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**DATE:** October 25, 2017

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**SUBJECT:** CAM004 Illicit Connection Survey

**REF:** CAM004 Sewer Separation and  
Surface Improvements Projects

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As part of the CAM004 Sewer Separation and Surface Improvements Projects, the contractors were responsible for conducting an Illicit Connection Survey to verify all storm drains within the contract area are free of sanitary sewer flow. The requirements for conducting the survey are dictated in Specification Section 02712 in each contract with additional guidance from the Massachusetts Department of Environmental Protection (MassDEP) freshwater quality sampling procedures. The following summarizes the steps taken by P. Gioioso & Sons (PGS) and Barletta Heavy Division (BHD) to satisfy this requirement.

CAM004 projects include:

- Huron A Sewer Separation and Surface Improvements Project (PGS)
- Huron B Sewer Separation and Surface Improvements Project (BHD)
- Concord Sewer Separation and Surface Improvements Project (PGS)
- Concord Lane and New Street Sewer and Pump Station Improvements Project (BHD)

## 1.0 Procedure

A step by step guide of the recommended illicit connection survey procedure has been included in **Appendix A**. Overall, the process the contractors followed involved creating a dam in the downstream drain manholes using sandbags to block and collect dry weather flow in order to collect a sample. After 48-72 hours with the sandbag in place during dry weather conditions, the manholes were inspected and sampling began. If the structure was dry and no standing water was observed behind the sandbag, the isolated upstream drain was considered compliant with no illicit connections. If the structure had flow backed up behind the sandbag then samples were collected for bacteria testing. The testing parameters included sampling for Escherichia Coli (E. Coli) as well as ammonia and surfactants. The laboratories used by the contractors included Alpha Analytical and G&L Laboratories. Field kits were used to test ammonia and surfactants and if the kits came back compliant then the only sample sent to the lab was E. Coli. If the field tests came back as non-compliant then additional samples were sent to the lab for ammonia and surfactants.

According to the Massachusetts Surface Water Quality Standards, 314 CMR, and as enforced by the MassDEP, the concentration of E. Coli shall not exceed 235 colonies per 100mL. E. Coli has been used as the main sampling parameter with ammonia and surfactants utilized as additional tracers. The allowable laboratory concentration of ammonia is below 0.5 mg/L and surfactants below 0.1 mg/L. Although these

concentrations for ammonia and surfactants are good indicators of illicit sanitary sewer connections they are not parameters set by the MassDEP.

## 2.0 Reaches Excluded from Sampling

Throughout all the projects, there were pipe reaches at intersections that were not included in the illicit connection sampling. These short reaches were often left out because of accessibility issues related to traffic such as locations in intersections. These sections have a low likelihood of lateral connections. In order to document that these pipe reaches do not have any illicit connections, the post construction CCTV has been reviewed and no unidentified suspect service laterals were found. These reaches have been identified in the sampling result tables discussed in the next section.

## 3.0 Results

The results from each project have been compiled into separate tables per contract. These result tables can be found in **Appendix B**. The lab reports have been compiled for each contract and can be made available upon request. The tables are broken down by street and reach from upstream manhole to downstream testing manhole. The manhole numbering scheme used in the table matches the record drawings. The tables include the testing timeframe, field test results as well as the laboratory sampling data and overall test result. When a non-compliant reach was encountered and additional sampling was conducted, the results are listed below the non-compliant row. In this way, the tables represent a systematic approach with a complete history of the contractor's illicit connection survey procedure. **Table 1** depicts the timeframe of the illicit surveys for each project.

**Table 1 – Illicit Connection Survey Timeframe**

Project	Start Date	End Date
Huron A	April 2014	December 2015
Huron B	September 2015	December 2015*
Concord	May 2015	December 2015*
Concord Lane/New Street	October 2015	December 2015

\* Additional sampling has been conducted after December 2015 to further track bacteria above testing parameters believed to be residual bacteria

## 4.0 Reaches with Bacteria above Testing Parameters

Throughout the sampling program for CAM004 there were several reaches with dry weather flow that exceeded the testing parameters. In these reaches, additional sampling and investigations were conducted to further narrow down potential contamination sources. There are a number of items that could result in higher sampling parameters that do not necessarily reflect direct illicit sanitary sewer connections. It is important to keep in mind that the E. Coli standard, as well as the ammonia and surfactants reference concentrations, are intended for receiving water bodies and the concentrated nature of storm water may lead to occasional exceedance of the water quality standards and IDDE benchmarks.

Protocols have been proposed and studies performed to determine typical storm water concentrations for sanitary contamination indicators such as E. Coli, ammonia, and surfactants. A wide range of E. Coli and ammonia concentrations has been reported in non-polluted storm waters. **Table 2** presents an array of observed ranges of chemical and bacteriological parameters in non-polluted storm water and surface waters.

**Table 2- Benchmarks and Observed Concentrations of Water Quality Indicators in Non-polluted Storm Water**

Document	Method	E. Coli (cfu/100mL)	Ammonia (mg/L)	Surfactants (mg/L)
Pitt et al. (1993)	Median concentration values (surface waters)	Not evaluated	0.44 – 1.0	0.1
Petersen et al. (2005)	Geometric mean concentration (E. Coli) and arithmetic mean concentration (ammonia)	4,664	0.48	Not evaluated
Brown et al. (2004)	Benchmark values - Flow chart for Birmingham, AL	Not used to determine sample compliance	Used to determine type of illicit flow. Does not determine sample compliance	0.06
	Benchmark values - Flow chart for Tuscaloosa, AL	12,000	Used to determine type of illicit flow. Does not determine sample compliance	0.25

In general, E. Coli is a bacterium that lives in the digestive tracts of humans and animals. However, the sampling test does not differentiate between a human source and an animal source such as dog waste. With catch basins collecting urban runoff, the possibility of the tests picking up E. Coli from an animal source is highly likely.

In addition to human wastes, ammonia is produced by the decomposition of plant and animal protein and is a main ingredient in fertilizer. With multiple sources of ammonia, a sample with high levels of ammonia must also be analyzed relative to the other testing parameters of E. Coli and surfactants in order to depict a complete picture of potential contamination.

Surfactants is reflective of soaps and detergents that are present in sanitary service connections, but can also be indicative of vehicles being washed in a driveway with the flow eventually entering a catch basin and altering a sampling test.

The specific drain reaches with dry weather flow that exceeded testing parameters have been described below per project area.

### **Huron A**

After conducting multiple rounds of sampling there remained (2) isolated drain reaches within Huron A that had samples that exceeded testing parameters. These included the following:

*Lakeview Ave (DMH-25 to DMH-22):*

- E. Coli = 73,000 cfu/100mL; Ammonia = 3.2 mg/L; Surfactants = Inconclusive

*Vassal Ln (D38DMH4230 to DMH-47):*

- E. Coli = 2200 MPN/100mL; Ammonia = 1.65 mg/L; Surfactants = 0.43 mg/L

Additional investigations were conducted on Lakeview Avenue in order to narrow down potential sources of the bacteria detected. During sampling there was sanitary flow in the Lakeview Avenue drain because the Huron Avenue separation in the Huron B contract had not been completed. In order to work around this situation, an airbag plug was installed in the upstream reach of the drain and PGS conducted bypass pumping in order to isolate the drain for the test. Even after cleaning the drain and isolating the upstream end, the bacteria levels remained high. Looking at the service lateral connections into the drain there were only (2) connections made, one from #225-227 Lakeview Avenue and one from #197 Lakeview Avenue. Full fixture dye testing was conducted on both properties and no illicit connections were found. It is suspected that the air bag plug may have leaked and sanitary flow from Huron Avenue impacted the test results. Additional sampling was conducted on Lakeview Avenue to further confirm this suspicion and is discussed in Section 5.0 Large Catchment Sampling.

The reach on Vassal Lane from D38DMH4230 to DMH-47 overlaps with the Huron B project area. This section of the Vassal Lane northern drain, from Chilton Street towards Standish Street, conveys flow from upstream on Vassal Lane and collects the flow from the Tobin School catch basins on the east side of the building. The reach contains (1) lateral connection from #153 Vassal Lane and was installed by PGS as part of the private property inflow removal program to redirect the flow from a sump pump. The testing parameters above the limits on Vassal Lane are therefore believed to be background contaminants and are not believed to reflect the presence of sanitary flow.

### **Huron B**

After numerous rounds of sampling for Huron B there remained (4) isolated drain reaches with samples that exceeded testing parameters. These included the following:

*Hutchinson St (DMH-93 to DMH-90)*

- E. Coli = 3780 MPN/100mL; Ammonia = 2.30 mg/L; Surfactants = 0.12 mg/L

*Vassal Ln (DMH-35A to DMH-35)*

- E. Coli = 2000 MPN/100mL, Ammonia = 1.25 mg/L; Surfactants = 0.12 mg/L

*Vassal Ln (DMH-34 to DMH-68) & Walden St (DMH-33A to DMH-68)*

- E. Coli = 8400 MPN/100mL; Ammonia = 1.47 mg/L; Surfactants = 0.12 mg/L

*Walden St (DMH-69 to DMH-33A)*

- E. Coli = 3700 MPN/100mL; Ammonia = 3.95 mg/L; Surfactants = 0.19 mg/L

Multiple rounds of sampling were conducted at the intersection of Vassal Lane and Walden Street as a result of samples above the testing concentrations. At the time of the sampling, the separation work was complete. However, there were temporary connections made due to other utility conflicts that were pending to be remediated. The bacteria detected on Walden Street within manhole DMH-33A was believed to be coming from Hutchinson Street with flow observed overflowing above the sandbag dam at the intersection of Walden Street and Hutchinson Street during sampling. In addition to visually

observing dry weather flow, sewer odors were detected within the catch basins and manholes on Hutchinson Street. Hutchinson Street originally passed the illicit connection survey after the downstream manhole was found to be dry on September 24, 2015, but based on the observations, additional investigations were conducted. CCTV investigations were conducted on December 15, 2015 and December 16, 2015 in order to identify potential illicit sources. The drain was found to be in poor condition with sections of broken pipe and multiple cracks along the reach. This section of drain was already scheduled to be CIPP lined, however the lining had not been completed at that time. As a result of the recent CCTV investigations, the proposed limits of CIPP lining were extended within the drain so that the complete drain on the street would be either new pipe or CIPP lined.

In total, there are four lateral connections into the drain on Hutchinson Street: #2 Hutchinson Street, #4 Hutchinson Street, #34 Hutchinson Street, and #414 Walden Street. All of these laterals were installed by BHD as part of the private inflow removal program or as a drain lateral stub in order to eliminate an icing concern. Building inspections and dye testing were conducted in December 2015 at all of these properties with a lateral connection into the drain. Thorough investigations were conducted at #414 Walden Street since the private inflow removal work involved redirection of an internal flat roof drain stack. The investigations included dye testing of sanitary fixtures within the basement as well as all three floors within the building and all dye was observed in the sanitary sewer. No illicit connections were found through the additional investigations.

Hutchinson Street was CIPP lined and another round of sampling was conducted by the DPW in June 2017. All three testing parameters remain slightly above the limits, but due to the level of due diligence executed within this stretch of drain, these levels of bacteria are believed to be background contaminants and are not believed to reflect the presence of sanitary sewer flow.

On Vassal Lane between DMH-35A and DMH-35, there are two lateral connections. These connections are for #29 Vassal Lane and #35 Vassal Lane. The lateral connection from #29 Vassal Lane was confirmed to convey drainage from the flat roof drain through investigations on August 27, 2015. The lateral connection from #35 Vassal Lane was confirmed to convey drainage from the flat roof drain on December 11, 2014. No illicit sanitary flow is therefore suspected within this pipe reach.

