
Otter Creek Basin Illicit Discharge Detection and Elimination Project

FINAL REPORT

May 31, 2014



Dye testing of toilets in two houses on North Pleasant Street in Middlebury revealed cross connections to a stormwater line, visible in this manhole above

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1. INTRODUCTION

Six towns participated in the Otter Creek Basin Illicit Discharge Detection and Elimination (IDDE) Project: Brandon, Middlebury, Pittsford, Rutland City, Rutland Town, and Vergennes. The goal of the project was to improve water quality by identifying and eliminating contaminated, non-stormwater discharges entering stormwater drainage systems and discharging to the Otter Creek and its tributaries. The project encompassed the entirety of the municipal closed drainage systems in the six participating towns. Prior to this project, there had been no assessment of stormwater infrastructure in the participating municipalities for the presence of illicit discharges, with the exception of some optical brightener monitoring performed at outfalls in the Moon Brook watershed in Rutland City.

The Vermont Department of Environmental Conservation (DEC) prepared stormwater infrastructure maps for the municipalities within the Otter Creek watershed between 2010 and 2012. The infrastructure mapping and IDDE work were funded by the same grant awarded to DEC in April 2010 by the Lake Champlain Basin Program (LCBP). DEC prepared a geodatabase of stormwater infrastructure for the participating municipalities, combining digitization of engineering plans with field survey in certain areas.

Stone and DEC submitted a draft Quality Assurance Project Plan to LCBP on August 6, 2010. This QAPP was approved with minor revisions on May 11, 2011. In 2011-2012, Stone assessed approximately 700 structures in 620 drainage systems among the six participating towns and identified a total of 59 potential illicit discharges (Table 1). Stone began field work on October 28, 2011 in Middlebury. Between October 28 and December 14, 2011, Stone performed illicit discharge assessments in Middlebury and Vergennes. Stone resumed field work in April 2012, performing much of the assessment work in Brandon and Pittsford in the spring before moving on to Rutland City and Rutland Town during the summer months. Illicit discharges were found in every town except Pittsfield. Stone also made progress investigating suspected illicit discharges in Middlebury and Vergennes to verify the presence of illicit discharges and to determine their sources. Three illicit discharges were eliminated in Middlebury, one in Vergennes, and two in Rutland City.

Resuming work in September 2013 under the second contract, Stone began advanced investigations of potential illicit discharges in Brandon, Rutland City, and Rutland Town. Due to time constraints and an early winter, further advanced investigative work in Vergennes and Middlebury was postponed until spring 2014.

Table 1. Summary of stormwater drainage systems assessed

Town	Closed Drainage Systems Assessed	Systems with Suspected Illicit Discharges
Brandon	46	7
Middlebury	164	11
Pittsford	25	0
Rutland City	170	21
Rutland Town	132	12
Vergennes	83	8
Total	620	59

The infrastructure mapping prepared by DEC was used extensively throughout the IDDE assessments and investigations to identify outfalls, select appropriate assessment points, and trace suspected contaminants.

1.1. Project roles and responsibilities

Stone Environmental developed the testing protocol and led the field assessment and reporting. The DEC project manager, Michaela Stickney, administered the project. The project team's primary municipal contacts were:

Brandon: Brian Sanderson, Public Works Director

Middlebury: Dan Werner, Director of Operations, Public Works Department
Bob Wells, Wastewater Superintendent

Pittsford: John Haverstock, Town Manager

Rutland City: Evan Pilachowski, Commissioner of Public Works
Alan Shelvey, City Engineer

Rutland Twn: Joe Zingale, Town Administrator

Vergennes: Jim Larrow, Public Works Director

2. METHODS

2.1. Preparations for the illicit discharge assessment

Preparations for the illicit discharge assessment were completed for each participating municipality. These preparations included obtaining and assembling necessary equipment and supplies; preparing a field data form (Appendix A), field maps, a Health and Safety Plan, and other documents and organizing these in project notebooks; and meeting with municipal representatives to gather information and plan the project. Field equipment was assembled from Stone's inventory. Consumable supplies, including test reagents, were purchased to meet the needs of the project. Large format field maps were prepared by overlaying DEC's stormwater infrastructure mapping and the best available orthophotography. A project notebook was assembled containing all these documents plus contact information, laboratory chain of custody forms, standard operating procedures, and other documents.

Prior to commencing field work, members of the project team met with municipal officials to gather information and plan the illicit discharge assessment in each community. Information collected during the kick off meetings included:

- Contact information for municipal managers and public works personnel.
- General schedules of road and wastewater and stormwater collection system projects to occur in 2012 (to avoid conflict with construction activities).
- Locations of any known, suspected, or potential cross connections, combined sewer overflows, and sanitary sewer overflows.
- The capabilities of each municipality to inspect pipelines and perform other advanced investigation techniques, either with municipal staff and equipment or using a contractor specializing in such work.
- Preferences concerning safe work practices in the public right-of-way.

2.2. Dry weather survey

Stormwater outfalls and other discharge points (earthen channels, groundwater seeps, pipes of indeterminate origin) were inspected during dry weather to minimize dilution by stormwater. Dry weather was defined as negligible rainfall (less than 0.1 inches) since approximately 12:00 p.m. on the previous day. Because outfall monitoring may not be sufficient to detect small sources of contaminants within larger stormwater collection systems due to flow dilution, selected catchbasins and junction manholes in these systems were also assessed. Stormwater outfalls, catchbasins, and manholes were accessed along the public right-of-way or from the bank of the receiving waterbody, as appropriate. In certain cases stormwater structures located on private property were assessed if these structures were connected to a municipal system and assuming permission was granted.

Every outfall or other stormwater structure assessed was assigned a unique identifying code. Scientists described 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. Dry weather flows were sampled directly into a sample container, by hand or using a telescopic pole. At catchbasins and manholes located at junctions in the storm sewer, samples were collected independently from each inflowing pipe, where possible. Field data were entered on printed forms or noted on field maps.

Each dry weather discharge was tested for ammonia, methylene blue active substances (common anionic detergents), and the presence of optical brightener to identify wastewater discharges from laundry facilities, failing septic systems, leaking sanitary sewers, and cross-connections. Optical brighteners are fluorescent dyes contained in most laundry detergents. Specific conductance was measured as an indication of the dissolved solids content. For detection of treated municipal water leakage, total chlorine was analyzed.

With certain exceptions, structures where no dry-weather flow was observed were assumed not to have illicit connections and no further assessment was made. Our general procedure is to provide additional assessment of dry structures only if there is evidence of contamination in the area below the outfall or in a catchbasin or manhole sump, such as deposits, staining, or offensive odors.

Water analysis methods

Ammonia was tested using Aquacheck ammonia test strips. Methylene blue active substances (MBAS) were tested using CHEMetrics test kit K-9400, a method consistent with APHA Standard Methods, 21st ed., Method 5540 C (2005). Total chlorine analysis was conducted with powdered DPD reagent (Hach Method 8167, equivalent to USEPA method 330.5) and a portable Hach DR/890 colorimeter. Specific conductance was measured using an Oakton model conductivity meter.

Optical brightener monitoring was performed at outfalls and selected catchbasins and manholes that were flowing at the time of inspection. To test for optical brightener, a cotton pad was placed in the flow stream for a period of 5-10 days, after which the pad was rinsed, dried, and viewed under a long-wave ultraviolet light ("black light"). Florescence of the pad indicates the presence of optical brightener. Pads are held in a mesh sleeve, clipped to the outfall structure 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 more often hung from the catchbasin grate or manhole rung into the sump. An advantage of optical brightener monitoring is that some intermittent or dilute wastewater discharges may be detected due to the multiple-day exposure of the pad, whereas the contaminant may not be detected in tests performed on grab samples.

Table 2 identifies water quality tests that scientists performed at all discharge points and selected catchbasins and manholes that were flowing at the time they were inspected.

Table 2. Water quality tests performed at flowing structures

Parameter	Sample Container	Analytical Method
Ammonia	Plastic beaker	Aquacheck ammonia test strips
MBAS detergents (anionic surfactants)	Glass beaker	APHA Standard Methods, 21st ed., Method 5540 C (2005)
Total chlorine	Glass beaker	By DPD, Hach Method 8167 (EPA 330.5)
Specific conductance	Glass beaker	SEI SOP 5.23.3
Optical brighteners	Cotton test pads	SEI SOP 6.38.0

Follow-up testing of stormwater discharge points

At certain discharge points where wastewater contamination was suspected (because of a positive optical brightener test, elevated ammonia, and/or wastewater odor), water samples were collected for *E. coli* and total phosphorus analysis. Samples collected for *E. coli* analysis were collected in sterile, plastic 100-mL bottles. Samples collected for total phosphorus analysis were collected in glass digestion tubes. *E. coli* analyses were performed by Endyne, Inc. in Williston, VT in 2011 and by the DEC Laboratory in 2013. Total phosphorus analyses were performed by the DEC Laboratory. Table 3 identifies the *E. coli* and total phosphorus methods used by each laboratory. *E. coli* values were determined using a 10:1 dilution in sterile dilution water.

Table 3. Laboratory sample analyses

Parameter	Sample Container (vol. required)	Analytical Method	Sample Preservation	Holding Time
Total phosphorus	Glass Digestion Tube (50 mL)	EPA 4500-P H	Cool ($\leq 6^{\circ}\text{C}$)	28 days
<i>E. coli</i>	Plastic (100 mL)	SM 9223B (Colilert Quanti-Tray) 10:1 dilution	Cool ($< 10^{\circ}\text{C}$)	6 hours

Flow measurement

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

2.3. Isolating contaminant sources within storm sewer segments

If, based on the results of the dry weather survey, a storm sewer was suspected of passing illicit discharges, additional observations and testing were performed within the collection 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 down-pipe manhole. DEC's stormwater infrastructure mapping was used to guide this effort.

In attempting to locate or bracket contaminant sources within storm sewer segments, the same testing methods or a subset were used as in the dry weather survey phase. Highly intensive optical brightener testing of storm sewer structures was performed to bracket the source of wastewater contamination in many stormwater systems, deploying pads in as many as 40 structures within the same system.

To describe various structures within the stormwater drainage network, two conventions were followed. The first catchbasin or manhole up-pipe from the outfall is referred to by appending an “-A” to the outfall structure ID, the second up-pipe structure by appending “-B”, and so on. At pipe junctions, the convention we used was to orient ones back to the outlet pipe and then name the influent pipes in a clockwise fashion as pipe A, B, C, et cetera. This nomenclature is used to identify catchbasins, manholes, and pipes in this report.

2.4. Advanced investigation

After pollutant discharges were characterized and bracketed to the degree possible through water quality testing, Stone typically visited each discharge location with municipal staff to plan for follow up investigation or elimination of the source of the discharge (where the source was apparent). The status of the advanced investigation and correction work is summarized in the main results data table for each municipality in the report sections which follow.

3. BRANDON RESULTS

Initial illicit discharge assessment in Brandon was performed in May and June, 2012. Map B0 illustrates mapped stormwater outfall locations in Brandon (Appendix B). Of the 46 outfalls assessed in Brandon, 24 were flowing or dripping when inspected. One or more contaminants were detected at seven of the assessed outfalls. These systems are identified in Table 4, which summarizes the results of the initial assessment, more recent (2013) findings, and status. The third column in Table 4 refers to a map number, if a map is needed to illustrate the stormwater drainage system. These findings were reviewed with the Town of Brandon Department of Public Works in a meeting held on November 20, 2013.

Table 4. Stormwater systems in Brandon with suspected or confirmed illicit discharges

System ID	Assessment Findings	Map
BN110	<p>Description: Outfall BN110 is an 18-inch diameter concrete pipe located on Route 7 south of the intersection with New Road. Ammonia, total chlorine, and MBAS detergent concentrations at the outfall were below detection on the initial assessment date, May 2, 2012. However, optical brightener was detected at the outfall. Monitoring pads were then placed throughout the system on June 25, 2012. Optical brightener was again detected at the outfall but was not present in catchbasins CB-A, CB-B, or CB-C.</p> <p>No dry weather flow was observed at the outfall on three visits in fall 2013; therefore no samples were collected for <i>E. coli</i> and total phosphorus analyses. On November 14, 2013 optical brightener was detected at the outfall and CB-A. Homes in this area on the east side of Route 7 may have malfunctioning septic systems. Incompletely treated wastewater from a malfunctioning septic system is the likely source of optical brightener in the system.</p> <p>Status: The Director of Public Works has stated that the Town of Brandon is not responsible for drainage infrastructure on Route 7 or for private septic systems in town. Therefore, by this report, this issue is referred to the DEC Wastewater Management Division.</p>	B1
BN124	<p>Description: Outfall BN124 is an 18-inch diameter concrete pipe located on Route 7 immediately south of the intersection with Steinberg Road. The outfall was dripping when assessed on June 12, 2012, but there was insufficient flow to collect samples. Optical brightener was detected in catchbasin CB-B only.</p> <p>Low <i>E. coli</i> (<10 MPN/100 mL) and total phosphorus (21.1 µg/L) concentrations were measured at the outfall on August 15, 2013. On November 6, 2013, no optical brightener was detected in CB-B Pipe A.</p> <p>Status: An illicit discharge in this system was not convincingly demonstrated; therefore, no action is recommended.</p>	N/A
BN130	<p>Description: Outfall BN130 is a 30-inch diameter concrete pipe located on Route 7 approximately ¼ mile south of the intersection with Steinberg Road. Optical brightener was detected and a low concentration of chlorine (0.11 mg/L) was measured when the outfall was assessed on May 2, 2012. Subsequently, on June 25, 2013, optical brightener was detected in the outfall and first up-pipe catchbasin (CB-A), but not in CB-B or CB-C.</p> <p>On November 6, 2013 optical brightener was detected in CB-A. No optical brightener was detected in CB-B. Incompletely treated wastewater from a malfunctioning septic system at one or more of the three residences on the east side of Route 7 between CB-A and CB-C is the likely source of optical brightener in the system. The house immediately south of CB-A is reportedly connected to the sanitary sewer via a force-main under Route 7.</p> <p>Status: The Director of Public Works has stated that the Town of Brandon is not responsible for drainage infrastructure on Route 7 or for private septic systems in town. Therefore, by this report, this issue is referred to the DEC Wastewater Management Division.</p>	B2
BN170	<p>Description: Outfall BN170 is a 12-inch diameter corrugated metal pipe located off Route 7 in a ravine adjacent to the post office. A low level of ammonia (0.25 mg/L) was measured at the outfall on May 2, 2012 and a slight sewer odor, suds, and iron staining were observed in the pool beneath the outfall. The ammonia concentration was slightly higher (0.5 mg/L) when the outfall was resampled on June 11, 2012. No optical brightener was detected at the outfall or in the first up-pipe catchbasin.</p> <p>Low <i>E. coli</i> (<10 MPN/100 mL) and total phosphorus (126 µg/L) concentrations were measured at the outfall on August 22, 2013 and ammonia, total chlorine, and MBAS detergent were all below detection. On November 6, 2013 a low concentration of ammonia (0.5 mg/L) was measured while total chlorine and MBAS detergent were below detection. No flow was observed in the first up-pipe catchbasin (CB-A). Groundwater infiltrating the system downpipe of CB-A is likely the source of flow at the outfall.</p> <p>Status: An illicit discharge in this system was not convincingly demonstrated; therefore, no action is recommended.</p>	N/A

System ID	Assessment Findings	Map
BN250	<p>Description: Outfall BN250 is a 15-inch diameter corrugated metal pipe located on West Seminary Street. No ammonia, total chlorine, or MBAS detergent were found at the outfall on May 2, 2012; however, optical brightener was detected. Pads deployed throughout the system on June 12, 2012 indicated optical brightener at the outfall and in the first four catchbasins up the line (CB-A through CB-D). Optical brightener was not present in catchbasins further up the line. An unmapped pipe entering CB-D is the primary source of dry-weather flow in the system. This pipe is believed to be an abandoned section of the former combined sewer line.</p> <p>High <i>E. coli</i> (12,030 MPN/100 mL) and low total phosphorus (103 µg/L) concentrations were measured at the outfall on August 22, 2013. On November 6, 2013, Pipe A in catchbasin CB-D was trickling, the only apparent source of dry-weather flow in the system. Pipe A extends north from CB-D for a few feet and then appears to give way to a box culvert that is partially filled with sediment. This pipe/culvert does not appear suitable for inspection with a track camera. On November 6, 2013 optical brightener was detected in CB-D Pipe A.</p> <p>On November 20, 2013, the sanitary sewer main was dye tested from the intersection of West Seminary Street and Case Street. The sanitary sewer in this area is only a few feet below ground, possibly shallower than the stormwater drainage system and CB-D Pipe A. Dye quickly appeared in a down-pipe sanitary manhole but did not appear in catchbasin CB-D, suggesting that the sewer main is not the source of contamination (although it is possible given the small flow and the sediment volume in the pipe that the dye eventually worked its way through to CB-D).</p> <p>There are four houses on West Seminary Street between the intersection of North Seminary Street and Case Street. Houses at #49 and #50 West Seminary Street were dye tested on November 20, 2013 and found to be connected to the sanitary sewer. The houses at #47 and #52 could not be accessed.</p> <p>Status: The high <i>E. coli</i> concentration and presence of optical brightener in this system suggest a sanitary wastewater connection, possibly from a leaking sewer lateral. Further investigation could begin with a second attempt to dye test the houses on West Seminary Street between the intersection of North Seminary Street and Case Street, starting with #47 and #52.</p>	B3
BN260	<p>Description: Outfall BN260 is a 24-inch diameter corrugated metal pipe located on West Seminary Street, immediately south of outfall BN250. No ammonia or MBAS detergent and a very low concentration (0.05 mg/L) of total chlorine were found at the outfall on May 2, 2012; however, optical brightener was detected. Monitoring pads deployed in the outfall and CB-A (the only catchbasin in the system) in June, 2012 indicated presence of optical brightener in both locations.</p> <p>High <i>E. coli</i> (8,660 MPN/100 mL) and low total phosphorus (86.1 µg/L) concentrations were measured at the outfall on August 22, 2013. On November 6, 2013 the outfall was dripping. The discharge was clear with no odor. The swale on the east side of West Seminary Street was dry. There are no direct connections visible from the outlet or inlet.</p> <p>Status: The high <i>E. coli</i> concentration and presence of optical brightener in this system suggest a sanitary wastewater connection, possibly the same source as detected in BN250. It has not been possible to identify the source of contamination in this system. Further investigation could begin with a second attempt to dye test the houses on West Seminary Street between the intersection of North Seminary Street and Case Street, starting with #47 and #52.</p>	B3
BN340	<p>Description: Outfall BN340 is a 12-inch diameter corrugated metal pipe located on Union Street below Barlow Avenue, just west of the wastewater treatment plant. No MBAS detergent and total chlorine and a low ammonia (0.25 mg/L) concentration were found at the outfall on May 2, 2012; however, optical brightener was detected. Monitoring pads deployed on June 12, 2012 indicated optical brightener at the outfall and in the first up-pipe structure, MH-A, but not at the next up-pipe structure, CB-A.</p> <p>Zero <i>E. coli</i> and a low total phosphorus concentration (15.2 µg/L) were measured at the outfall on August 22, 2013. On November 6, 2013 the outfall was trickling. The only catchbasin on the system, CB-A, was dry. Low concentrations of ammonia (0.25 mg/L), total chlorine (0.06 mg/L), and MBAS detergent (0.2 mg/L) were measured in the first up-pipe manhole (MH-A) on November 6, 2013. No optical brightener was detected in MH-A on the pad deployed on November 6, 2013.</p> <p>Status: An illicit discharge in this system was not convincingly demonstrated; therefore, no action is recommended. Optical brightener detected in 2012 may have resulted from the river surcharging the outfall and MH-A. The elevations of the outfall and the MH-A invert are close to the low river stage.</p>	N/A

4. MIDDLEBURY RESULTS

Initial illicit discharge assessment in Middlebury was performed between October 28, 2011 and mid-December, 2011. Map M0 illustrates mapped stormwater outfall locations in Middlebury (Appendix C). Of the 164 outfalls assessed in Middlebury, 59 were flowing or dripping when inspected. Forty-five other structures, primarily catchbasins, were also assessed at that time. Twelve storm sewer systems were investigated in some detail after detection of one or more contaminants. In 11 of these systems, one or more illicit discharges were suspected. These systems are identified in Table 5, which summarizes the results of the initial assessment, more recent findings, and current status. The third column in Table 5 refers to a map number, if a map is needed to illustrate the stormwater drainage system. These findings were reviewed with the Town of Middlebury Department of Public Works in meetings held on November 16, 2011 and May 27, 2014.

Outfalls on Middlebury College property were assessed in a separate study funded directly by the College; these results are not available to the public.


The system (MB170) discharging from the pump station at the end of Lucius Shaw Lane appears to have illicit discharges entering in three locations. The system draining the Woodland Park neighborhood and side streets (discharging at outfall MB1220) also appears to have illicit discharges in three locations. The other structures identified in Table 5 appear to have only one source of contamination.

In the initial discharge assessment, several systems were found to have low concentrations (0.2-0.5 mg/L) of MBAS detergents and non-detectable levels of the other measured constituents. Upon repeated sampling, we determined that most of these systems did not have chronic illicit discharges. Small amounts of detergents are commonly detected in dry weather flows due to transient sources, such as vehicle washing. Unless a chronic illicit discharge is suspected or bracket sampling was conducted, these systems are not discussed further in this report.

