Illicit Discharge Detection and Elimination Statewide Project #4

STONE ENVIRONMENTAL

PROJECT NO.

19-128

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Illicit Discharge Detection and Elimination Statewide Project #4: Final Report

Cover photo: Red dye at the SJ1730 outfall confirmed an illicit greywater connection

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1. Introduction

The goal of the Illicit Discharge Detection and Elimination Statewide Project #4 was to improve water quality by identifying and eliminating contaminated, non-stormwater discharges entering stormwater drainage systems (stormdrains) and discharging to Vermont waterways. The project was funded and administered by the Vermont Department of Environmental Conservation (DEC).

From May through September 2020, Stone assessed 140 stormdrains in Bolton, Coventry, Forest Dale in Brandon, Jay, Montgomery Village, Northfield, South Hero, Starksboro, St. Johnsbury, and Troy. Field tests were performed for ammonia; free chlorine; specific conductance; optical brighteners (OB), which are fluorescent whitening dyes contained in most laundry detergents; and methylene blue active substances (MBAS), which are common anionic detergents. Certain stormdrains were assessed in structures upstream from the mapped outfall location because the outfall could not be located, was buried or inaccessible, or was inundated by the receiving waterbody. Stormdrains and streams in and around the Jay Peak resort were also included in the assessments.

After detecting contaminants in 13 stormdrains in Coventry, Montgomery Village, Northfield, South Hero, and St. Johnsbury, advanced illicit discharge investigations were begun of these stormdrains. Additionally, 13 stormdrains with previously suspected illicit discharges were investigated in Barre City, Barre Town, Fairfield, Fayston, Hartford, Hyde Park, Montpelier, Morrisville, and Randolph, for a total of 26 advanced investigations. Stone initiated advanced investigations of stormdrains with suspected illicit discharges in 2020-2021 to confirm their presence and to attempt to determine their sources. DEC's stormwater infrastructure mapping was used to plan initial assessments and to guide advanced investigations in systems with suspected illicit discharges.

This report presents the initial assessment data as well as investigation findings for all the systems suspected of having illicit discharges. 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 Municipality

Municipality	Systems Assessed	Systems Assessed at Outfall	Systems Flowing or Dripping	Suspected Illicit Discharges	Confirmed Illicit Discharges
Barre City*	2	2	2	2	2
Barre Town*	2	2	1	0	0
Bolton	3	2	1	0	0
Coventry	4	3	1	2	1
Fairfield*	1	1	1	0	0
Fayston*	1	0	0	0	0
Forest Dale/Brandon	5	5	0	0	0

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Municipality	Systems Assessed	Systems Assessed at Outfall	Systems Flowing or Dripping	Suspected Illicit Discharges	Confirmed Illicit Discharges
Hartford*	1	1	1	0	0
Hyde Park*	1	1	1	1	1
Jay/Troy/Route 242	20	12	9	0	0
Montgomery Village	4	4	1	2	2
Montpelier*	6	6	5	4	0
Morrisville	1	0	0	1	0
Northfield	62	60	14	4	0
Randolph*	1	1	1	0	0
South Hero	7	5	2	3	3
St. Johnsbury	31	21	16	3	3
Starksboro	3	3	1	0	0
Total	**155**	**129**	**57**	**22**	**12**

* Indicates a municipality where only ongoing advanced investigations were performed

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2. Methods

2.1. Preparation for the Assessment

Preparation for the illicit discharge assessment included obtaining and assembling necessary equipment and supplies, preparing field maps, and contacting 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 annotated by staff in the field. A mobile field map application and data collection survey were developed. Communications with each municipality provided an opportunity to collect four key types of information:

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 Department of Public Works (DPW) 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 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, MBAS, and the presence of OB. Specific

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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 MBAS 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).

OB 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 OB, 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 OB. 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 OB 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 OB pad under fluorescent (left) and UV (right) lamps

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

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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 with 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, 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.
MBAS (anionic surfactants)	>=0.20 mg/L	Detection of low MBAS concentrations (0.10-0.30 mg/L) 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 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 OB. OB 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 greywater sources. Chlorine is degraded in the presence of organic materials; therefore, it is not a good wastewater indicator.

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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 OB monitoring throughout the drainage system. In several instances, we used OB 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 are 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 Barre City, Hyde Park, Montpelier, Morrisville, South Hero, and St. Johnsbury to identify potential improper connections. Camera inspections and smoke testing were performed in Barre City, Montpelier, Morrisville, and South Hero.

The findings of illicit discharge investigations in each town or village are presented in Sections 3 through 20. No suspected illicit discharges were identified in several municipalities (Bolton, Forest Dale in Brandon, Jay, Starksboro, and Troy); therefore, no further investigation occurred. In each of the remaining towns and villages, one or more illicit discharges were investigated.

2.4.1. *E. coli* and Phosphorus

At discharge points where wastewater contamination was suspected (because of a positive OB test, elevated ammonia, and/or septic odor), water samples were collected for *E. coli* and total phosphorus (TP) analyses. *E. coli* bacteria levels provide an indication of fecal contamination. Due to human health concerns, *E. coli* enumeration is recommended for all fresh waters used for contact recreation or water supply. Illicit discharges of sanitary wastewater via separated stormwater drainage systems or failed septic systems may contribute *E. coli*. Phosphorus was analyzed at all discharge points with suspected wastewater contamination because of its impact on the ecology and use of surface waters, particularly Lake Champlain. The State of Vermont's VAEL laboratory performed both analyses.

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Samples for *E. coli* analysis were collected in sterile, plastic 100-mL bottles and analyzed using Quanti-tray. Total P was analyzed by DEC's Standard Operating Procedure (SOP) for Determination of Phosphorus by Flow Injection, Revision 6. The preservation and holding time requirements are given in Table 4.

Table 4. Laboratory Sample Analyses

Parameter	Sample Container	Analytical Method	Sample Preservation	Holding Time
Total P	Glass vial (50 mL)	DEC SOP, Revision 6	Cool (4°C)	28 days
E. coli	Plastic (100 mL)	SM 9223B (Colilert Quanti-Tray)	Cool (4°C)	6 hours

At the same time that water samples were collected for *E. coli* and TP analyses, flow measurements were made to enable calculation of TP mass loading. Flow was measured by timing the filling of a container of known volume or using the float method.

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3. Barre City Results

Advanced investigations were performed in two systems in Barre City in 2020-2021. Data for these investigations are also included in Appendix B. The status of these investigations is described below.

3.1. BC560

BC560 drains a long section of Maple Avenue adjacent to the Hope Cemetery (Appendix C, Map 1). BC560 daylights in Gunners Brook upstream of the Brook Street bridge, behind 112 Maple Avenue. This system was flagged for reassessment based elevated concentrations of MBAS detergents, *E. coli,* and chlorine and detection of OB in 2016. In 2019 the City of Barre reportedly repaired a sewer pipe in the vicinity of CB2. Water quality data for this system are presented in Table 5.

Table 5. Water Analysis Data for Outfall BC560

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
BC560	9/23/2020	Dry	n/a	n/a	n/a	n/a	n/a	Checked 8-10 structures, all dry
BC560	11/17/20	Flowing	0.0	0.03	0.5	598	n/a	Clear, odorless
BC560	6/7/2021	Flowing	0.1	0.03	0.0	413	Negative	Suds present; WW odor in CB4, CB5, and CB6
BC560	9/2/2021	Flowing	0.0	n/a	n/a	n/a	n/a	
BC560-CB6	9/2/2021	Flowing	0.1	n/a	n/a	n/a	n/a	

Findings:

- In September 2018 Watershed Consulting Associates dye tested the sanitary sewer on Maple Avenue and ultimately found dye in catchbasin CB6 (Appendix C, Map 1). Despite repeated attempts, they were not able to repeat this result.
- On September 23, 2020, Stone checked 8-10 structures in this system, all of which were dry.
- A sample collected at the outfall on November 17, 2020, had elevated *E. coli* (727 MPN/100 mL) and TP (332 µg/L) concentrations (Table 31).
- On June 7, 2021, OB pads were deployed at the outfall and catchbasins CB1 through CB7. No OB was detected. However, a wastewater odor was observed in catchbasins CB4, CB5, and CB6.
- On September 2, 2021, Dave Braun, Jesse Attias (Stone), and Everett Hoyt (Barre City DPW) performed dye and smoke testing and camera inspection.

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- Dye was poured into the sanitary manhole on the north side of Hope Cemetery at the turnoff to the cemetery road. No dye was observed in any catchbasins.
- Dye was flushed in the toilet and sink in the maintenance building on Maple Avenue opposite the cemetery. Again, no dye crossed over to the stormdrain.
- Smoke testing was performed from a sanitary manhole located in the grass on the north side of the cemetery. No smoke was observed in the stormdrain.
- The smoke blower was then moved to a sanitary manhole on Maple Avenue downhill from the cemetery and the test was repeated. Diffuse smoke was observed at catchbasin CB6 (Figure 2), indicating crossover from the sanitary sewer. Smoke entered CB6 from the upstream direction. Catchbasin CB6 is the same structure at which Watershed Consulting observed dye in 2018 and Stone observed a wastewater odor on June 7, 2021.
- We were unable to perform pipeline inspections on this date due to traffic and a problem with the sewer camera transporter.

Figure 2. Smoke observed in catchbasin CB6

Conclusion: We suspect there is a break in the sanitary sewer main in the vicinity of catchbasin CB6 and storm manhole MH2. It is possible that damming by wastewater solids backs up sewer flow intermittently, causing it to leak from the sewer and enter the stormdrain through an unknown pathway. Such a scenario could explain the contamination in the system and the crossover of dye to CB6 during a test by Watershed Consulting in 2018. The likeliest point of wastewater entry to the stormdrain is to the pipe crossing Maple Avenue into MH2.

Resolution: Stone demonstrated there is a wastewater connection to the stormdrain in the vicinity of CB6 and MH2. We recommend the City of Barre camera the Maple Avenue sanitary sewer main in this area to pinpoint the wastewater leak or cross connection.

3.2. BC1630

This system drains sections of Hill, Nelson, and Camp Streets (Appendix C, Map 2). It discharges to Edgewood Brook east of Elmwood Cemetery. There is a long (>10 year) history of investigations and repairs of the sanitary sewer on Hill Street to eliminate discharges to the BC1630 stormdrain. Two leaking sections of sanitary sewer pipe and one broken house sewer lateral (204 Hill Street) have been replaced. More recently, a different consultant confirmed continuing wastewater contamination at the outfall (2,400 MPN/100 mL *E.*

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coli, 0.57 mg/L ammonia, and 0.25 mg/L MBAS), but was unable to locate the source. Watershed Consulting Associates concluded the remaining source must be below Nelson Street, which we believe is incorrect. Water quality data for this system are presented in Table 6.

Table 6. Water Analysis Data for Outfall BC1630

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
BC1630	9/23/2020	Flowing	3.0	0.00	0.8	292	n/a	Clear, obvious WW odor
BC1630-MH11	9/2/2021	Flowing	4.0	n/a	n/a	n/a	n/a	WW odor, grey biofilm
BC1630-MH12	9/2/2021	Trickling	0.0	n/a	n/a	n/a	n/a	

Findings:

- On a September 23, 2020, visit, an obvious wastewater odor was observed at the outfall. In addition to the standard tests, water was sampled for *E. coli*, TP, and pharmaceuticals and personal care products (PPCP) analyses.
  - Field tests revealed the presence of ammonia (3.0 mg/L) and MBAS detergents (0.8 mg/L).
  - High concentrations of six PPCPs were measured (Table 32). EPA indicated that the PPCP concentrations at the outfall were consistent with raw sanitary wastewater.
  - Concentrations of *E. coli* (>2,400 MPN/100 mL) and TP (2,220 µg/L) were also exceedingly high (Table 31).
- On September 2, 2021, Dave Braun, Jesse Attias, and Everett Hoyt performed dye and smoke testing and camera inspection on Hill Street.
  - Storm manhole MH10.5 was opened to determine if there could be a direct connection from a relict sewer main into this structure. Between the active storm drains entering from either side of Hill Street there is a sealed pipe connection in the 12:00 position (facing uphill), presumably from the old sanitary sewer. The seal appeared intact and there was no flow at this pipe penetration.
  - A grey biofilm was observed in storm manhole

Figure 3. Biofilm indicating wastewater contamination in MH11

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MH11, indicating presence of wastewater (Figure 3). A high concentration of ammonia (4.0 mg/L) was also measured.

- Dye added in the sanitary manhole at 204 Hill Street (adjacent to storm manhole MH12) appeared in storm manhole MH11 (Figure 4), demonstrating a sanitary connection above MH11 on Nelson Street.
- Dye was added again in the sanitary manhole at 204 Hill Street immediately before blowing smoke into this manhole. A camera was pushed from storm manhole MH12 downpipe toward MH11. At the maximum distance we could push the camera down the pipe (182 feet), no dye was observed in the stormdrain and smoke travelled up the pipe from the crossover point.

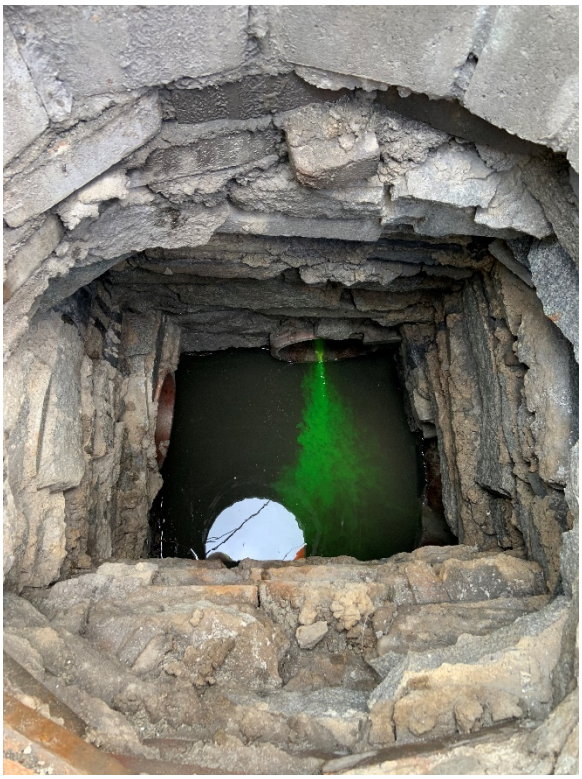

Figure 4. Dye entering stormwater manhole MH11

- The above test was repeated while pushing the camera up from storm MH11. At the maximum distance we could push the camera up the pipe (98 feet), the crossover point was not reached; dye and smoke entered the pipe further up the line.
- The distance between storm manhole MH11 and the sanitary manhole at 204 Hill Street is 330 feet. Therefore, the uninspected length of the stormdrain was approximately 50 feet. The crossover point into the stormdrain must be within this 50-ft. segment (between 98 and 148 feet up the pipe from MH11).

Conclusion: High concentrations of ammonia, MBAS detergents, PPCPs, *E. coli*, and TP and a strong wastewater odor all indicate there is an ongoing illicit wastewater discharge to this system. Through dye and smoke testing and camera inspection we isolated the crossover point of sanitary sewage to the stormdrain between 98 and 148 feet up the pipe from MH11.

Resolution: Working with the City DPW, Stone has demonstrated there is a fourth, substantial leak in the Hill Street sanitary sewer. We recommend the City of Barre reconstruct the sanitary sewer between Nelson Street and the sanitary sewer manhole at 204 Hill Street.

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4. Barre Town Results

Advanced investigations were performed in two systems in Barre Town in 2020-2021. Data for these investigations are also included in Appendix B. The status of these investigations is described below.

4.1. BT680

BT680 is a small system that drains Bolster Road in Barre Town (Appendix C, Map 3). The system discharges to a small tributary of the Jail Branch. BT680 was previously identified by a different consultant as having a suspected illicit discharge, the source of which was not confirmed. Water quality data for this system are presented in Table 7.

Table 7. Water Analysis Data for Outfall BT680

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
BT680	11/17/2020	1.3 L/min	0.0	0.02	0.3	3430	n/a	n/a
BT680	6/7/2021	Flowing	0.0	0.04	0.0	4910	Negative	n/a

Findings:

- Samples for *E. coli* and TP analyses were collected at the outfall on November 17, 2020. The flow rate was 1.3 L/min. Concentrations of *E. coli* (<1.0 MPN/100 mL) and TP (13.8 µg/L) were exceedingly low (Table 31).
  - No odor, suds, or other indicators of an illicit discharge were observed in CB1.
  - Concentrations of ammonia and free chlorine were below limits of detection.
- The outfall was resampled on June 7, 2021. While the specific conductivity was exceedingly high (4910 µS/cm), no OB or other contaminants were detected.

Conclusion: We do not believe there is a chronic illicit discharge in this system. We detected no indications of an illicit discharge in two separate assessments. The specific conductance is exceedingly high (presumably due to road salt accumulation), which interferes with analysis of detergents.

Resolution: Not applicable.

4.2. BT2440

BT2440 is a small system that drains sections of Smith Farm Road and Countryside Drive in Barre Town (Appendix C, Map 4). The system discharges south of Smith Farm Road to a small wetland, which flows to

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Edgewood Brook. BT2440 was previously identified by a different consultant as having a suspected illicit discharge, the source of which they did not confirm. Water quality data for this system are presented in Table 8.

Table 8. Water Analysis Data for Outfall BT2440

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
BT2440-CB1	9/23/2020	Wet/No flow	0.0	0.00	0.1	262	Negative	No odor

Findings:

- On September 23, 2020, samples were collected for *E. coli*, TP, and PPCP analyses. Samples were retrieved from the catchbasin CB1 sump because the outfall was dry.
  - No OB, odor, suds, or other indicators of an illicit discharge were observed in CB1.
  - Concentrations of ammonia, free chlorine, and MBAS in CB1 were below the limits of detection.
  - At catchbasin CB1, the *E. coli* concentration was elevated (1,986 MPN/100 mL) and three PCPPs (caffeine, cotinine, and paraxanthine) were detected at very low concentrations (Tables 31 and 32).
  - The area appears popular with dog walkers.

Conclusion: Stone generally avoids collecting samples of stagnant water from catchbasin sumps. On the date samples for PPCP and *E. coli* analyses were collected from the catchbasin CB1 sump, all pipes discharging to the catchbasin were dry. It was very difficult to collect samples without stirring up organic debris in the catchbasin. Furthermore, the catchbasin appears as a convenient repository for waste for the many dogwalkers on Smith Farm Road. We suspect the elevated *E. coli* concentration measured in catchbasin CB1 was caused by pet waste disposal in the catchbasin, an unfortunately common practice.

Resolution: We recommend placing a placard on the CB1 catchbasin grate warning residents not to dispose of pet waste in the catchbasin.

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5. Bolton Results

Illicit discharge detection was performed in Bolton in July 2020. Of the three systems assessed, one (BO03) was flowing during dry weather. Results of the initial assessments in Bolton are included in Appendix B. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

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6. Coventry Results

Illicit discharge detection was performed in Coventry in June 2020. Initial assessment data are included in Appendix B. Of the three stormwater drainage systems assessed, none were flowing during dry weather. Two had standing water. One system, CT01, was designated for further investigation due to detection of ammonia. Results of this investigation are described below. Additionally, an unmapped pipe (CT04) was found in the Black River that appeared to have discharged oil.

6.1. CT01

This system drains a small section of Main Street in Coventry before daylighting in a swale behind 235 Main Street. It also receives surface flow coming down Heermanville Road and Covered Bridge Road. Water quality data for this system are presented in Table 9.

Table 9. Water Analysis Data for Outfall CT01

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
CT01	6/17/2020	Wet (no flow)	0.5	0.04	0.2	1072	Negative	Heavy iron staining in swale, sheen, no odor
CT01-CB2	6/17/2020	Dry	n/a	n/a	n/a	n/a	Negative	n/a

Findings:

- A sample collected on June 17, 2020 from the swale below the CT01 outfall had a slightly elevated ammonia concentration (0.5 mg/L).
  - Iron staining was observed in the swale below the outfall (Figure 5).
  - OB pads set at the outfall and catchbasin CB2 were negative.
- On June 25, 2020, iron staining was observed in groundwater seeps in two other locations.

Conclusion: Iron staining and the elevated ammonia concentration measured in the swale likely result from a historic petroleum release. Ammonia is often associated with degraded petroleum and accumulations of ferric iron, due to reducing conditions in shallow groundwater. However, the origin of contamination is not clear in this case. The nearest known petroleum release (Berkewitz Transport; site 93-1449) is approximately 300 feet north of the closest catchbasin in the CB01 stormdrain. We suspect the low ammonia concentration and iron staining observed in the swale below the CT01 outfall result from a historic petroleum release, rather than a currently active discharge.

Resolution: Not applicable.

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Figure 5. Iron staining in swale below outfall CT01

6.2. Unmapped Outfall Near CT03 Outfall

An unmapped, submerged, 8-inch diameter iron pipe was found next to the CT03 outfall in a small backwater on the south bank of the Black River just upstream of the VT Route 14 bridge (Appendix C, Map 5). The coordinates of the pipe are 44°52'02.6" N, 72°15'43.1" W. Note that the line shown from McDermott's Garage to the unidentified pipe is assumed.

