Detecting and Eliminating Illicit Discharges in Basin 11

PROJECT NO.

18-027

PREPARED FOR:

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Detecting and Eliminating Illicit Discharges in the West-Williams-Saxtons-Lower Connecticut River Basin: Final Report

Cover photo: a broken sewer lateral discovered in a catchbasin in Weston

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1. Introduction

The goal of the Basin 11 Illicit Discharge Detection and Elimination Project was to improve water quality by identifying and eliminating contaminated, non-stormwater discharges entering stormwater drainage systems and discharging to the Williams River, Saxtons River, and Lower Connecticut River and their tributaries. The project was funded and administered by the Vermont Department of Environmental Conservation (DEC).

Seventeen towns and villages participated in the project, Chester, Dummerston, Grafton, Guilford, Jamaica, Londonderry, Marlboro, Newfane, Peru, Putney, Rockingham, Townshend, Vernon, Wardsboro, Westminster, Weston, and Winhall. The geographic scope of the project included the entire extents of the municipal closed drainage systems in these towns and villages, as well as infrastructure surrounding the Magic Mountain Ski Area and Bromley Mountain Ski Area. Prior to this assessment, DEC prepared stormwater infrastructure mapping for all the municipalities, which was used to plan the assessment and to guide further investigations in systems with suspected illicit discharges.

From May to December 2018, Stone assessed stormwater outfalls and certain manholes and catchbasins in each municipality for the presence of illicit discharges. A total of 244 stormwater drainage systems were assessed. Of the total, 206 systems were assessed at the outfall, while 38 systems were assessed in structures upstream from the mapped outfall location because the outfall could not be located, was inaccessible, or was inundated by the receiving waterbody. Field tests were performed for ammonia, free chlorine, optical brighteners (i.e., fluorescent whitening dyes contained in most laundry detergents), and common anionic detergents [using the methylene blue active substances (MBAS) method]. In addition, Stone measured the specific conductance of each discharge point. Of the 244 systems assessed, 68 were flowing, trickling, or dripping with sufficient volume to collect a water sample when inspected.

Among the 244 stormwater drainage systems assessed, contaminants indicating a possible illicit discharge were detected in 22 systems. In 2019, Stone completed its investigations of systems with suspected illicit discharges to confirm the presence of illicit discharges and to attempt to determine their sources. This report presents the assessment data and investigation findings for all the systems that were suspected of having an illicit discharge. Table 1 summarizes the number of systems assessed and the number in which an illicit discharge was suspected in each participating municipality.

Table 1. Summary of Assessments by Town/Village

Town	Systems Assessed	Systems Assessed at Outfall	Systems Flowing or Dripping	Suspected Illicit Discharges	Confirmed Illicit Discharges
Chester	26	19	2	1	0
Dummerston	4	3	2	0	0
Grafton	3	3	2	0	0
Guilford	8	8	1	0	0
Jamaica	5	2	2	0	0
Londonderry	18	15	4	1	1
Marlboro	6	5	1	0	0
Newfane	9	8	1	0	0
Peru	6	6	5	1	0
Putney	33	30	12	6	0
Rockingham	59	49	20	7	1
Townshend	10	9	0	0	0
Vernon	7	3	1	0	0
Wardsboro	4	4	2	1	0
Westminster	30	27	7	3	0
Weston	8	7	5	1	1
Winhall	8	8	1	1	0
Total	**244**	**206**	**68**	**22**	**3**

2. Methods

2.1. Preparation for the Assessment

Preparation for the illicit discharge assessment included obtaining and assembling necessary equipment and supplies; preparing an electronic survey field data form, field maps, a Health and Safety Plan, and other documentation; and meeting with each of the participating municipalities to gather information and plan the project in detail. Large-format field maps were prepared by overlaying DEC's stormwater infrastructure mapping on the best available orthophotography. These maps were consulted in the kickoff meetings and annotated in the field. The kickoff meeting with each municipality provided an opportunity to collect four key types of information, presented below.

1. Contact information for municipal managers and public works personnel.
2. General schedules of road, wastewater and stormwater collection system projects (to avoid conflict with construction activities).
3. Locations of any known, suspected, or potential cross connections, combined sewer overflows, and sanitary sewer overflows.
4. In-house capabilities of the Public Works or Highway Department to inspect pipelines and perform other advanced investigation techniques.

2.2. Dry Weather Survey

Stormwater drainage systems were assessed during dry weather to minimize dilution from stormwater runoff. Dry weather was defined as negligible rainfall (less than 0.1 inches), beginning at approximately 12:00 p.m. the previous day. Stormwater drainage systems with ten or fewer inlets were typically assessed only at the outfall. Within larger stormwater drainage systems, catchbasins and junction manholes were also assessed to account for any effects of dilution. Stormwater structures were accessed along the public right-of-way or from the receiving waterbody, as appropriate. Where access permission was obtained, stormwater structures located on private property were also assessed, particularly if these structures were connected to a municipal drainage system.

Every outfall or other stormwater structure assessed was assigned a unique identifying code. A visual inspection was made of the condition of each discharge point and the area immediately below each discharge point. If present, dry-weather flows were observed for color, odor, turbidity, and floatable matter. Obvious deficiencies in the structure, such as severe corrosion, were noted. Dry weather flows were sampled by hand, using a telescoping pole, or other similar method as appropriate. At catchbasins and manholes located at junctions in the storm sewer, samples were collected independently from each in-flowing pipe, when possible. Field data were entered on an electronic survey assessment form with the use of a mobile device and the position of each structure was geolocated.

In order to identify potential illicit discharges from laundry facilities, leaking sanitary sewers, and cross-connections, each dry weather discharge was tested for ammonia, methylene blue active substances (common detergents), and the presence of optical brighteners. Specific conductance was measured as an indication of the dissolved solids content. To detect treated municipal water leakage, samples were also analyzed for free chlorine concentration.

With few exceptions, structures that were not flowing at the time of the initial inspection were assumed not to have illicit connections and no further assessment of these structures was performed. Our general procedure is to provide additional assessment of non-flowing structures only if there is associated evidence of contamination, such as suds, odors, or certain deposits.

2.3. Water Analysis Methods

The ammonia concentration was tested using Aquacheck ammonia test strips. Samples were tested for methylene blue active substances using CHEMetrics test kit K-9400, a method consistent with American Public Health Association Standard Methods, 21st ed., Method 5540 C (2005). Free chlorine analysis was conducted with powdered DPD reagent (Hach Method 8167, equivalent to USEPA method 330.5) and a portable Hach DR/900 colorimeter. Specific conductance was measured using an Oakton model conductivity meter, according to Stone Environmental Standard Operating Procedure (SOP) SEI-5.23.3 (Appendix A).

Optical brightener monitoring was performed at outfalls and selected catchbasins and manholes that were flowing at the time of inspection, in accordance with Stone Environmental SOP SEI-5.52.2 (Appendix A). To test for optical brightener, a cotton pad was placed in the flow stream for a period of 4–10 days, after which the pad was rinsed, dried, and viewed under a long-wave ultraviolet light ("black light"). Florescence of the pad (see example in Figure 1) indicates the presence of optical brightener. Pads were held in a sleeve of fiberglass window screen, affixed to the rim of the outfall pipe or secured with fishing line to a rock or other anchor. At catchbasins and manholes located at junctions in the storm sewer, pads were deployed in incoming pipes if possible, but were often hung from the catchbasin grate or manhole rung into the sump. An advantage of optical brightener monitoring is that some intermittent or dilute wastewater discharges can be detected due to the multiple-day exposure of the pad, whereas the contaminant may not be detected in tests performed on grab samples.

Figure 1. Positive optical brightener monitoring pad under fluorescent (left) and UV (right) lamps.

Table 2, below, lists the water quality tests Stone performed at all discharge points and selected catchbasins and manholes that were flowing at the time of inspection.

Table 2: Water Quality Tests Performed at Flowing Structures

Parameter	Sample Container	Analytical Method
Ammonia	Plastic vial	Aquacheck ammonia test strips
MBAS detergents (anionic surfactants)	Plastic vial	APHA Standard Methods, 21st ed., Method 5540 C (2005)
Free chlorine	Glass jar	By DPD, Hach Method 8167 (EPA 330.5)
Specific conductance	Glass jar	Stone SOP SEI-5.23.3
Optical brightener	Cotton test pads	Stone SOP SEI-5.52.2

2.4. Advanced Investigations

Our IDDE experience has provided us an understanding of constituent concentrations likely to indicate the presence of an illicit discharge. These benchmark concentrations are summarized below in Table 3. Stormwater drainage systems were designated for follow-up sampling and/or investigation where these benchmarks were exceeded. In many cases, systems were resampled at a later date if low concentrations (concentrations near the method detection limit) of ammonia, MBAS detergents, or chlorine were measured; and were not designated for intensive investigation unless elevated concentrations reoccurred.

Table 3: Benchmark Levels for Determining Illicit Discharges

Test	Benchmark	Remarks
E. coli	>= 235 *E. coli*/100 mL	Undiluted municipal wastewater can have *E. coli* levels an order of magnitude or higher than this benchmark. Pet waste and wildlife sources also cause elevated *E. coli* levels.
Ammonia	>= 0.25 mg/L	In the absence of other wastewater indicators, follow-up investigation is performed when the ammonia concentration is 0.50 mg/L or higher. If other wastewater indicators are present, then the 0.25 mg/L benchmark is used. Decomposing vegetation under anoxic conditions can release ammonia to water, which can cause misleading results.
Detergents (methylene blue active substances)	>=0.20 mg/L	Detection of low concentrations (0.10-0.30 mg/L) of anionic detergents is common at stormwater outfalls. Most detections are not correlated with other wastewater indicators and do not lead to a definite source. These detections may be attributable to outdoor washing. However, concentrations as low as 0.20 mg/L have occasionally led us to significant wastewater sources that might otherwise have been missed; therefore, this is a useful test to trigger additional sampling or investigation.
Optical brightener	presence	Presence usually indicates contamination by sanitary wastewater or washwater. Exposure of the test pad for 4 -10 days means that diluted and intermittent discharges can be detected. Unfortunately, petroleum fluoresces at the same wavelength as optical brighteners. Optical brightener testing in catchbasins and manholes has proven to be our most effective method to bracket sources of contamination in storm sewers.
Free chlorine	>=0.10 mg/L	The field test used for free chlorine analyses is sufficiently sensitive to detect municipal tapwater sources diluted by groundwater or runoff approximately 3- to 10-fold, depending on the strength of the tapwater chlorine residual. Chlorine is a good indicator of tapwater leaks and graywater sources. Chlorine is degraded in the presence of organic materials; therefore, it is not a good wastewater indicator.

Test	Benchmark	Remarks
Specific conductance	>800 μS/cm	Specific conductance is not a reliable indicator of wastewater contamination. Road salt and metals from pipe corrosion often result in levels in the 1,000-10,000 μS/cm range, whereas flows contaminated with wastewater generally have specific conductance in the 600-1,000 μS/cm range. Although infrequent, this measurement has proven most useful in identifying certain industrial discharges.

If a stormwater drainage system was suspected of passing illicit discharges, based on the results of the dry weather survey, additional observations and testing were performed within the system to locate or bracket the origin of the contaminated flow. The goal was to bracket the contaminant source between adjacent structures, such as a stormline connecting a catchbasin to a downstream manhole. DEC's stormwater infrastructure mapping was used to guide this effort.

To locate or bracket contaminant sources within storm sewer segments, the same testing methods or a subset of methods were used as in the dry weather survey. The most reliable method to bracket sources of wastewater contamination is usually optical brightener monitoring throughout the drainage system. In several instances, we used optical brightener results to narrow the search area for illicit discharges to a specific structure or to the pipe between two structures. The presence and appearance of dry-weather flows were also useful in isolating sources of contamination within storm sewer segments.

Stone worked with participating municipalities to find specific improper connections, leaks, and other problems contributing to the contaminated flows observed in the stormwater drainage systems. After bracketing the discharge source as closely as possible using the water quality test methods, Stone corresponded with municipal representatives to describe our findings and discuss next steps as needed. Engineering plans were reviewed to identify possible cross-connections between sanitary sewers and stormwater drainage systems, particularly locations where leakage from a sanitary line could be intercepted by the stormwater system. Dye testing was performed in Londonderry, Rockingham, and Wardsboro to identify potential improper connections. Camera inspections and smoke testing were performed in Rockingham.

The findings of illicit discharge investigations in each town or village are presented in Sections 3 through 19. No suspected illicit discharges were identified in several municipalities; therefore, no further investigation occurred. In each of the remaining towns and villages, one or more illicit discharges was investigated. Correction of one illicit discharge (WE030) occurred in 2019 and two additional corrections (LO120 and RO010) are planned in 2020.

2.4.1. *E. coli* and Nitrogen

At discharge points where wastewater contamination was suspected (because of a positive optical brightener test, elevated ammonia, and/or septic odor), water samples were collected for *E. coli* and total nitrogen (TN) analyses. *E. coli* bacteria levels provide an indication of fecal contamination. Illicit discharges of sanitary wastewater via separated stormwater drainage systems or failed septic systems may contribute *E. coli*. In addition, TN was analyzed at all discharge points with suspected wastewater contamination due to concerns over nitrogen in the Connecticut River basin and its impacts on Long Island Sound. The State of Vermont's VAEL laboratory performed both analyses.

Samples for *E. coli* analysis were collected in sterile, plastic 100-mL bottles and analyzed using Colilert Quanti-tray. Samples collected for TN analysis were collected in 50-mL plastic vials provided by VAEL and analyzed using VAEL's Standard Operating Procedure (SOP) for Determination of Total Nitrogen by Flow

Injection Analysis, 24 7 1-2015 (Persulfate Digestion Method). The method preservation and holding time requirements are provided in Table 4, below.

Table 4. Laboratory Sample Analyses

Parameter	Sample Container	Analytical Method	Sample Preservation	Holding Time
TN	Plastic vial (50 mL)	4500-N C-modified	Cool (4°C), sulfuric acid	28 days
E. coli	Plastic bottle (100 mL)	SM 9223B (Colilert Quanti-Tray)	Cool (4°C), sodium thiosulfate	6 hours

At discharge points where wastewater contamination was suspected, alongside the water samples collected for *E. coli* and TN analyses, flow measurements were made to enable the calculation of TN mass loading. Flow was measured by timing the filling of a container of known volume.

3. Chester Results

Illicit discharge detection was performed in Chester in June 2018. Of the 26 systems assessed, two were either flowing or dripping during dry weather. Results of the initial assessment in Chester are included in Appendix B, Table 1. One system (CH260) was designated for further investigation due to detection of optical brightener. The status of this investigation is described in detail below.

3.1. CH260

The CH260 system drains a portion of the Green Mountain Turnpike near the intersection with VT Route 103 (Appendix C, Map 1). It discharges southwest of the Green Mountain Turnpike into the Williams River. Water quality data for this system are presented in Table 5.

Table 5. Water Analysis Data for Outfall CH260

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductivity (µS/cm)	OB Result	Observations
CH260-CB1	6/18/2018	Wet, no flow	0.0	0.03	0.0	48.3	Positive	Clear, no odor

Findings:

- Optical brightener was detected in the sump of catchbasin CB1 during the initial assessment on a pad retrieved on June 25, 2018. No other contaminants were detected above levels of concern.
- The system was revisited on June 19, 2019. The outfall is on private property and was not accessible from the street or the river. All flow in the system was coming from catchbasin CB1 pipe C, a footing drain trending toward the house at 3276 Green Mountain Turnpike. Pipes A and B were dry. The sump of catchbasin CB2 was also dry.
  - Optical brightener pads were placed in CB1 and CB2. In CB1, pads were placed in the flow paths of pipe B and pipe C (pads could not be secured within the pipes because the grate could not be removed). Optical brightener was not detected on any pads. The pad retrieved from the pipe B flow path was indeterminate.
- On July 10, 2019 samples were collected from the flowing sump of catchbasin CB1 for *E. coli* and TN analysis. No *E. coli* (<1.0 MPN/ 100 mL) was detected and a low TN concentration (1.25 mg/ L) was measured.
- Optical brightener was not detected on a pad placed in the flowing sump of CB1 on August 8, 2019.

- On August 28, 2019, pads were placed in CB1 in pipes A, B, and C, and in the outlets of CB1 and CB2. Optical brightener was not detected in CB1 pipe A or in the outlets of CB1 and CB2. Pads collected from CB1 pipe B and pipe C were indeterminate.
- Despite repeated attempts, Stone was unable to locate the owner of the house at 3276 Green Mountain Turnpike to arrange dye testing.

Conclusion: Repeated sampling and observation demonstrated no chronic discharge in the system. While several rounds of sampling resulted in indeterminate optical brightener results, no positive results were obtained. No other indications of contamination (i.e., MBAS, ammonia, or *E. coli*) were found in the system. Therefore, we believe optical brightener detected at the outfall during the initial assessment was the result of a transient source, such as outdoor washing.

Resolution: Not applicable.

4. Dummerston Results

Illicit discharge detection was performed in Dummerston during May and June 2018. Of the four systems assessed two were either flowing or dripping during dry weather. Results of the initial assessment in Dummerston are included in Appendix B, Table 2. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

5. Grafton Results

Illicit discharge detection was performed in Grafton in June 2018. Results of the initial assessment in Grafton are included in Appendix B, Table 3. Of the three systems assessed, two were flowing during dry weather. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

6. Guilford Results

Illicit discharge detection was performed in Guilford in June 2018. Results of the initial assessment in Guilford are included in Appendix B, Table 4. Of the eight stormwater drainage systems assessed in 2018, one was flowing during dry weather. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

7. Jamaica Results

Illicit discharge detection was performed in Jamaica in August 2018. Of the five systems assessed, two were either flowing or dripping during dry weather. Results of the initial assessment in Jamaica are included in Appendix B, Table 5. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

8. Londonderry Results

Illicit discharge detection was performed Londonderry in July and August 2018. Of the 18 systems assessed, four were flowing during dry weather. Results of the initial assessment in Londonderry are included in Appendix B, Table 6. One system (LO120) was designated for further investigation due to detection of optical brightener and low concentrations of MBAS and ammonia. The status of this investigation is described in detail below.

8.1. LO120

The LO120 system drains a portion of VT Route 100 and Pond Street (Appendix C, Map 2). It discharges south of Pond Street into the West River. Water quality data for this system are presented in Table 6.

