VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION
STORMWATER PROGRAM

Municipal Separate Storm Sewer System (MS4)
2018 Annual Report

A. Permittee Information	
1. Name of MS4: City of St. Albans	
2. Permit Number: 7074 - 9014	
B. Minimum Control Measures	
1. Public Education and Outreach Participation on Franklin County Stormwater collaborative	
1.1 Website address: www.fcsvt.org	
1.2 Participation in Regional Outreach Strategy ☐ No ■ Yes, summary of activities attached	
2. Public Involvement and Participation	
2.1 Participation in Regional Involvement Strategy ☐ No ■ Yes, summary of activities attached	
3. Illicit Discharge Detection and Elimination	
3.1 Stormwater infrastructure mapping complete or continuing: ☐ No ■ Yes	
3.1 Number of stormwater outfalls inspected: 9	
3.2 Number of stormwater outfalls tested: 9	
3.3 Number of illicit discharges detected and eliminated: Further investigations recommended on 2 outfalls. No distinct sources identified yet.	
3.4 Additional information attached ☐ No ■ Yes	
4. Construction Site Runoff Control	
4.1 Continued implementation of an Erosion Control Ordinance ☐ No ■ Yes	
4.2 Additional information attached ■ No ☐ Yes Rules in effect on July 1. Only one project required an EPSC Plan.	
5. Post Construction Management for New Development and Redevelopment	
5.1 Continued implementation of an ordinance for disturbances of greater than one acre that are not subject to the Agency's post-construction permit program ☐ No ■ Yes	
5.2 Additional information attached ■ No ☐ Yes No disturbances greater than 1 acre in 2018.	
6. Pollution Prevention and Good Housekeeping	
6.1 Participation in the Municipal Compliance Assistance Program ☐ No ■ Yes; Participation year: 2015	
6.2 Number of catch basins inspected: 430	
6.3 Number of catch basins cleaned: 430 - 142 yards of silt and debris removed.	
6.4 Lane miles swept: 2,110	6.5 Cubic yards of material collected by street sweeping: 261
6.6 Number of staff who attended training: 1	
6.7 Additional information attached ■ No ☐ Yes	
C. Flow Restoration Plan Implementation	
1. Summary of FRP implementation in stormwater impaired waters is attached: ☐ NA ■ Yes	
D. Phosphorus Control Plan Implementation	
1. Has a Road Erosion Inventory (REI) been completed for your municipality? ☐ NA ■ No ☐ Yes	

See attached PCP Report

E. Incorporated Previously Permitted Stormwater Systems

1. Has the municipality incorporated permitted stormwater systems into its MS4 authorization? ☐ No ■ Yes

2. If yes, complete the following table or include this information as an attachment

Stormwater Treatment Practice Name	State Stormwater Permit No.	Date of Last Inspection	Maintenance Completed
Murray Drive Swales (formerly "Lake Street S	1-0477	09/06/2018	■ NA ☐ Yes
Guyette Circle / Bowles Lane Swales (former	1-0691	09/06/2018	■ NA ☐ Yes
Lemnah Drive 1 (formerly "St. Albans Industri	2-0147	09/06/2018	■ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes
			☐ NA ☐ Yes

F. Other Reporting Requirements

1. Summary of stormwater activities planned for next reporting cycle: Pursue all MCMs. Continue development of PCP. Continue final design on flow restoration BMPs.

2. Proposed changes to the SWMP: None at this time.

3. Reliance on other entities to meet permit obligations: The City relies on the Franklin County Stormwater collaborative as an RSEP. It should also be noted that many planned treatment facilities will depend on permitting and other approvals from the State of Vermont and Town of St. Albans.

G. Certification

This Annual Report shall be signed by a principal executive officer, ranking elected official or other duly authorized employee consistent with 40 CFR §122.22(b) and certified as follows:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Chip Sawyer	Director of Planning & Development
Print Name	Title
Chip Sawyer Digitally signed by Chip Sawyer Date: 2019.03.29 11:08:18 -04'00'	March 29, 2019
Signature	Date

Franklin County Regional Stormwater Education,
Public Involvement and Participation Program
Summary of Activities January 1 – December 31, 2018

The information below summarizes many of the accomplishments in 2018 conducted by Northwest Regional Planning Commission and Friends of Northern Lake Champlain in fulfillment of the Regional Stormwater Educational Program (RSEP) for the City and Town of St. Albans. The RSEP is charged with satisfying the relevant requirements of the Minimum Control Measure (MCM) One, Public Education and Outreach, and MCM Two, Public Involvement and Participation of the Phase II NPDES Permit.

The minimum requirements to be completed on MCM 1 regarding Public Education and Outreach are provided in Table 1 below.

Table 1. MCM 1 – Public Education and Outreach activities and goals.

MCM #	Activity	Measurable Goal(s)	Status
1-1	Maintain stormwater website	Perform annual updates Document number of contacts and feedback to website	✓ ✓ 30
1-2,3,4	Participate in RSEP	Maintain Regional Stormwater Education Program (RSEP) membership and activities	✓
1-5a	Develop or acquire information brochures	Update brochures as necessary	✓ 4 2 Flyers created to promote FCS 2 Guidance documents
1-5b	Distribute stormwater brochures	Report number of brochures distributed	✓ 50
1-5c	Seek local news media to run new or feature stories	Report number of media buys and/or stories run	✓ 1 News story ✓ 2 Media buys ✓ Many Social Media shares
1-5d	Develop school materials and teacher meetings	Update of materials as necessary. Teacher meetings and attendance. Teacher input on use in classroom.	✓ 20+ Teachers engaged 500 students participated

Stormwater Website (www.fcsvt.org) - Task 1-1

NRPC performed updates to areas of the website as needed. The website was also used to announce RSEP sponsored events such as the clean-up events and the fall workshop. The website provides for an opportunity to promote stormwater awareness to community residents.

In 2019 NRPC has plans to add new material that has been developed (workshop materials and clean up event details) and reorganize the current website to be more interactive.

Google Analytics provides information about the use of the website, below is a summary of statistics from January 1, 2018 to December 31, 2018 for web traffic within the United States only:

- 44 visits from across the US and 30 of these visits originated in Vermont. The number of Vermont visits is equal to the number of visit from 2016.
- There were 68/47 page views (US/VT).
- 100% of VT visitors were new visitors to the website and spent an average duration of 0:55 (min:sec) on the site.
- 37% of the VT sessions were viewing multiple pages on the website per visit however the majority of visitors are only viewing one page.
- The majority of the page views were for pages about the program itself such as “About Us”, “Contact Us” and “Disclaimer”.

Informational Brochures – Task 1-5a,b

In 2018, the focus was to continue to bring awareness to the Franklin County Stormwater Collaborative brand. The Collaborative utilized existing printed promotional brochures that provide basic information on stormwater pollution and directs the person to the website for more information. NRPC created two promotional flyers that provided detail on the two workshops provided in 2018.

New brochures were developed for use at tabling events with partner organizations, for social media use, and electronic distribution (see Appendix 1). In 2018, a total of 50 brochures were distributed at local events including the “Take a Stake in Our Lake” event hosted by the St. Albans Area Watershed Association; brochures were also available to the public from the municipal offices of the City of St. Albans and the Town of St. Albans.

NRPC also developed two technical resources to aid the implementation of stormwater practices by homeowners. These resources will be made available online in 2019 with planned website updates.

1. Technical resource sheet that identifies potential contractors for stormwater best management practice design and implementation.
2. Guide to plant availability from local suppliers for rain gardens and shoreline stability projects in Northwestern VT (see Appendix 1 for excerpt).

Media and Marketing – Task 1-5c

The Collaborative aimed to engage local news media in events with press releases throughout the year as well as utilize the available resources for sharing information with the communities such as Front Porch Forum, Facebook and municipal websites. The following have been ways the Collaborative has gotten the word out:

- NRPC provided announcements of events or other messaging with City/Town staff to share on Facebook or Front Porch Forum.
- NRPC worked with the City to create message boards/lawn signs for the Vermont Maple Festival that promoted the stormwater retention features in Taylor Park and directed folks to the Collaborative's website.
- NRPC developed a 12-month outreach messaging plan to share on social media - starting in 2019.
- NRPC attended partner events to promote Franklin County Stormwater
    - Franklin County Conservation District's annual tree sale,
    - Friends of Northern Lake Champlain annual Tyler Place event, and
    - St. Albans Area Watershed Association's "Take a Stake in Our Lake" event.
- NRPC shared messaging with partners for posting on social media. It was discussed that NRPC will launch a Franklin County Stormwater Collaborative Facebook page in 2019 to have a presence in social media and a way for the messaging to be shared more readily by partners.
- FrontPorchForum Posts – NRPC posted 6 stormwater related announcements on FPF in 2018.
- Media buys were purchased in June and again in November/December 2018 that raised awareness of FCS and promoted the 2018 workshops on driveways and intentional gardening.
- There was once article in the St. Albans Messenger directly tied to stormwater in St. Albans and related to stormwater with the adoption of stormwater ordinance and utility (April 2018). The Messenger has a circulation of approximately 5,500 people.



Education of Teachers and Students – Task 1-5d

In 2018 the Collaborative contributed to the training of teachers as well as provided programing to area students.

- Teacher Training - In October of 2018 NRPC staff and Chip Sawyer from the City, assisted the Lake Champlain Basin Program with their "Watershed for Every Classroom" Educator Training. This year-long professional development program for educators in the Lake Champlain Basin (Vermont, New York and Québec) offers teachers inspiration, knowledge and skills to frame exciting place-based curriculum. The October session was focused in St. Albans to look at agricultural and water quality issues in the Bay area.

- Student Curriculum - In January of 2018 FNLC and NRPC partnered with the St. Albans Museum to develop an educational program for the Maple Run Unified School District and Georgia Elementary School. FNLC assembled a listing of potential water quality faculty and curriculum and St. Albans Museum brought history faculty, administrative, and financial resources (busing costs) to the project. The following is a summary of the programing provided to students in 2018.

In September 2018, over 500 third and fourth grade students and accompanying faculty and parent chaperons from St. Albans City and Town, and Georgia Elementary Schools participated in a half day pilot workshop which presented lessons on Lake Champlain and St. Albans Bay heritage and water quality improvement. These lessons have met with enthusiastic support from respective faculty and school administrators, so our non-profit organizations are encouraged to develop new curriculum for more advanced grades in the future.

Our program included five learning stations that are listed below with the faculty and organizations that served each station. Small groups of 12-18 students broke out to each station for about twenty minutes and congregated for a summary session at the conclusion of the morning.

Learning Stations:

1. **Lake Champlain History** was presented by Alex Lehning, St. Albans Museum Executive Director. Students formed into groups of three with a faculty member and a history note book to come up with answers about the historical transportation and community functions of St. Albans Bay.
2. **Creative Expression** was presented by Don McFeeters, St. Albans Museum Chair. Students created drawings of their impressions of the beach which are now on display at the St. Albans Museum.
3. **Soil Health** was demonstrated by Lindsey Wright, MRBA on the rainfall simulator table. Students were shown four types of soil (compacted ATV trail, cattle pasture, residential lawn, and forest), then they were asked to predict the amount and turbidity of runoff from a one-inch rainfall and discussed results of the demonstration and learned the value of building organic matter in soils.
4. **Watershed Runoff Table** was presented by LCBP Sea Grant to demonstrate runoff from a variety of pollutants (lawn fertilizer, road salt, cattle manure, etc.) from a variety of land uses (roads, lawns, farm fields) to their eventual endpoint (the Lake).
5. **Water Quality and Soil Conservation** practices on Vermont agricultural fields and farms were demonstrated and described by the state Agriculture Agency.

While the students participated in a wrap up exercise activity, faculty members were assembled for final feedback on the day and were unanimously supportive and requested to repeat the program on an annual basis. The local faculty members were especially appreciative that they were not handed a lesson plan that they would have to learn and teach from and that our program provided faculty members to lead each demonstration station.

This program is anticipated to continue in 2019.

The minimum requirements to be completed on MCM 2 regarding Public Involvement and Participation are provided in Table 2 below

Table 2. MCM 2 – Public Involvement and Participation activities and goals.

MCM #	Activity	Measurable Goal(s)	Status
2-1	Participate in RSEP	Maintain RSEP membership and activities	✓
2-2	Institute a public workshop series on stormwater awareness	Number of programs offered and participants at workshops	✓ 2 workshops ✓ 15 participants at St. Albans location and 47 participants overall
2-3	Institute a storm drain stenciling project	Number of storm drains stenciled or markers in place	*See Municipal reports*
2-4	Sponsor periodic community stream corridor "clean-up" days	Number of participants and nature of material removed	2 events April Stools Day's stats: ✓ 8 volunteers ✓ 20 piles of pet waste ✓ 20 lbs of trash

Workshops – NRPC is conducting two workshops in 2018 on stormwater best management practices for driveways (June & December 2018) and using native vegetation for water quality and attracting pollinators (December 2018). These workshops were offered twice, once in St. Albans and a second time in Enosburgh.

Storm drain stenciling – The Collaborative provides support to the City and Town in storm drain stenciling (mapping, volunteer recruitment if interest in engaging non-municipal staff in stenciling) and providing outreach messaging to bring awareness to the connection between the storm drain and the direct inputs to area waterways. Currently the municipalities are responsible for conducting stenciling activities of the storm drains and will report on the status of activities in their permit report.

Clean Up Events the Collaborative Lead or Participated in:

- April Stools Day event was held in Taylor Park on April 23rd, the Monday before Maple Fest in St. Albans. The Collaborative partnered with the Rotary for volunteer participation. Eight volunteers picked up 20 piles or poop and 20 pounds of trash.
- May Green Up Day event at St. Albans Bay Park on May 5th. FNLC partnered with the Boy Scouts and assisted with the cleanup but also educated volunteers present about the stormwater connection to the lake. We do not have a report of the number of volunteers or material removed from this event.

Other Efforts

- NRPC has received two grants that leverage the RSEP funding as match in order to further the RSEP's efforts and expand capacity.
    1. NRPC was awarded funding from EPA to develop 2 workshops for homeowners as mentioned above. The majority of NRPC's time to develop and hold workshops was covered by the grant and RSEP funds were used to match the cost of hiring consultants to develop presentations and additional resource material such as design case studies.
        - Stormwater BMP practices for driveways (offered June 2018 in St. Albans)
        - Intentional Gardening Using Native Vegetation (offered December 2018 in St. Albans)
    2. NRPC was awarded funding from the Lake Champlain Basin Program to convert NRPC's stormwater 101 workshop into a video series. This will provide this workshop material to a wider audience, accessible online. This project will continue into 2019.
- Partnered with Lake Champlain Sea Grant to create the St. Albans Green Infrastructure Bike Tour, this tour identified a series of practices along a bike route that can be visited to learn about different practices on the ground.

The following are examples of the range of promotional materials and advertising created for the 2018 Workshops. Brochures, posters, and flyers were displayed and distributed at a series of events in 2018.

TOP: Flyer used at tabling event.

LEFT: Messaging used in NRPC E-newsletter and shared with partners for distribution.

LEFT: Poster on display at local events.

TOP: Digital ad run by The Messenger.

LEFT: Print ad run by The Messenger.

Excerpts from plant availability guide.

Guide to Plant Availability in Northern Vermont

This resource indicates nurseries in and around Franklin and Grand Isle County that have plants available for use in rain gardens or other nature-based stor shoreline stability projects. This plant list was mainly deri *Manual* (2009) and *The Shoreline Stabilization Handbook*

The accompanying plant list is not all-inclusive as plant av Use this resource to plan where to buy specific plants nee with plant selection or combinations, contacting a nursery reviewing the resources below that provide information or as suggested planting plans:

- Vermont Rain Garden Manual (www.uvm.edu/seagrant/sites/default/files/uploads/publicat
- The Federation of Vermont Lakes & Ponds' publicatio Lakeshore Landscaping (https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewis

Native Plant Pri

Within the plant list, the column labeled "VT Native" den area or not. When a plant is native, it means that the plants developed, occurred naturally, or have existed for many y because they provide many benefits. They generally need water to thrive since they are adapted to the habitat and so

Please visit the websites below for more information on n

- https://vtfishandwildlife.com/conserve/conservatio
- http://vermontlakes.org/lakescaping-2/six-native-p
- https://vtinvasives.org/news-events/news/choose-n

Local Nursery List

If you do not see your local nursery on the list they may still have plants that are adequate for rain gardens, call ahead and ask them. If you would like to add a nursery to this resource please contact Amanda at aholland@nrpcvt.com.

