
Littleton FY19 Outfall Inventory and Dry Weather Screening Field Effort Summary

To: Chris Stoddard, PE, Director of Public Works
COPY: Town of Littleton Stormwater Management Program Files
FROM: Christian Boisvert and Andrew Gaughan, Engineering Technicians
Reviewed by Tighe & Bond
DATE: January 25, 2019

Per Section 2.3.4.7.b *Dry Weather Outfall and Interconnection Screening and Sampling* of the 2016 Small Municipal Separate Storm Sewer Systems (MS4) General Permit, **“all outfalls/interconnections ... shall be inspected for the presence of dry weather flow within three (3) years of the permit effective date.”** Tighe & Bond completed two rounds of outfall investigations during Fiscal Year 2017 (FY17) and Fiscal Year 2018 (FY18). Results from those field efforts were delivered under separate cover. Please see the FY17 and FY18 Littleton Outfall Inventory and Dry Weather Screening Field Effort Summaries for further information about field work preparation, methods of data collection, background about sampling requirements for stormwater pollutants, and results of prior investigations.

This memorandum presents a summary of the stormwater mapping effort and the third round of outfall investigation field work and findings conducted by Christian Boisvert and Andrew Gaughan, Engineering Technicians (Techs) for the Town of Littleton, Massachusetts.

1. Summary of Summer 2018 Outfall Investigations and Mapping

This memorandum provides a summary of the outfall inventory¹ and dry weather screening investigations that were completed in the Summer of 2018. Mapping and outfall investigations began on May 21, 2018 and continued until August 16, 2018. In total, 152 outfalls, 578 catch basins, 419 drain manholes, and 1,784 drain lines were added to the Littleton's GIS stormwater map using an iPad and Trimble R1 GPS unit in the field. The locations of the outfalls added to the Town's mapping are shown on the map in Attachment 1. Outfalls that did not have a unique identifying label were labeled based on the street the outfalls were located on.

Samples were taken at 6 outfalls with dry weather flow². The map in Attachment 2 shows the locations of all 343 mapped outfalls in Littleton. Each outfall is denoted as to whether the outfall inventory and dry weather screening were completed under the Summer 2018 field effort. See Section 2 of this memorandum for results from the field effort.

At the conclusion of this field effort, Tighe & Bond delivered updated GIS to the Town with the results of the outfall inventory and dry weather sampling, including photographs of the

¹ **Inventory/Inventoried:** This term refers to the General Permit requirement in Section 2.3.4.7.a to visually inspect each outfall during dry weather conditions and collect prescribed data such as location, size, and visual and olfactory evidence of an illicit discharge.

² **Dry Weather Flow:** This term refers to when there is flow present at an outfall/interconnection and there has been less than 0.10 inches of rainfall in the previous 24 hours and no significant snow melt is occurring.

outfalls investigated, additional outfall attributes, and water quality screening and laboratory results.

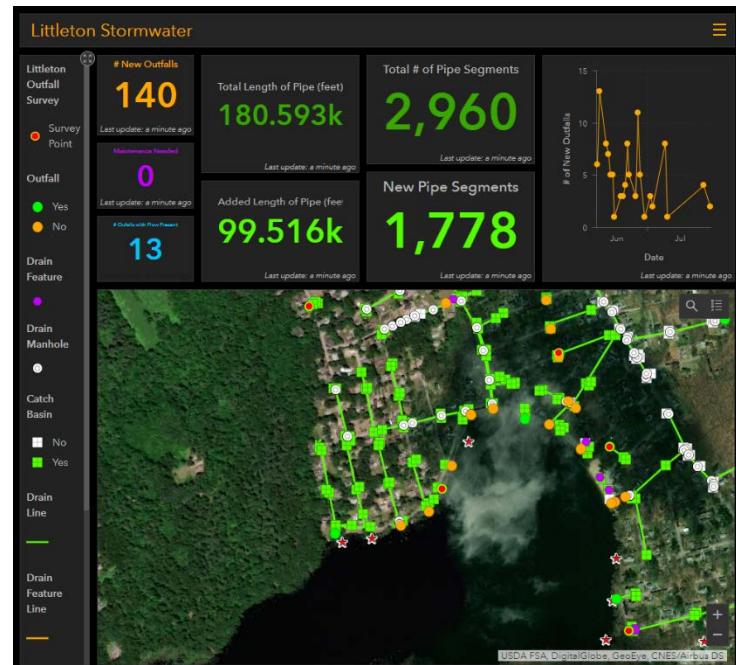
1.1 Background

Previous outfall investigations and scanned plans provided an original GIS map with some outfalls, catch basins, and little connectivity. The Littleton Operations Manager, Jim Clyde, provided a list of 79 potential missing outfalls which were added in the general location to the GIS map. Using the estimated location of missing outfalls, the Engineering Techs located the outfalls and mapped the locations in the field with a Trimble R1 handheld GPS device connected to an iPad. Based upon located outfalls, connectivity was improved. Catch basins and manholes were also opened to investigate connectivity. As more drainage infrastructure was mapped throughout the summer, additional outfalls were added to the Town's GIS map. Drainage plans were also used to improve connectivity and pipe locations.

Engineering Techs followed a Littleton-specific *Dry Weather Sampling Procedure* prepared by Tighe & Bond for outfall investigations and the sampling effort. Outfalls within the Town's MS4 with dry weather flow were screened and sampled.

1.2 GIS Mapping Improvements

The mapping effort by the Littleton Engineer Techs was started on May 21st and was conducted for a total of 46 days. Using a combination of ArcGIS Online and an iPad, the Engineering Techs captured spatial locations of outfalls, catch basins, drain manholes, and various drain features and connected them with pipes where applicable. The GIS database is hosted on Tighe & Bond's cloud site and accessible to the Town through the ArcGIS Online application. Mapping was conducted using ArcGIS Collector and the Survey123 application, which added data to the Littleton GIS stormwater database. Throughout the summer, mapping progress was monitored by the Director of Public Works, Chris Stoddard, using a personalized dynamic ArcGIS Operations Dashboard, as shown in the screen shot to the right. Chris Stoddard was able to monitor the outfalls and pipes added to the existing mapping each day.



