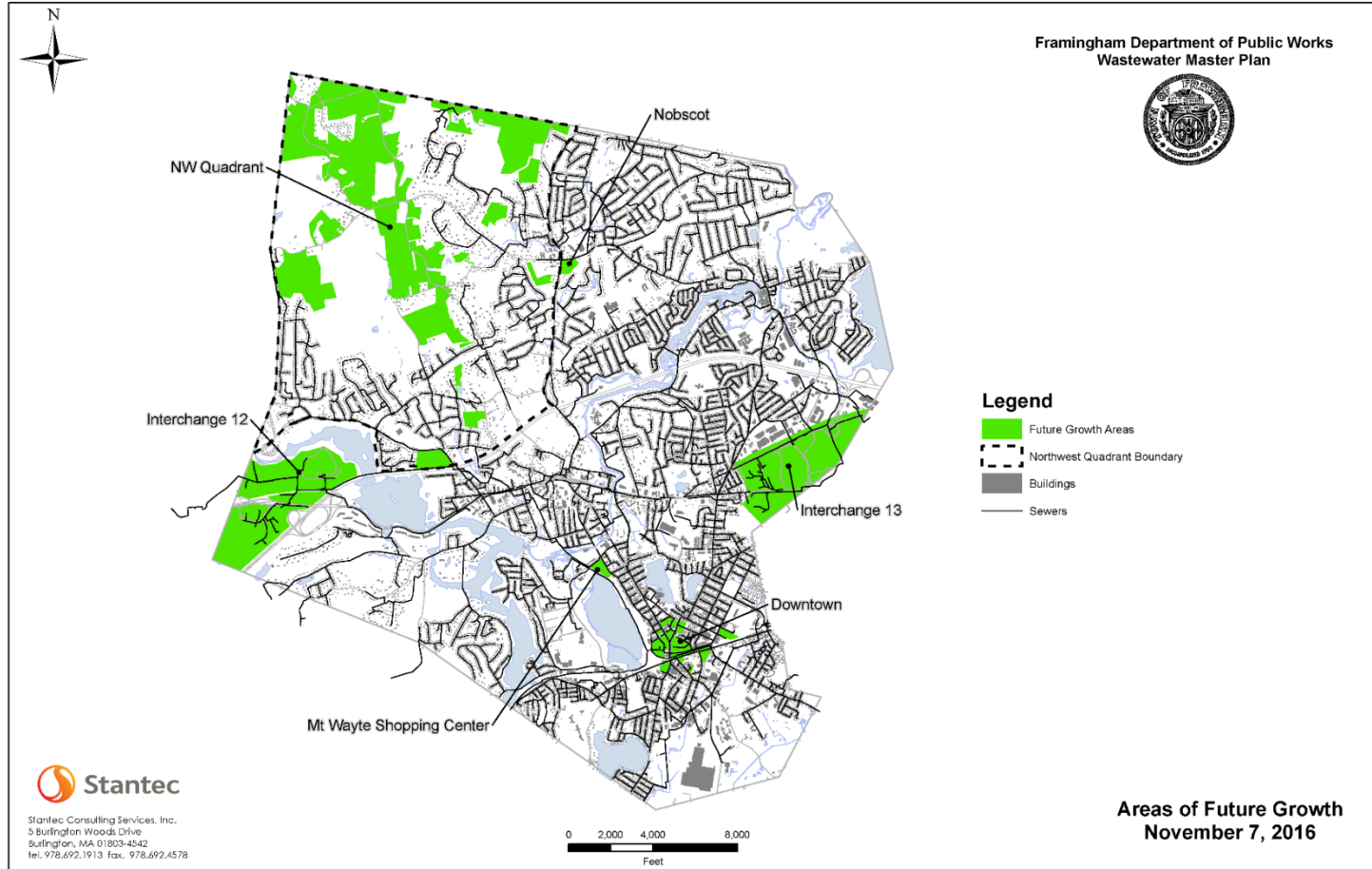
# A Programmatic Coordinated Approach to Capital Improvements, Operation and Management of Infrastructure:

- **Requires Acceptance by Public**
- **Poses Financial Challenges**
- **Will Result in Business / Neighborhood Revitalization**
  - ❑ Tech Park (9/90)
  - ❑ Saxonville Area
  - ❑ Downtown
  - ❑ A Street Area

# Planning for the Future

- Major Growth Areas
- Comprehensive Flow Metering Program
- Town-wide Sewer System Modeling
- Infiltration / Inflow Mitigation Program (Meeting / Exceeding DEP Req'ts.)
- Wastewater Master Planning
- Leveraging Technologies for System O&M (i.e., SCADA)