Nurseries	Perennials	Grasses	Ferns	Trees/Shrubs
H&B Greenhouse and Nursery	X			X
The River Berry	X	X		X
Arcana	X	X	X	X
Full Circle Garden	X	X	X	
The Farm Between				X
Vermont Willow Nursery				X
Intervale				X
Northeast Pollinator Plants	X	X		

H&B Greenhouse and Nursery
Address: 1213 Highgate Rd, Highgate Center, VT 05459
Phone: 802-868-3604
Website: www.hbgreenhouse.com
This nursery provides native and non-native perennials, shrubs, and trees suitable for shoreline and stormwater projects however, plant lists were not available for trees and

Rain Garden and Shoreline Stability Plant List

Blue is for Rain Garden
Yellow is for Shoreline Stability
Green is both

Boxes marked with an "x" means it is available
Boxes marked with an "ssp." means there is a similar plant or that it isn't specified in the catalogs

Latin Name	Common Name	VT Native	Northeast	Fairfax	Full Circle	Arcana	River Berry Farm	H&B	The Farm Between	Intervale
FERN										
Adiantum pedatum	Northern Maidenhair Fern	x			x					
Asplenium Platyneuron	Ebony Spleenwort	x			ssp.					
Asplenium trichomanes	Maidenhair Spleenwort	x			ssp.					
Athyrium filix-femina	Lady Fern	x		x	x					
Dennstaedtia punctilobula	Hay-scented Fern	x			x					
Dryopteris filix-mas x marginalis	Vermont Wood Fern	x			x					
Dryopteris goldiana	Goldie's Wood Fern	x			ssp.	x				
Dryopteris intermedia	Evergreen Wood Fern	x			ssp.					
Matteuccia struthiopetris	Ostrich Fern	x		x	x	x				
Onoclea sensibilis	Sensitive Fern	x			x					
Osmunda cinnamomea	Cinnamon Fern	x		x	x	x				
Osmunda claytoniana	Interrupted Fern	x				x				
Osmunda regalis	Royal Fern	x			x					
Parthenocissus quinquefolia	Virginia Creeper	x								
Polystichum acrostichoides	Christmas Fern	x		x	x					

LEFT: "Lawn sign" for stormwater planters along Main Street in St. Albans City.

2018 REPORT – CITY OF ST ALBANS – ILLICIT DISCHARGE DETECTION AND ELIMINATION STUDY

ST ALBANS, VERMONT

Progress Report

Prepared for:
City of St Albans, VT
Chip Sawyer
Director of Planning & Development
P: 802-524-1500 *259
c.sawyer@stalbansvt.com

Prepared by:
Watershed Consulting Associates, LLC
208 Flynn Avenue, Suite 2H | P.O. Box 4413
Burlington, VT 05406
P: 802.497.2367 *4
dana@watershedca.com

WATERSHED CONSULTING

TABLE OF CONTENTS

LIST OF TABLES ii
1 INTRODUCTION 1
2 METHODS 5
2.1 Field Work Preparation 5
2.2 Outfall Reconnaissance Inventory – Dry Weather Survey 5
2.3 Water Quality Analysis Methods 6
2.4 Advanced Investigation Methods 7
2.4.1 Televising Sanitary and Stormlines: 9
2.4.2 Smoke Testing with Vermont Rural Water Association: 9
2.4.3 Environmental Canine Services (ECS) Alerts: 9
3 RESULTS 10
3.1 Drainage Systems – Resolved 10
3.1.1 Outfall 24 10
3.1.2 Outfall 26 10
3.1.3 Outfall 27 10
3.1.4 Outfall 34 10
3.1.5 Outfall 43A 11
3.1.1 Outfall 11 11
3.1.1 Trunkline 11
3.1.1 Outfall 40 11
3.1.1 Outfall 26.2 11
3.1.1 Outfall 39 / 39.1 12
3.2 Drainage Systems – Unresolved (or Requiring Further Investigation) 12
3.2.1 Outfall 37 12
3.2.2 Outfall 16 15
3.2.1 Outfall 15 15
3.2.1 Outfall 38 16
3.2.1 Outfall 29/29.1 16
3.2.1 Outfall 14 16
3.2.1 Outfall 46 16
4 RECOMMENDATIONS FOR FUTURE ACTION 17
4.1 Outfall 37 – Future Action Recommendations: 17
4.2 Outfall 16 – Future Action Recommendations: 17
4.3 Outfall 15 – Future Action Recommendations: 17
4.4 Outfall 38 – Future Action Recommendations: 17
4.5 Outfall 29/29.1 – Future Action Recommendations: 17
4.6 Outfall 14 – Future Action Recommendations: 17
4.7 Outfall 46 – Future Action Recommendations: 17
5 CONCLUSIONS 18
6 REFERENCES 19

LIST OF TABLES

Table 1: Summary of Assessments by Outfall..... 4
Table 2: Water quality threshold values for determining possibility and nature of illicit discharges. 8

APPENDICES

St Albans 2018 IDDE – Advanced Investigation Maps

PREVIOUS REPORTS

City and Town of St. Albans Illicit Discharge Detection and Elimination(IDDE) Study Final Report, *Watershed Consulting Associates, LLC (2012)*

Missisquoi River Basin Advanced Illicit Discharge Detection and Elimination (IDDE) Study FINAL REPORT , *Aldrich + Elliott, PC & Stone Environmental (2014)*

1 INTRODUCTION

In Fall, 2018, Watershed Consulting Associates, LLC was awarded a contract with the City of St Albans to conduct Illicit Discharge Detection and Elimination (IDDE) work on a selection outfalls. This work involved initially reviewing the results of studies performed in 2007 (VT DEC), 2012 (Watershed Consulting, with Center for Watershed Protection working on a grant awarded by VT DEC) and 2014 (Aldrich + Elliott, PC, with Stone Environmental working on a grant awarded by VT DEC).

In 2007, limited optical brightener testing was conducted on 30 outfalls by Karen Bates of VT DEC and Jeff Rouleau, Bellows Free Academy using unbleached cotton pads left at the outfalls for a period of several days. Five (5) outfalls tested positive for optical brightener. No further investigation was performed as part of this study in 2007.

In 2012, a more comprehensive study was performed in the City of St Albans on 65 outfalls, 17 of which were suspected for some form of illicit discharge initially. 10 of these were more thoroughly investigated. 7 of these were not investigated further during the course of the 2012 study.

The 10 that were investigated in 2012 are:

1. Outfall 24 – Maple Pro Plant, Lemnah Drive
2. Outfall 26 – Blooming Minds Daycare, Lemnah Drive
3. Outfall 27 – Lower Welden Street
4. Outfall 34 – La Salle Street
5. Outfall 37 – Pearl Street
6. Outfall 43A – Rewes Street (across from St Albans Messenger)
7. Outfall 16 – Upper Welden Street / Main Street
8. Outfall 15 - Upper Welden Street / Main Street
9. Outfall 11 – Barlow Street
10. Trunkline (old sanitary sewer trunkline being used for stormwater conveyance)

The 7 outfalls that were not investigated in 2012 are:

1. Outfall 38 – Aldis Street
2. Outfall 29 / 29.1 – Lower Welden Street (Homeland Security Building)
3. Outfall 40 – North Elm Street (Four Winds Apartments)
4. Outfall 26.2 – Not Found
5. Outfall 39 / 39.2 – City of St Albans Public Works Garage Yard

In 2014 Aldrich + Elliott, PC, in partnership with Stone Environmental, conducted additional investigation on the 10 outfalls that were more thoroughly investigated in 2012 by Watershed Consulting. They found the following:

- Outfall 24: The team found high ammonia values in the system and discussed the issue with the owner of the Maple Pro Plant, but discussions were inconclusive. The study recommends cleaning the catch basins. No illicit discharge was either confirmed or denied.
- Outfall 26: Dye testing was conducted from the Blooming Minds Daycare facility but was inconclusive, as was televising the pipe network. The study recommends catch basin cleaning to alleviate the high ammonia seen at the site. No illicit discharge was either confirmed or denied.
- Outfall 27: The study found that this issue was due to a combined sewer manhole backing up on to the street and flowing into the separate storm sewer during rain events. The recommended

solution was to more adequately manage stormwater in the combined sewer system to alleviate flows. This work has begun. This constitutes a confirmed illicit discharge and the design and implementation of stormwater Best Management Practices (BMPs) constitutes a management plan to deal with it.

- Outfall 34: The study conducted dye testing from sanitary to storm sewers but did not see any dye crossover. The study also conducted televising of the storm line between two suspect manholes, but did not see any suspect pipe entering the storm line. There was mention of a pipe from the Holy Angel Rectory that needed to be found. No illicit discharge was confirmed or denied during this study.
- Outfall 37: Additional water quality bracket sampling was conducted at this outfall. The study concluded that the issue might be located near the intersection of North Elm Street and Pearl Street. Additionally, the stormwater line is regularly backwatered by Stevens Brook, which was thought to cause the high bacteria levels seen in the system.
- Outfall 43A: The study found slightly elevated *E. coli* of 108 MPN and conducted televising of the stormwater line which was inconclusive. No illicit discharge was confirmed or denied at this outfall.
- Outfall 16: Extensive water quality bracket sampling was conducted and a sanitary sewer crosstie into the stormwater sewer was found at North Main and Hudson Streets. The study recommended disconnection and the City planned on doing this work.
- Outfall 15: Based on the conclusion from the 2012 study that results were due to contaminated groundwater or runoff from upstream agricultural fields, no follow up was conducted.
- Outfall 11: As televising was conducted in 2012 as part of the previous study and nothing conclusive was found, no additional work was done on this outfall in 2014.
- Trunkline: Extensive televising of this system was conducted in 2014 using Hartigan's Septic Service. Of the areas that could be televised (some buried structures were hit that prevented televising), no obvious pipe connections were found. Numerous fractures were seen in this line. The study concluded that flow observed in the line is likely from groundwater intrusion to the line through pipe fractures or joints. The study also recommends that structure TL-7, which is adjacent to a former Central Vermont Power Systems cooling station and diesel depot, be referred to VT DEC's Site Management Division for investigation for acetone and naphthalene.

No other outfalls were investigated as part of the 2014 study.

Prior to commencing work in 2018, Watershed Consulting met with City of St Albans staff to discuss results from the previous studies and plan a course of action. The following strategies for follow up investigation were decided upon based on the previous studies conclusions, the City's priorities, and follow-up work that had already been conducted:

- Outfall 24: Based on inconclusive water quality testing in the past, coupled with the concern that the issue could possibly be due to illegal dumping or spills in the Maple Pro Plant yard, it was decided that smoke testing using liquid smoke would provide the most conclusive results.
- Outfall 26: Similar to Outfall 24, based on inconclusive water quality testing, dye testing, and televising in the past, it was decided that smoke testing would provide the best results.
- Outfall 27: This issue is known to be due to a combined sewer overflow entering the storm system via an open catch basin. As this is considered a confirmed illicit discharge, and given that the City of St Albans is actively pursuing stormwater management within the combined system to alleviate this issue, no further work was conducted as part of this study.
- Outfall 34: As dye testing and televising in 2014 was somewhat inconclusive, it was decided that smoke testing of the entire network would be the best way of finding any potential illicit discharges.

- Outfall 37: The 2014 report recommends conducting some additional water quality bracketing to further hone in on the potential issue. This work was conducted in 2018. Additionally, it was decided that smoke testing of this system could prove beneficial.
- Outfall 43A: Televising of the suspect line in 2014 did not find any obvious connections and the outfall and system were often dry, preventing water quality sampling. Based on this, it was decided that smoke testing would be the most efficient follow up method.
- Outfall 16: The 2014 study found a confirmed illicit discharge via the sanitary sewer crosstie into the stormwater system. The City had plans to disconnect this crosstie.
- Outfall 15: The 2012 report concluded that results seen at this outfall could potentially be due to farm field runoff. As a result, no follow-up was conducted in 2014. Based on these results, Watershed Consulting and the City of St Albans made this system a lower priority for investigation using Environmental Canine Services (ECS) Ship and Sniff testing (see Methods for explanation of this investigation technique).
- Outfall 11: No follow up was deemed warranted based on the conclusions of the two previous studies.
- Trunkline: No follow up was deemed warranted based on the conclusions of the two previous studies.
- Outfall 38: No work was performed in 2012 or 2014. Additional bracket sampling was performed on this outfall. Smoke testing was planned as time and conditions allow.
- Outfall 29 / 29.1: These two outfalls at the Homeland Security building would best be investigated using additional water quality testing, dye testing, or televising of the pipes. Smoke testing was deemed inadvisable due to the nature of the site. While these testing methods would be relatively easy to pursue, access might be an issue given that it is a Federal facility with possible security concerns. The City of St Albans planned on conducting outreach to determine the most feasible course of action. Watershed Consulting did not plan on conducting any additional work in 2018.
- Outfall 40: The system associated with this outfall is relatively small and residential. As a result it was decided that smoke testing would be the most efficient follow up method.
- Outfall 39 / 39.1: Water quality results from 2012 indicated that the source of contamination may be a result of deicing salts accumulating on the public works yard and running off to the outfall as well as possible washwater contamination from the yard. The City decided that the best course of action as a follow up would be to review the operational procedures for deicing material storage and handling to promote exclusion of these materials from runoff. The City also planned on reviewing vehicle washing procedures to ensure that no washwater could run off to the stormwater system in the yard. No additional investigation was conducted in 2018, nor is any planned as this is deemed to be an operational issue.
- Outfall 14: The only result at this outfall was from the 2007 optical brightener study which suspected a washwater source of illicit discharge to this outfall. It was decided that additional water quality bracketing needed to be conducted on this system. In 2018 sampling was conducted on the outfall only. Work is expected to resume in 2019. Of note regarding this outfall – there is potentially an old stone block sewer on Lincoln Avenue that may be allowing sanitary sewage to enter the stormwater system. The City has conducted some work on this issue in the past but may not have resolve the issue fully.
- Outfall 46: It was decided that water quality sampling at this outfall would be the best way to proceed. However, obtaining a sample from the outfall was infeasible in 2018 given that that outfall pipe was partially buried in sediment and backwatered by Stevens Brook. Upstream sampling was not possible due to a lack of flow. As a result, smoke testing would be the best follow-up strategy. This work was not conducted in 2018 due to early onset of wintry conditions.

Table 1: Summary of Assessments by Outfall

Outfall	Location	Summary
Outfall 24	Maple Pro Plant, Lemnah Drive	Resolved - Smoke Testing Indicates No Chronic or Direct Illicit Discharge
Outfall 26	Blooming Minds Daycare, Lemnah Drive	Resolved - Smoke Testing Indicates No Chronic or Direct Illicit Discharge
Outfall 27	Lower Welden Street	Resolved - Combined Sewer Overflow Being Managed Through Stormwater BMPs
Outfall 34	La Salle Street	Resolved - Smoke Testing Indicates No Chronic or Direct Illicit Discharge
Outfall 43A	Rewes Street	Resolved - Smoke Testing Indicates No Chronic or Direct Illicit Discharge
Outfall 11	Barlow Street	Resolved - 10' Pipe Doesn't Warrant Further Investigation
Trunkline	Below Lower Welden Street	Resolved - Refer Issues to DEC Site Management Division
Outfall 40	North Elm Street	Resolved - Smoke Testing Indicates No Chronic or Direct Illicit Discharge
Outfall 26.2	Not Found	Not Found - Neither City Nor Previous Consultants Know Where This Outfall Is
Outfall 39 / 39.2	Public Works Garage	Resolved - City to Review Deicing Material / Washwater Exclusion Practices
Outfall 37	Pearl Street	Not Resolved - One Possible Illicit Discharge Found Through Partial System Smoke Testing
Outfall 16	Upper Welden Street / Main Street	No Study Conducted in 2018
Outfall 15	Upper Welden Street / Main Street	No Study Conducted in 2018
Outfall 38	Aldis Street	Not Resolved - Water Quality Sampling at Outfall Conducted - Indicates Possible Illicit Discharge
Outfall 29 / 29.1	Lower Welden Street	No Study Conducted in 2018
Outfall 14	Lincoln Avenue	Not Resolved - Water Quality Sampling at Outfall Conducted - Indicates Possible Illicit Discharge
Outfall 46	Lake Street	Not Resolved - Preliminary Study in 2018 Only

2 METHODS

Our general methodology for this study follows the protocols and recommendations established by the Center for Watershed Protection (CWP), as well as additional guidelines developed over the course of several other studies by the State of Vermont.

2.1 Field Work Preparation

Initial preparation for the study involved obtaining the necessary field supplies for sample collection and analysis, creating a digital smartphone-based application for ORI and AI data collection in the field based on the Center for Watershed Protection's (CWP) ORI field and laboratory forms, and creating storm and sanitary sewer digital base layers to use within the smartphone app based on the most recent mapping performed by the VT DEC under the Stormwater Infrastructure Mapping Program.

A kick-off meeting was held with the City of St Albans to discuss methodology, access, and data generation.

2.2 Outfall Reconnaissance Inventory – Dry Weather Survey

Note – the methods described for the Outfall Reconnaissance Inventory only apply to systems where additional water quality bracket sampling was performed.

Stormwater systems were assessed during dry weather to minimize dilution by large volumes of runoff. Dry weather was defined as <0.1" precipitation in the previous 24 hours to the maximum extent practicable. There were times during the study when outfalls were assessed when precipitation had marginally exceeded this amount – this was noted on the Outfall Reconnaissance Inventory reports. Surveys during these times were kept to a bare minimum and avoided whenever possible. Outfalls in the public right of way or along a water body were accessed via public land. Where portions of the stormwater system were on private land, permission was obtained prior to investigating the system. If access to property was denied, infrastructure within the public right of way was assessed. Where no publicly accessible infrastructure existed, access denial was noted and the system was not analyzed.