Findings:

- When first observed on June 25, 2020, this pipe was noticeable due to the plume of black, oily sediment at the outlet (Figure 6). The plume of oily sediment measured roughly 4 feet x 6 feet. When probed, this sediment plume released bubbles of black oil which floated to the surface. Multiple stained white shop

Figure 6. Oily sediment plume from unmapped iron pipe

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rags were also seen in this sediment. The pipe did not appear to be flowing at the time of inspection.

- The closest facility to this outfall is a garage operated by McDermott's Inc., a trucking company.
- The garage site currently operated by McDermott Inc. is the site of a previous hazardous materials release (file 93-1449) when operated by a former business, Burkewitz Transport. Three leaking underground fuel storage tanks and 200 cubic yards of petroleum contaminated soil were removed from the site. Subsequent testing demonstrated acceptably low levels of petroleum vapor in the buildings on site. A plan for the site, provided in a letter dated February 15, 1994, from Dufresne-Henry, Inc. (Bruce Cox, P.E.) to the VTDEC Hazardous Materials Management Division (Chuck Schwer), shows a 4-inch diameter clay pipe passing diagonally across the site. It is likely this pipe is connected with the submerged iron pipe observed in the Black River, although this has not been confirmed. There is no mention of the iron pipe in the 93-1449 site file. If the clay tile line is connected with the iron pipe, the presence of the oily deposit at the pipe outlet may result from residual petroleum migrating from the site via the clay tile line to the Black River. However, the presence of rags at the site suggests a more direct connection, such as from a connected floor drain or sink in the garage building.

Conclusion: Because of the presence of petroleum and shop rags at the outlet of this pipe and due to its proximity to McDermott's Inc.'s garage, we suspect that the source of this discharge is a floor drain or sink in the garage.

Resolution: These findings were sent to the Town of Coventry's Road Commissioner on May 15, 2023, with a request that the Town of Coventry contact McDermott's garage. The VTDEC Hazardous Materials Management Division was recently notified of this issue in November 2023.

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7. Fairfield Results

Stone investigated one system, FFD01, in Fairfield in July 2020. A description of the investigation is included below.

7.1. FFD01

FFD01 is located on Route 36 in East Fairfield. It drains both sides of the highway before turning north and discharging into a swale behind a gas station and auto repair shop (Appendix C, Map 6). This system was flagged for advanced investigation based on high concentrations of ammonia and detergents measured by Watershed Consulting in 2017-2018 (WCA 2019). Stone collected the water quality data presented in Table 10.

Table 10. Water Analysis Data for Outfall FFD01

Structure ID	Date Assessed	Dry, Wet/no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
FFD01-CB2	7/6/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Negative	n/a
FFD01-CB3	7/6/2020	Dry	n/a	n/a	n/a	n/a	Negative	n/a
FFD01	7/13/2020	Dripping	0.0	n/a	<0.7[1]	n/a	Negative	Dripping after rain

1. MBAS measurement uncorrected

Findings:

- Catchbasin CB1 is located at the edge of a parking area and within 100 feet of the gasoline pumps.
- On July 6, 2020, Stone deployed OB pads at the outfall and in catchbasins CB2 and CB3. Catchbasin CB2 had water in the sump, and CB3 was dry. No OB was detected.
- The outfall was dripping when observed on July 13, 2020, following a light rain. No ammonia was detected. The uncorrected MBAS concentration was 0.7 mg/L. No conductivity measurement was made due to insufficient sample volume; therefore, the raw MBAS value cannot be corrected. Especially given the setting, we speculate that interference by chlorides is responsible for the elevated raw MBAS concentration.

Conclusion: There does not appear to be a chronic illicit discharge in this system. This system was not flowing on two visits in July 2020 and OB was not detected. Given the location of catchbasin CB1 at the edge of a gas station parking lot, it is quite likely that detergents and other automotive contaminants may runoff to the stormdrain during rain events. However, this runoff would not constitute an illicit discharge.

Resolution: Not applicable.

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8. Fayston Results

FAY-01-05 is a site on an unnamed tributary to Chase Brook in Fayston below a Sugarbush Resort parking lot (Appendix C, Map 7). Watershed Consulting recommended this site for advanced investigation due to concern that septic systems in the drainage area might have failed, discharging raw or poorly treated wastewater to the stream (WCA 2019). The basis for their concern was an elevated *E. coli* concentration (870 MPN/100 mL) and an "alert" by a dog trained to detect wastewater.

The FAY-01-05 site was sampled by Jim Pease on September 23, 2020, for *E. coli*, TP, and PPCPs. No PPCPs were detected, and the concentrations of *E. coli* (<1.0 MPN/100 mL) and TP (8.1 µg/L) were negligible (Tables 31 and 32). Therefore, we suspect that any wastewater contamination that may have been present at the time of Watershed Consulting's testing was transient, and that there is no chronic illicit discharge at this location.

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9. Forest Dale (Brandon) Results

Illicit discharge detection was performed in the unincorporated Village of Forest Dale in Brandon in July 2020. None of the five systems assessed were flowing during dry weather. Results of the initial assessments in Forest Dale are included in Appendix B. No systems were designated for further investigation.

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10. Hartford Results

Advanced investigation was performed on a single system in Hartford in May 2021. The status of this investigation is described below.

10.1. HRT446

HRT446 is located at the Town of Hartford's Maxfield Outdoor Sports Complex off North Hartland Road on Leslie Drive. This system was flagged for advanced investigation by Watershed Consulting Associates based on testing in 2017-2018 (WCA 2019). The facility has an onsite wastewater treatment system, which is indicated on Map 8 in Appendix C. Stone collected the water quality data presented in Table 11.

Table 11. Water Analysis Data for Outfall HRT446

Structure ID	Date Assessed	Dry, Wet/no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	Observations
HRT446	5/20/2021	Flowing	0.4	0.00	0.1	708	Cloudy, metallic odor, iron floc
HRT446-Cl2	5/20/2021	Flowing	0.5	0.02	0.1	770	Metallic odor, iron floc

Findings:

- On November 17, 2020, samples collected at the outfall had low concentrations of *E. coli* (31.3 MPN/100 mL) and TP (35.1 µg/L) (Table 31).
- Stone assessed the HRT446 drainage system on May 20, 2021.
  - There was no discernable connection from the onsite wastewater treatment system to the HRT446 stormdrain. Catchbasin CB1, which is closest to the wastewater system, had no outflow.
  - Flow at the outfall and in manhole MH1 (Figure 7) had an orange (iron) hue and a metallic sheen and odor.
  - All flow through the HRT446 system appeared to originate on the tree nursery property immediately south of the sports

Figure 7. Stormwater manhole MH1

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complex. Surface runoff and shallow groundwater were flowing off the nursery property in at least two areas (Figures 8 and 9). In the location labelled "drain outlets" on Map 8, the outlets of multiple drainage pipes were visible in a shallow gully (Figure 9). Flow from the nursery enters the HRT446 stormdrain at the culvert inlet labelled CI1 (Figure 10). The water flowing into CI1 had the same orange (iron) hue and metallic odor as the water in manhole MH1 and at the outfall.

Figure 8. Runoff from tree nursery property

Figure 9. Gully and drainage pipe at north side of nursery property

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Conclusion: We found no evidence of an illicit discharge on the property of the sports complex. The poor water quality in the HRT446 stormdrain flows into the stormdrain from the tree nursery south of the sports complex.

Resolution: It is unclear what, if any, recourse DEC or the Town of Hartford may have to reduce flow and transport of iron floc from the nursery property onto the sports complex property.

Figure 10. Culvert inlet (CI1) to the HRT446 stormdrain

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11. Hyde Park Results

Advanced investigation was performed on a single system in Hyde Park in 2020-2021. Data for this investigation are included in Appendix B. The status of this investigation is described below.

11.1. HDP01

The HDP01 system drains a short section of VT Route 100 in North Hyde Park near the intersection of Route 100C (Appendix C, Map 9). The system crosses private property and discharges to the Gihon River. In 2018 Watershed Consulting detected several contaminants in catchbasin CB1: ammonia (99 mg/L), MBAS (0.25 mg/L), and *E. coli* (>2400 MPN/100 mL) (WCA 2019). A wastewater odor was also observed. Subsequent smoke and dye testing revealed no direct connections to the stormdrain. Watershed Consulting ruled out the house at 5169 VT-100 as a possible source and suspected that contaminants were leaching into the stormdrain from the septic system at the Round Hill Kids Child Care Center.

Stone collected the water quality data presented in Table 12.

Table 12. Water Analysis Data for Outfall HDP01

Structure ID	Date Assessed	Dry, Wet/no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
HDP01	7/1/2020	Flowing	0.1	0.03	0.3	474	Negative	Clear, no odor
HDP01-CB1	7/1/2020	Wet (no flow)	0.1	0.02	0.3	339	Negative (x3)	Clear, no odor
HDP01-CB2	7/1/2020	Dry	n/a	n/a	n/a	n/a	Negative	n/a
HDP01-CB3	7/1/2020	Dry	n/a	n/a	n/a	n/a	Negative	n/a
HDP01-CB4	7/1/2020	Dry	n/a	n/a	n/a	n/a	Negative	n/a
HDP01	8/25/2020	Flowing	n/a	n/a	n/a	n/a	Negative	n/a
HDP01-CB1	8/25/2020	Wet (no flow)	0.0	n/a	n/a	n/a	n/a	n/a
HDP01-CB1	8/31/2020	Wet (no flow)	0.0	n/a	n/a	n/a	n/a	n/a
HDP01-CB2	8/31/2020	Wet (no flow)	0.0	n/a	n/a	n/a	n/a	n/a
HDP01-CB4	8/31/2020	Wet (no flow)	0.0	n/a	n/a	n/a	n/a	n/a

Findings:

- Stone began advanced investigation of this stormdrain on July 1, 2020. In catchbasin CB1, an unmapped 6-in diameter pipe (Figure 11) was noted entering the sump from the direction of the childcare center. It was mostly plugged with sediment.
  - The MBAS concentration at the outfall and at CB1 was slightly elevated, 0.3 mg/L.

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- On August 3, 2020, samples were collected at the outfall for *E. coli* and TP analysis. Concentrations of both *E. coli* (770.1 MPN/100 mL) and TP (211 µg/L) were elevated (Table 31).
- Stone obtained the septic system design plans for the Round Hill Kids Childcare Center, which show that the leachfield is at the top of the bank immediately uphill of catchbasin CB1 (Figure 12).
- On August 25, 2020, we dye tested the Round Hill Kids Childcare Center. Green dye was flushed down the toilet in the staff bathroom, and a timelapse camera and an OB pad were set up at the outfall. The camera recorded footage for five days.
  - No dye was seen in the timelapse photos, nor was dye visible on the pad left at the outfall. We do not regard these results as definitive evidence of a lack of an indirect connection because nighttime photographs were black and white and lower resolution and high flow storm events could well have diluted the dye beyond recognition. The pad was also negative for OB.

Figure 11. Pipe junctions in catchbasin CB01

Figure 12. Proximity of catchbasin CB01 (at cone) to leachfield

- During a third visit to the site on August 31, 2020, the ammonia concentration in catchbasins CB1, CB2, and CB4 were below detection.
- VTrans cleaned catchbasin CB1 during the summer of 2021, enabling camera inspection. On September 18, 2021, Dave Braun and Jim Pease inspected catchbasin CB1 with a push camera. The camera was inserted into pipe B (Figure 11), the unmapped pipe aligned with the Childcare Center. Beyond the concrete wall of the catchbasin, the pipe changes to corrugated metal. Only 2-3 feet into

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the pipe the camera was stopped by a solid plug of wet sediment. The sediment was stained orange with iron.

- On September 18, 2021, a sample collected from the CB1 sump had an ammonia concertation of 0.3 mg/L. After pumping down the catchbasin, we attempted to collect a sample inside Pipe B. This pipe B sample had the same ammonia concentration as the sump.

Conclusion: Based on the elevated *E. coli* concentration at the outfall, detection of ammonia in CB1 on VT Route 100, and the location and elevation of the leachfield at the Round Hill Kids Childcare Center relative to the stormdrain, we conclude that partially renovated wastewater from the Round Hill Kids Childcare Center infiltrates the HDP01 stormdrain at catchbasin CB1 before discharging to the Gihon River. This indirect connection was not conclusively established; however, it appears to be the only plausible explanation. Therefore, Stone's investigation reinforces Watershed Consulting's earlier conclusion.

Resolution: Infiltration of partially renovated effluent from onsite wastewater systems to downgradient stormdrains is not uncommon. As we have seen repeatedly, there is little the State of Vermont can do to remedy this. In the case of system HDP01, Stone recommended VTrans seal the opening of Pipe B in CB1.

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12. Jay/Troy/Route 242 Results

Illicit discharge detection was performed in Troy and Jay and along a section of VT Route 242 in June and July 2020. Of the 15 systems assessed, two were flowing during dry weather, two were trickling, and the others were either wet (not flowing) or dry. Results of initial assessments in these systems are included in Appendix B.

In addition to stormdrain assessments, five stream sites were sampled downstream of the Jay Peak resort on tributaries of the Jay Branch. These stream sites are identified as JB01 through JB05 in Table 31. Across the five stream sites, the concentrations of *E. coli* (range: 2.0–43.2 MPN/100 mL) and TP (range: 5.8–9.8 μg/L) were very low.

No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

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13. Montgomery Village Results

Illicit discharge detection was performed in Montgomery Village in July and August 2020. Of the four systems assessed, one was consistently flowing during dry weather. Results of the initial assessments in Montgomery Village are included in Appendix B. Two systems were designated for further investigation. The status of these investigations is described below.

13.1. MV01

The MV01 system drains a section of North Main Street east of the village center. MV01 daylights in a roadside swale near the town garage (Appendix C, Map 10). Water quality data for this system are presented in Table 13.

Table 13. Water Analysis Data for Outfall MV01

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
MV01	7/21/2020	Wet (no flow)	0.3	n/a	0.5	684	Positive (weak)	No odor, slightly turbid
MV01	8/19/2020	n/a	n/a	n/a	n/a	n/a	Positive	n/a
MV01-CB01	8/19/2020	n/a	n/a	n/a	n/a	n/a	Negative	n/a
MV01-CB02	8/19/2020	n/a	n/a	n/a	n/a	n/a	Positive (strong)	Strong wastewater odor

Findings:

- The initial assessment of MV01 was conducted on July 21, 2020. There was no flow at the outfall, but an OB pad was deployed and water samples were taken in the pool below the outfall. Ammonia and MBAS concentrations were slightly elevated (0.3 mg/L and 0.5 mg/L, respectively) and a weak OB signal was detected.
- On August 19, 2020, OB was detected at the outfall and in CB02 (Figure 13). A strong wastewater odor was observed in catchbasin CB02 and fluorescence of the OB pad was strong.

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Conclusion: Ammonia, MBAS, OB, and a wastewater odor were observed in MV01. These data indicate an illicit wastewater discharge to MV01. We suspect wastewater enters catchbasin CB02 through the underdrain that parallels Route 118, which is noted on Appendix C, Map 10. The length of this underdrain is unknown. The likeliest wastewater source is 1962 North Main Street, an auto repair shop.

Resolution: The Town of Montgomery is making progress planning community wastewater treatment systems for Montgomery Village and Montgomery Center. Stone is part of a team assisting the town in designing these systems. The MV01 drainage system is within the area to be served by the new village system. Construction of the wastewater collection and treatment systems is projected for 2025. Stone is confident that construction of the village wastewater system will eliminate any existing illicit wastewater discharges in Montgomery Village.

Figure 13. Catchbasin CB02 on stormdrain MV01

13.2. MV04

MV04 drains two catchbasins on Main Street in Montgomery Village (Appendix C, Map 11). It also conveys a small stream that enters the stormdrain from the northeast, at the location labeled "culvert inlet". The system daylights in a horse pasture south of Main Street before flowing several hundred feet to join the Trout River. MV04 was flagged for advanced investigation based on a positive OB reading. Water quality data for this system are presented in Table 14.

Table 14. Water Analysis Data for Outfall MV04

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
MV04	7/21/2020	Trickling	0.0	0.03	0.0	95.9	Positive (weak)	Clear, no odor
MV04-CB02	8/19/2020	n/a	n/a	n/a	n/a	n/a	Negative	n/a
MV04	8/25/2020	Flowing	n/a	n/a	n/a	n/a	Negative	Foamy
MV04-CB01	8/25/2020	Flowing	n/a	n/a	n/a	n/a	Negative	n/a
MV04-CB01	8/31/2020	Flowing	0.6	0.08, 0.07	0.1	143.1	n/a	n/a
MV04-SW01	8/31/2020	Flowing	0.5	n/a	n/a	n/a	Lost	n/a
MV04-SW02	8/31/2020	Flowing	0.0	n/a	n/a	n/a	n/a	n/a

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Findings:

- Water samples were collected at the outfall on July 21, 2020. OB was detected at the outfall, although the fluorescence was weak. A small amount of foam was also noted (Figure 14). The specific conductance was very low (95.9 μS/cm).
- In subsequent visits on August 19 and 25, 2020, we attempted to bracket the source of the OB. OB pads were placed at the outfall and in catchbasins CB01 and CB02. All these pads were negative.
- A fourth visit was made on August 31, 2020. Ammonia was detected at catchbasin CB01 and the culvert inlet (SW01). No ammonia was detected a short distance upstream from the culvert inlet (SW02). A faint wastewater odor was noted in the churchyard adjacent to the stream.

Figure 14. Suds at the MV04 outfall, July 21, 2020

Conclusion: Based on the presence of OB at the outfall on one occasion and the increase in the ammonia concentration (+0.5 mg/L) from SW02 to SW01, we suspect wastewater from an adjacent leachfield is migrating to the unnamed stream. Considering the proximity of the church to the stream and the faint wastewater odor observed in the churchyard, we suspect the leachfield serving the church is malfunctioning.

Resolution: The Town of Montgomery is making progress planning community wastewater treatment systems for Montgomery Village and Montgomery Center. Stone is part of a team assisting the town in designing these systems. The MV04 drainage system is within the area to be served by the new village system. Construction of the wastewater collection and treatment systems is projected for 2025. Stone is confident that construction of the village wastewater system will eliminate any existing illicit wastewater discharges in Montgomery Village.

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14. Montpelier Results

Illicit discharge detection was performed in Montpelier in July 2020. Six systems were assessed, five of which were flowing during dry weather. Assessment data are included in Appendix B. Three systems were investigated in more detail, and these are described below.

14.1. MP370

MP370 drains parts of Franklin Street, Scribner Place, Main Street, North Street, and the Main Street Middle School property (Appendix C, Map 12). The outfall discharges to the North Branch River at the base of a retaining wall behind 14 Franklin Street. Water quality data for this system are presented in Table 15.

A direct wastewater connection was eliminated at 172 Main Street in 2016, which required installation of a new sewer lateral to 172 Main Street. However, after this wastewater discharge was eliminated, detergent suds continued to appear in manhole CB7 (Figure 15), indicating an additional illicit discharge exists. Based on earlier camera inspection, we suspect this discharge occurs from the apartment in the rear of 176 Main Street.

Table 15. Water Analysis Data for Outfall MP370

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
MP370	7/9/2020	Flowing	n/a	n/a	n/a	n/a	n/a	
MP370-CB3	7/9/2020	Dry	n/a	n/a	n/a	n/a	n/a	No odor
MP370-CB3B	7/9/2020	Dry	n/a	n/a	n/a	n/a	Negative	No odor
MP370-CB3C	7/9/2020	Dry	n/a	n/a	n/a	n/a	Negative	No odor
MP370-CB4	7/9/2020	Dry	n/a	n/a	n/a	n/a	Negative	No odor
MP370-CB6	7/9/2020	Dry	n/a	n/a	n/a	n/a	Negative	No odor
MP370-CB7	7/9/2020	Dry	n/a	n/a	n/a	n/a	Lost	Dry, no odor
MP370	7/16/2020	Flowing	0.1	0.00	0.3	3100	Negative	Clear, slight odor

Findings:

- OB pads were deployed throughout the system on July 9, 2020; no OB was detected. All the catchbasins accessed were dry. At the time of assessment, the basketball court at Main Street Middle School was being rebuilt and catchbasin CB6 had been replaced.

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- Samples collected at the outfall on July 16, 2020, had slightly elevated MBAS (0.3 mg/L) and *E. coli* (461.1 MPN/100 mL) concentrations (Table 31).
- Dye testing of the apartment at the back of 176 Main Street was attempted on September 8, 2021; however, we could not access the apartment. Flow in manhole CB7 was clear and there was no odor.
- A sample collected at the outfall on September 8, 2022, had 124.6 MPN/100 mL *E. coli*.

Figure 15. Detergent suds entering manhole CB7

Conclusion: A significant illicit discharge to this stormdrain was eliminated. However, based on the information we have, we suspect an additional illicit discharge remains upstream of manhole CB7.

Resolution: As of July 2022, the Montpelier DPW was planning to smoke test the stormdrain. Per email correspondence with Kurt Motyka on June 6, 2023, smoke testing has not been completed. The DPW suspects that recent work done on the Union Elementary School property may have resolved the issue. Stone recommends further testing (for example, new time lapse photography) to establish whether a problem remains in this stormdrain.