On Vassal Lane there was a temporary connection installed between DMH-34 and DMH-68 due to pending utility relocations that were scheduled within the intersection. Since this time, the drain in this area was reinstalled with the flow directed from DMH-34 to DMH-33. At the time of the sampling, there was one lateral connection into the drain from #47 Vassal Lane. This property was confirmed to have a separate drain conveying flow from the flat roof through investigations on October 19, 2015 and additional push camera investigations on January 26, 2016. No illicit sanitary flow is therefore suspected within this pipe reach.

### **Concord**

After multiple rounds of sampling conducted throughout the Concord project area, the reaches that continued to detect bacteria were on Concord Avenue between Walden Street and Alpine Street. A memo was compiled to document the various rounds of sampling and results entitled "Illicit detection testing along Concord Avenue between Walden and Alpine streets," dated August 12, 2016. This memo has been included as **Appendix C** for reference. Overall, the initial sampling revealed bacteriological contamination on Concord Avenue between Walden Street and Alpine Street, however a new drain had been installed from Chilton Street to Alpine Street. There is one lateral connection within the drain reach from Chilton Street (DMH-14) to Alpine Street (DMH-11) for #369 Concord Avenue. This lateral was

installed by PGS as part of the private inflow removal program and redirected one sump pump to the storm drain. This lateral is not suspected of being an illicit connection and it is possible that flow from upstream altered the sampling from this reach. The focus then shifted to the section of Concord Avenue from Walden Street to Chilton Street. CIPP lining of the mainline drain was added to the contract within this reach. After the lining was complete, additional sampling was conducted on April 13, 2016 and the concentrations drastically dropped as seen in the sampling results below.

*Concord Ave (DMH-96 Walden St to D38DMH1745 Fayerweather St)*

- E. Coli = 50 MPN/100mL; Ammonia = 0.845 mg/L; Surfactants = 0.00 mg/L

*Concord Ave (D38DMH1745 Fayerweather St to DMH-14 Chilton St)*

- E. Coli = 2900 MPN/100mL; Ammonia = 1.2 mg/L; Surfactants = 0.05 mg/L

*Concord Ave (DMH-14 Chilton St to DMH-11 Alpine St)*

- E. Coli = 33 MPN/100mL; Ammonia = 0.131 mg/L; Surfactants = 0.05 mg/L

The initial bacteriological contamination was believed to have been caused by infiltration into the drain from potentially leaking sanitary sewer laterals crossing over the drain. The ammonia concentration above the designated benchmark was believed to be non-fecal organic matter with potential sources of decomposing leaves or other organic debris. Since the E. Coli and ammonia concentrations detected were still above the designated levels additional sampling was conducted after the August 12, 2016 memo was issued. This is further discussed in Section 5.0 Large Catchment Sampling.

### **Concord Lane/New Street**

All the drain reaches on Concord Lane were found to be compliant through the illicit connection survey. (2) Reaches on New Street had samples that exceeded the sampling parameters. These include the following:

*New St (D38DMH1740 to D38DMH1730):*

- E. Coli = 390 MPN/100mL; Ammonia = 0.585 mg/L; Surfactants = 0.13 mg/L

*New St (D38DMH1525 to D38DMH1850):*

- E. Coli = 1.0 MPN/100mL; Ammonia = 3.43 mg/L; Surfactants = 0.10 mg/L

Both these samples had relatively low levels of E. Coli and surfactants with higher levels of ammonia. These levels suggest background contamination and are not believed to reflect the presence of sanitary flow.

## **5.0 Large Catchment Sampling**

In December 2015, large catchment sampling was conducted of the drainage system upstream of Drain Vault No. 5 at the Concord Avenue /Alewife Brook Parkway rotary. The intent of the sampling was to confirm the larger drainage catchment area tributary to Drain Vault No. 5 was clean and free of illicit sanitary connections. Reaches were identified along Concord Avenue, Fresh Pond Parkway, Lakeview Avenue and Vassal Lane. At the same time, sampling was being conducted within the Huron B, Concord, and Concord Lane/New Street project areas to continue the illicit connection survey within those project areas. The sampling results for the individual projects have already been discussed and are included in the sampling results tables found in **Appendix B**.

The figure included in **Appendix D** depicts the December 2015 large catchment downstream sampling results. The majority of the samples collected had E. Coli results below the allowable concentrations except for the following:

*Vassal Lane (S61CMH4020):*

- E. Coli = 37,000 MPN/100mL; Ammonia = 6.50 mg/L; Surfactants = 0.19 mg/L

*Lakeview Avenue (S61CMH4020):*

- E. Coli = 6,500 MPN/100mL; Ammonia = 2.43 mg/L; Surfactants = 0.15 mg/L

It is suspected that the Hutchinson Street bacteriological contamination continued downstream passed the sandbags and altered the Vassal Lane testing sample. Building inspections had previously been conducted on Vassal Lane from Alpine Street to Lakeview Avenue between July and October 2015 with full fixture dye testing and no illicit connections were found.

High levels of E. Coli were initially detected on Lakeview Avenue as previously mentioned in Section 4.0 and, as a result, building inspections and full fixture dye testing were conducted with no illicit connections found. After the initial sampling, the separation work on Huron Avenue was completed and the Huron Avenue sanitary flow that was connected to the Lakeview Avenue drain was redirected to the appropriate Lakeview Avenue sewer. It is suspected that the storm drain did not have sufficient time to be flushed clean and, in turn, residual bacteria remained in the pipe.

Aside from E. Coli, the large catchment sampling also detected moderate to high levels of ammonia throughout the system and high levels of surfactants in the Lakeview Avenue drain between Worthington Street and Vassal Lane. As mentioned before, when looking at the results for ammonia they should also be compared to the other test parameters. Since the E. Coli remained low for the reaches where ammonia was detected, it is suspected this is the result of non-fecal organic matter. The high level of surfactants detected within the Lakeview Avenue drain is suspected to be from the car dealership at the intersection of Lakeview Avenue and Vassal Lane. Additional investigations were conducted at the car dealership to confirm there were no direct connections from the car wash area and none were found. It is possible that surfactants were detected as a result of numerous cars driving in and out of the property after recently being washed with residual detergents migrating to Lakeview Avenue catch basins.

After the December 2015 round of sampling was completed, there were additional samples collected in order to continue to monitor larger catchments within the CAM004 area. These include the following:

*Concord Avenue (DMH @ STA 3004+48, upstream of Drain Vault No. 4)*

- E. Coli = 200 MPN/100mL and 300 MPN/100mL; Ammonia = 9.0 mg/L; Surfactants = 0.2 mg/L

*Concord Avenue / Alewife Brook Parkway Rotary (Drain Vault No. 5)*

- E. Coli = 980 MPN/100mL; 6.4 mg/L; Surfactants = 0.11 mg/L

The sample taken from the drain manhole at station 3004+48, just upstream of Drain Vault No. 4, was collected on September 22, 2016 and included the majority of the Concord project area aside from Bay State Road and Birch Street. This sample, with results depicted above, had considerably low levels of E. Coli and surfactants with high levels of ammonia detected.

The sample collected from Drain Vault No. 5 was collected on September 11, 2017 and serves as the representative sample for the entire upstream collection area. The concentrations of E. Coli (980 MPN/100mL) and surfactants (0.11 mg/L) were found to be just above the designated allowable

concentrations with ammonia levels (6.4 mg/L) high as has been consistent throughout the larger catchment sampling. Based on these results, the upstream drain is believed to be free of sanitary sewer connections and the ammonia is suspected to be generated from decaying matter and sediment in the system. It should be noted that the contract closeout cleaning of the drainage system had not occurred prior to the sample being collected at Drain Vault No. 5.

## 6.0 Recommendations

Good housekeeping practices are recommended based on the detectable limits of bacteria. Frequent maintenance should be conducted, including street sweeping, catch basin cleaning, drain cleaning, and drain manhole sump cleaning. In addition, public outreach continues to be an important part of maintaining a clean drainage system within such an urban environment.

Additional sampling is recommended to continue to monitor the bacteria levels within the entire CAM004 catchment. If possible, this sampling is recommended to be completed after the closeout cleaning that is scheduled for the Huron B and Concord contracts. A sampling monitoring figure has been included in **Appendix E** that depicts locations where the City can further isolate each project area and continue to monitor the system. Six structures have been identified as potential sampling locations with a total of eight samples being collected. These locations were selected to isolate catchments and differentiate between the Huron A, Huron B and Concord contracts. The sampling locations could be modified to add sampling locations for greater isolation or to merge some locations if fewer samples are desired. The current schematic does not differentiate Concord Lane and New Street from the other project areas so additional sampling locations could be added if this separation is desired. Alternatively, the four samples at the Lakeview Avenue and Vassal Lane intersection (Shown in blue within **Appendix E**) could be condensed into two samples within the junction vault to sample both outlets. This however would not differentiate between the Huron A and Huron B catchment areas.

The City may also want to consider adding sucralose, or other human specific testing, into the sampling procedures for the reaches where E. Coli continues to exceed the designated parameters. Sucralose is an artificial sweetener and sugar substitute that is indigestible and therefore a reliable method for determining illicit sanitary sewer connections. It should be noted that there are often high sampling costs associated with conducting sucralose testing, but since the artificial sweeteners are typically in human food this can be effective at differentiating between human and animal waste sources.



**List of Appendices**

Appendix A – Recommended Illicit Connection Survey Procedure

Appendix B – Result Tables

    Appendix B.1 – Huron A Sampling Results

    Appendix B.2 – Huron B Sampling Results

    Appendix B.3 – Concord Sampling Results

    Appendix B.4 – Concord Lane New St Sampling Results

Appendix C – Illicit Detection Testing along Concord Avenue between Walden and Alpine Streets

Appendix D – Downstream Sampling Figure

Appendix E – Sampling Monitoring Figure

**Appendix A**  
**Recommended Illicit Connection Survey Procedures**

## Recommended Illicit Connection Survey Procedure

**Step 1:** Confirm separation work is complete and manhole inverts have been installed

**Step 2:** Clean storm drain and pump out flow in mainline sump manholes

**Step 3:** Designate testing reaches from upstream DMH to downstream DMH. If mainline sump manholes exist then the sump manhole must be designated as the downstream testing manhole

**Step 4:** Wait 48–72 hours after a rain event in order to allow the groundwater table to recede

**Step 5:** During a period of dryweather, install sandbags in downstream drain manholes creating a dam for upstream testing reach

**Step 6:** Wait 48 hours (2 nights and 2 mornings) with no precipitation for any dryweather flow to accumulate behind sandbag dam

**Step 7:** Begin sampling:

If no standing water is found behind sandbag dam then reach = compliant

If standing water is built up behind sandbag dam:

- Collect (2) E.coli samples for laboratory
- Use Field Kits to test Ammonia & Surfactants:
  - Ammonia Field Kit = CHEMets Kit No. K-1410
    - Compliant  $\leq 0.5$  mg/L
    - Non-compliant  $> 0.5$  mg/L
  - Surfactants Field Kit = CHEMets Kit No. K-9400
    - Compliant  $\leq 0.25$  mg/L
    - Non-compliant  $> 0.25$  mg/L
- If field kits are compliant no further samples are needed for the lab
- If field kits are non-compliant then collect Ammonia and Surfactants sample for the lab
- Lab Parameters:
  - E.coli Lab Sample:
    - Compliant  $\leq 235$  cfu/100mL
    - Non-compliant  $> 235$  cfu/100mL
  - Ammonia Lab Sample:
    - Compliant  $\leq 0.5$  mg/L
    - Non-compliant  $> 0.5$  mg/L
  - Surfactants Lab Sample:
    - Compliant  $\leq 0.1$  mg/L
    - Non-compliant  $> 0.1$  mg/L

**Step 8:** If sampling identifies non-compliant reaches begin dye testing buildings to identify illicit sources and redirect illicit within reach

**Step 9:** Repeat cleaning, sandbagging, and sampling procedure again to verify the storm drain has no illicit sanitary flow

## **Appendix B Result Tables**

**Appendix B.1**  
**Huron A Sampling Results**

**Huron A Illicit Connection Survey Results**

Conducted by P. Gioioso & Sons Inc.