Screen Shot of GIS Dashboard

Mapping improvements included adding drainage infrastructure spatial locations through field work, adding pipe connectivity with associated attributes (i.e. material and size), and mapping outfalls. Photos of the outfalls were attached to the point location and included in the database. Attribute information, pipe connectivity, and flow direction were updated. Connectivity was significantly improved during the mapping effort. Each Town-owned and maintained street was checked for drainage infrastructure and mapped accordingly if found. At the conclusion of the field effort, 152 outfalls were added to the Town's GIS database resulting in a total of 343 municipally-owned outfalls in the Town's stormwater database.

2. Results

Following is a summary of the Summer 2018 field work results:

- **152 outfalls were newly mapped (see map in Attachment 1)**
 - 103 new outfalls were successfully investigated (denoted in red in Attachment 2).
 - 16 outfalls had dry weather flow during the field effort but only 3 outfalls fell within the Town's urbanized area, had dry weather flow upon revisiting, and were sampled (denoted with a purple circle in Attachment 2).
 - 17 new outfalls were visited (denoted in green in Attachment 2) but an investigation was not completed (this includes inaccessible outfalls, ones that the field crew was unable to locate³, and others with incomplete inventory information).
 - 32 new outfalls were visited and should be removed from the outfall list since they were either privately-owned, state-owned, or fell outside of the MS4 regulated area (denoted in dark blue in Attachment 2).
- **191 outfalls were previously mapped⁴**
 - Of the 191 previously mapped outfalls, 77 were investigated or visited during the Spring/Summer 2017 field effort (denoted in yellow in Attachment 2) and 77 were investigated or visited during the Fall 2017 field effort (denoted in orange in Attachment 2). These outfalls were not revisited during the Summer 2018 field effort.
 - 19 outfalls were removed from the inventory because they fell outside the Town's MS4 Regulated Area or were confirmed private (denoted in blue in Attachment 2).
 - 11 outfalls were successfully investigated (denoted in red in Attachment 2). Of these 11 outfalls, 3 had dry weather flow and were sampled (denoted with a purple circle in Attachment 2).
 - 7 were visited (denoted in light green in Attachment 2) but an investigation was not completed (this includes inaccessible outfalls and others with incomplete inventory information). Of these 7 outfalls, 1 had dry weather flow and was sampled (denoted with a purple circle in Attachment 2).
- **Total: 343 mapped outfalls**

³ Some outfall locations were estimated based on record plans or the connectivity of drainage in the street but could not be field located.

⁴ Note that the subtotals listed for the previously mapped outfalls may be different than the subtotals presented in prior field work summary memoranda. This is due to work completed since those memoranda were delivered (e.g., additional mapping, development of the Notice of Intent, etc.). Additionally, it was determined that some outfalls investigated during these field efforts are not MS4 outfalls.

The table below includes a summary report of the new stormwater data collected throughout the Town during the Summer of 2018.

Stormwater Mapping Data Collected in Summer 2018*		
Feature	Count	Length (Miles)
Outfalls	136 municipal	
	1 state	
	15 private	
Catch Basins	512 municipal	
	4 state	
	62 private	
Manholes	391 municipal	
	7 state	
	21 private	
Structures subtotal	1,149	
Pipes	1,770 municipal	25.61
	13 private	0.19
	1 state	0.01
Culverts	27	0.28
Drain feature **	74	
Drain feature line **	20	0.94

*All counts and lengths include new stormwater infrastructure collected within the town boundary, both inside and outside of the Town's MS4 Regulated Area. These totals do not include existing structures that may have been updated during this effort.

** Drain features and drain feature lines are drainage infrastructure components that need to be categorized into outfalls, catch basins, BMPs, etc.

2.1 Dry Weather Flow Sampling Results

Dry weather sampling field work was completed on July 20th and 31st, August 1st and August 2nd. The Littleton Engineering Techs noted outfalls that had flow present during their mapping effort, which may have occurred under wet weather conditions. The Techs completed a separate field visit with sampling equipment to verify the flow under dry weather conditions and sample if needed. A total of 36 outfalls were revisited and 6 were determined to have dry weather flow. See Attachment 3 for additional information about the 36 outfalls visited during this field effort. The 6 outfalls with dry weather flow are listed in the table below.

Outfalls Where Dry Weather Sampling was Completed (Summer 2018)

Tighe & Bond Outfall ID	Town Outfall ID	Sampling Location	Street
TNB-012	44	Upstream DMH	Brook Lane
TNB-016	151	Outfall	Surrey Road
CB-03*	94	Outfall	Berry Bush Lane
	Foster-1	Upstream DMH	Foster Street
	Newtown-5	Outfall	Newtown Road
TNB-1	Grist Mill - 2	Upstream DMH	Grist Mill Road

* CB-03 was revisited after a significant storm and found to have no flow after consecutive dry days.

Sampling results for the outfalls listed in the table above as well as the prior field efforts are included in the Outfall Sampling Summary in Attachment 4. The Summary uses a color-coded ranking system for the results of the outfall monitoring, which demonstrates the severity of the sampling results (i.e., a red result denotes a higher, potentially problematic concentration of a stormwater pollutant). A priority ranking of "low" or "high" will be given to each outfall

depending on sampling results and its potential for the presence of an illicit discharge at the conclusion of all outfall investigation field work.

As shown in the Summary in Attachment 4, the outfall or upstream structures sampled during this field effort had some results with levels above EPA benchmarks. However, none of the results indicate a likely sanitary input as the levels of ammonia, E. coli, and surfactants are below EPA benchmarks.

It should be noted that many of the outfalls sampled during this field effort had high levels of salinity, conductivity, and chlorine, as shown in the Summary in Attachment 4. Salinity and conductivity are directly related, and elevated levels could be found in areas of Town with high road salt loadings. High chlorine levels could be caused by swimming pool discharges or hydrant flushing. With the exception of outfall TSP-4, total phosphorus was greater than the benchmark of 0.024 mg/L at all of the outfalls with dry weather flow found during the FY17, FY18, and FY19 field efforts. High phosphorus levels could be due to nearby septic systems or runoff from residential lawn watering with recent fertilizer applications. Other potential sources of phosphorus in stormwater runoff include agriculture (manure and fertilizers), soil erosion, yard waste and leaf litter, pet waste, and certain soaps and detergents. Potential sources or causes of total phosphorus in dry weather flow in Littleton should be further evaluated during development of a Phosphorus Source Identification Report, as required by General Permit Section 2.2.1.b and Appendix H Section 2.