14.2. MP580

MP580 drains a short section of State Street and the intersection of State Street and Bailey Avenue as well as the parking lot of an office building (Appendix C, Map 13). The outfall is located at the base of a steep bank on the Winooski River just downstream of the Bailey Avenue bridge. In 2017 the Montpelier DPW eliminated a direct wastewater connection from 153 State Street to catchbasin CB3. Despite this work, Stone detected OB in CB3 in follow-up testing. Smoke testing in combination with camera inspection indicated that a perforated road underdrain discharging to catchbasin CB3 was intercepting wastewater from a slow leak in a joint in the State Street sanitary sewer main, where the sewer main crosses over the underdrain.

Water quality data collected for this study are presented in Table 16.

Table 16. Water Analysis Data for Outfall MP580

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
MP580	7/16/2020	Dry	n/a	n/a	n/a	n/a	Negative	Dry
MP580-CB3	7/16/2020	Dry	0.1	0.01	0.5	318	Negative	Clear, slight odor

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Findings:

- The MP580 outfall was dry when this stormdrain was reassessed on July 16, 2020. OB pads left at the outfall and catchbasin CB3 were both negative. A low MBAS concentration (0.5 mg/L) was measured in the catchbasin CB3 sump.
- Public Works Director Kurt Motyka indicated in a July 6, 2022, email that the City of Montpelier is interested in sliplining the sanitary sewer in this area to eliminate the slow wastewater leak.

Conclusion: Conditions were dry when this system was reassessed in 2020 and the only indications of a continuing discharge were a slight odor and an elevated MBAS concentration in the catchbasin CB3 sump. Notwithstanding this result, the smoke testing and camera inspection Stone performed with Montpelier DPW and the Vermont Rural Water Association in 2017 pointed convincingly to a small leak in the State Street sanitary sewer intercepted by the underlying road underdrain and discharged at catchbasin CB3.

Resolution: Public Works Director Kurt Motyka confirmed in an email message on June 6, 2023, that the City plans to slipline the section of sanitary sewer on State Street crossing over the underdrain.

14.3. MP590

MP590 is a large system that drains the majority of Bailey Avenue, as well as portions of Baldwin Street, Terrace Street, Chapman Road, Clarendon Avenue, and the entirety of Dwinell Street, Dewey Street, and Sunnyside Terrace (Appendix C, Map 13). MP590 is a combined sewer overflow (CSO) system; there is an overflow weir on lower Bailey Avenue. In 2017 the City of Montpelier replaced the sanitary sewer and water lines from the intersection of Clarendon Avenue and Bailey Avenue up Clarendon Avenue to Jordan Street. A cross country sewer line was also mostly eliminated. These changes eliminated direct wastewater connections as well as leaking waterlines. This system was retested to confirm whether all illicit discharges had been eliminated. Water quality data for this system are presented in Table 17.

Table 17. Water Analysis Data for Outfall MP590

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
MP590	7/16/2020	Flowing	0.0	0.06	0.15	736	Negative	Clear, slight odor
MP590	9/8/2021	Flowing	0.0	0.06	0.11	684	Negative	No odor

Findings:

- The MP590 outfall was tested on July 16, 2020. No ammonia or OB were detected, and negligible chlorine and MBAS were measured. No *E. coli* were detected, and the TP concentration (11.8 µg/L) was very low (Table 31).
- The outfall was retested on September 8, 2021, and there was no evidence of continued illicit discharges to this system.

Conclusion: We confirmed that no illicit discharges remain to this system.

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Resolution: Illicit discharges to this system were successfully eliminated by the Montpelier DPW.

14.4. MP1350

MP1350 drains lower Berlin Street, Cedar Hill Lane, Wilson Street, and George Street (Appendix C, Map 14). The outfall discharges on a steep bank of the Winooski River north of River Street. Water quality data for this system are presented in Table 18.

This investigation focused on the Wilson Street neighborhood, where a prior Stone investigation indicated a possible wastewater connection. The existence of a combined sewer line on Highland Avenue, which was originally mapped by DEC as a separated stormdrain, has confused interpretation of water quality data. We also suspected a water leak near the intersection of Wilson Street and Highland Avenue, draining to catchbasin CB22. The Montpelier DPW reportedly repaired a water leak in this area prior to 2020.

Table 18. Water Analysis Data for Outfall MP1350

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
MP1350	7/9/2020	Flowing	n/a	0.00	0.4	968	Negative	Clear, no odor
MP1350-CB22	7/9/2020	Flowing	n/a	n/a	n/a	n/a	Negative	No odor
MP1350-CB23	7/9/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Negative	n/a
MP1350-CB24	7/9/2020	Dry	n/a	n/a	n/a	n/a	Negative	No odor
MP1350-CB28	7/9/2020	Dry	n/a	n/a	n/a	n/a	Indeterminate	No odor
MP1350-CB28B	7/9/2020	Trickling	n/a	n/a	n/a	n/a	Positive (weak)	Clear, no odor
MP1350-CB22	9/8/2021	Flowing	n/a	0.22	n/a	n/a	n/a	Clear, no odor
MP1350	8/15/2022	Unknown	n/a	n/a	n/a	n/a	Negative	
MP1350-CB1	8/15/2022	Unknown	n/a	n/a	n/a	n/a	Negative	
MP1350-CB9	8/15/2022	Unknown	n/a	n/a	n/a	n/a	Negative	
MP1350-CB11	8/15/2022	Unknown	n/a	n/a	n/a	n/a	Negative	

Findings:

- The outfall and several catchbasins in the Wilson Street neighborhood were tested on July 9, 2020. The MBAS concentration measured at the outfall was slightly elevated (0.4 mg/L); however, OB was not detected. No chlorine was detected at the outfall.
- In catchbasin CB28 on George Street, an unmapped 4-inch clay pipe (Figure 16) enters from the direction of 17 George Street. On July 16, 2020, a trickle of water was flowing out of the pipe. An OB

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pad placed in the pipe opening was positive, although the fluorescence was weak. A pad placed in the catchbasin sump was indeterminate.

- Samples collected at the outfall on July 16, 2020, had 131.4 MPN/100 mL *E. coli* and a very low (9.0 µg/L) TP concentration (Table 31). While not negligible, the *E. coli* concentration was below the level typically requiring further investigation.
- On September 8, 2021, Stone dye tested the combined sewer on Highland Avenue (via catchbasin CB27) and the sanitary sewer on George Street at SM2. In both tests, dye appeared in the Berlin Street sanitary sewer main and not in the Berlin Street stormdrain.
- Stone measured 0.22 mg/L of free chlorine in CB22 at the intersection of Wilson Street and Highland Avenue on September 8, 2021. Stone notified the Montpelier DPW regarding the continuing water leak in this area (email to Kurt Motyka, 9/9/2021).

Figure 16. Unmapped pipe enters catchbasin CB28

- OB pads placed at the outfall and catchbasins on Berlin Street above and below the Wilson Street connection in August 2022 were all negative.
- The Montpelier DPW did their own investigation of this area and found no sanitary wastewater connections to the separate stormwater system. They did, however, confirm a water leak at the Wilson Street–Highland Avenue intersection.

Conclusion: We do not suspect a sanitary wastewater connection to the separate stormdrain. Earlier sample results indicating wastewater contamination appear to have been taken at structures on the combined sewer system. According to email correspondence from Kurt Motyka, June 6, 2023, the leaking water line in the vicinity of the Wilson–Highland Avenue intersection is on DPW's 5-year plan for replacement.

Resolution: Not applicable.

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15. Morrisville Results

Results of investigation of the MO01 system in Morrisville are described below.

15.1. MO01

The MO01 system drains Bridge Street west of VT Route 100 (Appendix C, Map 15). A direct residential wastewater connection was eliminated in this system in 2019. Our investigation began as a reassessment following this repair. Water quality data for this system are presented in Table 19.

Table 19. Water Analysis Data for Outfall MO01

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
MO01-MH1	6/29/2020	Wet (no flow)	1.5	0.03	0.3	1382	Positive	2" in sump, feces, TP
MO01-MH1	7/1/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Positive (x2)	Feces and TP present
MO01-MH1	6/10/2021	Wet (no flow)	n/a	n/a	n/a	n/a	Positive	Clear, no odor
MO01-MH1	9/18/2021	Wet (no flow)	0.3	n/a	n/a	n/a	Positive	No WW solids: inlet dry and outlet buried
MO01-MH1	6/9/2022	Wet (no flow)	n/a	n/a	n/a	n/a	Negative	

Findings:

- There are no known stormwater inlets to this system. At this time, the entire system appears to have been abandoned, with no recognized purpose. The MO01 stormdrain outfall could not be located. It is likely buried. Therefore, all testing was performed at the first storm manhole up the line, MO01-MH1 (Figure 17).
- On June 29, 2020, there was about 2 in. of standing water in the sump of MH1 and obvious feces and sanitary paper. There was no inflow or outflow. Ammonia measured in the sump was quite high, 1.5 mg/L. MBAS detergents and OB were also detected in MH1. Given the obvious wastewater contamination, the question remained whether there were additional wastewater contribution(s) or whether the sanitary wastewater in MH1 was residual.
- To assess whether there was an ongoing discharge to MH1, on July 1, 2020, Stone placed two weighted bundles holding OB pads in the mouth of Pipe A. OB was detected on the pads.

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- To confirm that the inlet pipe flowed intermittently, ground cork was sprinkled inside the pipe, with the understanding that any flowing water would carry it into the sump. On August 25, 2020, Stone placed a timelapse camera in MH1 to monitor inflows. Over a 20-day period, there were multiple, very small flow events, causing the cork in the pipe and debris in the manhole sump to shift position (Figure 18).
- Jim Pease collected samples from manhole MH1 on December 16, 2020, for *E. coli* and TP analysis. *E. coli* were not detected, and the TP concentration (98.2 MPN/100 mL) was low (Table 31).
- MH1 was retested for OB on June 10, 2021, and was positive.
- Dye testing and camera inspection were performed on September 18, 2021, by Dave Braun and Jim Pease. In MH1, the inlet pipe was dry, and the outlet pipe was entirely buried in sediment. A camera was pushed as far up the inlet pipe as possible. The first ~7 feet of pipe is broken vitrified clay pipe. At 7 feet up the line, the pipe turns left and changes to a short section of

Figure 17. Manhole MH1

Figure 18. Manhole MO01-MH1: a) Cork placed in inlet pipe; b) after flow on August 17, 2020

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smooth pipe. Between 15 and 30 feet up the line, the pipe is corrugated metal and there is substantial coarse sediment and stones. The line changes back to vitrified clay at ~30 feet. At 32 feet in, a large stone blocked the camera.

- All houses on Bridge Street were dye tested except for two houses we could not access. No dye was seen in manhole MH1, and the inlet pipe remained completely dry.
- There are two inflow pipes to the sanitary manhole located closest to storm manhole MH1, one above the other. Only the lower pipe was flowing. Because we could not explain the existence of the second sewer line, we pushed the camera into the dry upper pipe. Approximately 3 ft. into the pipe, wastewater drops into a vertical pipe, which is connected to the lower, flowing pipe. This confirmed that the Bridge Street sanitary sewer is properly connected at this sanitary manhole, and thus to the connected wastewater pump station.
- MH1 was tested again on June 9, 2022. Finally, after two years of testing, the OB pad was negative.

Conclusion: There does not appear to be any remaining wastewater discharge to this system. The investigation in 2021 identified no remaining problems, and the absence of OB in manhole MH1 in June 2022 was conclusive. Apparently, it took three years for wastewater to flush out of this system after the direct sanitary connection was eliminated in 2019.

Resolution: Not applicable.

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16. Northfield Results

Illicit discharge detection was performed in Northfield between June and September 2020. Results of the initial assessments in Northfield are included in Appendix B. Of the 63 stormwater systems assessed, 14 were flowing or dripping during dry weather. Four systems were flagged for advance investigation. These systems are described below.

16.1. NF07

NF07 drains an area of Northfield Village that includes Depot Square and parts of East Street, Wall Street, Central Street, and South Main Street (Appendix C, Map 16). The outfall discharges to the Dog River north of Depot Square. This system was flagged for advanced investigation due to elevated ammonia and MBAS concentrations, as well as OB. Water quality data for this system are presented in Table 20.

Table 20. Water Analysis Data for Outfall NF07

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
NF07	7/22/2020	Trickling	0.5	0.00	0.7	486	Positive	Slightly yellow, odorless
NF07	7/31/2020	Flowing	0.8	0.01	1.5	564	Negative	Yellowish discharge, dishwater odor, obvious suds
NF07-CB02	8/17/2020	Dry	n/a	n/a	n/a	n/a	Negative	n/a
NF07-CB03	8/17/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Indeterminate	n/a
NF07-CB05	8/17/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Negative	n/a
NF07-CB07	8/17/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Positive (weak)	n/a
NF07	9/10/2020	Trickling	n/a	n/a	n/a	n/a	n/a	No odor
NF07-CB01	9/10/2020	Wet (no flow)	0.8	n/a	n/a	n/a	n/a	n/a
NF07-CB07	9/10/2020	Wet (no flow)	0.0	n/a	n/a	n/a	n/a	n/a
NF07-CB09	9/10/2020	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a

Findings:

- The outfall was trickling when first assessed on July 22, 2020. There was a yellow tinge to the water and iron staining around the outfall. Ammonia, MBAS, and OB were detected.
- On July 31, 2020, yellowish water, suds, and a washwater odor were observed at the outfall. Concentrations of ammonia (0.8 mg/L) and MBAS (1.5 mg/L) were higher than on July 22, 2020. However, the OB pad placed on July 31, 2020, and retrieved on August 14, 2020 was negative.

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- On August 17, 2020, Stone staff placed OB pads in catchbasins CB02 (negative), CB03 (indeterminate), CB05 (negative), and CB07 (positive, though weak). While none of these catchbasins were flowing, all had water in their sumps.
- On September 10, 2020, catchbasins CB01 and CB07 were tested for ammonia. Ammonia was elevated (0.8 mg/L) at CB01, but not detected at CB07. No odor was observed at CB09.
- On dates in August and September 2020, there was typically a trickle of flow at the outfall and no flow further up the system. This complicated bracket sampling, and it also suggests a source of contamination closer to the outfall. While an OB pad placed in CB07 on Main Street was positive (though weak), there was no convincing evidence of a problem upstream of the outfall.

Conclusion: The results of bracket sampling were inconclusive. Further investigation of this stormdrain is warranted, especially of the main line between catchbasin CB02 and the outfall, and any connections to this line.

Resolution: Further investigation is warranted.

16.2. NF15

NF15 drains Sherman Avenue, a small street off North Main Street north of Northfield Village (Appendix C, Map 17). The outfall is located on the Dog River floodplain. This system was flagged for advanced investigation based on elevated ammonia, MBAS, and chlorine concentrations at the outfall. Water quality data for this system are presented in Table 21.

Table 21. Water Analysis Data for Outfall NF15

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
NF15	6/12/2020	Flowing	1.0	0.26	1.0	36	Negative	Dark (almost black) and muddy. Turbid, with obvious odor
NF15-CB1	6/12/2020	Trickling	n/a	n/a	n/a	n/a	Indeterminate	Similar black malodorous mud in sump
NF15-CB2	6/12/2020	Trickling	0.5	0.27, 0.12	0.9	1092	Negative	Sump water turbid, not as muddy; odor the same as in CB01 and the outfall

Findings:

- The NF15 outfall was first visited on June 12, 2020. A problem was immediately apparent, as the discharge contained dark, malodorous sediment (Figures 19 and 20). Samples were taken and OB pads set at the outfall and at catchbasins CB01 and CB02, which contained the same dark, malodorous sediment. Ammonia, chlorine, and MBAS concentrations were elevated at the outfall and

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at catchbasin CB02. However, since these three tests are colorimetric and the water samples were extremely turbid, these may not be valid results. OB was not detected at the outfall.

Figure 19. Muddy effluent flowing over the grass below the NF15 outfall, June 12, 2020

Figure 20. Dark, muddy water in catchbasin CB02

- In repeated visits over the summer of 2020, this sediment discharge did not reoccur.

Conclusion: A transient sediment discharge was observed on June 12, 2020. The source appeared to originate upstream of catchbasin CB02. There are no mapped inlets to CB02; however, this should be confirmed in the field.

Resolution: Periodic checks should be made to see if this issue reoccurs, and to determine the source if it does.

16.3. NF44

This system drains the roof and surroundings of the Nantanna Mill building at 7 Belknap Avenue (Appendix C, Map 18). The outfall discharges to the Dog River on the north side of the facility. This system was flagged for advanced investigation due to detection of chlorine and MBAS detergents. Water quality data for this system are presented in Table 22.

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Table 22. Water Analysis Data for Outfall NF44

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
NF44	6/5/2020	Flowing	0.1	0.13	0.1	3380	Negative	Some foam, no odor
NF44	8/17/2020	Flowing	0.0	0.05, 0.06	0.3	2660	n/a	Clear, no odor

Findings:

- The initial assessment of this outfall occurred on June 5, 2020. The outfall was flowing, and a small amount of foam was caught in the vegetation. High specific conductance was measured at the outfall and the chlorine concentration was slightly elevated (0.13 mg/L).
- Samples collected on August 17, 2020, had negligible chlorine and no foam or other indication of a potential illicit discharge.

Conclusion: We do not suspect a chronic illicit discharge in this system.

Resolution: Not applicable.

16.4. NF52

NF52 drains parts of South Main Street, Spring Street, and Noridge Drive (Appendix C, Map 19). It also drains a stream that is fed from the east by the NF53 stormdrain. The NF52 outfall is located just west of South Main Street. This system was designated for advanced investigation after ammonia, MBAS, and OB were detected at the outfall. Water quality data for this system are presented in Table 23.

Table 23. Water Analysis Data for Outfall NF52

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
NF52	6/16/2020	Flowing	0.2	0.06	0.2	635	Positive (weak)	Clear, odorless
NF52	8/7/2020	Flowing	0.3	0.06	0.2	747	Positive (strong)	Sheen
NF52-CB01	8/17/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Lost	n/a
NF52-CB02	8/17/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Negative	Laundry odor
NF52-CB03	8/17/2020	Dry	n/a	n/a	n/a	n/a	Lost	n/a
NF52-CB04	8/17/2020	Dry	n/a	n/a	n/a	n/a	Negative	Slight laundry odor
NF52-SW01	8/17/2020	Trickling	n/a	n/a	n/a	n/a	Indeterminate	n/a
NF52-SW02	8/17/2020	Trickling	n/a	n/a	n/a	n/a	Indeterminate	n/a
NF52	11/17/2020	Flowing	0.0	0.02	0.2	738	NA	Collected *E. coli* sample

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Findings:

- OB was detected at the outfall when the system was first assessed on June 16, 2020, although the fluorescence was weak. A stronger OB signal was seen when the outfall was resampled on August 7, 2020.
- OB pads were deployed throughout the system on August 17, 2020. No positive results were obtained. Results were indeterminate in swales SW01 and SW02 (both pads had small fluorescent spots). Although OB was not detected in catchbasins CB02 and CB04, a slight laundry odor was observed.
- Samples collected at the outfall on November 17, 2020, had elevated *E. coli* (770.1 MPN/100 mL) and low TP (18.2 µg/L) concentrations (Table 31).

Conclusion: While there are inconsistencies in the bracket sampling data, taken together there is a reasonable likelihood of a sanitary wastewater or washwater discharge in the vicinity of Tuckaway Lane.

Resolution: Further investigation is warranted.

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17. Randolph Results

In Randolph, Stone assessed one system, RND98, that was flagged for investigation by a different consultant in a prior study. Results of this investigation are included in Appendix B. A description of the investigation is included below.

17.1. RND98

RND98 drains portions of Randolph Elementary School, the Randolph Technical Center, and Forest Street in Randolph. It discharges to Ayers Brook east of the Technical Center building (Appendix C, Map 20). Water quality data for this system are presented in Table 24.

Table 24. Water Analysis Data for System RND-OF-98

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
RND98	11/17/2020	Trickling	0.0	0.01	0.2	131.7	n/a	Clear, no odor
RND98	5/20/2021	Trickling	n/a	n/a	n/a	n/a	Outfall, MH1, MH2, MH4, CB1, CB2, CB3, CB4 & CB5--all negative	Clear, no odor

Findings:

- This system was assessed on November 17, 2020, and there were no indications of contamination. Negligible *E. coli* (16.6 MPN/100 mL) and TP (35.6 µg/L) were measured in samples collected at the outfall.
- OB pads were set throughout this system on May 20, 2021, and no OB was detected.

Conclusion: We do not believe there is a chronic illicit discharge in this system.

Resolution: Not applicable.

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18. South Hero Results

Of the seven stormdrains assessed in South Hero in July 2020, only SO01 was flowing. Results of the initial assessments in South Hero are included in Appendix B. Three stormwater systems were designated for further investigation. These investigations are described below.

18.1. SO01

The SO01 system drains a portion of US Route 2 and two parking lots in the Town of South Hero (Appendix C, Map 21). It discharges to a small stream in farm fields south of Route 2. This system was flagged for advanced investigation due to elevated free chlorine and MBAS detergent concentrations. Water quality data for this system are presented in Table 25.

