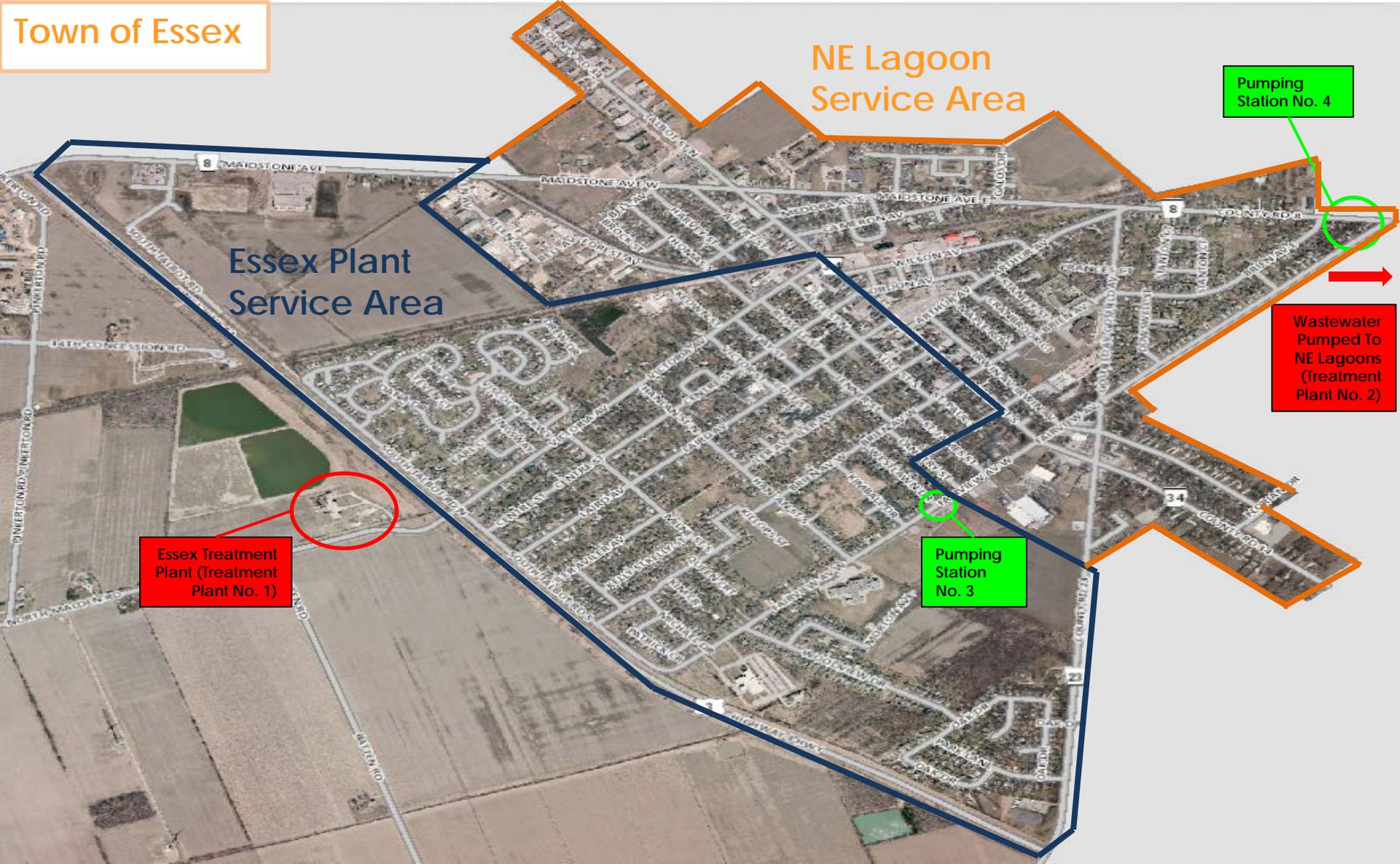


Basement Flooding Study

Town of Essex



Essex Plant Service Area

NE Lagoon Service Area

Pumping Station No. 4

Essex Treatment Plant (Treatment Plant No. 1)

Pumping Station No. 3

Wastewater Pumped To NE Lagoons (Treatment Plant No. 2)