Sampling at outfall TNB-16 (located in the SuAsCo watershed) should have included chlorine and total phosphorus. These samples were not analyzed in the field or sent for lab analysis. However, since every other parameter tested at this outfall was below EPA benchmarks, it is unlikely that there is a sanitary input. Tighe & Bond is considering this outfall screened.

2.2 Outfalls That Could Not Be Located

The table below summarizes the 7 outfalls that could not be located during this field effort. The outfalls were approximately located based on connectivity of a system and the direction of pipe. It is recommended to revisit during the fall or spring when outfalls may be more visible.

Outfalls That Could Not Be Located (Summer 2018)

Outfall ID	Street	Notes
Russell-2	Russell Street	Potentially buried
Robinson-1	Robinson Road	Hidden in tall grass, far into a yard
Springfield-1	Springfield Drive	Potentially buried
Russell-3	Russell Street	Potentially buried
Foster-4	Foster Street	Could not locate, located near stream
Whitcomb-5	Whitcomb Road	Could not locate
King-2	King Street	Blocked by a fence, could not locate behind building

2.3 Submerged Outfalls

The outfalls listed in the table below were at least partially submerged due to high water levels downstream. Per Section 2.3.4.7.b.2.iii of the General Permit, if an outfall is inaccessible or submerged, the investigator shall proceed to the first accessible upstream drain manhole or catch basin for the observation and sampling effort and report the location with the screening result. The Engineering Techs attempted to investigate upstream drain manholes at Gristmill-2, Whitcomb-1, Dahlia-1, Newtown-5, and Newtown-6. In future investigations, all remaining submerged outfalls should be checked for flow at accessible drain manholes if they are located in the MS4.

Submerged Outfalls (Summer 2018)

Outfall ID	Street	Notes
Middlesex-1	Queen Road	Fully submerged, possibly due to rise in Long Lake water level
Whitcomb-1	Whitcomb Avenue	Partially submerged
Newtown-5	Newtown Street	Partially submerged
Newtown-6	Newtown Street	Partially submerged
Gristmill-2	Grist Mill Road	Partially submerged
Tahattawan-3	Tahattawan Road	Partially submerged, overgrown
Tahattawan-4	Tahattawan Road	Partially submerged, overgrown
Gristmill-2	Grist Mill Road	Partially submerged, Covered in Debris
91	Florence Street	Partially submerged
Gilson-3	Gilson Road	Partially submerged, needs maintenance
Mill-3	Mill Road	Partially submerged
Dahlia-1	Dahlia Drive	Partially submerged
King School-4	King street	Partially submerged
Shaker School-2	Shaker Lane	Partially submerged, overgrown
Newtown-7	Newtown Road	Partially submerged
Maplehurst-1	Maplehurst Road	Partially submerged
Westchester-1	Westchester Drive	Partially submerged



Gristmill-2 Partially submerged outfall

2.4 Outfalls That Could Not Be Accessed

Below is a list of 4 outfalls that could not be accessed due to obstacles in the way. All 4 of these are located on state land and are being blocked off by a fence that surrounds I-495.

Outfalls That Could Not Be Accessed (Summer 2018)

Outfall ID	Street	Notes
Curtis-1	Curtis Street	Outfall is located on state property past the I-495 highway fence
Curtis-2	Curtis Street	Outfall is located on state property past the I-495 highway fence
Valley-1	Valley Drive	Outfall is located on state property past the I-495 highway fence
Harwood-3	Harwood Road	Outfall is located on state property past the I-495 highway fence

2.5 Outfalls to be Removed from the MS4

During the outfall investigation, every new outfall that was found was mapped and surveyed. Upon further investigation, it was determined that 21 outfalls of the outfalls mapped during this field effort should be removed from Littleton's MS4 outfall inventory. The outfalls listed below should be removed for various reasons; some are privately- or state-owned and do not need to be monitored by the town, others were assumed to be outfalls but were actually BMP inlets.

Additionally, some outfalls have been identified throughout the IDDE Program that are located outside of the Town's Regulated Area and therefore are not considered MS4 outfalls. These outfalls may not be reflected in the table below.

Outfalls to be Removed from the MS4 (Summer 2018)

Outfall ID	Street	Reason
Gray-2	Gray Farm Road	Private Street
Gray-3	Gray Farm Road	Private Street
Gray-1	Gray Farm Road	Private Street
Private-1	Harvard Road	Private Outfall
Private-2	Harvard Road	Private Outfall
Private-3	Harvard Road	Private Outfall
Private-4	Harvard Road	Private Outfall
Private-5	Harvard Road	Private Outfall
Private-6	527 Great Road	Private Outfall
Private-7	Foster Street	Private Outfall
Private-8	Foster Street	Private Outfall
Private-9	Foster Street	Private Outfall
Private-10	Great Road	Private Outfall
Private-11	Great Road	Private Outfall
State-1	Great Road	State Outfall found on Plans
Hill-1	Hill Road	Private Outfall
McIntosh-1	McIntosh Lane	Should be reclassified as BMP structure
McIntosh-4	McIntosh Lane	Should be reclassified as BMP structure
McIntosh-5	McIntosh Lane	Should be reclassified as BMP structure
King Park-2	King Street	Should be reclassified as BMP structure
King Park-3	King Street	Should be reclassified as BMP structure

2.6 Outfalls Requiring Maintenance

The outfalls included in the table below were noted as requiring maintenance and should be evaluated by Town staff and cleaned and/or repaired as soon as possible. The photo below the table depicts a clay pipe that has been separated at the outfall. Other outfalls requiring maintenance include those that were partially or completely full of sediment, leaves, or debris. Some outfalls were difficult to see due to thick brush, therefore it is recommended to revisit and check for any maintenance required.