Table 6. Water Analysis Data for Outfall LO120

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
LO120	8/15/2018	Flowing	0.25	0.02	0.25	777	Positive	Suds, no odor
LO120	6/19/2019	Flowing	0.25	0.00	0.15	941	Positive	Clear, no odor

Findings:

- Optical brightener was detected at the outfall during the initial assessment on a pad retrieved on August 21, 2018. Low concentrations of MBAS (0.25 mg/L) and ammonia (0.25 mg/L) were measured and suds were observed at the outfall on August 15, 2018.
- The system was revisited on June 19, 2019 and a low concentration of ammonia (0.25 mg/L) was measured at the outfall. All flow in the system was from the footing drain in catchbasin CB3. The system was dry above this structure. Optical brighter pads were deployed throughout the system. Pads in the outfall, CB1, and CB3 were positive, while pads in catchbasins CB5 and CB6 were negative.
- Samples collected at the outfall on July 10, 2019 had elevated concentrations of *E. coli* (410 MPN/100 mL) and TN (7.06 mg/L) (Table 27). Stone calculated an approximate loading rate of 6 g TN per day.
- On August 29, 2019 Dave Braun and Dan Curran met with Irwin Kuperberg, Londonderry Health Officer, to conduct dye testing of buildings proximate to CB3. The following observations were made:
  - The owner of 5850 VT-100, Chad Stoddard, was confrontational and uncooperative upon arrival. Mr. Stoddard denied Stone access to his property to perform an inspection and conduct dye

  - testing. CB3 is located on his property, and Mr. Stoddard denied permission to access the structure to view effluent during dye testing of surrounding buildings.
  - Mr. Kuperberg contacted the owner of 31 Pond Street, who granted permission to access catchbasin CB2, the next downstream structure.
  - The owners of 5821 VT-100, Becky and Nick Skandera, agreed to dye testing. Mrs. Skandera added dye into all three toilets on the property. No dye was observed at CB3 within 30 minutes of flushing. Mr. Kuperberg returned repeatedly throughout the day and no evidence of dye was observed.
  - The property owner of 105 Williams Street, located northwest of the infrastructure connected to catchbasin CB3, was not present and dye testing could not be completed.
- Between September 20 and October 7, 2019 Mr. Kuperberg conducted dye testing of the apartments at 76 High Street, located west of the stormwater system, and no evidence of dye was observed in the stormwater system.
- On October 11, 2019, Mr. Kuperberg dye tested a toilet at 105 Williams Street; no dye was observed in the stormwater system. However, the property owner indicated that the kitchen sink was directly connected to a graywater line upstream of catchbasin CB3.

Conclusion: We suspect effluent from a directly connected kitchen sink, and possibly other graywater sources, in the house at 105 Williams Street is responsible for the detections of optical brightener in the stormwater system.

Resolution: The graywater connection(s) at 105 Williams Street should be replumbed and the pipe connected to the LO120 drainage system should be capped or plugged. Stone is working with representatives of the Town of Londonderry to notify the homeowner that discharge of wastes to the stormdrain is impermissible.

9. Marlboro Results

Illicit discharge detection was performed in Marlboro in June 2018. Of the six systems assessed, only one was flowing during dry weather. Results of the initial assessments in Marlboro are included in Appendix B, Table 7. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation

10. Newfane Results

Illicit discharge detection was performed in Newfane in July 2018. Of the nine systems assessed, only one was flowing during dry weather. Results of the initial assessment in Newfane are included in Appendix B, Table 8. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

11. Peru Results

Illicit discharge detection was performed in Peru in June 2018. Of the six systems assessed, five were flowing during dry weather. Results of the initial assessment in Peru are included in Appendix B, Table 9. One system (PE020) was designated for further investigation due to detection of a moderate concentration of MBAS and exceedingly high specific conductance. The status of this investigation is described below.

11.1. PE020

The PE020 system drains a portion of Bromley Lodge Road, the Bromley base lodge, and a portion of the ski resort (Appendix C, Map 3). It discharges south of VT Route 11 into a drainage swale. Water quality data for this system are presented in Table 7.

Table 7. Water Analysis Data for Outfall PE020

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	Raw / Corrected MBAS (mg/L)	Specific Conductance (μS/cm)	OB Result	Observations
PE020	6/6/2018	Trickling	0.0	0.05	1.50/ 0.77	10,550	Negative	Clear, no odor
PE020	6/28/19	Flowing	NA	NA	NA	733	NA	Clear, no odor
PE020-CB1	6/28/19	Trickling	NA	NA	NA	737	NA	Clear, no odor

Findings:

- Exceedingly high specific conductance (10,550 μS/cm) was measured at the outfall on June 6, 2018. A high concentration of MBAS (1.50 mg/L) was also measured at the outfall; however, given the exceedingly high specific conductance and the established correlation between specific conductance and MBAS, the MBAS result is likely meaningless.
- The system was revisited on June 28, 2019 and low specific conductance (733 μS/cm) was measured at the outfall. A similar concentration (737 μS/cm) was observed in the sump of catchbasin CB1. No flow was observed in catchbasins CB2 and CB3 as well as the swale that drains into CB1.

Conclusion: We suspect the water quality data recorded at the outfall during the initial assessment were the result of the low flow conditions and a history of heavy road salt application in the drainage area. Repeated sampling and observation demonstrated no chronic illicit discharge in the system.

Resolution: Not applicable.

12. Putney Results

Illicit discharge detection was performed in Putney in August and September 2018. Of the 33 systems assessed, 12 were flowing during dry weather. Results of the initial assessment in Putney are included in Appendix B, Table 10. Six systems were designated for further investigation due to detection of optical brightener (PU330), MBAS (PU060, PU230, PU240), suds (PU110), or ammonia (PU020). The status of these investigations are described in detail below.

12.1. PU020

The PU020 system drains a portion of Perseverance Lane and the Landmark College campus (Appendix C, Map 4). It discharges west of Charles Drake Lane, near a parking lot by the Fine Arts Building. Water quality data for this system are presented in Table 8.

Table 8. Water Analysis Data for Outfall PU020

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
PU020	8/21/2018	Flowing	0.25	0.02	0.10	390	Negative	Clear, no odor
PU020	6/19/2019	Flowing	0.00	0.00	0.15	492	NA	Clear, no odor
PU020-CB14	6/19/2019	Flowing	0.00	0.00	0.10	109	NA	Clear, no odor

Findings:

- A low concentration of ammonia (0.25 mg/L) was measured at the outfall on August 21, 2018.
- The system was closely inspected on June 19, 2019. All flow was traced to the top of the system in catchbasin CB14. No flow was observed in any catchbasins connected to lines branching off from the mainline of the system. No footing drains or roof drains connected to the stormwater system were flowing.
  - Catchbasin CB14 is adjacent to a retaining wall and contains two footing drains that drain the wall. The area north of the retaining wall is an undeveloped, forested hillside.
- No ammonia was detected in a sample collected from the outfall on June 19, 2019. Water chemistry in the flowing sump of catchbasin CB14 was nearly identical to the sample collected from the outfall.
- Stone met with Kyle Skrocki, Director of Facilities Operations at Landmark College, during the sampling event. Mr. Skrocki informed Stone that the college applies fertilizer to the greenspaces around campus several times throughout the year.

Conclusion: Discharge from the footing drains which drain the retaining wall adjacent to catchbasin CB14 constitutes most of the flow in the system during dry weather, and water chemistry is nearly identical between the outfall and the source. Repeated sampling and observation demonstrated no chronic illicit discharge into the system. The slightly elevated ammonia concentration measured during the initial assessment may be the result of fertilizer application.

Resolution: Not applicable.

12.2. PU060

The PU060 system drains a portion of the Landmark College campus (Appendix C, Map 5). It discharges south of the Strauch Student Center building. Water quality data for this system are presented in Table 9.

Table 9. Water Analysis Data for Outfall PU060

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
PU060	8/21/2018	Flowing	0.00	0.02	0.25	754	Negative	Suds, no odor
PU060	6/19/2019	Trickling	NA	0.00	0.15	940	NA	Clear, no odor

Findings:

- A low concentration of MBAS (0.25 mg/L) was measured at the outfall on August 21, 2018. Stone personnel also noted suds at the outfall.
- The system was revisited on June 19, 2019 and a sample was collected from the trickling outfall. No contaminants were measured above levels of concern, and no suds were observed at the outfall. The system was closely inspected and found to be incorrectly mapped.
  - The closed drainage system ends at catchbasin CB7, north of Robert Rhodes Lane. The two catchbasins north of CB7 drain to a culvert that discharges to a swale which ultimately flows into CB7. The layout of the stormwater system was confirmed by Kyle Skrocki, Director of Facilities Operations at Landmark College, during the follow-up assessment.
- No flow was observed upstream of catchbasin CB3 in PU060 or in the system immediately north of catchbasin CB7. Catchbasins CB1 and CB2 are off-line and no flow was observed in either structure. A trickle was observed in the CB3 sump, indicating the source of dry weather flow is groundwater infiltration between CB3 and CB4.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge in the system.

Resolution: Not applicable.

12.3. PU110

The PU110 system drains a portion of Perseverance Lane, Charles Drake Lane, and the Landmark College campus (Appendix C, Map 6). It discharges south of the student dormitories near the intersection of Charles Drake Lane and Perseverance Lane. Water quality data for this system are presented in Table 10.

Table 10. Water Analysis Data for Outfall PU110

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
PU110	8/21/2018	Flowing	0.00	0.02	0.20	255	Negative	Suds, no odor
PU110	6/19/2019	Flowing	0.05	0.00	0.15	245	NA	Clear, no odor
PU110-CB12	6/19/2019	Flowing	0.00	0.00	0.15	97	NA	Clear, no odor

Findings:

- A low concentration of MBAS (0.20 mg/L) was measured at the outfall on August 21, 2018. Suds were also noted around the outfall.
- A sample was collected from the flowing outfall on June 19, 2019; no contaminants were measured above levels of concern and no suds were observed. The system was carefully inspected and found to be incorrectly mapped.
  - Catchbasins CB4, CB5, and CB6 could not be located, but there was a manhole north of catchbasin CB3. This likely serves as a junction for the branches extending to the east, north, and west.
  - The branch to the east, consisting of catchbasins CB5 through CB8, was dry. White spray paint was noted on the grate and in the sump of catchbasin CB8.
  - The branch to the west, consisting of catchbasins CB10 and CB11, was not flowing.
  - The branch to the north at catchbasin CB9 was flowing. An unmapped line continues north from catchbasin CB9 to an additional catchbasin, CB12. This catchbasin drains a swale coming off the hillside east of the edge of the retaining wall parallel to Perseverance Lane. The dry weather flow in the system appeared to originate in this area.
- A sample was collected of the flow entering the CB12 sump and no contaminants were measured above levels of concern.

Conclusion: The swale draining into catchbasin CB12 contributes most of the flow in the system during dry weather. Repeated sampling and observation demonstrated no chronic illicit discharge in the system.

Resolution: Not applicable.

12.4. PU230

The PU230 system drains a portion of Main Street (Appendix C, Map 7). It discharges into an eroded gulley south of the intersection of Main Street and Putney Landing Road. Water quality data for this system are presented in Table 11.

Table 11. Water Analysis Data for Outfall PU230

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	Raw / Corrected MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
PU230	8/24/2018	Flowing	0.0	0.01	0.40/ 0.30	1,545	Negative	Clear, no odor
PU230	6/19/2019	Flowing	0.0	0.04	0.15	912	NA	Clear, no odor

Findings:

- On August 24, 2018 a low concentration of MBAS (0.30 mg/L) was measured at the outfall, along with moderate specific conductance (1,545 µS/cm).
- When the system was revisited on June 19, 2019, no flow was detected north of the drop inlets, CB1 and CB2, which are located in a gulley. There was a substantial groundwater seeping from the bank of the gulley, which entered CB1 and CB2 as overland flow. Erosion was noted between CB1 and the outfall, and the stormwater pipe was broken in several places (Figure 2). No contaminants were measured above levels of concern at the outfall.

Figure 2. Erosion and broken stormwater pipes in the gulley containing PU230 and PU240

Conclusion: All flow through the system was found to result from groundwater discharge in the gulley. No flow was detected above the gulley along Main Street. Repeated sampling and observation demonstrated no chronic illicit discharge to the system.

Resolution: Not applicable

12.5. PU240

The PU240 system drains a portion of Main Street (Appendix C, Map 8). It discharges into an eroded gulley south of the intersection of Main Street and Putney Landing Road. Water quality data for this system are presented in Table 12.

Table 12. Water Analysis Data for Outfall PU240

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
PU240	8/24/2018	Flowing	0.0	0.05	0.30	646	Negative	Clear, no odor
PU240	6/19/2019	Flowing	0.0	0.01	0.15	1,074	NA	Clear, no odor

Findings:

- A low concentration of MBAS (0.30 mg/L) was measured at the outfall on August 24, 2018.
- A sample collected from the flowing outfall on June 19, 2019 contained no contaminants above levels of concern. No flow was detected in any structures above the outfall.
- There was significant erosion in the gulley below the outfall (Figure 3).

Figure 3. Broken stormwater outfall and significant erosion around PU240

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge in the system.

Resolution: Not applicable

12.6. PU330

PU330 is an outfall of unknown origin. (Appendix C, Map 9). It discharges to Sacketts Brook below the dam on Main Street. Water quality data for this system are presented in Table 13.

Table 13. Water Analysis Data for Outfall PU330

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
PU330	8/24/2018	Dry	NA	NA	NA	NA	Positive	NA

Findings:

- The origin of the PU330 pipe is unknown; however, it appears to trend toward an abandoned building on the northern bank. Optical brightener was detected at the outfall on a pad retrieved on August 24, 2018.
- The outfall was dry when revisited on September 20, 2018. The outfall could not be safely reached due to high flows in the falls. A pad placed upstream of the outfall was negative for optical brightener.
- Optical brightener was not detected at either the dry outfall or an upstream location on pads placed on June 12, 2019. On closer inspection, the outfall pipe appeared to be completely filled with sediment where it enters the bank, approximately 20-feet from the end.

- Additional pads placed at the upstream and outfall locations on August 9, 2019 and August 28, 2019 were also negative for optical brightener.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge in this location.

Resolution: Not applicable.

13. Rockingham Results

Illicit discharge detection was performed in Rockingham in July and August 2018. Of the 59 systems assessed, 20 were flowing during dry weather. Results of the initial assessment in Rockingham are included in Appendix B, Table 11. Seven systems were found to contain contaminants above levels of concern; these were designated for further investigation. The status of these investigations is described below.

13.1. RO010

The RO010 system drains a portion of the Rockingham Transportation Park north of Rockingham Road (VT Route 103) (Appendix C, Map 10). It discharges north of the transportation park into a severally eroded gulley south of the Williams River. Water quality data for this system are presented in Table 14.

Table 14. Water Analysis Data for Outfall RO010

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (μS/cm)	OB Result	Observations
RO010	7/25/2018	Flowing	4.0	0.07	0.30	889	Negative	Sewage odor
RO010	6/12/2019	Trickling	3.0	0.06	0.25	680	NA	Clear, no odor

Findings:

- An exceedingly high concentration of ammonia (4.0 mg/L) and elevated MBAS (0.30 mg/L) were measured at the outfall on July 25, 2018. A distinct wastewater odor was noted in catchbasins throughout the system. The outfall is located at the base of a steep and highly eroded bank at the north end of the property. The outfall was buried in approximately 1.5 feet of gravel and sand.
- A high concentration of ammonia (3.0 mg/L) and elevated MBAS (0.25 mg/L) were measured at the outfall on June 12, 2019.
- A sample collected at the outfall on July 10, 2019 had an exceedingly high *E. coli* concentration (>2,420 MPN/100 mL; Table 27), indicating a sanitary wastewater source. The TN concentration (14.82 mg/L) was also high.
- On August 29, 2019 Dave Braun and Dan Curran of Stone, with Wayne Graham of the Vermont Rural Water Association, met the property owner, Dave Boylan, of BART Energy to conduct dye testing and investigate the potential source of wastewater contamination into the stormwater system. The following observations were made:
  - Mr. Boylan located two septic tanks on the Transport Park property. The septic tank for the BART Energy building is located in a narrow strip of grass between the building and the fuel pumps. Mr. Boylan indicated this tank was replaced approximately 12 years ago. The location of the leachfield for this system is unknown. A second septic tank serves the Estes Express Lines

building, immediately east of the stormwater system near catchbasin CB1. Mr. Boylan reported that this tank was recently pumped and repaired due to intrusion of tree roots.

- We dye tested the downstairs toilet in the BART Energy building. After some time, the dye appeared in the septic tank. Dye was then added to the septic tank at the outlet. After a short delay the dye was observed in the sump of catchbasin CB1. No dye was observed at the RO010 outfall or at the outfall of the separate stormdrain located in the northern corner of the property.
- We proceeded to smoke test catchbasin CB2. Smoke was observed in CB1, and, after a delay, smoke appeared in the septic tank. In addition, air was heard being forced into the septic tank. No smoke was observed at the outfall of the RO010 system, indicating the line is obstructed or flooded at some point.
- We attempted to inspect the outlet pipe of Bart Energy's septic tank with a camera, but the camera was unable to pass through tight turns in the pipe.

Conclusion: A hydraulic connection from the onsite wastewater system at BART Energy to the stormwater system was confirmed, but we were unable to discover the exact location of the leak or cross connection. We suspect the sewer lateral from the septic tank at Bart Energy crosses over the stormline between CB2 and CB1, and that wastewater leaks into the underlying stormdrain.

Resolution: Stone advised the property owner to contract a septic system inspector to locate the leachfield serving the BART Energy building and to evaluate the sewer lateral from the septic tank to the leachfield for leaks. Mr. Boylan has retained Marquise and Morano, LLC to inspect the septic system at Bart Energy. This work is scheduled for spring 2020.

13.2. RO030

The RO030 system drains a portion of Shepard Lane and a portion of the campus and athletic fields at the Vermont Academy (Appendix C, Map 11). It discharges into a small stream south of Shepard Lane. Water quality data for this system are presented in Table 15.

Table 15. Water Analysis Data for Outfall RO030

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Cond. (µS/cm)	OB Result	Observations
RO030	7/25/2018	Flowing	0.0	0.02	0.20	536	Negative	Suds, no odor
RO030	6/12/2019	Flowing	0.0	0.03	0.05	317	NA	Clear, no odor
RO030-CB4	6/12/2019	Flowing	0.0	0.04	0.05	251	NA	Clear, no odor

Findings:

- Suds and a low concentration of MBAS (0.20 mg/L) were detected at the outfall on July 25, 2018. No flow was observed in the system above the outfall during the initial assessment.
- The system was revisited on June 12, 2019. No contaminants were measured above levels of concern in samples collected from the flowing outfall and the sump of catchbasin CB4. No suds were observed

in the system. The line above Shepard Lane was dry and all flow in the system was emanating from the line entering catchbasin CB4 from the west, toward a small ski slope. The line entering catchbasin CB4 from the south was dry.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge into the system.

Resolution: Not applicable.

13.3. RO140

The RO140 system drains portions VT Route 121, Pleasant Valley Road, and Corey Hill Road (Appendix C, Map 12). It discharges southeast of VT Route 121 into the Saxtons River. Water quality data for this system are presented in Table 16.