Outlines of Presentation

- 1 Introduction
- 2 Flow Monitoring Program
- 3 Manhole inspections
- 4 CCTV and Smoke Testing
- 5 Modeling
- 6 Findings and Proposed Improvements
- 7 Recommendations

1 Introduction

Locations of reported basement flooding on August 2014 storm event

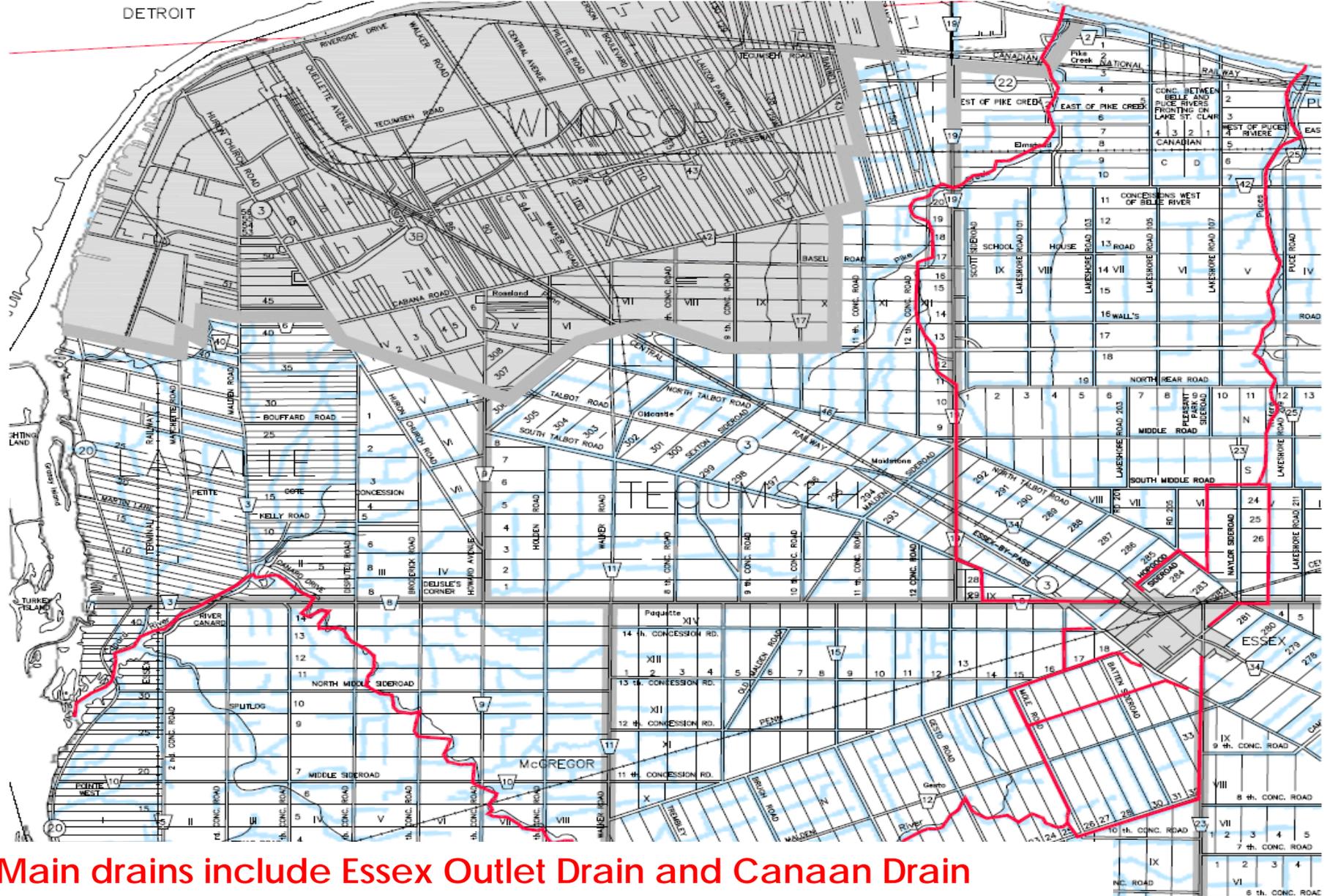
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Causes of Basement Flooding

- Surface water/floodplain
- Site grading/backfill/downspouts
- Groundwater
- Sewer backup
- Combinations of the above

Study is primarily focused on basement flooding caused by **SANITARY SEWER** backups.