Outfalls Requiring Maintenance (Summer 2018)

Outfall ID	Street	Reason
Gilson-5	Gilson Road	Partially buried
Ernies-1	Ernies Drive	Overgrown and difficult to access
Tahattawan-2	Tahattawan Road	Old clay pipe, may need repair
Birch-1	Birch Road	Needs to be cleaned out and give a path for water to flow
Foster-1	Foster Street	Located under heavy brush and thorns. Difficult to reach.
Oak Hill-9	Oak Hill Road	Partial submerged in debris and water.
Foster-9	Foster Street	Tree fallen on top, becoming buried into the hill.
Oak Hill-10	Oak Hill Road	Partially buried with sediment
Oak Hill-5	Oak Hill Road	Completely covered in leaves
Oak Hill-1	Oak Hill Road	Partially buried with sediment and leaves
Shattuck-1	Shattuck Street	Partially buried with sediment
Gilson-2	Gilson Road	Partially buried with leaves
Spectacle Pond-2	Spectacle Pond Road	Partially buried with sediment
Spectacle Pond-1	Spectacle Pond Road	Partially buried with sediment
Foster-5	Foster Street	Flared HDPE end is cracked, partially buried with sediment
Foster-3	Foster Street	Overgrown, partially buried with sediment
Foster-2	Foster Street	Partially buried with sediment
Mill-1	Mill Road	Completely covered in leaves
Lake Shore-2	Lake Shore Drive	Overgrown, completely covered in leaves
Washington-1	Washington Drive	Partially buried with sediment
Manchester-2	Manchester Drive	Partially buried with sediment
Harwood-4	Harwood Avenue	Partially buried with sediment
Nashoba Trail-1	Nashoba Trail	Partially buried with sediment, overgrown
Russell-4	Russell Street	Partially filled with leaves
Russell-5	Russell Street	Partially filled with leaves
Nagog Hill-2	Nagog Hill Road	Partially filled with leaves
Whitcomb-2	Whitcomb Avenue	Partially buried with sediment, covered in branches
Taylor-3	Taylor Street	Completely covered in sediment and leaves
Hill-1	Hill Road	Partially buried with sediment
King School-1	King Street	Filled in with surrounding rip-rap rocks
Shaker School-1	Shaker Lane	Overgrown
E.Roxbury-1	East Roxbury	Partially buried with sediment
Town-1	Town Road	Partially buried with sediment
Newtown-4	Newtown Road	Partially buried with sediment
King-1	King Street	Covered in branches
E.Roxbury-2	East Roxbury	Corroded metal, clogged with debris
Gilson-1	Gilson road	Buried in leaves
Suffolk-1	Suffolk Drive	Partially buried with sediment



Tahattawan-2 Clay Pipe Outfall in need of repair

3. Conclusions and Recommendations

As of the date of this memorandum, a vast majority of Littleton's stormwater system, including outfalls, catch basins, drain manholes, and various drain features, have been located and mapped. However, as discussed in Section 2.2 there are still 7 outfalls that cannot be located. Pipe connectivity is also nearly complete, with the exception of the following areas:

- **Intersection of Lake Drive and Lake Shore Drive:** This area contains 3 catch basins that are filled with water and have been all summer long. This water makes it impossible to see how the pipes are connected.
- **Citgo Gas Station on Harvard Road:** There are three catch basins surrounding it that are full of water, and one across the street at the bottling factory. These pipes are submerged in water, making them impossible to see.
- **Florence Street:** There is a pipe with unusual connectivity. The pipe connects two catch basins that flow in different directions to different outfalls. This pipe has been labeled under general comments on the map titled "Stormwater Mapping" on ArcGIS.

To determine the location of the 7 outfalls and the true connectivity of the Florence Street pipe, it is recommended that the pipes are jetted from the closest upstream structure to determine where the outfall is, and to determine if the Florence Street pipe does connect the two catch basins. Dye testing could also be another useful technique in determining direction of flow and connectivity of the Florence Street pipe.

During the summer field effort, a catch basin near 32 Lochslea Road was identified as having a strong chlorine odor. On August 2nd, 2018, the standing water in the catch basin was field tested for chlorine using a Hach Pocket Colorimeter II and the results were 2.2 mg/L, which was above the detectable limit of the Colorimeter. On the same day, a grab sample of the standing pool was sent to the lab to determine a more accurate level of chlorine present at the catch basin. The lab results reported the chlorine levels were 17.9 mg/L. Upon further

investigation, the Engineering Techs re-tested the water in the field on August 9th, 2018 and found the chlorine level had dropped to 0.25 mg/L. This level is still higher than the 0.02 mg/L EPA bench mark but had significantly decreased from the levels when originally tested. There is a 1" pipe coming from the house behind the basin, but the cause of the spike in chlorine levels is unknown. In accordance with EPA requirements and the Town's IDDE Plan, the Town shall locate, identify, and eliminate any illicit discharges "as expeditiously as possible" (i.e., within 60 days) or, if that is not possible, establish a schedule for its elimination and include it in annual reports to EPA. Procedures for identifying and removing an illicit discharge can be found in Section 8.1.1 of the IDDE Plan. Backup information for this catch basin, including lab results and guidance, were provided to Town staff under separate cover.

Once all drainage infrastructure is mapped, it is recommended that the Town of Littleton create a new naming convention for all structures, especially outfalls (i.e., OF-1, OF-2, OF-3, etc.).

The three field efforts completed by Tighe & Bond and Littleton's Engineering Techs have improved the Town's understanding of drainage mapping and connectivity and helped satisfy the Phase I and Phase II stormwater mapping and outfall investigation and dry weather screening requirements of the 2016 General Permit. As of the date of this memorandum, outfall investigations have been completed at 233 MS4 outfalls. 47 outfall investigations were attempted but not completed because the outfalls could not be located, could not be accessed, or were submerged. Throughout this process, 27 outfalls were recommended to be removed from the MS4 due to ownership or incorrectly classified culverts/BMP inlets and 36 were identified as being outside of the Town's Regulated Area. The status of the field work as of the date of this memorandum is shown in the map in Attachment 5. It is recommended that the Town attempt to investigate the 47 "visited" outfalls by June 30, 2021 (the end of Permit Year 3) in order to meet EPA's deadline for outfall investigations and dry weather screening.