Watershed developed a digital smartphone-based application to use for the collection, storage, analysis, and reporting of survey data. This application, developed using a third-party software platform, is based on the CWP field and laboratory forms merged into one overall interface and accessed in the field using a smartphone or tablet device. An integral part of the creation of this application was the import of all stormwater and sanitary sewer infrastructure points from Vermont DEC's stormwater infrastructure mapping program. Each of these features was imported into Watershed's app using a code assigned by previous studies. This enabled field staff to quickly find each outfall or other infrastructure point using the phone's built-in GPS. Using these previously-mapped points also ensured the accuracy of each point's geo-location as built-in phone GPS units are only accurate to 3-5 meters where most of the data is sub-meter accurate.

At every outfall point, the basic procedure was to search for the presence or absence of flow. If there was no flow during dry weather, it was generally assumed that there was no chronic illicit discharge present unless other non-flow-based indicators such as outfall damage, deposits or stains, abnormal vegetation, poor pool quality, or pipe benthic growth were noted. If none of these indicators was present, basic time/date information was entered into the application, along with a 'No' indicator for flow and non-flow based indicators and the outfall was assigned an overall characterization of 'Unlikely'.

If flow was present, immediate analysis for temperature, pH, specific conductance, and ammonia was conducted in the field. Other indicators, such as color, odor, turbidity, and floatables were noted as well. If any indicators were above established thresholds (see Table 2), a further sample was taken for analysis later that day for total chlorine (if applicable depending on municipality and methylene blue active substances (MBAS, a detergent indicator).

In cases where other non-flow based indicators (listed above) were present, or a sample was not otherwise able to be obtained from a flow or pool, a cotton pad was placed in the line of assumed flow to capture intermittent discharges and analyze them for the presence of optical brighteners. Watershed used this technique sparingly, as most outfalls, or other infrastructure, had adequate flow or a pool to sample from and the water could be analyzed for MBAS.

Additionally, Watershed noted any non-IDDE issues at the outfall or structure such as erosion, structure damage, headwall collapses, etc.

2.3 Water Quality Analysis Methods

Temperature/pH/Specific Conductance:
The Hannah Instruments HI98129 Combo pH and EC meter was used for all three parameters. Fresh pH and conductivity buffers were ordered at the beginning of the study from Endyne Labs in Williston, VT to ensure accuracy using standard solutions at known specific conductivity ranges.

Ammonia:
Ammonia was measured immediately in the field using the LaMotte Colorimeter 1200 (Model 3680-01). This unit uses Nessler's reagent for the detection of ammonia using a color reaction that is then measured by the colorimeter. The range is 0-5ppm/0.05ppm NH_3-N. Fresh reagents were maintained throughout the course of the study.

Methylene Blue Active Substances (MBAS):
The presence of detergents was determined using the Chemetrics R-9400 Detergents test which used a methylene blue active substances (MBAS) test, a method consistent with APHA Standard Methods, 21st ed., Method 5540 C (2005).

Total Chlorine:
Total chlorine was measured using the Hach Model CN66 Chlorine – Free and Total Color Disk Kit with a 0-3.5 mg/L range. This kit uses a powdered DPD reagent method and visual color wheel to quickly and accurately determine total chlorine concentration in samples.

Optical Brighteners:
Where indicated Watershed used cotton pads placed either in the potential flow path of water at the outfall or in the sump of a catchbasin where flow was anticipated. These pads were allowed to sit for a period of 4-10 days encased in a plastic-coated wire mesh pouch. After this period, pads were retrieved, rinsed, and dried, then exposed to a UV (black) light. In the presence of detergents, the pad will fluoresce to varying degrees. Watershed did not attempt to make measurements of the relative amount of fluorescence – this test was only for presence or absence. However, fouling with other debris and dirt often made reading a result difficult. In most cases where there was generally reliable flow or pooled water in the catchbasin sump, the MBAS test was used. Some studies have indicated that it takes a relatively high concentration of optical brighteners to cause a pad to fluoresce under UV light (up to 50 mg/L), while the MBAS test is reliable ranging from 0 – 3 ppm. For this reason we tended to use it more frequently.

2.4 Advanced Investigation Methods

Using water quality thresholds established by the Center for Watershed Protection and used by the US EPA in their Illicit Discharge Detection and Elimination guidance, as well as thresholds referenced in other studies performed throughout Vermont on IDDE (Table 2), outfalls were designated for follow-up investigation based on exceedance of these thresholds. In addition to these chemical benchmarks, other criteria such as outfall damage, deposits or stains, abnormal vegetation, poor pool quality, or pipe benthic growth, as well as water color, odor, turbidity, or the presence of floatables were used to supplement assessments.

Follow-up investigation consists primarily of following any observed flow up a stormline to pin-point its source, then testing that source using the aforementioned thresholds. If multiple sources were observed coming into a main line, those sources were tested as well to attempt to bracket possible pollution inputs. Where possible, a section of a stormline was isolated as possibly containing the origin point of pollution.

Table 2: Water quality threshold values for determining possibility and nature of illicit discharges.

Test	Threshold (US EPA)	Theshold (VT Specific Studies)	Notes
E. coli (MPN/100ml)	235	400	Wastewater (undiluted) will have levels far exceeding 400 MPN. However E. coli can occur due to animal waste entering the storm system though open catch basins. Additionally, there is some evidence which indicates that E. coli populations can survive in anaerobic sediment conditions found in streams, ponds, or other similar environments. E. coli is a difficult indicator to use in IDDE for these reasons.
Ammonia (mg/L)	0.1	0.25	Ammonia is an indicator of decompostion of organic matter. Decomposing landscaping vegetation within catch basins under anoxic conditions can cause elevated ammonia in water. This can cause misleading results. The threshold of 0.25 mg/L is only used when other indicators are present. Othewise a value of 0.5 mg/L is the trigger for additional investigation.
MBAS (mg/L)	0.25	0.2	Anionic detergents are fairly commonly found at outfalls in low-flow conditions found during dry weather as they correlate with various outdoor washing practices (of cars, house siding, windows, and also windshield washing fluid). Higher levels (typically 0.5-0.75 mg/L or greater) can sometimes indicate wastewater discharges.
Optical Brightener	N/A	Presence	Presence of optical brighteners can indicate washwater or wastewater contaminants as brighteners are contained in some hair conditions, bleached paper products, and laundry detergents. Petroleum products will also cause fluorescence. Some studies indicate that a relatively high concentration of OB must be present for detection. We only use this test when other indicators are strongly present.
Chlorine (mg/L)	N/A	0.06	This test is used only in municipalities where municipal water is provided and chlorinated. This test was used very sparingly during this study as few of the towns chlorinated their water. As it degrades in the presence of organic materials, it's not a good wastewater indicator.
Specific Conductance (uS/cm)	>2000	600	Specific conductance can be elevated by road deicing materials, or metals from corrosion. It can help in determining some industrial discharges but is primarily used in conjunction with other strong indicators.

2.4.1 Televising Sanitary and Stormlines:

An additional method to positively identify illicit discharges is to use either a push or track camera, depending on pipe type and size, to obtain video of pipe cross connections, leaks, or other means by which non-stormwater discharges may be entering storm pipes. This method is most effective when combined with line flushing using dyed water. We did not use this method during this study. It was, however, used in the 2012 and 2014 studies as noted.

2.4.2 Smoke Testing with Vermont Rural Water Association:

Smoke testing using non-toxic liquid smoke was used during this study. The general procedure for smoke testing is a follows:

- Smoke is blown into a manhole or catch basin structure (storm) and the system is allowed to pressurize with smoke until all (or nearly all in the case of larger systems) are observed emitting smoke.
- Visual observations are made of surrounding sanitary infrastructure (manholes are opened adjacent to the storm infrastructure, building sewer gas vent stacks are scrutinized for smoke escaping, and at times buildings are entered, with permission, to check for smoke in basements or other areas). This is to check to see if there are any direct or semi-direct connections between sanitary and storm sewers.
- The reverse test is also always done where smoke is blown into sanitary sewer infrastructure and the storm system is inspected, via manholes and catch basins, for smoke intrusion. Watershed has found that this is one of the most efficient, reliable means of identifying possible illicit discharges, especially when infrastructure is poorly mapped or understood. Smoke testing from sanitary sewer infrastructure also has the benefit of discovering bad or faulty plumbing issues within residences (cracked sewer pipes or other issues that could allow sewer gas to enter homes).

2.4.3 Environmental Canine Services (ECS) Alerts:

Environmental Canine Services (ECS) uses specially trained canines to detect the presence or absence of sanitary sewage. Watershed has used this method before in Vermont with success. There are two primary methods to use with ECS. The first method is the 'ship and sniff' method where a sample is collected in a sterile plastic Whirl-Pak bag. The outside of the bag is rinsed in distilled water and double-bagged in a resealable plastic bag. These samples are then shipped to ECS in Maine where they are evaluated by the canines and their handlers. A report is prepared of the results. If a dog alerts on a sample, that outfall is then flagged for additional follow-up investigation. This method provides a good screening of outfalls that, based on previous water quality parameters, may have illicit discharges to them. The second method involves bring a canine and handler to a storm sewer system and doing on-site field investigations of structures. During the course of this study, field investigation was not used.

3 RESULTS

3.1 Drainage Systems – Resolved

What follows are summaries for drainage systems where the investigation established conclusively an illicit discharge, or other confirmed or plausible explanation for the water quality results seen at the outfall or at other infrastructure within the network. These are the systems that require no further work at this time and should only be checked on semi-annually (to ensure that no new non-stormwater discharges are present). Each outfall has an associated map on which work is described as well.

3.1.1 Outfall 24

The system leading to Outfall 24, located in the loading yard area of the Maple Pro Plant on Lemnah Drive was smoke tested using the procedure described in the Methods section. During smoke testing, no smoke was observed crossing from one system into the next. The building was entered and an inspection made for any smoke entering the building via floor drains or other orifices. No smoke was seen.

Based on the results of this testing, we do not believe there to be a direct or chronic illicit discharge at this system.

3.1.2 Outfall 26

The system leading to Outfall 26, located near the Blooming Minds Daycare center, was smoke tested using the procedure described in the Methods section. During smoke testing, no smoke was observed crossing from one system into the next. The building was entered and an inspection made for any smoke entering the building via floor drains or other orifices. No smoke was seen.

Based on the results of this testing, we do not believe there to be a direct or chronic illicit discharge at this system.

3.1.3 Outfall 27

No investigation of this system was conducted as part of field work in 2018 as the illicit discharge source is known and is being actively managed using stormwater Best Management Practices (BMPs).

3.1.4 Outfall 34

The system leading to Outfall 34, which runs along La Salle, Spruce, North Elm, South Elm, and Lake Streets, was extensively smoke tested using the procedure described in the Methods section. During smoke testing, no smoke was observed crossing from one system to the next. However, several issues were discovered. The locations of each of these issues and descriptions can be seen on the summary map for this outfall. The issues found include:

- Sewer gas leak near a washer/dryer in a house on La Salle
- Sewer gas leak from a cracked iron pipe in a house basement on La Salle
- Sewer gas leak from the corner of a house foundation on Spruce
- Sewer gas leak from an improperly capped sewer pipe in a house basement on North Elm

Additionally there was a broken stormwater manhole on La Salle street that could not be opened due to damage. There was also a stormwater manhole that was fully backwatered on La Salle. This may prevent complete draining of the stormwater system during storms and may cause localized flooding.

This system also contains the Holy Angel Rectory, from which a suspect illicit connection was though to exist. However no smoke was observed entering this building. It would seem that this suspected pipe either does not exist or has been capped.

Based on the results of this testing, we do not believe there to be a direct or chronic illicit discharge at this system.

3.1.5 Outfall 43A

The system leading to Outfall 43A, located near the St Albans Messenger office building, was smoke tested using the procedure described in the Methods section. During smoke testing, no smoke was observed crossing from one system into the next.

Based on the results of this testing, we do not believe there to be a direct or chronic illicit discharge at this system.

3.1.1 Outfall 11

No investigation of this outfall was performed in 2018. The 2012 study notes that this outfall is only connected to a 10' pipe and that televising didn't show anything. The 2014 study does not draw conclusions different from the 2012. No further study of this outfall is recommended.

3.1.1 Trunkline

No further investigation of this system was performed in 2018.

Extensive televising of this system was conducted in 2014 using Hartigan's Septic Service. Of the areas that could be televised (some buried structures were hit that prevented televising), no obvious pipe connections were found. Numerous fractures were seen in this line. The study concluded that flow observed in the line is likely from groundwater intrusion to the line through pipe fractures or joints. The study also recommends that structure TL-7, which is adjacent to a former Central Vermont Power Systems cooling station and diesel depot, be referred to VT DEC's Site Management Division for investigation for acetone and naphthalene.

Apart from the recommendations made above, we do not believe that further investigation of this system needs to be performed.

3.1.1 Outfall 40

The system leading to Outfall 40, located on North Elm Street and encompassing the Four Winds Apartment buildings, was smoke tested using the procedure described in the Methods section. During smoke testing, no smoke was observed crossing from one system into the next.

Based on the results of this testing, we do not believe there to be a direct or chronic illicit discharge at this system.

3.1.1 Outfall 26.2

The 2012 study notes that this outfall should be investigated further. However, the study does not note where this outfall is nor is there a map included. The 2014 study also did not investigate this outfall. Watershed Consulting checked its internal database of mapped outfalls for St. Albans City (as Watershed was the original mapping contractor). However, outfall identifications had not been assigned during original mapping. This outfall could not be located and therefore no investigation of this outfall occurred during the 2018 season.

3.1.1 Outfall 39 / 39.1

Previous study results indicated that these outfalls were potentially experience issues related to deicing chemical runoff and potential washwater runoff to the outfalls. As this site is the City of St. Albans Public Works Garage, the City is reviewing best practices for the site with the intent of further excluding these substances from the outfalls. No further investigation of these outfalls was conducted during the 2018 season and no further investigation is planned for this site.

3.2 Drainage Systems – Unresolved (or Requiring Further Investigation)

3.2.1 Outfall 37

The system leading to Outfall 37, located on Pearl, North Elm, Cedar, and Walnut Streets, was bracket testing to determine if water quality indicators could be used to determine the source of a potential illicit discharge. These results can be seen on the investigation summary map. Water quality samples at the outfall (the nearest adjacent manhole was sampled as the outfall itself was backwatered by Stevens Brook) revealed ammonia at 0.5mg/L, detergents (as MBAS) at 0.5ppm, and *E. coli* at 550 MPN. Further testing of the system of the system upstream of the outfall was also conducted. One of the of the most suspect results came from SWMH-40, a stormwater manhole at the intersection of Pearl and North Elm Streets from the 'North pipe' (the pipe running north up North Elm Street). Ammonia was very high at 1.94 mg/L, indicating the possible presence of large amounts of decaying organic matter.

During smoke testing, Watershed found smoke coming from a catch basin opposite 67 North Elm Street while blowing smoke into the sanitary sewer from a manhole on lower Pearl Street (noted on the summary map). Watershed then blew smoke from the sanitary manhole directly adjacent to the catch basin - smoke immediately came out of the catch basin rim from the lower pipe in the catch basin. Watershed then cleared the line of smoke and blew smoke into the stormwater sewer from a nearby catch basin. Smoke came in from the upper pipe in the catch basin. The catch basin opposite 67 North Elm Street is tied to both the sanitary and storm sewer. As the pipe to the storm sewer is considerably higher than the pipe to the sanitary sewer, it would require a surcharge from the sanitary sewer of between 5-5.5' to cause sewage to flow into the stormwater sewer. However, this potential discharge should be eliminated as soon as possible.