Table 5. Stormwater systems in Middlebury with suspected or confirmed illicit discharges

System ID	Assessment Findings	Map
MB030	<p>Description: Outfall MB030 discharges to Otter Creek on the east side of the Storm Café on Mill Street. The system drains the eastern length of Mill Street and a short section of Main Street. During sampling on October 28, 2011, the field crew noted turbid water and a distinct swimming pool odor in the structure (catchbasin MB050) immediately up-pipe from the outfall. A sample collected from the catchbasin had an exceedingly high total chlorine concentration (2.20 mg/L) and elevated ammonia (0.5 mg/L). The MBAS detergent test was invalid, possibly because the concentration exceeded the analytical range. While samples were being processed, a Storm Café employee was witnessed dumping mop water into catchbasin MB050.</p> <p>Status: The employee and restaurant manager agreed to stop dumping to the storm sewer. During a follow up visit on December 8, 2011, ammonia and chlorine concentrations were below the limit of detection at the outfall and the restaurant manager confirmed that wastes were no longer discharged to the catchbasin. Therefore, we consider this discharge to have been eliminated.</p>	M1
MB070	<p>Description: Outfall MB070 is an 18-inch steel pipe located on the edge of the parking area south of Merchant's Row, adjacent to the railroad tracks. Elevated MBAS detergents (0.6 mg/L) were detected at the outfall on two dates, October 28 and December 15, 2011. Further tests were performed at catchbasin MB090 up-pipe from the outfall, near the rear of St. Stephen's Episcopal Church on the town green; however poor sample quality (leaves and decomposed organic matter) precluded accurate analyses.</p> <p>Status: The origin of the dry weather flow and detergents has not been determined. There are few access points to this storm sewer; therefore, the source cannot be isolated properly through bracket sampling. However, according to the Middlebury Wastewater</p>	M2

System ID	Assessment Findings	Map
	Superintendent, Bob Wells, this stormwater system is scheduled to be replaced with a modern system as part of a major train tunnel construction project scheduled to begin in the fall of 2014. The sanitary sewer will be reconstructed or realigned as well. Direct connections to the system from floor drains should be eliminated during reconstruction. Therefore, no other action is recommended.	
MB170 system	<p>Description: Manhole MB170 is a manhole on Lucius Shaw Lane at the former wastewater treatment plant (now a pump station). This extensive drainage system discharges to Otter Creek at an outfall identified as Middlebury CSO #10. MB170 is the first structure up-pipe from the outfall, which is inaccessible.</p> <p>It appears there are contaminated non-stormwater flows entering in three segments within the contributing drainage system, identified as #1 to #3 below.</p>	M3
	<p>#1: Optical brightener was detected in every structure assessed from manhole MB170 up to manhole MB400, east of the old train station. Due to ammonia and optical brightener detected at MB400, a sanitary wastewater source was suspected discharging to the stormline running between North Pleasant Street and manhole MB400 (see map M4). This line is an old combined sewer line that was believed to have been separated.</p> <p>A sample collected on December 1, 2011 from catchbasin MB380 had a high <i>E. coli</i> concentration (11,000 MPN/100 mL). Total phosphorus (195 µg/L) was not high and the flow was approximately 0.6 L/s. The <i>E. coli</i> result, combined with the optical brightener and ammonia detections, strongly suggest that sanitary wastewater is entering the system east of manhole MB400.</p> <p>On May 27, 2014, six houses on the west side of North Pleasant Street between Elm Street and Methodist Lane were dye tested with the assistance of the Middlebury Public Works Department. Sanitary wastewater connections were confirmed at #48 and #54 North Pleasant Street and a laundry connection was found at #52 North Pleasant Street (see inset photo). An inconclusive test was conducted at #50 North Pleasant Street. Dye did not appear when flushed in toilets at #50, #46, and #56 North Pleasant Street.</p> <p>Status: Illicit discharges into this stormline were confirmed very recently. The Town of Middlebury is aware of these findings and we expect the Town will be working with the property owners to eliminate the discharges as soon as possible.</p>	M4
	<p>#2: Catchbasin MB360 is located on the north side of Seminary Street in the grass next to the church parking lot. On two dates chlorine was detected in Pipe C, which crosses Seminary Street: 0.20 mg/L was measured on November 1, 2011 and 0.16 mg/L was measured on December 13, 2011. A tapwater leak is suspected in the vicinity that infiltrates the Pipe C stormline between catchbasin MB360 and the next up-pipe structure.</p> <p>Status: Small potable water leaks are essentially a municipal concern rather than sources of priority pollutants. We recommend acoustic leak detection be performed to locate the apparent leak.</p>	M3
	<p>#3: Catchbasin MB370 is located at the intersection of Seymour Street and Methodist Lane. The system in question drains the southern section of Seymour Street. During the assessment on November 2, 2011, there was small flow into the catchbasin from pipes A and B and suds in the sump. On two dates chlorine was detected in flow from Pipe B: 0.5 mg/L on November 2 and 0.09 mg/L on December 14, 2011. A tapwater leak is suspected in this vicinity that infiltrates the Pipe B stormline between catchbasin MB370 and the next up-pipe structure.</p> <p>Status: Small potable water leaks are essentially a municipal concern rather than sources of priority pollutants. We recommend acoustic leak detection be performed to locate the apparent leak.</p>	M3
	<p>Description: Catchbasin MB230 is located on Buttolph Drive at the southeast corner of the Shaw's Supermarket parking lot, in front of the building. Two stormlines discharge to this basin: Pipe A drains the Shaw's parking lot and an adjacent section of Washington Street and Pipe B drains a residential area on High Street, Washington Street, and Seminary Street. On the first sampling date, November 1, 2011, a very high chlorine concentration (>1 mg/L) was measured in flow from Pipe A, in addition to a low concentration (0.4 mg/L) of MBAS detergents. No contaminants were detected in flow from Pipe B. When Pipe A was resampled on December 15, 2011, the MBAS concentration was higher, 0.9 mg/L, while the chlorine concentration was below the limit of detection. The next catchbasin up Pipe A also had a MBAS detergents concentration of 0.9 mg/L. The suspected source of chlorine and MBAS detergents is a drain in Shaw's Supermarket or washwater dumping to catchbasins.</p> <p>Status: We recommend the Middlebury Public Works Department work with the property owner to isolate and resolve this problem, if the town has not done so to date.</p>	M5

System ID	Assessment Findings	Map
MB330	<p>Description: Outfall MB330 is a 15-inch diameter corrugated black plastic pipe that discharges into a wetland area to the south of Washington Street. The system drains a residential area from the top of the hill on the eastern section of Colonial Drive and a 200-foot section of Washington Street. Optical brightener was detected at the outfall on the first field visit, November 1, 2011. No other contaminants were detected although suds were observed.</p> <p>On November 16, 2011 monitoring pads were placed throughout the drainage system. The result at the outfall was indeterminate; however, optical brightener was detected at the next up-pipe manhole, labeled MB330-E. Two pipes discharge to catchbasin MB330-E. Pipe A is the main stormline, which was flowing when observed on November 16, 2011. Pipe B, which crosses Washington Street Extension, was not flowing when observed on November 16, 2011, but flow was entering the catchbasin beneath Pipe B. Optical brightener monitoring pads placed in Pipe A and up-pipe structures were negative. However, a pad placed in the flow stream beneath Pipe B yielded a positive optical brightener result.</p> <p>Due to the optical brightener detections in the drainage system, samples were collected from outfall MB330 for <i>E. coli</i> and total phosphorus analyses. Negligible <i>E. coli</i> (20 MPN/100 mL) and low total phosphorus (33.9 µg/L) concentrations were found in samples collected on December 1, 2011.</p> <p>Based on location of the flow entering catchbasin MB330-E and the detection of optical brightener in this flow stream, we suspect a diluted, partially renovated sanitary wastewater source. It is possible a leak in the sanitary sewer line along Washington Street Extension is infiltrating the basin in this location, after mixing with groundwater and filtering or decomposition of wastewater contaminants as effluent passes through the road base. This is speculation but we lack another explanation.</p> <p>Status: We recommend the Town of Middlebury dye test the sanitary sewer in the vicinity (east) of catchbasin MB330-E and also houses at #281 and #294 Washington Street Extension.</p>	M6
MB350	<p>Description: Outfall MB350 is a 15-inch diameter corrugated black plastic pipe that discharges into a swale south of the "Five-Corner" intersection of Washington Street, Washington Street Extension, Seminary Street, Seminary Street Extension, and Springside Road. The system drains a small area surrounding the Five Corner intersection, including the driveway for the Sunshine Children's Center. Optical brightener was detected at the outfall; the monitoring pad deployed on November 1 and retrieved November 8 tested positive. There were no other indications of contamination. A second monitoring pad, placed on November 16, 2011, was also positive, as was the pad placed in the next up-pipe structure, catchbasin MB350-A, in the driveway of the house located near the outfall. The optical brightener test in catchbasin MB350-B was indeterminate.</p> <p>Due to the repeated detections of optical brightener in the drainage system, on December 1, 2011 samples were collected from outfall MB350 for <i>E. coli</i> and total phosphorus analyses, both of which were low (110 MPN/100 mL and 48.8 µg/L).</p> <p>Status: Based on the detection of optical brightener and the absence of other tested contaminants, we suspect either a direct laundry wastewater (graywater) source or a diluted, partially renovated sanitary wastewater source. To rule out the possibility of a direct graywater connection, the Town of Middlebury proposed inspecting wastewater piping in the neighboring buildings. The current status of this inspection is unknown.</p>	M7
MB520	<p>Description: Outfall MB520 is a fully submerged pipe which discharges to Otter Creek just upstream of the Pulp Mill covered bridge. A small stream enters the system at the intersection of Seymour Street and Seymour Street Extension. Optical brightener and chlorine (0.11 mg/L) were detected when the outfall was first assessed on November 2, 2011. The optical brightener test was repeated at the outfall on November 17, 2011 and the result was again positive.</p> <p>Due to the optical brightener detections in the drainage system, on December 1, 2011 samples were collected for <i>E. coli</i> and total phosphorus analyses. Samples were collected from the up-pipe catchbasin MB520-B. Low <i>E. coli</i> (<10 MPN/100 mL) and total phosphorus (130 µg/L) concentrations were found, suggesting a washwater source rather than a sanitary wastewater source.</p> <p>On December 13, 2011, optical brightener monitoring pads were deployed throughout the drainage system. Positive results were found from outfall MB520 up the drainage system to a point below a white, 4-inch PVC pipe (see inset photo). This pipe is located behind a residence on Seymour Street Extension, south of Pinewood Road. There was an obvious laundry odor at the pipe outlet and discoloration of the surrounding area. The Middlebury Public Works Director was notified of the direct discharge on January 5, 2012.</p> <p>Status: The Department of Public Works contacted the landowner who quickly fixed the problem by connecting the laundry machine to the municipal sanitary sewer.</p>	 M8

System ID	Assessment Findings	Map
MB620	<p>Description: Outfall MB620 is a 12-inch corrugated metal pipe that discharges to an open channel at the main entrance of Middlebury High School. Elevated chlorine concentrations were detected when the system was assessed on November 2, 2011 (0.11 mg/L) and again on December 14, 2011 (0.08 mg/L). No other contaminants were detected. We suspect there is a leak in the municipal water distribution system in this vicinity.</p>	NA
	<p>Status: Small potable water leaks are essentially a municipal concern rather than sources of priority pollutants. We recommend acoustic leak detection be performed to locate the apparent leak.</p>	
MB1220 system	<p>Description: Outfall MB1220 is a 30-inch diameter corrugated metal outfall discharging to a wetland area south of Monroe Street. The system drains the entire residential area to the south of Woodland Park including Meadow Way, Harrow Way, Swanage Court, and the east end of Monroe Street. The stormwater pond located north of Woodland Park also discharges into this system. Given the large extent of the system, multiple structures were tested during the initial assessment on November 7-8, 2011.</p> <p>Due to the detection of optical brightener at six of the seven structures assessed, on December 13, 2011 pads were deployed in all accessible structures in this system. All six structures testing positive for optical brighteners in November were again positive. Intensive optical brightener monitoring narrowed the source to two locations. We suspect a direct laundry washwater connection to the storm sewer system in both areas. In a third location, a potable water leak is suspected. These discharges/locations are identified as #1 to #3 below.</p>	M9
	<p>#1: Catchbasin MB1220-14 is located at the top of Swanage Court at the intersection with Woodland Park. Optical brightener was detected at MB1220-14 but not in any up-pipe catchbasins, including MB1220-15 and MB1220-16. Therefore, a source of optical brightener must exist very close to MB1220-14. The most likely source is #394 Woodland Park.</p> <p>Status: We recommend that the Town of Middlebury inspect, and dye test if necessary, the houses (starting with #394 Woodland Park) surrounding catchbasin MB1220-14 in order to identify any direct connections. If no direct connections are found, then there may be a leak in the sanitary sewer system in this vicinity.</p>	M9
	<p>#2: The second location is catchbasin MB1220-45, at the intersection of Woodland Park and Heritage Circle. This catchbasin is the first structure down-pipe from the pond outlet structure. Therefore, it is uncertain whether the source of the optical brightener is near catchbasin MB1220-45 or is the pond. All accessible outfalls discharging to this pond were assessed during the November monitoring and no contamination was detected; however, there was at least one outfall on posted private property that could not be assessed.</p> <p>Status: We recommend that the Town of Middlebury inspect, and dye test if necessary, the houses surrounding catchbasin MB1220-45 in order to identify any direct connections.</p>	M9
	<p>#3: Catchbasin MB1320 is located on Harrow Way. On November 8, 2011, 0.20 mg/L of chlorine was measured in flow from Pipe B. The structure was retested on December 15, 2011, yielding a chlorine concentration of 0.23 mg/L. On both dates organic matter was present in the sample, which can interfere with the chlorine analysis.</p> <p>Status: Small potable water leaks are essentially a municipal concern rather than sources of priority pollutants. We recommend the Town of Middlebury perform acoustic leak detection in the vicinity to locate the suspected water leak.</p>	M9
MB1450	<p>Description: Outfall MB1450 is a 10-inch diameter smooth plastic pipe that discharges to a wetland south of Hannaford's Supermarket on Route 7. The system drains parking areas south and east of the supermarket. On November 8, 2011, chlorine (0.26 mg/L) was measured in the manhole (MB1452) immediately up-pipe from the outfall. The majority of the flow in the system was from a 4-inch PVC pipe discharging to catchbasin MB1460 from the direction of the supermarket. There was no flow in the line from the south side of the lot. The flow from the 4-inch diameter pipe in catchbasin MB1460 had a comparable chlorine concentration, 0.25 mg/L.</p> <p>Status: The Department of Public Works contacted the property owner who quickly fixed the water leak, which was estimated at 35 gallons per minute.</p>	M10
MB2100	<p>Description: Culvert MB2100 crosses the train tracks west of the Agri-Mark facility on Industrial Avenue. A system of swales on the Agri-Mark property drains to this culvert. A sample collected at the culvert on December 15, 2011 had a moderately high ammonia concentration of 3.0 mg/L. The chlorine and MBAS detergent concentrations were below the limit of detection. No ammonia was detected in a sample collected on May 27, 2014.</p> <p>Status: We recommend repeated sampling for ammonia at the culvert.</p>	M11

5. PITTSFORD RESULTS

Initial illicit discharge assessment in Pittsford was performed in May and June, 2012. Map P0 illustrates mapped stormwater outfall locations in Pittsford (Appendix D). Of the 25 outfalls assessed in Pittsford, only 7 were flowing or dripping when inspected. No ammonia, chlorine, MBAS, or optical brightener was detected in six of these seven outfalls. At outfall PT210, low levels of ammonia (0.5 mg/L) and MBAS (0.25 mg/L) were detected on May 23, 2012. However, when the outfall was resampled, the ammonia concentration was lower (0.25 mg/L) and MBAS was not detected. An optical brightener monitoring pad deployed at the outfall yielded an indeterminate result. Pads were placed throughout the system on June 11, 2012; none were positive and only the pad placed in catchbasin PT210-C was indeterminate. PT210-C is located at the gas station at the corner of Route 7 and Depot Hill Road. The cause of the indeterminate fluorescence was likely petroleum contaminated runoff from the gas pump aisles entering the catchbasin (gasoline and oil fluoresce at the same wavelength as optical brighteners). Based on the optical brightener results and the decline in the ammonia concentration upon resampling, no illicit discharge is suspected in this system.

6. RUTLAND CITY RESULTS

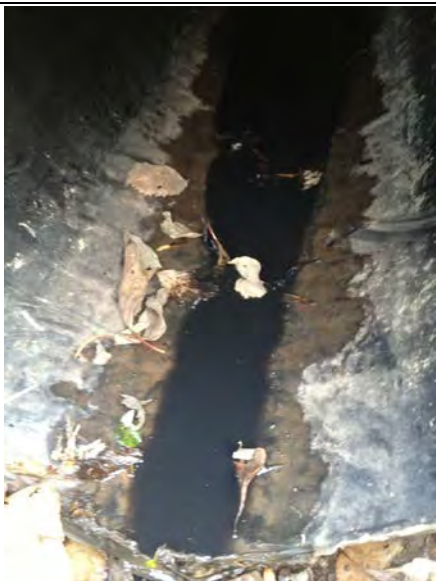
Stone assessed a total of 170 stormwater drainage systems in Rutland City in 2012 during the initial dry weather survey. Map RC0 illustrates mapped stormwater outfall locations in Rutland City (Appendix E). Of the 170 systems, 40 were flowing or dripping, 36 were wet but not flowing, and 94 were dry. We identified possible illicit discharges in 20 of the assessed systems. These systems are identified in Table 6, which summarizes the results of the initial assessment, recent (2013) findings, and current status. The third column in Table 6 refers to a map number, if a map is needed to illustrate the stormwater drainage system. These findings were reviewed with the Rutland City Department of Public Works in a meeting held on November 14, 2013.



Table 6. Stormwater systems in Rutland City with suspected or confirmed illicit discharges

System ID	Assessment Findings	Map
RU100	<p>Description: Outfall RU100 was mapped on the northwest side of the recreation fields in Rotary Park on North Street, west of Route 7. The outfall could not be located; therefore the first catchbasin (CB-A) up-pipe from the mapped outfall location was assessed. Low concentrations of total chlorine (0.09 mg/L) and ammonia (0.25 mg/L) were measured on June 20, 2012 in catchbasin CB-A Pipe B. No chlorine, ammonia, or MBAS detergent were detected in CB-A Pipe A. The monitoring pad set in CB-A did not indicate presence of optical brightener.</p> <p>A moderate concentration of total chlorine (0.18 mg/L) and zero ammonia was measured in CB-A Pipe B on October 30, 2013. The approximate flow from Pipe B was 3.5 L/m. Pipe B may drain the nearby tennis court. We suspect a municipal water leak may be the sources of flow and chlorine in Pipe B.</p> <p>Status: Status: Small potable water leaks are essentially a municipal concern rather than sources of priority pollutants. We recommended that the City of Rutland perform leak detection on the water line in the vicinity of the tennis courts and the abandoned structure.</p>	RC1
RU130	<p>Description: Outfall RU130 is an 18-inch diameter metal pipe located north of Killington Avenue, west of Ronaldo Court. A low concentration of total chlorine (0.06 mg/L) was measured at the outfall on June 20, 2012 and optical brightener was detected. Pads were deployed throughout the system on July 19, 2012 and optical brightener was detected at the outfall and in the manhole at the intersection of East Washington Street and Lafayette Street (MH-C). Catchbasins in this system are off-line, complicating bracket sampling.</p> <p>2013: Elevated <i>E. coli</i> (350 MPN/100 mL) and low total phosphorus (30.3 µg/L) concentrations were measured at the outfall on August 28, 2013. On October 23, 2013, the total chlorine concentration at the outfall was 0.04 mg/L, near the detection level. The catchbasins contributing to manhole MH-C (CB-F, -G, -H, and -I) were not flowing.</p> <p>Because we suspect that a leaking sanitary sewer main or house lateral on East Washington Street is the source of <i>E. coli</i> and optical brightener in the system, dye testing of homes on East Washington Street was begun on November 20, 2013. Only one house was successfully dye tested, #61 East Washington Street. Testing was generally inconclusive because most residents were not home and dye took over ½ hour to pass from a nearby home to manhole MH-C.</p> <p>The Public Works Department has provided camera footage of the East Washington Street sewer line. This footage was reviewed for any obvious leaks or inappropriate connections and none were seen.</p> <p>Status: Inconclusive. We recommend another attempt to dye test houses on East Washington Street to identify any cross connections or leaking sewer laterals.</p>	RC2

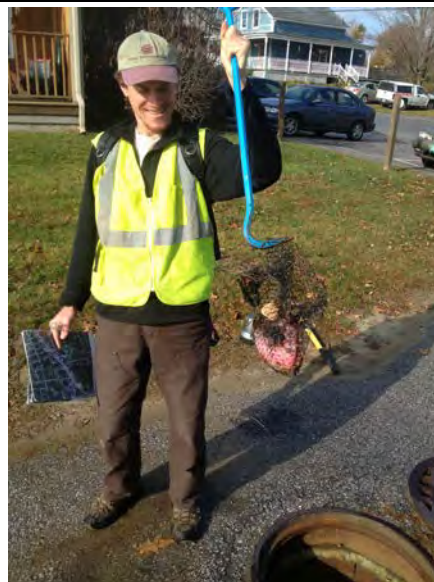
System ID	Assessment Findings	Map
RU170	<p>Description: Outfall RU170 is a 30-inch diameter smooth plastic pipe located at Rutland High School on Woodstock Avenue. On June 21, 2012, the first up-pipe online catchbasin, CB-B, was assessed because the outfall is located behind a locked gate. Low levels of chlorine (0.06 mg/L) and MBAS (0.3 mg/L) were measured in CB-B on June 21, 2012 and the specific conductance was high, 4,210 μS/cm. No optical brightener was detected.</p> <p>Very low concentrations of total chlorine (0.05 mg/L) and MBAS detergents (0.3 mg/L) and very high specific conductance (3.93 ms/cm) were measured at CB-B on October 23, 2013. Flow appeared to enter the system from two sources, a 4-inch diameter corrugated plastic pipe discharging to catchbasin CB-G and a groundwater seep entering a swale at the point labelled "inlet from swale" on map RC3. Both sources had specific conductance (4.14-4.44 ms/cm) and concentrations of total chlorine and MBAS detergents that were very similar to those measured at CB-B. We do not believe the levels observed constitute a problem or indicate that an illicit discharge is occurring. Rather, these levels may be characteristic of ambient groundwater in this area of Rutland.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	RC3
RU380	<p>Description: Outfall RU380 is a 15-inch diameter corrugated black plastic pipe located on the southeast corner of Moon Brook Drive. The outfall was dripping when assessed on June 21, 2012. The total chlorine concentration (0.06 mg/L) was low and the specific conductance (3,360 μS/cm) was high. No optical brightener was detected.</p> <p>No flow was observed on October 30, 2013 and there appear to be no illicit connections. The high specific conductance may be characteristic of groundwater in this area of Rutland.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	NA
RU410	<p>Description: Outfall RU410 was mapped at the intersection of Catherine Drive and Dogwood Lane. The outfall could not be located; therefore the first up-pipe catchbasin (CB-A) was assessed. Very low levels of chlorine (0.05 mg/L) and MBAS (0.25 mg/L) were measured. The outfall was located on August 2, 2013 and very low <i>E. coli</i> (10 MPN/100 mL) and total phosphorus (53.6 μg/L) concentrations were measured. On October 23, 2013, a moderate total chlorine concentration (0.11 mg/L) was measured. Similar results (0.08 mg/L) were obtained testing flow from a 4-inch pipe discharging to catchbasin CB-H, near houses #22 and #24 on Catherine Drive, suggesting this pipe is the source of the chlorine. We suspect there is a water line leak in the vicinity of #24 Catherine Drive.</p> <p>Status: Small potable water leaks are essentially a municipal concern rather than sources of priority pollutants. We recommended that the City of Rutland perform leak detection on the water line in the vicinity of #24 Catherine Drive.</p>	RC4
RU550	<p>Description: Outfall RU550 is an 18-inch diameter corrugated black plastic pipe located at the senior living facility on Wing Road. On July 3, 2012 low levels of chlorine (0.06 mg/L) and MBAS (0.25 mg/L) were measured at the outfall and the specific conductance was high, 2,680 μS/cm. The flow was traced to pipe B in catchbasin CB-C. Runoff from an irrigated lawn at the senior living facility was likely the source of the chlorine.</p> <p>On October 23, 2013, no total chlorine was detected at the outfall. High specific conductance (3,260 μS/cm) was measured.</p> <p>Status: We suspect the low chlorine concentration initially measured was from lawn irrigation and that the high specific conductance is characteristic of groundwater in this area of Rutland. An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	NA
RU650	<p>Description: Outfall RU650 is a 42-inch diameter corrugated black plastic pipe located south of the Rutland Regional Medical Center's southeastern parking lot. On July 12, 2012, low concentrations of MBAS (0.25 mg/L) and chlorine (0.07 mg/L) were measured at the outfall and specific conductance was very high, 3,140 μS/cm. Follow-up testing produced similar results. We suspect that the high specific conductance is characteristic of groundwater in this area of Rutland.</p> <p>Throughout the 2013 reassessment period (September– November) the outfall was dry.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended. Note that it is possible that an illicit discharge was eliminated after the City Engineer contacted the Medical Center regarding the results of the 2012 assessment.</p>	NA
RU690	<p>Description: Outfall RU690 is a 30-inch diameter corrugated black plastic pipe located west of Rutland Regional Medical Center's southwestern parking lot. The outfall was dripping when assessed on July 3, 2012. A low concentration of chlorine (0.07 mg/L), moderate concentration of MBAS (0.75 mg/L), and very high specific conductance (11,530 μS/cm) were measured. Flow appeared to originate at catchbasin CB-F.</p> <p>Throughout the 2013 reassessment period (September– November) the outfall was dry.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended. Note that it is possible that an illicit discharge was eliminated after the City Engineer contacted the Medical Center regarding the results of the 2012 assessment.</p>	NA