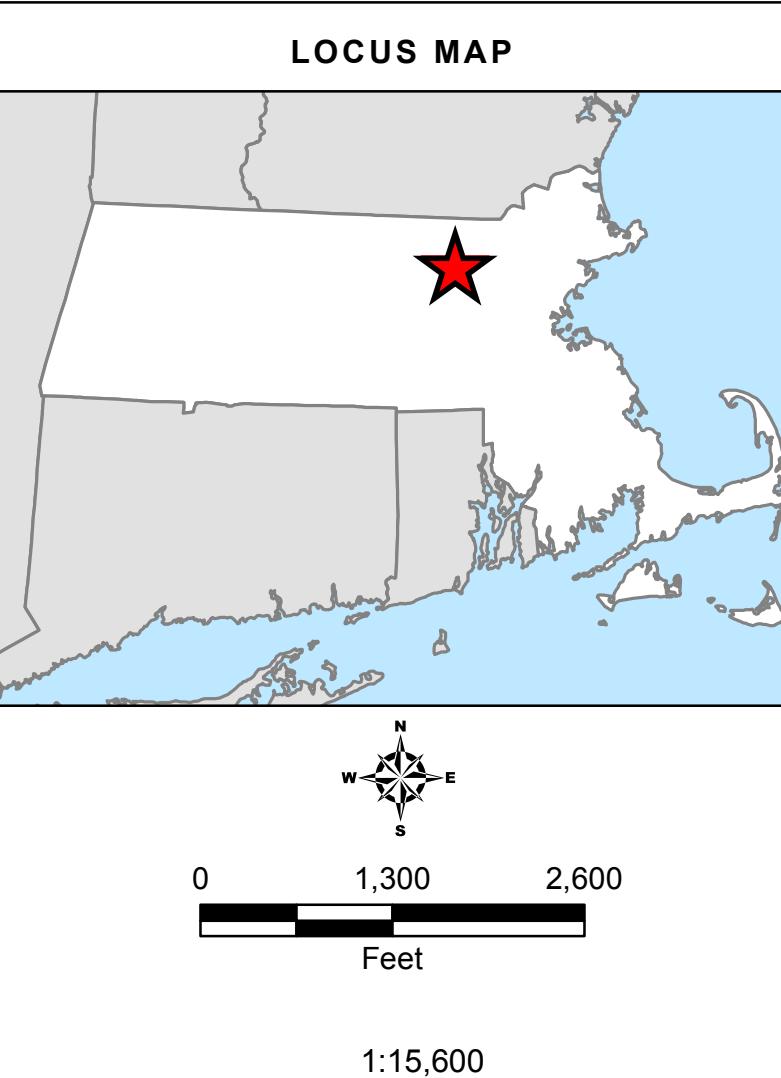
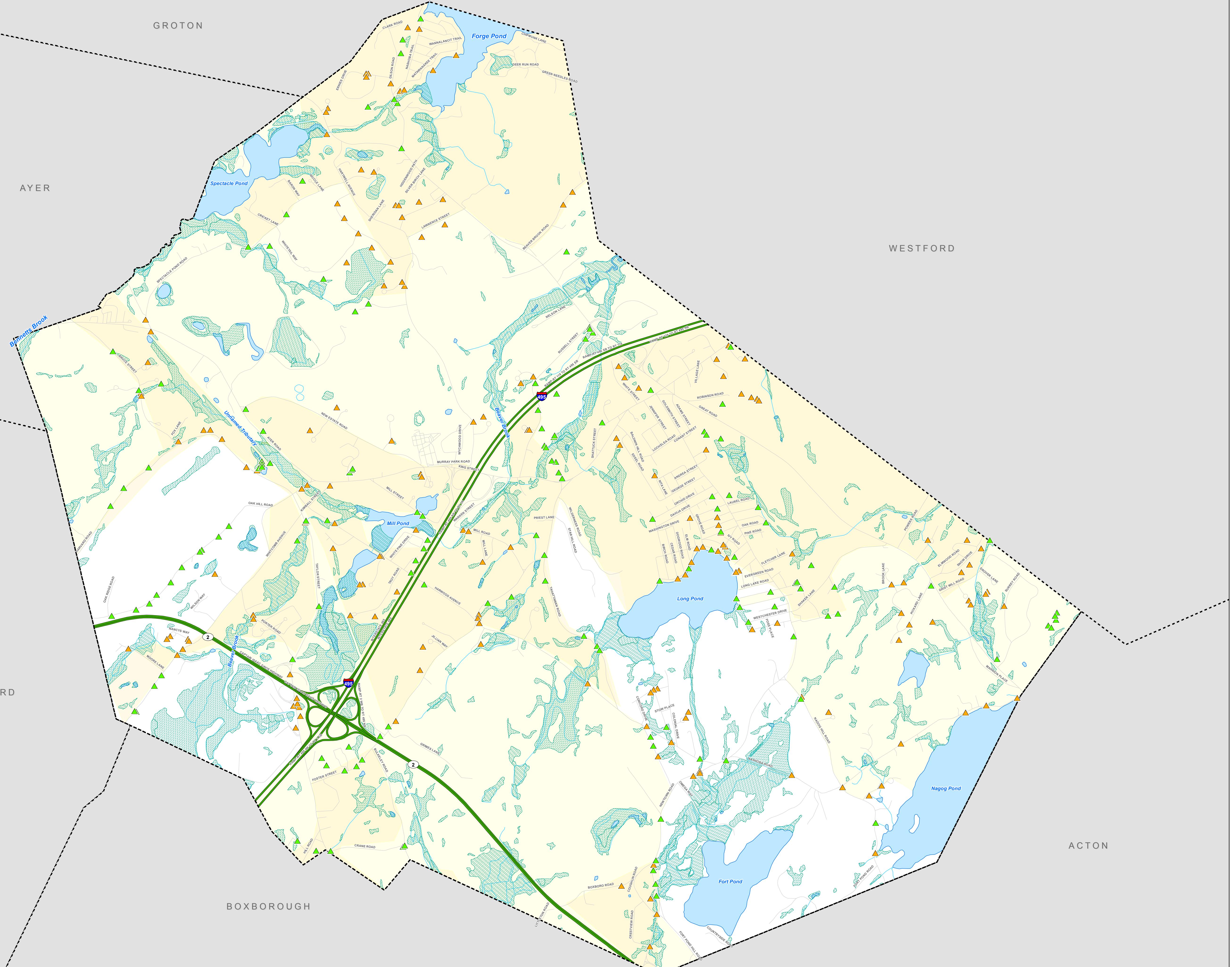
Attachments