Legend	
	Compliant
	Non-compliant
	CCTV utilized in place of Testing

Street	Area	Test Reach		Start Date	End Date	E.coli Samples Collected (Y/N)	Field Test Ammonia (Non-Compliant > 0.5 mg/L)	Field Test Surfactants (Non-Compliant > 0.25 mg/L)	Ammonia & Surfactants Sample Collected (Y/N)	Lab Results				Test Result (Compliant, Non-compliant, MH Dry)	Comments	
		Upstream Manhole	Downstream & Test Manhole							Report No.	E.coli (CFU/100mL) (Non-Compliant >235 cfu/100mL)	Ammonia (mg/L) (Non-Compliant >0.5mg/L)	Surfactants (mg/L) (Non-Compliant >0.1 mg/L)			
Grazier Road	Cul-de-sac to Huron (Grazier North)	DMH-4	DMH-5	4/2/2014	4/4/2014	N	NA	NA	N	NA	NA	NA	NA	MH Dry	No lateral connections within reach per CCTV	
		DMH-5	D38DMH8005													
Grazier Road	#24 Grazier to Huron (Grazier South)	D38DMH8115	DMH-6	4/2/2014	4/4/2014	Y	0.00	0.25	N	67163	40 40	NA	NA	Compliant	No lateral connections within reach per CCTV	
		DMH-6	D38DMH8005													
Hawthorne Park	Fresh Pond to Lexington	DMH-41	DMH-42	4/2/2014	4/4/2014	Y	0.00	0.25	N	67163	<10 <10	NA	NA	Compliant	No lateral connections within reach per CCTV	
		DMH-42	D38DMH7720													
Lakeview Avenue	#102 Lakeview to Huron (Lakeview South)	S61CMH7280	DMH-27	4/2/2014	4/4/2014	Y	3.00	Inconclusive	Y	67163	>80,000 >80,000	1.5	Missing	Non-compliant	Re-tested reach	
		DMH-27	DMH-25	8/8/2014	8/11/2014	N	NA	NA	NA	NA	NA	NA	NA	MH Dry	No lateral connections within reach per CCTV	
	Huron to #228 Lakeview (Lakeview North)	DMH-25	DMH-22 (Mainline Sump)	10/27/2014	10/29/2014	Y	2.00	Inconclusive	Y	69918	73,000	3.2	Missing	Non-compliant	Switched to dye testing due to upstream interim conditions	
		NA														(2) SD laterals for (2) properties on Lakeview between Huron and Worthington. Conducted full fixture dye test and no illicit found. (#225-227 Lakeview Ave dye tested on 7/27/2015 & #197 Lakeview Ave dye tested on 4/17/2015)
Larch Road	Larch Rd Park to Fresh Pond	D38DMH8430	D38DMH8405	4/2/2014	4/4/2014	Y	0.00	0.25	N	67163	330 680	NA	NA	Compliant		
		DMH-21	DMH-18	4/2/2014	4/4/2014	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
Lexington Avenue	#128 Lexington to Huron (Lexington South)	DMH-18	D38DMH7750												(2) lateral connections within reach. Suspect CB connections abandoned under Huron A and Huron B.	
		D38DMH7750	D38DMH7720 (Mainline Sump)	10/27/2014	10/29/2014	N	NA	NA	NA	NA	NA	NA	NA	MH Dry		
	Huron to Hawthorne (Lexington North)	D38DMH7720 (Mainline Sump)	D38DMH7710	10/27/2014	10/29/2014	N	NA	NA	NA	NA	NA	NA	NA	MH Dry		
Malcom Road	Lakeview to Standish	DMH-43	D38DMH4605	4/2/2014	4/4/2014	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		D38DMH4605	D38DMH4410												No lateral connections within reach per CCTV	
Poplar Road	Fresh Pond to Lexington	D38DMH7805	D38DMH7715	4/2/2014	4/4/2014	Y	2.00	2.00	Y	67163	27,000 21,000	22.4	Missing	Non-compliant	Resident stated he was dumping sewage into SP pit during testing	
				8/8/2014	8/11/2014	N	NA	NA	NA	NA	NA	NA	NA	NA	MH Dry	
Standish Street	Huron to #42 Standish	DMH-48	DMH-31	7/22/2015	7/25/2015	Y	0.0	0.0	N	72616	55 40	NA	NA	Compliant		
		DMH-31	D38DMH4408	7/22/2015	7/25/2015	Y	0.5	0.25	N	72616	40 30	NA	NA	Compliant		
	#53 Standish to Vassal	D38DMH4408	DMH-39	7/22/2015	7/25/2015	Y	0.0	0.0	N	72616	2640 2640	NA	NA	Non-compliant	Re-tested reach	
		DMH-39	Drain Vault No.1	8/28/2015	8/31/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
Vassal Lane	Standish to #202 Vassal (North Storage SD)	D38DMH4205	Grit Pit Structure												Dye tested properties within reach and conducted IDDE for outlets from school. No illicit found.	
	#202 Vassal to Lakeview (North Storage SD)	Grit Pit Structure	DMH-32												Dye tested properties within reach and conducted IDDE for outlets from school. No illicit found.	
	Chilton to #160 Vassal (North SD)	D38DMH4230	DMH-47	11/2/2015	11/4/2015	N	3.0	1.5	N	NA	NA	NA	NA	Non-compliant	Re-tested reach after cleaning drain	
				12/5/2015	12/7/2015	Y	3.0	0.75	Y	L1532112	2200	1.65	0.43	Non-compliant	Residual contamination	
	#160 Vassal to Standish (North SD)	DMH-47	Drain Vault No.1	11/2/2015	11/4/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Standish to Lakeview (Middle SD)	Drain Vault No.1	Drain Vault No.3													Dye tested properties within reach. No illicit found.
		Drain Vault No.3	Junction Vault													Dye tested properties within reach. No illicit found.
	Alpine to Standish (South SD)	DMH-46	Drain Vault No.1	11/2/2015	11/4/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Standish to Lakeview (South SD)	Drain Vault No.1	S61CMH4020													Dye tested properties within reach. No illicit found.
		Tobin School	DMH-34	11/2/2015	11/4/2015	N	NA	NA	N	NA	NA	NA	NA	NA	MH Dry	
Tobin School Outlets	Tobin School	Drain Vault No.1 (East Inlet)	11/2/2015	11/4/2015	N	NA	NA	N	NA	NA	NA	NA	NA	MH Dry		
	Tobin School	Drain Vault No.1 (West Inlet)	11/2/2015	11/4/2015	N	NA	NA	N	NA	NA	NA	NA	NA	MH Dry		
	D38CBN4277	D38DMH4227													Tobin School catch basin drain	
Waterman Road	#1 Waterman to Standish	D38DMH4407	D38DMH4405 (Tested Standish DMH-39)	7/22/2015	7/25/2015	Y	0.0	0.0	N	72616	2640 2640	NA	NA	Non-compliant	Tested Standish and included Waterman. Re-tested	
				8/28/2015	8/31/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		

## **Appendix B.2**

### **Huron B Sampling Results**

**Huron B Illicit Connection Survey Results**  
 Conducted by Barletta Heavy Division (BHD)

Legend	
	Compliant
	Non-compliant
	CCTV utilized in place of Testing

**Notes:**  
 1. Hutchinson Street sampling between June 14 and June 16, 2017 conducted by CDPW.

Street	Area	Test Reach		Start Date	End Date	E.coli Samples Collected (Y/N)	Field Test Ammonia (Non-Compliant > 0.5 mg/L)	Field Test Surfactants (Non-Compliant > 0.25 mg/L)	Ammonia & Surfactants Sample Collected (Y/N)	Lab Results				Test Result (Compliant, Non-compliant, MH Dry)	Comments	
		Upstream Manhole	Downstream & Test Manhole							Report No.	E.coli (cfu/100mL) (Non-Compliant >235 cfu/100mL)	Ammonia (mg/L) (Non-Compliant-0.5mg/L)	Surfactants (mg/L) (Non-Compliant >0.1 mg/L)			
Appleton Rd	Appleton Rd to Huron	DMH-96	DMH-77 (DMH-79 Tested)	10/5/2015	10/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
Appleton St	Dunstable to Huron	DMH-74	DMH-79	10/5/2015	10/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Huron	DMH-79	DMH-20	10/14/2016	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Concord to Huron	DMH-84	DMH-80	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-80	DMH-20												No lateral connections within reach per CCTV	
Blakeslee St	Reservoir to Huron	DMH-72	DMH-73	9/1/2015	9/3/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-72	DMH-106	11/4/2015	11/9/2015	Y	0.00	3.00	Y	L1529065	<10	0.606	11.4	Non-Compliant, Re-tested	See Re-test on 11/25/2015	
		DMH-73	DMH-106	11/23/2015	11/25/2015	N	0.25	0.25	Y	L1531164	NA	0.00	0.00	Compliant		
		DMH-106	DMH-16	10/26/2015	10/28/2015	N	NA	NA	N	NA	NA	NA	NA	NA	MH Dry	
Chilton St	Huron to Vassal	DMH-43	DMH-47	10/5/2015	10/7/2015	Y	0.00	0.25	N	L1525278	<1	NA	NA	Compliant		
		DMH-47	DMH-27												No lateral connections within reach per CCTV	
Dunstable Rd	Dunstable to Appleton	D38LPH6705	DMH-94	10/5/2015	10/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
			DMH-94	DMH-75											No lateral connections within reach per CCTV	
Fayerweather St	Reservoir to Huron	DMH-49	DMH-53	9/22/2015	9/24/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-53	DMH-12												(2) lateral connections called out in CCTV. (1) Abandoned with brick bulkhead visible. Suspect (1) from abandoned CB.	
	Huron to Vassal	DMH-12	DMH-56	9/18/2015	9/21/2015	Y	0.00	0.25	N	L1523343	1.0	NA	NA	Compliant		
	Saville to Vassal	DMH-56	DMH-29												(1) Lateral connection observed in CCTV for PI DL for #115 Fayerweather St SP	
Granville Rd	Huron to Vassal	DMH-58	D38DMH4240	10/7/2015	10/9/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-59	DMH-61	9/16/2015	9/18/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Huron to Vassal	DMH-61	D38DMH4250												No lateral connections within reach per CCTV	
	Saville to Vassal	DMH-62	DMH-104	10/5/2015	10/7/2015	Y	0.00	0.25	N	L1525278	<10	NA	NA	Compliant		
Gurney St	Fayerweather to Huron	DMH-104	D38DMH4250	10/5/2015	10/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-40	D38DMH5303	9/16/2015	9/21/2015	Y	0.00	0.25	N	L1523343	9.4	NA	NA	Compliant		
		D38DMH5303	DMH-10													No lateral connections within reach per CCTV
		Fresh Pond to Lexington	DMH-1	D38DMH7750	9/25/2015	9/28/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
Huron Ave	Lexington to Lakeview	DMH-4	DMH-25 (Huron A)	10/26/2015	10/28/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Lakeview to Fayerweather	DMH-7	DMH-12	10/26/2015	10/28/2015	Y	0.00	0.25	N	L1527591	34 24	NA	NA	Compliant		
	Reservoir to Fayerweather	DMH-13A	DMH-12	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Fayerweather to Reservoir	DMH-13	DMH-14A	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Blakeslee to Reservoir	DMH-16	DMH-14	10/26/2015	10/28/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Blakeslee to Vassal	DMH-19B	DMH-20	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Concord to Sparks	D31DMH2070	D31DMH2055	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Sparks to Vassal	DMH-22	DMH-20	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	Hutchinson St	Appleton to Walden	DMH-93	DMH-90	9/21/2015	9/24/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
			DMH-93	DMH-90	6/14/2017	6/16/2017	Y	N	N	Y	7F16019 (Netlab)	3780	2.3	0.12	Non-compliant, Residual Bacteria	Sampling conducted by CDPW
DMH-90			DMH-69												No lateral connections within reach per CCTV	
Lincoln Ln	Lincoln to Fayerweather	D39DMH5133	DMH-50	10/5/2015	10/7/2015	Y	0.00	0.25	N	L1525278	<10	NA	NA	Compliant		
Manassas Ave	Manassas to Huron	DMH-88	D31DMH2060 (Tested D38DMH2055)	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
Reservoir St	Highland to Huron	DMH-63	DMH-65	9/1/2015	9/3/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-65	D38DMH6105 (DMH-14A)												No lateral connections within reach per CCTV	
Royal Ave	Concord to Huron	D38DMH6105 (DMH-14A)	DMH-68	10/5/2015	10/7/2015	Y	0.00	0.25	N	L1525278	<10	NA	NA	Compliant		
		DMH-86	D38DMH7005	10/5/2015	10/7/2015	Y	0.00	0.25	N	L1525278	63	NA	NA	Compliant		
Saville St	Appleton to Walden	DMH-99	DMH-97	9/8/2015	9/10/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-97	DMH-70												No lateral connections within reach per CCTV	
Vassal Ln	Huron to Walden/Reservoir	DMH-20	DMH-35	10/14/2015	10/16/2015	Y	0.25	0.25	N	L1526318	390 280	NA	NA	Isolated reach and re-tested, see below	See below for reach broken up and re-tested	
		DMH-20	DMH-34	10/26/2015	10/28/2015	Y	3.00	0.25	Y	L1527591	4300 2400	2.74	0.14	Isolated reach and re-tested, see below	See below for reach broken up and re-tested	
		DMH-20	DMH-37	11/6/2015	11/9/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-27	DMH-36	11/6/2015	11/9/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
		DMH-36	DMH-35A	11/6/2015	11/9/2015	N	NA	NA	N	NA	NA	NA	NA	NA	MH Dry	