System ID	Assessment Findings	Map
RU840	<p>Description: Outfall RU840 is a 12-inch diameter corrugated black plastic pipe located on Curtis Avenue west of the intersection with Preston Park. The chlorine concentration at the outfall was 0.11 mg/L on July 3, 2012. Suds and iron staining were observed. The source of flow and contamination is believed to be a 4-inch diameter underdrain flowing from the south into catchbasin CB-B. The chlorine concentration from this underdrain was high, 0.55 mg/L.</p> <p>On October 23, 2013 a low total chlorine concentration (0.05 mg/L) was measured at CB-C. As in 2012, a high total chlorine concentration (0.47 mg/L) was measured in flow from the 4-inch diameter underdrain entering CB-B. We could not identify the origin of the flow. According to the City Engineer, there has been a history of leaking pipelines in the Preston/Billings neighborhood.</p> <p>Status: Small potable water leaks are essentially a municipal concern rather than sources of priority pollutants. We suspect a water leak in this vicinity is infiltrating the underdrain discharging at catchbasin CB-B. As this system is privately owned, our recommendation is simply that the City Engineer informs the property owner of this finding.</p>	RC5
RU860	<p>Description: Outfall RU860 is an 18-inch diameter corrugated black plastic pipe discharging to a stormwater pond behind Panera Bread on Route 7. The flow at the outfall appeared yellow-brown in color on July 3, 2012. An oily sheen and strong petroleum odor were observed. The ammonia concentration was moderately high (1.0 mg/L), the MBAS concentration was low (0.25 mg/L), and specific conductance was high, 2,160 µs/cm. No visible inlet structures appear contaminated and no optical brightener was detected.</p> <p>On August 2, 2013 zero E. coli and a low total phosphorus concentration (19.9 µg/L) were measured. A moderate concentration of ammonia (1.0 mg/L) was measured. Specific conductance was high (1,572 µs/cm) and a low level of MBAS detergents was measured (0.25 mg/L). On October 23, 2013 the outfall was wet but there was not enough flow to sample.</p> <p>Status: We suspect that the source of contamination is residual groundwater contamination resulting from a petroleum release in the area. There is a known contaminated site in this vicinity. Because the DEC Sites Management Section has investigated the site previously, no further action is recommended.</p>	N/A
RU900	<p>Description: Outfall RU900 is a 30-inch diameter concrete pipe located immediately south of Cumberland Farms on Route 7. On July 5, 2012 low levels of ammonia (0.25 mg/L) and MBAS (0.5 mg/L) were measured at the outfall and the specific conductance was high, 1,942 µs/cm. No optical brightener was detected.</p> <p>On August 2, 2013 zero E. coli and a low total phosphorus concentration (16.1 µg/L) were measured. On this date zero ammonia and a low concentration of MBAS detergents (0.25 mg/L) were measured. On October 23, 2013 a low concentration of ammonia (0.25 mg/L) and MBAS detergents (0.2 mg/L) was measured. The discharge had a distinct petroleum odor.</p> <p>Status: We suspect that the source of contamination is residual groundwater contamination resulting from a petroleum release in the area. There is a known contaminated site in this vicinity. Because the DEC Sites Management Section has investigated the site previously, no further action is recommended.</p>	N/A
RU910	<p>Description: Outfall RU910 is an 18-inch diameter concrete pipe located on Route 7 between the intersections of Curtis Avenue and Chaplin Avenue. A low MBAS concentration (0.5 mg/L) was measured at the outfall on July 5, 2012. Up-pipe catchbasins were flowing to the top of the line, in the vicinity of Mama T's restaurant and a car wash. No optical brightener was detected.</p> <p>On October 23, 2013, very low ammonia (0.25 mg/L) and MBAS detergents (0.2 mg/L) concentrations were measured. No chlorine was detected.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A

System ID	Assessment Findings	Map
RU980	<p>Description: Outfall RU980 is an 18-inch diameter corrugated black plastic pipe located on the north side of the Rutland Plywood facility off Park Street. The flow appeared milky in color on July 05, 2012. A low level of chlorine (0.05 mg/L) and exceedingly high specific conductance (53,500 $\mu\text{S}/\text{cm}$) were measured at the outfall. There are no catchbasins or other visible inlets in this system. The source of the flow and contamination appears to be within the facility. The outfall was dry on a follow-up visit.</p> <p>On October 30, 2013 the outfall was trickling. The discharge was black in color and had no odor. Zero total chlorine and a low ammonia concentration (0.25 mg/L) were measured. The specific conductance was low (862 $\mu\text{S}/\text{cm}$).</p> <p>Status: Following our November 14, 2013 meeting, the City Engineer contacted a manager at Rutland Plywood regarding this discharge. The discharge reportedly resulted from two floor drains in the facility. A building tenant had been rinsing equipment near these drains, thinking that they connected to the sanitary sewer. The material being rinsed off was comprised of water and dust that is created when tiles are tumbled in a wet finishing process. The color of the tiles varies, explaining the different color discharges. This practice has been permanently halted, so the drains will no longer be a source of discharges. In addition, Rutland Plywood has contacted John Daly of DEC's Environmental Assistance Office, seeking guidance on best practices for managing floor drains in order to prevent a recurrence.</p>	 RC6
RU1220	<p>Description: Outfall RU1220 was mapped southeast of Stone Ridge Drive. The outfall could not be located; therefore the first catchbasin (CB-A) up-pipe from the mapped outfall location was assessed on July 6, 2012. The flow was cloudy and had a yellow-brown color. A high ammonia concentration (2.0 mg/L) and low chlorine concentration (0.08 mg/L) were measured. The majority of dry weather flow in the system appears to enter via a small diameter pipe discharging to catchbasin CB-C. No optical brightener was detected in the system. On July 31, 2012, a pink liquid was found flowing into a catchbasin, which was traced to a worker cutting concrete.</p> <p>On August 27, 2013 the outfall was found. No ammonia or chlorine was detected. Iron staining and foam were observed. On October 23, 2013, low ammonia (0.25 mg/L) and total chlorine (0.05 mg/L) concentrations were measured.</p> <p>Status: With the exception of the concrete cutting lubricant, no illicit discharge has been confirmed in this system. Release of the concrete cutting lubricant may explain the high ammonia levels measured on July 6 and July 31, 2012.</p>	N/A
RU1240	<p>Description: Outfall RU1240 is a 24-inch diameter corrugated metal pipe located on Dorr Drive, south of Stone Ridge Drive. Low levels of chlorine (0.07 mg/L) and MBAS (0.5 mg/L) were measured at the outfall on July 6, 2012. The source of the flow in this system appears to be the swale entering from the west. Outfall RU1220 discharges to this swale.</p> <p>On August 2, 2013 low <i>E. coli</i> (40 MPN/100 mL) and total phosphorus concentrations (19.9 $\mu\text{g}/\text{L}$) were measured at the outfall. On October 23, 2013, concentrations of ammonia, total chlorine, and MBAS detergents were below detection. Optical brightener pads deployed throughout the system on October 23, 2013 were negative.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A
RU1330	<p>Description: Outfall RU1330 is a concrete pipe located west of Meadow Street and north of the baseball field. The outfall could not be sampled because it is partially submerged. A manhole on School Street (MH-B) was assessed on July 6, 2012. Chlorine (0.12 mg/L), ammonia (0.25 mg/L), MBAS (0.25 mg/L), and specific conductance (2,350 $\mu\text{S}/\text{cm}$) were all elevated in this manhole. Optical brightener was detected on one occasion, but not on subsequent tests.</p> <p>On October 30, 2013, zero ammonia, zero total chlorine, and low MBAS detergents (0.2 mg/L) were measured in MH-C. Specific conductance was moderate (1,708 $\mu\text{S}/\text{cm}$). Subsequently, we were informed that the sampled manhole is down-pipe from a regulated combined sewer overflow.</p> <p>On November 14, 2013, manhole MH-E at the intersection of Forest Street and Union Street was assessed. This manhole is above the combined sewer overflow. Concentrations of ammonia, total chlorine, MBAS detergents in MH-E were at or below the method detection limits. No optical brightener was detected in MH-E on a pad set on November 14, 2013.</p> <p>Status: When assessed up-pipe from the combined sewer overflow structure, there was no evidence of an illicit discharge in this system.</p>	N/A

System ID	Assessment Findings	Map
RU1400	<p>Description: RU1400 is a combined sewer overflow structure located at the West Street Bridge over East Creek. When this structure was assessed on July 10, 2012, sanitary sewage was overflowing the weir and discharging to East Creek due to clogs in both sewer lines. The City of Rutland responded immediately to clear the clogged pipes. The City reported that it inspects the structure frequently, but bridge construction work may have limited access to the structure in the few weeks prior to the July 10 assessment.</p>  <p>Status: The City of Rutland responded immediately to clear the clogged pipes causing the sanitary sewer overflow. The City reported the release to DEC as it was required to do. Since this incident, the City of Rutland installed instruments (see inset photo) to monitor the water level in the structure and communicate the data to the Public Works Department.</p> 	NA
RU1460	<p>Description: Outfall RU1460 is a 48-inch diameter concrete pipe located on State Street by the east bank of East Creek. A low total chlorine concentration (0.08 mg/L) was measured at the outfall on July 10, 2012. No ammonia, MBAS detergents, or optical brightener was detected. The source of the flow appears to be the lot where the abandoned Lynda Lee building is located. No flow was observed on October 30, 2013 and there appear to be no improper connections.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A
RU1590	<p>Description: Outfall RU1590 is a 12-inch diameter smooth plastic pipe draining the northern portion of Baxter Street. A low chlorine concentration (0.07 mg/L) was measured at the outfall on July 11, 2013. No ammonia, MBAS detergents, or optical brightener was detected. On October 30, 2013, zero ammonia, low MBAS detergents (0.2 mg/L), and no free chlorine were detected.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A
RU1650	<p>Description: Outfall RU1650 is an 18-inch diameter corrugated black plastic pipe located west of the office building at 271 North Main Street. It was dripping when assessed on July 11, 2012. The concentration of ammonia (1.0 mg/L) was moderate and concentrations of chlorine (0.08 mg/L) and MBAS detergent (0.5 mg/L) were low. No optical brightener was detected. The contaminated flow appears to enter catchbasin CB-C from the southwest corner of the building. On August 28, 2013 no flow was observed at the outfall. On October 30, 2013 low concentrations of ammonia (0.5 mg/L) and MBAS detergents (0.75 mg/L) were measured at the outfall. Zero free chlorine was measured. Moderate ammonia (1.0 mg/L) and low MBAS detergent (0.5 mg/L) concentrations were also measured in the sump of catchbasin CB-C. The only flow entering catchbasin CB-C was from a plastic pipe aligned with the corner of the office building.</p> <p>Status: There appears to be an illicit discharge of washwater from the office building at 271 North Main Street. The City Engineer has agreed to contact the property owner to inquire about any connected drains within the building.</p>	RC7

System ID	Assessment Findings	Map
RU1870	<p>Description: Catchbasin RU1870 is located immediately south of the condominiums on Templewood Court. This structure is the furthest accessible downstream structure in a separated stormwater drainage system that discharges to the combined sewer on Woodstock Avenue. Low concentrations of MBAS (0.5 mg/L) and chlorine (0.10 mg/L) were measured in the sump on July 26, 2012. Only catchbasins CB-A and CB-B were flowing.</p> <p>On October 30, 2013, low concentrations of free chlorine (0.11 mg/L) and MBAS detergents (0.5 mg/L) were measured in catchbasin RU1870. Zero ammonia was measured. Low free chlorine was measured in CB-A and CB-B (0.03 mg/L and 0.04 mg/L, respectively). A moderate concentration of MBAS detergents (0.75 mg/L) as well as a strong chemical odor and suds were observed in CB-C. No ammonia or free chlorine was measured in this catchbasin.</p> <p>In investigating this system, a large urinal cake was found in catchbasin CB-D (see inset photo). This was the source of the chemical odor and was likely the source of the MBAS detergents and suds. The Property Maintenance Supervisor, Bob Pelletier, explained that the City placed the urinal cake in the catchbasin to control odor after a condominium resident complained.</p> <p>Status: This system discharges to the combined sewer system on Woodstock Avenue. Therefore, placement of urinal cake in catchbasins may not be viewed as an illicit discharge.</p>	N/A



7. RUTLAND TOWN RESULTS

In 2012, Stone assessed 132 stormwater drainage systems in Rutland Town. Map RT0 illustrates mapped stormwater outfall locations in Rutland Town (Appendix F). Of the 132 systems, 19 were flowing, 3 were dripping, 25 were wet but not flowing, and 85 were dry. Stone identified 12 systems as possibly having illicit discharges. These systems are identified in Table 7, which summarizes the results of the initial assessment, recent (2013) findings, and current status. The third column in Table 7 refers to a map number, if a map is needed to illustrate the stormwater drainage system. These findings were reviewed with the Rutland Town Administrator, Joe Zingale, in a meeting held on October 15, 2013.

Table 7. Stormwater systems in Rutland Town with suspected or confirmed illicit discharges

System ID	Assessment Findings	Map
RT100	<p>Description: Outfall RT100 is a 15-inch diameter concrete pipe located at the intersection of Middle Road and Dyer Road, southeast of the Kia dealership on Middle Road. Low concentrations of ammonia (0.25 mg/L), chlorine (0.06 mg/L), and MBAS detergents (0.5 mg/L) were measured and a "fruity" odor was observed when the outfall was initially assessed on August 7, 2012. Optical brightener was not detected. The outfall was dry on two subsequent visits.</p> <p>On August 22, 2013 no flow was observed at the outfall. On October 15, 2013 the outfall was trickling. On this date the second up-pipe catchbasin CB-B was sampled. The water in the sump was clear with no odor. Concentrations of ammonia, total chlorine, and MBAS detergents in CB-B were below detection. No inappropriate pipe connections were visible in this system.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A
RT130	<p>Description: Outfall RT130 is a 24-inch diameter concrete pipe located immediately south of the Aldi grocery store on Route 7. Low concentrations of ammonia (0.5 mg/L) and MBAS detergents (0.75 mg/L) were measured and an oily odor was detected when the outfall was initially assessed on August 7, 2012. The flow was a murky gray color. Optical brightener was not detected. In follow up sampling, the ammonia concentration was 0.5 mg/L and an oily odor was again detected.</p> <p>On August 27, 2013, samples collected at the outfall had a moderate <i>E. coli</i> concentration (350 MPN/100 mL) and a low total phosphorus (30.3 µg/L) concentration. On this date, low ammonia (0.3 mg/L) and MBAS detergents (0.2 mg/L) concentrations were measured. Specific conductance was moderate (1640 µs/cm) and zero total chlorine was measured. The iron staining and oil odor were strong at the outfall. No iron staining was observed in the first up-pipe catchbasin. A mapped pipe from the adjacent southern lot (Valvoline station) is inaccessible.</p> <p>Status: This does not appear to be a municipal concern. The iron staining and oily odor found at the outfall are likely a result of hydrocarbon contamination in the area. The Aldi location is a registered hazardous waste site (UST-Gasoline). Site management activities were completed in 2007. No action is recommended.</p>	N/A
RT140	<p>Description: Outfall RT140 is a 15-inch diameter corrugated black plastic pipe located southwest of Suburban Propane on Randbury Road. A low concentration of chlorine (0.09 mg/L) was measured at the outfall on August 7, 2012. No ammonia, MBAS detergents, or optical brightener was detected.</p> <p>On October 22, 2013, the outfall was trickling. The free chlorine concentration was 0.04 mg/L, approximately the limit of detection.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A
RT220	<p>Description: Outfall RT220 is a 12-inch diameter corrugated plastic pipe that discharges to a stormwater pond at the Toyota dealership on Route 7, north of Seward Road. There was insufficient flow to sample when the system was initially assessed on August 7, 2012. A weak florescence was observed on the optical brightener monitoring pad set at the outfall on August 7, 2012. No optical brightener was detected on September 5, 2012.</p> <p>Throughout the 2013 reassessment period (September – November) the outfall was dry.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A

System ID	Assessment Findings	Map
RT270	<p>Description: Outfall RT270 is a 12-inch diameter corrugated metal pipe located south of the Holiday Inn on Route 7. The flow was clear, with no odor; however, white globs of fibrous material were noted below the outfall on August 8, 2012. After optical brightener was detected at the outfall, pads were placed in all the structures in the system. Only the pad placed in the outfall was positive.</p> <p>2013: On August 22, 2013 high <i>E. coli</i> (3,250 MPN/100 mL) and low total phosphorus (84.5 µg/L) concentrations were measured at the outfall. On October 15, 2013 paper products and floss was observed at the outfall. The observations and <i>E. coli</i> data indicate a sanitary wastewater source.</p> <p>Status: In an October 15, 2013 meeting, the Town Administrator, Joe Zingale, committed to contacting the property owner to resolve this illicit discharge.</p>	N/A
RT320	<p>Description: Outfall RT320 is a 30-inch diameter corrugated metal pipe located at the western edge of the Diamond Run Mall parking lot. Low concentrations of ammonia (0.25-0.5 mg/L) and MBAS (0.25-0.5 mg/L) were measured on two occasions in August, 2012. No optical brightener was detected. Specific conductance was high, 4,160-5,940 µS/cm. The sources of dry weather flow were two green PVC pipes discharging into a catchbasin (CB-B) in the parking lot.</p> <p>On October 15, 2013, the outfall was not flowing. The first up-pipe catchbasin, CB-A, was sampled. Ammonia, total chlorine, and MBAS detergents concentrations were below detection and specific conductance was low (417 µS/cm). On October 15, 2013 Stone spoke with the manager of the Diamond Run mall. The mall is built on a slab, therefore the two green pipes entering CB-A are believed to be footing drains, not basement floor drains.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A
RT490	<p>Description: Outfall RT490 is a 24-inch diameter concrete pipe located next to the USGS gaging station on Old Falls Road. On August 8, 2012, ammonia, total chlorine, and MBAS detergents concentrations were below detection. Optical brightener was detected at the outfall, although fluorescence was weak. No structures above CB-B were flowing on August 21, 2012. Monitoring pads placed at the outfall, CB-A, and CB-B on August 21, 2012 were all negative.</p> <p>On August 28, 2013, low <i>E. coli</i> (160 MPN/100 mL) and total phosphorus (40.2 µg/L) concentrations were measured at the outfall. Optical brightener was not detected at the outfall, CB-A, or CB-B on October 22, 2013.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	RT1
RT730	<p>Description: Outfall RT730 is a 6-inch diameter corrugated plastic pipe located off Gleason Road at the end of East Mountain View Drive. After optical brightener was detected at the outfall on August 15, 2012, pads were placed in all four connected catchbasins, CB-A through CB-D. Optical brightener was detected in all four, suggesting that the source of contamination is flow entering catchbasin CB-D at the top of the line.</p> <p>On October 22, 2013, the outfall was trickling and there was a laundry odor in catchbasin CB-C. Optical brightener was detected in catchbasins CB-C and CB-D. A 4-inch diameter pipe discharging to CB-D from the direction of the house located at the corner of East Mountain View Drive and Gleason Road appears to be the only pipe entering this system. A pad set in this pipe indicated presence of optical brightener (strong). A laundry connection to this 4-inch diameter pipe is believed to be the source of optical brightener in the system.</p> <p>Status: This finding will be referred to Joe Zingale to follow up with the property owner. The source was identified subsequent to our October 15, 2013 meeting.</p>	RT2
RT1210	<p>Description: Outfall RT1210 is a 15-inch diameter corrugated plastic pipe located opposite #167 Annette Terrace. Optical brightener and a low concentration of chlorine (0.07 mg/L) were detected at the outfall on August 16, 2012. A second pad placed in the outfall on August 23, 2012 was also positive. No ammonia or MBAS detergents were detected. There is only one catchbasin draining to the outfall and all dry weather flow entering the catchbasin was from an underdrain. The underdrain is therefore the likely source of optical brightener.</p> <p>On August 22, 2013, zero <i>E. coli</i> and a low concentration of total phosphorus (62.3 µS/cm) were measured at the outfall. Flow in the system is from a 4-inch pipe discharging into CB-A. On October 15, 2013, zero ammonia and a low concentration of total chlorine (0.05 mg/L) were measured in the flow from this pipe. On October 22, 2013, no optical brightener was detected on a pad placed in this pipe.</p> <p>Status: Although optical brightener was not detected in monitoring in 2013, two positive detections in 2012 suggest there is--or was--some type of laundry connection to the underdrain. The Rutland Town Administrator is currently working with the owner of #167 Annette Terrace to evaluate and resolve the matter.</p>	N/A

System ID	Assessment Findings	Map
RT1220	<p>Description: Outfall RT1220 is an 8-inch diameter corrugated metal pipe located on Annette Terrace, across a driveway southeast of outfall RT1210. No ammonia, chlorine, or MBAS detergents were detected at the outfall on the initial assessment date. Optical brightener was detected at the outfall, although the fluorescence was weak, and the flow had a yellowish cast and a laundry odor. A second pad placed in the outfall was negative for presence of optical brightener.</p> <p>On August 22, 2013, low E. coli (10 MPN/100 mL) and total phosphorus (212 µg/L) concentrations were measured. On October 15, 2013 low concentrations of total chlorine (0.07 mg/L) and ammonia (0.75 mg/L) were measured. No optical brightener was detected in catchbasin CB-A or at the outfall.</p> <p>Status: An illicit discharge in this system was not demonstrated due to inconsistent detection of optical brightener in 2012 and 2013; therefore, no action is recommended.</p>	N/A
RT1250	<p>Description: Outfall RT1250 is an 18-inch diameter corrugated plastic pipe located on Post Road, immediately west of the Easy Street intersection. Optical brightener was detected at the outfall on August 16, 2012. Low concentrations of ammonia (0.25 mg/L) and MBAS detergents (0.5 mg/L) were also measured. The outfall was dry on a subsequent visit.</p> <p>On October 15, 2013, low concentrations of ammonia (0.25 mg/L) and MBAS detergents (0.25 mg/L) were measured at the outfall. A laundry odor was detected in catchbasin CB-B, located in the yard of #26 Easy Street. When the owner of this home offered to run a load of laundry, the flow to CB-B from a small diameter pipe aligned with the house increased markedly, confirming a washwater connection. On October 22, 2013, optical brightener was detected in CB-B.</p> <p>Status: On October 15, 2013, Town Administrator Joe Zingale agreed to contact the homeowner concerning the apparent washwater connection at #26 Easy Street and work to resolve the issue. The connection may be a direct laundry machine connection or an overflow from a graywater system.</p>	RT3
RT1260	<p>Description: Outfall RT1260 is a 12-inch diameter smooth plastic pipe located west of the Rutland Town School on Post Road. On August 16, 2012, a low concentration (0.5 mg/L) of MBAS was detected at the outfall and the specific conductance was high (3,470 µS/cm). No ammonia, total chlorine, or optical brightener was detected.</p> <p>On October 22, 2013, no ammonia, chlorine, or MBAS detergents were detected.</p> <p>Status: An illicit discharge in this system was not demonstrated; therefore, no action is recommended.</p>	N/A

8. VERGENNES RESULTS

Initial illicit discharge assessment in Vergennes was performed in November and December 2011. Map V0 illustrates mapped stormwater outfall locations in Vergennes (Appendix G). Of the 83 outfalls assessed in Vergennes, 49 were flowing or dripping when inspected. Ten other structures, primarily catchbasins, were also assessed at that time. Eight storm sewer systems were investigated in some detail after detection of one or more contaminants. These systems are identified in Table 8, which summarizes the results of the initial assessment, more recent findings, and current status. The third column in Table 8 refers to a map number, if a map is needed to illustrate the stormwater drainage system. These findings were presented to the Town of Vergennes Department of Public Works in an interim report and were subsequently reviewed with the Public Works Director.