- Attachment 1: New Outfalls Mapped Summer 2018
- Attachment 2: Summer 2018 Outfall Inventory and Sampling Map
- Attachment 3: Summer 2018 Outfall Inventory Summary
- Attachment 4: Outfall Sampling Results
- Attachment 5: Outfall Inventory and Sampling Map – All Field Efforts 2017-2018

Attachment 1

New Outfalls Mapped Summer 2018

ATTACHMENT 1
NEW OUTFALLS
MAPPED SUMMER 2018



NOTES

**Illicit Discharge Detection
and Elimination Plan**

Littleton, Massachusetts

June 2018

Tighe&Bond

Attachment 2
Summer 2018 Outfall Inventory and Sampling Map

ATTACHMENT 2

SUMMER 2018

OUTFALL INVENTORY AND SAMPLING

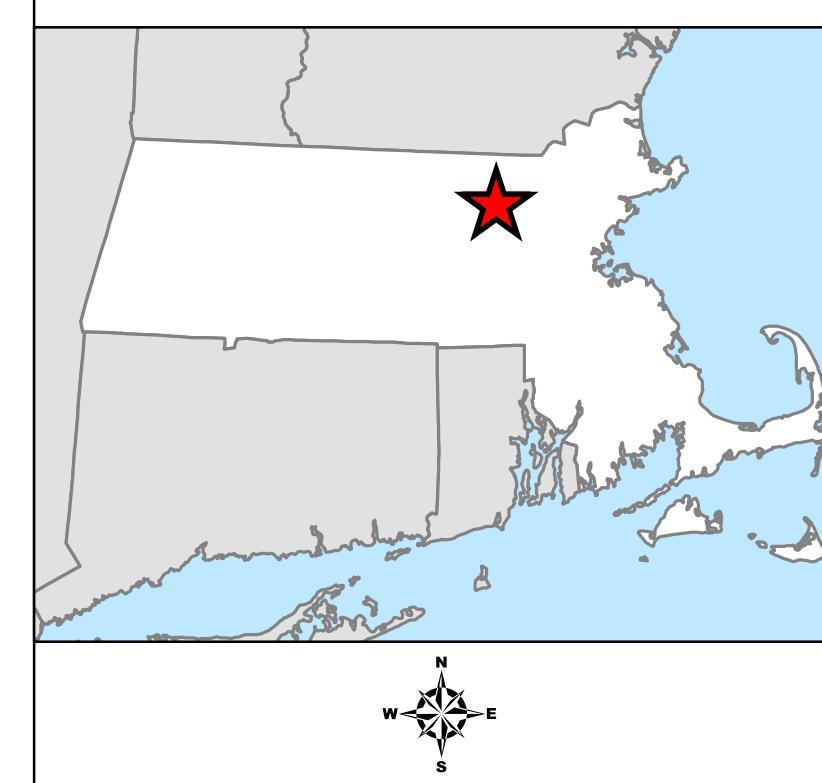
LEGEND

Outfall Inventory

Category

- ▲ Investigated Summer 2018
- ▲ Visited Summer 2018
- ▲ Remove Summer 2018
- ▲ Fall 2017 Fieldwork
- ▲ Spring/Summer 2017 Fieldwork
- Sampled
- ✚ Urban Area (Census 2000)
- ✚ Urban Area (Census 2010)
- ✚ Town Boundary

LOCUS MAIL



NOTES

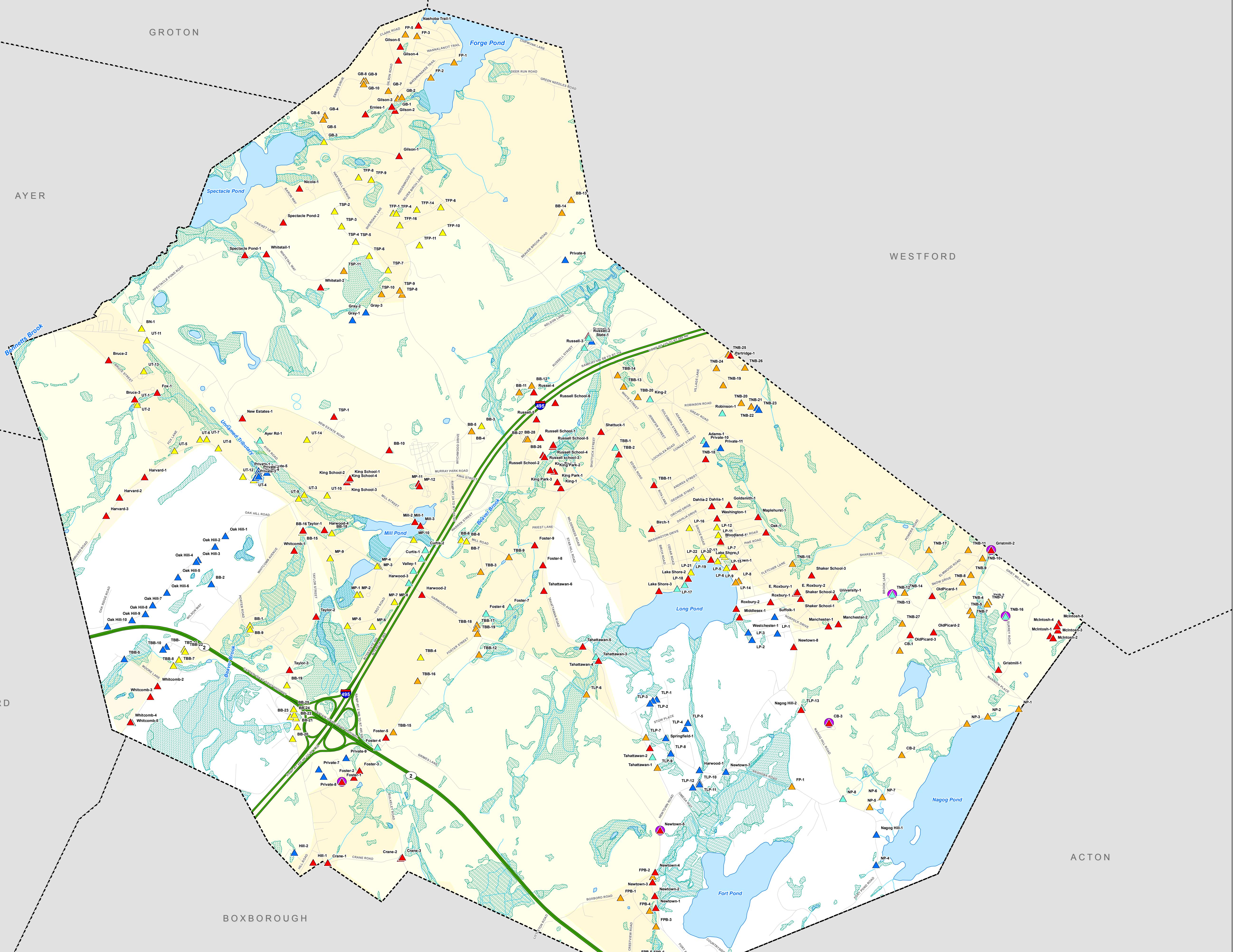
1. Outfalls denoted as "Visited" were not inventoried. This may be due to the outfall being submerged or inaccessible.
2. "Sampled" indicates the outfalls that had dry weather flow and were sampled.