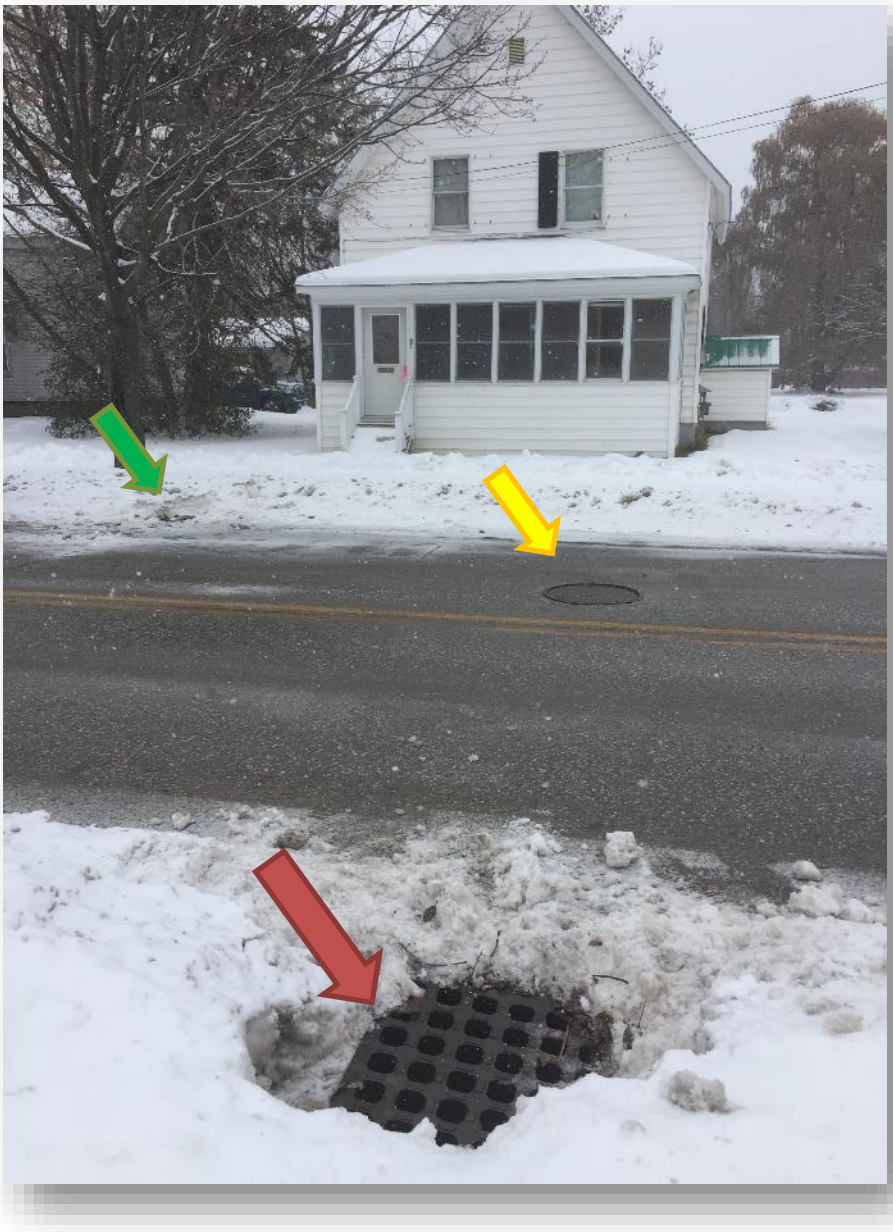


Figure 1: Picture taken facing 67 North Elm Street (white house in the background). The catch basin in the foreground (red arrow) is directly connected to both the storm and sanitary sewers. The lower pipe in the catch basin flows directly to the sanitary manhole (yellow arrow). The catch basin in the background (green arrow) is not connected to the sanitary system.

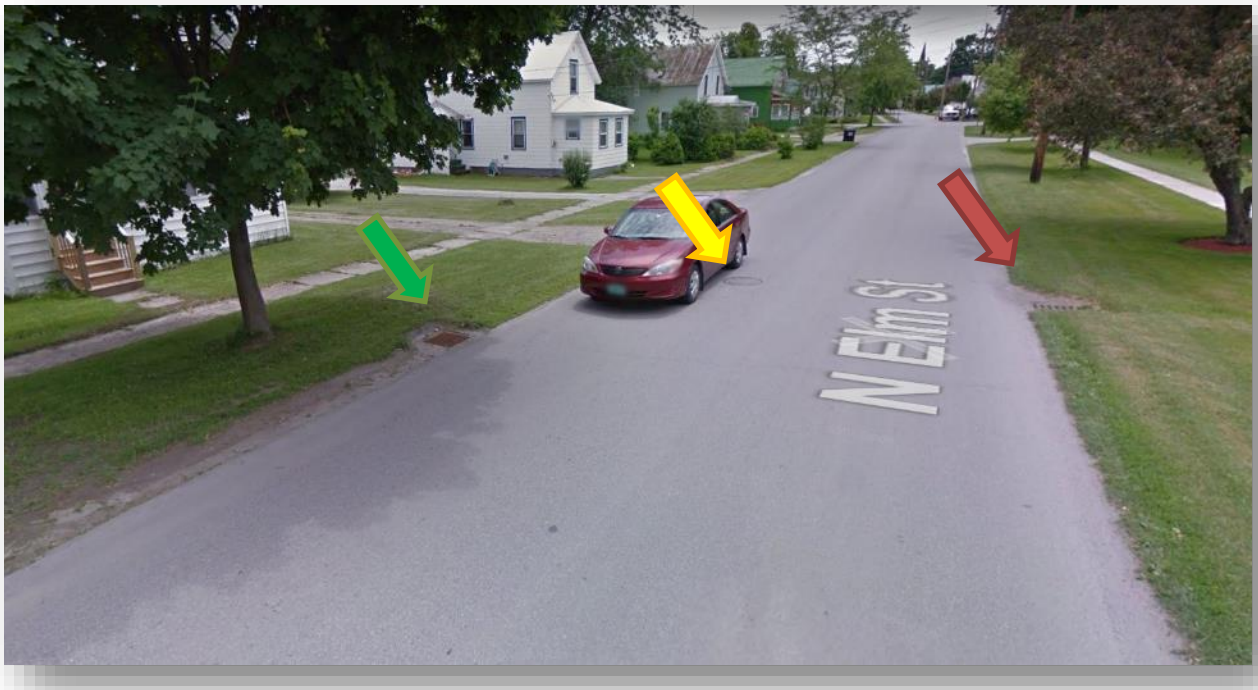


Figure 2: Image from Google StreetView. The red arrow indicates the catch basin connected to both the sanitary and storm sewers. The yellow arrow indicate the sanitary sewer manhole to which the catch basin is connected. The green arrow indicates the catch basin that is not connected to the sanitary sewer.

Figure 3: Picture of the catch basin connected to both the sanitary and storm sewers. The red arrow is pointing to the pipe that is directly connected to the sanitary sewer (lower pipe). The blue arrow points to the pipe that leads to the stormwater sewer. In runoff events most runoff would go into the sanitary sewer.

Smoke testing and additional investigation of the system was not conducted beyond the intersection of Pearl and North Elm Streets. Water quality indicators, other than the ECS alerts, don't indicate the strong potential of an illicit discharge above this intersection. However, because of the ECS alerts, additional investigation should be conducted using either smoke or in-field investigation using ECS canines.

We consider this outfall to be partially resolved.

3.2.2 Outfall 16

No investigation of this outfall was performed in 2018. The issue was studied in 2014 and found to be a sanitary sewer crosstie into the stormwater sewer at North Main and Hudson Streets. The City of St Albans was planning to disconnect this tie. No further study of this outfall should occur until this repair occurs as it could mask other potential illicit discharges to the stormwater system.

3.2.1 Outfall 15

No investigation of this outfall was performed in 2018. The issue was determined to potentially be due to groundwater flow contaminated with farm field runoff. In speaking with the City of St Albans, they noted that their sewer main runs underneath Stevens Brook (and in certain locations is actually in the Brook where the pipe has begun to emerge from the ground). For this reason, it may be worthwhile to investigate this area using ECS Ship and Sniff or using in-field investigation with ECS.

3.2.1 Outfall 38

Only initial outfall sampling was conducted at this outfall in 2018. While most water quality indicators were weak (ammonia was 0.25 mg/L, just at threshold for potential illicit discharge, detergent were 1.0 ppm which is somewhat elevated, and *E. coli* was 56 MPN, which is below threshold of 400 MPN), ECS canines alerted on a sample sent via the Ship and Sniff program. The alert may be due to some backwatering of the outfall by Stevens Brook, which may contain enough residual sanitary sewage, or other non-stormwater constituents, to trigger the dogs. However, we believe that this is enough to warrant further investigation using liquid smoke. The system is small and located in a relatively quiet area, traffic-wise.

3.2.1 Outfall 29/29.1

No investigation of this outfall was performed in 2018. The City of St Albans is still in the process of conducting outreach to the Department of Homeland Security for access to the site to conduct advanced investigation using either smoke, dye, or camera techniques. We would recommend that this system be investigated in 2019.

3.2.1 Outfall 14

Only initial outfall sampling was conducted at this outfall in 2018. Ammonia was above threshold at 0.73 mg/L and detergents were 1.0 ppm, while *E. coli* was above threshold at 2400 MPN. ECS canines did alert on this sample as well. The system that drains to this outfall is large and will require additional bracket sampling at key system intersection points. This work was not performed in 2018 due to the early onset of wintry conditions. However, this work may be able to be performed during the winter of 2019 or spring/summer of 2019. We would recommend that bracket sampling be conducted first prior to smoke testing as the system is large and could prove challenging to smoke test efficiently unless better target areas are first established. We would recommend that this system be further investigated in 2019.

3.2.1 Outfall 46

An initial screening of this outfall was conducted in 2018 during an attempt to sample flow from the outfall. However, the outfall is partially buried in sediment and is backwatered by Stevens Brook under the middle of a bridge on Lake Street. Additionally, no flow was seen in the upstream infrastructure. It was therefore decided that smoke testing would be the most efficient means to identify a potential illicit discharge. However, the early onset of wintry conditions prevented this work from occurring. We would recommend that this system be further investigated in 2019 using smoke testing as the primary technique.

4 RECOMMENDATIONS FOR FUTURE ACTION

4.1 Outfall 37 – Future Action Recommendations:

- The crosstie found near 67 North Elm Street should be fixed as soon as possible. Once fixed, this area should be smoke tested again and the rest of system investigated for other possible illicit discharges.

4.2 Outfall 16 – Future Action Recommendations:

- The crosstie found near Hudson and North Main Streets should investigated and repaired by the City of St Albans.
- Once this work is done, water quality testing should be conducted within the drainage area.
- If indicated, this work should be followed by smoke testing in targeted locations.

4.3 Outfall 15 – Future Action Recommendations:

- Smoke testing of this outfall should be conducted to determine if prior water quality results were due to an illicit connection or to groundwater flow contaminated with farm field runoff as previously thought.
- The reach of Stevens Brook near Outfall 15 should be investigated using Environmental Canine Services Field Team to determine if and where the sanitary sewer main may be leaking into the Brook directly.

4.4 Outfall 38 – Future Action Recommendations:

- Smoke testing of this outfall should be conducted to determine if there is an illicit discharge as possibly indicated by initial water quality testing results or if the results can be attributed to backwatering by Stevens Brook.

4.5 Outfall 29/29.1 – Future Action Recommendations:

- The City of St Albans should secure access to investigate these outfalls.
- If possible, smoke testing of these outfalls would be expedient and efficient.
- If not possible, dye testing or televising of the pipes could occur following water quality testing.

4.6 Outfall 14 – Future Action Recommendations:

- Additional water quality bracketing of this system should occur to further target investigation of the system.
- Following water quality testing smoke testing should occur if and where warranted to confirm the location of suspected illicit discharges.

4.7 Outfall 46 – Future Action Recommendations:

- Smoke testing of this outfall should be conducted to determine if there is an illicit discharge. Water quality sampling of this system proved infeasible.

5 CONCLUSIONS

Of the 17 systems investigated for non-stormwater discharges to the stormwater system:

- 1 system was found to have a confirmed non-stormwater (illicit) discharge to the stormwater system (Outfall 37).
- 10 systems were investigated and are considered Resolved with respect to potential illicit discharges (whether through management of confirmed illicit discharge or lack of an illicit discharge to the stormwater system).
- 6 systems have yet to be fully investigated for illicit discharge. These are noted in Section 4 – Recommendations for Future Action.

6 REFERENCES

Brinkmeyer R, Amon RMW, Schwarz JR, Saxton T, Roberts D, Harrison S, Ellis N, Fox J, DiGuardi K, Hochman M, Duan S, Stein R, Elliott C. Distribution and persistence of Escherichia coli and Enterococci in stream bed and bank sediments from two urban streams in Houston, TX. Science of the Total Environment 2015; 502:650-658.

Byappanahalli MN, Fowler M, Schively D, Whiteman R. Ubiquity and persistence of Escherichia coli within a midwestern stream. Appl Environ Microbiol 2003; 69: 4549–55.

Center for Watershed Protection and Pitt, Robert, Illicit Discharge Detection and Elimination: A Guidance for Program Development and Technical Assessments, October, 2004.

Center for Watershed Protection, Illicit Discharge Detection and Elimination Tracking Guide, December, 2011.

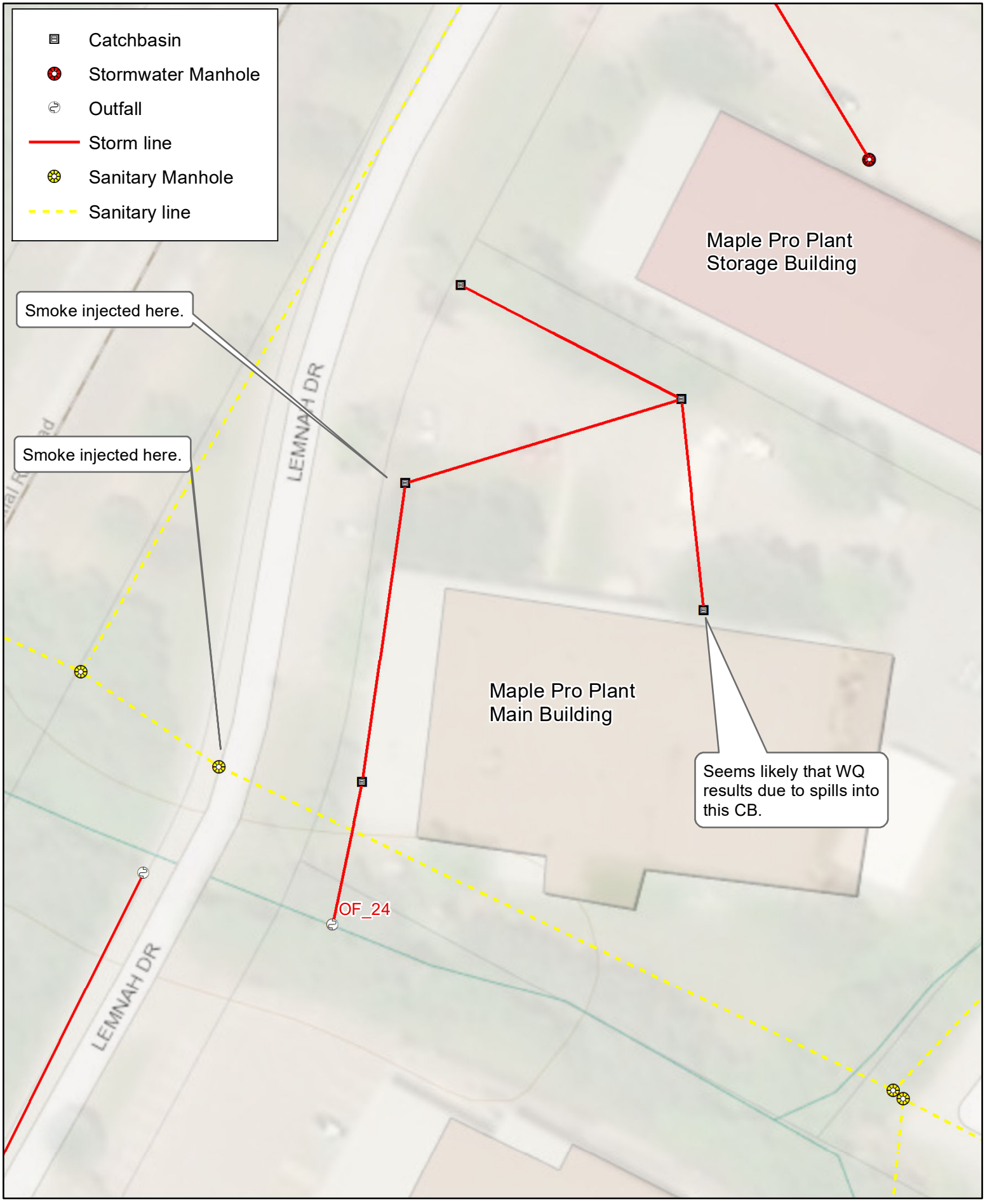
Hartel, P., Rodgers, K., Fisher, J., McDonald, J., Gentit, L., Otero, E., Rivera-Torres, Y., Bryant, T., Jones, S., Survival and regrowth of fecal enterococci in desiccated and rewetted sediments, Proceedings of the the 2005 Georgia Water Resources Conference, April, 2005.