Table 16. Water Analysis Data for Outfall RO140

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Cond. (μS/cm)	OB Result	Observations
RO140	7/31/2018	Flowing	0.0	0.06	0.0	237	Negative	Clear, no odor
RO140-CB7	7/31/2018	Flowing	0.0	0.09	0.10	239	Negative	Clear, no odor
RO140	6/12/2019	Flowing	0.0	0.06	0.0	133	NA	Clear, no odor
RO140-CB7	6/12/2019	Flowing	0.0	0.03	0.0	1136	NA	Clear, no odor

Findings:

- A low concentration of free chlorine (0.06 mg/L) was measured at the outfall during the initial assessment on July 31, 2018. A comparable free chlorine concentration (0.09 mg/L) was measured in the flowing sump of catchbasin CB7.
- Very low concentrations of free chlorine were measured at the outfall (0.06 mg/L) and in CB7 (0.03 mg/L) on June 12, 2019.
- According to the ANR Natural Resources Atlas this area is not served by a public drinking water system and it lies outside the sewer service area of the Village of Saxtons River.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge into the system.

Resolution: Not applicable.

13.4. RO150

The RO150 system drains a portion of VT Route 121 (Appendix C, Map 13). It discharges south of VT Route 121 into the Saxtons River. Water quality data for this system are presented in Table 17.

Table 17. Water Analysis Data for Outfall RO150

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Cond. (μS/cm)	OB Result	Observations
RO150	7/31/2018	Trickling	0.0	0.08	0.20	250	Negative	Clear, no odor
RO150	6/12/2019	Flowing	0.0	0.01	0.10	170	NA	Clear, no odor
RO150-CB3	6/12/2019	Flowing	0.0	0.02	0.10	179	NA	Clear, no odor

Findings:

- Low concentrations of free chlorine (0.08 mg/L) and MBAS (0.20 mg/L) were measured at the outfall on July 31, 2018.
- No contaminants were measured above levels of concern in a sample collected from the flowing outfall on June 12, 2019. Water chemistry was nearly identical in a sample collected from the sump of the last flowing structure, catchbasin CB3.
- According to the ANR Natural Resources Atlas this area is not served by a public drinking water system and it lies outside the sewer service area of the Village of Saxtons River.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge into the system.

Resolution: Not applicable.

13.5. RO230

The RO230 system drains a portion of River Street (Appendix C, Map 14). It discharges south of River Street above the Saxtons River. Water quality data for this system are presented in Table 18.

Table 18. Water Analysis Data for Outfall RO230

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (μS/cm)	OB Result	Observations
RO230	8/6/2018	Flowing	0.0	0.08	0.10	1,080	Negative	Clear, no odor
RO230	6/12/2019	Trickling	0.0	0.00	0.05	845	NA	Clear, no odor

Findings:

- A low concentration of free chlorine (0.08 mg/L) was measured at the outfall on August 8, 2018. The specific conductance (1,080 μS/cm) was slightly elevated.
- No contaminants were measured above levels of concern at the trickling outfall on June 12, 2019. Furthermore, all structures above the outfall were dry.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge into the system.

Resolution: Not applicable.

13.6. RO260

The RO260 system drains a portion Westminster Street and Warner Center Road (Appendix C, Map 15). It discharges east of Westminster Street at the falls on the Saxtons River. Water quality data for this system are presented in Table 19.

Table 19. Water Analysis Data for Outfall RO260

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Cond. (µS/cm)	OB Result	Observations
RO260	8/6/2018	Trickling	0.0	0.10	0.10	213	Negative	Clear, no odor
RO260-CB17	8/6/2018	Trickling	0.0	0.05	0.10	170	NA	Clear, no odor
RO260	6/12/2019	Trickling	0.0	0.0	0.0	185	NA	Clear, no odor
RO260-CB17 (sump)	6/12/2019	Trickling	NA	0.04	NA	143	NA	Clear, no odor
RO260-CB17 (A)	6/12/2019	Trickling	NA	0.0	NA	149	NA	Clear, no odor

Findings:

- A low concentration of free chlorine (0.10 mg/L) was measured at the outfall August 6, 2018. The free chlorine concentration was lower (0.05 mg/L) in the flowing sump of catchbasin CB17.
- On June 12, 2019 no contaminants were measured above levels of concern in samples collected from the trickling outfall, the catchbasin CB17 sump, or pipe A in catchbasin CB17. An indoor pool was observed in the facility at 17 Warner Center Road; however, this facility was in disrepair and the pool appeared to be long abandoned.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge into the system.

Resolution: Not applicable.

13.7. RO420

The RO420 system drains a large portion of the Village of Bellows Falls, including the area between Hapgood Street to the north, the Saxtons River to the southeast, the Rockingham Recreation Center to the west, the Oak Hill Cemetery to the southwest, and Oak Hill Terrace to the south. (Appendix C, Map 16). It discharges to the Connecticut River approximately 0.1 mile southeast of the wastewater treatment plant. The outfall is submerged approximately 75 feet offshore in the Connecticut River. Water quality data for this system are presented in Table 20.

Table 20. Water Analysis Data for Outfall RO420

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Cond. (µS/cm)	OB Result	Observations
RO420-MH1	8/8/2018	Flowing	0.0	0.00	0.60	150	Negative	Clear, no odor
RO420-MH1	6/12/2019	Trickling	0.0	0.04	0.00	147	NA	Clear. No odor
RO420- CB1	6/12/2019	Trickling	0.0	0.05	0.10	65	NA	Clear. No odor
RO420-MH1	8/9/2019	Trickling	0.0	0.00	0.10	123	NA	Clear, no odor
RO420-MH Earl	8/9/2019	Dripping	NA	NA	0.10	NA	NA	Clear, no odor
RO420-MH1	8/28/2019	Trickling	NA	NA	0.00	101.6	NA	Clear, no odor
RO420-MH Earl	8/28/2019	Trickling	NA	NA	0.00	82.4	NA	Clear, no odor

Findings:

- A moderate concentration of MBAS (0.60 mg/L) was measured in the flowing sump of manhole MH1 on August 8, 2018.
- On June 12, 2019 no contaminants were measured above levels of concern in the trickling sump of manhole MH1 or in the next assessible structure, catchbasin CB1. No flow was observed in the system above catchbasin CB1.
- No contaminants were measured above levels of concern in manhole MH1 on August 9, 2019. Similar low concentrations were measured in the sump of the manhole located at the top of Earl Street, the first accessible structure downstream of a main stormdrain junction. No flow was observed in any line above this junction.
- No contaminants were measured above levels of concern in manhole MH1 on August 28, 2019 and no significant flow was observed in any line above the main junction.

Conclusion: The elevated MBAS measured in MH1 on August 8, 2018 likely resulted from a transient source, such as vehicle washing. Repeated sampling and observation demonstrated no chronic illicit discharge in this system.

Resolution: Not applicable.

14. Townshend Results

Illicit discharge detection was performed in Townshend in August 2018. Results of the initial assessment in Townshend are included in Appendix B, Table 12. None of the ten stormwater systems assessed in 2018 were flowing during dry weather; therefore, no systems were designated for further investigation.

15. Vernon Results

Illicit discharge detection was performed in Vernon in June 2018. Results of the initial assessment in Vernon are included in Appendix B, Table 13. Of the seven stormwater systems assessed, only one was flowing during dry weather. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

16. Wardsboro Results

Illicit discharge detection was performed in Wardsboro in July 2018. Of the four systems assessed, two were either flowing or trickling during dry weather. Results of the initial assessment in Wardsboro are included in Appendix B, Table 14. One system (WX020) was designated for further investigation due to the detection of high specific conductivity and free chlorine at the outfall. The status of this investigation is described below.

16.1. WX020

The WX020 system drains a portion of Main Street (Appendix C, Map 17). It discharges to a stream west of the Wardsboro Town Hall. Water quality data for this system are presented in Table 21.

Table 21. Water Analysis Data for Outfall WX020

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	Raw / Corrected MBAS (mg/L)	Specific Cond. (µS/cm)	OB Result	Observations
WX020	7/3/2018	Flowing	0.0	0.10	0.25/ 0.11	2,000	Negative	Discolored effluent, possible TP
WX020	6/28/2019	Wet, no flow	0.0	0.03	0.20/ 0.12	1,206	NA	Iron staining
WX020-CB1	6/28/2019	Wet, no flow	NA	NA	NA	2,108	NA	Iron staining
WX020-CB2	6/28/2019	Wet, no flow	Na	NA	NA	470	NA	Iron staining

Findings:

- A low concentration of free chlorine (0.10 mg/L) and high specific conductance (2,000 µS/cm) were measured at the outfall on July 3, 2018. The discharge was discolored red/orange/brown with significant iron staining. Field personnel noted deteriorated paper near the outfall, possibly toilet paper.
- Stone revisited the system on June 28, 2019 and carefully inspected every structure. There was no flow in the system. Significant iron staining and iron floc were observed at the outfall and in the sumps of catchbasins CB1 and CB2. The inlet located across Main Street was dry. The source of the iron floc appeared to be catchbasin CB2, located between the Town Office building and a house at 57 Main Street. No toilet paper was observed in any structure.
- Stone performed dye testing of surrounding properties on July 30, 2019, recording the following observations:
  - Dan Curran met with the Wardsboro Town Clerk to conduct dye testing of the Town Office and the Town Hall buildings. In both buildings, dye was flushed down the first-floor toilets.

- Both buildings are connected to a shared septic tank located behind the Town Hall. Wastewater is pumped from the tank to a leachfield. The town clerk indicated the leachfield is located upgradient to the west of the septic tank.
- We were unable to remove the concrete septic tank cover to confirm whether dye had reached the tank; however, the pump cycled several times during flushing.
- No dye was observed at the outfall, in any catchbasins, or along the small stream to which the outfall discharges.
- The town clerk noted that 57 Main Street had been vacant for over two years.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge in the system. Dye testing confirmed that the onsite wastewater system serving the Town Hall and Town Office buildings is not hydraulically connected to the stormwater system.

Resolution: Not applicable.

17. Westminster Results

Illicit discharge detection was performed in Westminster in May and June 2018. Of the 30 systems assessed, seven were flowing during dry weather. Results of the initial assessment in Westminster are included in Appendix B, Table 15. Five stormwater systems were found to contain contaminants above levels of concern; these were designated for further investigation. The status of these investigations is described below.

17.1. WM110

WM110 drains a portion of VT Route 121 (Appendix C, Map 18). It discharges over an embankment southeast of the intersection of VT Route 121, Gage Street, and Church Avenue. Water quality data for this system are presented in Table 22.

Table 22. Water Analysis Data for Outfall WM110

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Cond. (µS/cm)	OB Result	Observations
WM110	5/24/2018	Flowing	0.2	0.08	0.0	76	Negative	Clear, no odor
WM110	6/2/2019	Flowing	0.0	0.03	0.0	64	NA	Clear, no odor
WM110-CB3	6/2/2019	Flowing	0.0	0.04	0.0	103	NA	Clear, no odor

Findings:

- A low concentration of free chlorine (0.08 mg/L) was measured at the outfall during the initial assessment on May 24, 2018.
- On June 2, 2019 no contaminants were measured above levels of concern in samples collected from the outfall and the sump of catchbasin CB3, the last flowing structure in the system.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge into the system.

Resolution: Not applicable.

17.2. WM120

The WM120 outfall is an unmapped pipe immediately south of WM110 (Appendix C, Map 18). It discharges over an embankment southeast of the intersection of VT Route 121, Gage Street, and Church Avenue. Water quality data for this system are presented in Table 23.

Table 23. Water Analysis Data for Outfall WM120

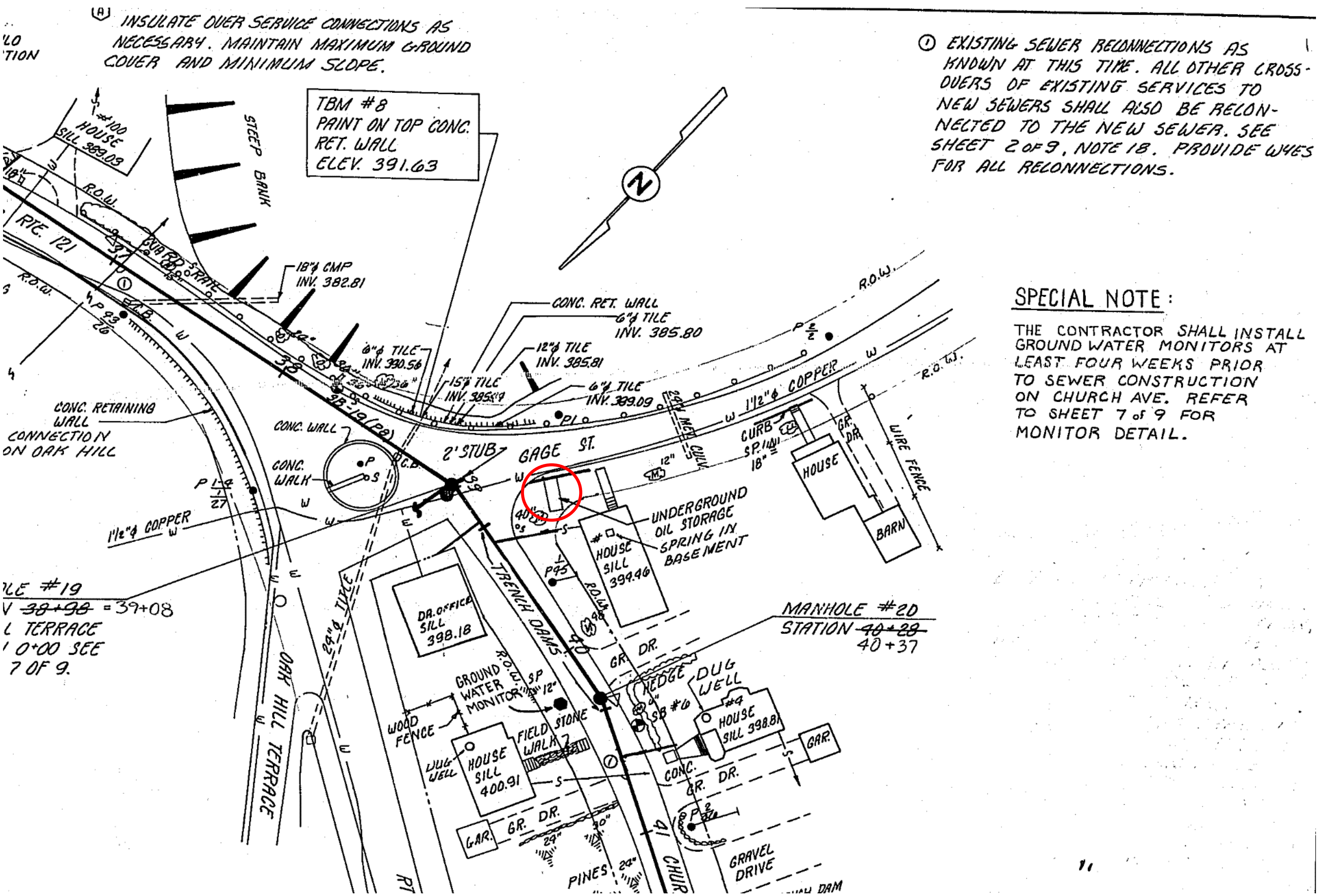
Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
WM120	5/24/2018	Flowing	0.20	0.0	0.25	500	Positive	Clear, no odor

Findings:

- A low concentration of MBAS (0.25 mg/L) was measured at the outfall during the initial assessment on May 24, 2018. Optical brightener was detected on a pad collected from the outfall on May 30, 2018.
- Optical brightener was also present on a second pad collected from the outfall on June 19, 2019. On this date, we confirmed there are no visible stormwater or wastewater structures along Church Avenue.
- Stone reviewed engineering plans for this area provided by the VTDEC (Figure 4). There are five outfalls indicated along the retaining wall, though none match the description of the WM120 outfall (8-inch diameter corrugated black plastic). The plans show an underground storage tank (UST) for oil at the intersection of Gage Street and Church Avenue. This tank is circled in Figure 4.
- On May 17, 2019 Stone searched the ANR Environmental Research Tool (ERT) for known hazardous waste sites and spills in the area. A spill was reported at the intersection of Church Avenue and Gage Street (spill number 2008 WMD400) on August 14, 2008. According to the ANR ERT petroleum contaminated soils were encountered when the town was excavating a waterline. Field screening readings with a photoionization detector ranged from 3 to 107 ppm. Petroleum contaminated soils were stockpiled on a nearby property, and a limited investigation was completed. A source was not determined.

Conclusion: We suspect groundwater contaminated by degraded petroleum products from documented releases, likely from the oil UST depicted in engineering plans provided by the VTDEC and confirmed by spill number 2008 WMD400, have resulted in false detections of optical brightener at the outfall.

Resolution: By this report, the problem is referred to the VTDEC Hazardous Waste Management Section and the VTDEC UST Program.



(A) INSULATE OVER SERVICE CONNECTIONS AS NECESSARY. MAINTAIN MAXIMUM GROUND COVER AND MINIMUM SLOPE.
① EXISTING SEWER RECONNECTIONS AS KNOWN AT THIS TIME. ALL OTHER CROSS-OVERS OF EXISTING SERVICES TO NEW SEWERS SHALL ALSO BE RECONNECTED TO THE NEW SEWER. SEE SHEET 2 OF 9, NOTE 18. PROVIDE WYES FOR ALL RECONNECTIONS.
TBM #8
PAINT ON TOP CONC. RET. WALL
ELEV. 391.63
SPECIAL NOTE:
THE CONTRACTOR SHALL INSTALL GROUND WATER MONITORS AT LEAST FOUR WEEKS PRIOR TO SEWER CONSTRUCTION ON CHURCH AVE. REFER TO SHEET 7 of 9 FOR MONITOR DETAIL.
STEEP BANK
RTE. 121
GAGE ST.
OAK HILL TERRACE
TRENCH DAMS
UNDERGROUND OIL STORAGE
SPRING IN BASEMENT
MANHOLE #20
STATION 40+28 40+37
GROUND WATER MONITOR
CONC. RETAINING WALL
CONNECTION ON OAK HILL
1 1/2"φ COPPER
CONC. RET. WALL
6"φ TILE INV. 385.80
12"φ TILE INV. 385.81
18"φ CMP INV. 382.81
2' STUB
HOUSE
BARN
WIRE FENCE
DUG WELL
GRAVEL DRIVE
PINES

17.3. WM160

The WM110 system drains a portion of Turrell Road, Mayo Road, and a portion of the area surrounding the Kurn Hattin School (Appendix C, Map 19). It discharges into a swale north of Mayo Road. Water quality data for this system are presented in Table 24.