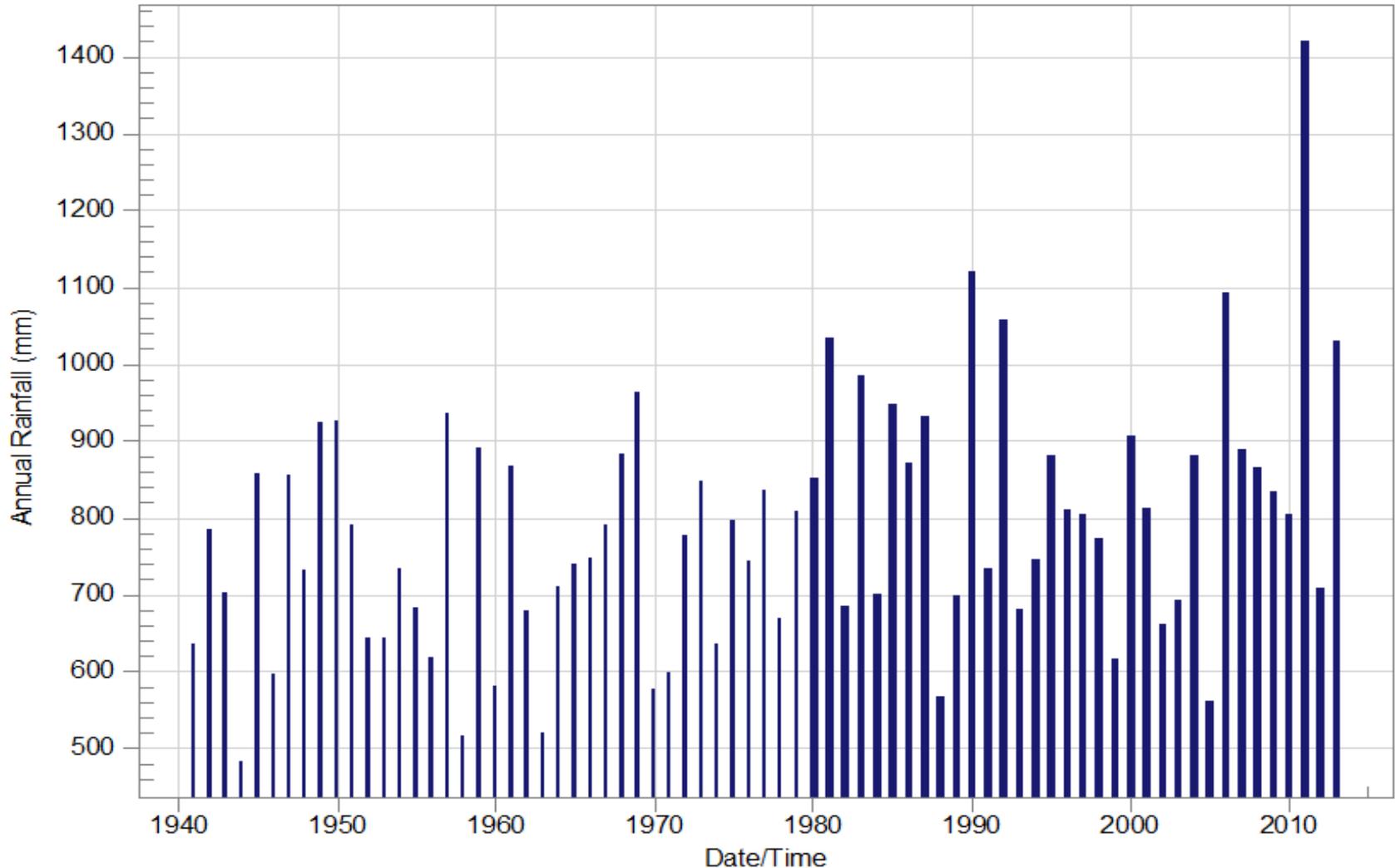
Surface water/floodplain



Main drains include Essex Outlet Drain and Canaan Drain

Causes of Basement Flooding: Weather

Figure 1: Annual rainfall at Windsor airport from 1940 – 2014