Illicit Discharge Detection and Elimination Plan

Littleton, Massachusetts

December 2018

Tighe&Bond



Attachment 3
Summer 2018 Outfall Inventory Summary

Outfall ID		Lab Monitoring Parameters					Field Monitoring Parameters					Impaired Water	Noteworthy Items
Tighe & Bond ID	Town ID	Surfactants	Ammonia	E. Coli	Total Phosphorus	BOD5	Conductivity	Salinity	Temperature	Chlorine	Dissolved Oxygen		
BB-010	79	X	X	X			X	X	X	X		All general parameters	No Flow
CB-03	94	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	Sampled
GB-01	7	X	X	X			X	X	X	X		All general parameters	CNL, Homeowner sees it every fall
LP-17	185	X	X	X	X	X	X	X	X	X	X	All general parameters, Long Pond, SuAsCo TMDL	No Flow
LP-18	186	X	X	X	X	X	X	X	X	X	X	All general parameters, Long Pond, SuAsCo TMDL	No Flow
MP-011	170	X	X	X			X	X	X	X		All general parameters	No Flow
MP-012	171	X	X	X			X	X	X	X		All general parameters	No Flow
NP-08	129	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TBB-01	1	X	X	X			X	X	X	X		All general parameters	No Flow
TBB-011	91	X	X	X			X	X	X	X		All general parameters	No Flow
TBB-02	2	X	X	X			X	X	X	X		All general parameters	No Flow
TLR-013	131	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TNB-01	33	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TNB-012	44	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	Sampled, Outlets into Culvert under Road
TNB-013	45	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TNB-016	151	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	Sampled
TNB-018	88	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow

Note: Highlighted rows indicate that samples were collected.

Outfall ID		Lab Monitoring Parameters					Field Monitoring Parameters					Impaired Water	Noteworthy Items
Tighe & Bond ID	Town ID	Surfactants	Ammonia	E. Coli	Total Phosphorus	BOD5	Conductivity	Salinity	Temperature	Chlorine	Dissolved Oxygen		
TNB-022	158	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TNB-023	159	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TNB-06	38	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TNB-08	40	X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
TSP-01	11	X	X	X			X	X	X	X		All general parameters	No Flow
Great Road		X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
Pickard Lane 1		X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
Pickard Lane 2		X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow, Under water and debris
Harvard Road		X	X	X			X	X	X	X		All general parameters	No Flow
Gilson Road		X	X	X			X	X	X	X		All general parameters	No Flow
Foster Street		X	X	X			X	X	X	X		All general parameters	Sampled at upstream DMH. Can not access
Bulkeley Road		X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
Harwood Ave		X	X	X			X	X	X	X		All general parameters	No Flow
Whitcomb Ave		X	X	X			X	X	X	X		All general parameters, Beaver Brook MA84B-05	No Flow
Crane Road		X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	No Flow
Newtown Road		X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	Sampled, went back when flow was substantial (after rain event) found suds floating on water
Orchid Drive		X	X	X			X	X	X	X		All general parameters	No Flow

Note: Highlighted rows indicate that samples were collected.

Outfall ID		Lab Monitoring Parameters					Field Monitoring Parameters					Impaired Water	Noteworthy Items
Tighe & Bond ID	Town ID	Surfactants	Ammonia	E. Coli	Total Phosphorus	BOD5	Conductivity	Salinity	Temperature	Chlorine	Dissolved Oxygen		
Railroad		X	X	X			X	X	X	X		All general parameters	No Flow
Grist Mill Road		X	X	X	X		X	X	X	X		All general parameters, SuAsCo TMDL	Sampled at upstream DMH. Pooled at outfall
Total		36	36	36	21	2	36	36	36	36	2		

Note: Highlighted rows indicate that samples were collected.