Table 24. Water Analysis Data for Outfall WM160

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Conductance (μS/cm)	OB Result	Observations
WM160	5/30/2018	Dripping	0.0	0.18	0.0	297	Negative	Clear, no odor
WM160	6/12/2019	Flowing	0.0	0.04	0.0	142	NA	Clear, no odor

Findings:

- A moderate concentration of free chlorine (0.18 mg/L) was measured at the outfall during the initial assessment on May 30, 2018.
- On June 12, 2019 no contaminants were measured above levels of concern. The outfall was flowing, but no flow was observed above catchbasin CB3. The school was operating during the inspection, and no discharges were observed in footing drains from the building into the stormwater system.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge into the system

Resolution: Not applicable.

18. Weston Results

Illicit discharge detection was performed in Weston in June 2018. Of the eight systems assessed, five were flowing during dry weather. Results of the initial assessment in Weston are included Appendix B, Table 16. One stormwater system (WE030) was designated for further investigation due to the detection of optical brightener and high specific conductance at the outfall. The status of this investigation is described below.

18.1. WE030

The WE030 system drains a portion of VT Route 100 and several parking lots east and west of VT Route 100 (Appendix C, Map 20). It discharges to the West River west of VT Route 100. Water quality data for this system are presented in Table 25.

Table 25. Water Analysis Data for Outfall WE030

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	Raw / Corrected MBAS (mg/L)	Specific Conductance (µS/cm)	OB Result	Observations
WE030	6/6/2018	Dripping	0.0	0.04	0.20/ 0.09	1,700	Positive	Clear, no odor

Findings:

- High specific conductance (1,700 µS/cm) was measured at the outfall during the initial assessment on June 6, 2018. Optical brightener was also detected.
- The system was not flowing when visited on June 28, 2019. Each structure was inspected, and optical brightener pads were deployed in every accessible structure, including the outfall and catchbasins CB1, CB3, CB4, CB5, CB6, and CB7. Optical brightener was detected at the outfall, although fluorescence was weak. All other pads were negative.
- We attempted to collect *E. coli* and TN samples on July 7, 2019, but the system was dry.
- While inspecting catchbasin CB1, a hole was observed in the top of a pipe labeled sewer line in the VTDEC maps. There was a shim over the hole loosely held in place with a hose clamp (Figure 5).

Figure 5: Broken sewer lateral in catchbasin CB1

- On July 17, 2019 Stone contacted Regina Downer, the Weston Health Officer, and Bruce Downer, of the Weston Select Board to discuss the findings of the investigation. At Mr. Downer's request, Stone provided photographs of the damaged sewer lateral and a map of the stormwater system. Mr. Downer indicated that he reviewed the documents and that he along with Charles Goodwin, also of the Weston Select Board, inspected the sewer lateral in the sump of catchbasin CB1. They confirmed that there was a hole in the lateral. Mr. Downer and Mr. Goodwin spoke with the property owner, Andrew Harper, of 652 Main Street. Mr. Harper confirmed that the pipe is the sewer lateral serving 652 Main Street and indicated he was willing to grant access to perform dye testing.
- On December 2, 2019 in an email to Jim Pease of the VTDEC, Mr. Harper indicated that he had repaired the pipe at the recommendation of the Weston Select Board and Weston Health Officer.

Conclusion: A hole was located in the sewer lateral crossing through catchbasin CB1 from the house at 652 Main Street. We suspect that wastewater flowed out of the damaged lateral into the stormdrain under high flow conditions.

Resolution: Stone recommends VTDEC inspect the repair in the sewer lateral crossing catchbasin CB1.

19. Winhall Results

Illicit discharge detection was performed in Winhall in July 2018. Of the eight systems assessed, only one was flowing during dry weather. Results of the initial assessment in Winhall are included in Appendix B, Table 17. One system (WI020) was designated for further investigation due to detection of a moderate concentration of free chlorine at the outfall. The status of this investigation is described in detail below.

19.1. WI020

The WI020 system drains a portion of Tollgate Road (Appendix C, Map 21). It discharges into a swale south of Tollgate Road. Water quality data for this system are presented in Table 26.

Table 26. Water Analysis Data for Outfall WI020

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Specific Cond. (µS/cm)	OB Result	Observations
WI020	7/10/2018	Trickling	0.0	0.25	0.10	479	Negative	Very turbid, no odor
WI020	6/28/2019	Flowing	NA	0.04	NA	NA	NA	Clear, no odor
WI020-Stream	6/28/2019	Flowing	NA	0.02	NA	NA	NA	Clear, no odor

Findings:

- A moderate concentration of free chlorine (0.25 mg/L) was measured at the outfall during the initial assessment on July 10, 2018. The outfall was trickling, and the discharge was discolored dark brown. The sample was very turbid.
- Stone carefully inspected the system on June 28, 2019. No contaminants were measured above levels of concern at the flowing outfall. All flow to the outfall was from a small stream emanating from the woods. This stream joins the stormwater system at CB1, not at the outfall as depicted in the VTDEC infrastructure mapping. The drop inlets shown in Appendix C, Map 21 could not be accessed to collect samples; however, these are connected to a swale which was not flowing at the time of the inspection.

Conclusion: Repeated sampling and observation demonstrated no chronic illicit discharge in this system.

Resolution: Not applicable.

20. *E. coli* and Total Nitrogen Results

Samples were collected July 10, 2019 for *E. coli* and TN analysis by VAEL. A discharge measurement was made immediately following sample collection, where possible. Daily TN loads were calculated from the concentration and discharge data. These data are presented in Table 27. Sample collection for *E. coli* and TN analysis was also attempted at outfall WE030, but there was no flow on the sampling date. The high *E. coli* and TN concentrations measured in the RO010 system confirmed the presence of a sanitary wastewater discharge, while elevated *E. coli* and TN concentrations in the LO120 system are consistent with one or more direct graywater connections.

Table 27. E. coli and TN Data for Selected Drainage Systems

System	Date	*E. coli* (MPN/100 mL)	TN (mg/L)	Discharge (L/s)	TN loading (g/day)
CH260	7/10/2019	<1.0	1.20	NA	NA
LO120	7/10/2019	411	7.06	0.010	6.0
RO010	7/10/2019	>2,420	14.82	0.010	13

21. Conclusions

A thorough assessment was made of the stormwater drainage systems in 17 towns and villages discharging to the Williams River, Saxtons River, and Lower Connecticut River and their tributaries. A total of 244 systems were assessed. Based on water quality data collected during the dry weather surveys, 22 systems were designated for further investigation. Investigation of these drainage systems confirmed three illicit wastewater or graywater discharges. One illicit discharge was eliminated in the fall of 2019 when a broken house sewer lateral in Weston was repaired. We expect the remaining two discharge—an apparent wastewater leak in Rockingham and a graywater connection in Londonderry—to be resolved in 2020.

22. References

American Public Health Association, Standard Methods for the Examination of Water and Wastewater, 21st edition, Washington D.C., 2005.

Hach Company. Hach Method #8167. Loveland, CO.

Stone Environmental, Inc., SEI SOP 5.23.3: Maintenance and Calibration of the pH/Con 10 Meter. February 24, 2003.

Stone Environmental, Inc., SEI SOP 6.38.0: Optical Brightener Testing, September 11, 2008.

Appendix A. Stone Environmental SOPs

STANDARD OPERATING PROCEDURE

SEI-5.23.3

MAINTENANCE AND CALIBRATION OF THE pH/CON 10 METER

SOP Number: SEI-5.23.3	Date Issued: 5/14/99
Revision Number: 3	Date of Revision: 2/24/03

1.0 OBJECTIVE

This standard operating procedure (SOP) explains the calibration and maintenance of the Oakton pH/Con 10 meter and the Cole-Parmer pH/Con 10 meter. The meters are identical except for the distributor's names. The meter is manufactured by Cole-Parmer and distributed by Cole-Parmer and Oakton. The operator's manual should be referred to for the applicable procedures described below. The pH/Con 10 meter is used for measuring the pH, specific conductance, and temperature of water. The pH/conductivity meters generate and measure data, and thus must meet the requirements of 40 CFR part 160 subpart D.

2.0 POLICIES

1. According to 40 CFR Part 160, Subpart D, Section 160.61, Equipment used in the generation, measurement, or assessment of data and equipment used for facility environmental control shall be of appropriate design and adequate capacity to function according to the protocol and shall be suitable located for operation, inspection, cleaning, and maintenance.
2. Personnel will legibly record data and observations in the field to enable others to reconstruct project events and provide sufficient evidence of activities conducted.

3.0 SAFETY ISSUES

1. If necessary and appropriate, a site-specific health and safety plan shall be created for each study site. A template for creating a proper health and safety plan is provided on the SEI network.
2. If necessary and appropriate, all chemicals are required to be received with Material Safety Data Sheets (MSDS) or appropriate application label. These labels or MSDS shall be made available to all personnel involved in the sampling and testing.

4.0 PROCEDURES

4.1 Equipment and Materials

1. The pH/Con 10 meter, pH/conductivity/ temperature probe. The probe cable has a notched 6-pin connector to attach to probe meter.
2. If necessary and appropriate, standard solutions (e.g., standard pH 4.0 and 7.0, conductivity standards)

3. Clean beakers or other appropriate containers
4. Log or other appropriate medium to record calibration.

4.2 Meter Set-up and Conditioning

1. The pH/Con 10 meter uses a combination pH/conductivity/temperature probe. The probe cable has a notched 6-pin connector to attach the probe meter. Keep connector dry and clean.
2. To connect the probe, line up the notches and 6-pins on the probe connector with the holes in the connector located on the top of the meter. Push down and the probe connector will lock into place.
3. To remove probe, slide up the metal sleeve on the probe connector. While holding onto metal sleeve, pull probe away from the meter. Do not pull on the probe cord or the probe wires might disconnect.
4. Be sure to decontaminate the probe prior to use. The probe shall be tripled rinsed with distilled or deionized water. Further decontamination and cleaning procedures may be called for in special situations or outlined in approved protocols or work plans. This will be documented in field notes or in an appropriate logbook.
5. Be sure to remove the protective rubber cap of the probe before conditioning, calibration, or measurement. If the probe is clean, free of corrosion, and the pH bulb has not become dehydrated, simply soak the probe in tap water for ten minutes before calibrating or taking readings to saturate the pH electrode surface to minimize drift. Wash the probe as necessary in a mild detergent solution. If corrosion appears on the steel pins in the conductivity cell, use a swab soaked in isopropyl alcohol to clean the pins. Do not wipe the probe; this causes a build-up of electrostatic charge on the glass surface. If the pH electrode has dehydrated, soak it for 30 minutes in a 2M-4M KCI boot solution prior to soaking in tap water.
6. Wash the probe in deionized water after use and store in pH 4.0 standard solution or an approved boot solution (per the manufacturer's instruction).

4.3 pH Calibration

1. The meter is capable of up to 3-point pH calibration to ensure accuracy across the entire pH range of the meter. At the beginning of each day of use, perform a 2 or 3-point calibration with standard pH buffers 4.00, 7.00, and 10.00. Calibration standards that bracket the expected sample range should be used. Never reuse buffer solutions; contaminants in the solution can affect the calibration.
2. Press the MODE key to select pH mode. The pH indicator appears in the upper right corner of the display.

3. Dip the probe into the calibration buffer. The end of the probe must be completely immersed into the buffer. Stir the probe gently to create a homogeneous buffer solution. Tap probe to remove any air bubbles.
4. Press CAL/MEAS to enter pH calibration mode. The primary display will show the measured reading while the smaller secondary display will indicate the pH standard buffer solution.
5. Press or keys to scroll up or down until the secondary display value is the same as the pH buffer value (pH 4.00, 7.00 or 10.00).
6. Wait for the measured pH value to stabilize. The READY indicator will display when the reading stabilizes. After the READY indicator turns on, press ENTER to confirm calibration. A confirming indicator (CON) flashes and disappears. The meter is now calibrated at the buffer indicated in the secondary display.
7. Repeat steps 3, 5, and 6 using a second or third pH standard
8. Press CAL/MEAS to return to pH measurement mode.

4.4 Conductivity Calibration

1. Select a conductivity standard with a value near the sample value expected. The meter should be calibrated by the user(s) at the beginning of each day of use.
2. Pour out two separate portions of your calibration standard and one of deionized water into separate clean containers.
3. Press MODE key to select Conductivity. The ΦS or mS indicator will appear on the right side of the display.
4. Rinse the probe with deionized water, and then rinse the probe in one of the portions of calibration standard Record the calibration standard on the per-use maintenance form or other appropriate medium.
5. Immerse the probe into the second portion of calibration standard. The meter's auto-ranging function selects the appropriate conductivity range (four ranges are possible). Be sure to tap the probe to remove air bubbles. Air bubbles will cause errors in calibration.
6. Wait for the reading to stabilize. The READY indicator lights when the reading is stable. Press the CAL/MEAS key. The CAL indicator appears above the primary display. The primary display shows the measured reading and the secondary display shows the temperature. Record the initial calibration standard on the per-use maintenance form or other appropriate medium.
7. Press the or keys to scroll to the value of your conductivity standard Press and hold the or keys to scroll faster. The meter automatically compensates for temperature differences using a factor of 2.00% per BC.

8. Press ENTER key to confirm calibration. Upon confirmation, the CON indicator appears briefly. The meter automatically switches back into Measurement mode. The display now shows the calibrated, temperature compensated conductivity value. However, if the calibration value input into the meter is different from the initial value displayed by more than 20%, the ERR annunciator appears in the lower left corner of the display

4.5 Temperature Calibration/Verification

1. The built-in temperature sensor is factory calibrated. Therefore, no additional calibration is necessary. However, the temperature may be verified against another working thermometer. However, if errors in temperature readings are suspected or if a replacement probe is used. Refer to the operating instructions if temperature calibration is necessary.

4.6 General and Annual Maintenance

Individual users are responsible for the calibration, cleaning, repair, and maintenance of the instrument.

Routine inspection and maintenance schedules vary from each piece of equipment. Typically, there are minor maintenance needs each piece of equipment will need to undergo prior to use in the field (such as cleaning or conditioning). Always consult the manufacturer=s instructions for general maintenance.

Specific per use maintenance needs for the pH /Con 10 meter include but are not limited to:

1. Inspect probe for physical damage and debris
2. Inspect meter for physical damage and debris
3. Clean probe w/ mild detergent
4. Rinse probe in distilled water
5. Clean conductivity pins with isopropyl alcohol (if necessary)
6. Condition probe
7. Calibrated to pH 7.0
8. Calibrated to pH 4.0
9. Calibrated to pH 10.0

The pH /con 10 meter shall be stored in a clean dry place, usually the padded box that it came in. Care should be given to keep the instrument from dust and contamination.

Wash the probe in distilled water after use, and store in pH 4 solution.

All maintenance, repairs, and calibrations are to be documented on an equipment maintenance log or other appropriate medium. Follow the checklist provided on the equipment maintenance log for regular use maintenance needs. Any maintenance must include documentation of whether the maintenance was routine and followed the SOP or not.

Equipment logs shall be brought to the field for documenting use and calibration. The logs will be returned to the office after each field use and filed in the equipment records filing cabinet.

In the event of failure due to breakage or loss of parts, an attempt will be made to repair or replace the necessary parts by the field personnel who discover the malfunction. All repairs will be documented in field notes and/or on a non-routine maintenance log. If the instrument is rendered "out of service" or "broken", it should be tagged as such. If further repair is necessary, return the instrument to the manufacturer following proper shipping procedures.

Non-routine repairs must include documentation of the nature of the defect, how and when the defect was discovered, and any remedial action taken in response to the defect.

5.0 RESPONSIBILITIES

1. All personnel will legibly record data and observations (including phone conversations) in accordance with this SOP to enable others to reconstruct project events and provide sufficient evidence of activities conducted.
2. Prior to use and after use, all equipment will be appropriately cleaned, decontaminated, calibrated (if necessary) and stored in accordance with the manufacturer's instructions and this SOP.

6.0 DEFINITIONS

1. *Decontamination* – Procedures followed to ensure cross contamination does not occur between sampling points or that potential contamination of equipment does not pose a hazard to sampling personnel.
2. *EPA* the U.S. Environmental Protection Agency.
3. *FIFRA* the Federal Insecticide, Fungicide, and Rodenticide Act as amended.
4. *Maintenance* – Actions performed on equipment to standardize and/or correct the accuracy and precision of a piece of equipment to ensure that the equipment is operating within the manufacturer's specifications and standard values.
5. *Study* means any experiment at one or more test sites, in which a test substance is studied in a test system under laboratory conditions or in the environment to determine or help predict its effects, metabolism, product performance (pesticide efficacy studies only as required by 40 CFR 158.640) environmental and chemical fate, persistence, or residue, or other characteristics in humans, other living organisms, or media. The term "study" does not include basic exploratory studies carried out to determine whether a test substance or a test method has any potential utility.

7.0 REFERENCES

40 CFR Part 160 Good Laboratory Practice Standards, August 1989.

8.0 TABLES, DIAGRAMS, FLOWCHARTS, AND VALIDATION DATA

None

9.0 AUTHORIZATION

Revisited by: ______________________________ Date: __________

Michael Nuss, Staff Scientist

Approved by: ______________________________ Date: __________

Christopher T. Stone, President

10.0 REVISION HISTORY

Revision number 1:

1. Changed title and references to Oakton in Sections 1.0 and 2.0 to enable this standard operating procedure to apply to both the Oakton pH/Con 10 meter and the Cole-Parmer pH/Con 10 meter, as these are identical meters.
2. Added instructions about cleaning and re-hydrating the probe to Section 3.1.
3. Added Section 9.0.
4. Reformatted.
5. Minor word editing.

Revision number 2:

1. Changed the title.
2. Removed sections 7.0 (Measurement) and 8.0 (Maintenance/Repairs).
3. Added section called (General and Annual Maintenance).
4. Minor editing.
5. Reformatted.

Revision number 3:

1. Minor wording edits in Section 1.0, Objective.
2. Updated style to match SEI Style Guide – font and text. Reformatted using MS Word
3. Added standardized section headers: 2.0 Policies, 3.0 Safety, 5.0 Responsibilities, 6.0 Definitions, 7.0 References, 8.0 Tables, Diagrams, Flowcharts and Validation data. Authorization moved to Section 9.0, andSection10.0 Revision History.
4. Deleted section on logs being given to the QAU.
5. Other minor wording edits.

STANDARD OPERATING PROCEDURE

SEI-6.38.1

OPTICAL BRIGHTENER TESTING

SOP Number: SEI-6.38.1 Date Issued: 9/11/08

Revision Number: 1 Date of Revision: 3/18/13

1.0 OBJECTIVE

Optical brighteners are a class of fluorescent dyes used in almost all laundry detergents. Many paper products also contain optical brighteners. When optical brightener is applied to cotton fabrics, they will absorb ultraviolet (UV) rays in sunlight and release them as blue rays. These blue rays interact with the natural yellowish color of cottons to give the garment the appearance of being "whiter than white". Optical brightener dyes are generally found in domestic wastewaters that have a laundry effluent component. Because optical brighteners absorb UV light and fluoresce in the blue region of the visible spectrum, they can be detected using a long wave UV light (a "black" light).