Street	Area	Test Reach		Start Date	End Date	E.coli Samples Collected (Y/N)	Field Test Ammonia (Non-Compliant > 0.5 mg/L)	Field Test Surfactants (Non-Compliant > 0.25 mg/L)	Ammonia & Surfactants Sample Collected (Y/N)	Lab Results				Test Result (Compliant, Non-compliant, MH Dry)	Comments
		Upstream Manhole	Downstream & Test Manhole							Report No.	E.coli (cfu/100mL) (Non-Compliant >235 cfu/100mL)	Ammonia (mg/L) (Non-Compliant-0.5mg/L)	Surfactants (mg/L) (Non-Compliant >0.1 mg/L)		
Vassal Ln	Huron to Walden/Reservoir	DMH-35A	DMH-35	11/6/2015	11/9/2015	Y	1.00	0.25	Y	L1529065	130 31	2.12	0.07	Non-compliant, Residual Bacteria	
				12/5/2015	12/7/2015	Y	Not Conducted	Not Conducted	Y	L1532077	2000 980	1.25	0.12	Non-compliant, Residual Bacteria	
		DMH-35	DMH-34	11/6/2015	11/9/2015	Y	0.25	0.25	N	L1529065	210 0	NA	NA	Compliant	
		DMH-34	DMH-68	12/5/2015	12/7/2015	Y	Not Conducted	Not Conducted	Y	L1532077	8400	1.47	0.12	Non-compliant	Temporary interim connection between DMH-34 and DMH-33 until work within intersection could be completed. See DMH-34 to DMH-33 for fully constructed reach
		DMH-33													(1) Lateral connection observed in CCTV for #47 Vassal Lane SD lateral. Dye testing confirmed separate SD lateral.
	Walden/Reservoir to Fayerweather (North SD)	DMH-33	D38DMH4240	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
	Fayerweather to Chilton (North SD)	D38DMH4240	D38DMH4230	9/25/2015	9/28/2015	Y	3.00	0.25	Y	L1524170	170	5.96	0.38	Non-compliant Re-tested	See Re-test on 12/7/2015
				11/4/2015	11/9/2015	Y	0.25	0.25	N	L1529065	590	NA	NA	Non-compliant Re-tested	See Re-test on 12/7/2015
	Walden/Reservoir to Chilton (South SD)	DMH-68	DMH-28	12/5/2015	12/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
				9/24/2015	9/28/2015	Y	0.00	0.25	N	L1524170	1.0	NA	NA	NA	Compliant
Chilton to Alpine (South SD)	DMH-27	DMH-46 (Huron A)	11/4/2015	11/6/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
Walden St	Concord to Hutchinson	DMH-71	DMH-69	9/21/2015	9/24/2015	Y	0.25	0.25	N	L1523789	<10	NA	NA	Compliant	
	Hutchinson to Vassal	DMH-69	DMH-33A	12/5/2015	12/7/2015	Y	Not Conducted	Not Conducted	Y	L1532077	460000	13.9	5.23	Non-compliant	No laterals within reach from DMH-69 to DMH-33A. Suspect Hutchinson St reach leaked past sandbags. See Hutchinson test results
		DMH-91 (On Hutchinson)	DMH-33A	1/20/2016	1/22/2016	Y	Not Conducted	Not Conducted	Y	L1601891	3700 2900	3.95	0.19	Non-compliant	
		DMH-33A	DMH-68	12/5/2015	12/7/2015	Y	Not Conducted	Not Conducted	Y	L1532077	8400	1.47	0.12	Non-compliant	Temporary interim connection between DMH-33A and DMH-68. Suspect Hutchinson St reach leaked past sandbags. See notes for DMH-33A to DMH-33 and DMH-33 to DMH-68.
		DMH-33A	DMH-33											No lateral connections within reach per CCTV	
	DMH-33	DMH-68												No lateral connections within reach	
Wyman Rd	Wyman to Huron	D38DMH7220	D38DMH7205 (Tested DMH-20)	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	

## **Appendix B.3**

### **Concord Sampling Results**

**Concord Illicit Connection Survey Results**

Conducted by P. Gioioso & Sons Inc.

**Notes:**

1. MWH/Stantec conducted sample at DV5 outlet on September 11, 2017. Work not conducted by PGS.

Legend	
	Compliant
	Non-compliant
	CCTV utilized in place of Testing / Other

Street	Area	Test Reach		Start Date	End Date	E.coli Samples Collected (Y/N)	Field Test Ammonia (Non-Compliant > 0.5 mg/L)	Field Test Surfactants (Non-Compliant > 0.25 mg/L)	Ammonia & Surfactants Sample Collected (Y/N)	Lab Results				Test Result (Compliant, Non-compliant, MH Dry)	Comments	
		Upstream Manhole	Downstream & Test Manhole							Report No.	E.coli (cfu/100mL) (Non-Compliant >235 cfu/100mL)	Ammonia (mg/L) (Non-Compliant >0.5mg/L)	Surfactants (mg/L) (Non-Compliant >0.1 mg/L)			
Alpine St	Vassal Ln to Concord Ave	DMH-45D	DMH-11	5/13/2015	5/15/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	No standing water observed	
	Field St to Concord Ave	D38DMH2105	DMH-11	11/17/2015	11/19/2015	N	NA	NA	N	NA	NA	NA	NA	Non-compliant See re-test	Silt in line, not able to sample. Need to re-test after cleaning	
		D38DMH2105	DMH-47							Y (Surfactants Only)	L1532081	26	NA	0.1	Compliant	Missing CCTV. Approx. 15LF of drain. Low risk.
Bay State Rd	#41 Bay State Rd to New St	D38DMH1625	D38DMH1610	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	No standing water observed	
		D38DMH1610	D38DMH1605													Missing CCTV. Approx. 18LF of drain. Low risk.
Birch St	#67 Bay State to Concord Ave	DMH-89	D38DMH1805	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	Less than 1/4" of water observed	
	At Concord	D38DMH1805	Drain Vault No. 4													(1) Lateral connection observed in CCTV. Suspect from #1-7 Birch St downspout into ground
Chilton St	Vassal Ln to Concord Ave	DMH-55	DMH-14	5/13/2015	5/15/2015	Y	0.75	0.75	N	71236	10	NA	NA	MH Dry	Not enough standing water to collect sample	
	Field St to Concord Ave	DMH-29 (Isolated from DMH-31)	DMH-14	10/14/2015	10/16/2015	Y	0.00	0	N	74021	280 230	NA	NA	Compliant	Included upstream section of Field St with test	
Concord Ave	Huron Ave to Donnell St	DMH-23	D38DMH1835	5/13/2015	5/15/2015	Y	0.00	Inconclusive	Y (Ammonia Only)	71236	10	NA	1.1	Compliant	There are zero connections to the SD within this section of pipe therefore there is no chance of an illicit connection. This test is considered unnecessary and the non-compliant surfactant result is believed to be a soap discharge to one of the catch basins. No further test required.	
	Donnell St to Fayerweather St	DMH-20	D38DMH1745	5/13/2015	5/15/2015	Y	2.00	1.5	N	71236	59,000	NA	NA	Non-compliant See re-test		
				10/14/2015	10/16/2015	Y	0.75	0.25	Y	74021	5500 4600	0.33	NA	Non-compliant See re-test		
	Donnell St to Fern St	DMH-20	DMH-5	10/6/2015	10/8/2015	N	1.50	2	N	NA	NA	NA	NA	Non-compliant See re-test		
	Donnell St to Walden St	DMH-20	DMH-96	11/17/2015	11/19/2015	Y	0.50	0.75	Y	74303	10	0.58	0.01	Compliant		
	Walden St to Fayerweather St	DMH-96	D38DMH1745	11/17/2015	11/19/2015	Y	1.50	0.25	N	74303	46,000 36,000	NA	NA	Non-compliant See re-test		
	Walden St to #319 Concord Ave	DMH-96	D38DMH1750	12/3/2015	12/5/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry		
	#319 Concord Ave to #335 Concord Ave	D38DMH1750	DMH-17	12/5/2015	12/7/2015	Y	0.00	0.25	N	L1532112	690	NA	NA	NA	Non-compliant See re-test	
				12/15/2015	12/17/2015	Y	1.25	1.50	Y	L1533410 L1533418	20000	1.09	0.27	NA	Non-compliant See re-test	
	#335 Concord Ave to Fayerweather St	DMH-17	D38DMH1745	12/5/2015	12/7/2015	Y	0.25	0.25	N	L1532112	2400	NA	NA	NA	Non-compliant See re-test	
				12/15/2015	12/17/2015	Y	Inconclusive	0.75	Y	L1533410 L1533418	10000	0.612	0.07	NA	Non-compliant See re-test	
	Walden St to Fayerweather St	DMH-96	D38DMH1745	1/13/2016	1/15/2016	Y	NA	NA	Y	L1601272	3900	0.482	0.06	NA	Non-compliant See re-test	Unofficial test. Pipe was not bagged. While testing for Fayerweather north we decided to sample this location
				3/4/2016	3/7/2016	Y	NA	NA	Y	L1606324	690 1100	12.2	0.05	NA	Non-compliant	
				5/11/2016	5/13/2016	Y	NA	NA	Y	L1614575	31 50	0.845	0.00	NA	Non-compliant See re-test	Post CIPP lining. Only failed ammonia
	Fayerweather St to Alpine St	D38DMH1745	DMH-11	11/17/2015	11/19/2015	N	3.00	0.75	N	NA	NA	NA	NA	Non-compliant See re-test	Lab samples not collected since field kits were non-compliant	
Fayerweather St to Chilton St	D38DMH1745	DMH-14	12/5/2015	12/7/2015	Y	2.00	0.75	Y	L1532081	400000	26.2	0.3	NA	Non-compliant See re-test		
			12/15/2015	12/17/2015	Y	Inconclusive	1.50	Y	L1533410 L1533418	69000	1.9	0.11	NA	Non-compliant See re-test		
			5/11/2016	5/13/2016	Y	NA	NA	Y	L1614575	2900 2400	1.2	0.05	NA	Non-compliant See re-test		
Chilton St to Alpine St	DMH-14	DMH-11	12/5/2015	12/7/2015	Y	Inconclusive	0.25	Y (Ammonia Only)	L1532081	4300	1.58	NA	NA	Non-compliant See re-test		
			12/15/2015	12/17/2015	Y	0.75	0.50	Y	L1533410 L1533418	12000 16000	0.757	0.0	NA	Non-compliant See re-test		
			5/11/2016	5/13/2016	Y	NA	NA	Y	L1614575	32 33	0.131	0.05	NA	Compliant		