Attachment 4
Outfall Sampling Results

Outfall Sampling Summary - Littleton, MA

Location						Laboratory Analysis ⁽³⁾							Water Quality Meter ⁽³⁾					
Date	Time	Tighe & Bond Outfall ID	Town ID	Street	Sample Location	Ammonia	Surfactants	Chlorine	E. coli	Fecal Coliform	Total Suspended Solids	BOD ₅	Total Phosphorus	Temperature	Salinity	Conductivity	pH	Dissolved Oxygen
						mg/L	mg/L	mg/L	CFU/100mL	CFU/100mL	mg/L	mg/L	mg/L	°F	ppt	µS/cm ⁽⁴⁾	mg/L	
4/19/2017 ⁽¹⁾	8:30	UT-5 ⁽²⁾	138	Bruce Street at Harvard Road	Outfall	-	-	-	-	14	-	-	0.18	-	-	-	-	
6/12/2017	14:50	UT-5	138	Bruce Street	Outfall	0.22	< 0.025	< 0.02	860	1,030	-	-	-	60.1	0.23	483	6.85	
5/18/2017	14:00	TSP-4	51	Spartan Arrow Lane	Outfall	< 0.1	< 0.025	< 0.02	246	-	-	< 2	0.02	70.3	0.16	367	6.88	
5/18/2017	13:20	TSP-7	54	Spartan Arrow Lane	Outfall	0.12	< 0.025	< 0.02	22	-	-	< 2	0.04	69.4	0.08	166	6.13	
6/15/2017	9:20	BB-3	62	Pine Brook Lane	Outfall	0.11	< 0.025	< 0.02	26	48	10	< 2	0.08	54.3	0.46	935	6.27	
6/15/2017	9:45	TSP-3	50	Spartan Arrow Lane	Outfall	< 0.1	< 0.025	< 0.02	10	-	-	4	0.08	47.9	0.09	188	7.25	
6/15/2017	10:15	LP-23		Washington Drive	Outfall	0.11	< 0.025	< 0.02	172	-	-	< 2	0.22	64.4	0.00	0	6.19	
6/15/2017	10:50	LP-13	145	Lake Shore Drive	Upstream DMH	< 0.1	< 0.025	< 0.02	24	-	-	< 2	0.06	65.23	0.00	0	6.39	
6/15/2017	11:00	LP-13	145	Lake Shore Drive	Upstream CB	0.79	< 0.025	< 0.02	14	-	-	< 2	0.12	56.18	0.30	619	6.55	
11/21/2017	11:15	TSP-8	69	Hartwell Avenue	Outfall	< 0.1	< 0.025	0.02 ⁽⁵⁾	< 2	-	-	-	-	62.2	0.065	110	5.66	
7/20/2018	9:10	TNB-16	151	Surrey Road	Outfall	< 0.1	< 0.025	-	< 2	-	-	-	-	60.82	0.37	751	7.48	
7/31/2018	11:10	CB-03	94	Berry Bush Lane	Outfall	0.33	< 0.025	0.04 ⁽⁵⁾	4	-	-	-	3.1	60.6	1.51	2,667	-	
7/31/2018	10:20	TNB-12	44	Brook Lane	Upstream DMH	< 0.1	< 0.025	0.02 ⁽⁵⁾	2	-	-	-	0.1	58.58	0.95	1,841	-	
8/1/2018	7:55	Foster-1		Foster Street	Upstream DMH	< 0.1	< 0.025	0.13	< 2	-	-	-	-	72.64	1.29	2,440	-	
8/1/2018	8:47	Gristmill-2		Gristmill Road	Upstream DMH	0.16	< 0.025	0.24	84	-	-	-	0.28	65.58	1.97	3,880	-	
8/1/2018	1:45	Newtown-5		Newtown Road	Outfall	< 0.1	< 0.025	0.05	68	-	-	-	0.38	68.15	1.12	2,305	-	

Notes:

(1) Dry weather sampling on 4/19/2017 was completed by the Littleton Clean Lakes Committee

(2) Littleton Clean Lakes Committee completed dry weather sampling at the outfall on Bruce Street at Harvard Road, which Tighe & Bond assumes is UT-5

(3) "-" means no analysis was completed

(4) µS/cm is equivalent to µhos/cm

(5) The chlorine samples taken on 11/21/2017 were analyzed using a Hach Pocket Colorimeter II and not submitted to the laboratory for analysis

REPORTING LIMITS

Ammonia = 0.1 mg/L

Surfactants = 0.025 mg/L

Chlorine = 0.02 mg/L

E. coli = 2 CFU/100mL

Fecal Coliform = 2 CFU/100mL

Total Suspended Solids = 1 mg/L

BOD₅ = 2 mg/L

Total Phosphorus = 0.01 mg/L

COLOR KEY (benchmarks are bold)													
	Ammonia	Surfactants	Chlorine	E. coli	Fecal Coliform			Toal Phosphorus	Temperature ^(a)	Salinity	Conductivity	pH	Dissolved Oxygen ^(a)
	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL			mg/L	°F	ppt	µS/cm		mg/L
	≥ 6	≥ 1.0	≥ 1.0	≥ 10,000	≥ 10,000			≥ 0.908		≥ 1.0	≥ 2,000		
	≥ 1.0	≥ 0.5	≥ 0.3	≥ 1,260	≥ 1,000			≥ 0.466		≥ 0.75	≥ 1,500	≤ 5	
	≥ 0.5	≥ 0.25	≥ 0.02	≥ 235	≥ 200			≥ 0.024	≥ 83	≥ 0.5	≥ 1,000	< 6.5 or > 8.3	< 5.0
	< 0.5	< 0.25	< 0.02	< 235	< 200			< 0.024	< 83	< 0.5	< 1,000	6.5 to 8.3	≥ 5.0

Notes:

(a) Nagog Brook is a Class B cold water. Therefore, benchmarks for outfalls draining to this receiving water (NP-5, NP-6, NP-7, and NP-8) should be: Dissolved Oxygen < 6.0 mg/L, Temperature ≥ 68 °F

Benchmark Sources:

Ammonia, Surfactants, and Chlorine - *EPA General Permit for Stormwater Discharges from Small MS4 in Massachusetts*

E. coli, Temperature, and Dissolved Oxygen - *314 CMR 4.00: Massachusetts Surface Water Quality Standards*

pH - *314 CMR 4.00: Massachusetts Surface Water Quality Standards and Center for Watershed Protection Illicit discharge Detection and Elimination Guidance Manual*

Total Phosphorus - *EPA Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion XIV*

Fecal coliform - *MWRA Water Quality Standards for Class B and Class SB Waters*

Salinity - *EPA Volunteer Estuary Monitoring: A Methods Manual*

Conductivity - *Center for Watershed Protection Illicit discharge Detection and Elimination Guidance Manual*

TSS and BOD₅ have no quantitative benchmark for surface water grab samples

Attachment 5
Outfall Inventory and Sampling Map –
All Field Efforts 2017-2018

ATTACHMENT 5
OUTFALL INVENTORY AND
SAMPLING - ALL FIELD
EFFORTS 2017-2018