Optical brightener monitoring can be used to indicate the presence of wastewater in stormwater drainage systems, streams, and other water bodies. Since optical brighteners are removed by adsorption onto soil and organic materials as effluent passes through soil and aquifer media, optical brightener monitoring may also be used to identify incompletely renovated wastewater effluent in groundwater at wastewater dispersal sites.

To test for optical brightener, a cotton pad is placed in a flow stream for a period of 4-10 days, after which the pad is rinsed, air dried, and viewed under a long-range UV light. Florescence indicates the presence of optical brightener. Optical brighteners may be monitored in a wide range of structures and flow streams. For example, monitoring pads may be placed in stormwater outfall pipes, within catchbasins and manholes, or in any other man-made or natural water conveyance. Optical brightener pads may be placed in dry pipes or other dry structures to monitor possible intermittent flow streams. However, the more common application is to monitor discharge points that are flowing under dry weather conditions.

2.0 POLICIES

1. According to Stone's Corporate Quality Management Plan, Stone shall have standard operating procedures in writing setting forth study methods that management is satisfied are adequate to ensure the quality and integrity of the data generated in the course of a study.
2. Personnel will legibly record data and observations in the field to enable others to reconstruct project events and provide sufficient evidence of activities conducted.

3.0 SAFETY ISSUES

1. If necessary and appropriate, a site-specific health and safety plan shall be created for each study site. A template for creating a proper health and safety plan is provided on the SEI network.
2. Care must always be taken when approaching a sampling location. Do not, under any circumstances, place yourself in danger to collect a sample.
3. If necessary and appropriate, all chemicals are required to be received with Material Safety Data Sheets (MSDS) or appropriate application labels. These labels or MSDS shall be made available to all personnel involved in the sampling and testing.

4.0 PROCEDURES

4.1 Equipment and Materials

1. Untreated cotton pad measuring approximately 10 cm by 10 cm (e.g., VWR cat no. 21902-985 or equivalent).
2. Fiberglass or nylon screen to enclose the cotton pad (sewn or stapled).
3. Monofilament fishing line (approximately 20 to 50 lb. test).
4. Binder clips of various sizes.
5. Field notebook, sample collection form, or other acceptable medium for recording field data.
6. Protective gloves if contamination is suspected in the water to be sampled, or if cold weather may be hazardous with wet hands.

4.2 Sampling Procedure and Sample Handling

4.2.1 Optical Brightener Pad Assembly

To assemble an optical brightener monitoring pad, place an untreated cotton pad measuring approximately 10 cm by 10 cm (e.g., VWR cat no. 21902-985) in an envelope made of a screen material. A light fiberglass screen is preferred. The pad may be folded in half to double its thickness. Sew, staple, or otherwise secure all open sides of the screen envelope to enclose the pad.

4.2.2 Optical Brightener Pad Placement

1. Secure the pad at the monitoring point using high test nylon fishing line (20 - 50 lb. test), a binder clip, or both. The pad may be attached to any convenient anchor, provided the pad is as well exposed to the flow stream as possible and the anchor point appears stable enough to resist the force of high flow events. When sampling culverts or stormwater outfall pipes, the pad may be clipped directly to the inner rim of the outfall. The pad should lie flat against the bottom surface of the pipe. The pad may also be hung from a catchbasin grate or manhole rung.

2. If a suitable anchor is not present, a heavy object may be placed in the flow stream or channel to anchor the pad. For example, a pad may be anchored in a stream by tying it to a concrete block.
3. Two or more optical brightener monitoring pads may be placed at monitoring points if appropriate. If more than a single pad is used, the pads should be anchored so that they do not become entangled.
4. Record the date each pad is deployed and any other relevant information in a field logbook or on a specified sample collection form.

4.2.3 Optical Brightener Pad Retrieval and Handling

1. After a 4-10 day period of exposure, optical brightener pads should be collected. The collection of each pad should be recorded in a field logbook or on a specified sample collection form.
2. Any object inserted in a pipe or other structure to anchor the pad should be removed.
3. Pads should be placed in individually labeled, re-sealable plastic bags. The sample label should indicate the monitoring point identification.
4. The pad should be removed from the screen envelope using scissors to cut open the envelope. The pad should be gently rinsed using cold tap water. Lightly squeeze out excess water with a clean hand. Do not wring out the pad. When processing the pads be aware that you may spread dye from one pad to another with your hands. Wear disposable gloves.
5. The pad should then be returned immediately to the labeled bag.
6. Pads should be air dried. The pad may be hung on a line to dry within the labeled bag. If a re-sealable plastic bag is used, cut the bottom corners of the bag to allow airflow to the pad.

4.3 Optical Brightener Analysis

1. When the pad is dry, expose the pad under a high-quality long-range UV light in a room that is completely dark. A non-exposed and an exposed pad are used as controls and compared to each test pad as it is exposed to the UV light.
2. There are three qualitative results: Positive, Negative, and Indeterminate. A pad will very definitely glow (fluoresce) if it is positive. If it is negative it will be noticeably drab and similar to the control pad. All other tests are indeterminate. Pads may be sorted into the basic categories: positive test, negative test, and indeterminate. Further, for positive tests, the pads may be sorted into categories by the relative strength of the fluorescence. A pad that is fluoresces brightly over most or all its surface may be considered a strongly positive test, whereas a pad on which fluorescence appears patchy or faint may be considered a weakly positive test. Indeterminate results generally dictate that the test be repeated.
3. In some instances, only a portion of the pad or simply the outer edge will fluoresce after being exposed to optical brightener. This can be caused by many factors but is usually the result of an uneven exposure to the dye in the flow stream due to sedimentation or the way the pad was

positioned in the water. Regardless, as long as a portion of the pad fluoresces, it should be considered positive.

4. Since paper and cotton dust is so pervasive, it is common to see fluorescent fibers or specks on the test or control pads. These should be ignored and not used to indicate a positive result.
5. With the lights back on, record the identification number and the test result for each pad.
6. It is advisable to have a second reader perform the pad observations independently. The results are then compared. Any conflicting interpretations may be resolved though repeated observation of the pad in question, or a by a third observer.

5.0 RESPONSIBILITIES

1. All personnel will legibly record data and observations (including phone conversations) in accordance with this SOP to enable others to reconstruct project events and provide sufficient evidence of activities conducted.

6.0 DEFINITIONS

1. *Study* means any experiment at one or more test sites, in which a test substance is studied in a test system under laboratory conditions or in the environment to determine or help predict its effects, metabolism, product performance (pesticide efficacy studies only as required by 40 CFR 158.640) environmental and chemical fate, persistence, or residue, or other characteristics in humans, other living organisms, or media. The term “study” does not include basic exploratory studies carried out to determine whether a test substance or a test method has any potential utility.

7.0 REFERENCES

40 CFR Part 160 Good Laboratory Practice Standards, August 1989.

MASS Bay Program. 1998. An Optical Brightener Handbook. http://www.thecompass.org/8TB/pages/SamplingContents.html

8.0 TABLES, DIAGRAMS, FLOWCHARTS, AND VALIDATION DATA

None

9.0 AUTHORIZATION

Revisited by: ______________________________ Date: __________

Dave Braun, Project Scientist/Water Quality Specialist

Approved by: ______________________________ Date: __________

Christopher T. Stone, President

10.0 REVISION HISTORY

Revision number 1:

1. Minor clarifications and rewording throughout.
2. Changed 4-8-day pad exposure period to 4-10-day exposure period.
3. Changed description of indeterminate results.
4. Added use of binder clips to secure pads.
5. Updated procedure for processing exposed pads.

Appendix B. Assessment Data Tables

Table 1: Chester Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
CH010	6/18/2018	TAR	Outfall	12	Vitrified clay	Dripping	na	Free flow	No	No	Clear, no odor	None	None	Corrosion	None	0.00	0.00	0.00	435	0.00	17.3	Negative	
CH020-CB1	6/18/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Whole system dry. Could not find outfall. Looked like the system was buried. Could not find inlet or outlet of CB1, only 1 foot dee
CH030	6/18/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not find outfall, catchbasin dry.
CH040	6/18/2018	DTC	Outfall	12	Corrugated meta	Dry	na	Free flow	No	No	Dry	None	None	Cracking	None	na	na	na	na	na	na	na	Unclear if this pipe is outfall, only thing in area but seems too high on bank. Possibly mis-mapped? All CBs are wet no flo
CH050	6/18/2018	DTC	Outfall	16	Corrugated meta	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Located unmapped outfall under bridge. System is dry
CH060	6/18/2018	DTC	Outfall	16	Concrete	Dry	na	Free flow	No	No	Dry	None	None	Cracking	None	na	na	na	na	na	na	na	Dry.
CH070	6/18/2018	DTC	Outfall	24	Corrugated meta	Dry	na	Free flow	No	Small gully	Dry	None	None	Crushed	None	na	na	na	na	na	na	na	Has a smaller (16"?) vitrified clay inside metal bell. System is dry, did not sample any CB
CH080	6/18/2018	DTC	Outfall	14	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	Sediment	Broken	None	na	na	na	na	na	na	na	Also a ~20" corrugated metal outfall above this one. Both dry. Metal one is completely clogged with sedimer
CH090	6/18/2018	TAR	Outfall	18	Corrugated meta	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
CH100	6/18/2018	DTC	Culvert outlet	16	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	Sediment	None	None	na	na	na	na	na	na	na	Culvert outlet connected to two catchbasins. All dry
CH110	6/18/2018	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
CH120-CB1	6/18/2018	DTC	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	Sediment	None	None	na	na	na	na	na	na	na	Could not find outfall, map likely correct that it discharges to a drywell. Pipe appears to be 12" corrugated metal at exit of C
CH130	6/18/2018	TAR	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
CH140	6/18/2018	DTC	Outfall	14	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Dry.
CH150	6/18/2018	DTC	Outfall	14	Corrugated meta	Dry	na	Free flow	No	No	Dry	None	Sediment	Corrosion	Partially obstructed	na	na	na	na	na	na	na	
CH160	6/18/2018	TAR	Outfall	16	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
CH170	6/18/2018	TAR	Outfall	18	Corrugated black plastic	Wet (no flow)	na	Free flow	No	No	Dripping	None	None	None	None	na	na	na	na	na	na	na	
CH180-CB1	6/18/2018	TAR	Catchbasin	na	na	Wet (no flow)	na	na	No	No	Wet, no flow	None	None	None	None	na	na	na	na	na	na	na	Outfall located across the street on private property, could not access. Catchbasin wet/ no flow
CH190-CB1	6/18/2018	DTC	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not locate outfall in overgrowth. System is dry
CH200	6/18/2018	DTC	Outfall	na	Corrugated meta	Dry	na	Free flow	No	No	Dry	None	Sediment	Crushed	Partially obstructed	na	na	na	na	na	na	na	Outfall discharges below grade. Outfall is crushed and partially burie
CH210	6/18/2018	DTC	Outfall	32	Concrete	Wet (no flow)	na	Partially submerged	No	No	Clear, no odor.	None	None	None	None	na	na	na	na	na	na	na	No flow out of outfall, but is surcharged. Did not sample stagnant surcharged wate
CH220	6/18/2018	DTC	Outfall	24	Corrugated green plastic	Wet (no flow)	na	Free flow	No	No	Clear no odor	None	None	None	None	na	na	na	na	na	na	na	System is dry
CH230	6/18/2018	DTC	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
CH250-CB1	6/18/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Outfall was located in extremely dense bush. Unable to get to it. Catchbasin 1 was dry
CH260-CB1	6/18/2018	DTC	Catchbasin	na	na	Wet (no flow)	na	na	No	No	Clear no odor	None	None	None	None	0.03	0.00	0.00	48.3	0.00	23.3	Positive	Could not access outfall on private property. Sampled and padded CB1. Only the footing from house into CB1 trickling. CB2 and footing are dry.
CH270	6/18/2018	TAR	Outfall	18	Corrugated meta	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Outfall is located inside stone wall cave (it is located under the road

Table 2: Dummerston Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
DM010	5/30/2018	TAR	Outfall	36	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
DM020	5/30/2018	TAR	Outfall	19	Corrugated metal	Trickling	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.01	0.10	0.09	178.3	0.00	16.6	Negative	Pad is across the street from mapped location
DM020-CB3	5/30/2018	TAR	Catchbasin	na	na	Flowing	na	na	No	No	Clear, no odor	None	None	None	None	0.01	0.00	0.00	154.2	0.00	16.6	Negative	Free chlorine originally read 0.14, retested sample and it read 0.01.
DM030	6/12/2018	TAR	Outfall	37	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
DM040-CB1	6/25/2018	TAR	Catchbasin	na	Concrete	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Both catchbasins dry. Could not locate outfall. Should be on the border of farm and private property.

Table 3: Grafton Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
GT010	6/25/2018	TAR	Outfall	18	Corrugated black plastic	Flowing	0.25	Free flow	No	No	Clear, no odor	None	None	None	None	0.06	0.00	0.00	998	0.00	18.2	Negative	
GT020	6/25/2018	TAR	Outfall	18	Corrugated metal	Wet, no flow	na	Free flow	No	No	Clear, no odor, stagnant	None	None	None	None	na	na	na	na	na	na	na	Wet, no flow. Not enough flow to test, no pad placed. Outfall buried under rocks on stream bank.
GT030	6/25/2018	TAR	Outfall	17	Corrugated metal	Flowing	0.5	Free flow	No	No	Clear, no odor	None	None	None	Partially obstructed	0.05	0.10	0.08	290	0.00	16.7	Negative	3/4 filled in with sediment. Padded outfall.

Table 4: Guilford Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
GF010	6/7/2018	DTC	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	Minor scouring at outfall	Dry	None	None	None	None	na	na	na	na	na	na	na	No flow in system.
GF020	6/7/2018	DTC	Outfall	18	Corrugated black plastic	Flowing	0.5	Free flow	No	No	Clear, no odor	None	None	None	None	0.04	0.00	0.00	211	0.00	16.1	Negative	
GF030	6/7/2018	DTC	Outfall	16	Corrugated black plastic	Dripping	na	Free flow	No	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	Insufficient drip to collect sample. No flow in system.
GF040	6/7/2018	DTC	Outfall	18	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is not flowing. Mapped incorrectly, outfall on other side of bridge. Appears to be a recent construction. Resident complained of sewage smell in area (from pump station?)
GF050	6/7/2018	DTC	Outfall	16	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	No flow in system. Business complained of stormwater erosion problem near road, but not connected to this system.
GF060	6/12/2018	TAR	Outfall	23	Smooth plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
GF070-CB1	6/12/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not locate. CB1 dry.
GF080	6/12/2018	TAR	Outfall	28	Smooth metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	

Table 5: Jamaica Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
JA010-CB1	8/29/2018	DTC	Catchbasin	na	na	Dry	na	na	no	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall on private property. No flow in CB.
JA020-CB1	8/29/2018	DTC	Catchbasin	na	na	Trickling	na	na	no	No	Clear,no odor	None	None	None	None	0.05	0.00	0.00	136	0.00	23.7	Negative	Cannot access outfall on private property.
JA030-CB1	8/29/2018	DTC	Catchbasin	na	na	Dry	na	na	no	No	Dry	None	None	None	None	na	na	na	na	na	na	na	No flow in system. Cannot access outfall on private property
JA040	8/29/2018	DTC	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System dry. GPS point wrong, no service. Outfall is directly under bridge.
JA050	8/29/2018	DTC	Outfall	18	Corrugated black plastic	Flowing	0.25	Free flow	No	No	Clear, no odor	None	None	None	None	0.06	0.00	0.00	176	0.00	18.9	Negative	

Table 6: Londonderry Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
LO010	7/16/2018	TAR	Outfall	24	Corrugated black plastic	Dry	na	Free flow	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	
LO020	7/16/2018	TAR	Outfall	24	Corrugated metal	Dripping	na	Free flow	No	na	Clear, no odor	None	None	None	None	0.05	0.10	0.09	233	0.10	23.4	Negative	Green moss/ algae forming under outfall.
LO030	7/16/2018	TAR	Outfall	24	Corrugated metal	Wet No Flow	na	Free flow	No	na	Damp ground, no flow	None	None	None	None	na	na	na	na	na	na	Negative	Wet, no flow. Not enough flow to test water. Pad placed.
LO040	7/16/2018	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	
LO050	7/16/2018	TAR	Outfall	18	Corrugated metal	Dry	na	Free flow	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	
LO060	7/16/2018	TAR	Outfall	18	Corrugated metal	Dry	na	Free flow	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	
LO070	7/16/2018	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	Partially blocked by large boulders on the bank.
LO080	7/16/2018	TAR	Outfall	na	Tunnel	Dry	na	Free flow	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not locate pipe. Outfall looked to be fully buried. Ditch and sediment show where outfall should be. New road must have covered the outfall.
LO090-CB1	7/16/2018	TAR	Catchbasin	na	na	Dry	na	na	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	Outfall on private property. Nobody home, could not access. Both catchbasins were dry. Looked like a 1-foot metal, corrugated pipe.
LO100	8/15/2018	TAR	Outfall	28	Corrugated metal	Flowing	0.5	Free flow	No	na	Clear, no odor	None	None	Cracking	None	0.05	0.25	0.24	174	0.00	20.6	Negative	
LO110	8/15/2018	TAR	Outfall	24	Corrugated black plastic	Wet No Flow	na	Partially submerged	no	na	Greenish tint, no flow, still water	None	None	None	None	na	na	na	na	na	na	na	No flow in system No sample collected, no pad placed.
LO120	8/15/2018	TAR	Outfall	18	Corrugated black plastic	Flowing	0.1	na	no	na	Clear, no odor	Suds	None	None	None	0.02	0.25	0.20	777	0.25	20.5	Positive	
LO130	8/15/2018	TAR	Catchbasin	na	na	na	na	na	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not locate outfall. Most likely buried underneath rocks on river bank. CB1 is dry.
LO140-CB1	8/15/2018	TAR	Catchbasin	na	na	na	na	na	No	na	Wet, no flow	None	None	None	None	na	na	na	na	na	na	na	Could not locate outfall. Probably buried in the brush or underneath rocks on river bank. CB1 wet with no flow.
LO150	8/15/2018	TAR	Outfall	24	Corrugated metal	Trickling	na	Free flow	No	na	Clear, no odor	None	None	None	None	0.05	0.15	0.12	556	0.00	22.3	Negative	
LO160-CB1	8/15/2018	TAR	Catchbasin	na	na	na	na	na	No	na	Wet, no flow	None	None	None	None	na	na	na	na	na	na	na	Could not locate outfall. Catchbasin 1 is wet, no flow.
LO170	8/15/2018	TAR	Outfall	24	Corrugated metal	Dry	na	Free flow	No	na	Dry	None	None	None	None	na	na	na	na	na	na	na	
LO180	8/15/2018	TAR	Outfall	18	Corrugated black plastic	Wet No Flow	na	Partially submerged	no	na	Rusty, still water, no flow	None	None	None	None	na	na	na	na	na	na	na	

Table 7: Marlboro Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
MB010	6/25/2018	TAR	Outfall	9	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
MB020	6/25/2018	TAR	Outfall	12	Corrugated black plastic	Wet, now flow	na	Partially submerged	No	No	Clear, no odor	None	None	None	None	0.02	0.00	0.00	104.6	0.00	15.9	na	Outfall partially submerged 3 inches. No visible flow, however a slight trickle was seen in CB1, therefore water tested and pad placed
MB030-CB1	6/25/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Outfall not located. CB1 dry.
MB040	6/25/2018	TAR	Outfall	na	Unknown, fully submerged	Wet, now flow	na	Submerged	No	No	Clear, no odor. Very stagnant	None	None	None	None	na	na	na	na	na	na	na	Water pools up. No flow. Fully submerged. Not tested. No pad.
MB050	6/25/2018	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	No service for accurate GPS coordinates.
MB060	6/25/2018	TAR	Outfall	na	Unknown, fully buried	Dry	na	Free flow	No	No	Dry	None	None	None	Fully obstructed	na	na	na	na	na	na	na	Outfall fully obstructed by debris. Catchbasins dry. No sign of flow at outfall.