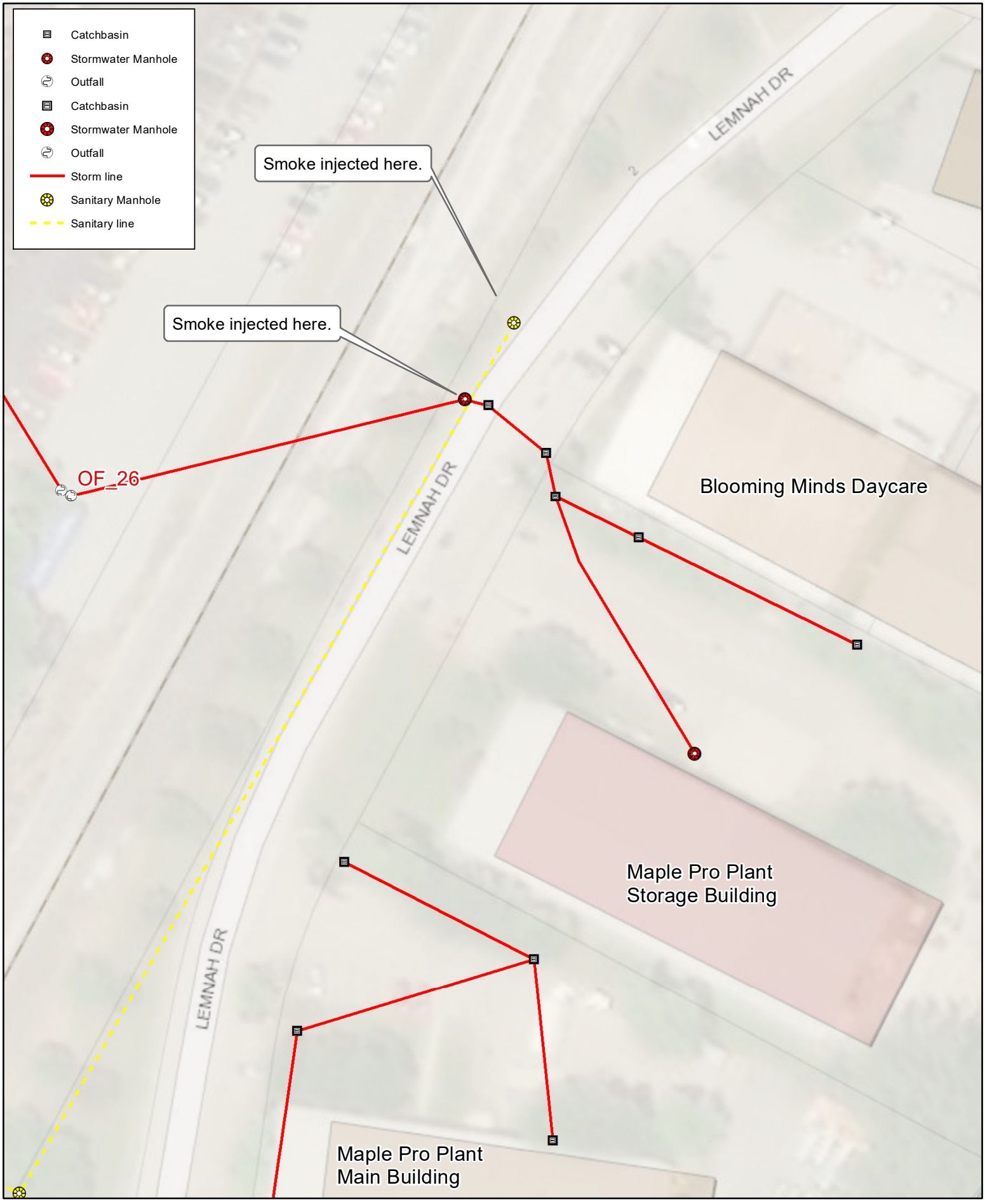
Rutland Natural Resources Conservation District and Stone Environmental, Inc., Detecting and Eliminating Illicit Discharges in Rutland County to Improve Water Quality – Final Report, March, 2014.

U.S. EPA, 2002, Onsite Wastewater Treatment Systems Manual, US Environmental Protection Agency, Office of Water, February, 2002, EPA/625/R-00/008.

Vermont Dept. of Environmental Conservation and Aldrich & Elliott, PC, Mississquoi River Basin Advanced Illicit Discharge Detection and Elimination (IDDE) Study – Final Report, October, 2014.

Vermont Dep. Of Environmental Conservation and Stone Environmental, Inc., Detecting and Eliminating Illicit Discharges to Improve Water Quality in the Lamoille River Basin – Final Report, July, 2014.


Catchbasin
Stormwater Manhole
Outfall
Storm line
Sanitary Manhole
Sanitary line
Maple Pro Plant
Storage Building
Smoke injected here.
Smoke injected here.
LEMNAH DR
Maple Pro Plant
Main Building
Seems likely that WQ results due to spills into this CB.
OF_24
LEMNAH DR
0
50 Feet
N
St. Albans IDDE AI - AI Summary Map
Outfall 24
WATERSHED
CONSULTING



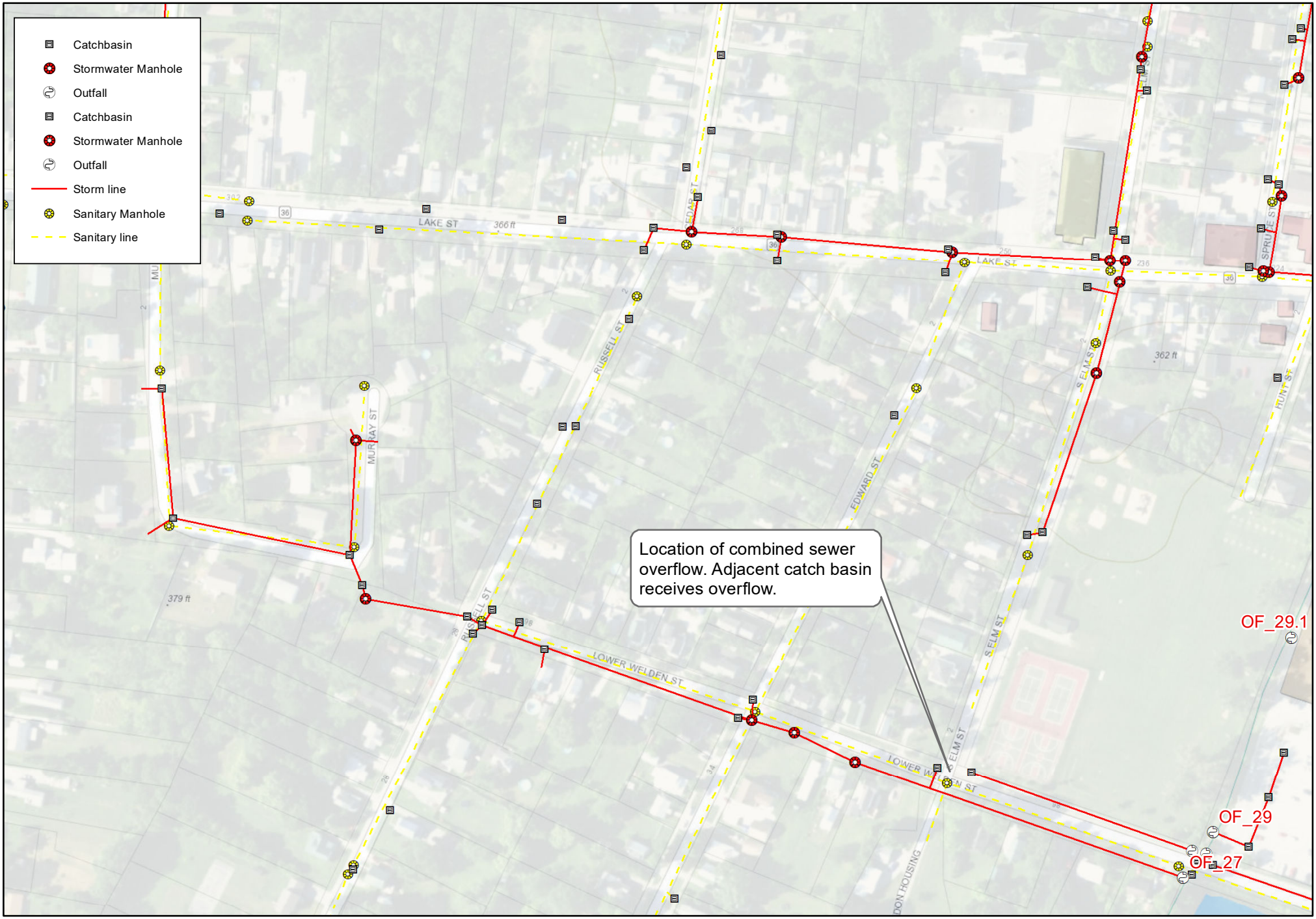
0 80 Feet

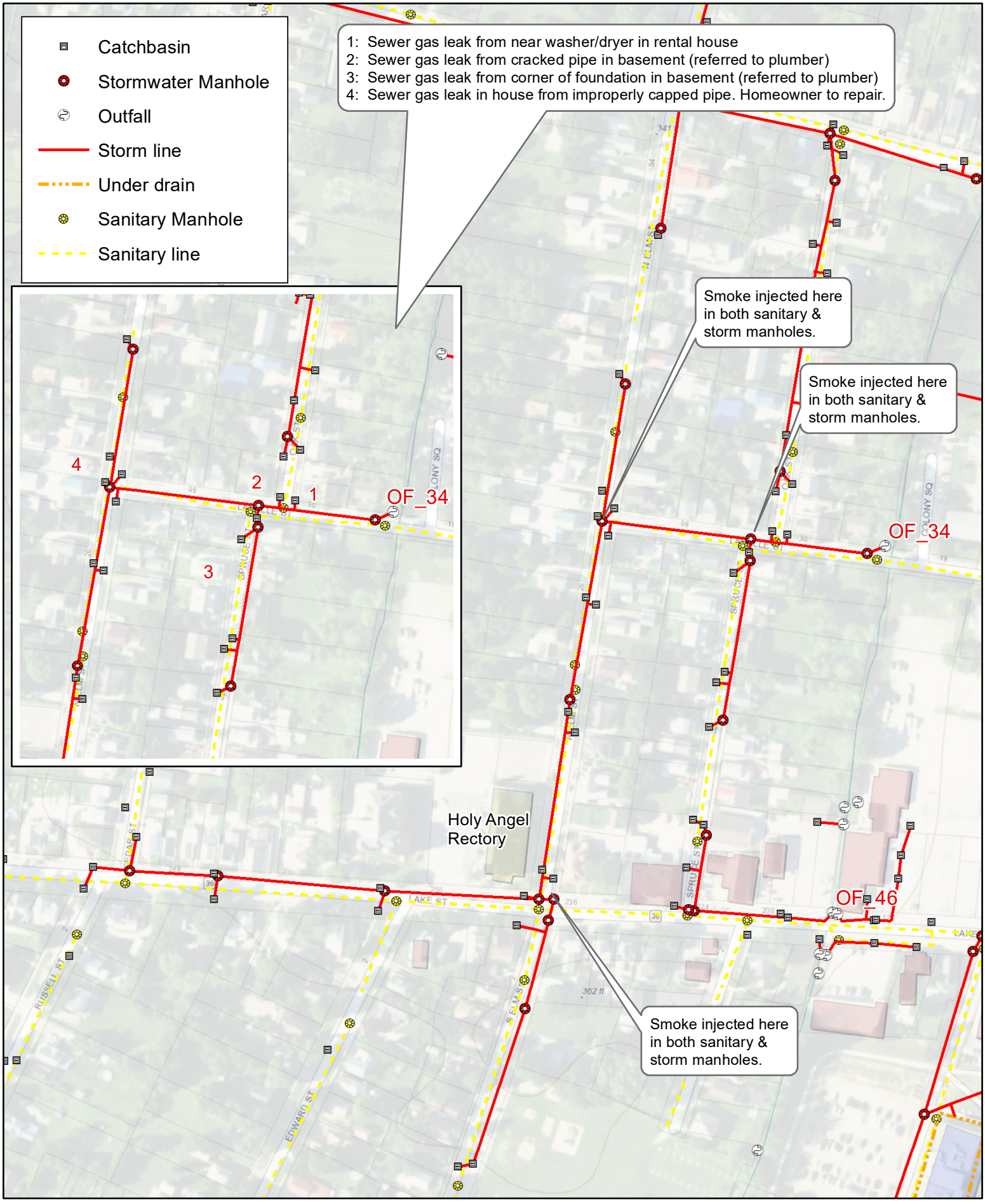
N

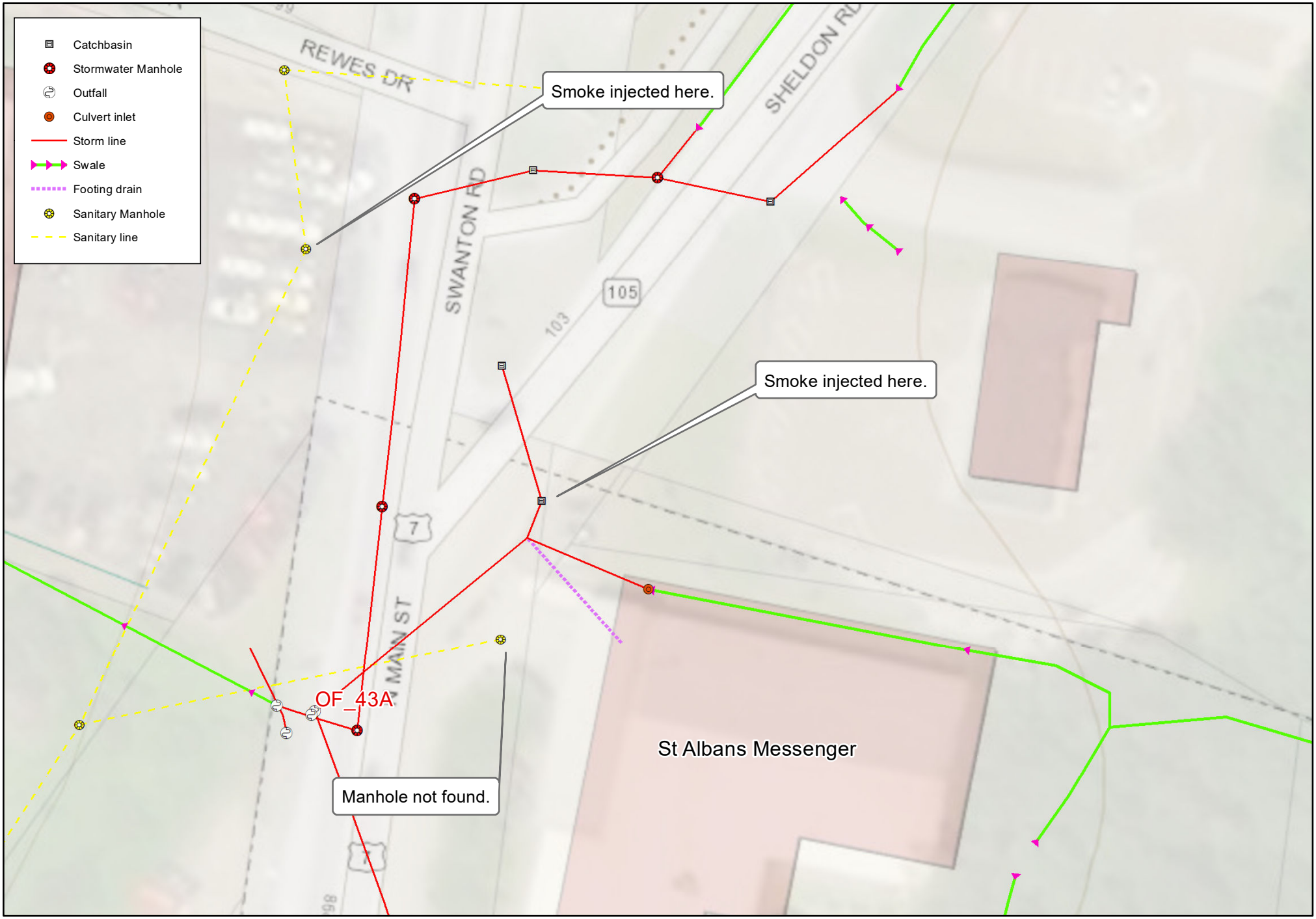
St. Albans IDDE AI - Summary Map

Outfall 26

WATERSHED CONSULTING ASSOCIATES, LLC


Catchbasin
Stormwater Manhole
Outfall
Catchbasin
Stormwater Manhole
Outfall
Storm line
Sanitary Manhole
Sanitary line
LAKE ST
366 ft
LAKE ST
362 ft
CEDAR ST
RUSSELL ST
MURRAY ST
379 ft
EDWARD ST
S ELM ST
HUNT ST
LOWER WELDEN ST
OF_29.1
OF_29
OF_27
Location of combined sewer overflow. Adjacent catch basin receives overflow.
0
300 Feet
N
St. Albans IDDE AI - Summary Map
Outfall 27
WATERSHED
CONSULTING ASSOCIATES, LLC