Table 25. Water Analysis Data for Outfall SO01

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
SO01	7/6/2020	Trickling	0.0	0.02	0.1	2830	Negative	n/a
SO01-CB3	7/6/2020	Wet (no flow)	0.1	0.14, 0.14	1.0	2980	Negative	Clear, no odor, slight foam when shaken
SO01-CB6	7/6/2020	Dripping	0.0	0.06, 0.05	0.8	1000	Negative	Clear, no odor
SO01	6/1/2021	Trickling	0.0	0.25	0.1	2540	NA	Cloudy, no odor or foam
SO01-CB3	6/1/2021	Trickling	0.0	0.07	0.1	3530	NA	Minor foam

Findings:

- On July 6, 2020, high specific conductance (2,830 µS/cm) was measured at the outfall, which was trickling. Elevated MBAS was found in catchbasins CB3 and CB6.
- On June 1, 2021, a visual inspection was made of the SO01 system. The Jolley gas station is immediately upstream of catchbasin CB3. There are several connected catchbasins in the gas station parking lot and a large, two-chamber stormwater vault. The water in the stormwater vault was dark in color, had a petroleum odor, and foamed slightly when agitated. Water was trickling into the SO01 stormdrain from the stormwater vault.

Conclusion: Runoff from the Jolley gas station parking lot on US-2 is the likely source of the high specific conductance at the outfall and catchbasin CB3 on both assessment dates and the petroleum odor and discoloration observed in the stormwater vault on June 1, 2021.

Resolution: Not applicable.

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18.2. SO02

SO02 drains a section of US Route 2 near the Town of South Hero fire department (Appendix C, Map 22). The stormdrain outfall is located within a cross-culvert that passes under Route 2. The cross-culvert also drains an intermittent stream from agricultural fields south of Route 2. OB was detected at the downstream end of the cross-culvert. Water quality data for this system are presented in Table 26.

Table 26. Water Analysis Data for Outfall SO02

Structure ID	Date Assessed	Dry, Wet/no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observation
SO02 culvert	7/6/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Positive	
SO02 culvert	7/30/2020	Unknown	n/a	n/a	n/a	n/a	Positive	
SO02-CB02	7/30/2020	Dry	n/a	n/a	n/a	n/a	Negative	
SO02-CB03	7/30/2020	Dry	n/a	n/a	n/a	n/a	Negative	
SO02-CB04	7/30/2020	Dry	n/a	n/a	n/a	n/a	Negative	
SO02 culvert	8/6/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Positive	
SO02 culvert	8/27/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Positive (strong)	
SO02-SW01	8/27/2020	Dry	n/a	n/a	n/a	n/a	Indeterminate	
SO02-CB02	6/1/2021	Flowing	3 inflow pipes: <0.25	n/a	n/a	n/a	n/a	No odor

Findings:

- The SO02 outfall is located within a cross-culvert under Route 2, about 10 feet from the inlet end of the culvert (Figure 21). Because the stormdrain outfall is difficult to access, monitoring was performed at the outlet of the culvert.
- OB was detected at the culvert outlet in July 2020. Stone then placed OB pads in catchbasins CB02, CB03, and CB04. OB was detected at the culvert outlet again, but not in the SO02 catchbasins.
- On August 27, 2020, we placed an OB pad in the stream channel upstream of the cross-culvert (point SW01). The SWO1 pad was indeterminate, while OB was detected at the culvert outlet once again.
- On June 1, 2021, staff entered the cross-culvert and noted an unmapped stormdrain outlet directly opposite the SO02 outlet (Figure 21). The water pooled near the unmapped outlet foamed when agitated. A catchbasin (CB1) located just east of the cross-culvert confirmed the unmapped stormdrain.

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- On August 25, 2021, the stormline upstream of the unmapped outlet was inspected. There was a strong wastewater odor in CB1, but no obvious wastewater solids. A 2-inch diameter PVC pipe (Figure 22) enters catchbasin CB1, apparently from the house at 255 US-2. When the toilet in the house was flushed, the flow rate from this 2-inch diameter pipe increased. The discharge had a moderately high ammonia concentration of 1.5 mg/L.

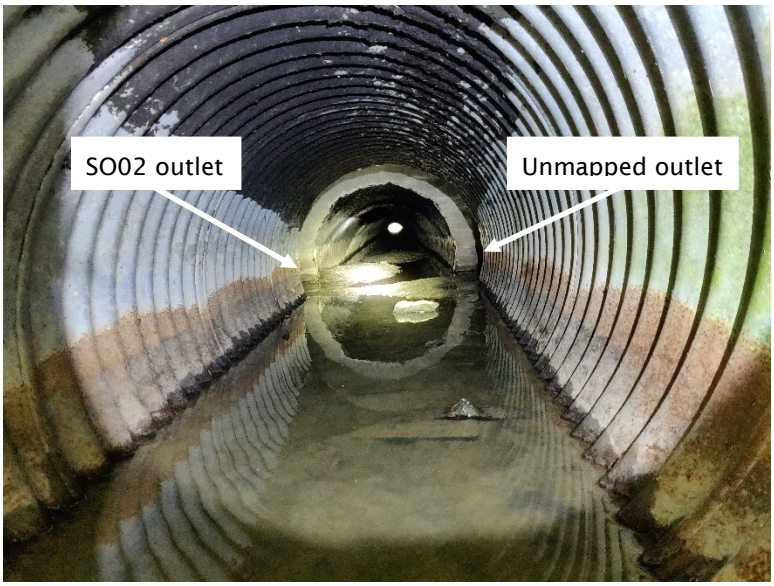

Figure 22. View down US Route 2 cross-culvert

The stormdrain between CB1 and the unmapped outlet was inspected with a sewer camera. Approximately 25 feet into the line from CB1 a 4-inch diameter PVC pipe enters the stormdrain, near the property line and east of the driveway to 257 US-2. There was no visual indication of contamination at the 4-inch pipe outlet. It is likely an underdrain.


Figure 21. Pipe (circled) entering catchbasin CB1

Conclusion: The presence of OB at the outlet of the US Route 2 cross-culvert was consistent and obvious. However, there was no evidence of an illicit discharge in the SO02 stormdrain. Rather, a sanitary wastewater connection was identified from 255 US-2 to a different (unmapped) stormdrain that also discharges to the US Route 2 cross-culvert. Given the odors and discoloration observed in CB1, and the fact that the flow rate increased when the toilet was flushed, this is almost certainly a sanitary connection. However, the absence of wastewater solids suggests the connection is a septic tank overflow pipe rather than a straight pipe.

Resolution: With this report, we are notifying the Town of South Hero and DEC's Regional Wastewater Engineer of this finding.

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18.3. SO05

The SO05 stormdrain discharges into a swale east of US-2, south of Keeler's Bay Road. There are two branches of this system (Appendix C, Map 23). The system was flagged for advanced investigation based on detection of OB as well as laundry odors. Water quality data for this system are presented in Table 27.

Table 27. Water Analysis Data for Outfall SO05

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
SO05	7/6/2020	Wet (no flow)	n/a	n/a	n/a	n/a	Positive (strong)	
SO05	7/30/2020	n/a	n/a	n/a	n/a	n/a	Positive (strong)	Laundry odor
SO05-CB01	7/30/2020	Dry	n/a	n/a	n/a	n/a	Positive (strong)	Laundry odor
SO05-CB02	7/30/2020	Dry	n/a	n/a	n/a	n/a	Positive (strong)	No odor
SO05-CB03	7/30/2020	Dry	n/a	n/a	n/a	n/a	Negative	Laundry odor
SO05-CB04	7/30/2020	Dry	n/a	n/a	n/a	n/a	Positive (strong)	Laundry odor
SO05-CB05	7/30/2020	Dry	n/a	n/a	n/a	n/a	Positive (strong)	No odor
SO05-MH01	7/30/2020	Dry	n/a	n/a	n/a	n/a	Positive (strong)	Laundry odor
SO05-CB02	8/25/2021	Unknown	1.5	n/a	n/a	n/a	n/a	
SO05-CB04	8/25/2021	Unknown	6.0	n/a	n/a	n/a	n/a	
SO05-CB2A	8/25/2021	Unknown	n/a	n/a	n/a	n/a	Positive (strong)	
SO05-CB3	8/25/2021	Unknown	n/a	n/a	n/a	n/a	Negative	

Findings:

- OB was detected at the outfall when the stormdrain was assessed in July 2020. The outfall was not flowing, but when the OB pad was retrieved a strong laundry odor was apparent.
- On July 30, 2020, Stone placed OB pads in catchbasins CB01, CB02, CB03, CB04, and CB05. A laundry odor was observed in several catchbasins. A pad was also placed in an odd, unmapped manhole (MH01) found between CB04 and CB05. MH1 has an unmapped pipe entering it from the direction of 471 US-2, which appeared vacant. OB was detected on all the pads except the pad deployed at CB03.
- On June 1, 2021, we opened catchbasins on the SO05 stormdrain and noted wastewater odors and water with a blue-grey cast (Figure 23). We also observed an unmapped pipe outlet within the stormdrain between CB04 and CB05.
- Catchbasins CB04 (in front of 473 US-2) and CB02 (in front of 479 US-2) had high ammonia concentrations on August 25, 2021. The ammonia concentrations were 6.0 mg/L in CB04 and 1.5 mg/L in CB02.
- On August 25, 2021, Stone staff worked with Wayne Graham of the Vermont Rural Water Association to smoke test and inspect the SO05 stormdrain. In the southern branch of the system, two pipes enter the stormdrain between catchbasins CB05 and CB04, both aligned with houses to the

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west. The first pipe (Figure 24) enters the stormdrain ~25 feet downstream (north) of catchbasin CB05 and appears aligned with 471 US-2. The second pipe enters the stormdrain ~56 feet downstream of CB05 and appears aligned with the side yard at 473 US-2. When we smoke tested this section of the stormdrain, the basement of 471 US-2 filled with smoke, which indicates the first pipe is either a connected interior drain or possibly a wastewater connection venting through a dry plumbing trap. The house at 471 US-2 was vacant, which makes the dry trap scenario plausible. Also, faint smoke appeared in the side yard at 473 US-2 in the vicinity of the septic tank, suggesting the second pipe is a septic tank overflow from 473 US-2.

Figure 23. View up SO05 stormdrain from catchbasin CB04, June 1, 2021

- Camera inspection of the northern branch of the stormdrain was less conclusive because excessive sediment and water prevented inspection of a ~75-ft. section between catchbasins CB03 and CB02A, in which we suspect a problem.
  - CB03 to north: pipe bricked over 1-2 feet into pipe (no problem)
  - CB03 to CB02A: 10 feet to refusal (camera stuck)
  - CB02A to CB03: 27 feet to refusal (camera stuck); ~75 ft. inspection gap
  - CB02 to CB02A: 82 feet to refusal; 4" PVC pipe enters (dry)
  - CB02A to CB02: 40 feet past the prior refusal point; 1-2" pipe enters top of stormdrain (no flow)

Figure 24. View downstream (north) in SO05 stormdrain

- Also on August 25, 2021, we dye tested the toilet at 487 US-2, but saw no evidence of dye in the stormdrain.

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- OB pads placed in CB02A and CB03 on August 25, 2021 confirmed an illicit discharge entering the stormdrain between these structures. The pad placed in CB03, immediately north of the driveway to 487 US-2, was negative, while the pad placed in CB02A, the closest downstream access point, was strongly positive.

Conclusion: There is a wastewater discharge to both branches of this system. In the southern branch, there appears to be a septic tank overflow piped to the stormdrain from 473 US-2. There is also a pipe connection from 471 US-2; however, since this house was vacant, we could not determine whether this was a wastewater connection or a drain.

In the northern branch of the system, we suspect there is a wastewater connection from 487 US-2 or the trailer set back from the road, which shares the same driveway. We were unable to confirm and locate the suspected connection because of excessive sediment and water in the stormdrain. However, the OB and ammonia data collected at CB02A support this conclusion.

Resolution: With this report, we are notifying the Town of South Hero and DEC's Regional Wastewater Engineer of these findings.

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19. St. Johnsbury Results

Illicit discharge detection was performed in St. Johnsbury in May and June of 2020. Of the 31 systems assessed, nine were flowing during dry weather, while seven were trickling or dripping. Results of the initial assessments in St. Johnsbury are included in Appendix B. Two stormwater systems (SJ1500 and SJ1730) were designated for further investigation due to detection of OB at the outfall. A third (SJ1200) had elevated MBAS and chlorine concentrations. The status of these investigations is described below.

19.1. SJ1200

SJ1200 is a small stormwater drainage system in the parking lot of St. Johnsbury Buick GMC on Memorial Drive. (Appendix C, Map 24). The system daylights to a swale before crossing beneath Memorial Drive and discharging to the Passumpsic River. Water quality data for this system are presented in Table 28.

Table 28. Water Analysis Data for Outfall SJ1200

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
SJ1200	5/28/2020	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a
SJ1200	6/3/2020	Flowing	0.1	0.35, 0.41	0.5	565	Negative	Muddy and turbid; slight muddy odor

Findings:

- This outfall was wet but not flowing during an initial visit on May 28, 2020.
- On a second visit, on June 3, 2020, there was substantial flow at the outfall. The water was dark and muddy, with a slight odor. Concentrations of free chlorine (~0.4 mg/L) and MBAS (0.5 mg/L) were elevated. The source of the flow and contamination was runoff from the dealership's carwash, which was flowing across the parking lot and into catchbasin CB01. This flow is visible in Appendix C, Map 24 as the wet pavement north of the dealership building.
- A third visit was made on June 10, 2020. The dealership was not washing cars, and there was no flow at the outfall.

Conclusion: The source of this illicit discharge was runoff from the car wash at the St. Johnsbury Buick GMC dealership at 538 Memorial Drive. While the discharge was intermittent, it appeared to be a routine occurrence.

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Resolution: The Town of St. Johnsbury DPW was notified of this problem in an email to Steve Beauregard on August 13, 2020. A more complete description of the problem was sent on May 22, 2023. The DPW has requested guidance from VTDEC on addressing this problem.

19.2. SJ1500

The SJ1500 system drains an industrial area off Bay Street between the railroad tracks and the Passumpsic River (Appendix C, Map 25). The system discharges into the floodplain of the Passumpsic River. It was flagged for advanced investigation after OB was detected at the outfall. Water quality data for this system are presented in Table 29.

Table 29. Water Analysis Data for Outfall SJ1500

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
SJ1500	5/28/2020	Wet (no flow)	0.1	0.13, 0.04	0.0	1583	Positive	Clear, no odor
SJ1500	6/17/2020	n/a	n/a	n/a	n/a	n/a	Positive x2	n/a
SJ1500-MH01	6/17/2020	n/a	n/a	n/a	n/a	n/a	Positive	n/a
SJ1500-MH02	6/17/2020	n/a	n/a	n/a	n/a	n/a	Positive	n/a
SJ1500-CB02	6/17/2020	n/a	n/a	n/a	n/a	n/a	Positive	n/a
SJ1500-MH03	7/21/2020	n/a	n/a	n/a	n/a	n/a	Negative	n/a
SJ1500-CB02	7/21/2020	n/a	n/a	n/a	n/a	n/a	Negative	n/a
SJ1500-CB03	7/21/2020	n/a	n/a	n/a	n/a	n/a	Positive (weak)	n/a

Findings:

- At the time of the initial assessment on May 28, 2020, the SJ1500 outfall was partially surcharged in a small pool. There was no obvious contamination at this time; however, OB was detected at the outfall.
- In a subsequent visit, on June 17, 2020, OB pads were deployed to bracket the source of contamination. Two pads were placed at the outfall and more in manholes MH01 and MH02 and catchbasin CB02. All the pads were positive, indicating that OB entered the system at or upstream of catchbasin CB02. We also observed rags caught on the CB02 grate (Figure 25).
- On July 21, 2020, we placed pads in catchbasins CB02 and CB03 and manhole MH03. OB was detected at CB03, but not at CB02 or MH03. The negative result at CB02 was contrary to that of the previous visit.
- Samples were collected from catchbasin CB01 on September 23, 2020, for analysis of *E. coli*, TP, and nine PPCP compounds. Five of the nine were detected, including carbamazepine (39 ng/L) and metoprolol (5.5 ng/L) (Table 32). The TP concentration (722 ug/L) was elevated (Table 31).
- On August 19, 2020, Stone technician George Valentine worked with a representative from the St. Johnsbury DPW to dye test 492 Bay Street. Dye was observed in the sanitary sewer (at SMH02) but

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not in the stormdrain, confirming that 492 Bay Street is properly connected. The building at 521 Bay Street was discounted as a source of contamination as it appeared abandoned. Given detection of OB at CB02 and CB03, another possible source of contamination was any unmapped connection(s) into these catchbasins. After CB02 and CB03 were vacuumed out, no such connections were observed.

- When it was clear there were no direct illicit connections to CB02 and CB03, two St. Johnsbury DPW employees explained that combined sewer manhole SMH03 had overflowed to the street several times during rainstorms over the summer, including once in the week prior to the August 19, 2020, visit. In this most recent event, sanitary wastewater had flowed out into the parking lot at 492 Bay Street.

Figure 25. Shop rags on catchbasin CB02 grate

Conclusion: We believe the OB detected on multiple occasions in the separate stormdrain on Bay Street resulted from overflows of combined sewer manhole SMH03 (and possibly others) to the street and downslope to catchbasin CB02. The fact that OB was detected in both CB02 and CB03 is consistent with overland flow of sanitary wastewater. Tracking of wastewater by vehicles probably caused the weak detection of OB at CB03. The rags observed on the CB02 grate likely resulted from combined sewer overflow events.

Resolution: The Town of St. Johnsbury DPW was aware of this problem prior to Stone's investigation. Steve Beauregard, DPW Director, explained in an email received May 22, 2023, that a collapsed sewer main under Bay Street was causing backup problems. An entire 600-ft. section of sewer main was replaced with 14-inch SDR pipe. There have been no known sewer surcharges since this repair.

19.3. SJ1730

SJ1730 drains a small intermittent stream and a short section of Breezy Hill Road in St. Johnsbury Center (Appendix C, Map 26). The outfall discharges to Roberts Brook behind 1719 Breezy Hill Road. SJ1730 was flagged for advanced investigation after detection of OB at the outfall in a previous study by Stone Environmental. Water quality data for this system are presented in Table 30.

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Table 30. Water Analysis Data for Outfall SJ1730

Structure ID	Date Assessed	Dry, Wet/ no flow, Dripping, or Flowing?	Ammonia (mg/L)	Free Chlorine (mg/L)	MBAS (mg/L)	Sp. Cond. (µS/cm)	OB Result	Observations
SJ1730	6/3/2020	Flowing	0.1	0.00	0.2	387	Positive	Clear, no odor
SJ1730	6/10/2020	n/a	n/a	n/a	n/a	n/a	Positive (strong)	n/a
SJ1730-CB1	6/10/2020	n/a	n/a	n/a	n/a	n/a	Positive (strong)	n/a
SJ1730-CB2	6/10/2020	n/a	n/a	n/a	n/a	n/a	Negative	n/a
SJ1730-IS2	6/10/2020	n/a	n/a	n/a	n/a	n/a	Negative	n/a
SJ1730-IS3	6/10/2020	n/a	n/a	n/a	n/a	n/a	Negative	n/a
SJ1730-CB3	6/17/2020	n/a	n/a	n/a	n/a	n/a	Positive (strong)	n/a

Findings:

- This system was first visited on June 3, 2020. OB was detected at the outfall, which was flowing.
- On June 10, 2020, Stone placed OB pads in the outfall, CB1, CB2, and the intermittent streams entering the stormdrain from the north. OB was detected at the outfall and in catchbasin CB1.
- A pad set at catchbasin CB3 on June 17 had a strong positive OB signal. The pattern of detections indicated that OB was entering the system in the main line downstream of the confluence of the swales and upstream of CB3.
- Along with a representative from the St. Johnsbury DPW, Stone dye tested houses at 1744 and 1714 Breezy Hill Road on August 19, 2020. Both houses have traditional septic systems. No dye entered the stormdrain after dye testing toilets at 1744 and 1714 Breezy Hill Road.
- Stone technician George Valentine returned to 1714 Breezy Hill Road to inspect its wastewater piping. The homeowner confirmed that for as long as they have occupied the house a pipe has drained greywater from the rear of the house, separate from the septic system. The existence of this 3-in. pipe was confirmed in the basement. It drained the kitchen sink, dishwasher, shower, and bathroom sink (Figure 26). Red dye poured in the shower drain appeared at catchbasin CB1 (Figure 27a) and at the outfall (Figure 27b) shortly afterward.