Table 8: Newfane Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
NE010	7/3/2018	12:11	TAR	Outfall	28	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Outfall is partially crushed. Size is estimated
NE020	7/3/2018	12:14	TAR	Outfall	12	Corrugated metal	Wet, no flow	na	Partially submerged	No	No	Partially submerged half way up piped.	None	None	None	None	na	na	na	na	na	na	na	Partially submerged, no flow. No sample collected
NE030	7/3/2018	12:33	TAR	Outfall	28	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	Sediment	None	None	na	na	na	na	na	na	na	Partially submerged by sandy sediment nearly halfway up the pipe. Whole system dry.
NE040	7/3/2018	12:45	TAR	Outfall	24	Corrugated metal	Dripping	na	Free flow	No	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	Very slow drip, not enough to sample, no pad placed.
NE050	7/3/2018	12:48	TAR	Outfall	18	Corrugated metal	Wet, no flow	na	Partially submerged	No	No	Partially submerged, no flow.	None	None	None	None	na	na	na	na	na	na	na	No flow in system.
NE060	7/3/2018	12:54	TAR	Outfall	30	Corrugated metal	Dripping	na	Free flow	No	No	Clear, no odor, small drip.	None	None	None	None	na	na	na	na	na	na	na	Insufficient drip to collect sample.
NE070	7/3/2018	13:02	TAR	Outfall	22	Corrugated metal	Flowing	0.25	na	No	No	Clear, no odor	None	None	None	None	0.01	0.01	0.00	182.4	0.00	20.3	Negative	
NE080-CB1	7/3/2018	13:17	TAR	Catchbasin	na	na	Wet, no flow	na	na	No	No	Wet, no flow	None	None	None	None	na	na	na	na	na	na	na	Could not located outfall. CB1 is wet, no flow.
NE090	7/3/2018	13:23	TAR	Outfall	18	Corrugated metal	Wet, no flow	na	Partially submerged	No	No	No flow	None	None	None	Partially obstructed	na	na	na	na	na	na	na	Wet, no flow and partially submerged. No sample collected. There was also a 2.5-inch diameter smooth plastic outfall right next to it, also submerged, no flow. CBs were wet, no flow.

Table 9: Peru Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
PE010	6/6/2018	13:12	TAR	Outfall	18	Corrugated metal	Trickling	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.03	0.05	0.00	803	0.00	14.1	Negative	
PE020	6/6/2018	13:18	TAR	Outfall	na	na	Trickling	na	Submerged	No	No	Clear, no odor	None	None	None	Fully obstructed	0.05	1.50	0.77	10550	0.00	13.8	na	Looks like outfall is completely submerged underground. A small trickling stream appears where the outfall should be located. Sample collected but, no pad placed.
PE030	6/6/2018	13:40	TAR	Outfall	25	Corrugated metal	Flowing	0.25	Free flow	No	No	Clear, no odor	None	None	None	None	0.02	0.10	0.08	406	0.00	13.0	Negative	
PE040	6/6/2018	13:55	DTC	Outfall	17	Corrugated metal	Flowing	0.25	Free flow	No	No	Clear no odor	None	Sediment	None	None	0.01	0.00	0.00	367	0.00	13.5	Negative	Heavy algae build up at exit with significant sediment deposits in pipe.
PE050	6/6/2018	14:05	TAR	Outfall	18	Corrugated metal	Dripping	na	Free flow	No	No	Insufficient flow for testing. Appears to be clear, no odor.	None	None	None	None	na	na	na	na	na	na	na	Insufficient flow for sample.
PE060	6/6/2018	14:23	TAR	Outfall	18	Corrugated black plastic	Flowing	0.25	Free flow	No	No	Clear, no odor	None	None	None	None	0.04	0.00	0.00	158	0.10	13.5	Negative	

Table 10: Putney Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
PU010	8/21/2018	11:07	TAR	Outfall	36	Concrete	Wet, no flow	na	Partially submerged	no	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	CB1 is dry.
PU020	8/21/2018	11:38	TAR	Outfall	18	Concrete	Flowing	0.5	Free flow	No	No		None	None	None	None	0.02	0.10	0.08	390	0.25	21	Negative	
PU030-CB1	8/21/2018	12:09	TAR	Catchbasin	na	Concrete	na	na	na	No	No	Clear, no odor	None	None	None	Partially obstructed	0.01	0.30	0.21	1350	0.00	21.6	Negative	Inaccessible in thorn bush. CB1 had two footings, a dry plastic pipe and flowing concrete pipe.
PU040	8/21/2018	12:26	TAR	Outfall	18	Corrugated metal	Flowing	0.2	Free flow	No	No	Clear, no odor. The water pooled underneath is foamy with bubbles.	Suds	None	Cracking	None	0.04	0.20	0.18	361	0.00	25.4	Negative	Pad placed on the bank under the outfall because outfall is cracked.
PU050	8/21/2018	12:30	TAR	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU060	8/21/2018	12:54	TAR	Outfall	24	Concrete	Flowing	0.2	Free flow	No	No	No odor, suds	Suds	None	Cracking	None	0.02	0.25	0.20	754	0.00	25.6	Negative	
PU070	8/21/2018	13:10	TAR	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU080	8/21/2018	13:14	TAR	Outfall	6	Smooth plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	CB1 is wet, no flow
PU090	8/21/2018	13:20	TAR	Outfall	24	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU100	8/21/2018	13:26	TAR	Outfall	30	Corrugated black plastic	Flowing	0.3	Free flow	No	No	Clear, no odor	None	None	None	None	0.01	0.20	0.20	117.9	0.00	21	Negative	
PU110	8/21/2018	13:30	TAR	Outfall	30	Corrugated black plastic	Trickling	na	Free flow	No	No	Suds below, no odor	Suds	None	None	None	0.02	0.20	0.19	255	0.00	26.9	Negative	
PU120	8/21/2018	13:44	TAR	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU130	8/21/2018	14:05	TAR	Outfall	12	Corrugated black plastic	Wet, no flow	na	Partially submerged	no	No	Clear, no odor	None	None	None	None	0.00	0.10	0.08	276	0.00	25.9	Negative	Sampled and padded CB1.
PU140	8/21/2018	14:26	TAR	Outfall	18	Corrugated black plastic	Flowing	0.2	Free flow	No	No	Clear, no odor	None	None	None	None	0.00	0.25	0.23	404	0.00	24.2	Negative	
PU150	8/21/2018	14:42	TAR	Outfall	12	Corrugated black plastic	Flowing	0.2	Free flow	No	No	Clear, no odor	None	None	None	None	0.01	0.2	0.19	274	0.00	23	Negative	
PU160	8/21/2018	15:01	TAR	Outfall	8	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU170	8/21/2018	15:03	TAR	Outfall	10	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU180	8/24/2018	10:16	TAR	Outfall	12	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall from concrete wall. Can see outfall is dry
PU190-CB2	8/24/2018	10:37	TAR	Catchbasin	na	na	na	na	na	No	No	Clear, no odor	None	None	None	None	0.01	0.10	0.09	240	0.00	20.9	Negative	Outfall not accessible under bridge.
PU190-CB3	8/24/2018	10:48	TAR	Catchbasin	na	na	na	na	na	No	No	Clear, no odor	None	None	None	None	0.02	0.10	0.09	275	0.00	20	Negative	Outfall not accessible under bridge.
PU200	8/24/2018	11:14	TAR	Outfall	18	Corrugated black plastic	Wet, no flow	na	Free flow	No	No	Barely damp. Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	No flow in system
PU210	8/24/2018	11:23	TAR	Outfall	13	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU220	8/24/2018	11:30	TAR	Outfall	20	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU230	8/24/2018	11:48	TAR	Outfall	24	Corrugated metal	Flowing	0.2	Free flow	No	Ditch	Clear, no odor	None	Iron staining	Cracking	None	0.01	0.40	0.30	1545	0.00	18.5	Negative	Ground very unstable.
PU240	8/24/2018	11:55	TAR	Outfall	18	Corrugated metal	Trickling	na	Free flow	No	Ditch	Clear, no odor	None	Iron staining	Cracking	None	0.05	0.30	0.26	646	0.00	20.4	Negative	Very unstable ground.
PU250-CB1	8/24/2018	13:07	TAR	Catchbasin	na	na	na	na	na	No	No	Wet, no flow	None	None	None	None	na	na	na	na	na	na	na	Low income property apartments. One of the residents said the “land trust” owns the property. CB1 is wet, no flow.
PU260	8/24/2018	13:15	TAR	Outfall	12	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU270	8/24/2018	13:29	TAR	Outfall	16	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU280	8/24/2018	13:31	TAR	Outfall	16	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU290	8/24/2018	13:32	TAR	Outfall	16	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
PU300	8/24/2018	13:47	TAR	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Outfall was on private property but can be seen from cul-de-sac. Outfall is dry. Unsure of size of pipe or material.
PU310	9/5/2018	8:55	DTC	Outfall	na	na	na	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	Negative	Outfall of road culvert. Padded for river walk. Padded 2x metal pipes between outfall and river as well.
PU320	8/24/2018	14:22	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	Negative	Outfall is dry, pad placed during river walk.
PU330	8/24/2018	14:35	TAR	Outfall	6	Vitrified clay	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	Positive	Outfall is dry, pad placed during river walk. Outfall trends towards abandoned building.
PU-TAR	8/31/2018	12:37	DTC	Other	na	na	na	na	na	No	No	Tar	None	None	None	None	na	na	na	na	na	na	na	Location of tar in the river below the dam.

Table 11: Rockingham Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
RO010	7/25/2018	10:38	TAR	Outfall	8	Corrugated metal	Trickling	na	Partially submerged	No	No	Clear, no odor	None	None	None	Partially obstructed	0.07	0.30	0.24	889	4.0	22.0	Negative	Two separate outfalls flowing. Both were located further down than mapped. One was the 8-inch metal pipe (sampled). The other was leaking from a crack underneath junk/debris. Padded both.
RO020	7/25/2018	11:14	TAR	Outfall	6	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Plan to either add to or redo the stormwater system during upcoming factory redevelopment.
RO030	7/25/2018	11:50	TAR	Outfall	26	Concrete	Flowing	0.25	Free flow	No	No	Clear, no odor	Suds	None	None	None	0.02	0.20	0.17	536	0.00	18.5	Negative	
RO030-CB4	7/31/2018	11:26	TAR	Catchbasin	na	na	na	na	na	No	No	Clear, no odor	None	None	None	None	0.06	0.00	0.00	400	0.00	22.2	na	All flow appears to be coming from western pipe (draining ski hill)
RO040	7/25/2018	11:52	TAR	Outfall	10	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO050	7/30/2018	11:25	DTC	Outfall	na	Unknown	Flowing	na	Partially submerged	No	Gully	Clear, no odor	None	Sediment	None	Partially obstructed	0.06	0.10	0.04	918	0.10	18	Negative	Seep next to RO010. Seep coming from under metal debris in bank. Padded and sampled due to flow.
RO060	7/30/2018	12:19	DTC	Outfall	41	Concrete	Flowing	0.1	Free flow	No	No	Clear, no odor	None	None	None	None	0.00	0.00	0.00	719	0.00	25.6	Negative	Nearly all CBs are dry or wet, no flow and offline. No flow apparent from Elm, Steuben, Lincoln Meadow, Morgan, etc.. Flow on Brimley.
RO060-CB-Bramley	7/30/2018	13:52	DTC	Manhole	na	na	Flowing	na	na	No	No	Clear, no odor	None	None	None	None	0.04	0.10	0.05	750	0.00	17.5	na	First manhole in Brimley St. near intersection with Pond Rd. here and outfall are not flowing and offline.
RO070-CB1	7/30/2018	13:04	DTC	Catchbasin	na	na	na	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot locate outfall. No flow in CB1. Opened multiple CBs and manholes, system is dry.
RO080	7/30/2018	14:06	DTC	Outfall	na	Concrete	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Located outfall, could not measure from position on bank. System is dry.
RO090	7/30/2018	14:15	DTC	Outfall	41	Concrete	Wet, no flow	na	Partially submerged	yes	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	Outfall is surcharged in river. Opened first accessible MH at intersection of Wells and Route 5 and line is dry. Pulled MH at intersection of Wells and Laurel: that whole part of the line is dry. Pulled CB at intersection with Butterfield St. is dry.
RO100	7/31/2018	10:41	TAR	Outfall	18	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	Sediment	None	Partially obstructed	na	na	na	na	na	na	na	
RO110	7/31/2018	11:44	TAR	Outfall	6	Smooth plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO120	7/31/2018	11:56	TAR	Outfall	18	Concrete	Flowing	0.2	Free flow	No	No	Clear, no odor	None	None	None	None	0.02	0.00	0.00	427	0.00	21.3	Negative	
RO130	7/31/2018	12:03	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO140	7/31/2018	13:34	TAR	Outfall	41	Concrete	Flowing	0.3	Free flow	No	No	Clear, no odor	None	Red moss growing at outfall	None	None	0.06	0.00	0.00	237	0.00	23.5	Negative	
RO140-CB7	7/31/2018	13:12	TAR	Catchbasin	na	na	Flowing	na	na	No	No	Clear, no odor	None	None	None	None	0.09	0.10	0.09	239	0.00	22.5	na	
RO150	7/31/2018	13:52	TAR	Outfall	19	Concrete	Trickling	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.08	0.20	0.19	250	0.00	23	Negative	Mystery, 4-inch, smooth plastic pipe is dripping into CB4.
RO160	7/31/2018	14:02	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO170	7/31/2018	14:26	TAR	Outfall	19	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Behind fire station
RO180	7/31/2018	14:34	TAR	Outfall	19	Concrete	Dry	na	Free flow	No	Yes	Dry	None	None	Crushed	Partially obstructed	na	na	na	na	na	na	na	Pipe split, almost entirely covered by brush and boulders
RO190	8/6/2018	10:53	TAR	Outfall	16	Vitrified clay	Flowing	0.5	Partially submerged	No	No	Clear, no odor	None	None	None	None	0.04	0.10	0.04	982	0.00	18.5	Negative	
RO200	8/6/2018	11:10	TAR	Outfall	15	Corrugated metal	Dripping	na	Free flow	No	No	Clear, no odor	None	None	Cracking	None	0.04	0.10	0.07	545	0.00	21.6	Negative	Pipe split, broken at outfall. Pad placed in the crack where it is broken, clipped to the pipe.
RO210	8/6/2018	11:24	TAR	Outfall	16	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO220	8/6/2018	11:35	TAR	Outfall	15	Corrugated metal	Flowing	0.25	Partially submerged	No	No	Clear, no odor	None	None	Cracking	None	0.04	0.10	0.06	569	0.00	21.8	Negative	
RO230	8/6/2018	12:48	TAR	Outfall	18	Corrugated metal	Flowing	0.5	Partially submerged	No	No	Clear, no odor	None	Sediment	None	Partially obstructed	0.08	0.10	0.03	1080	0.00	22.3	Negative	Construction right down the street, rebuilding WW treatment facility.
RO240	8/6/2018	13:00	TAR	Outfall	na	na	na	na	na	No	No	System destroyed	None	None	None	None	na	na	na	na	na	na	na	System was destroyed in the construction of new WW treatment facility.
RO250	8/6/2018	13:07	TAR	Outfall	16	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO260	8/6/2018	13:20	TAR	Outfall	21	Concrete	Trickling	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.10	0.10	0.09	213	0.00	24	Negative	Insufficient flow to collect from outfall. Sampled in ditch below outfall
RO260-CB17	8/6/2018	13:43	TAR	Catchbasin	na	na	na	na	na	No	No	Clear, no odor	None	None	None	None	0.05	0.10	0.09	170	0.00	21.5	na	
RO270	8/6/2018	13:49	TAR	Outfall	5	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO280	8/6/2018	13:51	TAR	Outfall	14	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO290	8/6/2018	13:57	TAR	Outfall	13	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
RO300	8/8/2018	10:09	DTC	Outfall	5	Cast iron	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	Negative	
RO310	8/8/2018	10:11	DTC	Outfall	24	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Size is estimated, cannot measure off bridge
RO320	8/8/2018	10:18	DTC	Outfall	24	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry. Diameter is estimated, cannot access outfall down steep embankment
RO330	8/8/2018	10:28	DTC	Outfall	4	Smooth plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry
RO340	8/8/2018	10:33	DTC	Outfall	10	Vitrified clay	Dry	na	Free flow	No	Minor scouring	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry
RO350	8/8/2018	10:44	DTC	Outfall	16	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall behind fence. Size is estimated.
RO360	8/8/2018	10:47	DTC	Outfall	36	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall behind fence. Size is estimated. System is dry.
RO370-CB1	8/8/2018	10:50	DTC	Catchbasin	na	na	Wet, no flow	na	na	No	No	No flow in system	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall behind fence. System is dry. Outfall possible submerged.
RO380-CB1	8/8/2018	11:14	DTC	Catchbasin	na	na	na	na	na	No	No	Clear, no odor	None	None	None	None	0.02	0.00	0.00	261	0.00	26.1	Negative	Cannot access behind fence. Sampled and padded CB1. Significant flow (2+"). Road crew said it always flows from a thermal well. No flow in offline CBs.
RO390	8/8/2018	11:35	DTC	Outfall	12	Cast iron	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry. CB2 is completely filled with sediment.
RO400	8/8/2018	11:57	DTC	Outfall	48	Concrete	Flowing	0.25	Free flow	No	No	Clear, no odor	None	None	None	None	0.01	0.00	0.00	362	0.00	22.1	Negative	Rob Wheeler states it is mostly draining thermal spring nearby. Padded downstream of outfall.
RO410	8/8/2018	12:03	DTC	Outfall	18	Concrete	Dry	na	Free flow	No	No	System is dry	None	None	None	None	na	na	na	na	na	na	na	
RO420-MH1	8/8/2018	12:31	DTC	Manhole	na	na	Flowing	0.2	Submerged	No	No	Clear, no odor	None	None	None	None	0.00	0.60	0.59	150.2	0.00	21.4	Negative	Outfall is deeply submerged in river. Padded and sample MH1.
RO430	8/8/2018	13:19	DTC	Outfall	14	Smooth plastic	Flowing	0.1	Free flow	No	No	Clear, no odor	None	None	None	None	0.00	0.00	0.00	196.2	0.00	25.1	Negative	
RO440-CB1	8/8/2018	13:33	DTC	Catchbasin	na	na	Wet, no flow	na	na	No	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall on private property. No flow in system.
RO450	8/8/2018	13:43	DTC	Outfall	16	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry,
RO460-CB1	8/8/2018	13:48	DTC	Catchbasin	na	na	Wet, no flow	na	na	No	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	No flow In system. Cannot access outfall on private property.
RO470-CB1	8/8/2018	13:55	DTC	Catchbasin	na	na	na	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	No flow In system. Cannot access outfall on private property.
RO480	8/21/2018	10:12	DTC	Outfall	30	Corrugated black plastic	Flowing	0.1	na	No	No	Clear, no odor	None	None	None	None	0.03	0.05	0.05	32	0.00	20.8	Negative	Only one outfall in area.
RO490	8/21/2018	10:18	DTC	Outfall	6	Smooth plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry.
RO500	8/21/2018	10:52	DTC	Outfall	16	Corrugated metal	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not locate outfall, mapped correctly. Pipe goes underground by Whitney Blake and it is not in the area between road and rail yard. Facilities manager believes it outlets at river and is buried under rail yard. CBs are dry.
RO510-CB1	8/21/2018	10:58	DTC	Catchbasin	na	na	Wet, no flow	na	Submerged	No	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	Cannot locate outfall in stormwater pond. No flow in system.
RO520-CB1	8/21/2018	11:15	DTC	Catchbasin	na	na	na	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot locate outfall on embankment. No flow in systems.
RO530	8/21/2018	11:34	DTC	Outfall	12	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry
RO540	8/21/2018	11:39	DTC	Outfall	na	Unknown	Dry	na	Submerged	No	Pothole	Dry	None	Sediment	None	Fully obstructed	na	na	na	na	na	na	na	Outfall is completely buried in pothole. System is dry. Unknown size and material
RO550-CB1	8/21/2018	11:47	DTC	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall on private property. System is dry.
RO560	8/21/2018	11:51	DTC	Outfall	18	Corrugated black plastic	Wet, no flow	na	Free flow	No	No	Clear, no odor	None	None	None	None	na	na	na	na	na	na	na	Outfall wet is wet, no flow. No flow in system.
RO570	8/21/2018	11:59	DTC	Outfall	16	Corrugated black plastic	Trickling	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.04	0.10	0.08	351	0.00	20.3	Negative	
RO580	8/21/2018	12:17	DTC	Outfall	18	Corrugated black plastic	Flowing	0.1	Free flow	No	No	No odor, iron floc and staining	None	Iron staining	None	None	0.04	0.10	0.07	475	0.00	19.7	Negative	Investigated system. No flow in either major branch. Everything is wet, no flow at all junctions of main line, but is dripping from both sides into CB2.
RO590	8/21/2018	13:12	DTC	Outfall	16	Concrete	Flowing	0.1	Free flow	No	No	Clear, no odor	None	Iron staining	None	None	0.03	0.10	0.04	898	0.00	21	Negative	
RO-MH-Burt	8/9/2018	11:26	TAR	Manhole	na	na	na	na	na	No	No	Clear, no odor	None	None	None	None	0.02	0.10	0.08	364	0.00	20	Indeterminate	System likely flows into RO400. See maps.