Several stormwater drainage systems in Vergennes appear to receive graywater or laundry washwater discharges. After extensive bracket sampling to narrow down possible sources, Stone scheduled fieldwork with the Public Works Director to dye test houses suspected of having inappropriate connections. However, on May 22, 2014 Stone encountered an uncooperative resident on South Water Street, who subsequently complained to the Town Manager and others about the study. According to the Public Works Director, Jim Larrow, the Town Manager has temporarily suspended further involvement with the project. Therefore, several suspected problems in Vergennes are pending further investigation.

Table 8. Stormwater systems in Vergennes with suspected or confirmed illicit discharges

System ID	Assessment Findings	Map
VG260	<p>Description: Outfall VG260 is a 12-inch diameter smooth plastic pipe located behind the Vergennes Residential Care building on North Green Street. The outfall is down the hill behind the building on the east side of the yard. The system drains the parking area for the Residential Care building as well as a section of North Street. During the first field visit on November 22, 2011 there was a flow of approximately ¼ inch depth at the outfall but no flow apparent in the connected catchbasins. A sewage or laundry odor was present at the outfall and there was a grayish cast in the pool below. A moderately high ammonia concentration (2.0 mg/L) was measured and optical brightener was detected.</p> <p>Due to the positive optical brightener test and laundry/wastewater odor, on December 1, 2011 samples were collected for <i>E. coli</i> and total phosphorus analysis. The <i>E. coli</i> concentration was reported as >24,000 MPN/100 mL and the total phosphorus concentration was also elevated (1,210 µg/L). The discharge rate was approximately 0.10 L/s.</p> <p>Status: The Town of Vergennes Department of Public Works was notified immediately about this problem and within days had identified a sanitary sewer break and repaired it. No contamination was seen in a recent visit (May 15, 2014).</p>	V1
VG450	<p>Description: Outfall VG450 is a 4-inch diameter smooth plastic pipe located in the back yard of a house on South Water Street. The pipe discharges directly to Otter Creek and is assumed to be a building drain of some type. There are no municipal stormwater structures connected. When assessed on November 28, 2011, the ammonia, chlorine, and MBAS detergent concentrations were below detection; however, optical brightener was detected. A second pad deployed on December 14, 2011 was also positive for optical brightener.</p> <p>Status: We suspect there is a laundry connection from either #70 or #74 South Water Street. We recommend that the Vergennes Department of Public Works inspect pipe connections for any washing machines in these houses and that dye tests be performed if necessary to determine if one of the two buildings has an inappropriate connection. Stone attempted to dye test #74 South Water Street on May 22, 2014 but the homeowner refused to cooperate.</p>	V2
VG470	<p>Description: Outfall VG470 is a 24-inch corrugated metal pipe located two houses north of the intersection of South Maple Street and Victory Street. The system drains a segment of South Maple Street between School Street and Victory Street. The MBAS concentration was at the limit of detection and no ammonia or chlorine was detected at the outfall; however, optical brightener was detected both at</p>	V3

System ID	Assessment Findings	Map
	<p>the outfall and at catchbasin VG480. On December 14, 2011 optical brightener monitoring pads were deployed throughout the system to bracket the source of the optical brightener. The source was effectively narrowed to the catchbasin VG470-6 at the intersection of South Maple Street and Roberts Street.</p> <p>Status: We recommend that the Vergennes Department of Public Works Dye test several houses on South Maple Street: #45, #46, #48, #51, #53, and #54.</p>	
VG570	<p>Description: Outfall VG570 is a 15-inch smooth plastic pipe located behind #12 Sunset Drive. The system drains all of Sunset Drive and discharges to a rip-rapped gully leading to a swampy area. Dry weather flow sampled on November 28, 2011 had no detectable ammonia, chlorine, or MBAS detergent; however, optical brightener was detected at the outfall. On December 14, 2011, the tests were repeated and an optical brightener monitoring pad was placed in every accessible structure in the system. Optical brightener was detected at the outfall and at the second catchbasin up-pipe from the outfall labeled VG570-3. The pad placed in the first catchbasin up-pipe from the outfall labeled VG570-2 (a drain in the backyard) was negative, which is an inconsistency with the detection in catchbasin VG570-3. Outfall VG570 is a 15-inch diameter smooth plastic pipe located behind a house on Sunset Drive. Optical brightener was detected at the outfall and at the second catchbasins up-pipe from the outfall.</p> <p>Status: The source of the optical brightener has been bracketed as closely as possible using monitoring pads. We recommend that the Town of Vergennes inspect, and dye test if necessary, the houses (#12, #14, and #16 Sunset Drive) surrounding the second catchbasin in order to identify any direct connections. If no direct connections are found, then there is probably a leak in the sanitary sewer system in this vicinity.</p>	V4
VG640	<p>Description: Outfall VG640 is a 24-inch corrugated metal pipe located at the eastern edge of Bowman Road. It discharges to a stormwater pond. The system drains Bowman Road, Crosby Court, and Booska Court as well as an extensive system of swales. On November 28, 2011 dry weather flow was sampled and an optical brightener monitoring pad was deployed at the outfall. To independently assess the two main branches of this system, pads were also placed at the outlets of two stormlines in the first catchbasin up-pipe from the outfall. A weak positive result was obtained at the outfall and at Pipe A in catchbasin VG640-2; optical brightener was not detected in Pipe B. On December 14, 2011, pads were deployed throughout the branch of the system discharging via Pipe A. The result at the outfall was indeterminate, but optical brightener was detected in two catchbasins (VG640-2 and VG640-3). Optical brightener was subsequently detected in catchbasins VG640-6 and VG640-16, which are up-pipe from VG640-2 and VG640-3.</p> <p>Status: We recommend that the Town of Vergennes inspect, and dye test if necessary, #5/#9 Bowman Road, # 2 Crosby Court, and #21 Bowman Road in order to identify any direct connections.</p>	V5
VG670	<p>Description: Outfall VG670 is a 24-inch corrugated black plastic pipe that discharges directly to Otter Creek at the southeast corner of the Main Street bridge. The system drains West Main Street from the bridge up to Elm Street. On November 29, 2011, ammonia, chlorine, and MBAS detergents were below the detection limit in dry weather flow; however, optical brightener was detected.</p> <p>Pads were deployed throughout the system on December 14, 2011 to bracket the source of optical brightener. Optical brightener was again detected at the outfall, the only positive result in this system. An indeterminate result was obtained in the first up-pipe catchbasin (labeled VG670-3) along the eastern stormline. Therefore, a laundry connection or sanitary sewer leak is suspected on West Main Street between Scovel Lane and the outfall.</p> <p>Status: We recommend that the Town of Vergennes inspect, and dye test if necessary, the houses surrounding the second catchbasin in order to identify any direct connections. If no direct connections are found, then there is probably a leak in the sanitary sewer system in this vicinity.</p>	V6
VG830	<p>Description: Outfall VG830 is a 30-inch corrugated metal pipe that discharges to a ravine behind an industrial building on Pantown Road. The system drains the parking areas at the north and east sides of the building. On, November 29, 2011, a low level (0.5 mg/L) of MBAS detergent was detected in dry weather flow at the outfall and suds were observed in the pool below the outfall. The specific conductivity was also high. Follow up testing resulted in a lower, but still significant, concentration of MBAS (0.25 mg/L) and suds were again observed.</p> <p>Status: No action taken or referral made. We suspect there are drains discharging washwater within the facility. Contact with the facility owner has not been made and the issue remains unresolved pending participation by the Town of Vergennes.</p>	V7
VG890	<p>Description: Outfall VG890 is a 36-inch corrugated metal pipe which discharges to a wooded area on the north side of Hillside Drive. The system drains the majority of Hillside Drive and a swale system to the south. Vergennes Public Works staff suspected a tapwater leak into this system and requested that sampling be performed to confirm this. On November 29, 2011, a total chlorine concentration of 0.09 mg/L was measured at the outfall. No other tested constituent was present. This result confirms presence of tapwater in the system.</p> <p>On December 14, 2011, samples were collected for chlorine analysis from Pipe B in the second catchbasin up-pipe from the outfall (labeled VG890-1). This was the only accessible structure in the system that was flowing. Pipe B runs along the south side of Hillside Drive. The chlorine concentration at the outlet of Pipe B was 0.23 mg/L. Therefore, tapwater infiltration into the stormline must be occurring in the pipe B segment above the second catchbasin up-pipe from the outfall.</p> <p>On 05/14/14, the main stormline on Hillside Drive was trickling, but chlorine was below detection.</p>	V8

System ID	Assessment Findings	Map
	Status: Small potable water leaks are essentially a municipal concern rather than a source of priority pollutants. We recommend acoustic leak detection be performed to locate the apparent leak in the water line on Hillside Drive.	

9. CONCLUSIONS AND NEXT STEPS

Approximately 700 structures were assessed in Middlebury, Vergennes, Brandon, Pittsford, Rutland City, and Rutland Town during the initial dry weather screening. A total of 59 suspected illicit discharges were identified. Illicit discharges were identified in every town except Pittsford. Bracket sampling was performed to isolate the sources of contamination in the drainage systems. In several instances, the source of the illicit discharge was apparent and the problem has been remedied. Where source of an illicit discharge were less apparent and the problem more challenging, Stone worked with the municipalities to find the sources of the contaminated flows detected and eliminate the illicit discharge. While there were many notable successes in this project, many of the suspected illicit discharges remain unresolved. Discussions are in progress to initiate a Phase 2 project to work with the participating towns to further characterize and pursue elimination of remaining illicit discharges.

10. REFERENCES

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

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

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

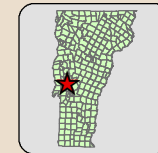
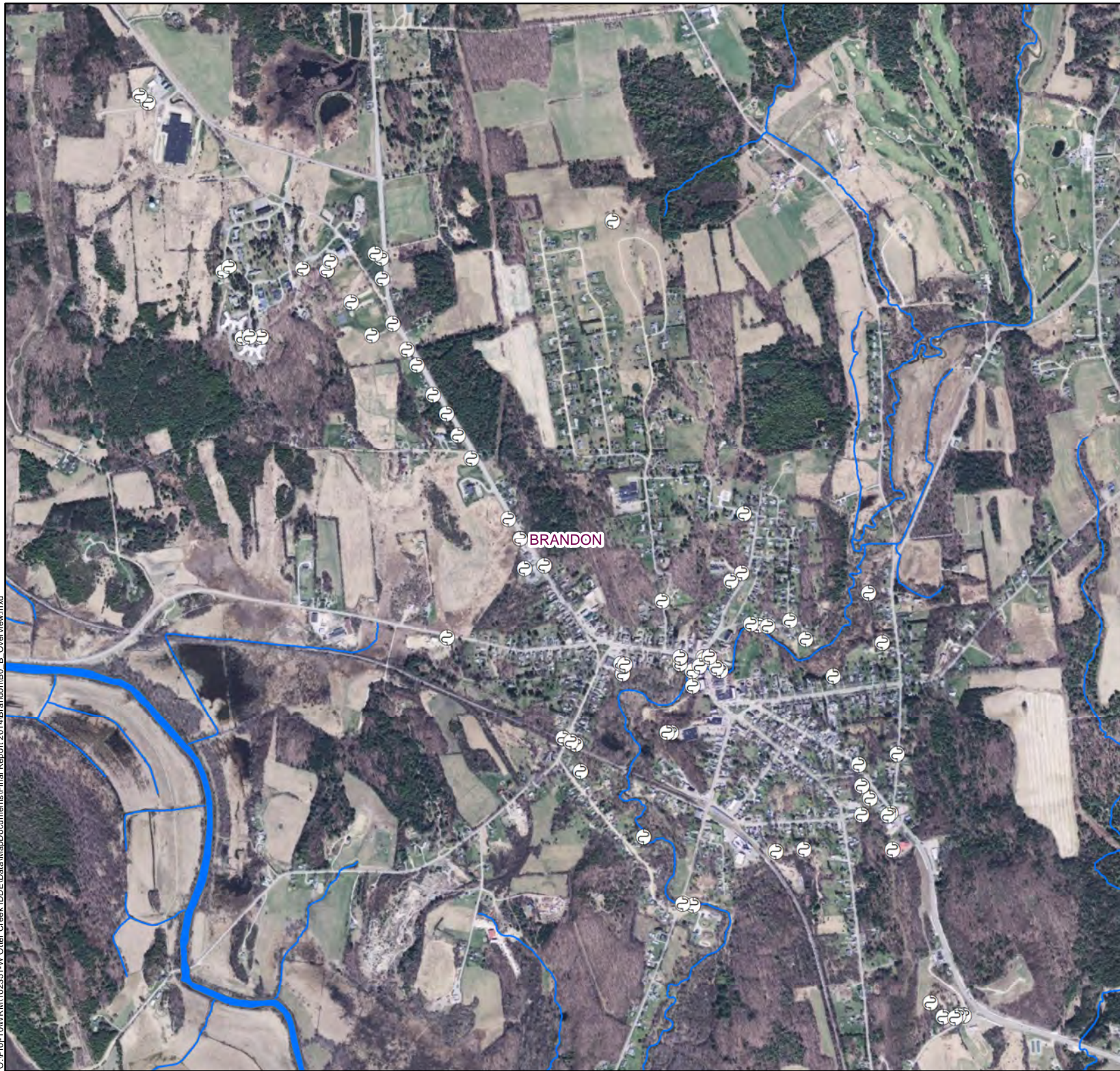
Stone Environmental, Inc., SEI SOP 6.38.0: Optical Brightener Testing, September 11, 2008.

APPENDICES

APPENDIX A: FIELD DATA SHEET




IDDE ID: _____				DEC ID Cross Ref.: _____	
Date: _____		Time: _____		Inspector: _____	
Structure type: _____				Inner diameter (outfall only) _____ in.	
Material (outfall only):	corrugated metal	concrete	corrugated black plastic	smooth plastic	other (describe): _____
Flow depth (outfall only):	dry	Wet (no flow)	dripping	Flowing depth _____ (in.)	
Pipe position (outfall only):	Free flow	partially submerged	submerged	If partially submerged, surcharged? YES NO	
Erosion at outfall	none	If present, describe: _____			
Discharge characteristics (observations on color, turbidity, and odor of flow): 					
Floatables:	none	sheen	sewage	suds	other _____
Deposits or staining:	none	sediment	oily	iron staining	other _____
Damage to structure:	none	cracking, spauling	corrosion	crushed	other _____
Obstructions:	none	partially obstructed		fully obstructed	other _____
OB pad set? YES NO			Date OB pad retrieved _____		
Ammonia _____ mg/L			Specific conductance _____ μ S/cm		
Total chlorine _____ mg/L			Free chlorine _____ mg/L		
Anionic surfactants _____ mg/L					
Sample collected for <i>E. coli</i> analysis: YES NO NA				Time: _____	
Sample collected for N analysis: YES NO NA				Time: _____	
Flow measurement (if <i>E. coli</i> and/or nutrients sample collected): 					
Comments: 					

APPENDIX B: BRANDON MAPS



0 1,000 2,000 Feet

Legend

-  Outfall
-  River or Stream
-  Town Boundaries

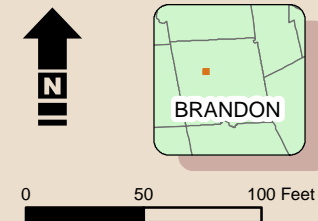
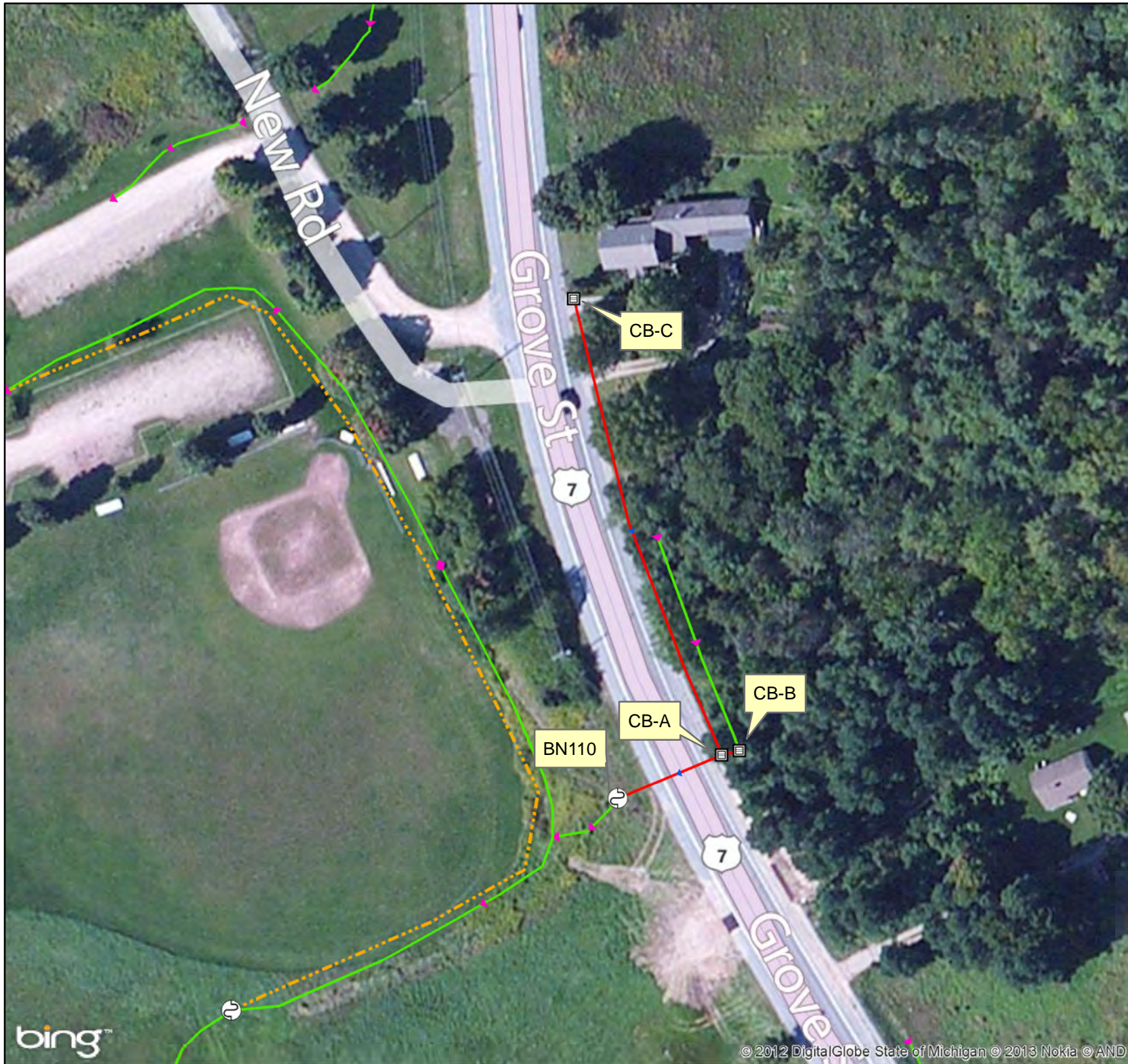
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

 **STONE ENVIRONMENTAL INC.**

Stormwater Outfalls

Otter Creek Basin IDDE

Map B0



- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

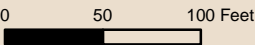
STONE ENVIRONMENTAL INC

BN110

Map B1

Otter Creek IDDE

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- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