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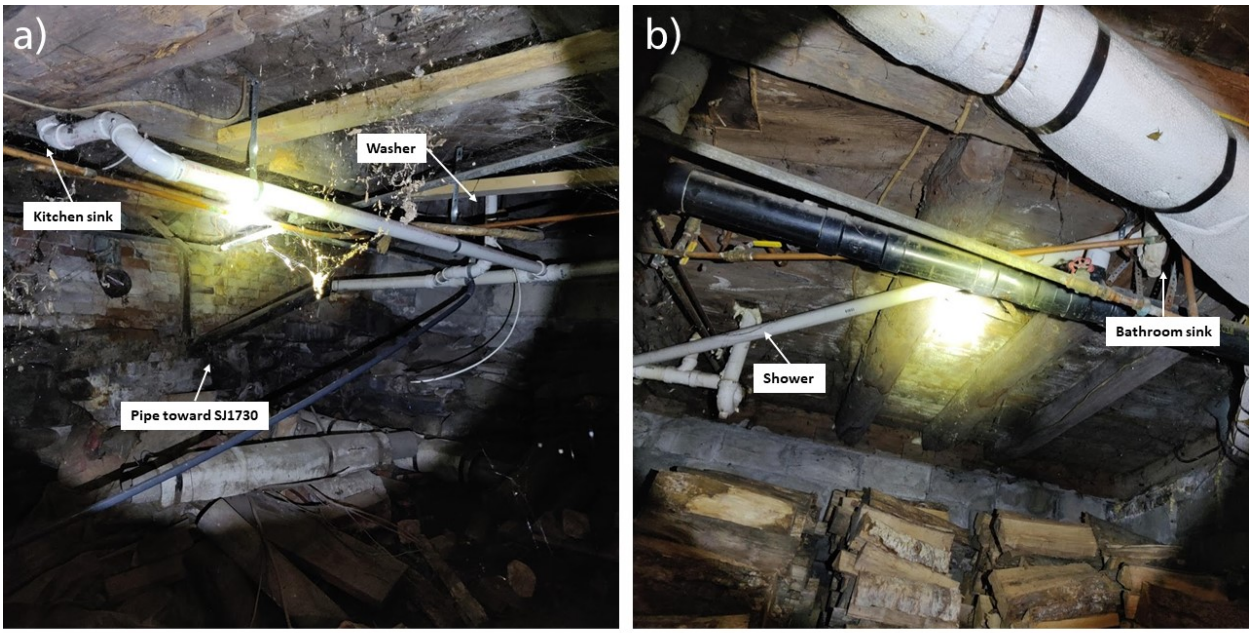

Figure 26. Greywater connection at 1714 Breezy Hill Road

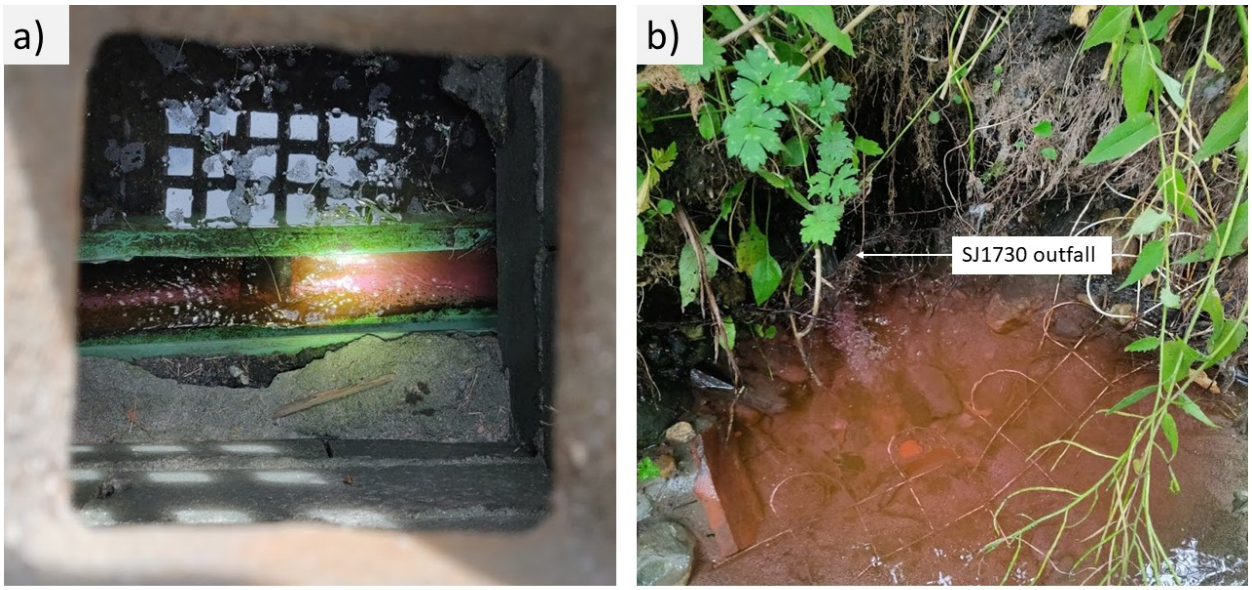

Figure 27. Red fluorescent dye a) in catchbasin CB01 and b) at the SJ1730 outfall

Conclusion: A direct greywater connection was identified from the house at 1714 Breezy Hill Road.

Resolution: The homeowner at 1714 Breezy Hill Road eliminated the illicit discharge to system SJ1730 by April 2021. Stone set an OB pad at the outfall in July 2021, which was negative, confirming elimination of the discharge.

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20. Starksboro Results

Illicit discharge detection was performed in Starksboro in July 2020. Results of the initial assessments are included in Appendix B. Of the three stormwater systems assessed, none were flowing during dry weather. No contaminants were detected above levels of concern; therefore, no systems were designated for further investigation.

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21. *E. coli* and Total Phosphorus Results

Table 31 presents the results provided by VAEL for samples collected in 2020.

Table 31. E. coli and TP Data for Selected Drainage Systems

System	Sample Date	*E. coli* (MPN/100 mL)	TP (µg/L)	PPCP Sample?
BC560	11/17/20	727.0	332	
BC1620	9/23/20	3	146	PPCP
BC1630	9/23/20	>2419.6	2,220	PPCP
BT680	11/17/20	<1.0	13.8	
BT2440-CBI	9/23/20	1986.3	622	PPCP
EN210	9/23/20	1986.3	16.2	PPCP
FAY-01-5-stream 1	9/23/20	<1.0	8.1	PPCP
HDP01	8/03/20	770.1	211	
HRT446	11/17/20	31.3	35.1	
JB01	8/03/20	43.2	9.8	
JB02	8/03/20	41.0	9.1	
JB03	8/03/20	2.0	6.9	
JB04	8/03/20	29.2	5.8	
JB05	8/03/20	19.9	6.7	
MP250	7/16/20	67.7	28.1	
MP370	7/16/20	461.1	33.4	
MP370	9/8/22	124.6	NS	
MP590	7/16/20	<1.0	11.8	
MP890	7/16/20	344.8	21.6	
MP1350	7/16/20	131.4	9.0	
MO01	12/16/20	<1.0	98.2	
NF52	11/17/20	770.1	18.2	
RO-10*	11/23/20	16.0	NS	
RND98	11/17/20	16.6	35.6	
SJ440	11/23/20	980.4	NS	PPCP
SJ1500-CB01	9/23/20	8.1	722	PPCP

PPCP = Sample also collected for PPCP analyses (see Table 32)
[A] = Stormdrain outfall at Rockingham Transportation Park, Rockingham, VT

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22. Pharmaceuticals and Personal Care Products Results

Table 32 presents the PPCP results provided by EPA for samples collected on September 23, 2020.

Table 32. PPCP Concentration Data (ng/L) for Samples Collected September 23, 2020

Location	Acetaminophen	Atenolol	Caffeine	Carbamazepine	Cotinine	Diphenhydramine	Metoprolol	Paraxanthine	PPCPs detected
BC1620	ND	ND	ND	67	5.3	0.49	ND	ND	3
BC1630	ND	1,800	26,000	0.85	340	270	220	9,100	7
BT2440-CB1	ND	ND	9.7	ND	2.7	ND	ND	2.1	3
EN210	33	ND	7.9	ND	1.4	0.43	ND	2.3	5
FAY-OF-S-STREAM1	ND	ND	ND	ND	ND	ND	ND	ND	0
SJ440-CB1	20	3.4	21	ND	240	ND	ND	3.7	5
SJ440-CBH	46	ND	510	ND	500	ND	ND	23	4
SJ1500-CB01	ND	ND	9.3	39	24	1.8	5.5	ND	5
RIALABV	ND	ND	16	ND	1.7	ND	ND	5	3
RIALUND-STIR	ND	ND	13	ND	0.89	ND	ND	ND	2
RIALUND-GR	18	ND	13	ND	3.4	ND	ND	7.1	4
RIALBEL	ND	ND	7.3	ND	0.74	ND	ND	ND	2

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23. Conclusions

A thorough assessment was made of 140 previously unassessed stormwater drainage systems in 10 towns and villages discharging into Vermont waterways. Based on water quality data collected during dry weather surveys, 13 systems in these towns and villages were added to the 13 systems previously suspected of having illicit discharges, bringing the total number designated for advanced investigation to 26. Investigation of these stormdrains confirmed multiple illicit wastewater or greywater discharges, several of which were successfully eliminated.

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24. References

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Appendix A. Stone Environmental SOPs

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STANDARD OPERATING PROCEDURE

SEI-5.23.3

MAINTENANCE AND CALIBRATION OF THE pH/CON 10 METER

SOP Number: SEI-5.23.3
Revision Number: 3

Date Issued: 5/14/99
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)

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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.

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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.

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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.

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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

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9.0 AUTHORIZATION

Revisited by: _____ Date: _____

Michael Nuss, Staff Scientist

Approved by: _____ Date: _____

Christopher T. Stone, President

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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.

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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.

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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.

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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

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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

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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.

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Appendix B. Assessment Data Tables

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Table 1: Barre City Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
BC560	9/23/2020	DCB	Outfall	14	Vitrified clay	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Checked 8-10 structures, all of which were dry
BC560	11/17/2020	HC	Outfall	14	Vitrified clay	Flowing	Free flow	None	Clear, odorless	None	None	None	0.0	0.03	598	0.5	n/a	Behind 112 Maple Avenue. Also collected TP and *E. coli* samples
BC560	6/7/2021	SW	Outfall	14	Vitrified clay	Flowing	Free flow	None	Suds present	None	None	None	0.1	0.03	413	0.0	All Neg.	Negative OB at outfall and CB1 through CB7. Strong WW odor in CB4 through CB6
BC560	9/2/2021	JA	Outfall	14	Vitrified clay	Flowing	Free flow	None		None	None	None	0.0	n/a	n/a	n/a	n/a	
BC560-CB6	9/2/2021	JA	Outfall	n/a	n/a	Flowing	n/a	n/a		None	None	None	0.1	n/a	n/a	n/a	n/a	
BC1630	9/23/2020	DCB	Outfall	15	Cor, black plastic	0.077 L/s	Free flow	None	Clear, obvious WW odor	None	None	None	3.0	0.00	292	0.8	n/a	Sampled for *E. coli*, TP, and PPCP
BC1630	5/25/2021	JA	Outfall	15	Cor. black plastic	Trickling	Free flow	n/a	WW odor in by Nelson	None	None	None	n/a	n/a	n/a	n/a	MH12=Neg. MH13=Neg.	MH11 pad lost
BC1630-MH11	9/2/2021	JA	Manhole	n/a	n/a	Flowing	n/a	n/a	WW odor in stormdrain	None	Grey biofilm	None	4.0	n/a	n/a	n/a	n/a	
BC1630-MH12	9/2/2021	JA	Manhole	n/a	n/a	Trickling	n/a	n/a		None		None	0.0	n/a	n/a	n/a	n/a	

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Table 2: Barre Town Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
BT680	11/17/2020	HC	Outfall	16	Cor. metal	Flowing	Free flow	Considerable erosion around outfall pipe	Clear, odorless	None	None	None	0.0	0.02	3430	0.3	n/a	Flow rate 45 s/L
BT680	6/7/2021	SW	Outfall	16	Cor. metal	Flowing	Free flow			None	None	None	0.0	0.04	4910	0.0	All Neg.	Pads set at outfall and in the PVC pipe aligned with #6 Bolster Road
BT2440-CB1	9/23/2020	DCB	Outfall	12	Cor. black plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	0.0	0.00	262	0.1	Neg.	Outfall dry; sampled CB1 sump for standard tests plus *E. coli*, TP, and PPCP; no odor in CB1

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Table 3: Bolton Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
BO01	7/13/2020	GV	Outfall	6	Smooth plastic	Wet (no flow)	Free flow	Outfall slightly undercut, eroded pool	No odor	None	None	None	0.0	n/a	n/a	n/a	Negative	Tested water in small pool for ammonia
BO02	7/13/2020	GV	Outfall	12	Smooth plastic	Wet (no flow)	Partially submerged	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	
BO03	7/13/2020	GV	Catch Basin	n/a	Concrete	Trickling	n/a	n/a	Clear, no odor	None	None	None	0.1	0.07, 0.06	1075	0.1	Negative	Could not open CB grate; sample taken at culvert outlet under telephone pole

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Table 4: Coventry Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
CT01	6/17/2020	GV	Outfall	18	Cor. metal	Wet (no flow)	Free flow	Light	Heavy iron staining, oil sheen, no odor	Sheen	Iron staining	None	0.5	0.04	1072	0.2	Negative	
CT01-CB2	6/17/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	CB2A dry; OB pad in sump
CT02	6/17/2020	GV	Outfall	18	Concrete	Dry	Free flow	None	Oil sheen in CB1, no odor	None	None	None	n/a	n/a	n/a	n/a	Negative	OB pad set in CB1 sump
CT03	6/17/2020	GV	Outfall	24	Cor. metal	Wet (no flow)	Partially submerged	None	Wet	None	None	None	n/a	n/a	n/a	n/a	n/a	
CT03-CB2	6/17/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
CT03-CB4	6/17/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
CT04	6/25/2020	GV	Culvert	n/a	n/a	Flowing	n/a	None	Water clear, no odor	Sediment	None	None	n/a	n/a	n/a	n/a	Negative (x2)	3 OB pads tied to inlet stake

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Table 5: Fairfield Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
FFD01-CB2	7/6/2020	GV	Catch Basin	n/a	Concrete	Wet (no flow)	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
FFD01-CB3	7/6/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
FFD01	7/13/2020	GV	Outfall	18	Cor. metal	Dripping	Free flow	Slight erosion creating plunge pool	n/a	None	None	None	0.0	n/a	n/a	<0.7	Negative	Dripping just after rain

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Table 6: Village of Forest Dale (Brandon) Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
BN01	7/20/2020	GV	Outfall	18	Cor. metal	Wet (no flow)	Partially submerged	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	Pipe surcharged; evidence of high flows
BN02	7/20/2020	GV	Outfall	8	Vitrified clay	Dry	Partially submerged	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
BN03	7/20/2020	GV	Outfall	36	Concrete	Dry	Partially submerged	None	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Culvert mostly sedimented in and grown over
BN04	7/20/2020	GV	Outfall	18	Cor. metal	Wet (no flow)	Partially submerged	None	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	
BN05	7/20/2020	GV	Outfall	8	Cor. metal	Dry	Free flow	None	Sediment staining in lawn around outfall	None	None	None	n/a	n/a	n/a	n/a	Negative	

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Table 7: Hartford Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
HRT446	5/20/2021	DCB	Outfall	Large	Cor. metal	Flowing	Partially submerged	None	Cloudy, metallic odor	None	Iron floc	None	0.4	0.00	708	0.1	n/a	
HRT446-CI2	5/20/2021	DCB	Culvert Inlet	n/a	Cor. black plastic	Flowing	n/a	n/a	Metallic odor	None	Iron floc	None	0.5	0.02	770	0.1	n/a	

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Table 8: Hyde Park Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
HDP01	7/1/2020	GV	Outfall	8	Smooth plastic	Flowing	Free flow	Minor erosion on bank beside outfall	Clear, no odor	None	None	None	0.1	0.03	474	0.3	Negative	
HDP01-CB1	7/1/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	Sump looks clear, no odor	n/a	n/a	n/a	0.1	0.02	339	0.3	Negative (x3)	Sample taken in sump; OB pads placed in pipes A, B, C
HDP01-CB2	7/1/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
HDP01-CB3	7/1/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
HDP01-CB4	7/1/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
HDP01	8/25/2020	GV	Outfall	n/a	Concrete	Flowing	Free flow	None	n/a	Suds	None	None	n/a	n/a	n/a	n/a	Negative	
HDP01-CB1	8/25/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a	0.0	n/a	n/a	n/a	n/a	
HDP01-CB1	8/31/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a	0.0	n/a	n/a	n/a	n/a	
HDP01-CB2	8/31/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a	0.0	n/a	n/a	n/a	n/a	
HDP01-CB4	8/31/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a	0.0	n/a	n/a	n/a	n/a	

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Table 9: Jay/Troy/Route 242 Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
JY01	7/2/2020	GV	Outfall	24	Cor. black plastic	Flowing	Free flow	None	Clear, no odor. slight oil sheen	Sheen	None	None	0.1	0.02	535	0.2	Negative	
JY02	7/2/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Sump looks clear, no odor	None	None	None	0.1	0.04	485	0.2	Negative	Pad set in JY02; water sample taken in CB01 from the pipe running from JY03
JY03	7/2/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Sump mostly clear, no odor	None	None	None	0.1	0.02	469	0.1	Negative	Pipe A flowing, pipe B dry
JY04	7/2/2020	GV	Outfall	18	Cor. black plastic	Wet (no flow)	Free flow	None	Clear, no odor	None	None	None	n/a	n/a	n/a	n/a	Negative (x2)	6" PVC pipe enters outfall just before it daylights; set OB pads in both pipes
JY05	7/2/2020	GV	Outfall	36	Cor. black plastic	Flowing	Free flow	None	Clear, no odor	None	None	None	0.1	0.04	633	0.2	Negative	
JY06	7/2/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Sump water tan/turbid, light oil sheen	Sheen	None	None	0.0	0.03	234	0.6	Negative	Water sample taken in sump
JY07	7/2/2020	GV	Outfall	24	Cor. black plastic	Dry	Free flow	None	Dry	None	None	None	n/a	n/a	n/a	n/a	Negative	
TY01	6/17/2020	GV	Outfall	18	Cor. metal	Wet (no flow)	Free flow	Plunge pool	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	Still wet, not flowing 6/25/20
TY02	6/25/2020	GV	Outfall	18	Cor. metal	Wet (no flow)	Partially submerged	None	Clear, no odor	None	None	None	0.0	0.04	1409	0.1	Negative	
TY03	6/25/2020	GV	Outfall	15	Cor. metal	Dry	Partially submerged	None	n/a	None	None	None	0.2	0.05, 0.04	837	0.0	Negative	
TY04	6/25/2020	GV	Outfall	15	Cor. metal	Trickling	Free flow	Plunge pool & gully forming, eroding toward road	Slightly turbid, no odor	None	None	None	0.0	0.03	472	0.2	Negative	
TY05	6/17/2020	GV	Outfall	22	Cor. metal	Dry	Partially submerged	None	Slight oil sheen	Sheen	Oily	None	n/a	n/a	n/a	n/a	Negative	Curtain drain daylights next to outfall; still dry 6/25/20
TY06	6/17/2020	GV	Outfall	22	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	Still dry 6/25/20
TY07	6/25/2020	GV	Outfall	24	Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
TY08	7/2/2020	GV	Outfall	8	Smooth plastic	Dry	Partially submerged	None	Clear, no odor	None	None	None	n/a	n/a	n/a	n/a	Negative	OB pad placed in surcharged end of pipe--surface water may contact pad

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Table 10: Montgomery Village Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
MV01	7/21/2020	GV	Outfall	15	Concrete	Wet (no flow)	Partially submerged	n/a	No odor, slightly turbid	None	None	None	0.3	n/a	684	0.5	Positive (weak)	
MV01	8/19/2020	DCB	Outfall	n/a	n/a	n/a	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Positive	
MV01-CB01	8/19/2020	DCB	Outfall	n/a	n/a	n/a	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
MV01-CB02	8/19/2020	DCB	Outfall	n/a	n/a	n/a	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	Strong wastewater odor
MV02	7/7/2020	GV	Outfall	12	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
MV03	7/7/2020	GV	Outfall	24	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	Also padded CB5 (negative); trash noted at outfall, appears to have flowed out
MV04	7/21/2020	GV	Outfall	24	Cor. black plastic	Trickling	Free flow	None	Clear, no odor	None	None	None	0.0	0.03	95.9	0.0	Positive (weak)	Watch for electric fences
MV04-CB02	8/19/2020	DCB	Catch Basin	n/a	n/a	n/a	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
MV04	8/25/2020	GV	Outfall	24	Cor. black plastic	Flowing	Free flow	None	Foamy	Suds	None	None	n/a	n/a	n/a	n/a	Negative	
MV04-CB01	8/25/2020	GV	Catch Basin	n/a	Concrete	Flowing	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
MV04-CB01	8/31/2020	GV	Catch Basin	n/a	Concrete	Flowing	n/a	n/a	n/a	None	None	None	0.6	0.08, 0.07	143.1	0.1	n/a	
MV04-SW01	8/31/2020	GV	Swale	n/a	Concrete	Flowing	Free flow	None	n/a	None	None	None	0.5	n/a	n/a	n/a	Lost	1st pad lost
MV04-SW02	8/31/2020	GV	Swale	n/a	n/a	Flowing	Free flow	None	n/a	None	None	None	0.0	n/a	n/a	n/a	n/a	Two small pipes in stream between SW01 and here; slight sewage odor in church yard