Table 12: Townshend Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
TO010	8/29/2018	DTC	Outfall	24	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	Sediment	None	None	na	na	na	na	na	na	na	No flow in system
TO020-CB1	8/29/2018	DTC	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry
TO030	8/29/2018	DTC	Outfall	24	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	Corrosion	None	na	na	na	na	na	na	na	Outfall is corroded. Also a dry 16” culvert outlet in ditch.
TO040	8/29/2018	DTC	Outfall	14	Cast iron	Dry	na	Free flow	No	No	Dry	None	Sediment	None	None	na	na	na	na	na	na	na	Dry
TO050	8/29/2018	DTC	Outfall	15	Concrete	Dry	na	Free flow	No	No	Dry	None	Sediment	None	None	na	na	na	na	na	na	na	System is dry
TO060	8/29/2018	DTC	Outfall	20	Corrugated black plastic	Dry	na	Free flow	No	Small gully	Dry	None	None	None	None	na	na	na	na	na	na	na	
TO070	8/29/2018	DTC	Outfall	24	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
TO080	8/29/2018	DTC	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	Gully	Dry	None	None	None	None	na	na	na	na	na	na	na	Trash dumping on bank at outlet
TO090	8/29/2018	DTC	Outfall	18	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
TO100	8/29/2018	DTC	Outfall	6	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry

Table 13: Vernon Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
VE010	6/7/2018	12:35	DTC	Outfall	36	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	Sediment	None	None	na	na	na	na	na	na	na	
VE020-CB1	6/7/2018	12:52	DTC	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not access outfall. No flow in system.
VE030	6/7/2018	13:05	DTC	Outfall	24	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Unmapped outfall from CB has multiple pipes entering from fenced in hydro dam.
VE040-CB1	6/7/2018	13:20	DTC	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not locate outfall. Either has been rerouted or is submerged in pond. All CBs are dry.
VE040-CB1	6/7/2018	13:27	DTC	Outfall	16	Corrugated metal	Dry	na	Free flow	No	Minor scouring	Dry	None	None	Cracking	None	na	na	na	na	na	na	na	
VE060-CB1	6/7/2018	13:35	DTC	Outfall	16	Corrugated metal	Flowing	Unknown	Free flow	No	No	Clear no odor	None	None	Corrosion	None	0.05	0.20	0.11	1404	0.00	14.4	Negative	Outfall very corroded and discharges deep in bank. Cannot estimate flow. Sampled and padded CB1.
VE070-CB1	6/7/2018	14:05	DTC	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Cannot access outfall on private property. No flow in system.

Table 14: Wardsboro Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
WX010	7/3/2018	10:45	TAR	Outfall	18	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	System is dry
WX020	7/3/2018	10:55	TAR	Outfall	18	Corrugated black plastic	Flowing	0.1	Free flow	No	No	Water red/orange/brown. Possible toilet paper.	Possible toilet paper	None	None	None	0.10	0.25	0.11	2000	0.00	23.0	Negative	Water very orange/red. Looks like pieces of toilet paper floating.
WX030	7/3/2018	11:19	TAR	Outfall	18	na	Trickling	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.03	0.10	0.08	354	0.00	19.6	Negative	
WX040	7/3/2018	11:29	TAR	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	

Table 15: Westminster Assessment Table

IDDE ID	Date	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
WM010	5/24/2018	TAR	Outfall	10	Concrete	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM020	5/24/2018	TAR	Outfall	30	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Newer, black plastic corrugated pipe was on top of an older, metal corrugated pipe.
WM030	5/24/2018	TAR	Outfall	15	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM040	5/24/2018	TAR	Outfall	15	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM050	5/24/2018	TAR	Outfall	25	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM060	5/24/2018	TAR	Outfall	24	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	Sediment	None	Partially obstructed	na	na	na	na	na	na	na	
WM070	5/24/2018	TAR	Outfall	24	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM080-CB1	5/24/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not locate outfall. System dry.
WM090-CB1	5/24/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Could not access outfall on private property.
WM100	5/24/2018	TAR	Outfall	14	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM110	5/24/2018	TAR	Outfall	18	Corrugated black plastic	Flowing	1.00	Free flow	No	No	Clear, no odor	None	None	None	None	0.08	0.00	0.00	76.0	0.20	14.9	Negative	
WM120	5/24/2018	TAR	Outfall	8	Corrugated black plastic	Flowing	0.25	Free flow	No	No	Clear, no odor	None	None	None	None	0.00	0.25	0.22	500	0.20	16.3	Positive	Pipe of unknown origin, appears to run up Church Ave. Cl2 was under range. Repadded outfall 6/12/18.
WM130	5/24/2018	TAR	Outfall	20	Corrugated metal	Trickling	na	Free flow	No	No	Clear, no odor	None	None	Corrosion	None	0.01	0.10	0.06	679	0.00	14.2	Negative	Cl2 originally read 0.11 mg/L, retested and read 0.01 mg/L. No pink coloration during test.
WM140	5/24/2018	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	Sediment	None	Partially obstructed	na	na	na	na	na	na	na	3 inches of sediment present.
WM150-CB1	5/24/2018	TAR	Catchbasin	na	na	Dry	na	na	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	Outfall on private property, could not be investigated. Catchbasin is dry.
WM160	5/30/2018	TAR	Outfall	23	Corrugated meta	Dripping	na	Free flow	No	No	Clear, no odor	None	None	Corrosion	None	0.18	0.00	0.00	297	0.10	17.4	Negative	Cl2 originally read zero, but appeared somewhat pink. Tested again and read 0.18 mg/L
WM170	5/30/2018	TAR	Outfall	4	Smooth plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM180	5/30/2018	TAR	Outfall	15	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	Partially obstructed	na	na	na	na	na	na	na	
WM190	5/30/2018	TAR	Outfall	18	Corrugated black plastic	Dripping	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.02	0.00	0.00	1940	0.10	19.0	Negative	There were 2 outflow pipes, the larger one (WM190) was the one flowing.
WM200	5/30/2018	TAR	Outfall	31	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM210	5/30/2018	TAR	Outfall	7	Corrugated metal	Trickling	na	Free flow	No	No	Clear, no odor	None	None	Corrosion	None	0.06	0.10	0.00	1617	0.00	15.0	Negative	Parked across the street from police station, hiked down the woods across river.
WM220	5/30/2018	TAR	Outfall	21	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM230	5/30/2018	TAR	Outfall	13	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	There are two metal 14-inch diameter outfalls in the same spot. Both are dry.
WM240	5/30/2018	TAR	Outfall	21	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM250	5/30/2018	TAR	Outfall	12	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM260	6/12/2018	TAR	Outfall	15	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM270	6/12/2018	TAR	Outfall	19	Corrugated black plastic	Dripping	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.06	0.10	0.01	1340	0.00	18.0	Negative	Could not locate outfall. System dry.
WM280	6/12/2018	TAR	Outfall	15	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WM290	6/25/2018	TAR	Outfall	18	Corrugated black plastic	Wet, no flow	na	Free flow	No	No	Clear, no odor. Insufficient flow to sample	None	None	None	None	na	na	na	na	na	na	na	
WM300	6/25/2018	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	

Table 16: Weston Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
WE010	6/6/2018	10:22	TAR	Outfall	23	Concrete	Flowing	0.75	Free flow	No	No	Clear, no odor	None	None	None	None	0.03	0.00	0.00	180	0.00	13.8	Negative	
WE020	6/6/2018	10:29	TAR	Outfall	18	Corrugated black plastic	Dry	na	Free flow	No	No	Dry, no flow	None	None	None	None	na	na	na	na	na	na	na	
WE030	6/6/2018	11:01	TAR	Outfall	9	Corrugated metal	Dripping	na	Free flow	No	No	Clear, no odor	None	None	None	None	0.04	0.20	0.09	1700	0.00	13.3	Positive	Outfall located on river under rocks. There was a small amount of algae growing on the outfall.
WE030-CB1	6/6/2018	10:45	TAR	Catchbasin	6	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	No odor present
WE040	6/6/2018	10:51	TAR	Outfall	18	Concrete	Flowing	0.5	Free flow	No	No	Clear, no odor	None	None	None	None	0.04	0.00	0.00	209	0.00	14.5	na	
WE050	6/6/2018	11:26	TAR	Outfall	na	na	Flowing	na	Submerged	No	No	Clear, no odor	None	None	None	None	0.03	0.10	0.09	198	0.00	12.1	Negative	Outfall fully submerged. Pad set, and sample tested at pool where outfall should be located.
WE060	6/6/2018	11:49	TAR	Outfall	18	Concrete	Flowing	0.25	Free flow	No	No	Clear, no odor	None	None	None	None	0.01	0.05	0.04	190.5	0.00	12.0	Negative	Nothing flowing on the newer system.
WE070	6/6/2018	11:54	TAR	Outfall	35	Corrugated metal	na	na	Partially submerged	Partially	No	No flow from outfall	None	None	None	None	na	na	na	na	na	na	na	Outfall partially submerged. No flow from outfall to river. Water not tested. CB1 dry.
WE080-CB1	6/6/2018	11:57	DTC	Catchbasin	na	na	Wet, no flow	na	na	No	No	Wet no flow. No odor	None	Sediment	None	Partially obstructed	na	na	na	na	na	na	na	Could not locate outfall, buried in debris. Small amount of stagnant water around outfall area in ditch. All CBs are wet, no flow.

Table 17: Winhall Assessment Table

IDDE ID	Date	Time	Inspector	Structure Type	Inner Diameter (in.)	Material (Outfall Only)	Flow	Flow depth (in.)	Outfall position	Surcharged?	Erosion at outfall	Discharge Characteristics	Floatables	Deposits/ Staining	Structural Damage	Obstructions	Free chlorine (mg/L)	MBAS (mg/L)	Corrected MBAS (mg/L)	Sp. Cond. (µS/cm)	Ammonia (mg/L)	Temp. (°C)	OB results	Comments
WI010	7/10/2018	11:15	TAR	Outfall	18	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WI020	7/10/2018	11:18	TAR	Outfall	18	Corrugated metal	Trickling	na	Partially submerged	No	No	Dark sandy brown color	None	None	None	none	0.25	0.10	0.07	479	0.00	18.1	Negative	Free Cl2 measured as 0.25 mg/L, tested again and measured as 0.35 mg/L. The water was very turbid with suspended solidsColor changed from light coffee to dark brown/ pink.
WI030	7/10/2018	12:00	TAR	Outfall	30	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WI040	7/10/2018	12:03	TAR	Outfall	12	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	Partially obstructed	na	na	na	na	na	na	na	Outfall almost entirely buried.
WI050	7/10/2018	12:07	TAR	Outfall	18	Corrugated metal	Dry	na	Free flow	No	No	Dry	None	None	None	None	na	na	na	na	na	na	na	
WI060	7/10/2018	12:12	TAR	Outfall	24	Smooth plastic	Wet, no flow	na	Partially submerged	No	No	Wet, no flow. Submerged halfway up.	None	None	None	None	na	na	na	na	na	na	na	
WI070	7/10/2018	12:13	TAR	Outfall	24	Smooth plastic	Wet, no flow	na	Partially submerged	No	No	Wet, no flow. Submerged halfway up.	None	None	None	None	na	na	na	na	na	na	na	
WI080	7/10/2018	12:28	TAR	Outfall	12	Corrugated metal	Dripping	na	Free flow	No	No	Iron stained	None	Iron staining	None	Partially obstructed	na	na	na	na	na	na	Negative	There are two outfalls. The one of interest is the smaller outfall located inside the rock wall. Not enough flow to sample, padded. Lots of iron staining.

Appendix C. Maps

N

LEGEND

US Feet
0 10 20 40 60 80

Stormwater Line
- Storm line
- Swale
- Footing drain

Stormwater Point
- Catchbasin
- Outfall
- Culvert inlet
- Culvert outlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

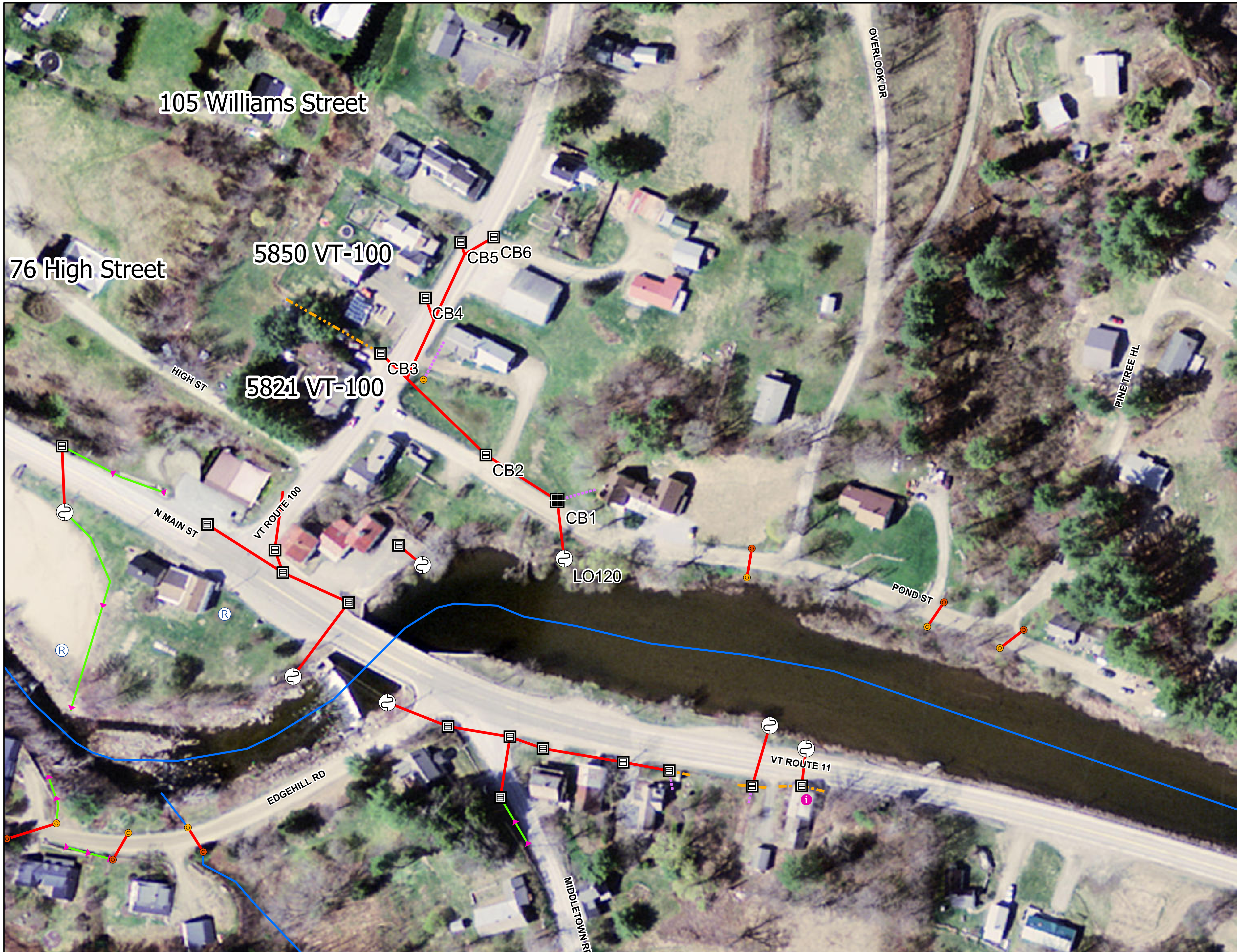
Path: O:\PROJ-18\WRM\18-027 Basin 11 IDDE\GIS\MapDocuments\PresentationsAndReports\Figure Stone_Landscape_11x17 Exported: 1/10/2020 3:11 PM by hcox