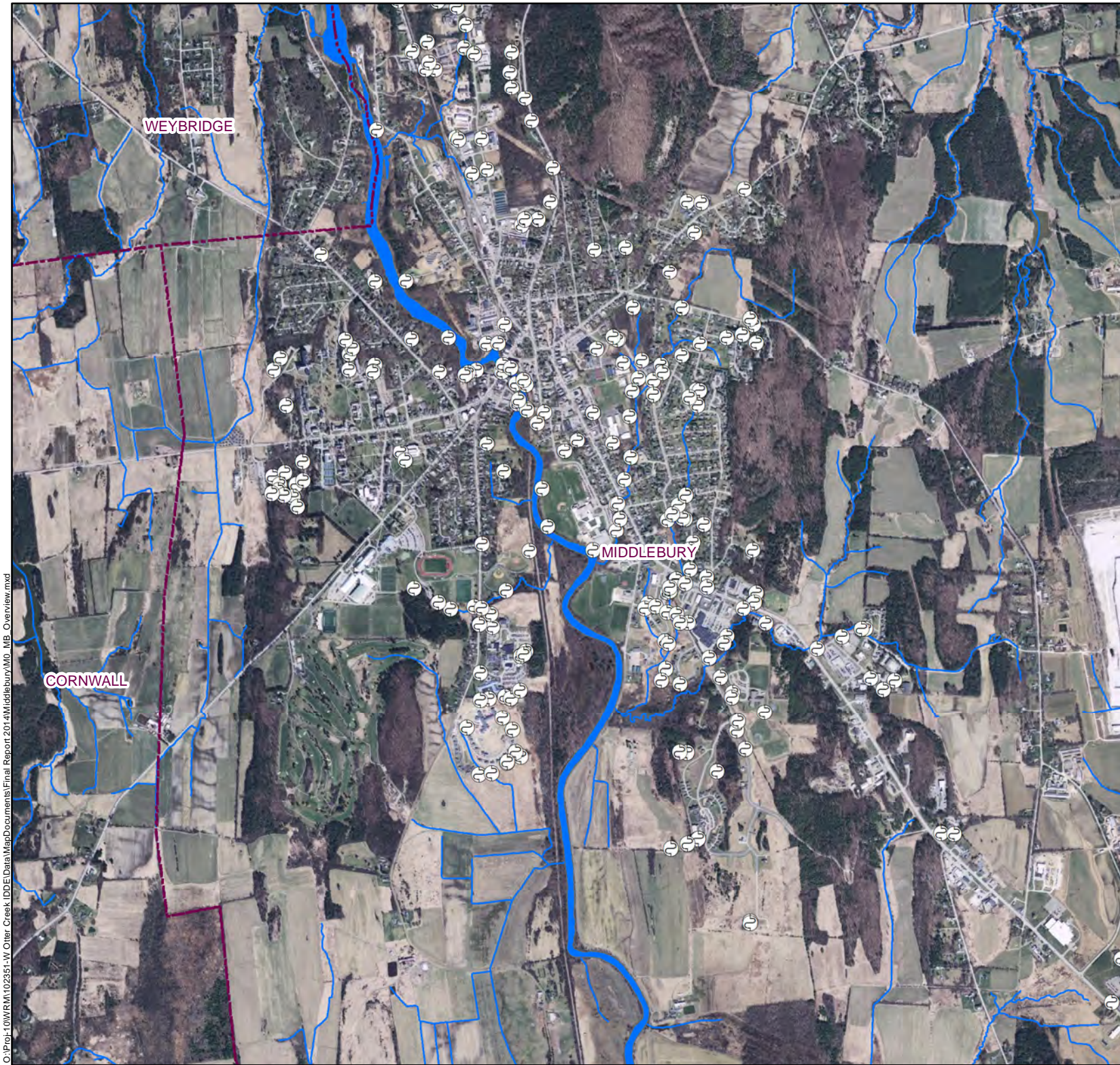
STONE ENVIRONMENTAL INC

BN250

Otter Creek IDDE




Map B3

APPENDIX C: MIDDLEBURY MAPS



0 1,250 2,500 Feet

Legend

-  Outfall
-  River or Stream
-  Town Boundaries

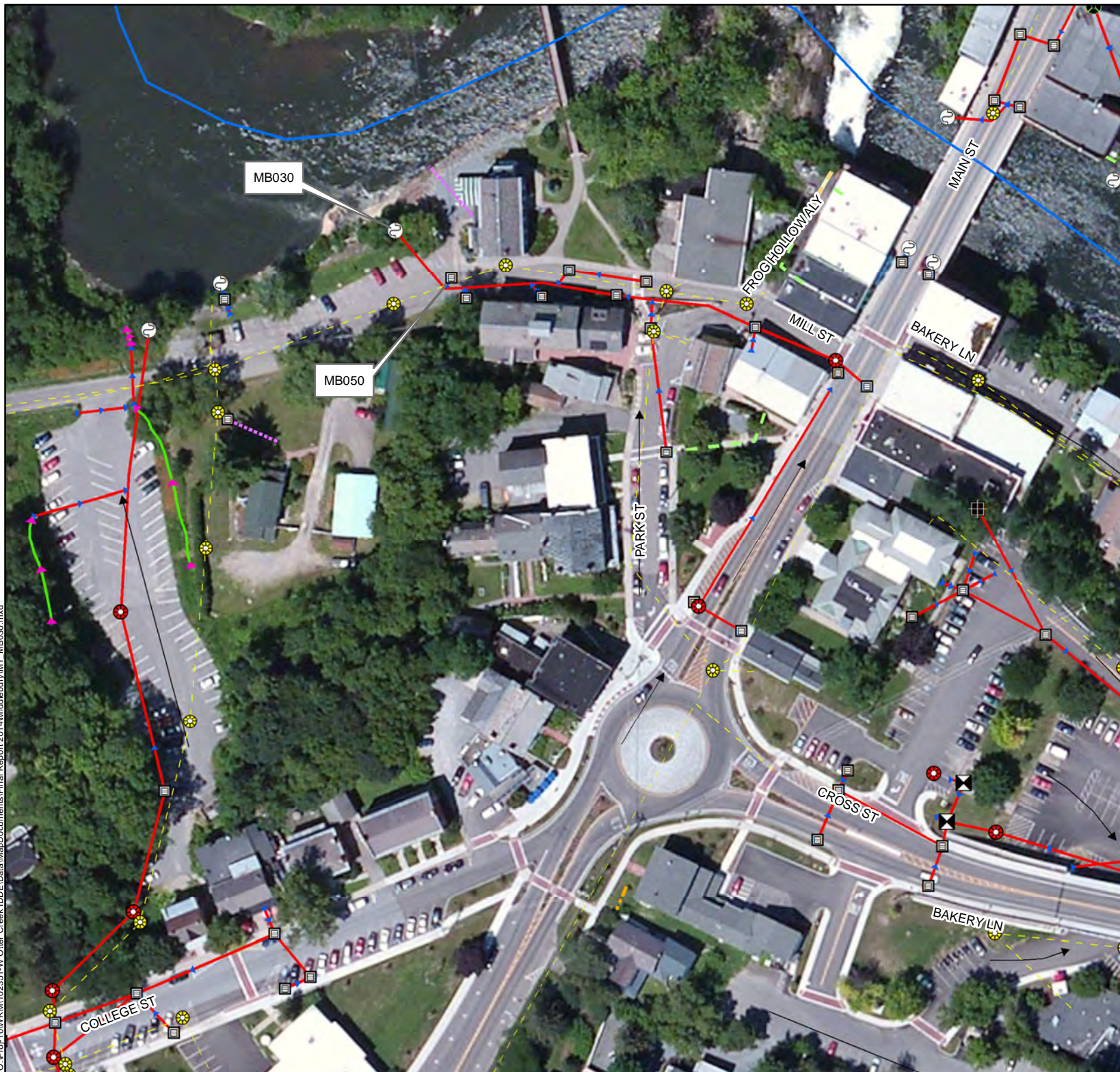
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

 STONE ENVIRONMENTAL INC.

Stormwater Outfalls

Otter Creek Basin IDDE

Map M0



0 60 120 Feet

Legend

- Catchbasin
- Drop Inlet
- Yard drain
- Stormwater Manhole
- Sanitary Manhole
- Outfall
- Treatment feature
- Storm line
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Trench drain
- Stream
- Overland flow

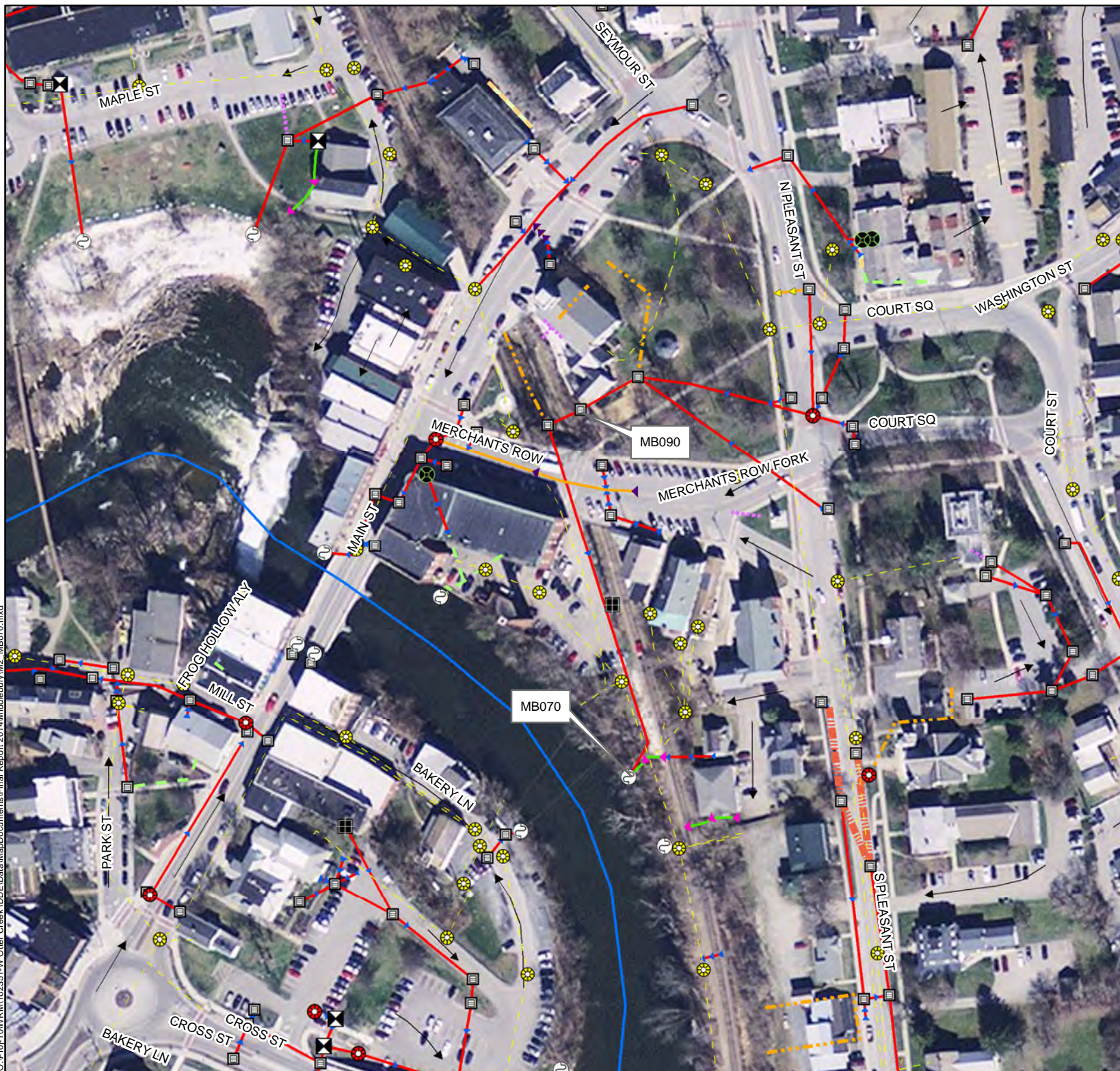
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC.

MB030

Map M1

Otter Creek Basin IDDE



Legend



Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

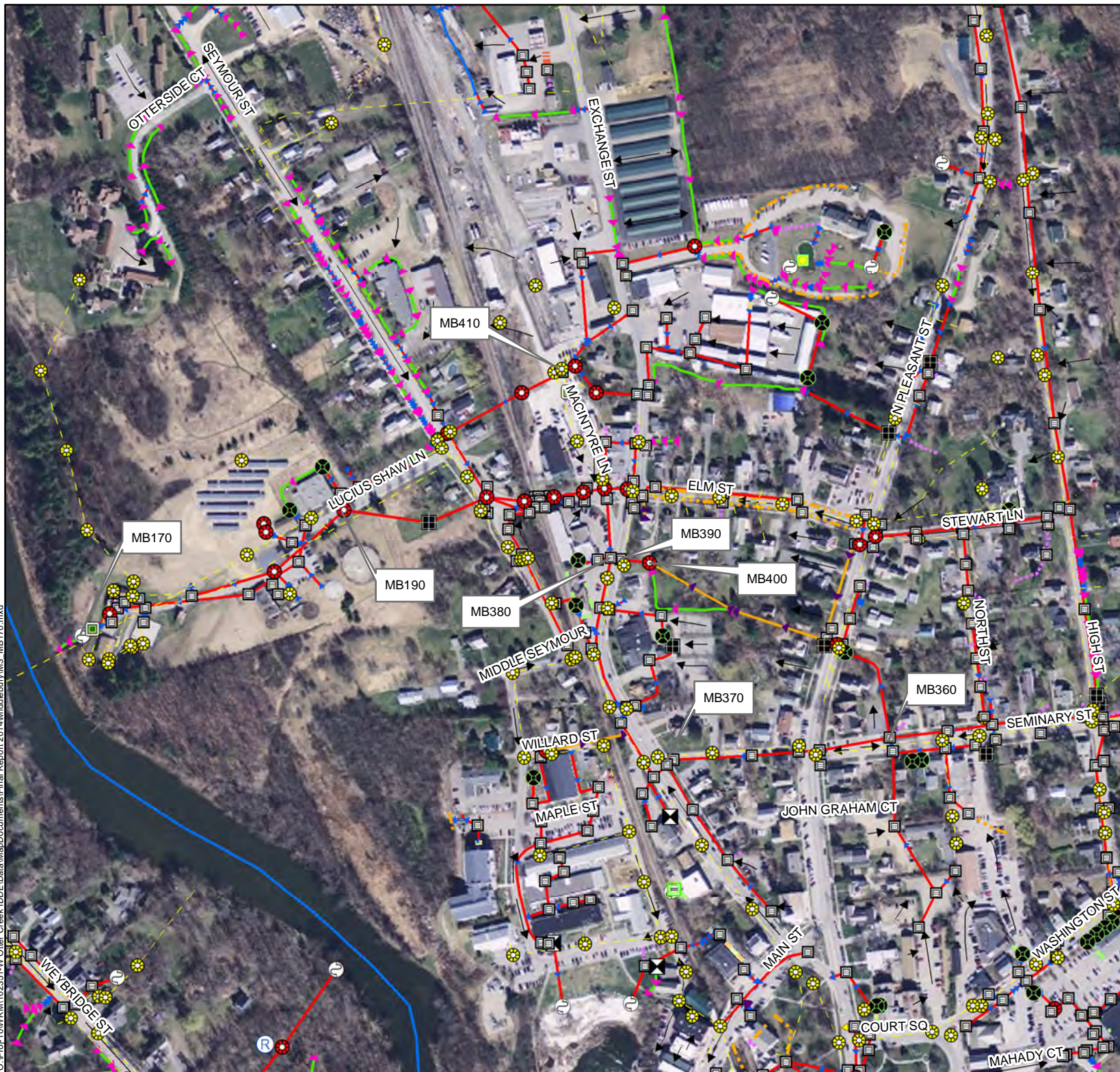

STONE ENVIRONMENTAL INC.

MB070

Map M2

Otter Creek Basin IDDE

C:\P\10\W\RM\102351-W Otter Creek IDDE\Data\MapDocuments\Final Report 2014\Middlebury\M3_MB170.mxd



0 240 480 Feet

Legend

- Catchbasin
- Dry Well
- Drop Inlet
- Yard drain
- Junction Box
- Stormwater Manhole
- Combined sewer MH
- Sanitary Manhole
- Outfall
- Pond outlet structure
- Treatment feature
- Retrofit
- Storm line
- Storm line (old Sanitary)
- Combined sewer
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Trench drain
- Infiltration pipe
- Stream
- Overland flow
- Stormwater storage

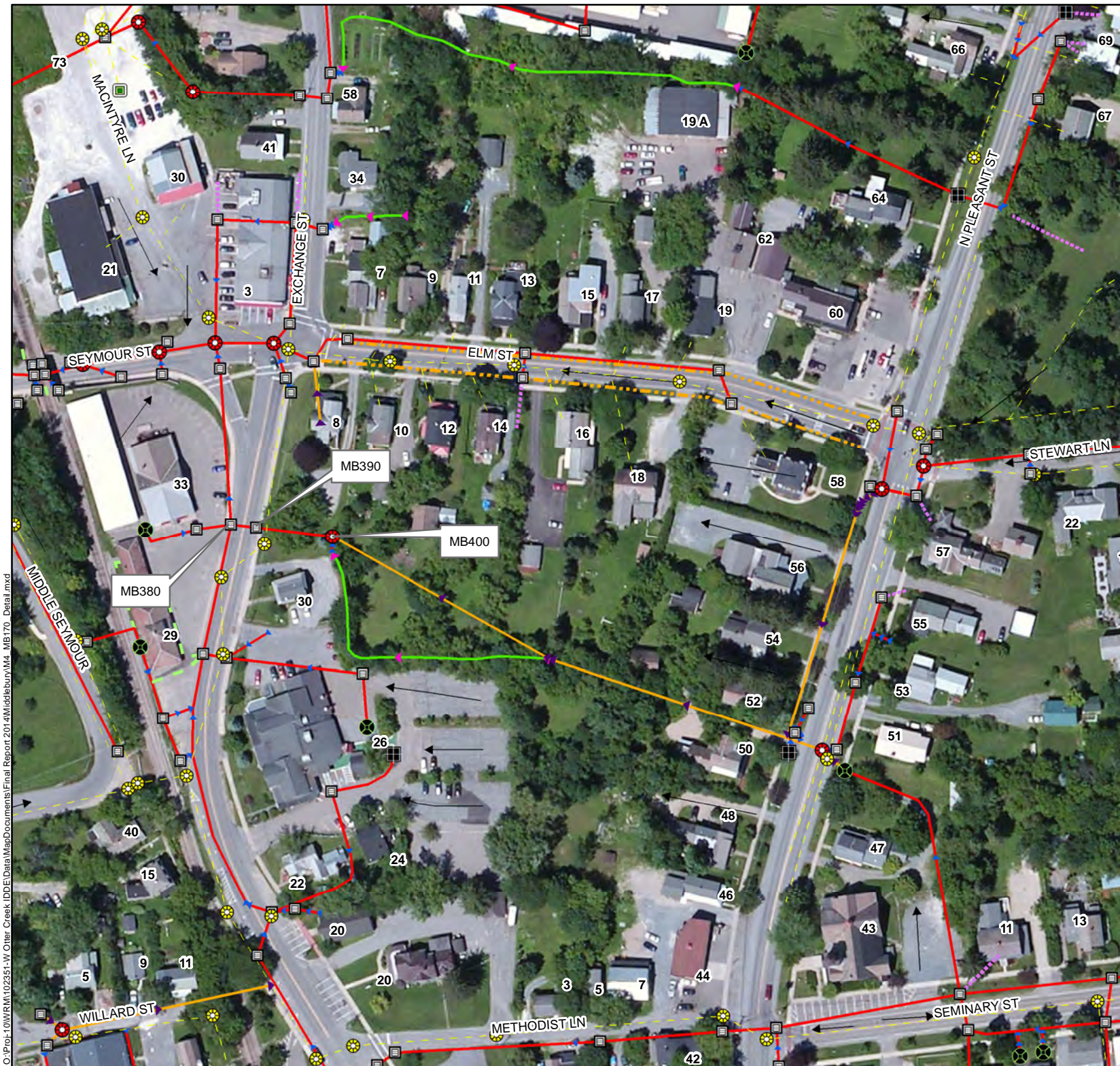
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC

MB170

Otter Creek Basin IDDE

Map M3



0 90 180 Feet

Legend

- Catchbasin
- Drop Inlet
- Yard drain
- Junction Box
- Stormwater Manhole
- Sanitary Manhole
- Storm line
- Storm line (old Sanitary)
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Overland flow

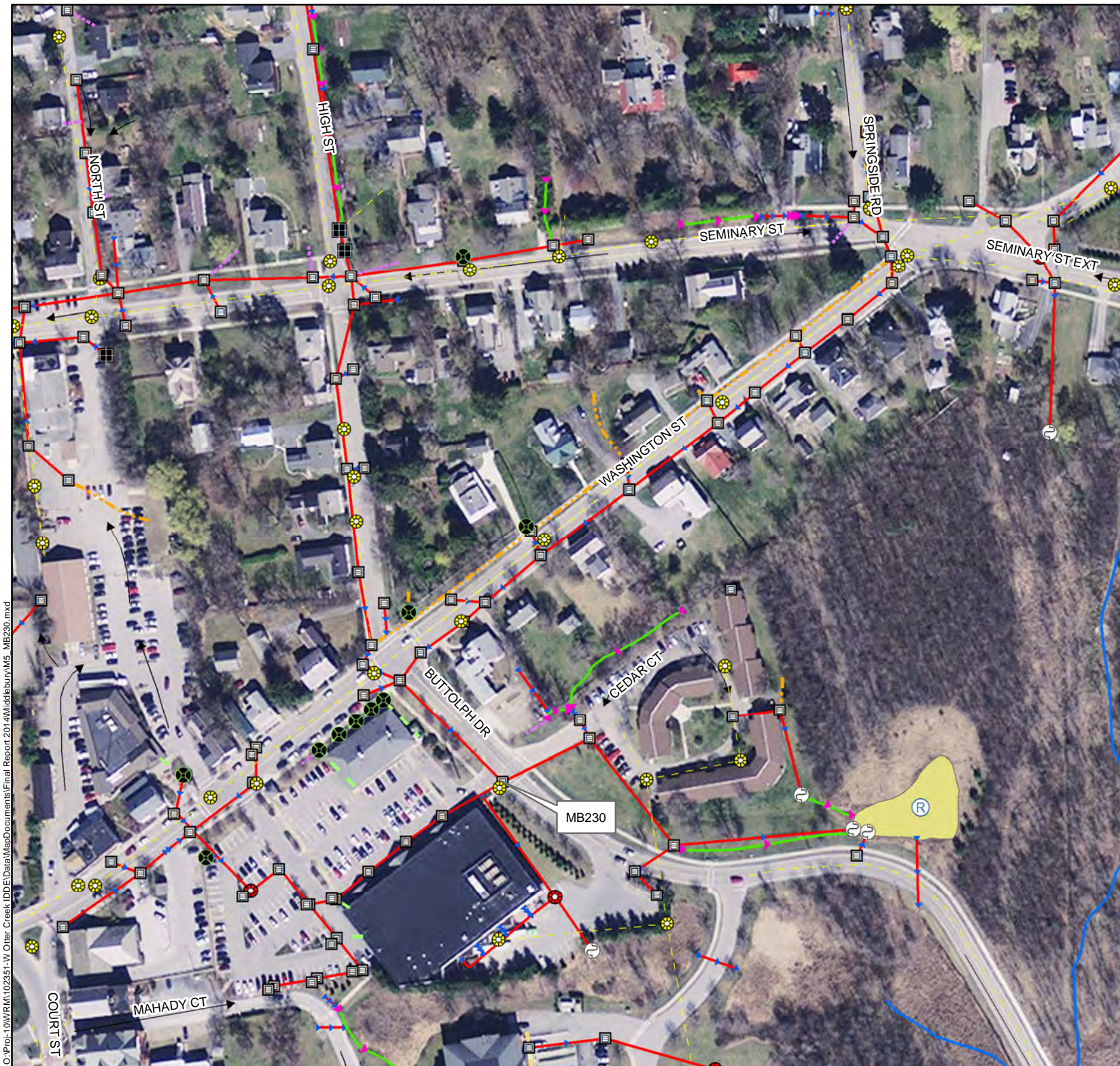
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC

MB170 Detail

Otter Creek Basin IDDE

Map M4



0 110 220 Feet

Legend

- Catchbasin
- Drop Inlet
- Yard drain
- Stormwater Manhole
- Sanitary Manhole
- Outfall
- Retrofit
- Storm line
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Trench drain
- Stream
- Overland flow
- Sedimentation basin

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC.