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Table 11: Montpelier Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
MP250-CB1	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative (x2)	OB pads set in CB1B and CB1C
MP250-CB2	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	
MP250	7/16/2020	GV	Outfall	24	Concrete	Flowing	Free flow	OF set back, bank eroded ~10ft back to OF	Clear, slight odor, some suds	Suds	None	None	0.1	0.00	759	0.2	Negative	Sampled for *E. coli* and TP
MP370-CB3	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	n/a	Pads set in CB3B and CB3C
MP370-CB3B	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Pad had fallen into sump upon retrieval
MP370-CB3C	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	
MP370-CB4	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Heavy sediment in sump
MP370-CB6	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	
MP370-CB7	7/9/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	Dry, no odor	None	None	None	n/a	n/a	n/a	n/a	Lost	Bottom collapsed into pipe below; OB pad placed in this pipe. Update: ECI replaced structure 7/22/20, while pad was out
MP370	7/16/2020	GV	Outfall	24	Cor. black plastic	Flowing	Free flow	None	Clear, slight odor	None	None	None	0.1	0.00	3100	0.3	Negative	
MP580	7/16/2020	GV	Outfall	24	Cor. metal	Dry	Free flow	None	Dry	None	None	Partially obstructed	n/a	n/a	n/a	n/a	Negative	
MP580-CB3	7/16/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	Clear, slight odor	None	None	None	0.1	0.01	318	0.5	Negative	
MP590	7/16/2020	GV	Outfall	24	Cor. metal	Flowing	Free flow	None	Clear, slight odor	None	None	None	0.0	0.06	736	0.2	Negative	
MP590	9/8/2021	JA	Outfall	24	Cor. metal	Flowing	Free flow	None	No odor	None	None	None	0.0	0.06	684	0.1	n/a	
MP890	7/16/2020	GV	Outfall	24	Cor. metal	Flowing	Free flow	None	Clear, no odor	None	None	None	0.1	0.00	302	0.1	Negative	Also took E. coli and TP; set OB pad in underdrain OF directly upstream and east of MP890
MP1350	7/9/2020	GV	Outfall	51	Cor. metal	Flowing	Free flow	None	Clear, no odor	None	None	None	n/a	0.00	968	0.4	Negative	Also took E. coli and TP
MP1350-CB22	7/9/2020	GV	Catch Basin	n/a	n/a	Flowing	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Flowing substantially given dry weather
MP1350-CB23	7/9/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
MP1350-CB24	7/9/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Barely a trickle; suspect that leak is between here and CB22 because of flow increase
MP1350-CB26	7/9/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	No noticeable odor	None	None	None	n/a	n/a	n/a	n/a	Positive	Sanitary paper in sump; lots of foam and laundry odor 7/16/20; CB26A is unmapped 18" PVC pipe
MP1350-CB28	7/9/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Ind.	In line with pipe; unmapped drain enters from 17 George St. - trickling 7/9/20. Placed pad
MP1350-CB28B	7/9/2020	GV	Catch Basin	n/a	n/a	Trickling	n/a	n/a	Clear, no odor	None	None	None	n/a	n/a	n/a	n/a	Positive	Unmapped drain entering CB28; trickling 7/9/21
MP1350-CB22	9/8/2021	JA	Catch Basin	n/a	n/a	Flowing	n/a	n/a	Clear, no odor	None	None	None	n/a	0.22	n/a	n/a	n/a	
MP1350	8/15/2022	JM	Outfall	n/a	n/a	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
MP1350-CB1	8/15/2022	JM	Catch Basin	n/a	n/a	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
MP1350-CB9	8/15/2022	JM	Catch Basin	n/a	n/a	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
MP1350-CB11	8/15/2022	JM	Catch Basin	n/a	n/a	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	

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Table 12: Morrisville Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
MO01-MH1	6/29/2020	GV	Manhole	n/a	n/a	Wet (no flow)	n/a	n/a	2" water in sump, feces, toilet paper	Sewage	None	None	1.5	0.03	1382	0.3	Positive	Could not locate outfall; placed pad in manhole sump
MO01-MH1	7/1/2020	GV	Manhole	n/a	n/a	Wet (no flow)	n/a	n/a	Feces and toilet paper	Sewage	None	None	n/a	n/a	n/a	n/a	Positive (x2)	Placed 2 bundles with OB pads in pipe A inlet; noted minor separation in 1st section of pipe A
MO01-MH1	6/10/2021	JP	Manhole	n/a	n/a	Wet (no flow)	n/a	n/a	Clear, no odor	None	None	None	n/a	n/a	n/a	n/a	Positive	Pad collected by Jim Pease; minor suds in bag containing wet pad
MO01-MH1	9/18/2021	DCB	Manhole	n/a	n/a	Wet (no flow)	n/a	n/a	No wastewater solids, inlet dry	None	None	None	0.3	n/a	n/a	n/a	n/a	Outlet pipe completely buried. Inlet pipe dry. No suds or other indications of WW
MO01-MH1	6/9/2022	JP	Manhole	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	Pad set and retrieved by Jim Pease. Dates not exact

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Table 13: Northfield Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
NF01	6/5/2020	HC	Outfall	12	Smooth plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF02	6/5/2020	HC	Outfall	18	Cor. black plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF03	6/5/2020	HC	Outfall	16	Smooth metal	Flowing	Submerged	None	Cannot see (submerged)	None	None	None	n/a	n/a	n/a	n/a	n/a	Cannot see - totally submerged in stream; CB1=wet/no flow, CB4=wet/no flow
NF04	7/9/2020	HC	Outfall	23	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF05-CB1	7/31/2020	HC	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Could not find outfall - CB1 not flowing, no obvious issues with stagnant water
NF06	7/9/2020	HC	Outfall	31	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Dry, rusted out at the bottom
NF07	7/22/2020	HC	Outfall	29	Concrete	Trickling	Free flow	None	Slightly yellow, odorless	None	Iron staining	None	0.5	0.00	486	0.7	Positive	Light iron staining on rocks around pipe
NF07	7/31/2020	HC	Outfall	29	Concrete	Flowing	Free flow	None	Yellowish, dishwater odor, obvious suds	Suds	None	None	0.8	0.01	564	1.5	Negative	
NF07-CB02	8/17/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
NF07-CB03	8/17/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Indeterminate	Tiny spots on pad, not fibers
NF07-CB05	8/17/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
NF07-CB07	8/17/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Positive (weak)	
NF07	9/10/2020	GV	Outfall	29	Smooth plastic	Trickling	Free flow	None	No noticeable odor at outfall	Suds	Iron staining	None	n/a	n/a	n/a	n/a	n/a	
NF07-CB01	9/10/2020	GV	Catch Basin	n/a	Concrete	Wet (no flow)	n/a	n/a	n/a	None	None	None	0.8	n/a	n/a	n/a	n/a	
NF07-CB07	9/10/2020	GV	Catch Basin	n/a	Concrete	Wet (no flow)	n/a	n/a	n/a	None	None	None	0.0	n/a	n/a	n/a	n/a	
NF07-CB09	9/10/2020	GV	Catch Basin	n/a	Concrete	Wet (no flow)	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF08	6/5/2020	HC	Outfall	18	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF09	7/9/2020	HC	Outfall	9	Smooth plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF10	7/9/2020	HC	Outfall	11	Looks like asbestos	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF11	7/9/2020	HC	Outfall	9	Cor. metal	Dry	Free flow	Washed out down steep bank, gully forming	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF12	6/5/2020	DCB	Outfall	18	Smooth plastic	Flowing	Free flow	None	Clear, no odor	None	None	None	0.2	0.07	2430	0.0	Negative	
NF13	7/9/2020	HC	Outfall	23	Cor. black plastic	Wet (no flow)	Free flow	Bank is eroding and collapsing over outfall	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF14	7/9/2020	HC	Outfall	18	Cor. black plastic	Dry	Free flow	Soil washed out down slope	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF15	6/12/2020	GV	Outfall	6	Vitrified clay	Flowing	Free flow	Recent erosion at outfall	Black, muddy, turbid, with obvious odor.	None	None	None	1.0	0.26	36	1.0	Negative	CB1 and CB2 have same mud, same odor. Let sediment settle before testing sample. MBAS test hard to read (> 1 mg/L)
NF15-CB1	6/12/2020	GV	Catch Basin	n/a	n/a	Trickling	n/a	n/a	Black odorous mud	None	None	None	n/a	n/a	n/a	n/a	Indeterminate	CB sunk down in yard, grate clogged with black sediment
NF15-CB2	6/12/2020	GV	Catch Basin	n/a	n/a	Trickling	n/a	n/a	Turbid, same odor as CB1 and OF	None	None	None	0.5	0.27, 0.12	1092	0.9	Negative	MBAS very hard to read
NF16	7/22/2020	HC	Outfall	24	Cor. metal	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF17	7/22/2020	HC	Outfall	Unknown	Concrete	Dry	Free flow	None	Could not find outfall	None	None	None	n/a	n/a	n/a	n/a	n/a	Could not find outfall - thick knotweed all along the bank
NF18	7/22/2020	HC	Outfall	20	Cor. black plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF19	7/22/2020	HC	Outfall	18.5	Cor. metal	Dry	Free flow	Minor erosion around outfall	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF20	7/22/2020	HC	Outfall	15	Cor. black plastic	Dry	Free flow	Gully forming down bank	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	End of outfall pipe (4 ft) has come off and is lying in the gully
NF21	7/22/2020	HC	Outfall		Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Could not find - there have been some changes here; I can see stone lined swale but no pipe
NF21-CB1	7/31/2020	HC	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Looks like this is no longer operational - it was covered with mown grass and dry at bottom
NF22	7/22/2020	HC	Outfall		Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Could not find - there have been some changes here; I can see stone lined swale but no pipe
NF22-CB1	7/31/2020	HC	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Looks like this used to be a catchbasin but has now been filled in with dirt
NF23	7/22/2020	HC	Outfall	18	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Diameter is approximate - could not safely measure
NF24	7/22/2020	HC	Outfall	16	Cor. black plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	

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IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
NF25	7/9/2020	HC	Outfall	12	Cor. metal	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF26-CB1	7/31/2020	HC	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Could not find outfall. CB barely trickling, not enough to sample but looks clear, no odor
NF27	6/5/2020	HC	Outfall	12	Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
NF28	6/16/2020	HC	Outfall	36	Cor. black plastic	Flowing	Free flow	None	Clear, no odor	None	None	None	0.1	0.00	538	0.1	Negative	
NF29	6/16/2020	HC	Outfall	18	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF30	7/9/2020	HC	Outfall	78	Concrete	Flowing	Free flow	None	Clear, colorless	None	None	None	0.0	0.02	167.2	0.2	Positive (weak)	
NF30	7/31/2020	HC	Outfall	78	Concrete	Flowing	Free flow	None	n/a	None	None	None	0.0	0.03	190	0.0	Negative	
NF31	6/5/2020	HC	Outfall	6	Smooth plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF32	7/22/2020	HC	Outfall	14.5	Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF33	6/16/2020	HC	Outfall	15	Cor. black plastic	Flowing	Free flow	None	Clear, odorless	None	Iron staining	None	0.1	0.04	633	0.1	Negative	Set pad
NF34	7/31/2020	HC	Outfall	24	Cor. black plastic	Flowing	Free flow	None	Clear, no odor	None	None	None	0.0	0.01	154.3	0.1	Negative	Realized that I previously sampled the wrong outfall here
NF34	8/17/2020	GV	Outfall	24	Cor. black plastic	Flowing	Free flow	None	Clear, no odor	None	None	None	n/a	0.01	179.4	0.0	n/a	
NF34a	6/16/2020	HC	Outfall	16	Cor. black plastic	Trickling	Free flow	None	Clear, no odor, mown grass and slime	Minor foam	None	Partially obstructed	0.1	0.29	1253	0.0	Negative	Stagnant, but can hear water trickling in the pipe; plastic guard at outfall has collapsed; looks like rock lining may soon collapse
NF34a-CB1	6/16/2020	HC	Catch Basin	n/a	n/a	Dry	n/a	n/a	Sump looks clear, odorless	None	None	None	0.1	0.03	0.89	0.1	n/a	CB1 upslope from NF34, next to Green Mountain Practice and Rehab Therapy parking lot
NF34a	9/10/2020	GV	Outfall	18	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF35	6/12/2020	GV	Outfall	18	Cor. black plastic	Flowing	Free flow	Creating small plunge pool	Clear, no odor	None	None	None	0.1	0.08	384	0.0	1st=I., 2nd=Neg.	
NF36	7/31/2020	HC	Outfall	18	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF37	6/5/2020	HC	Outfall	12	Steel	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF38	6/5/2020	HC	Outfall	8	Asbestos cement	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Overgrown with knotweed
NF39	7/9/2020	HC	Outfall	15	Cor. black plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF40	6/12/2020	GV	Outfall	18	Cor. metal	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF41	7/22/2020	HC	Outfall	19	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF42	7/22/2020	HC	Outfall	12	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF43	7/22/2020	HC	Outfall	15	Cor. black plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF44	6/5/2020	HC	Outfall	24	Concrete	Flowing	Free flow	None	Clear, no odor	Suds	None	None	0.1	0.13	3380	0.1	Negative	Minor foam caught in vegetation
NF44	8/17/2020	GV	Outfall	24	Concrete	Flowing	Free flow	None	Clear, no odor	None	None	None	0.0	0.05, 0.06	2660	0.3	n/a	
NF45	6/5/2020	DCB	Outfall		Other	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Could not find outfall among junk vehicles and tall weeds; first CB upstream is buried or removed; CB2 on Main St. is dry
NF46	6/5/2020	HC	Outfall	18	Smooth plastic	Flowing	Free flow	None	Clear, no odor	None	None	None	0.2	0.05, 0.05	63.7	0.0	Negative	
NF47	7/9/2020	HC	Outfall	12	Cor. black plastic	Dry	Free flow	None	n/a	None	None	Fully obstructed	n/a	n/a	n/a	n/a	n/a	
NF48	6/12/2020	GV	Outfall	24	Cor. black plastic	Dry	Free flow	None	Dry	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF49	6/16/2020	HC	Outfall	18	Vitrified clay	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF50	7/9/2020	HC	Outfall	23	Cor. black plastic	Flowing	Free flow	None	Light oily sheen on water	Sheen	None	None	0.1	0.00	237	0.2	Positive (weak)	
NF50	7/31/2020	HC	Outfall	23	Cor. black plastic	Flowing	Free flow	None	n/a	None	None	None	0.0	0.07	273	0.1	Negative	Second test at this outfall
NF51	6/16/2020	HC	Outfall	18	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF52	6/16/2020	HC	Outfall	26	Concrete	Flowing	Free flow	None	Clear, odorless	None	None	None	0.2	0.06	635	0.2	Positive (weak)	
NF52	8/7/2020	HC	Outfall	26	Concrete	Flowing	Free flow	None	Sheen on water	Sheen	None	None	0.3	0.06	747	0.2	Positive (strong)	
NF52-CB01	8/17/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Lost	1st OB pad lost
NF52-CB02	8/17/2020	GV	Catch Basin	n/a	n/a	Wet (no flow)	n/a	n/a	Laundry odor	None	None	None	n/a	n/a	n/a	n/a	Negative	
NF52-CB03	8/17/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Lost	
NF52-CB04	8/17/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Slight laundry odor	None	None	None	n/a	n/a	n/a	n/a	Negative	
NF52-SW01	8/17/2020	GV	Swale	n/a	n/a	Trickling	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Indeterminate	Tiny spots on pad, not fibers
NF52-SW02	8/17/2020	GV	Swale	n/a	n/a	Trickling	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Indeterminate	Tiny spots on pad, not fibers
NF52	11/17/2020	HC	Outfall	26	Concrete	Flowing	Free flow	None	Clear, odorless, flow 30 s/liter	None	None	None	0.0	0.02	738	0.2	n/a	Collected TP and *E. coli* samples
NF53	6/16/2020	HC	Outfall	12	Cor. black plastic	Dry	Free flow	Minor washout below outfall	Stagnant and odorless	None	Iron staining	None	n/a	n/a	n/a	n/a	n/a	See photo from HC
NF54	6/16/2020	HC	Outfall	22	Cor. metal	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF55	6/16/2020	HC	Outfall	15	Cor. black plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	

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IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
NF56	6/16/2020	HC	Outfall	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	n/a	n/a	n/a	n/a	n/a	Could not find outfall in blackberry thicket; water appears to be seeping out of the ground
NF57	6/16/2020		Outfall	12	Smooth plastic	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	No flow, no pad
NF58	6/12/2020	GV	Outfall	36	Concrete	Wet (no flow)	Free flow	None	Wet	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF59	6/12/2020	HC	Outfall	8	Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
NF60	7/31/2020	HC	Outfall	17	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Rusted through on underside
NF60	8/24/2020	GV	Outfall	18	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
NF61	7/22/2020	HC	Outfall	8	Cor. metal	Dry	Free flow	None	n/a	None	None	Partially obstructed	n/a	n/a	n/a	n/a	n/a	Outfall is totally surrounded by knotweed filling the ditch

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Table 14: Randolph Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
RND98	11/17/2020	HC	Outfall	22	Smooth plastic	Trickling	Free flow	Gully erosion around outfall	Clear, odorless	None	None	Partially obstructed	0.0	0.01	131.7	0.2	n/a	Leaf dam caught in the grate covering end of outfall pipe. Barely trickling. Collected TP and *E. coli* samples.
RND98	5/20/2021	DCB	Outfall	22	Smooth plastic	Trickling	Free flow	Gully erosion around outfall	Clear, odorless	None	None	Partially obstructed	n/a	n/a	n/a	n/a	All Negative	Pads set at outfall, MH1, MH2, MH4, CB1, CB2, CB3, CB4, and CB5

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Table 15: South Hero Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
SO01	7/6/2020	GV	Outfall	8	Cor. metal	Trickling	Free flow	Major erosion around sides and beneath outfall	n/a	None	None	None	0.0	0.02	2830	0.1	Negative	
SO01-CB3	7/6/2020	GV	Catch Basin	n/a	Concrete	Wet (no flow)	n/a	n/a	Slightly foamy when shaken	None	None	None	0.1	0.14, 0.14	2980	1.0	Negative	Sample taken in sump
SO01-CB6	7/6/2020	GV	Catch Basin	n/a	Concrete	Dripping	n/a	n/a	Clear, no odor	None	None	None	0.0	0.06, 0.05	1000	0.8	Negative	Sample taken in sump
SO01	6/1/2021	DCB	Outfall	8	Cor. metal	Trickling	Free flow	Hole at junction of stormdrain and cross culvert	Cloudy, no odor, no foam	None	None	None	0.0	0.25	2540	0.1	n/a	High suspended solids. Slow to settle out.
SO01-CB3	6/1/2021	DCB	Catch Basin	n/a	Concrete	Trickling	n/a	n/a	Minor foam	None	None	None	0.0	0.07	3530	0.1	n/a	The Jolley gas station is immediately upstream of CB3. There are multiple catch basins and a stormwater vault in the fueling area. The water in the vault is dark in color and foams when agitated. Petroleum odor. Looks like dirty parking lot runoff.
SO02	7/6/2020	GV	Outfall	24	Cor. metal	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Positive	2nd pad placed 7/30/20
SO02	7/30/2020	GV	Outfall	24	Cor. metal	Unknown	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Positive	
SO02-CB02	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	Dead skunk on CB grate	None	None	None	n/a	n/a	n/a	n/a	Negative	
SO02-CB03	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
SO02-CB04	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
SO02	8/6/2020	GV	Outfall	24	Cor. metal	Wet (no flow)	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Positive	
SO02	8/27/2020	GV	Outfall	24	Cor. metal	Wet (no flow)	Partially submerged	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	
SO02-SW01	8/27/2020	GV	Swale	n/a	Concrete	Dry	n/a	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Indeterminate	
SO02-CB02	6/1/2021	DCB	Catch Basin	n/a	Concrete	Flowing	n/a	n/a	Dead skunk on CB grate	None	None	None	n/a	n/a	n/a	n/a	n/a	3 incoming pipes all had NH3<0.25 mg/L
SO03-CB2	7/6/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	Could not locate CB1
SO04-CB1	7/6/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	70.4	n/a	n/a	
SO04-MH1	7/6/2020	GV	Manhole	n/a	Concrete	Wet (no flow)	Free flow	None	Clear, no odor	None	None	None	0.0	0.01	165.4	0.1	Negative	
SO04-MH3	7/6/2020	GV	Manhole	n/a	Concrete	Dry	Free flow	None	Clear, no odor	None	None	None	n/a	n/a	125.5	n/a	Lost	1st pad lost; 2nd set 7/13/20; 7/13 after rain MH3A dry, MH3B flowing
SO04-MH4	7/6/2020	GV	Manhole	n/a	Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	140.9	n/a	n/a	
SO05	7/6/2020	GV	Outfall	18	Concrete	Wet (no flow)	Free flow	Eroded plunge pool, erosion @ sides of pipe	Laundry odor 7/30/20	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	
SO05	7/30/2020	GV	Outfall	18	Concrete	Unknown	Free flow	Eroded plunge pool, erosion @ sides of pipe	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive (strong)	
SO05-CB01	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	Laundry odor	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	
SO05-CB02	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	
SO05-CB03	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	Laundry odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Pipe continued farther north unmapped
SO05-CB04	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	Laundry odor	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	
SO05-CB05	7/30/2020	GV	Catch Basin	n/a	Concrete	Dry	n/a	n/a	No odor	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	Unmapped pipe continues south
SO05-MH01	7/30/2020	GV	Manhole	n/a	Concrete	Dry	Free flow	None	Laundry odor	None	None	None	n/a	n/a	n/a	n/a	Positive (strong)	Drain from house enters here
SO05-CB02	8/25/2021	DCB	Catch Basin	n/a	Concrete	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	1.5	n/a	n/a	n/a	n/a	
SO05-CB04	8/25/2021	DCB	Catch Basin	n/a	Concrete	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	6.0	n/a	n/a	n/a	n/a	
SO05-CB2A	8/25/2021	JA	Catch Basin	n/a	Concrete	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive (strong)	
SO05-CB3	8/25/2021	JA	Catch Basin	n/a	Concrete	Unknown	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	
SO06	7/6/2020	GV	Outfall	Unknown	Concrete	Wet (no flow)	Free flow	None	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	1st pad lost, 2nd pad set 7/13/20; 2nd pad lost, 3rd pad set 7/30/20
SO07	7/6/2020	GV	Outfall	Unknown	Concrete	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Buried - could not locate outfall; CB1 and CB2 full of sediment