# Major Growth Areas

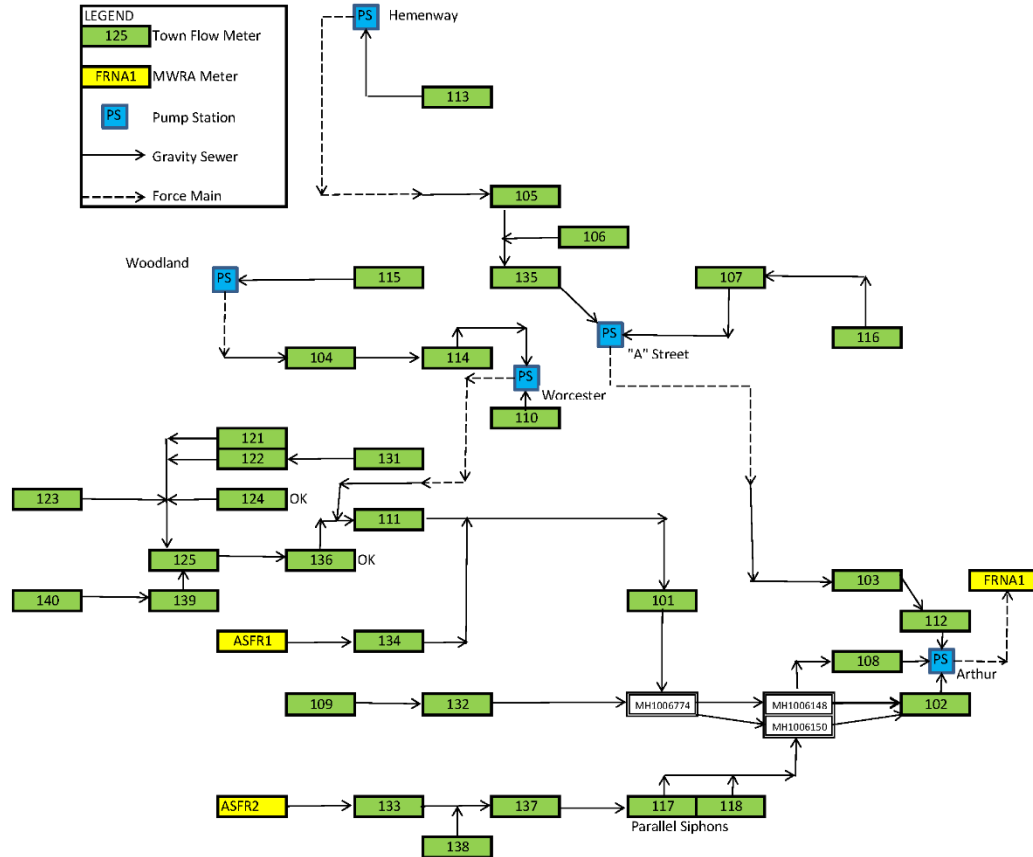


### Total Estimated Increase in Average Daily and Peak Hour Wastewater Flows

Growth Area	Buildout Period	Buildout ADF (gpd)	Existing Water Use (gpd)	Estimated ADF Increase (gpd)	Increase in Peak Hour Flow (gpd)
Interchange 12 (Tech Park & 9/90)	10 yrs			258,000	468,500
Interchange 13 (Golden Triangle)	10 yrs	851,000	214,000	675,000	1,350,000
Downtown	20 yrs	726,000	66,000	661,000	992,000
Northwest Quadrant	10 yrs			414,000	669,000
Mt Wayte Shopping Center	10 yrs	27,000	1,000	26,000	40,000
Nobscot Area	10 yrs	46,000	5,500	40,500	81,000
Subdivision and Infilling	50 yrs			2,430,000	4,860,000
<b>Totals</b>				<b>4,504,500</b>	<b>8,460,500</b>