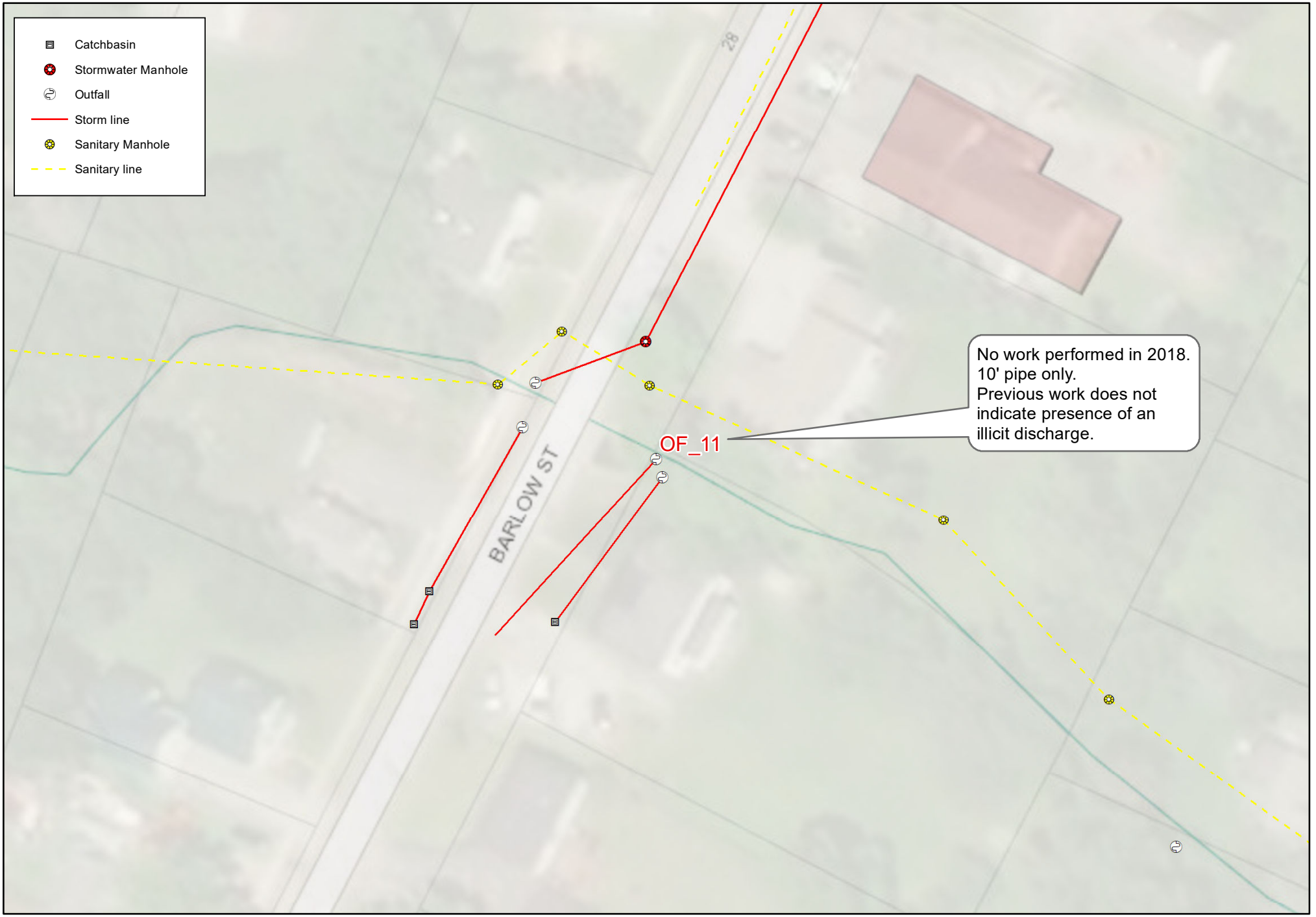

Catchbasin
Stormwater Manhole
Outfall
Storm line
Under drain
Sanitary Manhole
Sanitary line
1: Sewer gas leak from near washer/dryer in rental house
2: Sewer gas leak from cracked pipe in basement (referred to plumber)
3: Sewer gas leak from corner of foundation in basement (referred to plumber)
4: Sewer gas leak in house from improperly capped pipe. Homeowner to repair.
Smoke injected here in both sanitary & storm manholes.
Smoke injected here in both sanitary & storm manholes.
Smoke injected here in both sanitary & storm manholes.
OF_34
OF_34
OF_46
4
2
1
3
Holy Angel Rectory
LAKE ST
SPRUCE ST
EDWARD ST
RUSSELL ST
COLONY SQ
362 ft
0
300 Feet
N
St. Albans City IDDE AI - Summary Map
Outfall 34
WATERSHED
CONSULTING ASSOCIATES, LLC



St. Albans IDDE AI - Summary Map

Outfall 43A

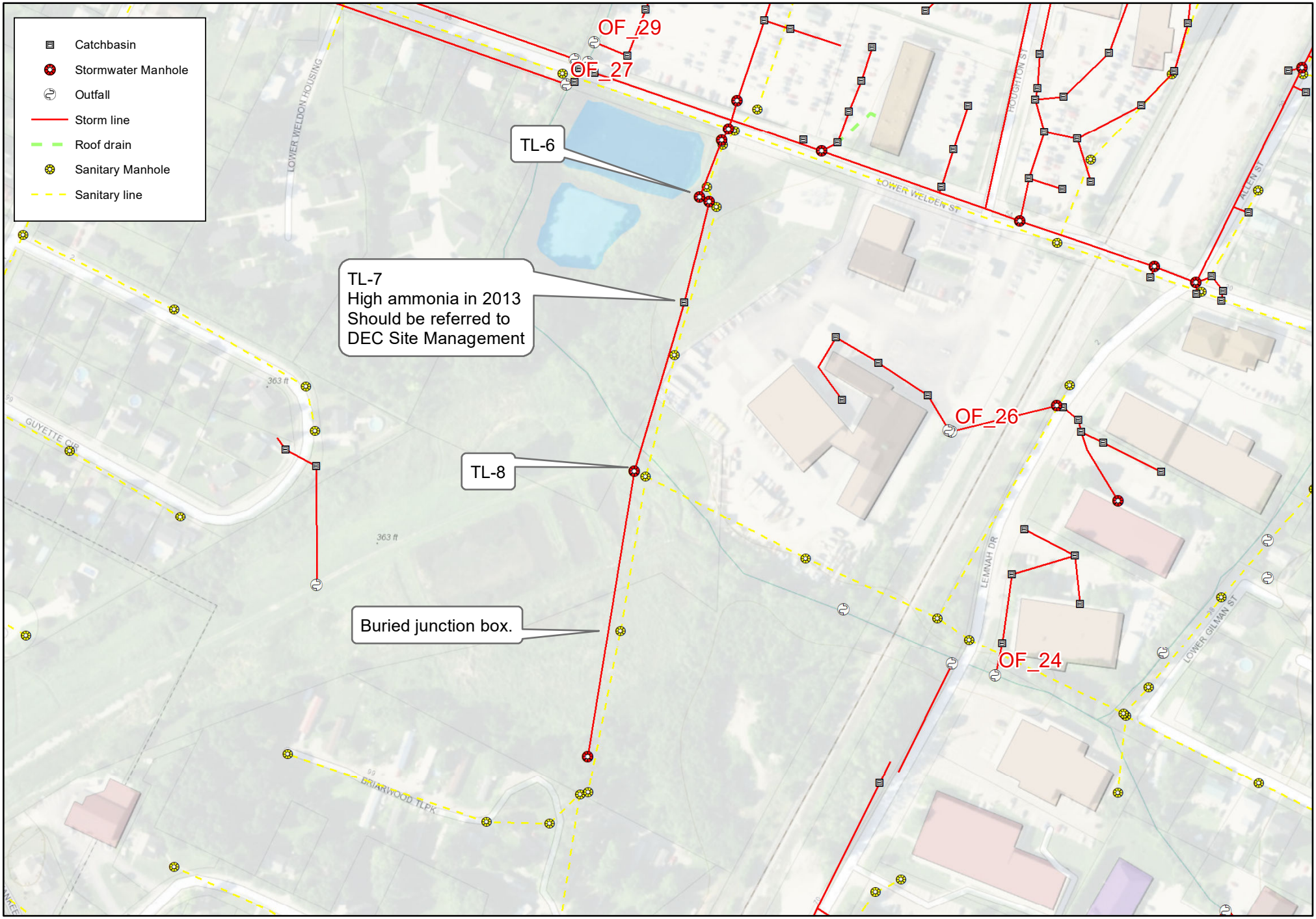
WATERSHED CONSULTING

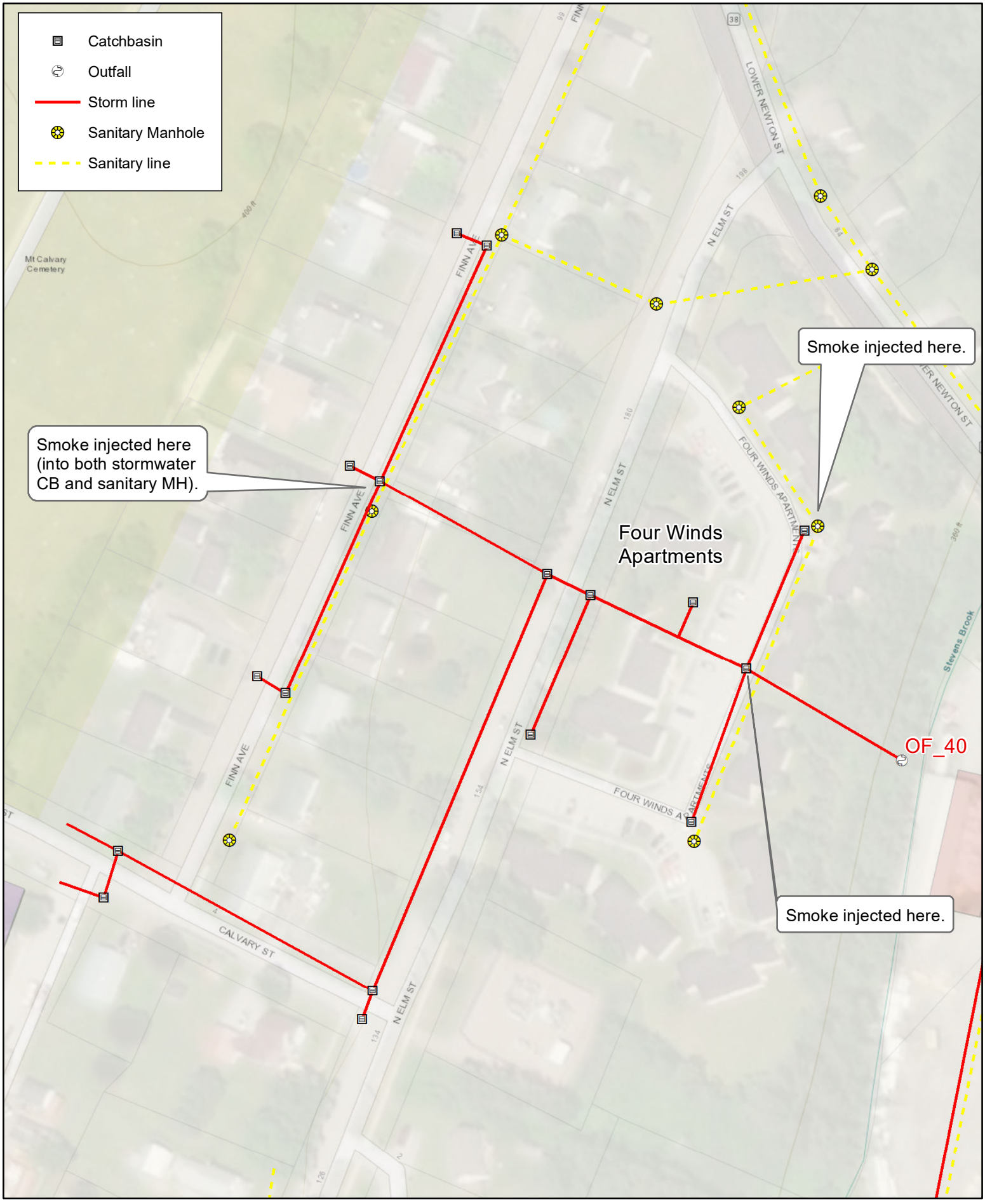


St. Albans IDDE AI - Summary Map

Outfall 11

WATERSHED CONSULTING


Catchbasin
Stormwater Manhole
Outfall
Storm line
Roof drain
Sanitary Manhole
Sanitary line
OF_29
OF_27
TL-6
TL-7
High ammonia in 2013
Should be referred to
DEC Site Management
TL-8
Buried junction box.
OF_26
OF_24
LOWER WELDON HOUSING
LOWER WELDEN ST
HOUGHTON ST
ALLEN ST
GUYETTE CIR
363 ft
363 ft
LEMNAH DR
LOWER GILMAN ST
BRIARWOOD TLPK
0
250 Feet
N
St. Albans IDDE AI - Summary Map
Trunkline
WATERSHED
CONSULTING