MB230

Otter Creek Basin IDDE

Map M5



0 75 150 Feet

Legend

- Catchbasin
- Stormwater Manhole
- Sanitary Manhole
- Outfall
- Storm line
- Sanitary line
- Swale
- Stream
- Overland flow

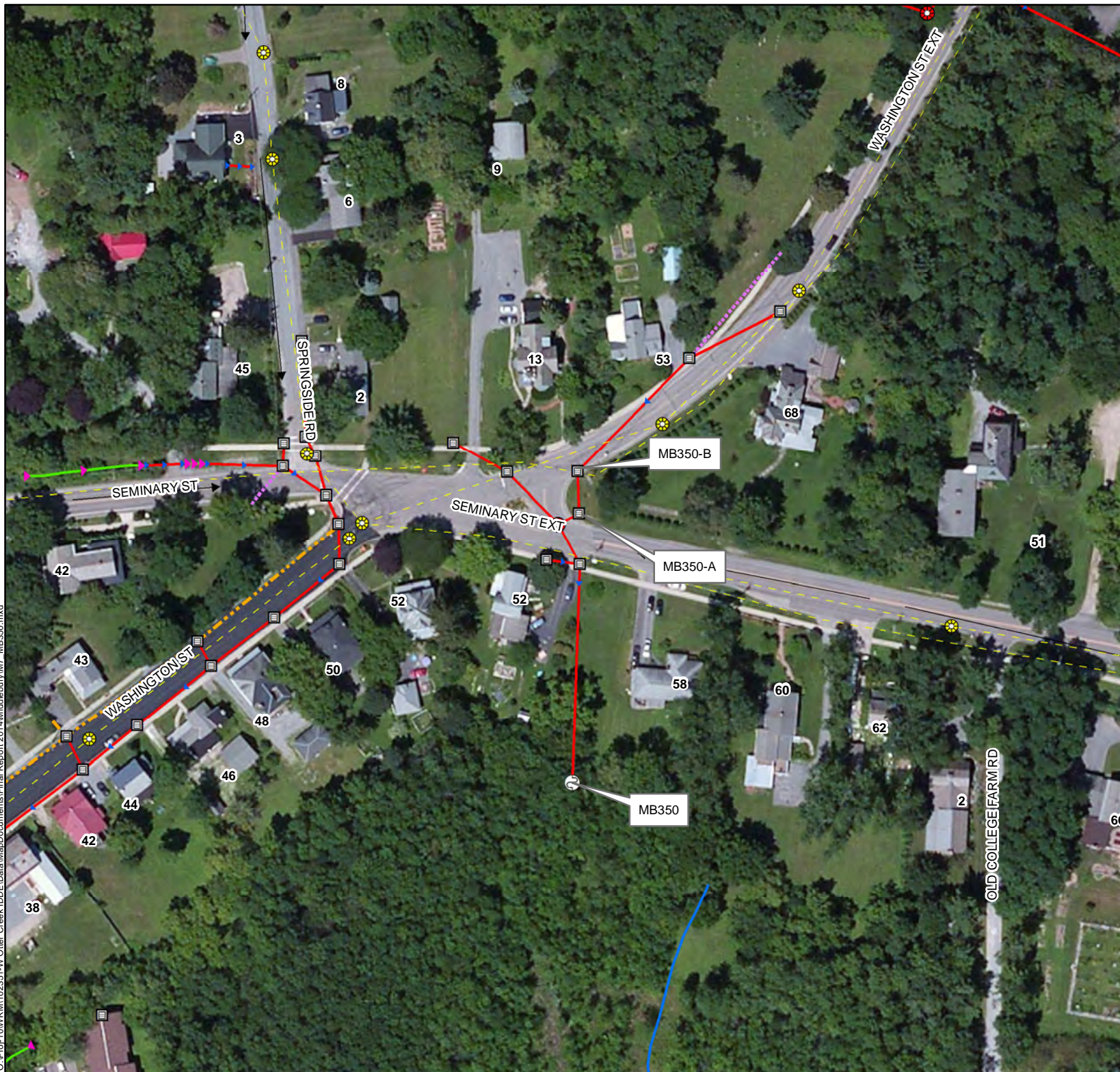
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC.

MB330

Otter Creek Basin IDDE

Map M6



0 75 150 Feet

Legend

- Catchbasin
- Stormwater Manhole
- Sanitary Manhole
- Outfall
- Storm line
- Sanitary line
- Swale
- Footing drain
- Under drain
- Stream
- Overland flow

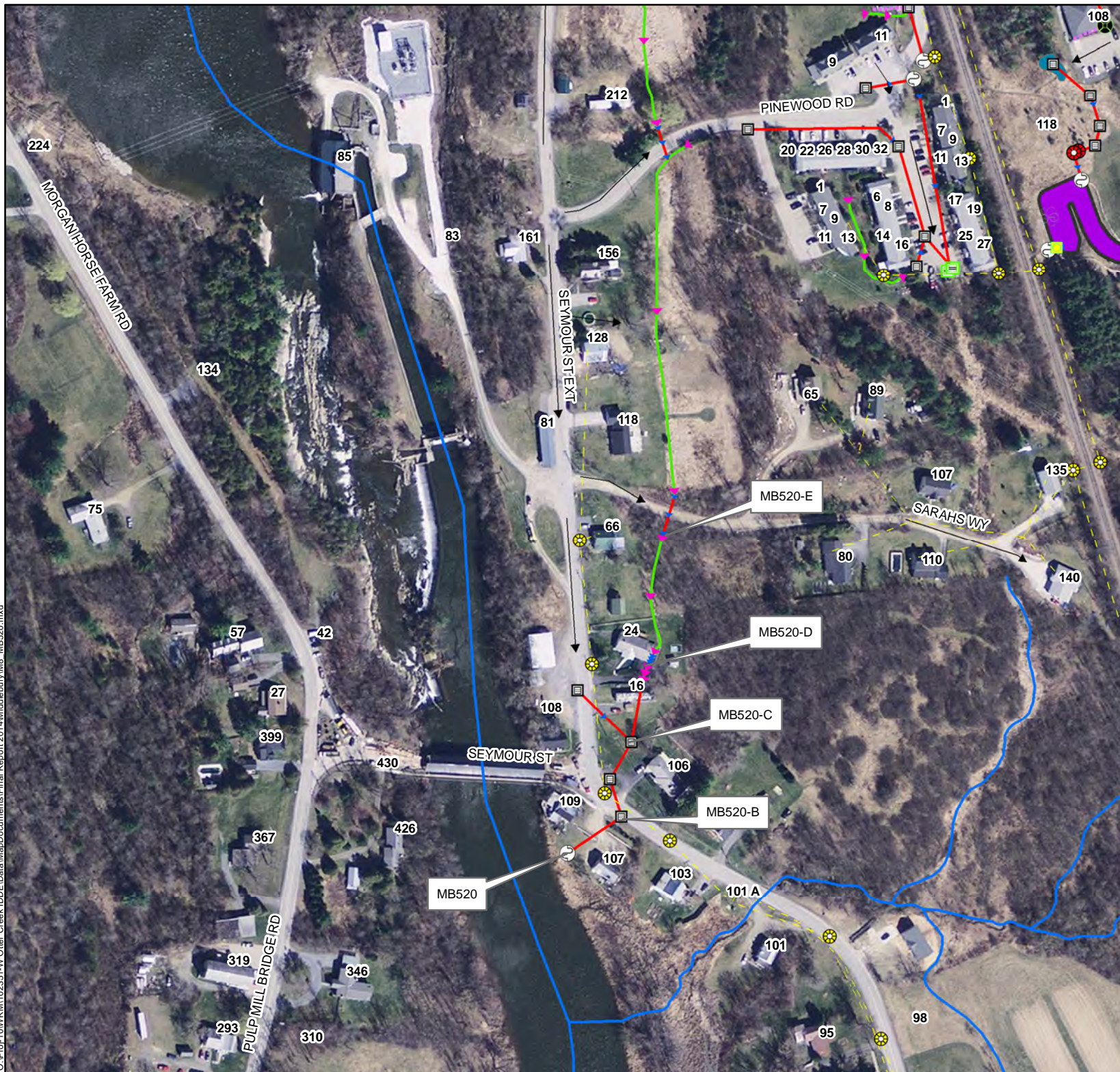
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC.

MB350

Otter Creek Basin IDDE

Map M7



0 140 280 Feet

Legend

- Catchbasin
- Dry Well
- Yard drain
- Stormwater Manhole
- Sanitary Manhole
- Outfall
- Pond outlet structure
- Storm line
- Sanitary line
- Swale
- Footing drain
- Emergency spillway
- Stream
- Overland flow
- Detention pond
- Pooling area
- Stormwater storage

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC



















MB520

Map M8

Otter Creek Basin IDDE



Legend

-  Catchbasin
-  Dry Well
-  Drop Inlet
-  Yard drain
-  Stormwater Manhole
-  Sanitary Manhole
-  Outfall
-  Pond outlet structure
-  Storm line
-  Sanitary line
-  Swale
-  Footing drain
-  Under drain
-  Roof drain
-  French drain
-  Stream
-  Overland flow
-  Treatment structure

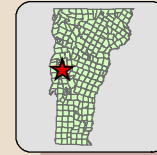
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC.

MB1220

Map M9

Otter Creek Basin IDDE



0 80 160 Feet

Legend

- Catchbasin
- Stormwater Manhole
- Sanitary Manhole
- Outfall
- Pond outlet structure
- Treatment feature
- Storm line
- Sanitary line
- Swale
- Footing drain
- Under drain
- Roof drain
- Emergency spillway
- Stream
- Overland flow
- Detention pond
- Stormwater storage

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC.

MB1450



Otter Creek Basin IDDE

Map M10



0 120 240 Feet

Legend

-  Catchbasin
-  CB tied to sanitary sewer
-  Stormwater Manhole
-  Sanitary Manhole
-  Outfall
-  Pond outlet structure
-  Treatment feature
-  Storm line
-  Combined sewer
-  Sanitary line
-  Swale
-  Footing drain
-  Roof drain
-  French drain
-  Infiltration pipe
-  Stream
-  Overland flow
-  Detention pond
-  Sedimentation basin

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

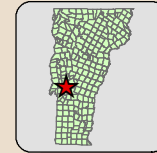
STONE ENVIRONMENTAL INC.

MB2100

Otter Creek Basin IDDE




Map M11

APPENDIX D: PITTSFORD MAP



0 750 1,500 Feet

Legend

-  Outfall
-  River or Stream
-  Town Boundaries

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

 **STONE ENVIRONMENTAL INC.**

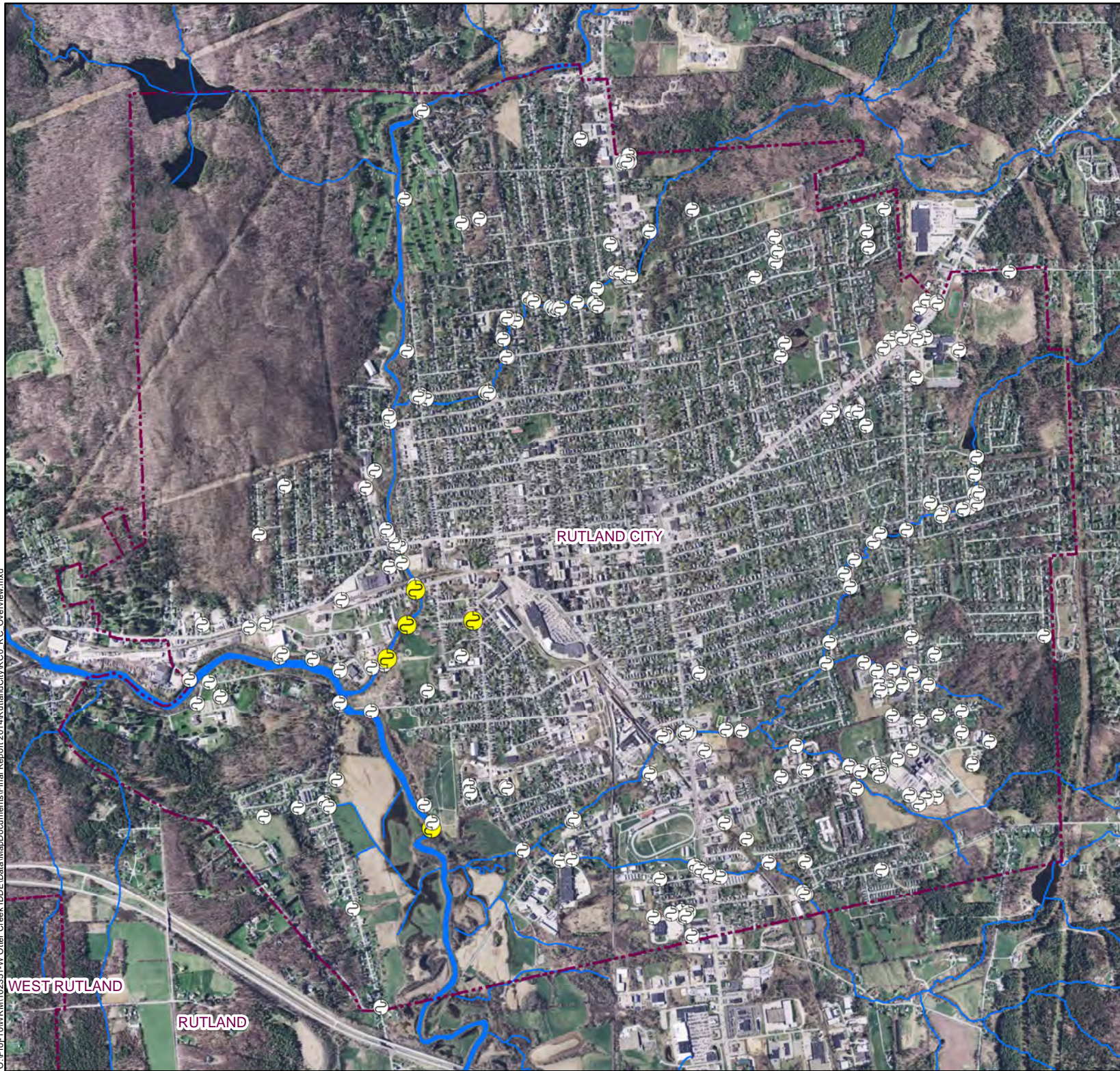
Stormwater Outfalls

Otter Creek Basin IDDE

Map P0





APPENDIX E: RUTLAND CITY MAPS

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0 1,400 2,800 Feet

Legend

-  Outfall
-  Known CSO outfalls
-  River or Stream
-  Town Boundaries

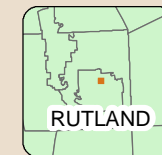
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

 STONE ENVIRONMENTAL INC.

Stormwater Outfalls

Otter Creek Basin IDDE

Map RC0



0 25 50 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

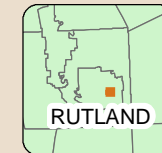
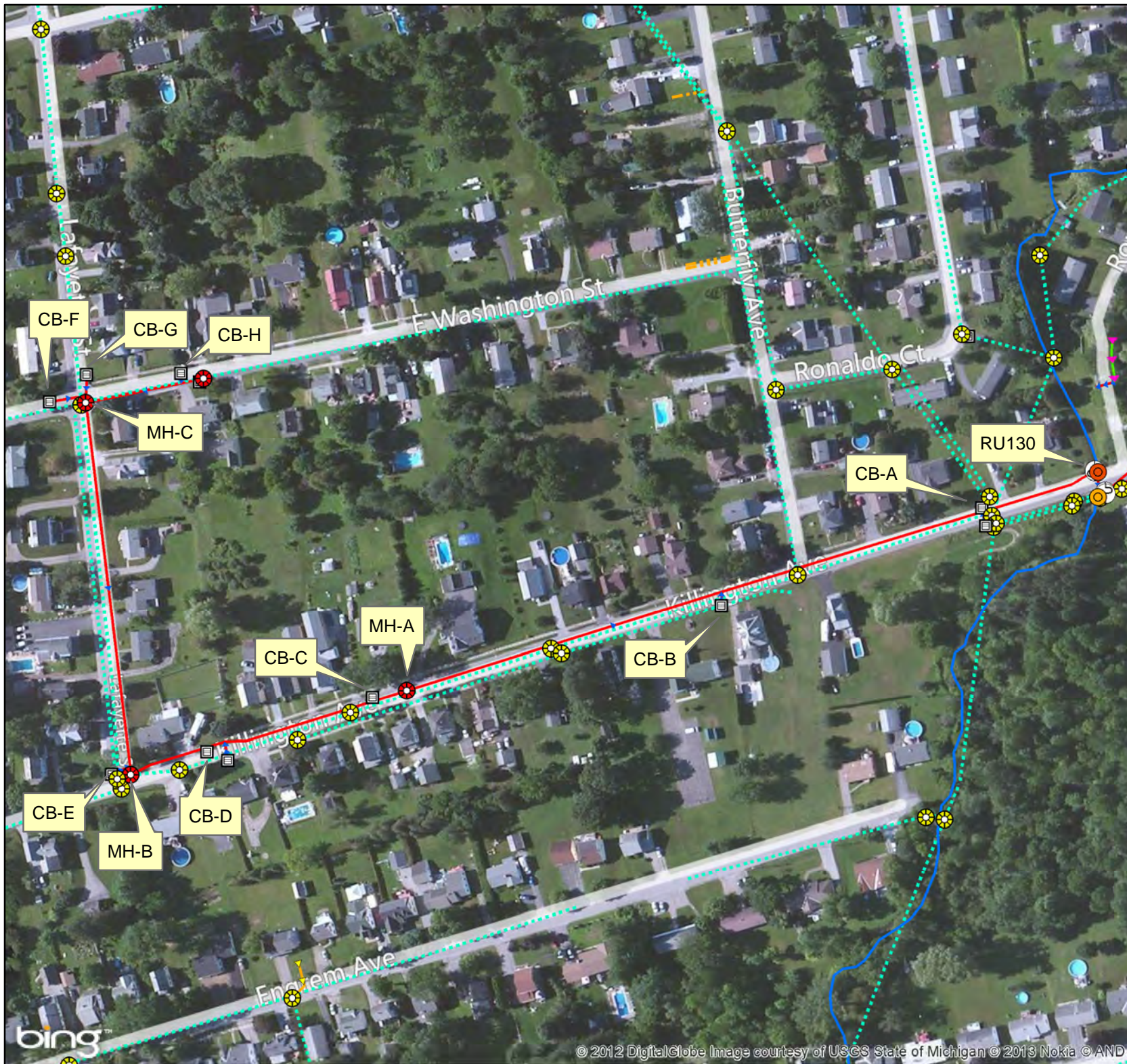
Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

RU100

Map RC1

Otter Creek IDDE



0 100 200 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

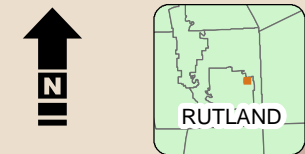
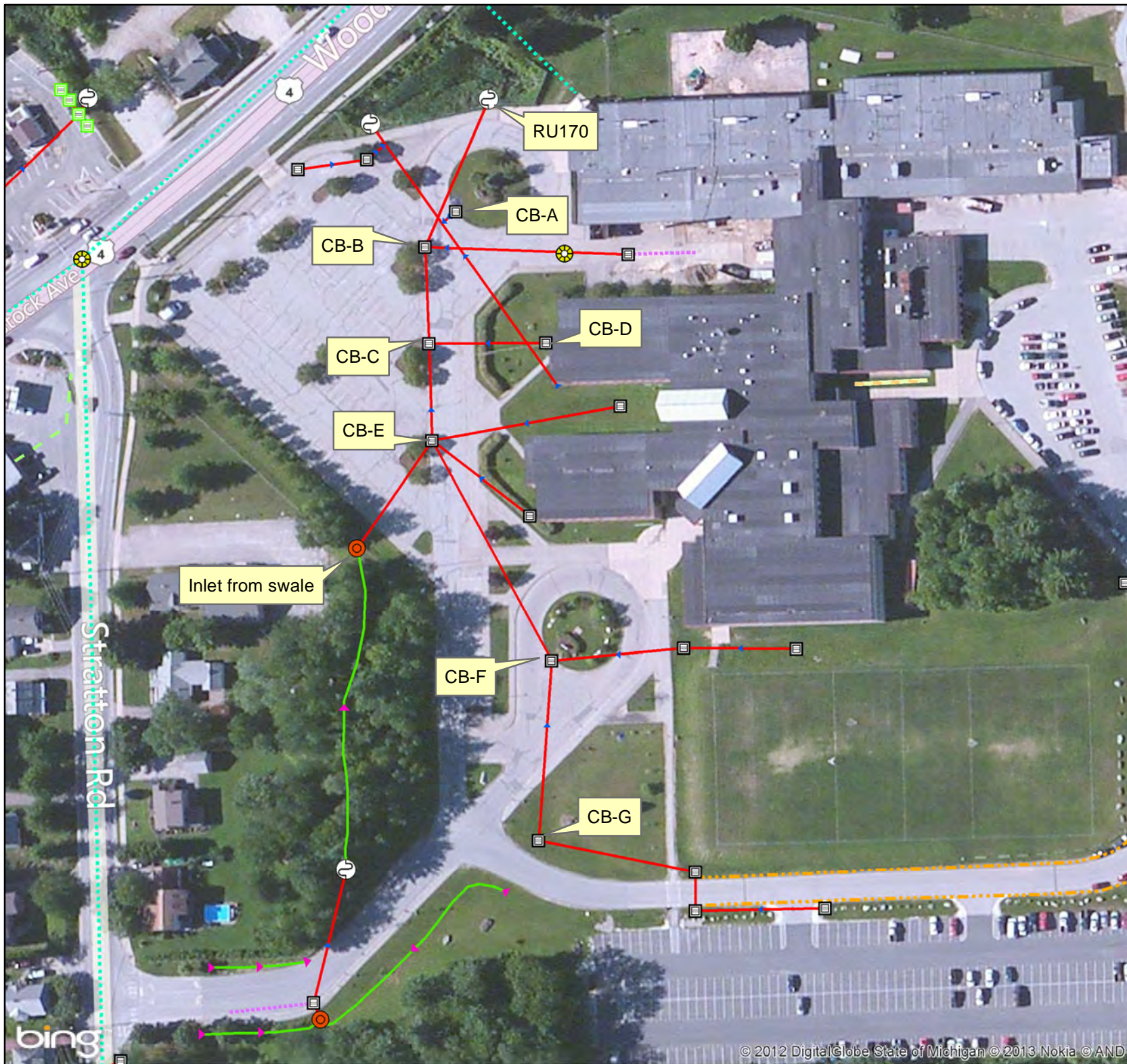
Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

RU130

Otter Creek IDDE

Map RC2



0 50 100 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

RU170

Otter Creek IDDE

Map RC3



0 50 100 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

RU410

Map RC4

Otter Creek IDDE



0 25 50 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

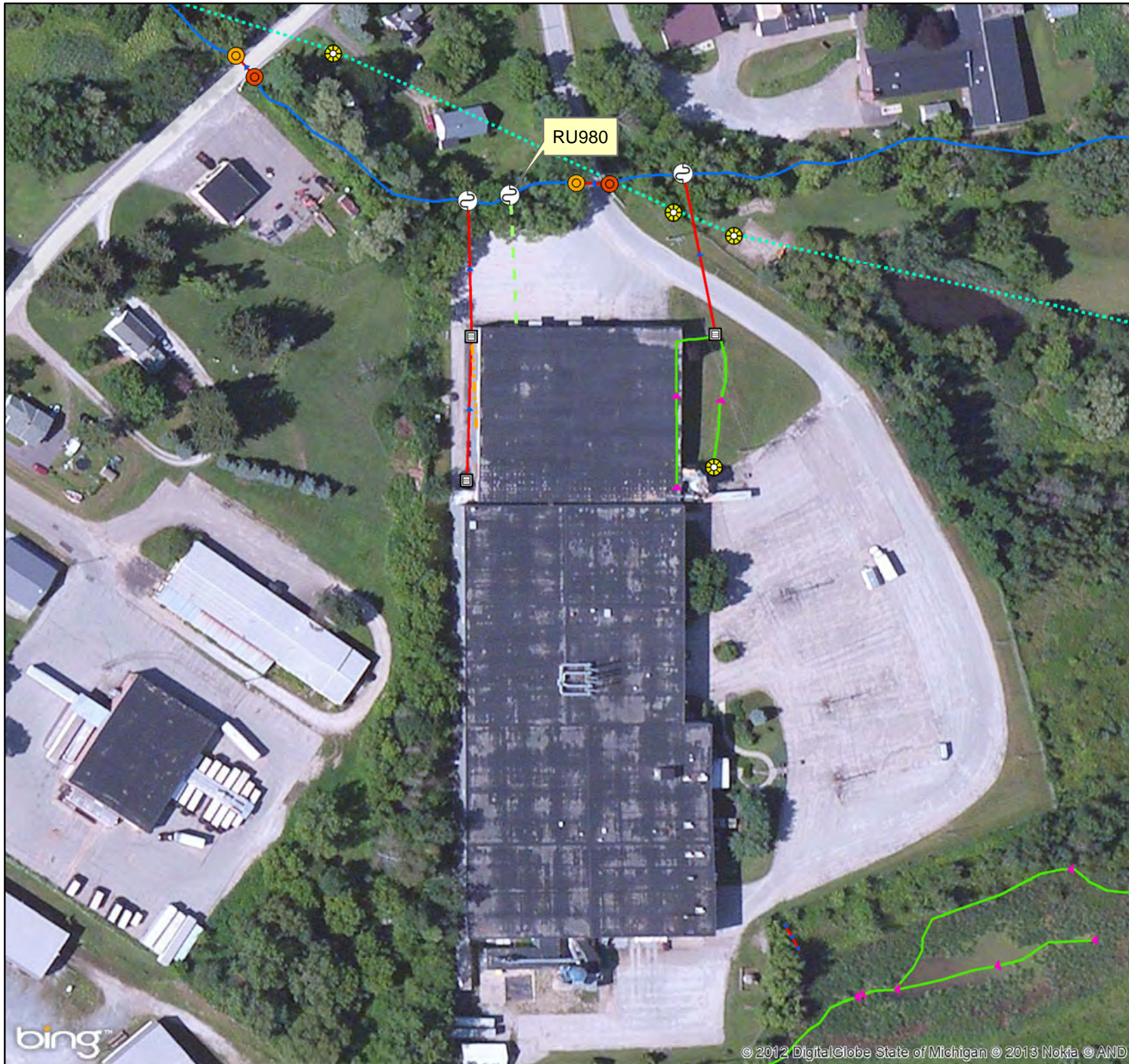
Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

RU840

Otter Creek IDDE

Map RC5



0 50 100 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

RU980

Otter Creek IDDE

Map RC6



0 25 50 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC.