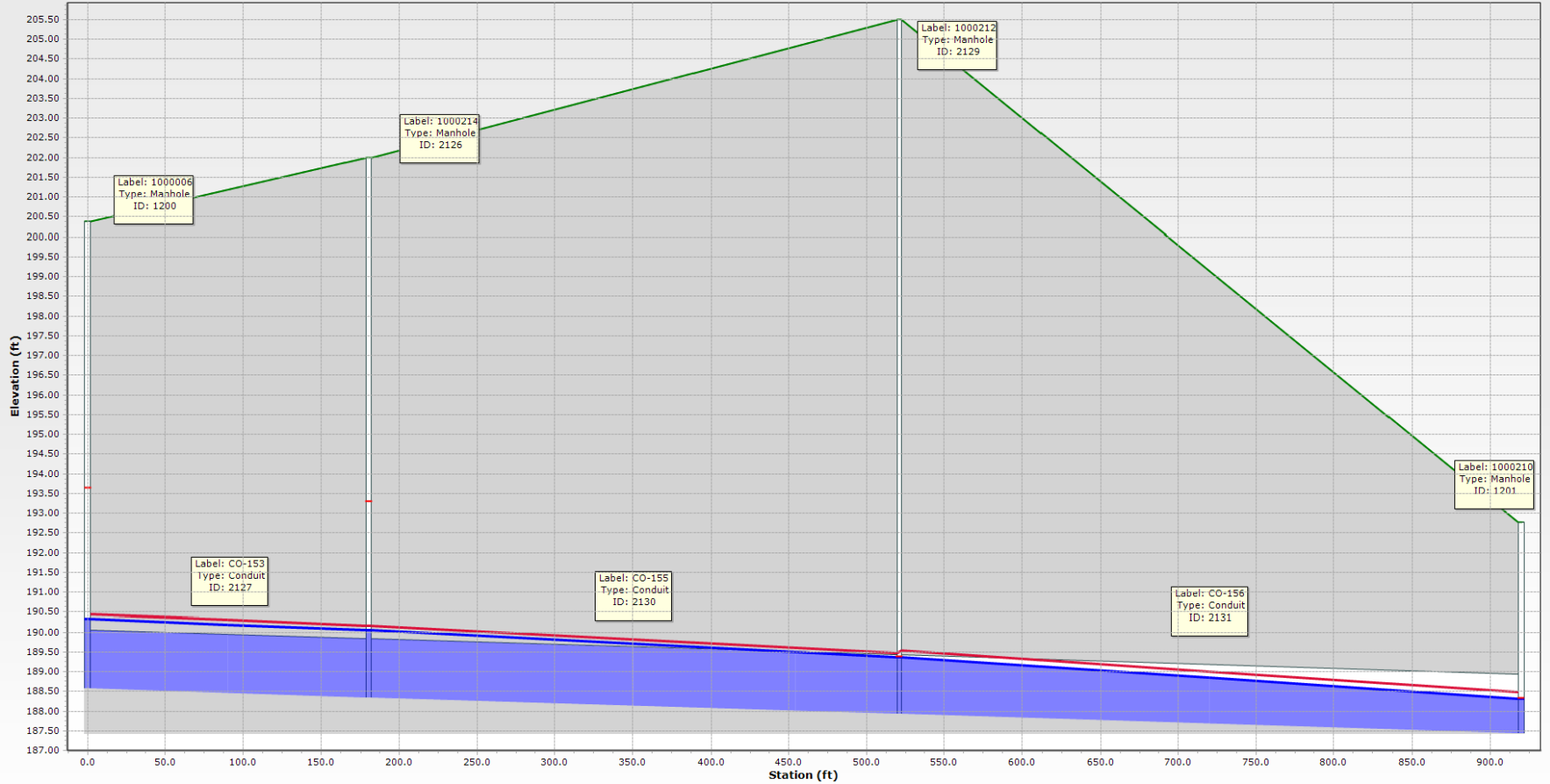
# Flow Metering Schematic



# Town Wide Sewer System Modeling

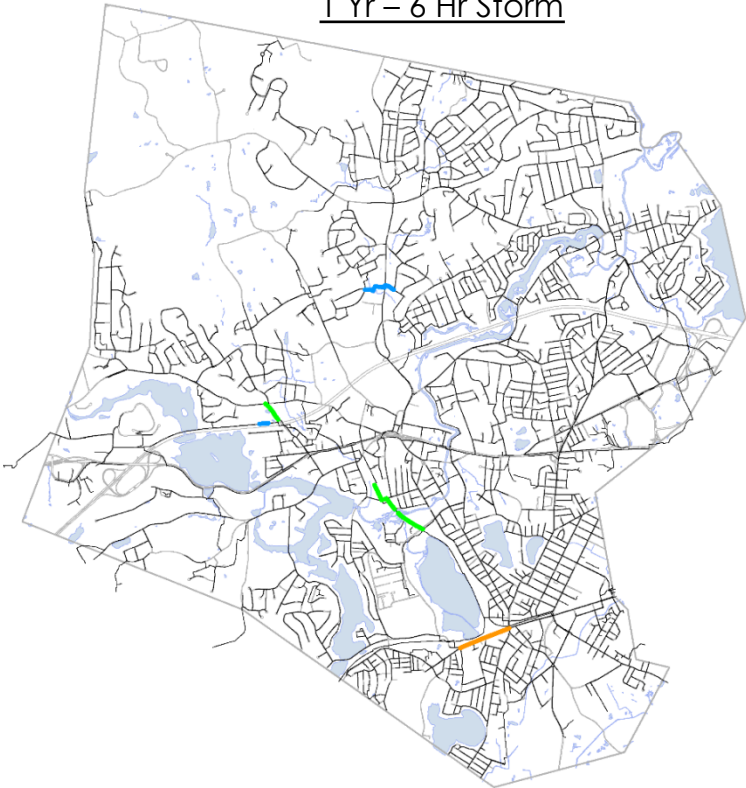
- Existing System Model Outdated
- Model Updated to Reflect System Improvements
- Flow Metering Results Applied to Model for Calibration and Verification
- Baseline Model of Existing Conditions
- Modeling Projections for 10 yr, 20 yr and 50 yr Buildout Conditions