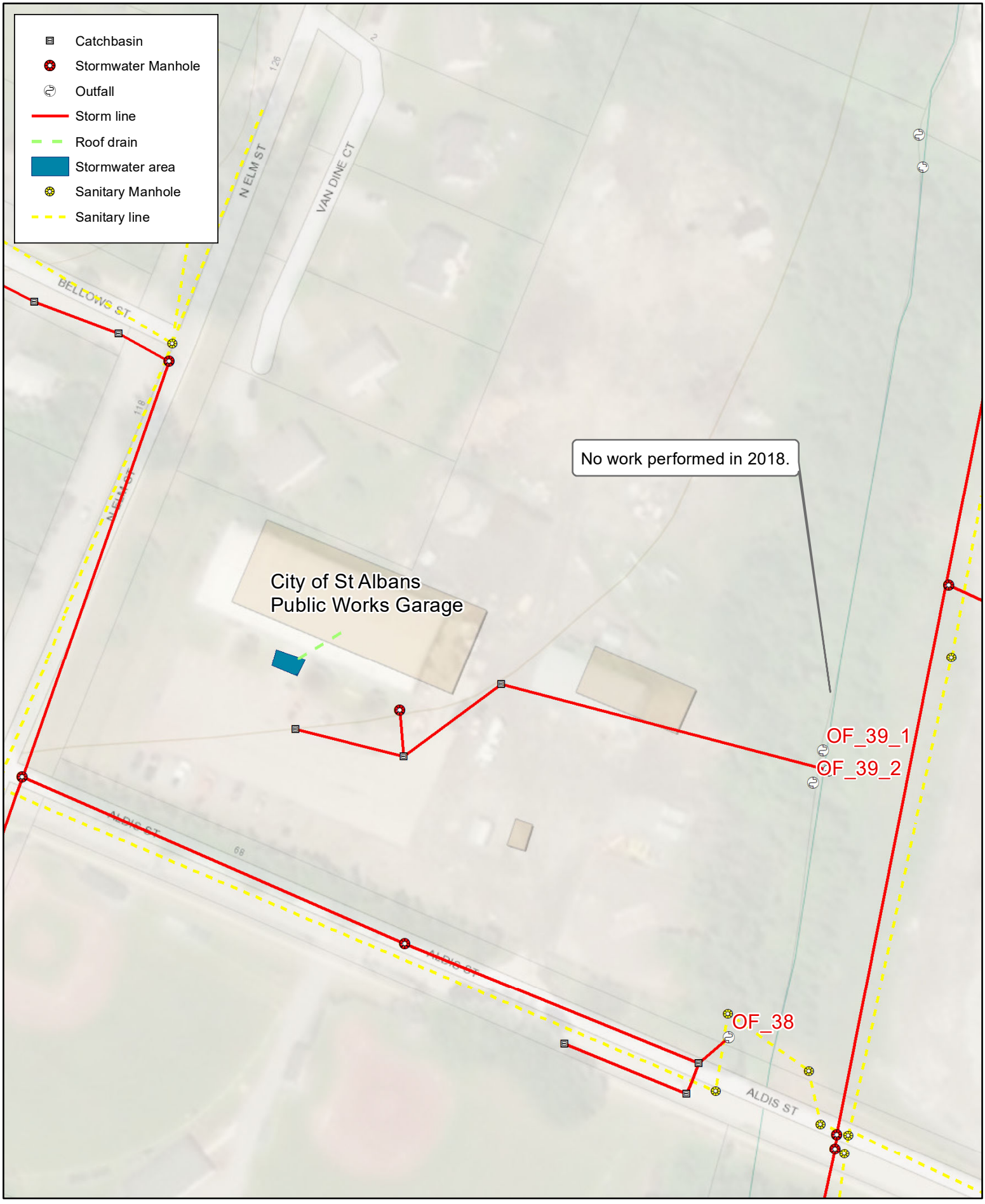
0 150 Feet

N

St. Albans City IDDE AI - Field Map

Outfall 40

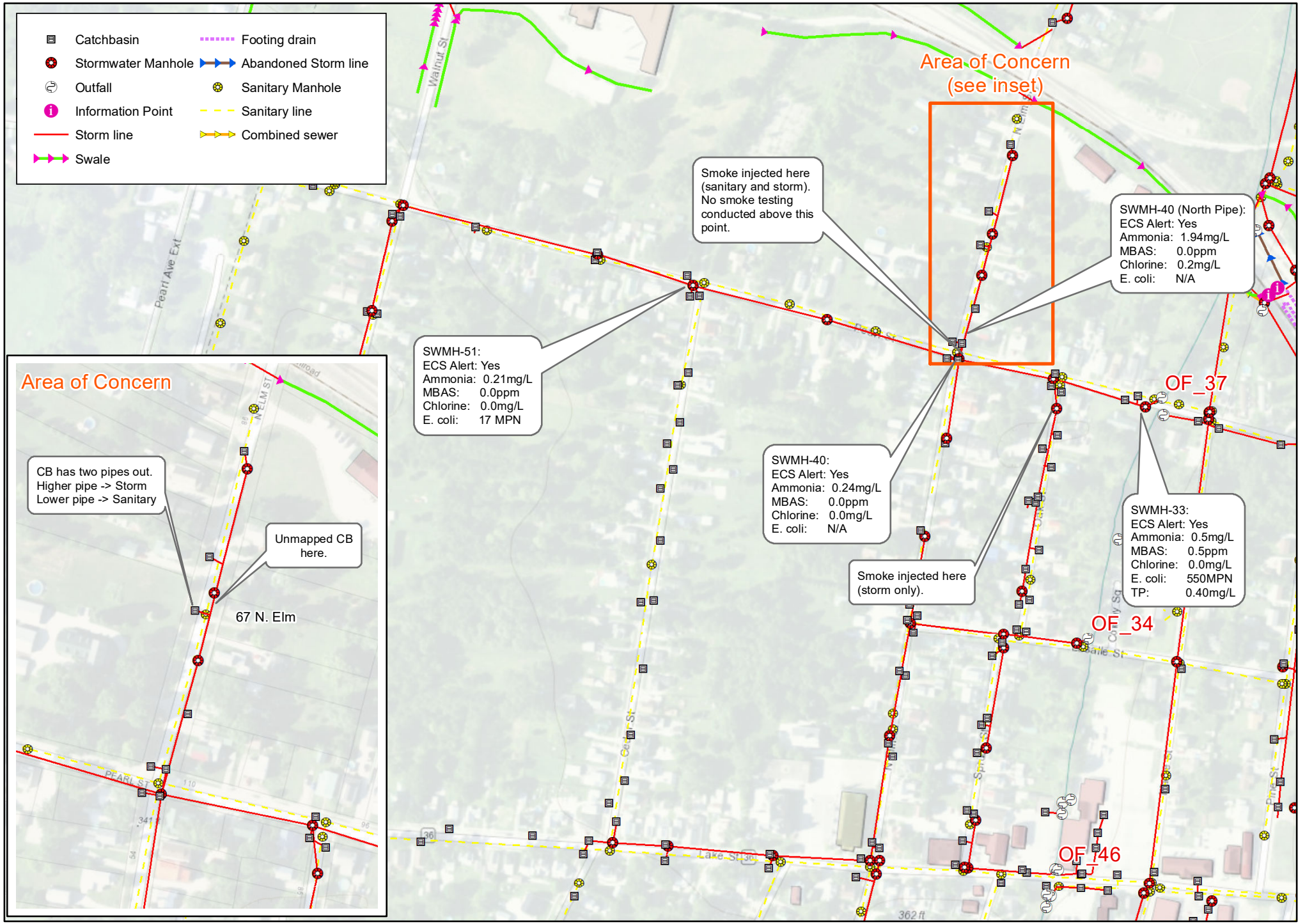
WATERSHED CONSULTING



St. Albans City IDDE AI - Summary Map

Outfall 39.1 / 39.2

WATERSHED CONSULTING

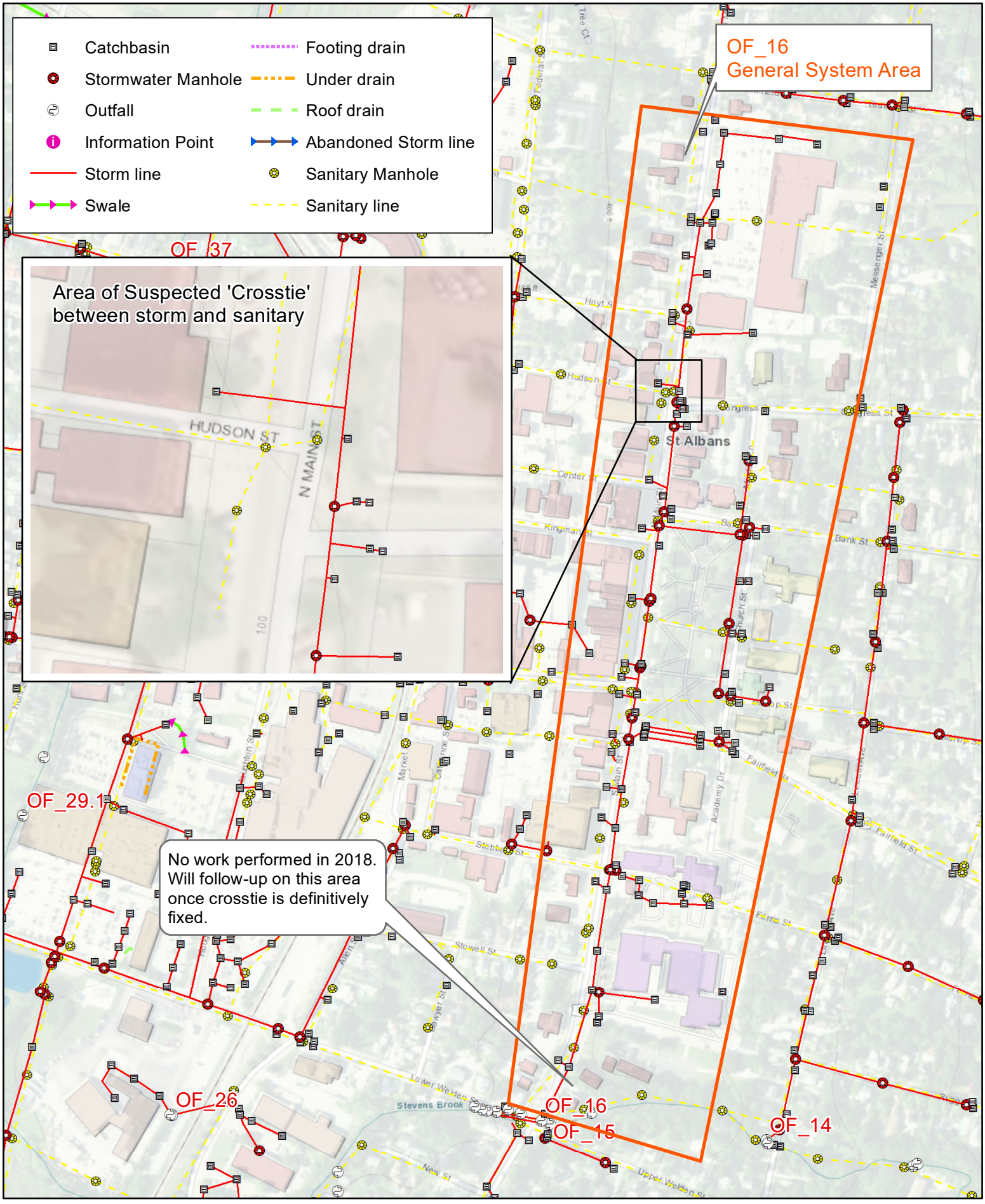


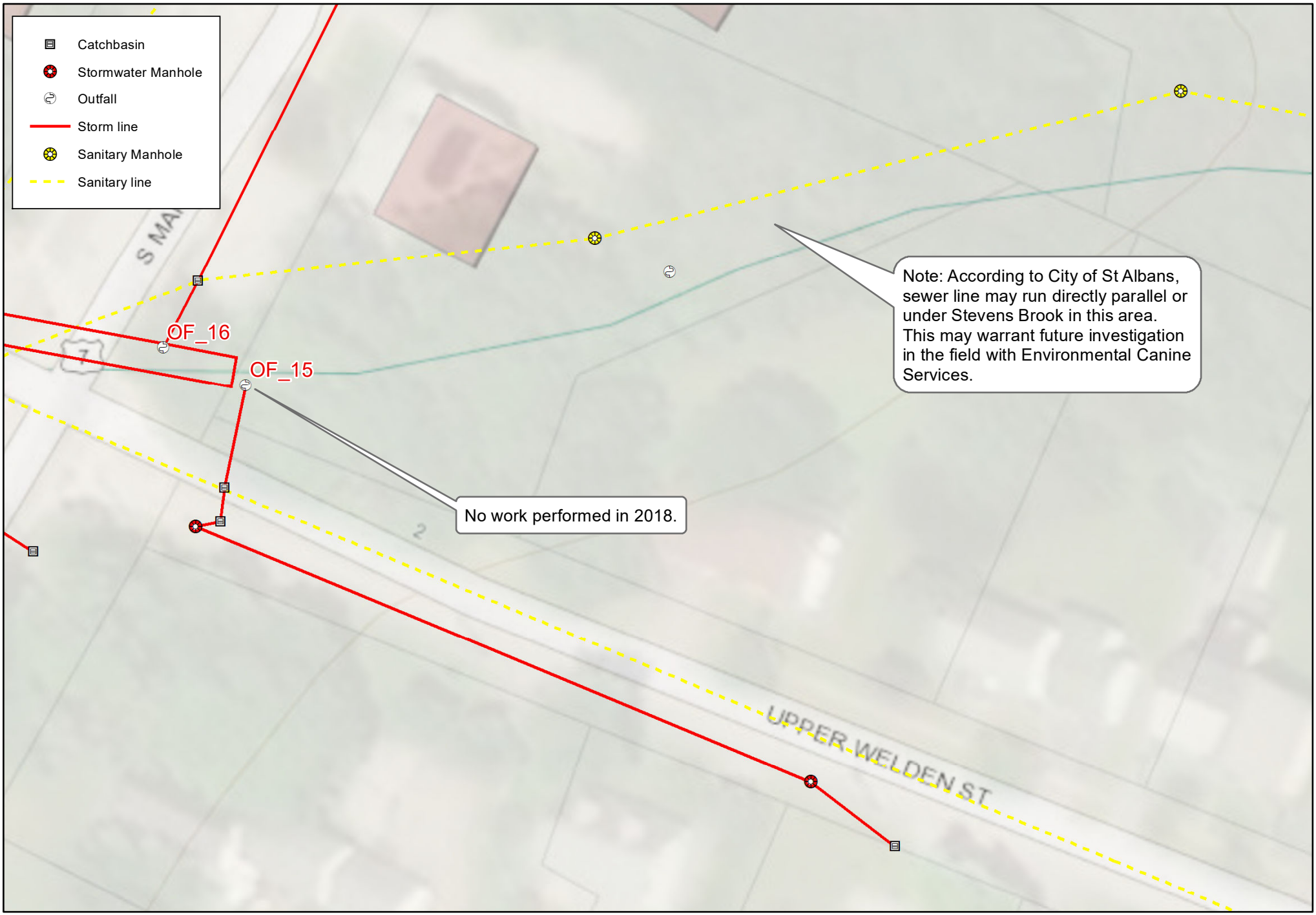
0 350 Feet

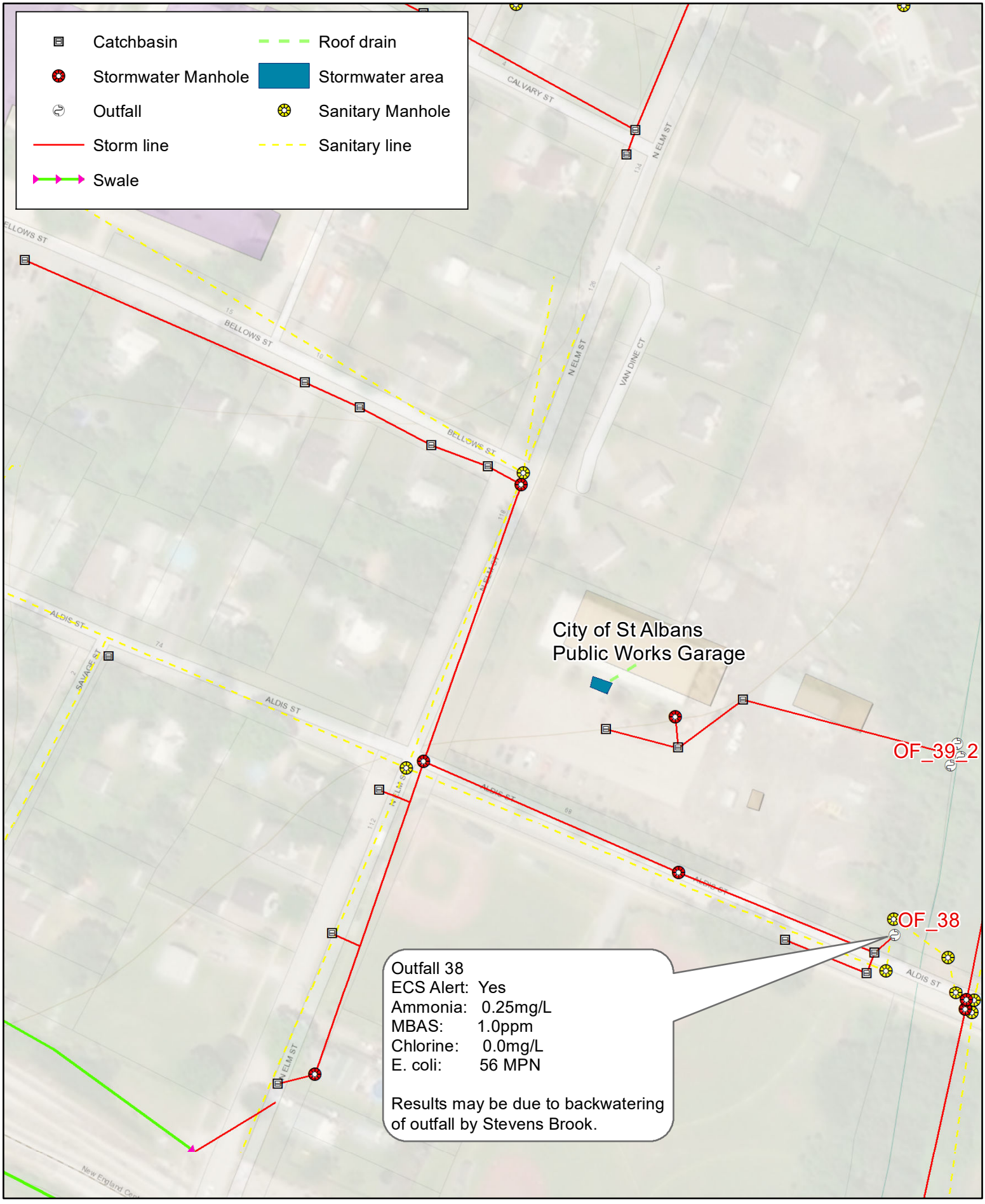
N

St. Albans IDDE AI - Summary Map
Outfall 37

WATERSHED CONSULTING


Catchbasin
Stormwater Manhole
Outfall
Information Point
Storm line
Swale
Footing drain
Under drain
Roof drain
Abandoned Storm line
Sanitary Manhole
Sanitary line
OF_16
General System Area
OF_37
Area of Suspected 'Crosstie'
between storm and sanitary
HUDSON ST
N MAIN ST
St Albans
OF_29.1
No work performed in 2018.
Will follow-up on this area
once crosstie is definitively
fixed.
OF_26
OF_16
OF_15
OF_14
Stevens Brook
0
475 Feet
N
St. Albans City IDDE AI - Summary Map
Outfall 16
WATERSHED
CONSULTING


Catchbasin
Stormwater Manhole
Outfall
Storm line
Sanitary Manhole
Sanitary line
OF_16
OF_15
Note: According to City of St Albans, sewer line may run directly parallel or under Stevens Brook in this area. This may warrant future investigation in the field with Environmental Canine Services.
No work performed in 2018.
UPPER WELDEN ST
0
50 Feet
N
St. Albans City IDDE AI - Summary Map
Outfall 15
WATERSHED CONSULTING