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Table 16: St. Johnsbury Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
SJ270	5/20/2020	GV	Outfall	30	Concrete	Flowing	Free flow	Substantial erosion, pipe section broke off	Clear, no odor	None	None	None	0.0	0.05	1405	0.0	Negative	
SJ270-MH1.3	5/20/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Clear, no odor	None	None	None	n/a	0.01	n/a	n/a	n/a	Manhole mapped as drain at corner of TH44
SJ270-MH1A	5/20/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Clear, no odor	None	None	None	0.2	0.10, 0.05	1351	0.0	Negative	Sewer manhole mapped as stormwater on St. John St.; also set pad at MH2 on Crestview Terrace
SJ290	5/20/2020	GV	Outfall	18	Concrete	Flowing	Free flow	None	Clear, no odor	None	None	None	0.0	0.03	426	0.1	Negative	
SJ740	5/28/2020	GV	Outfall	24	Cor. metal	Dry	Free flow	None	n/a	None	Iron staining	None	n/a	n/a	n/a	n/a	n/a	Outfall location does not match map data--see printed map for annotations; still dry 6/10/20
SJ790	5/28/2020	GV	Outfall	36	Cor. metal	Dry	Partially submerged	None	Dry	None	Sediment	None	n/a	n/a	n/a	n/a	n/a	Outfall partially buried/backed up with sediment. still dry 6/10/20
SJ790-MH1	5/28/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Clear, no odor	None	None	None	n/a	n/a	n/a	n/a	Negative	SJ1790-MH01A, MH01B, MH01C, MH01D all dry; set OB pad in MH sump
SJ1030-CB1	6/3/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	Outfall and CB position different than map (annotated on map)
SJ1200	5/28/2020	GV	Outfall	18	Cor. black plastic	Wet (no flow)	Free flow	Minor erosion in lawn at outfall. ~1 ft depth	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	
SJ1200	6/3/2020	GV	Outfall	15	Cor. black plastic	Flowing	Free flow	Minor erosion in lawn, 1ft deep x 4ft long.	Muddy and turbid	None	None	None	0.1	0.35, 0.41	565	0.5	Negative	Dealership washing cars; outfall not flowing for long; low confidence in tests due to high turbidity; 6/10/20: not flowing, no cars being washed
SJ1280	5/20/2020	GV	Outfall	38	Cor. metal	Flowing	Free flow	None	Clear, no odor, no sediment	None	None	None	0.1	0.00	499	0.1	Negative	Ammonia: CB2A=0.2, CB2B=0
SJ1500	5/28/2020	GV	Outfall	36	Cor. black plastic	Wet (no flow)	Partially submerged	None	Clear, no odor	None	Sediment	None	0.1	0.13, 0.04	1583	0.0	Positive	Outfall partially submerged in small pool; sampled just inside pipe
SJ1500	6/17/2020	GV	Outfall	36	Cor. black plastic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive	Pad #1, 2nd round of pads
SJ1500	6/17/2020	GV	Outfall	36	Cor. black plastic	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive (strong)	Pad #2, 2nd round of pads
SJ1500-MH1	6/17/2020	GV	Manhole	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive	2nd round of pads
SJ1500-MH2	6/17/2020	GV	Manhole	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive	2nd round of pads
SJ1500-CB2	6/17/2020	GV	Catch Basin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive	2nd round of pads
SJ1500-MH3	7/21/2020	GV	Manhole	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	3rd round of pads
SJ1500-CB2	7/21/2020	GV	Catch Basin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	3rd round of pads
SJ1500-CB3	7/21/2020	GV	Catch Basin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive (weak)	3rd round of pads
SJ1510	5/28/2020	GV	Outfall	18	Cor. black plastic	Trickling	Free flow	None	No odor, clear	None	Sediment	None	0.2	0.01	5660	0.2	Negative	Unable to open grate of CB01; CB01A and CB01B both dry
SJ1520	6/3/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Clear, no odor	None	None	None	0.0	0.02	4660	0.3	Negative	All tests taken and OB pad set in SJ1520-CB1 because the outfall is in main road
SJ1530	6/10/2020	GV	Manhole	n/a	n/a	Trickling	n/a	None	Clear, no odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Insufficient flow to sample. Set OB pad. CB2 trickling on 6/17/20
SJ1540	5/21/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Clear, no odor	None	None	None	0.2	0.04	442	0.2	Negative	OB pad set in basin; some sediment and leaf bits in sample water
SJ1550	5/21/2020	GV	Catch Basin	n/a	n/a	Flowing	n/a	n/a	Clear, no odor	None	None	None	0.2	0.10, 0.07	1639	0.1	Negative	
SJ1550-MH1A	5/21/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Clear, no odor	None	None	None	0.2	0.11, 0.07	1310	0.1	Negative	SJ1550-MH1B is dry; taken in same MH as SJ1550-MH1C
SJ1550-MH1C	5/21/2020	GV	Manhole	n/a	n/a	Flowing	n/a	None	Clear, no odor	None	None	None	0.1	0.06, 0.10	2070	0.1	n/a	
SJ1550-MH2A	5/21/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	SJ1550-MH2A is dry; trickle leaking into basin above pipe
SJ1550-MH2B	5/21/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Sump clear, no odor	None	None	None	0.2	0.09, 0.05	1336	0.0	Negative	Lost 1st OB pad set 5/21/20
SJ1550-MH4	5/21/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Sump clear, no odor	None	None	None	n/a	n/a	n/a	n/a	Negative	SJ1550-MH4A, MH4B, MH4C, MH4D all dry; placed OB pad in sump; 1st OB pad set 5/21/20 lost
SJ1550-MH5	5/21/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Dry	None	None	None	n/a	n/a	n/a	n/a	n/a	SJ1550-MH5A and MH5B are dry
SJ1550-MH6	5/21/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Dry	None	None	None	n/a	n/a	n/a	n/a	n/a	SJ1550-MH6A and MH6B are dry, MH6C dripping slightly, CB1 (downstream) is dry
SJ1560	5/21/2020	GV	Outfall	24	Cor. metal	Trickling	Free flow	None	No odor, slight organic film	None	None	None	0.1	0.04, 0.04	1134	0.1	Negative	Outfall submerged in pool, mostly buried underground
SJ1560-MH1	5/21/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	Sump water slightly turbid, no odor	None	Sediment	None	0.1	0.03	303	0.2	Negative	
SJ1570	5/21/2020	GV	Outfall	15	Cor. black plastic	Dry	Free flow	Minor local erosion	n/a	None	None	None	0.1	0.01	343	0.0	Negative	
SJ1580	5/28/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Sump clear, no odor	None	None	None	0.2	0.02	82	0.3	Negative	SJ1580-A dry

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IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
SJ1590	6/10/2020	GV	Manhole	n/a	n/a	Wet (no flow)	n/a	None	Clear	None	None	None	n/a	n/a	n/a	n/a	Negative	Insufficient flow to sample; set OB pad.
SJ1600	5/28/2020	GV	Catch Basin	n/a	n/a	Dry	n/a	n/a	Sump clear, no odor	None	None	None	0.1	0.07, 0.07	3870	0.1	Negative	SJ1600-A (6" pvc pipe) not on map, trickling. SJ1600-B is wet
SJ1610	5/20/2020	GV	Outfall	24	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	Also dry at CB1. 1st OB pad set 5/20/20 was lost. 2nd OB pad set in CB1. Pad buried in sediment at pickup.
SJ1620	5/20/2020	GV	Outfall	40	Cor. metal	Dry	Free flow	None	n/a	None	None	Partially obstructed	n/a	n/a	n/a	n/a	Negative	Outfall crushed by flooding; pool in CB1, no flow or odor
SJ1630	6/10/2020	GV	Manhole	n/a	n/a	Flowing	n/a	None	Sump clear, no odor	None	None	None	0.1	0.01	1224	0.0	Negative	
SJ1640	5/20/2020	GV	Outfall	36	Cor. metal	Flowing	Free flow	None	Clear, no odor	None	None	None	0.0	0.08, 0.06	373	0.1	Negative	Pipe A Cl2=0.06 mg/L, Pipe D Cl2=0.05 mg/L.
SJ1650	6/3/2020	GV	Outfall	15	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	n/a	Half full of sediment, plants growing in it. Does not seem to flow often. SJ1650-MH1 and MH2 dry, SJ1650-CB1 dry, CB2 sump had water. Unmapped pipe coming into CB2
SJ1660	5/28/2020	GV	Outfall	24	Cor. black plastic	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	OF still dry 6/10/20; set OB pad anyway
SJ1670	5/28/2020	GV	Catch Basin	n/a	n/a	Dripping	n/a	n/a	Clear, no odor	None	None	None	0.0	0.07, 0.06	3930	0.0	Negative	
SJ1680	6/3/2020	GV	Outfall	16	Cor. metal	Trickling	Free flow	Small plunge pool	Clear, no odor	Brown skin on surface	None	None	0.1	0.00	593	0.0	Negative	
SJ1690	6/3/2020	GV	Outfall	36	Concrete	Flowing	Free flow	None	High flow, clear, no odor	Suds	None	None	0.0	0.03	616	0.1	Negative	Most of flow coming from pond above property
SJ1690-MH2B	6/3/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	High flow, clear, slight odor	None	None	None	0.2	0.02	606	0.1	Negative	SJ1690-MH2A dry
SJ1690-MH1	6/10/2020	GV	Manhole	n/a	n/a	Dry	n/a	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	SJ1690-MH1A dry. Set OB pad in basin pool
SJ1700	6/3/2020	GV	Outfall	15	Cor. black plastic	Dripping	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	
SJ1710	5/28/2020	GV	Outfall	12	Steel	Flowing	Free flow	None	Clear, no odor	None	Iron staining	None	0.2	0.00	2080	0.1	Negative	Heavy iron staining at outfall
SJ1720	5/28/2020	GV	Outfall	11	Smooth plastic	Trickling	Free flow	None	Clear, slight odor	None	Iron staining	Partially obstructed	0.1	0.01	3040	0.0	Negative	Heavy iron staining at outfall; end of pipe cracked off by flooding
SJ1730	6/3/2020	GV	Outfall	10	Vitrified clay	Flowing	Free flow	Small plunge pool and undercut bank	Clear, no odor	None	None	None	0.1	0.00	387	0.2	Positive (strong)	Pipe end is gone, outfall is set back under undercut bank
SJ1730	6/10/2021	GV	Outfall	10	Vitrified clay	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive (strong)	2nd round of pads
SJ1730-CB1	6/10/2021	GV	Catch Basin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive (strong)	2nd round of pads
SJ1730-CB2	6/10/2021	GV	Catch Basin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	2nd round of pads
SJ1730-IS2	6/10/2021	GV	Swale	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	2nd round of pads
SJ1730-IS3	6/10/2021	GV	Swale	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	2nd round of pads
SJ1730-CB3	6/17/2021	GV	Catch Basin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Positive (strong)	3rd round of pads
SJ1730	7/15/2021	HK	Outfall	10	Vitrified clay	Flowing	Free flow	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Negative	

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Table 17: Starksboro Assessment Data

IDDE ID	Date	Inspector	Structure type	Inner diameter (in.)	Material (outfall only)	Flow	Outfall position	Erosion at outfall	Discharge characteristics	Floatables	Deposits/ staining	Obstructions	Ammonia (mg/L)	Free chlorine (mg/L)	Sp. cond. (µS/cm)	Corrected MBAS (mg/L)	OB results	Comments
SB01	7/20/2020	GV	Outfall	18	Cor. metal	Dripping	Free flow	None	No odor	None	None	None	n/a	n/a	n/a	n/a	Negative	Some suds in stream nearby, cannot attribute to this OF
SB02	7/20/2020	GV	Outfall	24	Cor. black plastic	Wet (no flow)	Free flow	None	Clear, no odor	None	None	None	0.0	0.05, 0.05	585	0.2	Negative	
SB03	7/20/2020	GV	Outfall	24	Cor. metal	Dry	Free flow	None	n/a	None	None	None	n/a	n/a	n/a	n/a	Negative	

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Appendix C. Maps

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N

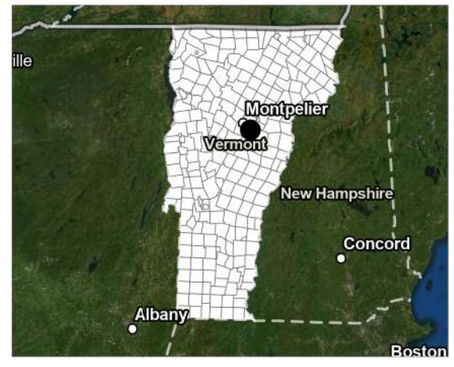
0 275 550 US Feet

LEGEND

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

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #1
BARRE CITY
BC560

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 205 410 US Feet

LEGEND

- Catchbasin
- Drop Inlet
- Junction Box
- Stormwater Manhole
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

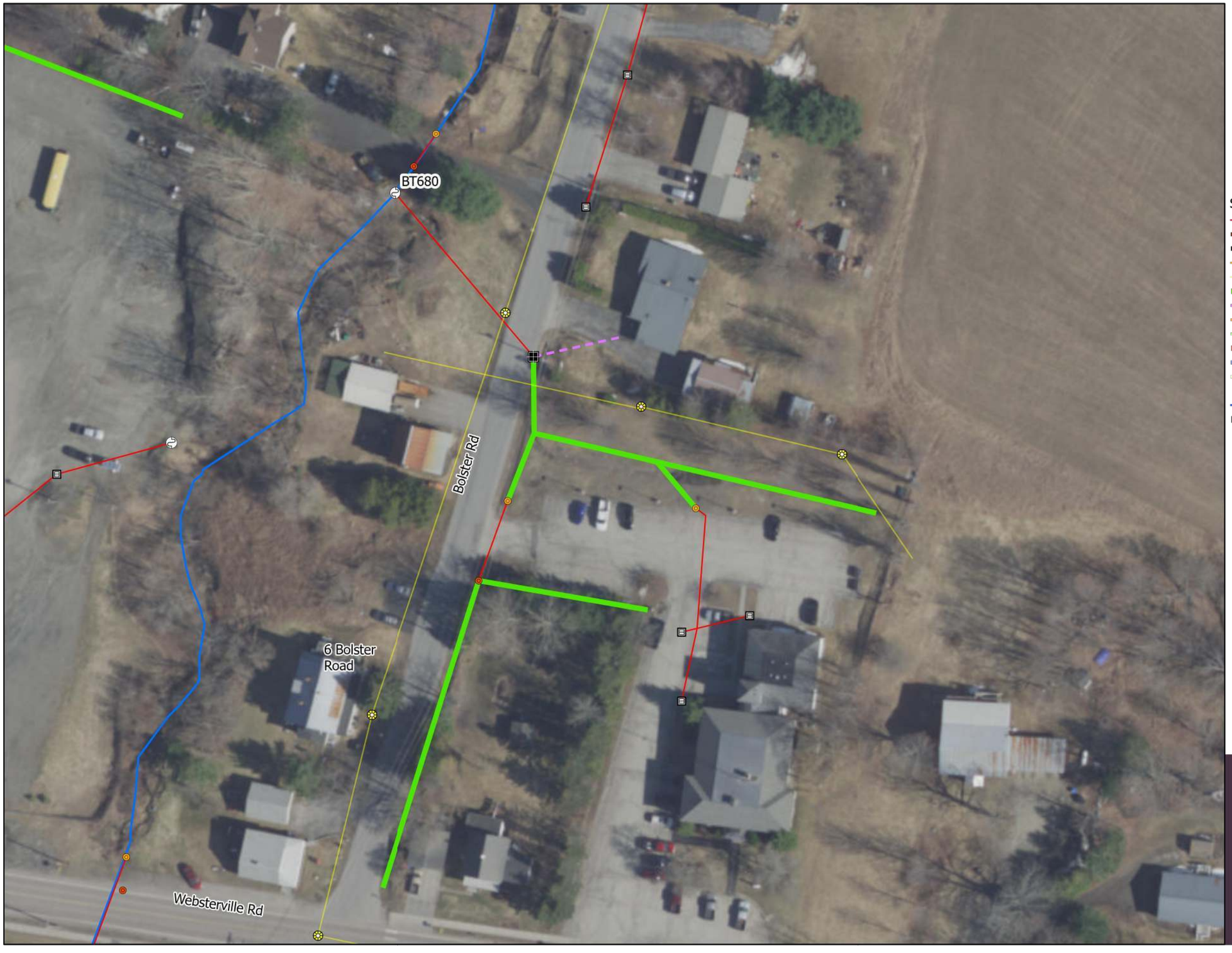
- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #2
BARRE CITY
BC1630

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL



N

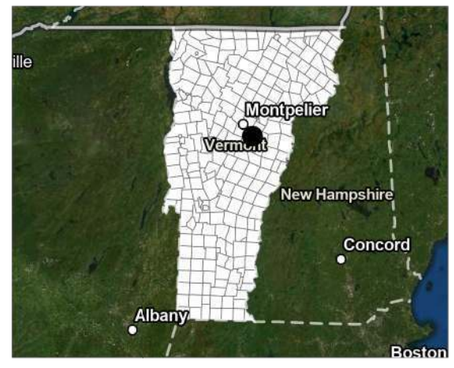
0 65 130 US Feet

LEGEND

- Catchbasin
- Drop Inlet
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

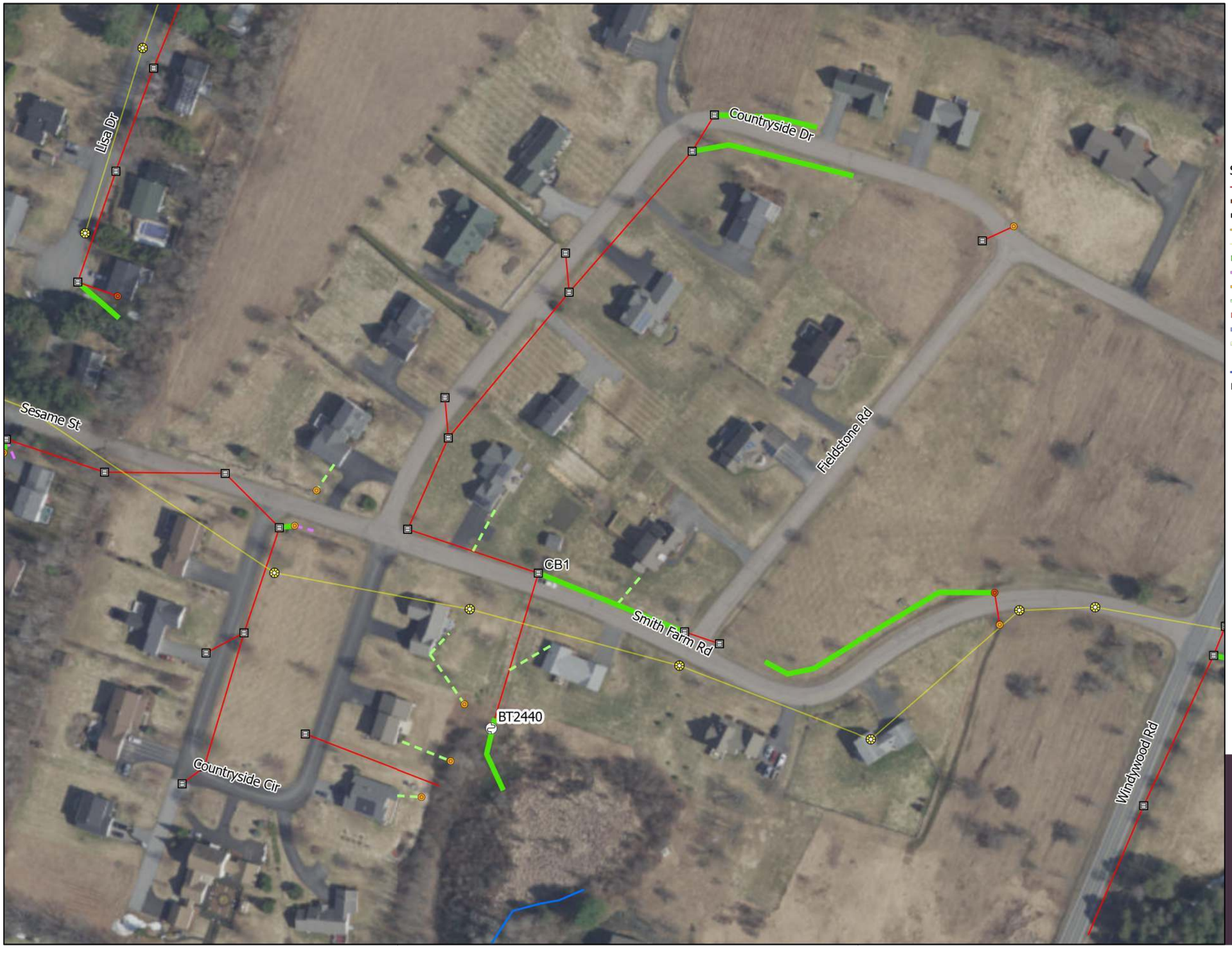


Source: Esri World Imagery, Stormwater Infrastructure from VT DEC, System details by Stone