### West of Interceptor (1) - 50-Year Buildout 5Y24H - Time: 33.17

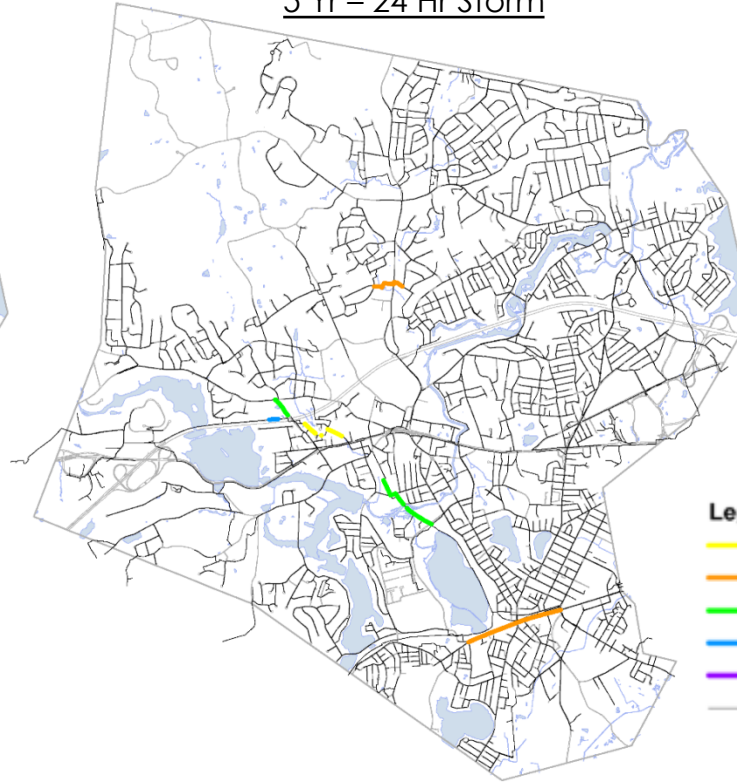


# Flow Modeling Surcharged Pipe Segments

1 Yr – 6 Hr Storm



5 Yr – 24 Hr Storm

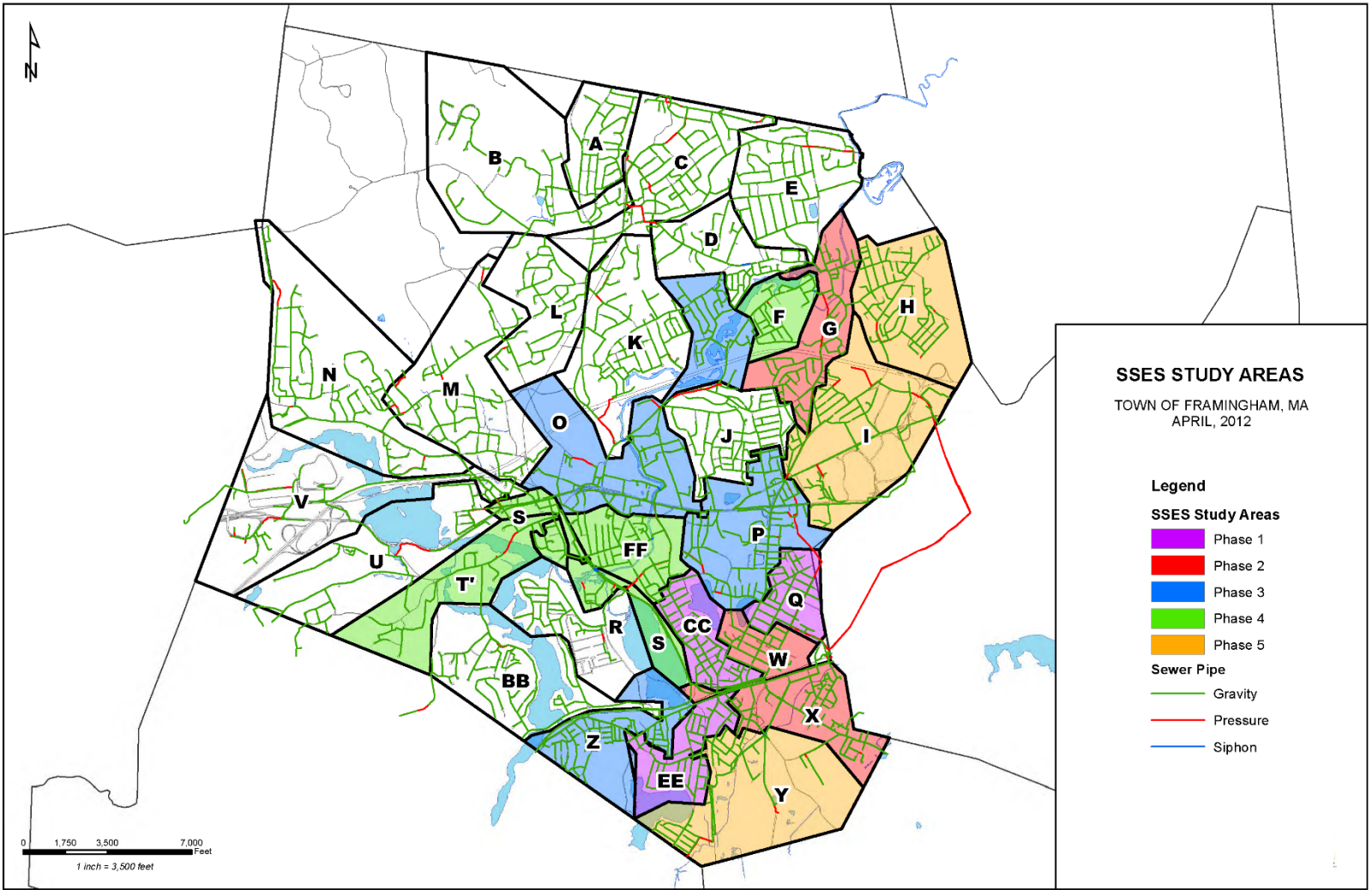


## Legend

- Surcharged Piping Existing Conditions
- Surcharged Piping Existing Conditions and 10-Year Buildout
- Additional Surcharged Piping 10-Year Buildout
- Additional Surcharged Piping 20-Year Buildout
- Additional Surcharged Piping 50-Year Buildout
- Other Sewers

# Infiltration / Inflow Mitigation Program

- I/I Analysis from Original CWMP
- Phased SSES Investigations (5 Phases Completed)
- High Priority Defects Identified
- Annual Capital Improvements to Address HP Defects
- Updated I/I Analysis from 2015 Town-wide Flow Metering Program
- Updated I/I Severity Ratings by Metered Sewershed
- Compliance with New MassDEP I/I Regulations