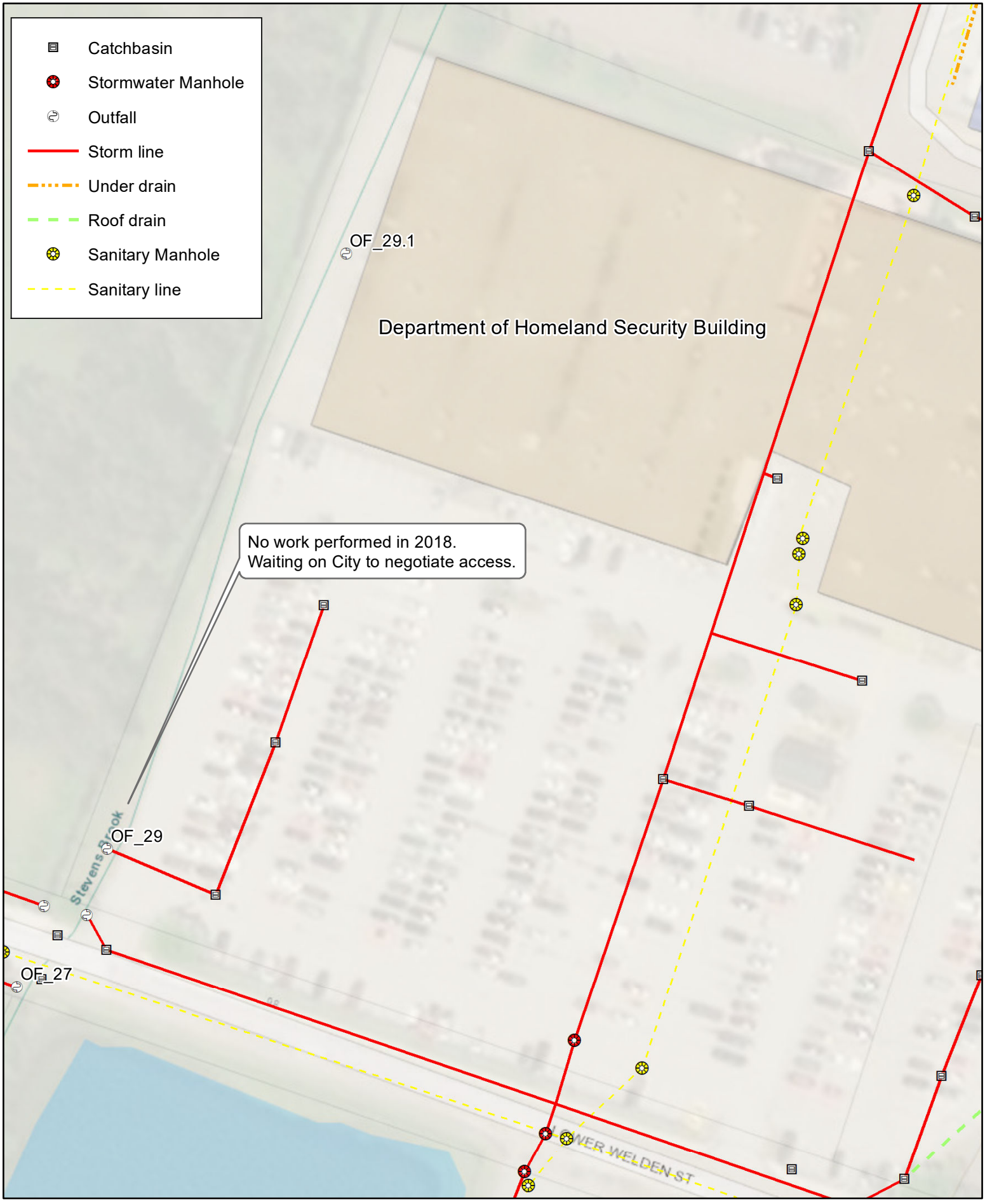
0 175 Feet

N

St. Albans City IDDE AI - Summary Map

Outfall 38

WATERSHED CONSULTING ASSOCIATES, LLC

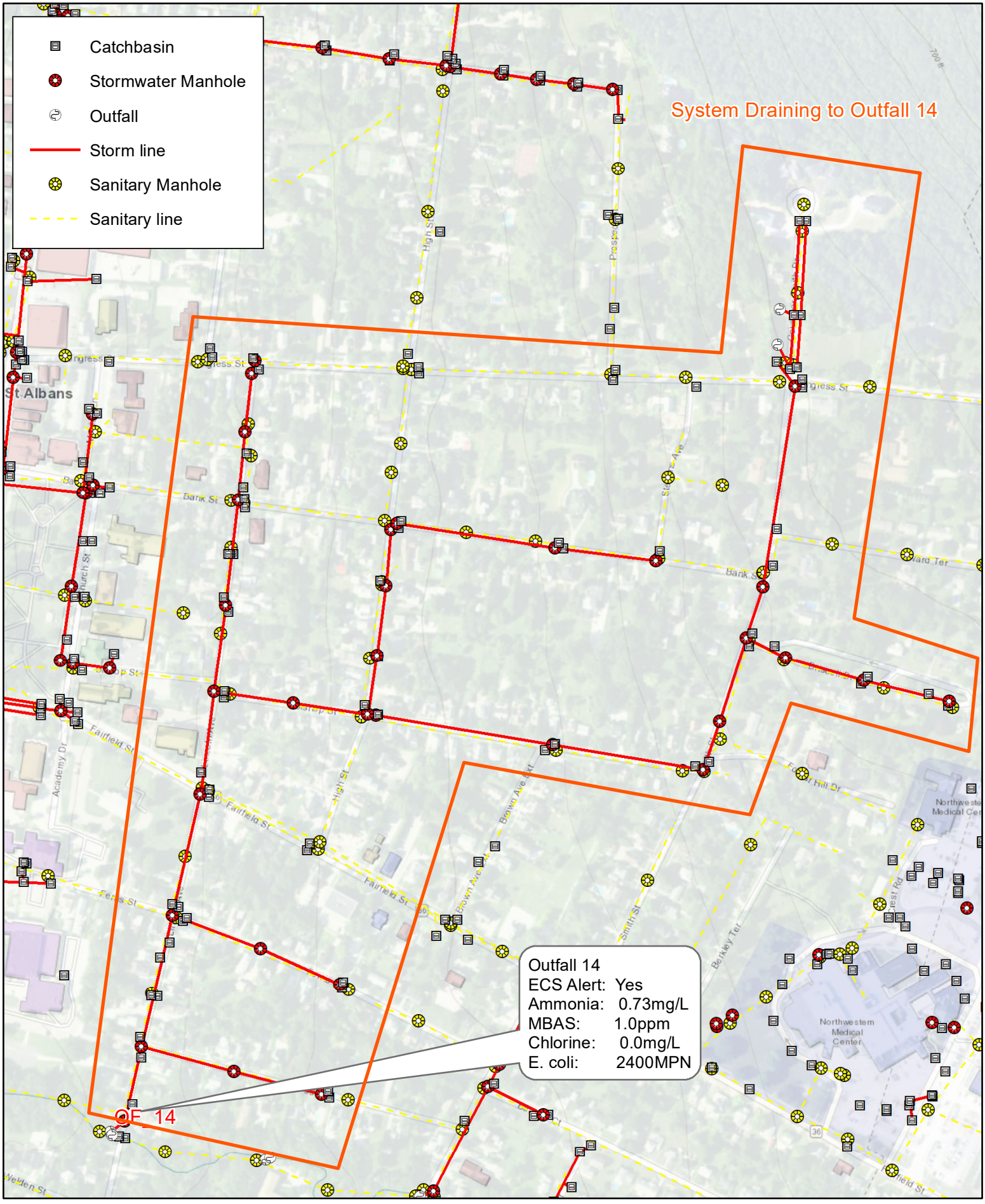


0 100 Feet N

St. Albans City IDDE AI - Summary Map

Outfall 29 / 29.1

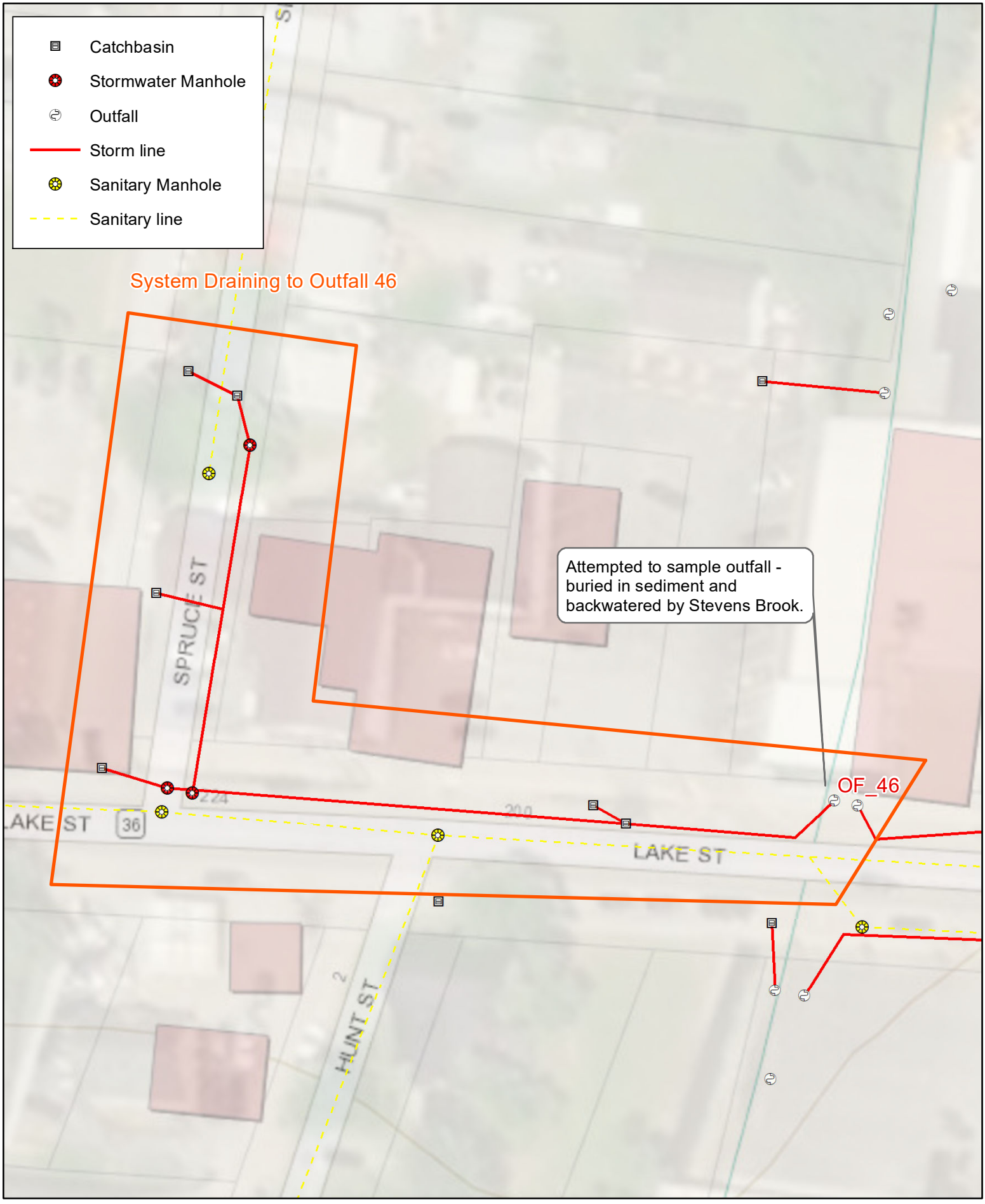
WATERSHED CONSULTING



St. Albans City IDDE AI - Summary Map

Outfall 14

WATERSHED CONSULTING



St. Albans City IDDE AI - Summary Map

Outfall 46

WATERSHED CONSULTING

March 28, 2019

Christy Witters
MS4 and MSGP Program Coordinator
Vermont Department of Environmental Conservation
1 National Life Drive, Main 2
Montpelier, VT 05620-3522

Re: Flow Restoration Plan Report

Christy,

In accordance with the City of St. Albans MS4 Authorization to Discharge Permit No. 7074-9014, here is a Flow Restoration Plan (FRP) Report.

Local Stormwater Funding

I am pleased to report that the City's stormwater utility was established as of July 1, 2018. The first stormwater fee bills went out to property owners last month. With this new source of revenue for stormwater activities, the City will be able to match other funds for final design and construction activities on flow restoration BMPs.

Project Implementation and Schedule

The City is moving forward on its first BMP. With Clean Water Block Grant funding provided via Northwest Regional Planning Commission and matched by the City's stormwater utility, the City has engaged the services of Watershed Consulting Associates to provide final design and construction document services for the "SASH / Nason St. Connector" BMP. This BMP would treat 4.9 acres of impervious surface located within the City, St. Albans Town, and VTrans right-of-way, all within the Rugg Brook watershed. The project is currently in the wetlands delineation stage and aims to be completed in July of 2019. The SASH / Nason St. BMP will not treat the most stormwater out of all of the City's BMPs, but it does present the least complicated project for the most treatment, since the City currently owns the vast majority of land that would be needed.

The City has also begun the process to explore the "GMP Cooling Ponds" BMP, which would treat 54 acres of impervious surface in the City within the Stevens Brook watershed. This BMP would be located on land currently owned by Green Mountain Power. The City has received a $100,000 federal grant administered by the Lake Champlain Basin Program to develop final designs for this BMP and to explore the possibilities of public-private partnerships with 3+ acre sites in the drainage area. The RFP for consultant services will go out next month.

City of Saint Albans • P.O. Box 867 • 100 North Main Street • Saint Albans, VT 05478
P: 802-524-1500 • F: 802-524-1505 • info@StAlbansVt.com • www.StAlbansVt.com

The City has begun a conversation with GMP about the land. There has also been a site visit with the City and representatives of VT DEC covering the subjects of wetlands, river corridors, floodplain management, and stormwater management. Also, $100,000 of federal money has been set aside for St. Albans to explore using the BMP to also treat 3-acres parcels within its drainage area.

The City has also been in communication with representatives of the Maple Run Unified School District about the St. Albans Town Education Center (SATEC) BMP. This treatment facility would expand the existing stormwater pond on SATEC land. The primary challenge identified thus far is that SATEC feels it cannot afford to lose any of the parking adjacent to their existing pond. The next step for the City would be to work on concepts for treatment that would preserve as much existing parking as possible.

In terms of FRP schedule, the City is in a satisfactory state. Under the original schedule the City was supposed to be in design stages for the SATEC and Lemnah Dr. BMPs in Stevens Brook in 2018. This has not occurred in earnest, but it is made up for with the activity surrounding the GMP Cooling Ponds BMPs, which was not originally scheduled to being design until 2020. Concerning the Rugg Brook BMP schedule, the City is still well within the 7-9 year goal for BMP implementation.

Next Steps

The City's goals for FRP implementation in 2019 include:

1. Develop a Phosphorous Control Plan and determine if any of the currently planned FRP BMPs need to be adjusted for phosphorous treatment.
2. Finish the final design of the SASH / Nason St. BMP and pursue funding for construction.
3. Move forward with final design of the GMP Cooling Ponds BMP.
4. Continue the conversation on the SATEC BMP.
5. Seek funding for final design activities for the Lemnah Drive BMP.

I look forward to any questions or comments.

Sincerely,

Chip Sawyer
Director of Planning & Development

March 28, 2019

Chip Sawyer
City of St Albans
Director of Planning and Development
St. Albans, Vermont

RE: St. Albans City Phosphorus Control Plan (PCP) Progress Report - 2019

Dear Chip,

This memorandum summarizes the progress made toward the completion of a Phosphorus Control Plan (PCP) for the City of St. Albans. The PCP is a required component of the City's MS4 permit with the State of Vermont DEC. The implementation schedule included in the MS4 permit is as follows:

April 1, 2019	Submit the first Annual PCP Report
April 1, 2020	Submit the Annual PCP Report and the Implementation Table with results of the Road Erosion Inventory (REI)
April 1, 2021	Submit the Annual PCP Report and the Implementation Table with results of the Road Erosion Inventory (REI)
April 1, 2022	Submit Annual PCP Report
No later than June 17, 2036	Complete full implementation of the approved PCP

At this stage, several initial planning tasks are ongoing that will inform the development of the complete PCP. These include the following:

- <u>Review of PCP requirements and target assigned to St. Albans City</u>

  The DEC has informed the MS4 communities including the City of St. Albans that they (the DEC) will not be calculating the Phosphorus reduction targets for each community, but that it will be the responsibility of the MS4 community to complete this calculation. We have reviewed the instruction sheet the DEC provided and are in the process of calculating the Phosphorus reduction target required for the City of St. Albans.

- Flow Restoration Plan (FRP) review

  Existing retrofit and newly proposed BMPs included in the Rugg Brook and Stevens Brook FRPs are being assessed for optimization for Phosphorus control. BMPs in design presently include the SASH project. This project is being designed as a gravel wetland to not only provide flow reduction but to also provide Phosphorus control. Future projects are also being assessed to ensure they will benefit the PCP planning effort.

- City Stormwater Ordinance

  The City stormwater ordinance will be reviewed to determine how Phosphorus benefits can be achieved by treating runoff from redeveloped impervious surfaces from private lands.

- Good Housekeeping

  A street cleaning and leaf litter study is in process currently and we have been reviewing preliminary findings to understand the benefits of street sweeping toward meeting PCP goals. A summary of this study is provided here: https://www.usgs.gov/centers/new-england-water/science/nutrient-and-sediment-load-reduction-estimates-intensive-street?qt-science_center_objects=0#qt-science_center_objects

- 3 Acre Permit

  Under the new Stormwater Rule the DEC will be releasing a 3-acre permit that will require retrofit of larger impervious surfaces in the City (3 acres or more of impervious area). We are in the process of analyzing how the City will receive credit for retrofit of these 3-acre sites under their PCP, and how the PCP and FRP plan requirements overlap and interplay.

Sincerely,

Andres Torizzo, Principal
Watershed Consulting Associates, LLC