Street	Area	Test Reach		Start Date	End Date	E.coli Samples Collected (Y/N)	Field Test Ammonia (Non-Compliant > 0.5 mg/L)	Field Test Surfactants (Non-Compliant > 0.25 mg/L)	Ammonia & Surfactants Sample Collected (Y/N)	Lab Results				Test Result (Compliant, Non-Compliant, MH Dry)	Comments
		Upstream Manhole	Downstream & Test Manhole							Report No.	E.coli (cfu/100mL) (Non-Compliant >235 cfu/100mL)	Ammonia (mg/L) (Non-Compliant >0.5mg/L)	Surfactants (mg/L) (Non-Compliant >0.1 mg/L)		
Concord Ave	Alpine St to Corporal Burns Rd	DMH-11	DMH-8	12/5/2015	12/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
	Corporal Burns Rd to Fern St	DMH-8	DMH-5	12/5/2015	12/7/2015	Y	0.00	0.5	Y	L1532081	5.2	NA	0.09	Compliant	
	Fern St to #445 Concord Ave	DMH-5	DMH-1	12/5/2015	12/7/2015	Y	0.00	0.25	N	L1532081	11 6.3	NA	NA	Compliant	
	Entire Upstream Catchment Upstream of DV4	Entire Upstream Catchment	DMH at STA 3004+48	9/20/2016	9/22/2016	Y	NA	NA	Y	L1629943	200 300	9.0	0.2	Non-compliant	Sampled at DV4 for entire catchment area upstream
	Entire CAM004 Catchment Upstream of DV5	Entire Upstream Catchment	DV5	NA	9/11/2017	Y	NA	NA	Y	L1731927	980	6.4	0.11	Non-compliant	Did not use sandbags for sample. Pulled sample from stagnant dryweather standing water
Copley St	Walden St to Fayerweather St	DMH-78	DMH-63 (Sampled at DMH 62)	5/13/2015	5/15/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	Included portion of Fayerweather St with test
Corporal Burns Rd	Field St to Concord Ave	DMH-44 DMH-42	DMH-42 DMH-08	8/6/2015	8/8/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	No lateral connections within reach per CCTV
Fayerweather St	Walden St to Copley St	DMH-33 (Isolated from DMH-65)	DMH-34	5/13/2015	5/15/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	Included Walden St in test
	Copley St to Concord Ave	DMH-34	DMH-62	5/13/2015	5/15/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
		DMH-62	D38DMH1745	5/13/2015	5/15/2015	N	NA	NA	N	NA	NA	NA	NA	NA	MH Dry
	Walden St to Concord Ave	DMH-34	D38DMH1745	1/13/2016	1/15/2016	N	NA	NA	N	NA	NA	NA	NA	MH Dry	Retested in an effort to help identify the high hits on Concord at Chilton
Fern St	Saville St to Concord Ave	DMH-59	D38DMH1745	5/13/2015	5/15/2015	Y	0.00	0.25	N	71236	10	NA	NA	Compliant	Test included Saville St
	Field St to Concord Ave	DMH-41	DMH-05	10/6/2015	10/8/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
Field St	Fern St to Alpine St	D38DMH2325	D38DMH2105	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
	Fayerweather St to Chilton St	DMH-31	DMH-14	10/14/2015	10/16/2015	Y	0.00	0	N	74021	280 230	NA	NA	Compliant	
	Chilton St to Alpine St	DMH-27	DMH-47	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
Garden St	Walden St to Hazel St	DMH-54	DMH-50	10/6/2015	10/8/2015	Y	0.25	0.00	N	73942	100 190	NA	NA	Compliant	
	Hazel St to Alpine St	DMH-51	D38DMH2105	10/14/2015	10/16/2015	N	3.00	0.5	N	NA	NA	NA	NA	Non-compliant See re-test	
		DMH-50	D38DMH2105	11/6/2015	11/9/2015	Y	3.00	0.5	Y	74210	360 140	0.55	NA	Compliant	
Hazel St	Field St to Garden St	DMH-79	DMH-80	10/14/2015	10/16/2015	N	2.00	0.75	N	NA	NA	NA	NA	Non-compliant See re-test	
		DMH-80	DMH-50	11/5/2015	11/9/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	No lateral connections within reach per CCTV
Ivy Street	Fayerweather St to Garden St	D38DMH2610	DMH-81	10/14/2015	10/16/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
Saville Street	Walden St to Fayerweather St	DMH-81	DMH-52												No lateral connections within reach per CCTV
		DMH-75	DMH-59 (Sampled at D38DMH1745)	5/13/2015	5/15/2015	Y	0.00	0.25	N	71236	10	NA	NA	Compliant	
Walden Street	Concord Ave to Fayerweather St	DMH-65	DMH-35 (Sampled at DMH 34)	5/13/2015	5/15/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
	Fayerweather St to Garden St	DMH-71	DMH-84												Flows outside CAM004 catchment area

**Appendix B.4**  
**Concord Lane New Street Sampling Results**

**Concord Lane/New Street Illicit Connection Survey Results**

Conducted by Barletta Heavy Division (BHD)

Legend	
	Compliant
	Non-compliant
	CCTV utilized in place of Testing

Street	Area	Test Reach		Start Date	End Date	E.coli Samples Collected (Y/N)	Field Test Ammonia (Non-Compliant > 0.5 mg/L)	Field Test Surfactants (Non-Compliant > 0.25 mg/L)	Ammonia & Surfactants Sample Collected (Y/N)	Lab Results				Test Result (Compliant, Non-compliant, MH Dry)	Comments
		Upstream Manhole	Downstream & Test Manhole							Report No.	E.coli (cfu/100mL) (Non-Compliant >235 cfu/100mL)	Ammonia (mg/L) (Non-Compliant >0.5mg/L)	Surfactants (mg/L) (Non-Compliant >0.1 mg/L)		
Concord Lane	Full length	DMH-14	DMH-1	10/26/2015	10/28/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
		D38DMH1740	D38DMH1730	12/5/2015	12/7/2015	Y	NA	NA	Y	L1532088	390	0.585	0.13	Non-compliant	
		D38DMH1730	D38DMH1715	12/5/2015	12/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
		D38DMH1715	D38DMH1705	12/5/2015	12/7/2015	N	NA	NA	N	NA	NA	NA	NA	MH Dry	
		D38DMH1705	D38DMH1608											D38DMH1608 contains a flap gate that prohibits sampling. No lateral connections within reach per CCTV.	
		D38DMH1525	D38DMH1850	12/5/2015	12/7/2015	Y	NA	NA	Y	L1532088	1.00	3.43	0.10		Non-compliant

**Appendix C**  
**Illicit Detection Testing along Concord Avenue**  
**between Walden and Alpine Streets**



# MEMORANDUM

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**DATE:** 04/21/2016  
Revised: 8/12/16

**TO:** Catherine Woodbury, CDPW

**FROM:** David Bedoya, Michael Smith, Zachary Halstead, MWH

**CC:** Kathy Watkins, CDPW, David Van Hoven, MWH, Christine Clancy, Kleinfelder

**SUBJECT:** DRAFT-Illicit detection testing along Concord Avenue between Walden and Alpine streets

**KLEINFELDER NO.:** 20110140.002A

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Within the last year, a total of twenty samples have been collected in the Concord Avenue drain between Walden and Alpine streets. Samples were also collected at all the drains on side streets tributary to the Concord Avenue drain. Samples were even collected in the sumps of two basements, specifically 329 Concord Ave and 335 Concord Ave. To date, all of the side street drains have been deemed free of sanitary flows after undergoing full separation and elimination of identified illicit connections. The storm drain reach on Concord Avenue between Fayerweather and Alpine streets has not yet been deemed free of contamination after numerous attempts to identify potential sources.. A chronology of the sampling performed and adoptive corrective measures are outlined below. Detailed sampling results are provided in Appendix A. Figure 1 depicts the Concord Avenue storm reach as well as different manholes where samples were collected and properties with connected basement sump pumps.

## 1. First round:

- a. Test section was isolated to the Concord Ave storm drain reach between Fayerweather St (DMH-1745) to the dead end manhole at Appleton (DMH-20)
- b. Sampling on 05/15/2015 at DMH-1745 fails to pass. E. Coli -> 59,000 cfu/100mL, Ammonia -> 2.0 mg/L
- c. Corrective measure adopted: One illicit connection found and removed at 312 Concord Ave.





# MEMORANDUM

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## 2. Second round:

- a. Test section was again isolated to the Concord Ave storm drain reach between Fayerweather St (DMH-1745) to the dead end manhole at Appleton (DMH-20)
- b. Sampling on 10/16/16 at DMH-1745 fails to pass. E. Coli -> 5500
- c. Corrective measure adopted:
  - i. CCTV review and re-cleaned line. Two capped connections were found so no action was deemed necessary.
  - ii. Further isolate this reach with intermediate sections of pipe.

## 3. Third round:

- a. Test section was isolated to three sub-reaches:
  1. From Alpine St to Fayerweather St (DMH-11 to DMH-1745);
  2. From Fayerweather St to Walden St (DMH-1745 to DMH-96);
  3. From Walden St to the upstream end-of-line manhole at Appleton (DMH-96 to DMH-20)
- b. Sampling on 11/19/15:
  1. At Alpine (DMH-11) no samples taken, field kit failed.
  2. At Fayerweather (DMH-1745) fails to pass. E. Coli -> 46,000 cfu/100m
  3. At Walden (DMH-96) samples pass
- c. Corrective measure adopted: Further isolated smaller sub-reaches with increased sandbagging between Alpine and Walden streets as well as additional cleaning.