**SSES STUDY AREAS**

TOWN OF FRAMINGHAM, MA  
APRIL, 2012

**Legend**

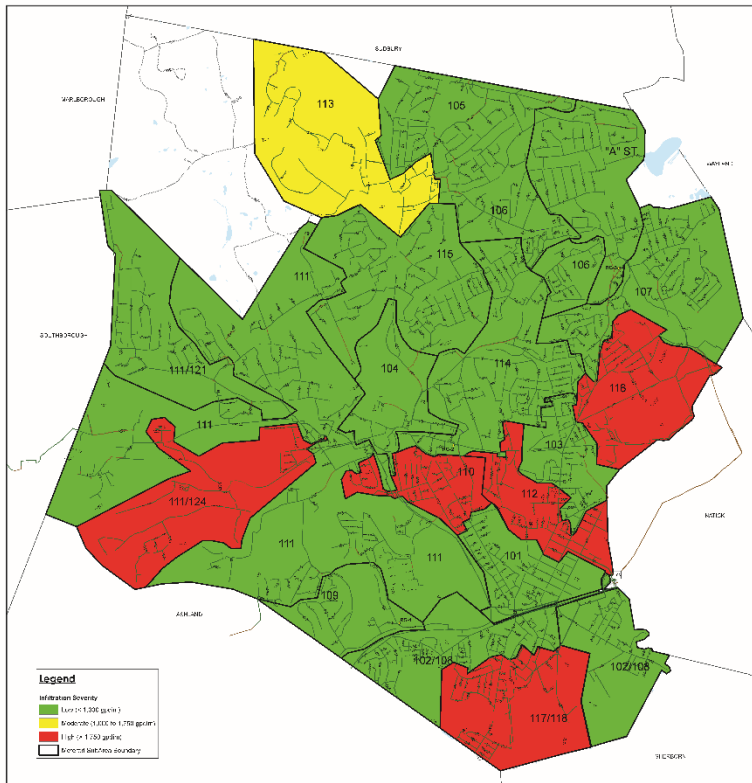
**SSES Study Areas**

- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5

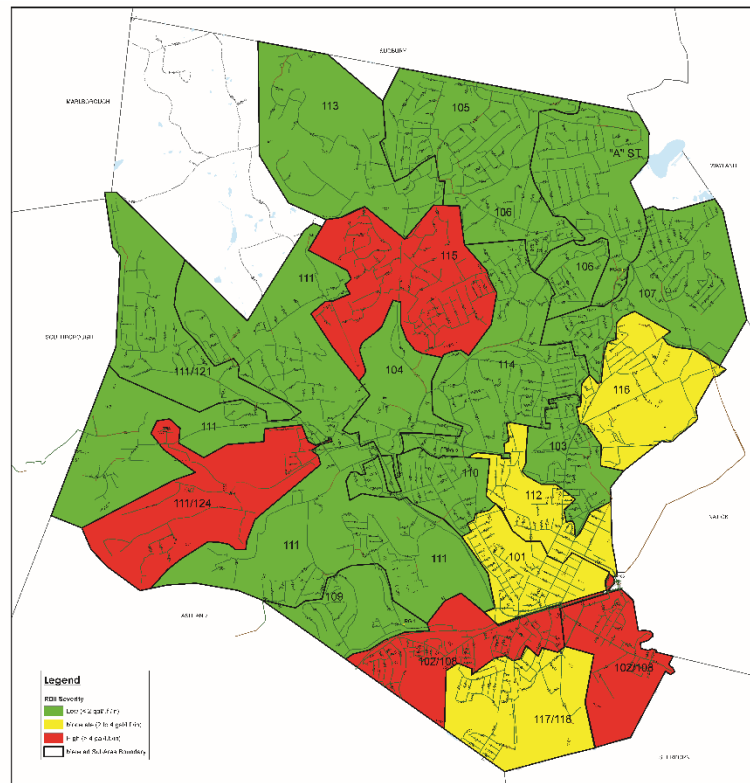
**Sewer Pipe**

- Gravity
- Pressure
- Siphon

0 1,750 3,500 7,000  
Feet  
1 inch = 3,500 feet



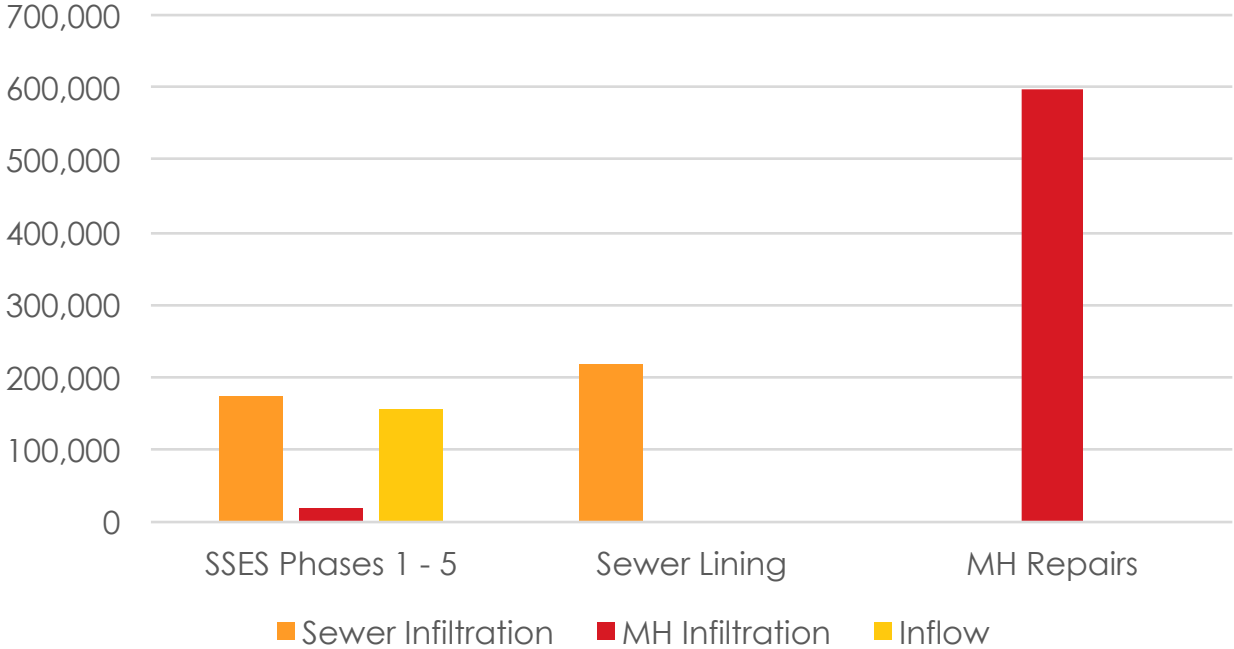
FALL 2015 INFILTRATION SEVERITY RATINGS BY METERED SEWERSHED  
 Framingham Department of Public Works  
 Wastewater Master Plan



FALL 2015 RDH SEVERITY RATINGS BY METERED SEWERSHED  
 Framingham Department of Public Works  
 Wastewater Master Plan



# I/I Identified and Removed from Sewer System (GPD)





# Wastewater Master Planning

- Sewer System Condition Assessment
- System Condition Rating Criteria
  1. Age
  2. Material
  3. Size
  4. Force Main Proximity
- High Priority Defects
- Under Capacity Sewer Segments
- I/I Priority Areas
- Long Term Capital Improvement Program
- Recommended Master Plan

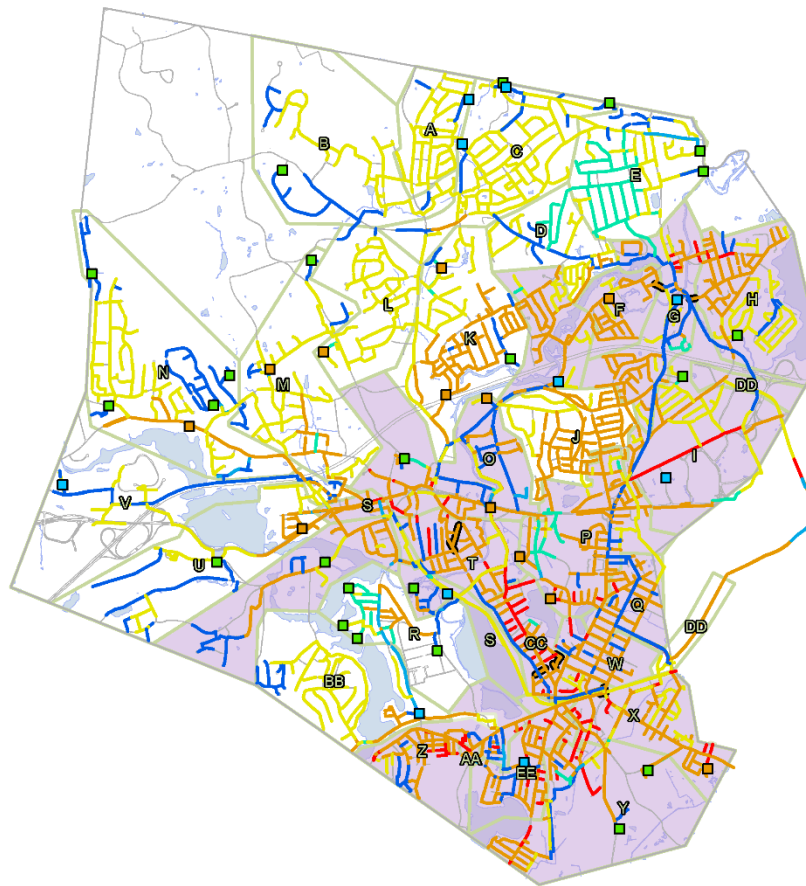
# Framingham Sewer System Assessment

**Sewer Condition Rating Criteria Matrix**

<b>Criteria</b>	<b>Weight</b>	<b>Rank within Class</b>
Age	3	10 = >80 years old 7 = 60-79 years old 3 = 40-59 years old 0 = <40 years old
Material	3	10 = AC or RCP 8 = VC (clay) 5 = Cast or ductile iron 0 = Plastic 0 = Brick
Size	1	10 = 24" diameter or greater 8 = 18" – 23" diameter 8 = <8" diameter 5 = 8" to 17" diameter
Proximity to Force Main	5	5 = <400 diameters downstream of force main 0 = >400 diameters downstream of force main



# Framingham Department of Public Works Wastewater Master Plan



## Legend

### Sewer Condition Rating (0-95, 95 is worst)

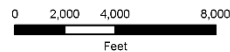
- Less than 20 (246,375 L.F.)
- 20 - 29 (20,752 L.F.)
- 30 - 39 (53,399 L.F.)
- 40 - 49 (426,761 L.F.)
- 50 - 59 (367,405 L.F.)
- 60 - 69 (33,471 L.F.)
- 70 - 95 (0 L.F.)
- Sewers Adjacent to 14" Water Mains (3,538 L.F.)