Map #3
BARRE TOWN
BT680

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL



N

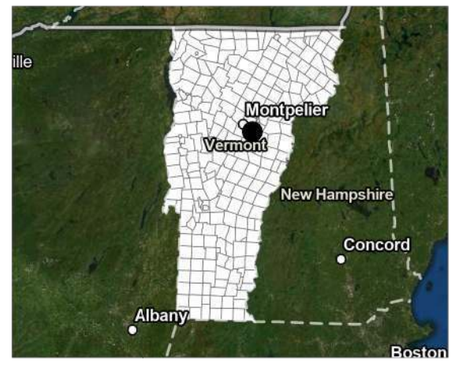
0 137.5 275 US Feet

LEGEND

- Catchbasin
- Sanitary Manhole
- Culvert inlet
- Culvert outlet

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #4
BARRE TOWN
BT2440

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 65 130 US Feet

LEGEND

- Catchbasin
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #5
COVENTRY
CT04

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

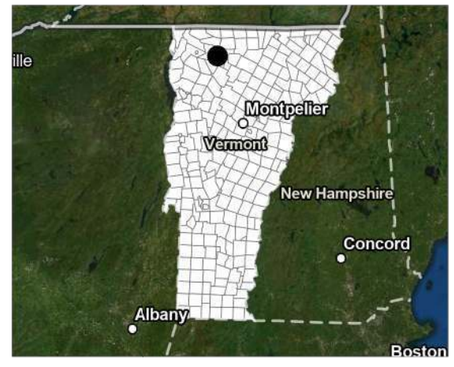
0 65 130 US Feet

LEGEND

- Catchbasin
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #6
FAIRFIELD
FFD01

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

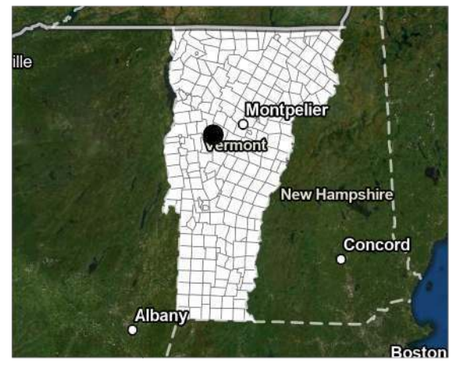
0 205 410 US Feet

LEGEND

- Culvert inlet
- Culvert outlet
- Outfall
- Pond outlet structure

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #7
FAYSTON
FAY-01-05

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 65 130 US Feet

LEGEND

- Catchbasin
- Yard drain
- Stormwater Manhole
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #8
HARTFORD
HRT446

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

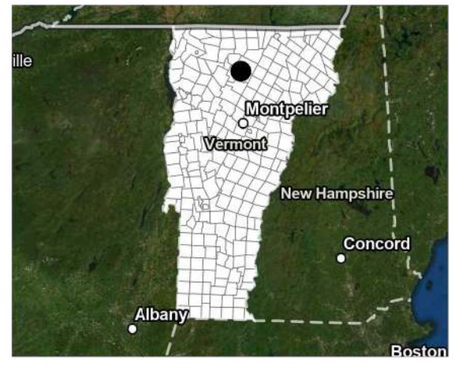
0 65 130 US Feet

LEGEND

- Catchbasin
- Culvert inlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #9
HYDE PARK
HDP01

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

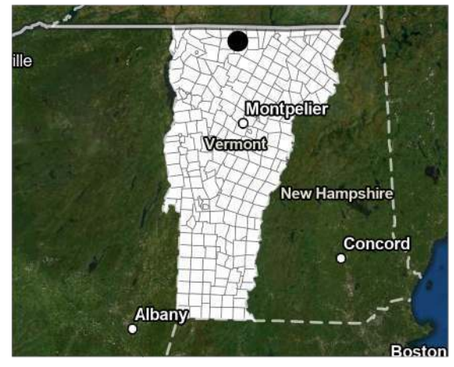
0 65 130 US Feet

LEGEND

- Catchbasin
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #10
MONTGOMERY
MV01

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

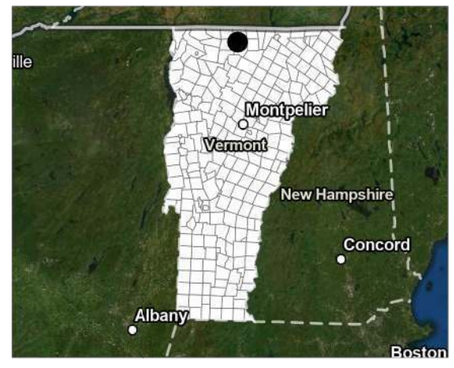
0 65 130 US Feet

LEGEND

- Catchbasin
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #11
MONTGOMERY
MV04

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

MP370
CB1
CB2
CB3
CB5
MSMS
CB6
CB7
CB4
Peck Pl
Cross St
Franklin St
Scribner Pl
North St
Liberty St
Main St
Jay St
32 NORTH ST
24 NORTH ST
1 SCRIBNER PL
172 MAIN ST
176 MAIN ST

N

0 65 130 US Feet

LEGEND

- Catchbasin
- Yard drain
- Stormwater Manhole
- Sanitary Manhole
- Culvert outlet

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #12
MONTPELIER
MP370

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

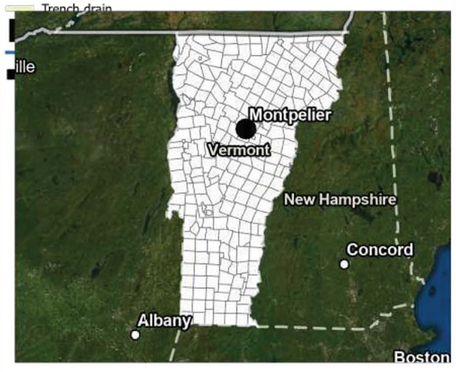
0 275 550 US Feet

LEGEND

- Catchbasin
- Drop Inlet
- Grate/Curb Inlet
- Yard drain
- Junction Box
- CB tied to sanitary sewer
- Stormwater Manhole
- Combined sewer MH
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall
- Known CSO outfalls (location approximate)

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain



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

Map #13
MONTPELIER
MP590

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

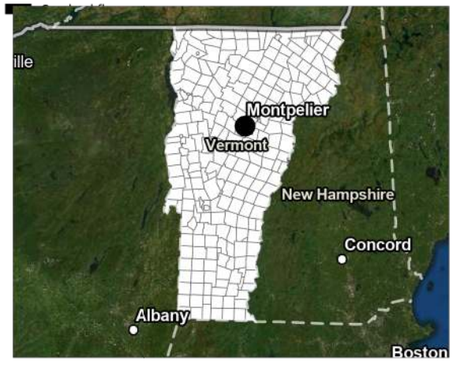
0 410 820 US Feet

LEGEND

- Catchbasin
- Grate/Curb Inlet
- Yard drain
- Junction Box
- CB tied to sanitary sewer
- Stormwater Manhole
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream



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

Map #14
MONTPELIER
MP1350

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

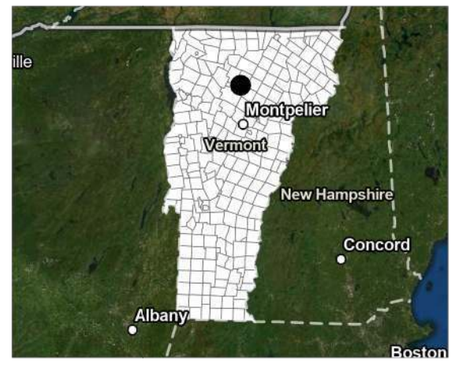
0 65 130 US Feet

LEGEND

- Catchbasin
- Drop Inlet
- Stormwater Manhole
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #15
MORRISTOWN
MO01

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 137.5 275 US Feet

LEGEND

- Catchbasin
- Yard drain
- CB tied to sanitary sewer
- Stormwater Manhole
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall
- Known CSO outfalls (location approximate)
- Pond outlet structure

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #16
NORTHFIELD
NF07

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

US Feet

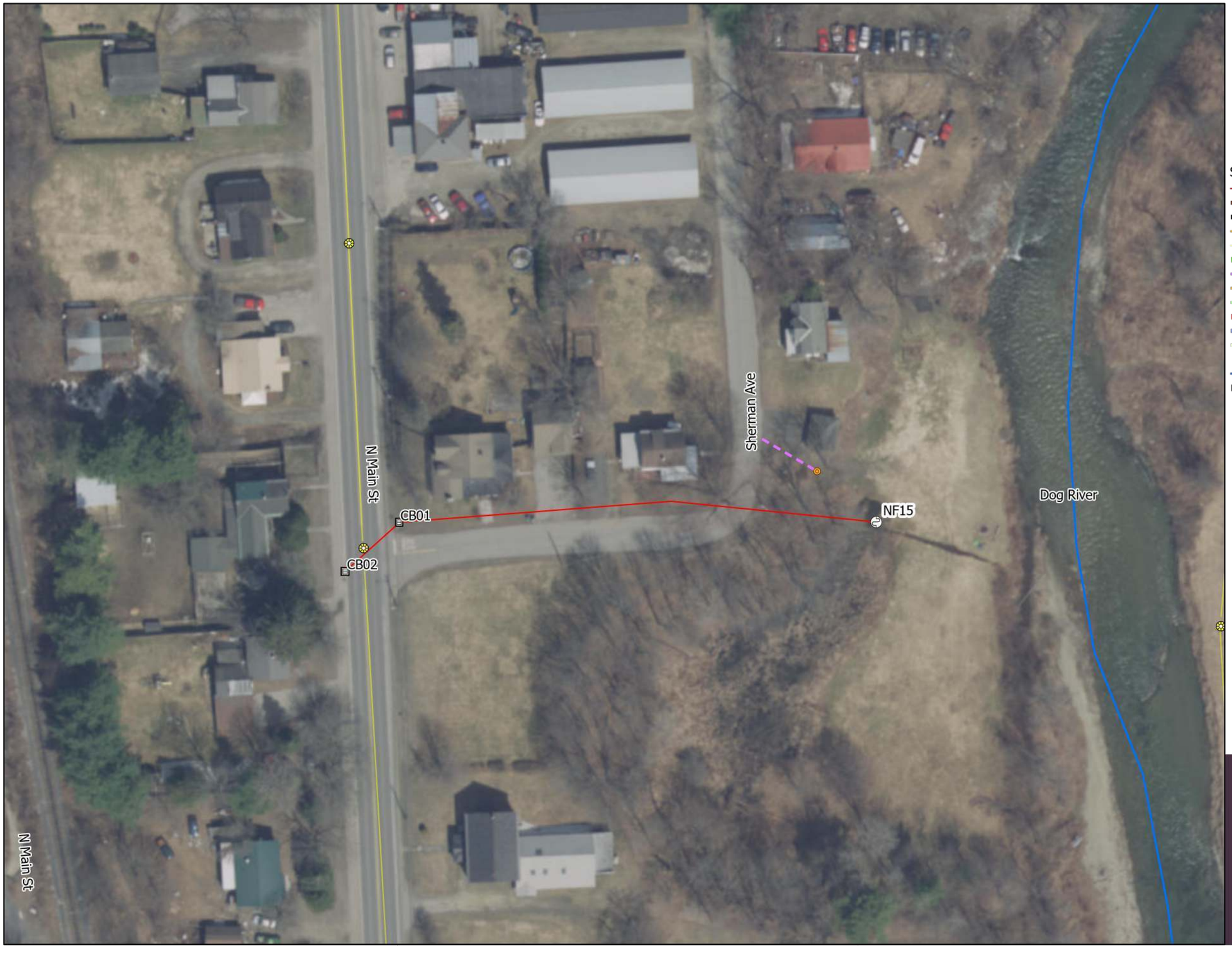
0 65 130

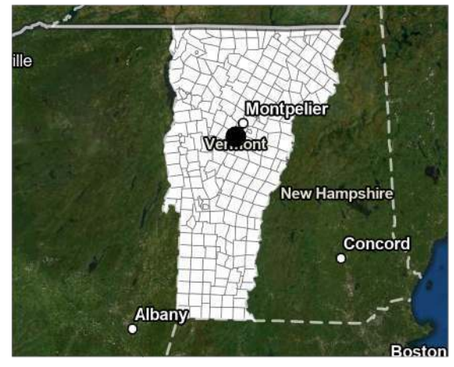
LEGEND

- Catchbasin
- Sanitary Manhole
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow





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

Map #17
NORTHFIELD
NF15

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 65 130 US Feet

LEGEND

- Catchbasin
- Yard drain
- Junction Box
- CB tied to sanitary sewer
- Stormwater Manhole
- Combined sewer MH
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall
- Unknown Point

Stormwater and Wastewater Infrastructure (line)

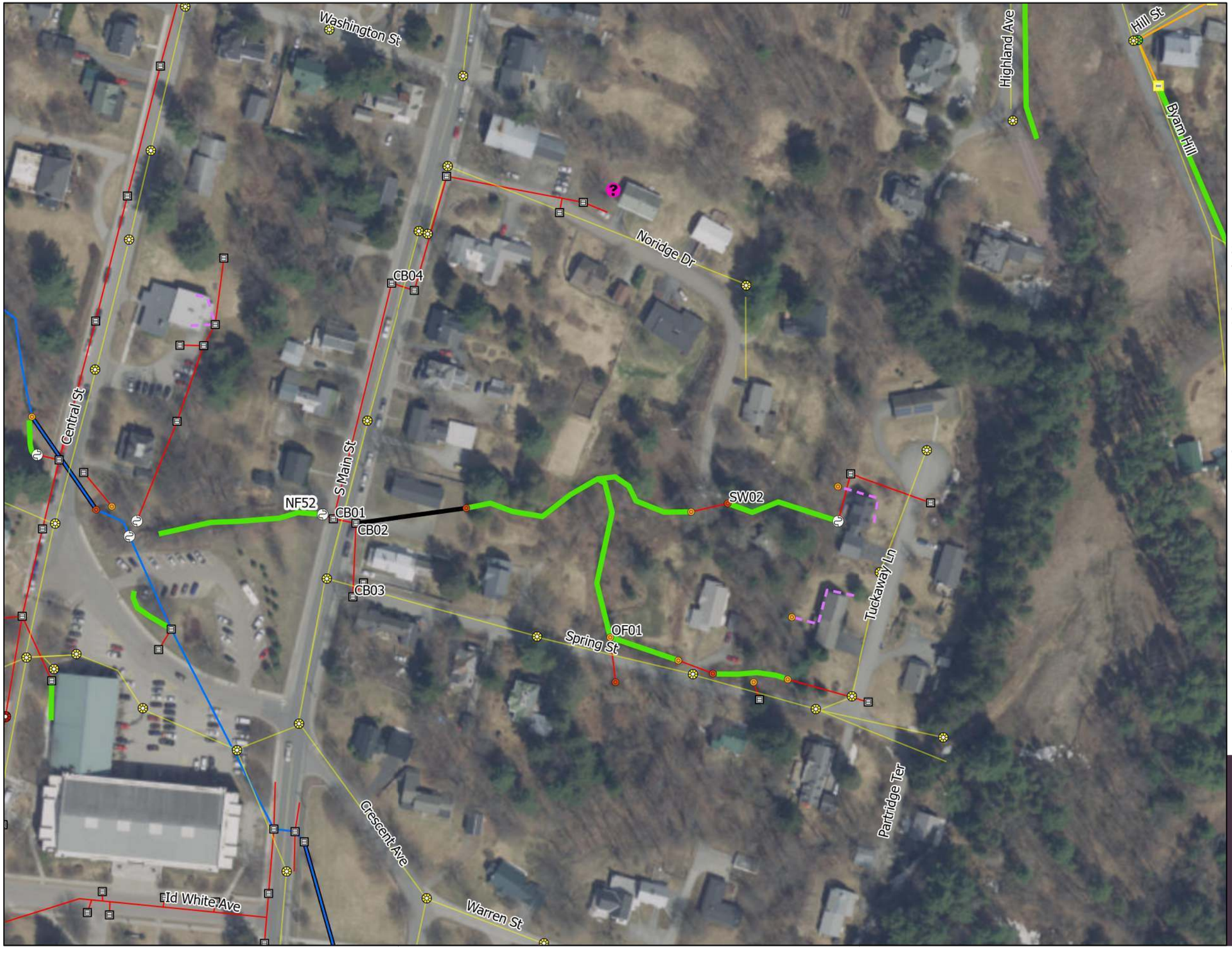
- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway

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

Map #18
NORTHFIELD
NF44

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL



N

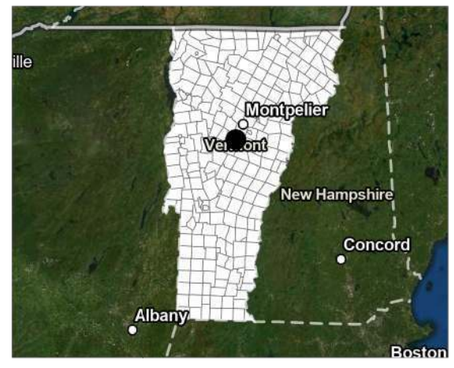
0 137.5 275 US Feet

LEGEND

- Catchbasin
- CB tied to sanitary sewer
- Stormwater Manhole
- Combined sewer MH
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall
- Unknown Point

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #19
NORTHFIELD
NF52

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 137.5 275 US Feet

LEGEND

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

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #20
RANDOLPH
RND98

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 205 410 US Feet

LEGEND

- Catchbasin
- Dry Well
- Stormwater Manhole
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #21
SOUTH HERO
SO01

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

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N

0 137.5 275 US Feet

LEGEND

- Catchbasin
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #22
SOUTH HERO
SO02

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

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N

0 137.5 275 US Feet

LEGEND

- Catchbasin
- Culvert inlet
- Culvert outlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #23
SOUTH HERO
SO05

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 65 130 US Feet

LEGEND

- Catchbasin
- Stormwater Manhole
- Sanitary Manhole
- Culvert inlet
- Culvert outlet
- Outfall
- Pond outlet structure

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #24
ST. JOHNSBURY
SJ1200

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

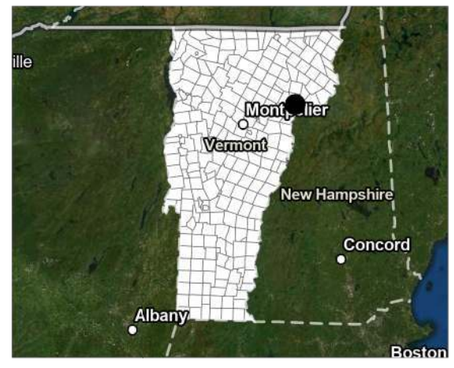
0 65 130 US Feet

LEGEND

- Catchbasin
- Stormwater Manhole
- Combined sewer MH
- Sanitary Manhole
- Culvert outlet
- Outfall
- Known CSO outfalls (location approximate)

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow



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

Map #25
ST. JOHNSBURY
SJ1500

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL

N

0 65 130 US Feet

LEGEND

- Catchbasin
- CB tied to sanitary sewer
- Combined sewer MH
- Sanitary Manhole
- Culvert inlet
- Outfall

Stormwater and Wastewater Infrastructure (line)

- Storm line
- Storm line (old Sanitary line)
- Tunnel (storm)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Infiltration pipe
- French drain
- Trench drain
- Emergency spillway
- Stream
- Overland flow

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

Map #26
ST. JOHNSBURY
SJ1730

Statewide IDDE Project #4
Prepared for VT DEC

STONE ENVIRONMENTAL