## 4. Fourth round:

- a. Test section was isolated to five sub-reaches
  1. From Alpine St to Chilton St (DMH-11 to DMH-14);
  2. From Chilton St to Fayerweather St (DMH-14 to DMH-1745);
  3. From Fayerweather St to Walden St there were three reaches:
    - a. DMH-1745 to DMH-17
    - b. DMH-17 to DMH-1750
    - c. DMH-1750 to DMH-96
- b. Sampling on 12/5/15:
  1. In between Walden and Fayerweather (DMH-1750) observed no standing water, section passes



# MEMORANDUM

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- c. Sampling on 12/7/15:
  - 1. At Alpine (DMH-11) fails to pass. E. Coli -> 4,300 cfu/100m, Ammonia 1.58 mg/L
  - 2. At Chilton (DMH-14) fails to pass. E. Coli -> 400,000 cfu/100m, Ammonia 26.2 mg/L
  - 3. At Fayerweather (DMH-1745) fails to pass. E. Coli -> 2400 cfu/100m
  - 4. Between Fayerweather and Walden (DMH-17) fails to pass. E. Coli 690 cfu/100m
- d. Corrective measure adopted: CCTV'ed all lateral connections along the non-compliant reaches. A total of three connections were found between Fayerweather Street (DMH-1745) and DMH-1750 (in front of 319 Concord Ave). One connection was capped, another service at the Fayerweather intersection ran about 20 feet into a wall of dirt and the third one went all the way into the basement of 320/322 Concord Ave. Dye testing of every fixture at 320/322 was performed and were confirmed to be connected to the sanitary sewer. The lateral for 320/322 was redirected to the sanitary sewer and the lateral at the Fayerweather intersection was properly capped. No more laterals were identified and therefore, the possibility of a direct illicit connection was fully discarded at this point. Further pipe cleaning was performed. Adjacent side streets were re-tested even though they had previously passed. These side streets once again passed.

## 5. Fifth round:

- a. Test section was isolated to four sub-reaches on Concord Ave.
  - 1. From Alpine St to Chilton St (DMH-11 to DMH-14);
  - 2. From Chilton St to Fayerweather St (DMH-14 to DMH-1745);
  - 3. From Fayerweather St to Walden St there were three reaches:
    - a. DMH-1745 to DMH-17
    - b. DMH-17 to DMH-1750
- b. Sampling on 12/17/15:
  - 1. At Alpine (DMH-11) fails to pass. E. Coli -> 16,000 cfu/100m, Ammonia .757 mg/L
  - 2. At Chilton (DMH-14) fails to pass. E. Coli -> 69,000 cfu/100m, Ammonia 1.9 mg/L



# MEMORANDUM

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3. At Fayerweather (DMH-1745) fails to pass. E. Coli -> 10,000 cfu/100m, Ammonia .612 mg/L
  4. Between Fayerweather and Walden (DMH-17) fails to pass. E. Coli 20,000 cfu/100m, Ammonia 1.09 mg/L
  - c. Corrective measure adopted: Focused on upstream stretch between Walden and Fayerweather. CCTV'ed all sewer service laterals with in this stretch to assess condition of pipe in an effort to identify a potential source of exfiltration from a sewer lateral with infiltration to the storm drain. No laterals with in this stretch were found to be collapsed. Two laterals were found to have slightly offset joints. After directing the contractor to repair these joints it was found that the joints were not accessible due to utility conflicts. This effort was abandoned. Another round of cleaning was performed and a retest of Fayerweather St from Concord to Walden was done as well as another test on Concord from Fayerweather to Walden.
- 6. Sixth Round:**
- a. Test section was isolated to one reach on Concord Ave and one reach on Fayerweather.
    1. Concord Ave from Fayerweather to Walden (DMH-1745 to DMH-96)
    2. Fayerweather St from Concord Ave to Walden (DMH-1745 to DMH-34)
  - b. Sampling on 1/15/16:
    1. Concord reach (DMH-1745) fails to pass. E. Coli -> 3,900 cfu/100m
    2. Fayerweather reach (DMH-1745) no standing water observed, section passes.
  - c. Corrective measure adopted: The 10 to 12-inch drain between Walden St (DMH-96) and Fayerweather St (DMH-1745) was CIPP-lined in order to prevent potential infiltration inflows from damaged building sewer laterals crossing over the drain or other sources of contaminated inflows infiltrating the storm drain.
- 7. Seventh Round:**
- a. Test section was isolated to the recently CIPP lined section of 10" and 12" storm drain pipe between Fayerweather (DMH-1745) and Walden (DMH-96).



# MEMORANDUM

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- b. Sampling on 3/7/16 at Fayerweather (DMH-1745) fails to pass. E. Coli 690 MPN/100ml, Ammonia 12.2 mg/L
- c. Special Note: The E.Coli concentration was reduced by two orders of magnitude and it was very close to compliance in relative terms (E.Coli concentration was 10,000MPN/100mL and 3,900MPN/100mL one and two months before lining and 690MPN/100mL after CIPP-lining). The surfactants concentration was compliant with the Class B water standard. The ammonia concentration, however, was very high at 12.2mg/L, which remains a concern.
- d. Corrective measure adopted: The 31x33-inch drain between Fayerweather St (DMH-1745) and Chilton Street (DMH-14) was also CIPP-lined. In addition, the two property owners with new connections (the only connections) to the storm drain between Fayerweather and Walden were asked to turn their sump pumps off during the test period. Samples were also collected within the sump in the basement of each property (329 Concord Ave and 335 Concord Ave). Further review of the post-lining CCTV videos were reviewed to ensure no other illicit connections were possible with in the stretch of storm drain between Chilton and Walden. Please reference the attached post-lining reports detailing the only two connections to the storm drain between Chilton (DMH-15) and Walden (DMH-96) are the two new service laterals for 329 and 335 Concord Ave.

## 8. Eighth Round

- a. Test section was isolated to three reaches on Concord Ave and two sumps in the basement of 329 Concord Ave and 335 Concord Ave.
  - 1. From Alpine (DMH-11) to Chilton (DMH-14)
  - 2. From Chilton (DMH-14) to Fayerweather (DMH-1745)
  - 3. From Fayerweather (DMH-1745) to Walden (DMH-96)
  - 4. 329 Sump
  - 5. 335 Sump
- b. Sampling on 5/13/16:
  - 1. At Alpine (DMH-11) samples pass. E. Coli 32 MPN/100ml, Ammonia .131 mg/L
  - 2. At Chilton (DMH-14) fails to pass. E. Coli 2400 MPN/100ml, Ammonia 1.2 mg/L



# MEMORANDUM

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3. At Fayerweather (DMH-1745) E. Coli sample passes with 31 MPN/100 mg/L, Ammonia sample fails with .845 mg/L
4. 329 Sump samples pass
5. 335 Sump samples pass

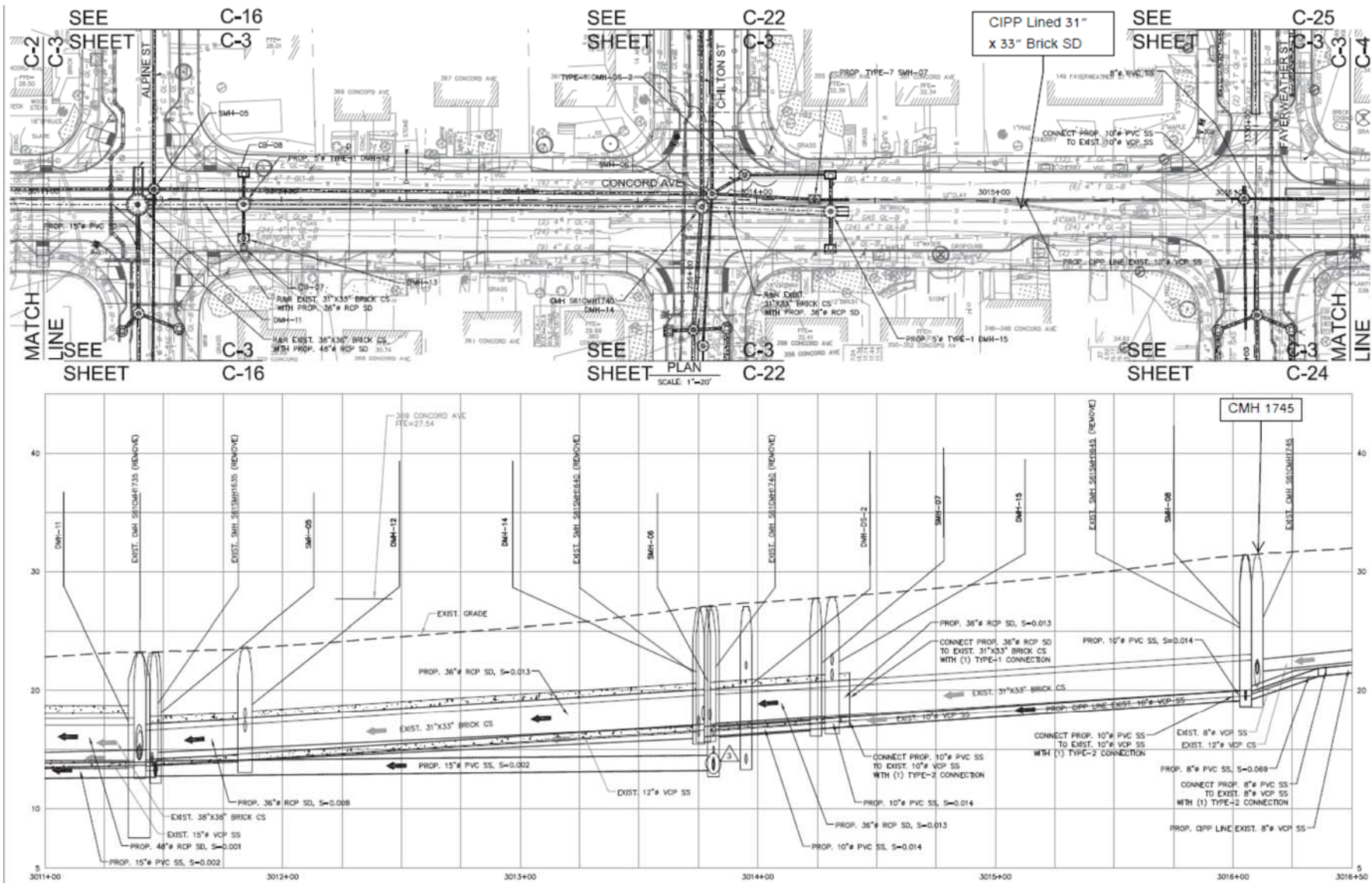


Figure 1. Concord Avenue storm drain reach from Alpine to Fayerweather; pipe size, manholes, and properties referenced in the text