### Pump Stations

- Built 1946 - 1970 (13)
- Built 1971 - 2003 (23)
- Built After 2003 (12)
- Sewer Sub Areas
- SSES Study Areas Inspected



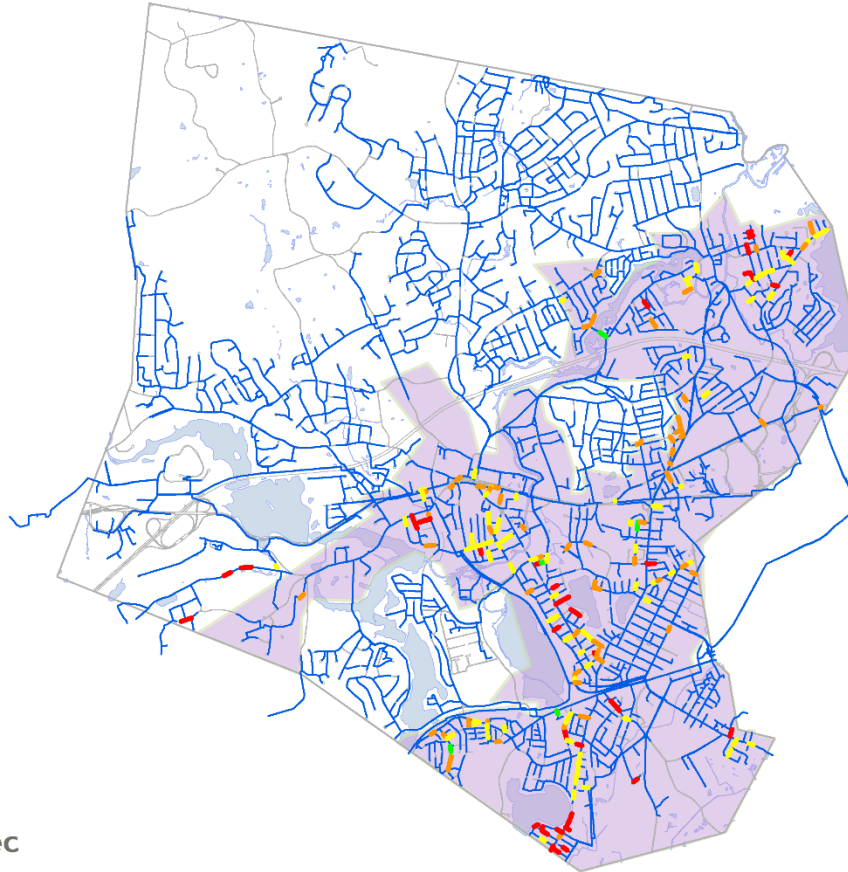
Stantec Consulting Services, Inc.  
5 Burlington Woods Drive  
Burlington, MA 01803-4542  
Tel. 978.692.1913 Fax. 978.692.4578



## Sewer System Condition Rating Summary November 10, 2016









Framingham Department of Public Works  
Wastewater Master Plan



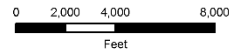
**Legend**

**Sewers with High Priority Defects**

-  Sewers To Be Replaced (10,190 L.F.)
-  Sewers Requiring Spot Repair / Liner (14,143 L.F.)
-  Sewers To Be Lined (17,403 L.F.)
-  Sewers To Be Cleaned / Inspected (1,143 L.F.)
-  Sewer Pipes
-  SSES Study Areas Inspected



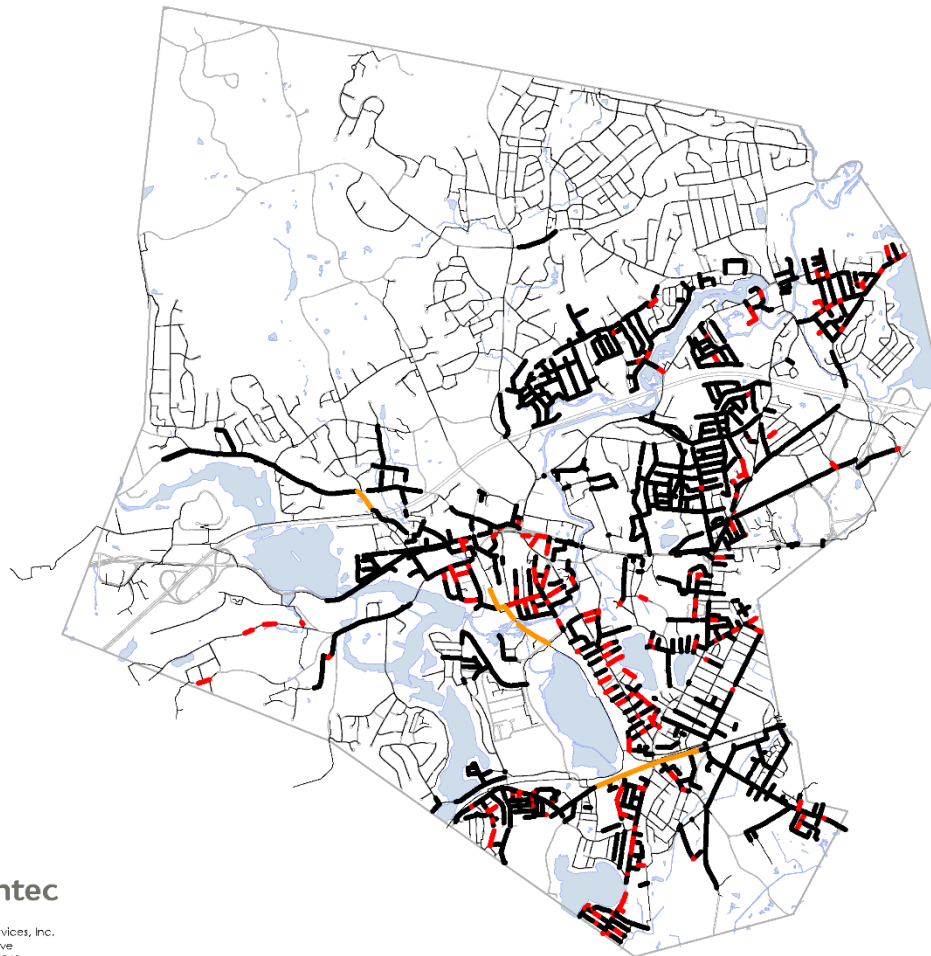
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**Sewers with High Priority Defects**  
**November 10, 2016**