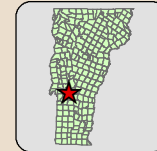
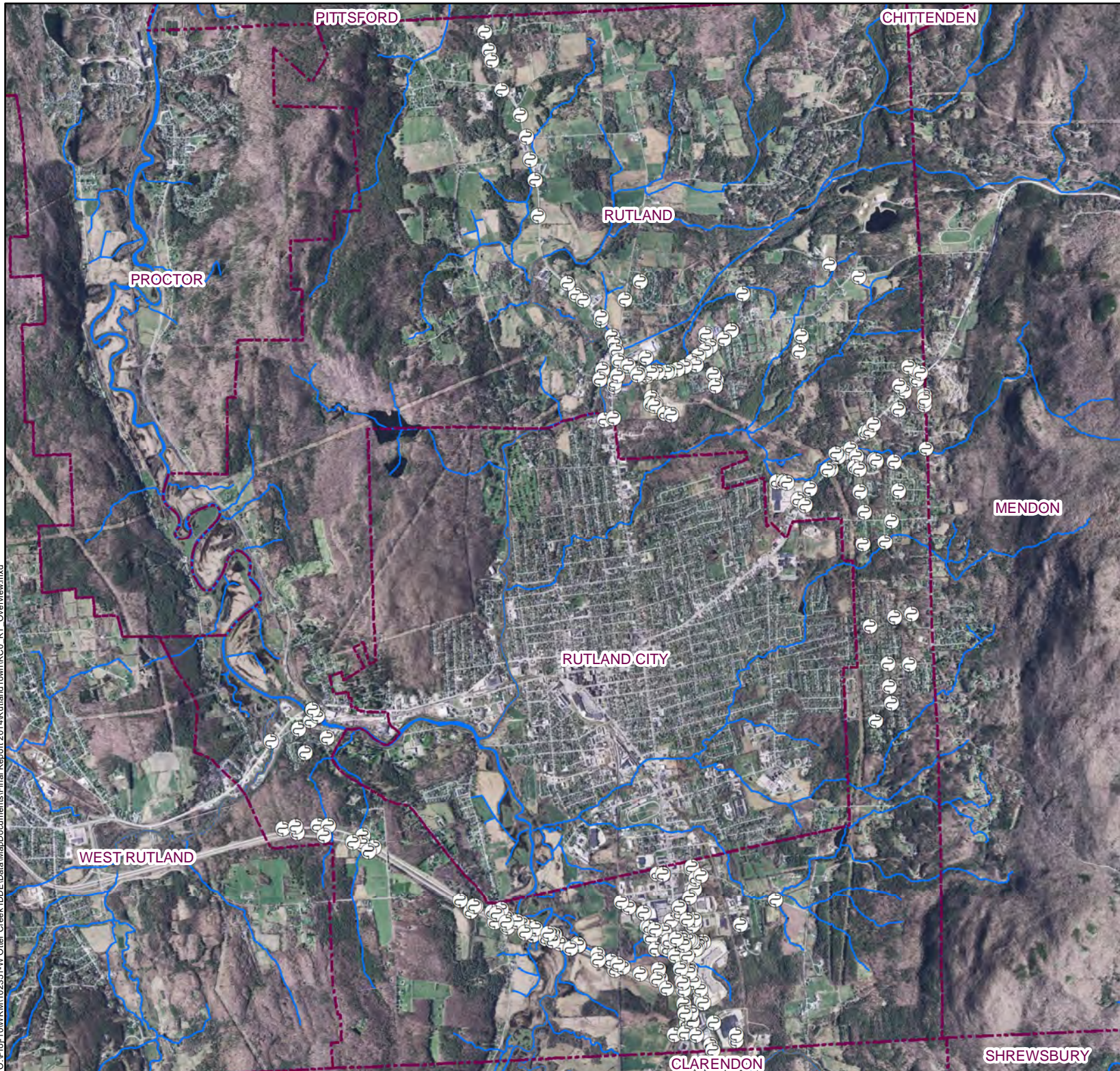
RU1650

Otter Creek IDDE

Map RC7




APPENDIX F: RUTLAND TOWN MAPS

O:\Proj-10\WRM\102351-W Otter Creek IDDE\Data\MapDocuments\Final Report 2014\ Rutland\Town\RC0_RT_Overview.mxd



0 2,750 5,500 Feet

Legend

-  Outfall
-  River or Stream
-  Town Boundaries

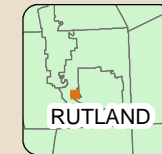
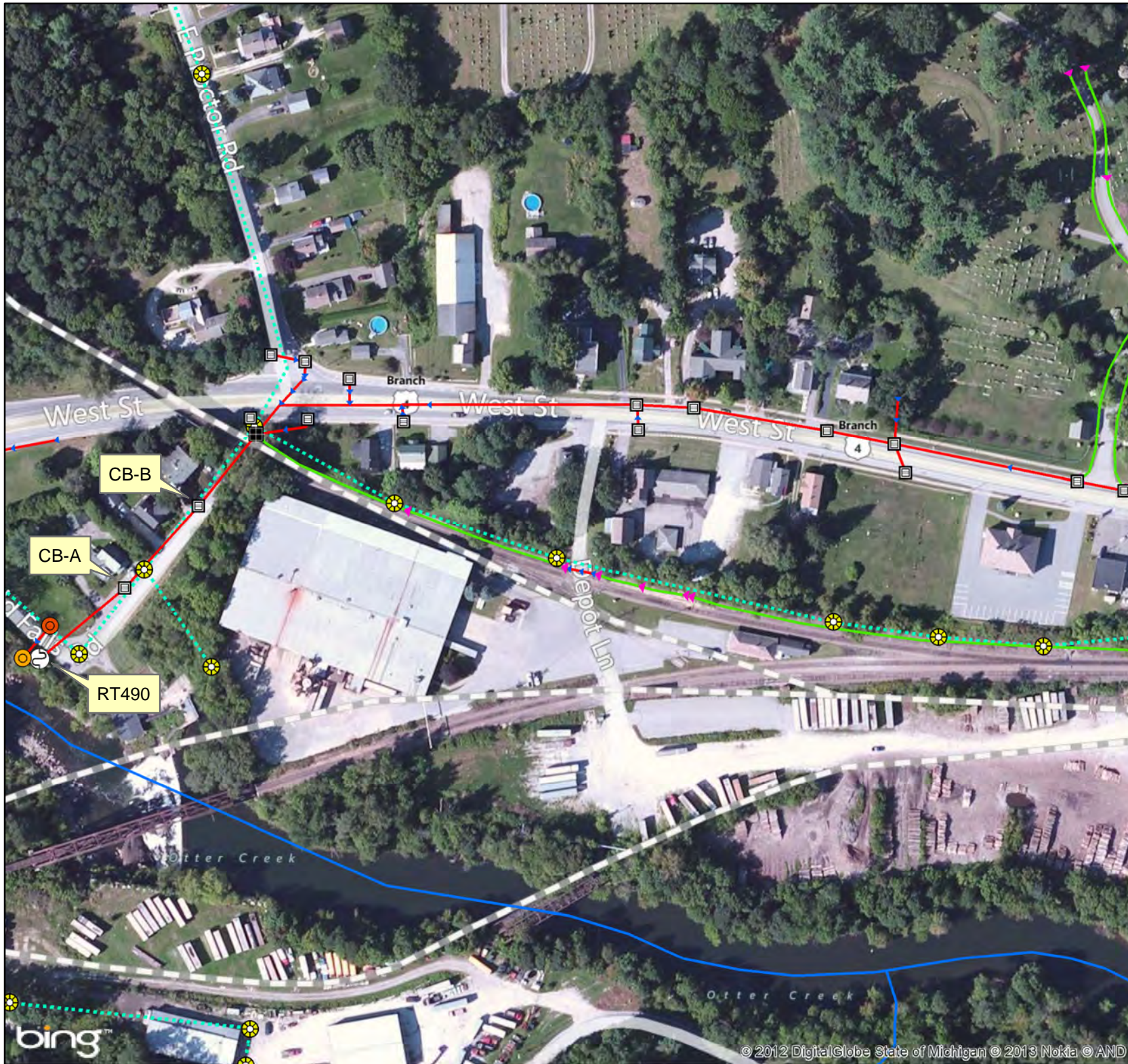
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

 **STONE ENVIRONMENTAL INC.**

Stormwater Outfalls

Otter Creek Basin IDDE

Map RT0



0 25 50 Feet

Combined sewer

Emergency spillway

Footing drain

French drain

Infiltration pipe

Roof drain

Sanitary line

Storm line

Storm line (old Sanitary line)

Stream

Swale

Trench drain

Tunnel (storm)

Under drain

Catchbasin

Combined sewer MH

Culvert inlet

Culvert outlet

Drop Inlet

Dry Well

Grate/Curb Inlet

Junction Box

Known CSO outfalls

Outfall

Pond outlet structure

Sanitary Manhole

Stormwater Manhole

Treatment feature (see notes)

Yard drain

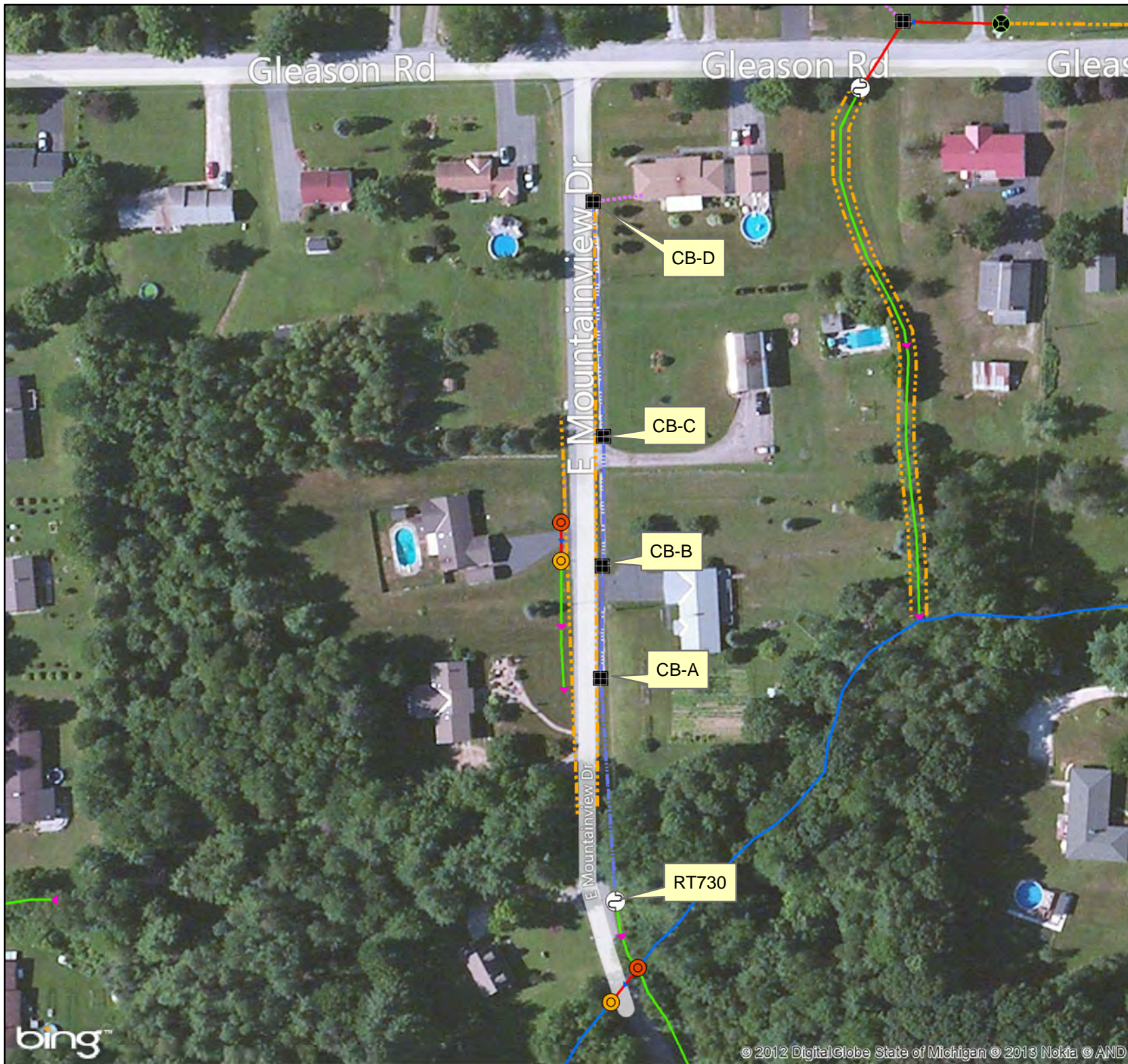
Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

RT490

Otter Creek IDDE

Map RT1



0 50 100 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure;
Vermont DEC; Imagery: Bing Maps.
STONE ENVIRONMENTAL INC

RT730

Otter Creek IDDE

Map RT2



0 25 50 Feet

- Combined sewer
- Emergency spillway
- Footing drain
- French drain
- Infiltration pipe
- Roof drain
- Sanitary line
- Storm line
- Storm line (old Sanitary line)
- Stream
- Swale
- Trench drain
- Tunnel (storm)
- Under drain
- Catchbasin
- Combined sewer MH
- Culvert inlet
- Culvert outlet
- Drop Inlet
- Dry Well
- Grate/Curb Inlet
- Junction Box
- Known CSO outfalls
- Outfall
- Pond outlet structure
- Sanitary Manhole
- Stormwater Manhole
- Treatment feature (see notes)
- Yard drain

Sources: Stormwater Infrastructure:
Vermont DEC; Imagery: Bing Maps.

STONE ENVIRONMENTAL INC

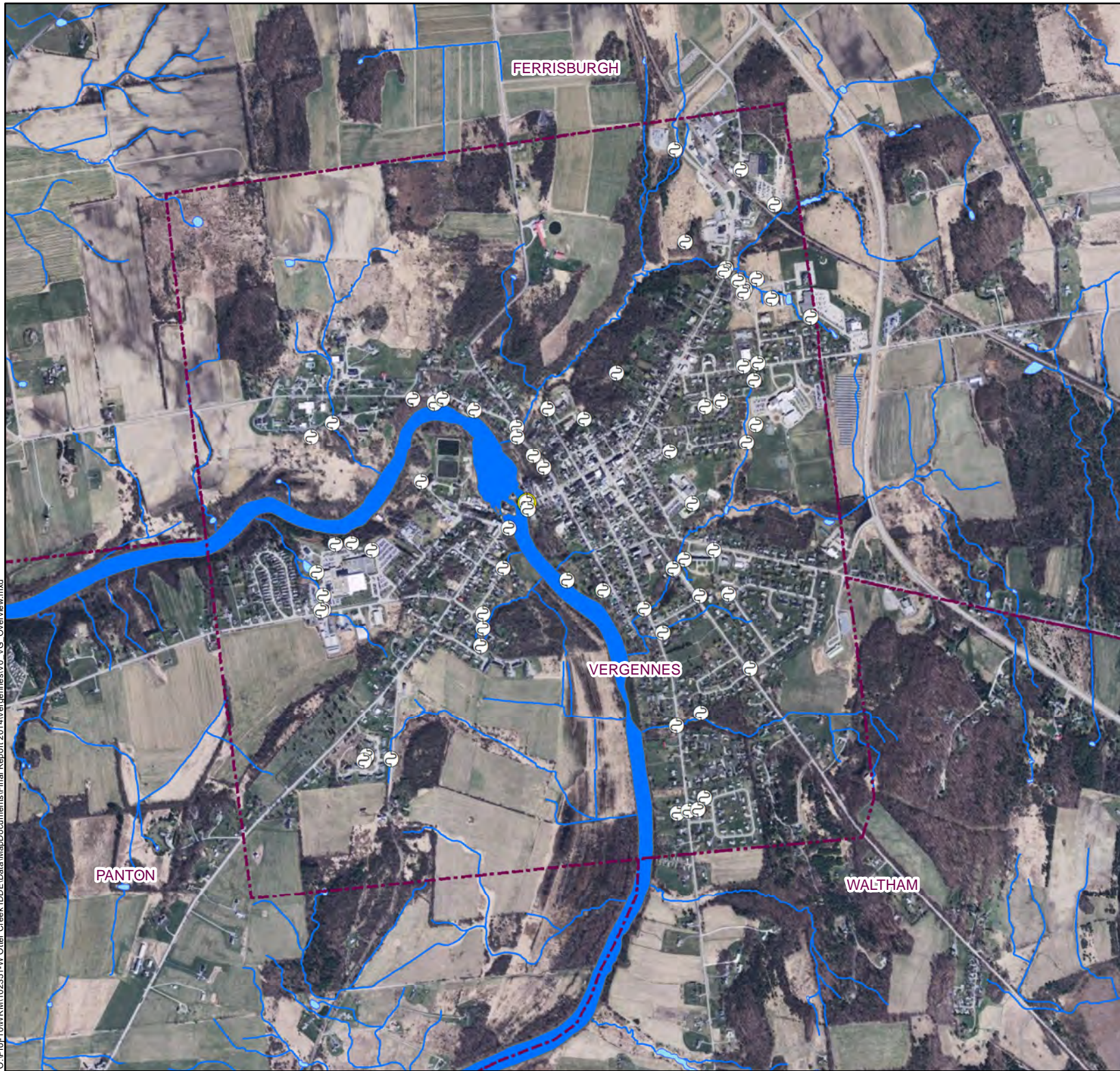
RT1250

Otter Creek IDDE

Map RT3





APPENDIX G: VERGENNES MAPS

C:\Proj-1\01\WRM\102351-W Otter Creek\IDDE\Data\MapDocuments\Final Report 2014\VerGenes\VG Overview.mxd



0 1,000 2,000 Feet

Legend

-  Outfall
-  Known CSO outfalls
-  River or Stream
-  Town Boundaries

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

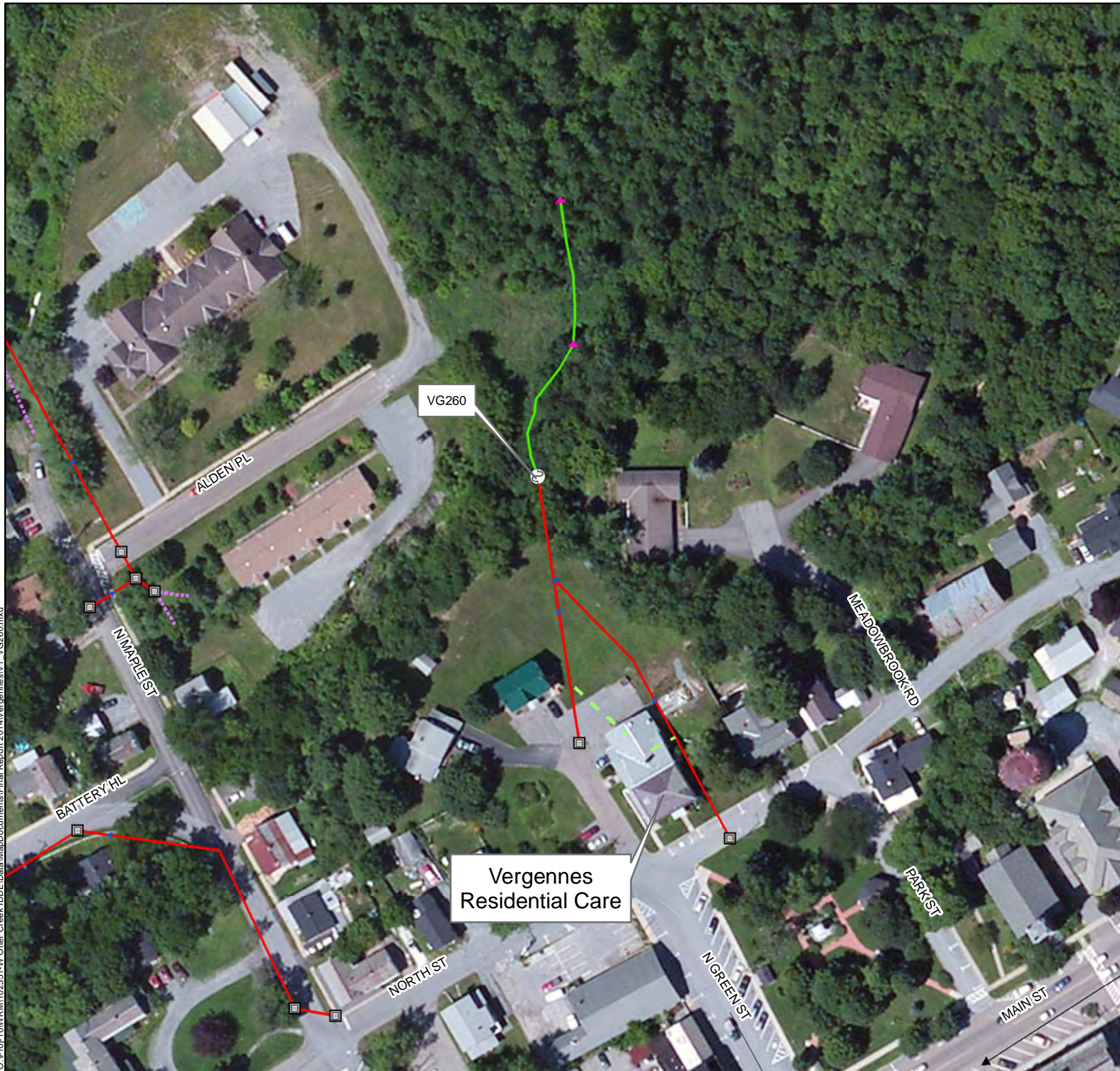
 STONE ENVIRONMENTAL INC.