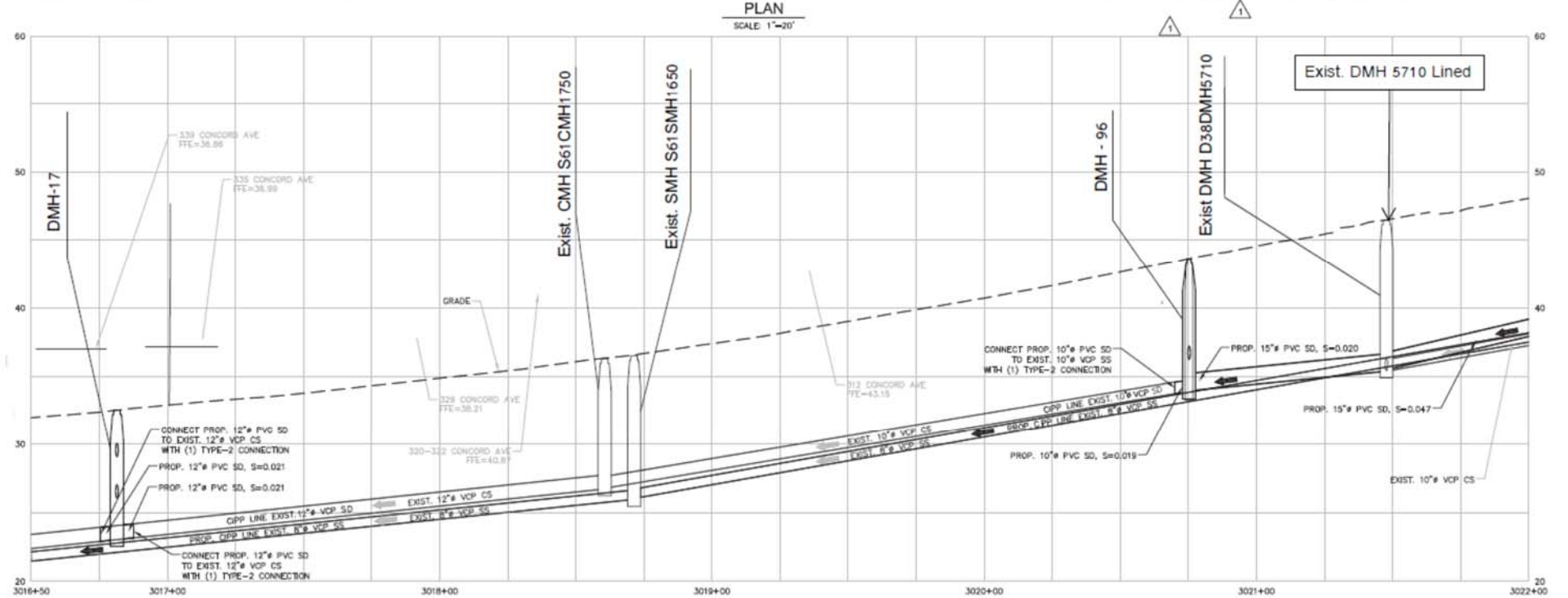
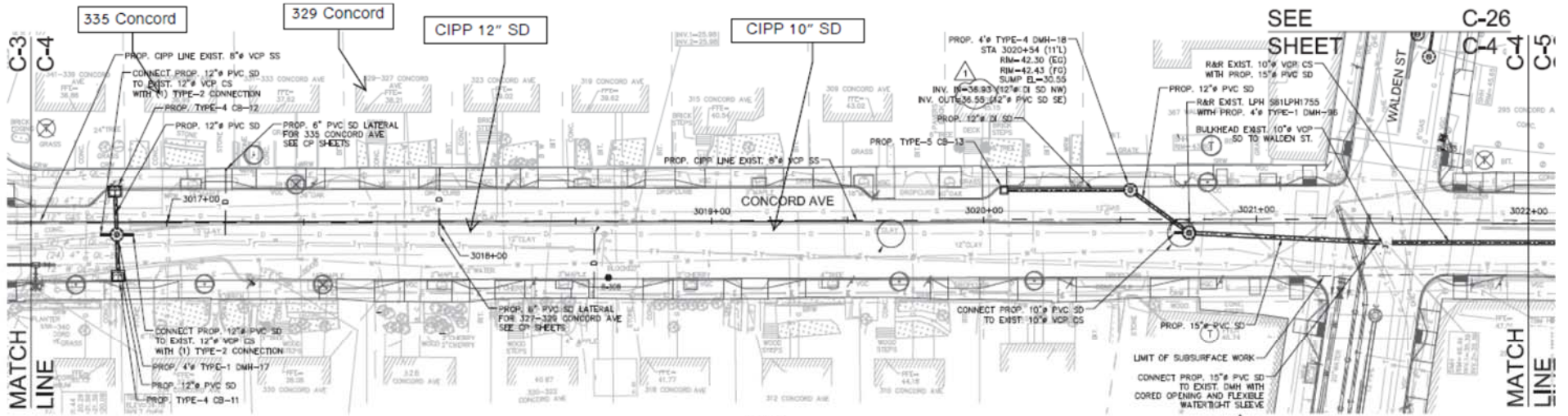


Figure 2. Concord Avenue storm drain reach from Fayerweather to Walden; pipe size, manholes, and properties referenced in the text

**Conclusions:**

The different rounds of sampling results evidence that after the fourth round of sampling bacteriological contamination was caused by infiltration into the drain from potentially leaking building laterals crossing over the drain or from other unknown diffuse sources. This became clear after the significant reduction in E.Coli counts post-CIPP-lining of the 10 to 12-inch drain between Walden and Fayerweather streets and the 31x33-inch drain between Fayerweather and Chilton. While the E.Coli concentrations are still above the Class B water standard of 235MPN/100mL at Chilton, the residual concentration of 2400MPN/100mL can be attributed to diffuse sources typical of high density urban environments and can be most likely addressed by thorough street and catch basin cleaning as well as public education and outreach. In addition, the Ammonia concentration is slightly above the Class B standard of 0.5 mg/L at Fayerweather, the residual concentration of 0.845 mg/L can suggest that non-fecal organic matter is getting into the drain. Potential sources may be decomposing leaves or other organic debris that entered the drain via catch basins and can also be addressed by thorough street and catch basin cleaning as well as public education and outreach. In general terms, if the E.Coli is in the same order of magnitude as the standard it is unlikely that direct sanitary sources of contamination are still the culprit and diffuse sources are a highly likely cause. In all, the efforts have been made to ensure that no direct illicit connections to the storm drain remain. In addition extensive efforts have been made to reduce the potential for infiltration

**Recommendations:**

Based on the results outlined above, the following recommendations are provided:

1. Heavy street and catch basin cleaning project wide.
2. Collect samples at Drain Vault 4. This is the most downstream location of the project area. Ensure that storm water exiting the project is with in Class B Standards.

## **Appendix A**

### **Sampling Results in the Concord Avenue Drain**



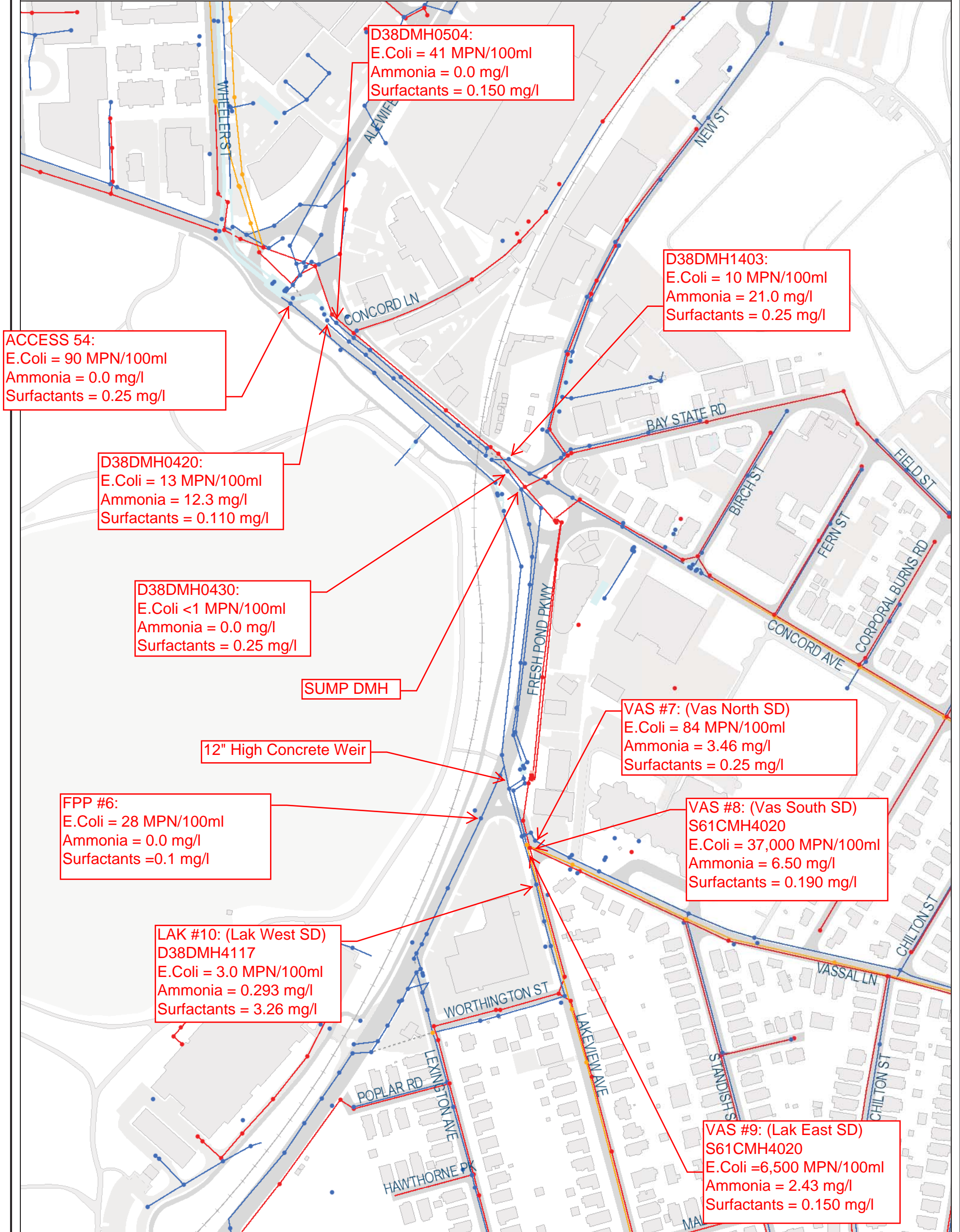
### Concord Illicit Connection Survey Results

Conducted by P. Gioioso & Sons Inc.