Framingham Department of Public Works  
Wastewater Master Plan



**Legend**

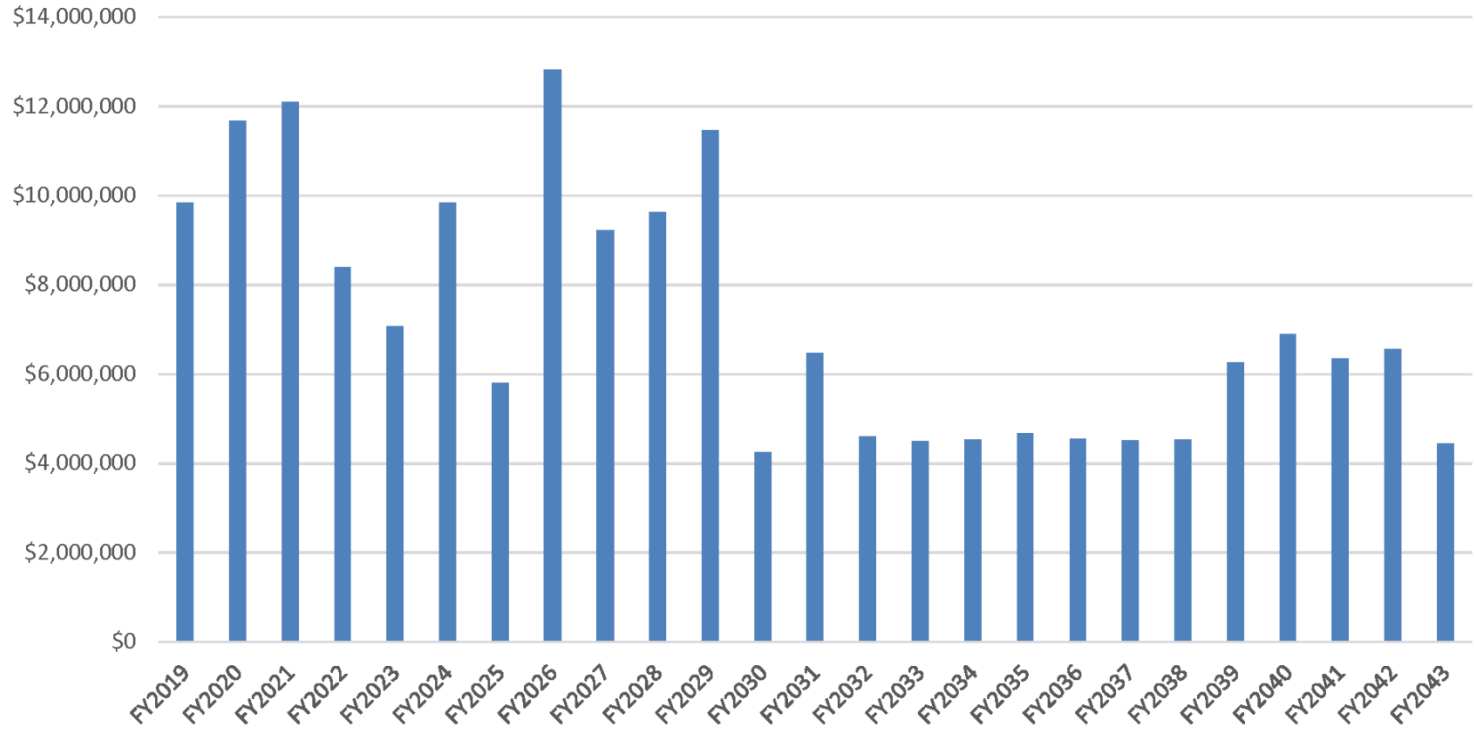
-  Sewers with High Priority Defect (42,879 L.F.)
-  Surcharged Sewers to be Replaced (8,161 L.F.)
-  Sewers with Condition Rating 50 or Higher (400,876 L.F.)
-  Other Sewers



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**Sewers with Rehabilitation Requirements  
November 14, 2016**

## Wastewater Infrastructure 25-Year Capital Improvement Plan Fiscal Year Costs



# Major Next Steps: 2017 - 2019

- CIP Projects Implementation
  - *High Priority Defects*
  - *Capacity Upgrades*
  - *Blackberry PS Upgrade*
- Risk Analysis for Resiliency (Security)
- Conformance with DEP Regs for I/I Mitigation and PS Operations
- Full Upgrades to PS for SCADA Communications
- Water System Master Planning
- Working with Planning Ofc. on New Developments

# Acknowledgements

## **Framingham Dept. of Public Works:**

Peter Sellers, Executive Director

William Sedewitz, Chief Engineer

Blake Lukis, Director, Water and Wastewater

Jim Barsanti, Assistant Director, Water and Wastewater

John DeLuca, Operations, Wastewater

Peter Lampasona, Operations Manager

John Rogers, Director of Project Development and Right-of-Way Acquisition

Ashley Dunn, Senior Water and Wastewater Engineer

Katy Weeks, Director of Project Development and Right-of-Way Acquisition (Ret.)

Operations, Engineering and Administrative Staff

## **Stantec:**

*Robert Dunn, Steve Calabro, Kurt Karlson, Isadora Sartor, Ken Scully*





# QUESTIONS ??



Thank you for your time

# Why Long Term Flow Metering?

- Gain Understanding of System Performance over Multiple Seasons / Years
- Improved Assessment and Projections of I/I
- Improved Prioritization and Targeting of SSES Investigations
- Can Be Used for Tracking Rehabilitation Impacts
- Enhance Sewer System Model Calibration and Verification
- Confirmation of MWRA Revenue Metering

# Integrating Wastewater, Drinking Water, Stormwater and Highway Infrastructure Improvement Priority Needs within Allocated Capital Budgets – Striking the Right Balance

- Sewer System Master Planning
- Stormwater System Master Planning
- Water System Master Planning
- Roads

**SEWER SYSTEM REHABILITATION CAPITAL IMPROVEMENT PLAN SUMMARY  
UNDER CAPACITY, HIGH PRIORITY DEFECTS AND CONDITION RATING ≥50**