CH260

Map #1
Chester, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL



N

LEGEND

US Feet
0 30 60 120 180 240

Stormwater Line
- Storm line
- Swale
- Footing drain
- Under drain
- Stream

Stormwater Point
- Catchbasin
- Drop Inlet
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit
- Information Point

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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LO120

Map #2
Londonderry, Vermont

Basin 11 IDDE Project

Prepared for VT DEC

Stone Environmental

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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PE020

Map #3
Peru, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 150 300 US Feet

LEGEND

Stormwater Point
- Catchbasin
- Yard drain
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Retrofit

Stormwater Line
- Storm line
- Swale
- Footing drain
- Under drain
- Roof drain
- Emergency spillway
- Stream

Stormwater points

Stormwater Point
- Pipe Cross (not connected)
- Catchbasin
- Dry Well
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Treatment feature (see notes)
- Retrofit
- Unknown Point
- Information Point

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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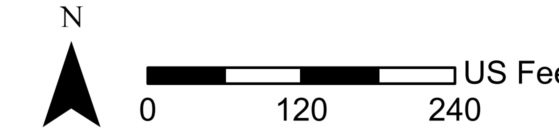
PU020

Map #4
Putney, Vermont

Basin 11 IDDE Project

Prepared for VT DEC

STONE ENVIRONMENTAL



LEGEND

Stormwater Point
- Catchbasin
- Yard drain
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Retrofit

Stormwater Line
- Storm line
- Swale
- Footing drain
- Under drain
- Roof drain
- Emergency spillway
- Stream

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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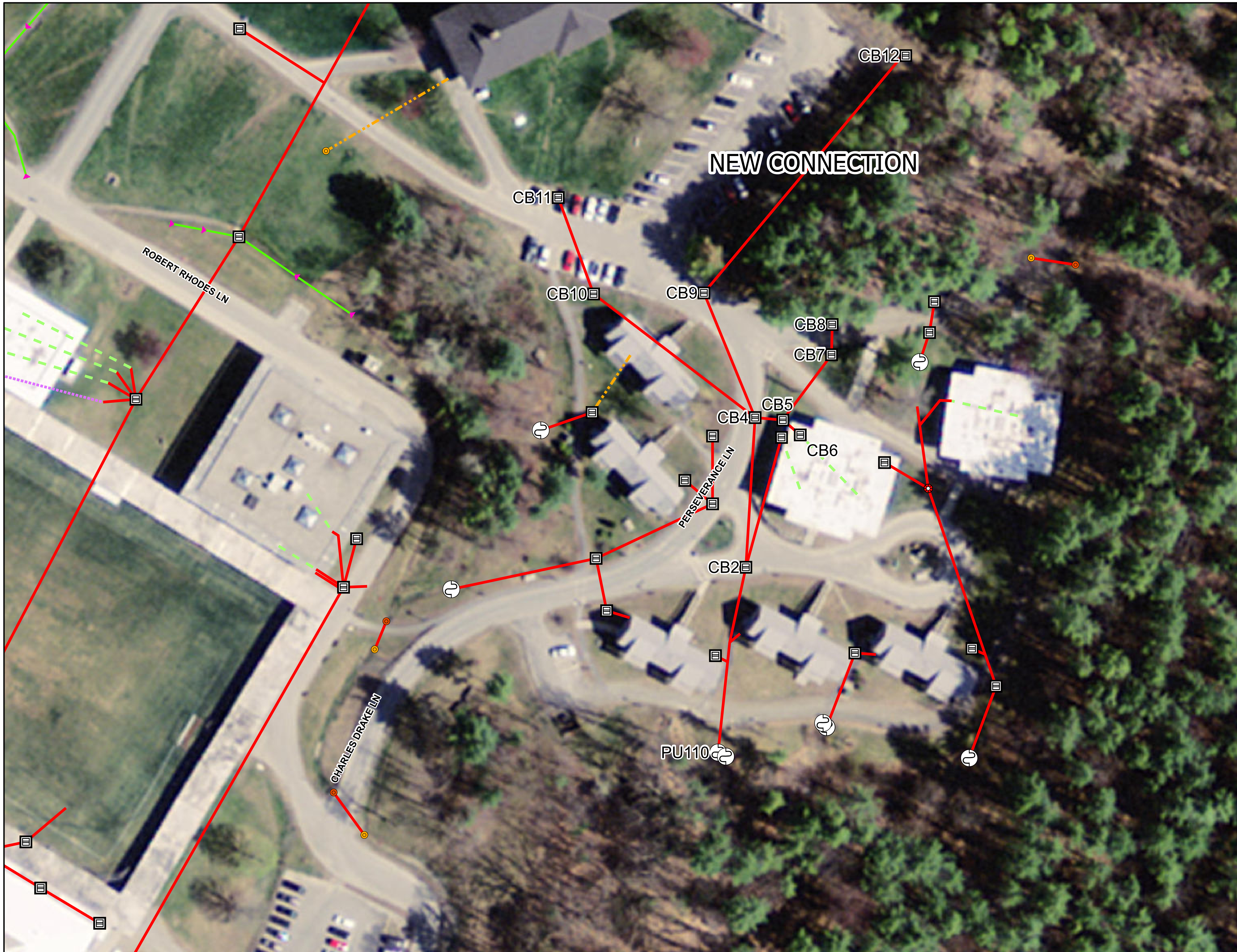
PU060

Map #5
Putney, Vermont

Basin 11 IDDE Project

Prepared for VT DEC

STONE ENVIRONMENTAL



N

LEGEND

US Feet
0 15 30 60 90 120

Stormwater Line
- Storm line
- Swale
- Footing drain
- Under drain
- Roof drain

Stormwater Point
- Catchbasin
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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PU110

Map #6
Putney, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 0.05 0.1 Miles

LEGEND

Stormwater Point

- Catchbasin
- Dry Well
- Grate/Curb Inlet
- Yard drain
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Pond outlet structure
- Retrofit

Stormwater Line

- Storm line
- Sanitary line
- Swale
- Footing drain
- Roof drain
- Trench drain
- Stream

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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PU230

Map #7
Putney, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 50 100 US Feet

LEGEND

Stormwater Point
- Catchbasin
- Junction Box
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit

Stormwater Line
- Storm line
- Sanitary line
- Swale
- Roof drain

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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PU240

Map #8
Putney, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

US Feet
0 15 30 60 90 120

Stormwater Line
- Storm line
- Sanitary line
- Swale
- Footing drain
- Under drain
- Stream

Stormwater Point
- Catchbasin
- Stormwater Manhole
- Outfall
- Unknown Point

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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PU330

Map #9
Putney, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

0 45 90 180 270 360 US Feet

Stormwater Line
- Storm line
- Stream

Stormwater Point
- Catchbasin
- Outfall
- Culvert outlet
- Retrofit
- Septic tanks

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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RO010

Map #10
Rockingham, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

0 60 120 240 360 480 US Feet

Stormwater Line

- Storm line
- Sanitary line
- Swale
- Footing drain
- Under drain
- Stream

Stormwater Point

- Catchbasin
- Outfall
- Culvert inlet
- Culvert outlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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RO030

Map #11
Rockingham, Vermont

Basin 11 IDDE Project

Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

US Feet
0 25 50 100 150 200

Stormwater Line
Storm line
Swale
Under drain
Stream

Stormwater Point
Catchbasin
Outfall
Culvert inlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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RO140

Map #12
Rockingham, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

US Feet
0 12.5 25 50 75 100

Stormwater Line
- Storm line
- Under drain
- Stream

Stormwater Point
- Catchbasin
- Outfall
- Culvert inlet
- Culvert outlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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RO150

Map #13
Rockingham, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

US Feet
0 10 20 40 60 80

Stormwater Line
- Storm line
- Storm line (old Sanitary line)
- Sanitary line
- Under drain

Stormwater Point
- Catchbasin
- Outfall
- Culvert inlet
- Culvert outlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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RO230

Map #14
Rockingham, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

0 50 100 200 300 400 US Feet

Stormwater Line

- Storm line
- Storm line (old Sanitary line)
- Sanitary line
- Swale
- Under drain
- Roof drain
- Stream

Stormwater Point

- Catchbasin
- Grate/Curb Inlet
- Junction Box
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit
- Information Point

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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RO260

Map #15
Rockingham, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 275 550 US Feet

LEGEND

Stormwater Point

- Catchbasin
- Grate/Curb Inlet
- Yard drain
- CB tied to sanitary sewer
- Stormwater Manhole
- Outfall
- Culvert inlet
- Culvert outlet
- Retrofit
- Information Point

Stormwater Line

- Storm line
- Storm line (old Sanitary line)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Stream

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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RO420

Map #16
Rockingham, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 45 90 US Feet

LEGEND

Stormwater Point

- Catchbasin
- Grate/Curb Inlet
- Outfall
- Retrofit

Stormwater Line

- Storm line
- Footing drain
- Stream

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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WX020

Map #17
Wardsboro, Vermont

Basin 11 IDDE Project

Prepared for VT DEC

STONE ENVIRONMENTAL

N

LEGEND

0 25 50 100 150 200 US Feet

Stormwater Line
- Storm line
- Sanitary line
- Swale
- Footing drain
- Stream

Stormwater Point
- Catchbasin
- Grate/Curb Inlet
- Junction Box
- Outfall
- Culvert inlet
- Culvert outlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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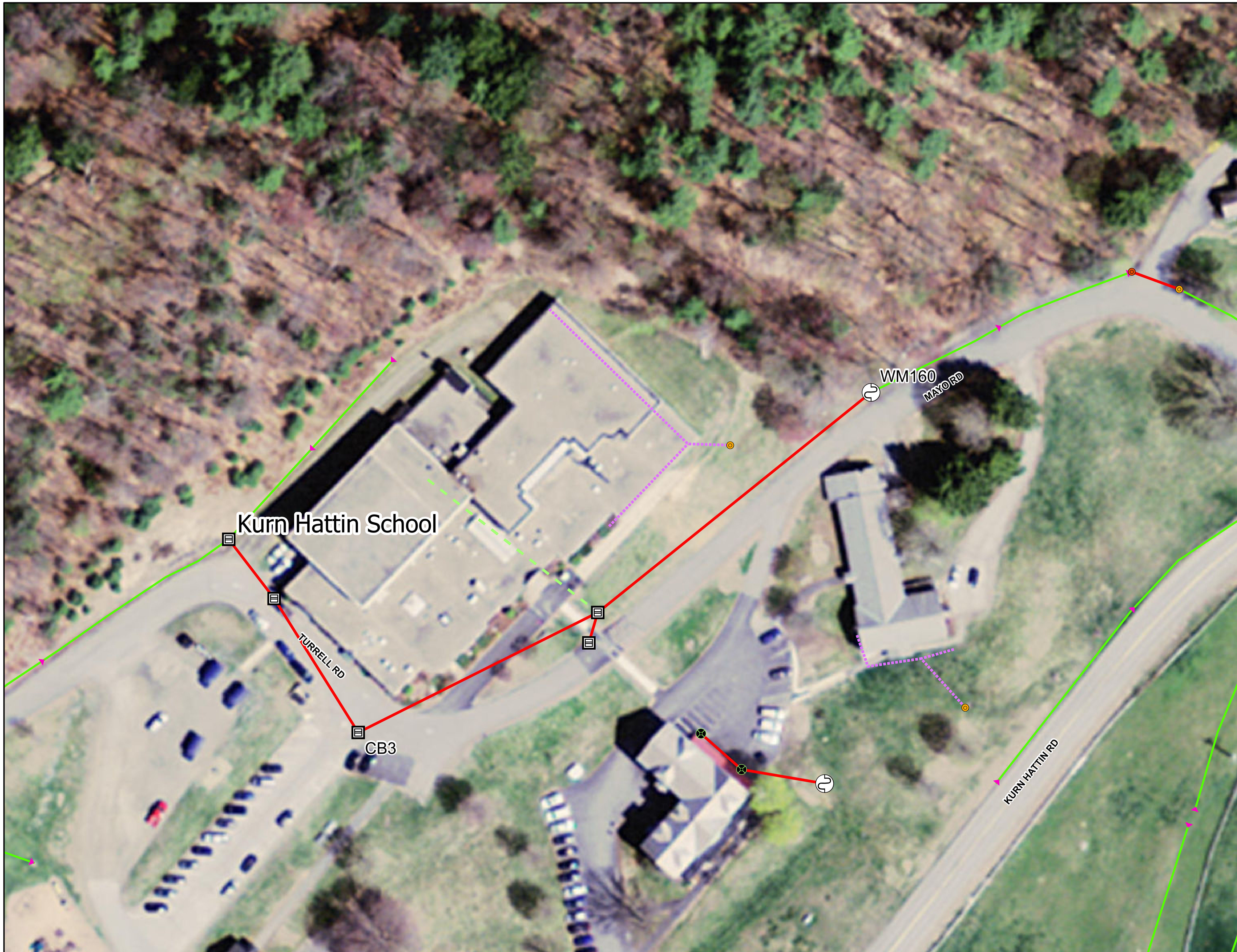
WM110 & WM120

Map #18
Westminster, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

Stone Environmental



N

LEGEND

0 15 30 60 90 120 US Feet

Stormwater Line
- Storm line
- Swale
- Footing drain
- Under drain
- Roof drain

Stormwater Point
- Catchbasin
- Yard drain
- Outfall
- Culvert inlet
- Culvert outlet

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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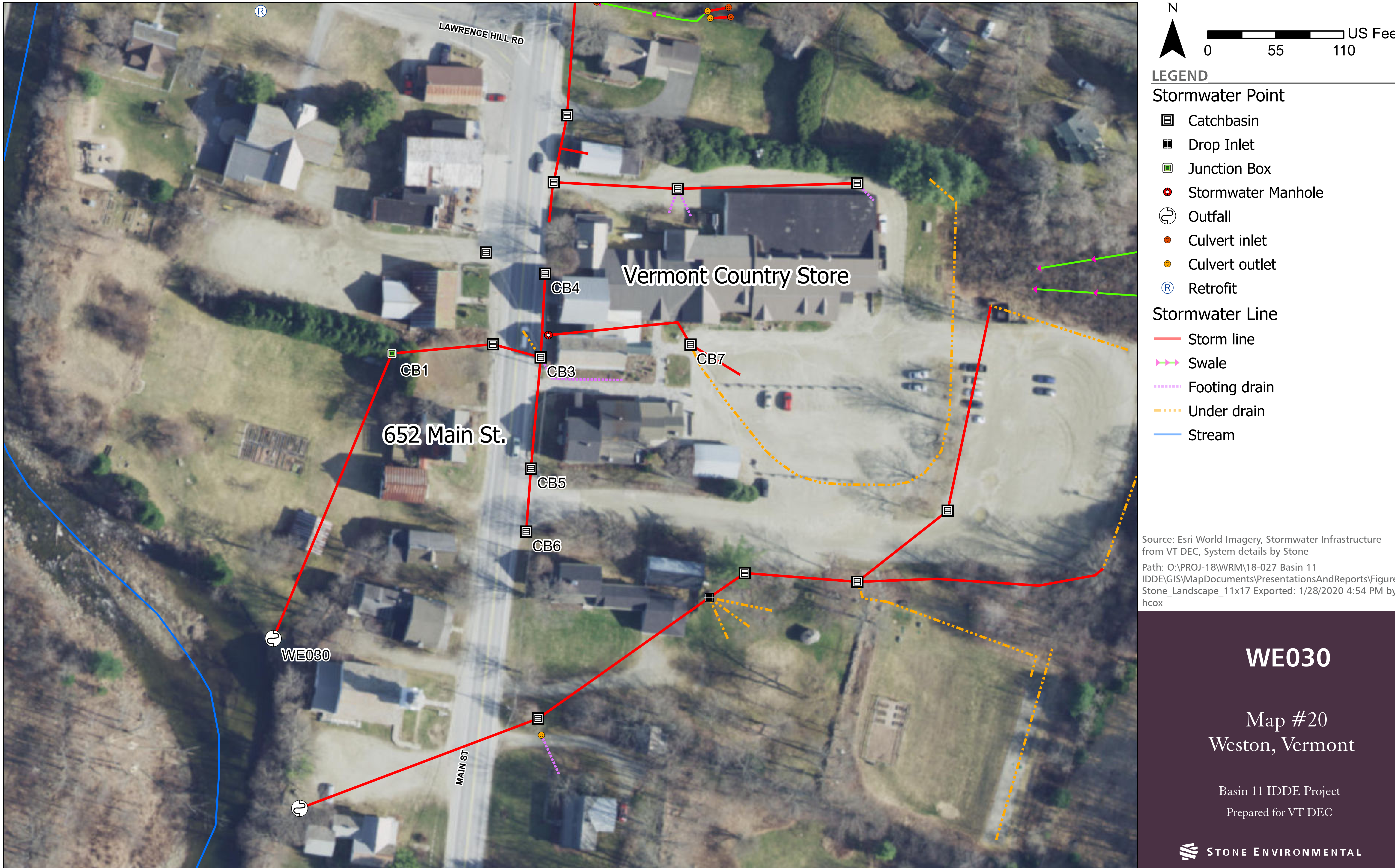
WM160

Map #19
Westminster, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL



Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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WE030

Map #20
Weston, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 55 110 US Feet

LEGEND

Stormwater Point
- Catchbasin
- Junction Box
- Outfall
- Culvert inlet
- Culvert outlet

Stormwater Line
- Storm line
- Swale
- Stream

Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

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WI020

Map #21
Winhall, Vermont

Basin 11 IDDE Project
Prepared for VT DEC

STONE ENVIRONMENTAL