Legend	
	Compliant
	Non-compliant
	Pending

Street	Test Reach		Start Date	End Date	E.coli Samples Collected (Y/N)	Field Test Ammonia (Non-Compliant > 0.5 mg/L)	Field Test Surfactants (Non-Compliant > 0.25 mg/L)	Ammonia & Surfactants Sample Collected (Y/N)	Lab Results				Test Result	
	Upstream Manhole	Downstream & Test Manhole							Report No.	E.coli (ctu/100mL) (Non-Compliant > 235 ctu/100mL)	Ammonia (mg/L) (Non-Compliant > 0.5mg/L)	Surfactants (mg/L) (Non-Compliant > 0.1 mg/L)		
Concord	DMH-20	DMH-1743	5/13/2015	5/15/2015	Yes	2.00	1.5	No, follow up required	71236	59,000	-	-	Fail, Retest	
Seville/Fayerweather	DMH-75	DMH-1743	5/13/2015	5/15/2015	Yes	0.00	0.25	No	71236	<10	-	-	Pass	
Fayerweather	DMH-62	DMH-1743	5/13/2015	5/15/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Fayerweather	DMH-34	DMH-62	5/13/2015	5/15/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Copley	DMH-78	DMH-62	5/13/2015	5/15/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Walden	DMH-65	DMH-34	5/13/2015	5/15/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Alpine	DMH-45A	DMH-11	5/13/2015	5/15/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Chilton	DMH-55	DMH-14	5/13/2015	5/15/2015	Yes	0.75	0.75	Not enough H2O	71236	<10	-	-	Pass	
Concord	DMH-23	DMH-1835	5/13/2015	5/15/2015	Yes	0.00	Inconclusive	Yes	71236	<10	-	1.1	Pass	
Corporal Burns	DMH-44	DMH-42	8/6/2015	8/8/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Fern St	DMH-41	DMH-05	10/6/2015	10/8/2015	No	1/4 inch standing water observed. Not enough to sample			-	-	-	-	Pass	
Concord Ave	DMH-23	DMH-05	10/6/2015	10/8/2015	No	1.50	2	No	-	-	-	-	Fail, Retest	
Garden St	DMH-34	DMH-30	10/6/2015	10/8/2015	Yes	<0.25	0	No	-	-	-	-	Pass	
Concord Ave	DMH-20	DMH-1743	10/14/2015	10/16/2015	Yes	0.75	0.25	Yes	74021	3500 & 4600	0.33	-	Fail, Retest	
Ivy Street	DMH-2610	DMH-81	10/14/2015	10/16/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Hazel Street	DMH-79	DMH-80	10/14/2015	10/16/2015	No	2.00	0.75	No	-	-	-	-	Fail, Retest	
Chilton St./Field St.	DMH-31	DMH-14	10/14/2015	10/16/2015	Yes	0.00	0	No	74021	280 & 230	-	-	Pass	
Field Street	DMH-2325	DMH-2105	10/14/2015	10/16/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Garden Street	DMH-51	DMH-2105	10/14/2015	10/16/2015	No	3.00	0.5	No	-	-	-	-	Fail, Retest	
Field Street	DMH-27	DMH-47	10/14/2015	10/16/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Birch Street	DMH-89	DMH-1805	10/14/2015	10/16/2015	No	Less than 1/4" of water observed. No samples required			-	-	-	-	Pass	
Bay State Road	DMH-1625	DMH-1610	10/14/2015	10/16/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Hazel Street	DMH-79	DMH-80	11/5/2015	11/9/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Garden	DMH-30	DMH-2105	11/6/2015	11/9/2015	Yes	3.00	0.5	Yes	74210	360 & 140	0.55	-	Pass	
Garden	DMH-30	DMH-2220	11/17/2015	11/19/2015	No	2.00	0.25	No	Not Necessary, Already Passed				Fail, Retest	
Garden	DMH-2220	DMH-2215	11/17/2015	11/19/2015	No	3.00	0.5	No					Fail, Retest	
Garden	DMH-2215	DMH-2105	11/17/2015	11/19/2015	No	1.50	0.5	No					Fail, Retest	
Alpine	DMH-2105	DMH-11	11/17/2015	11/19/2015	No	Silt in line, not able to sample. Need to re-test after cleaning			-	-	-	-	Fail, Retest	
Concord	DMH-96	DMH-1743	11/17/2015	11/19/2015	Yes	1.50	0.25	No, already passed 10/16	74303	48,000 & 38,000	-	-	Fail, Retest	
Concord	DMH-20	DMH-96	11/17/2015	11/19/2015	Yes	25 - 5	0.75	Yes	74303	10 & <10	0.58	0.01	Pass	
Concord	DMH-1743	DMH-11	11/17/2015	11/19/2015	No	3.00	0.75	No	-	-	-	-	Fail, Retest	
Concord	DMH-96	DMH-1750	12/3/2015	12/5/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Concord	DMH-5	DMH-1	12/5/2015	12/7/2015	Yes	0.00	0.25	No	L1532081	11 & 6.3	-	-	Pass	
Concord	DMH-89	DMH-3	12/5/2015	12/7/2015	Yes	0.00	0.5	Yes, Surfactants	L1532081	5.2	-	0.09	Pass	
Concord	DMH-11	DMH-8	12/5/2015	12/7/2015	No	No standing water observed. No samples required			-	-	-	-	Pass	
Concord	DMH-14	DMH-11	12/5/2015	12/7/2015	Yes	Inc. clear	0.25	Yes, Ammonia	L1532081	4300	1.58	-	Fail, Retest	
Concord	DMH-1743	DMH-14	12/5/2015	12/7/2015	Yes	2.00	0.75	Yes	L1532081	400000	26.2	0.3	Fail, Retest	
Concord	DMH-17	DMH-1743	12/5/2015	12/7/2015	Yes	0.25	0.25	No	L1532112	2400	-	-	Fail, Retest	
Concord	DMH-1750	DMH-17	12/5/2015	12/7/2015	Yes	0.00	0.25	No	L1532112	690	-	-	Fail, Retest	
Alpine	DMH-47	DMH-11	12/5/2015	12/7/2015	Yes	0.00	0.75	Yes, Surfactants	L1532081	26	0.1	-	Pass	
Concord	DMH-14	DMH-11	12/15/2015	12/17/2015	Yes	0.75	0.50	Yes	L1533410/L1533441	12000/16000	0.757	ND	Fail, Retest	
Concord	DMH-1743	DMH-14	12/15/2015	12/17/2015	Yes	Inc.	1.50	Yes	L1533410/L1533441	69000	1.9	0.11	Fail, Retest	
Concord	DMH-17	DMH-1743	12/15/2015	12/17/2015	Yes	Inc.	0.75	Yes	L1533410/L1533441	10000	0.612	0.07	Fail, Retest	
Concord	DMH-1750	DMH-17	12/15/2015	12/17/2015	Yes	1.25	1.50	Yes	L1533410/L1533441	20000	1.09	0.27	Fail, Retest	
Fayerweather	DMH-34	DMH-1743	1/13/2016	1/15/2016	No	No standing water observed. No samples required			-	-	-	-	Pass	
Concord	-	DMH-1743	-	1/15/2016	Yes	-	-	-	L1601272	3900	0.482	0.06	Fail	
Concord	DMH-96	DMH-1743	3/4/2016	3/7/2016	Yes	All samples sent in for testing. No			Yes	L1606324	690 / 1100	12.2	0.05	Fail
Concord	DMH-14	DMH-11	3/11/2016	3/13/2016	Yes	All samples sent in for testing. No			Yes	L1614575	32/33	0.131	0.05	Pass
329 Concord Ave Sump Pump in basement			No bags	3/13/2016	Yes	All samples sent in for testing. No			Yes	L1614575	<1/ <1	0.103	ND	Pass
335 Concord Ave Sump Pump in basement			No bags	3/13/2016	Yes	for testing. No field tests performed			Yes	L1614575	<1/ <1	0.086	0.05	Pass
Concord	DMH-1743	DMH-14	3/11/2016	3/13/2016	Yes	for testing. No field tests performed			Yes	L1614575	2900/2400	1.2	0.05	Fail
Concord	DMH-96	DMH-1743	3/11/2016	3/13/2016	Yes	for testing. No field tests performed			Yes	L1614575	31/50	0.845	ND	Fail (just ammonia)

**Appendix D**  
**Downstream Sampling Figure**



City of Cambridge  
Massachusetts

1" = 238 ft

All data is provided for graphic representation only. The City of Cambridge expressly disclaims all warranties of any type, expressed or implied, including, but not limited to, any warranty as to the accuracy of the data, merchantability, or fitness for a particular purpose.

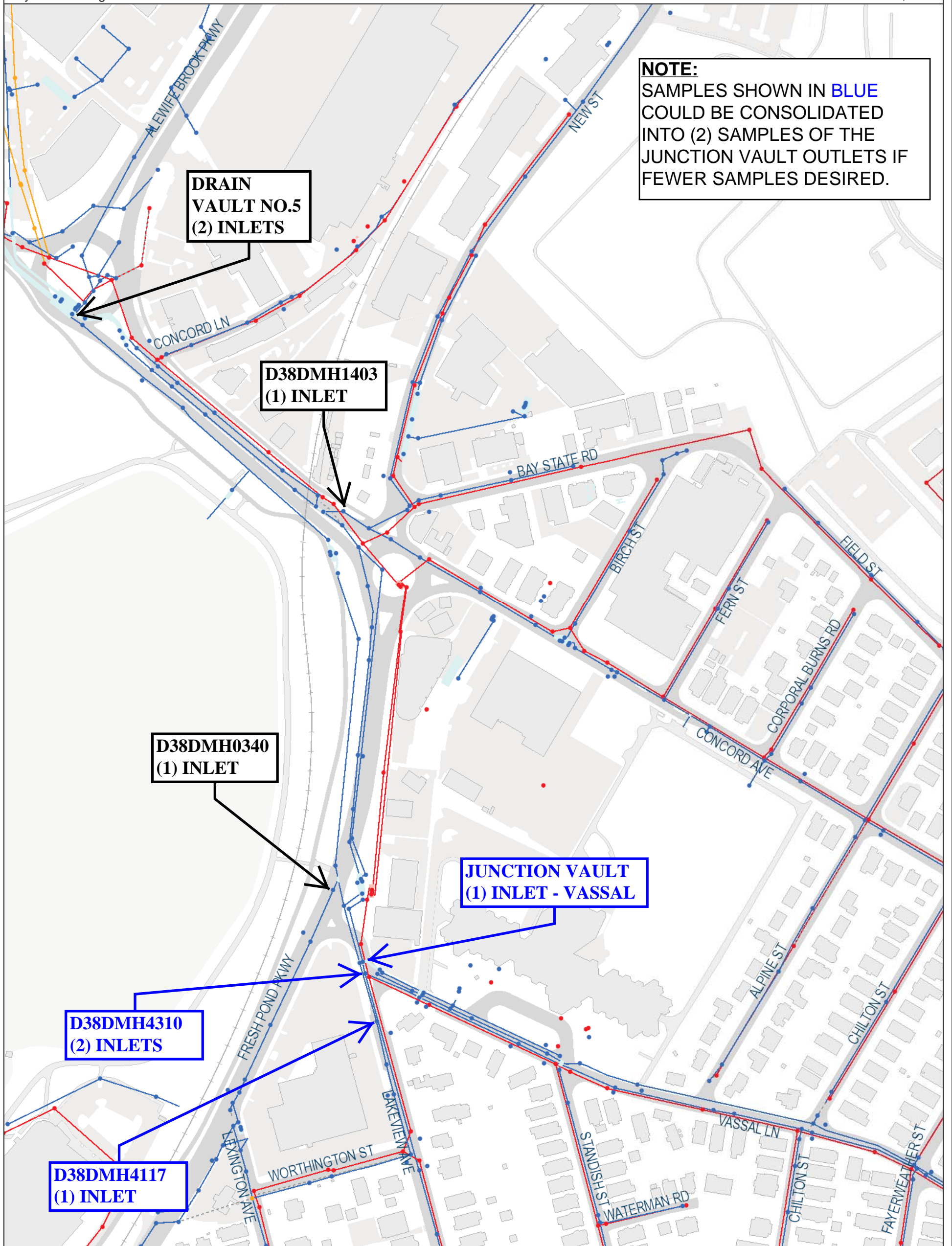
www.cambridgema.gov/gis

- Gravity Mains
- Stormwater
- Sewage
- Combined Sewage
- Abandoned
- Zoom Three Paved Surfaces
  - Paved Roads
  - Other Paved Surface
  - Bridges
  - Public Footpath



**Appendix E**  
**Sampling Monitoring Figure**

**NOTE:**  
 SAMPLES SHOWN IN **BLUE**  
 COULD BE CONSOLIDATED  
 INTO (2) SAMPLES OF THE  
 JUNCTION VAULT OUTLETS IF  
 FEWER SAMPLES DESIRED.



City of Cambridge  
 Massachusetts  
 1" = 200 ft

- Gravity Mains
- Stormwater
- Sewer
- Combined Sewer
- Abandoned
- Zoom Three Paved Surfaces
  - Paved Roads
  - Other Paved Surface
  - Bridges
  - Public Footpath

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