<b>CIP Year</b>	<b>Total Length (ft)</b>	<b>Total Length (mi)</b>	<b>Capital Improvement</b>	<b>Total Capital Cost</b>
FY2019	3,139	0.59	H.P. Defects	\$1,468,700
FY2020	3,270	0.62	H.P. Defects	\$1,490,900
FY2021	4,020	0.76	H.P. Defects	\$1,841,500
FY2022	12,093	2.29	Under Cap., H.P. Defects	\$6,088,700
FY2023	8,047	1.52	Under Cap., H.P. Defects	\$5,007,500
FY2024	9,193	1.74	H.P. Defects, CR≥50	\$1,685,600
FY2025	9,063	1.72	H.P. Defects, CR≥50	\$1,628,500
FY2026	9,384	1.78	H.P. Defects, CR≥50	\$1,575,000
FY2027	9,426	1.79	H.P. Defects, CR≥50	\$1,574,200
FY2028	9,061	1.72	H.P. Defects, CR≥50	\$1,677,300
FY2029	6,647	1.26	H.P. Defects, CR≥50	\$1,474,800
FY2030	8,190	1.55	CR≥50	\$1,506,700
FY2031	7,705	1.46	CR≥50	\$1,470,300
FY2032	27,734	5.25	CR≥50	\$4,602,100
FY2033	22,713	4.30	CR≥50	\$4,504,400
FY2034	16,854	3.19	CR≥50	\$4,535,000
FY2035	25,944	4.91	CR≥50	\$4,670,700
FY2036	21,524	4.08	CR≥50	\$4,554,200
FY2037	24,747	4.69	CR≥50	\$4,520,700
FY2038	25,205	4.77	CR≥50	\$4,527,300
FY2039	26,597	5.04	CR≥50	\$6,259,100
FY2040	28,389	5.38	CR≥50	\$6,616,400
FY2041	34,226	6.48	CR≥50	\$6,348,300
FY2042	34,021	6.44	CR≥50	\$6,566,900
FY2043	18,521	3.51	CR≥50	\$4,443,700
<b>TOTAL</b>	<b>405,713</b>	<b>76.84</b>		<b>\$90,638,500</b>

Capital Improvement Descriptions:

1. H.P. Defects: Repair of High Priority Defects as recommended from the 5 SSES Phases
2. Under Cap.: Upgrading of sewers determined from modeling to be under capacity under 1-Yr and/or 5-Yr storms
3. CR≥50: Sewer severity Condition Rating of 50 and above from sum of evaluation criteria including age, size, material and proximity to a force main discharge

# Town of Framingham Sewer Pipes as of 08/05/2015

## Legend

### SSES High Priority Defects

— GRAVITY

### Lined Sewer pipe

— YES

### Sewer Pipes Installed Since 2004

#### SIPHON 12" - 24"

— 2004 - 2008

— 2009 - 2013

#### PRESSURE 12" AND UNDER

— 2004 - 2008

— 2009 - 2013

#### PRESSURE 38"

— 2004 - 2008

— 2009 - 2013

#### PRESSURE 16" to 24"

— 2004 - 2008

— 2009 - 2013

#### PRESSURE, UNKNOWN SIZE

— 2004 - 2008

— 2009 - 2013

#### GRAVITY 8" to 12"

— 2004 - 2008

— 2009 - 2013

#### GRAVITY, UNKNOWN SIZE

— 2004 - 2008

— 2009 - 2013

#### GRAVITY 2.5" to 6"

— 2004 - 2008

— 2009 - 2013

#### GRAVITY 14" to 24"

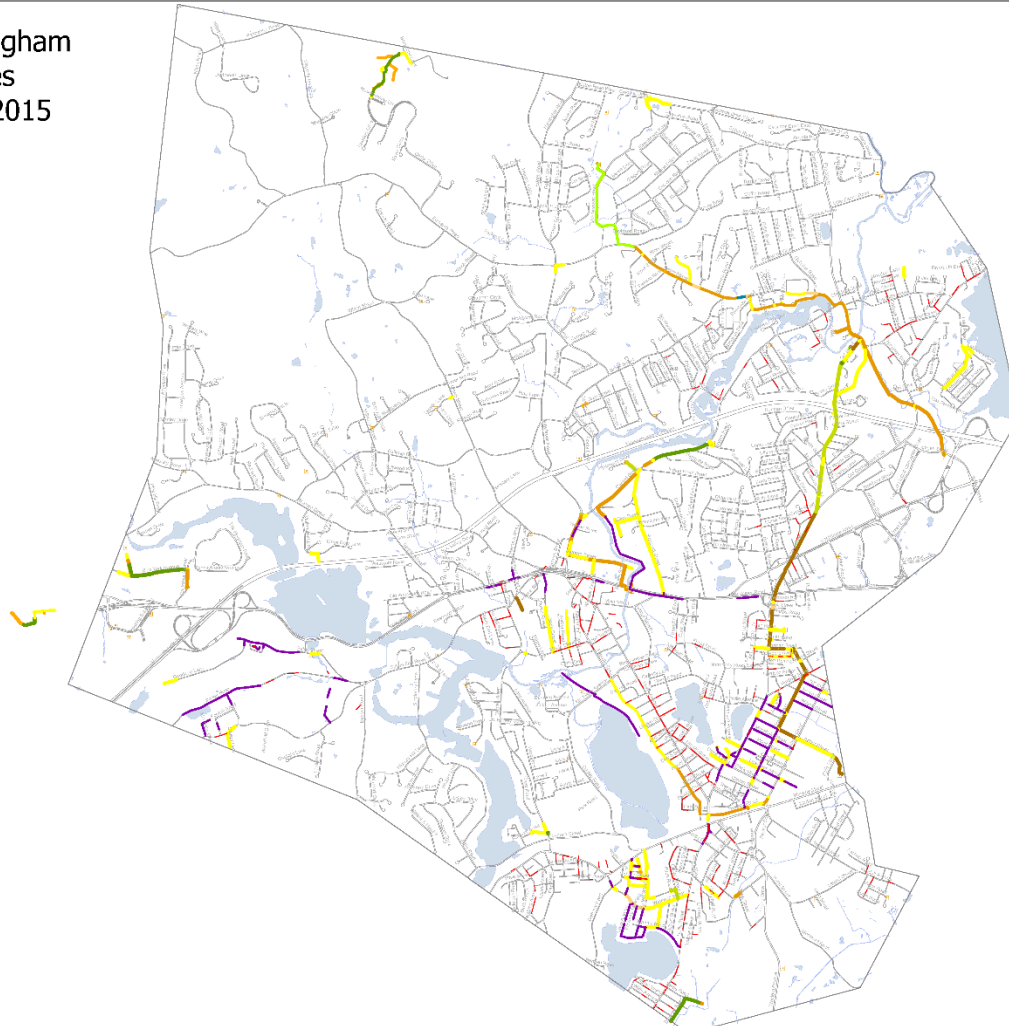
— 2004 - 2008

— 2009 - 2013

#### GRAVITY 30" to 42"

— 2004 - 2008

— 2009 - 2013



# New DEP Sewer System O&M Regulations Lead to CWMP Update

(314 CMR 12.04 – Maintenance of Treatment Works and Sewer Systems)

- I/I Assessment by Dec. 31, 2017
- Develop SSES Program and Implementation Schedule
- 5 Yr. – 24 Hr. Storm for SSO Evaluation
- 4:1 I/I Removal for Compensating New Flows
- Routine Pump Station Inspections and Logging
- SCADA and Real-time Status
- Operational Warning Alarms
- Automatic Backup Power (or Sufficient Storage)