Stormwater
Infrastructure

Otter Creek Basin IDDE








Map V0

C:\Proj-1\01\VRM\102351-W Otter Creek IDDE\Data\MapDocuments\Final Report 2014\Verennes\V1_VG260.mxd



0 70 140 Feet

Legend

-  Catchbasin
-  Outfall
-  Storm line
-  Swale
-  Footing drain
-  Roof drain
-  Overland flow

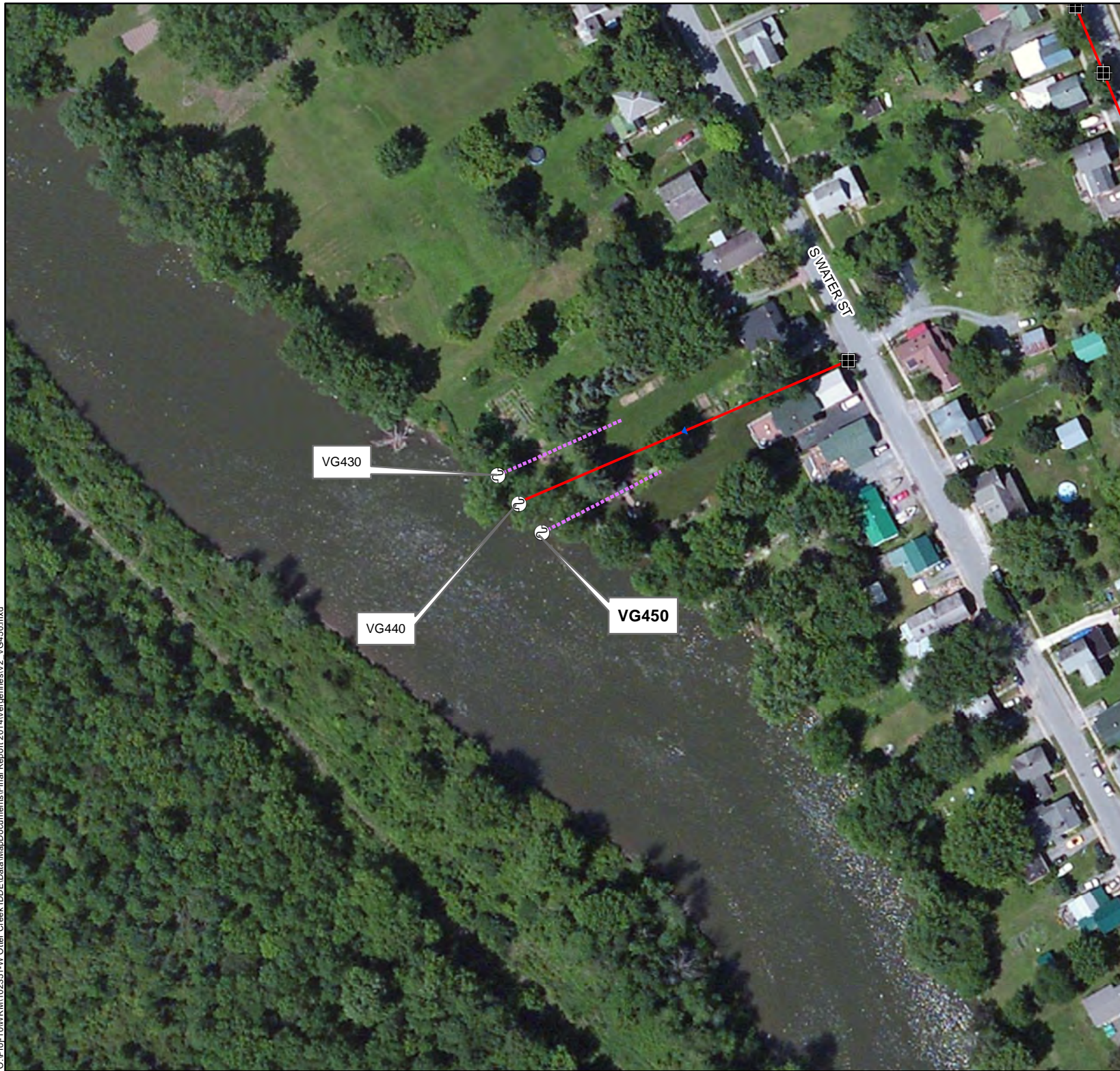
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

 STONE ENVIRONMENTAL INC

VG260





Otter Creek Basin IDDE

Map V1



0 75 150 Feet

Legend

-  Drop Inlet
-  Outfall
-  Storm line
-  Footing drain

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

 STONE ENVIRONMENTAL INC.

VG450

Map V2

Otter Creek Basin IDDE



0 130 260 Feet

Legend

- Catchbasin
- Drop Inlet
- Outfall
- Storm line
- Swale
- Footing drain
- Under drain
- Roof drain
- French drain
- Stream
- Overland flow

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

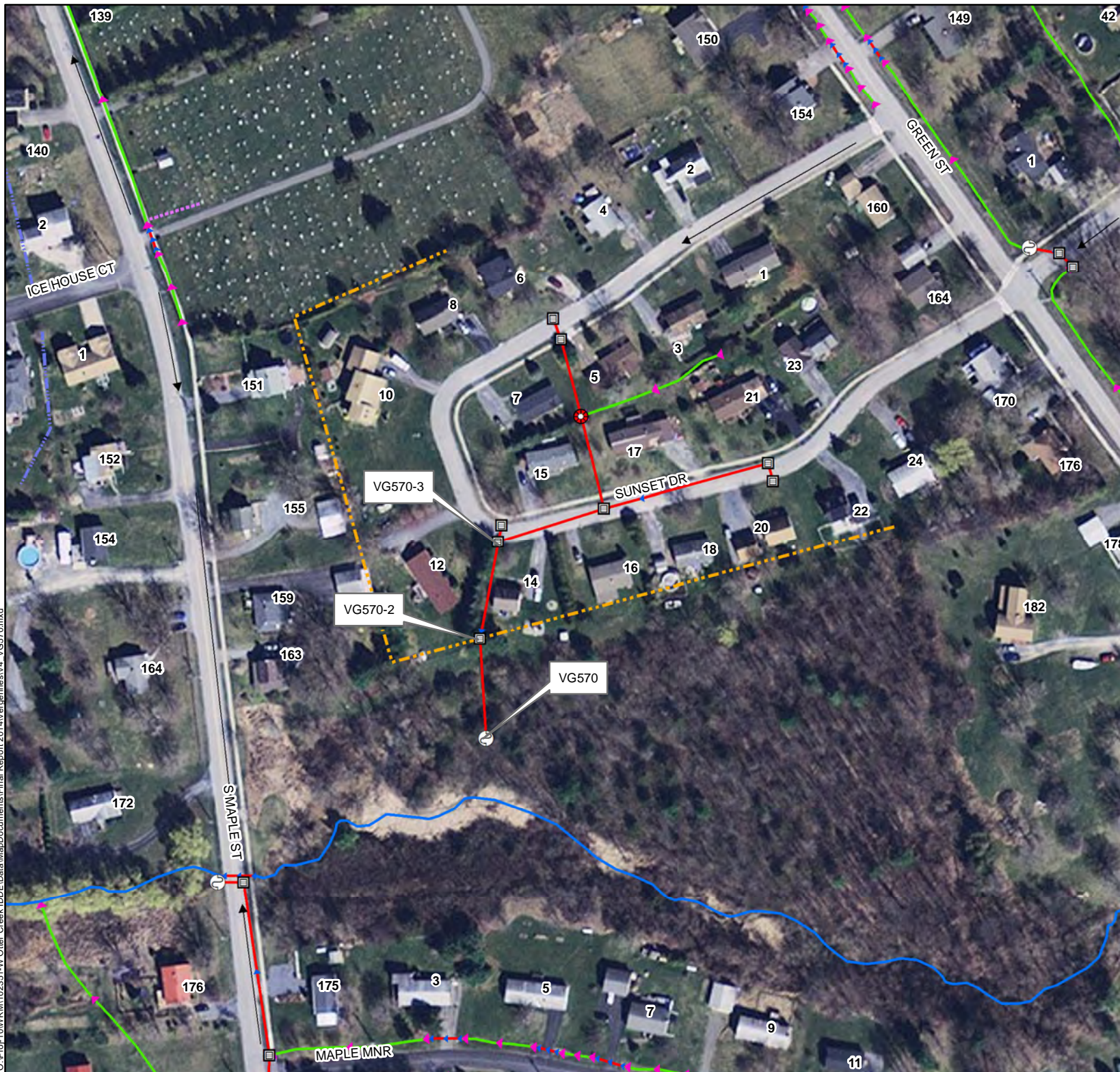
STONE ENVIRONMENTAL INC

VG470

Map V3

Otter Creek Basin IDDE

C:\P\10\W\RM\102351-LW Otter Creek IDDE\MapDocuments\Final Report 2014\Verigennes\V4_VG570.mxd



0 90 180 Feet

Legend

- Catchbasin
- Stormwater Manhole
- Outfall
- Storm line
- Swale
- Footing drain
- Under drain
- French drain
- Stream
- Overland flow

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC

VG570

Map V4

Otter Creek Basin IDDE



0 125 250 Feet

Legend

- Catchbasin
- Stormwater Manhole
- Outfall
- Pond outlet structure
- Retrofit
- Storm line
- Swale
- Footing drain
- French drain
- Emergency spillway
- Overland flow
- Detention pond

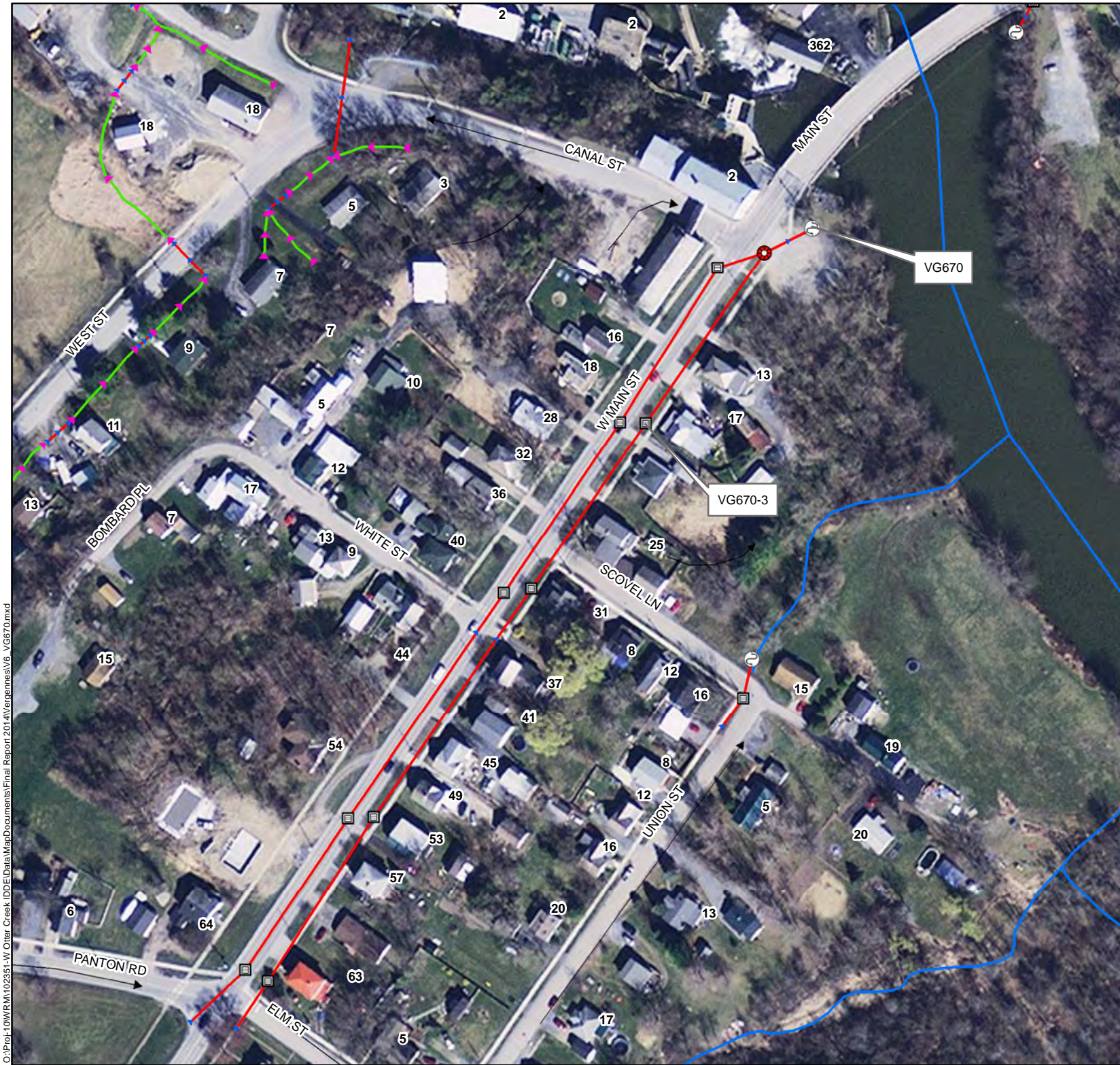
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

STONE ENVIRONMENTAL INC.

VG640

Otter Creek Basin IDDE

Map V5



0 100 200 Feet

Legend

- Catchbasin
- Stormwater Manhole
- Outfall
- Storm line
- Swale
- Stream
- Overland flow

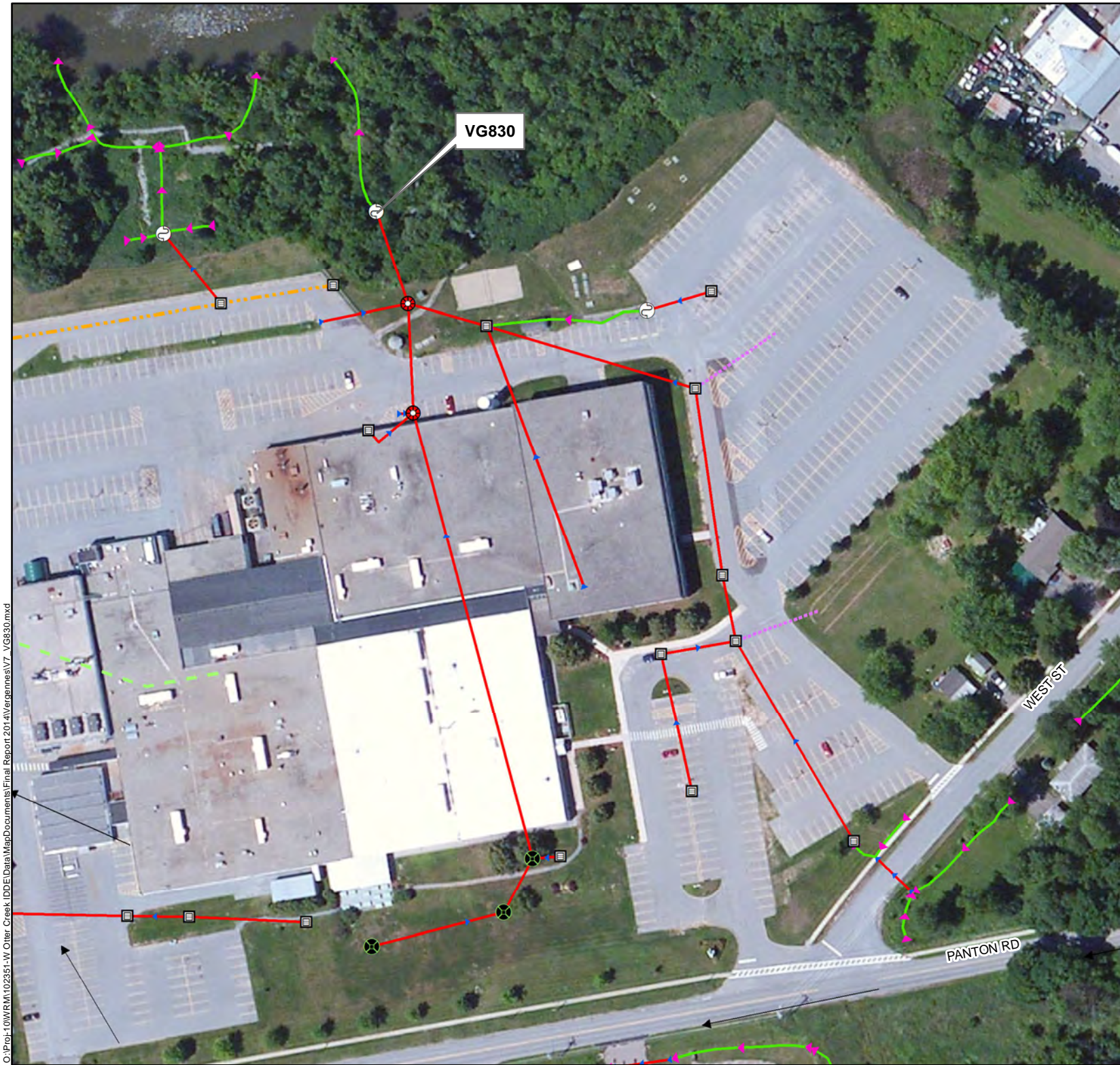
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

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VG670

Map V6

Otter Creek Basin IDDE



0 75 150 Feet

Legend

- Catchbasin
- Yard drain
- Stormwater Manhole
- Outfall
- Storm line
- Swale
- Footing drain
- Under drain
- Roof drain
- Overland flow

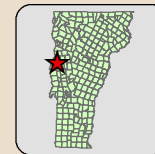
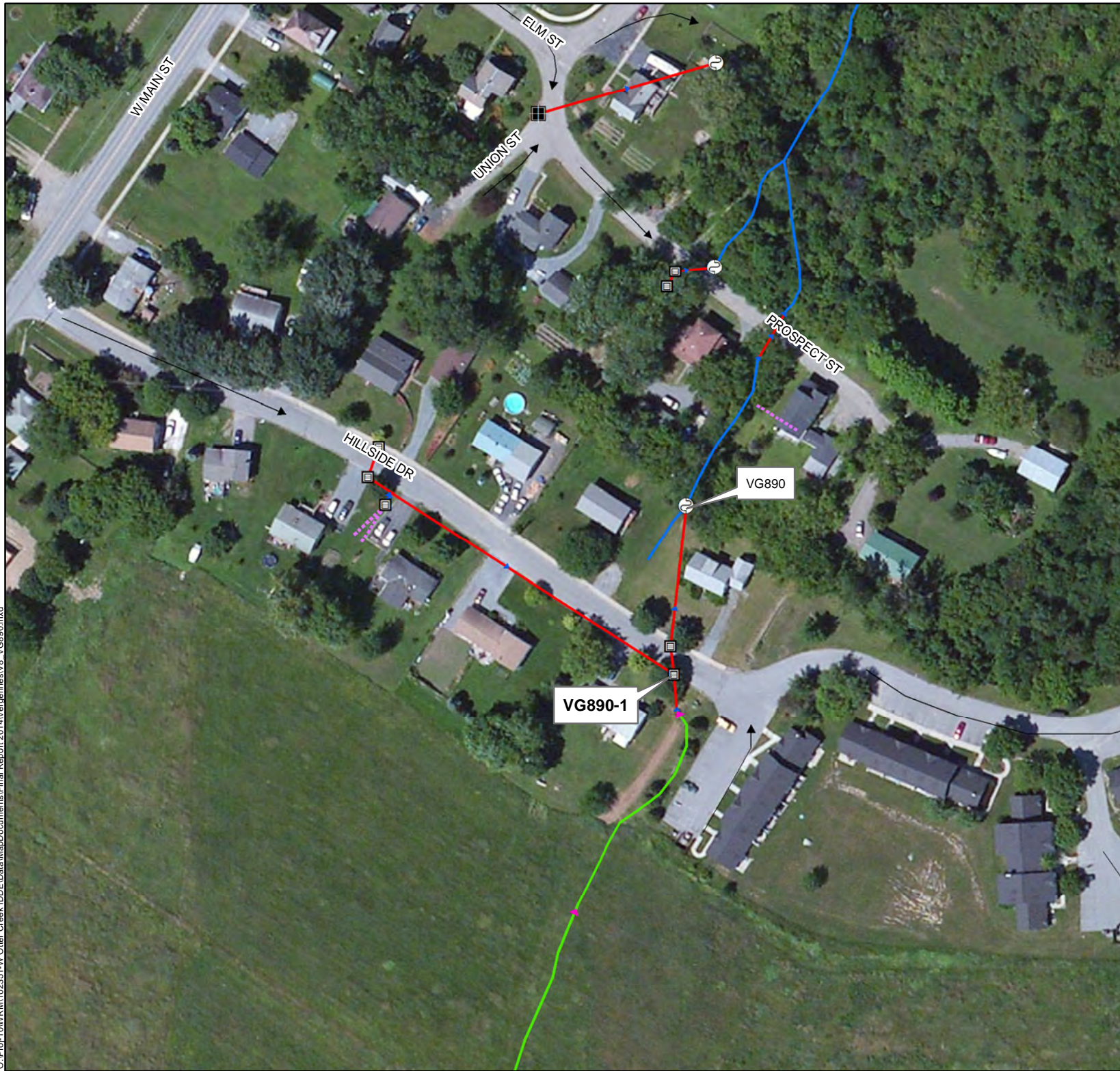
Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

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VG830









Map V7

Otter Creek Basin IDDE



0 75 150 Feet

Legend

-  Catchbasin
-  Drop Inlet
-  Outfall
-  Storm line
-  Swale
-  Footing drain
-  Stream
-  Overland flow

Sources: Stormwater Infrastructure: ANR;
Hydrography, Town Boundaries: VCGI;
Imagery: esri.

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VG890

Map V8

Otter Creek Basin IDDE