Surface water/floodplain

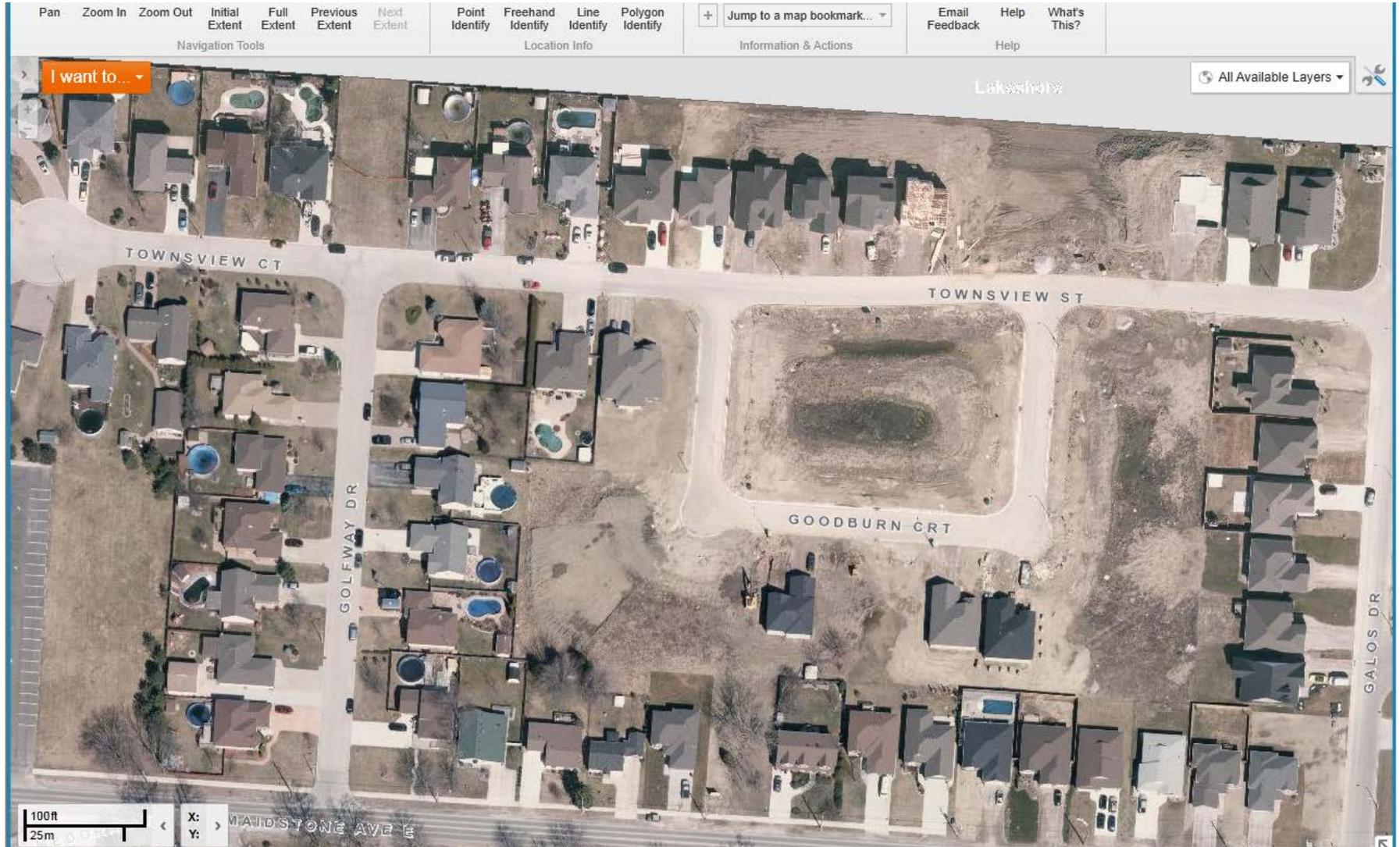


Figure 2: Essex Outlet Drain PRIOR to a small storm event (June 2015).



Figure 3: Essex Outlet Drain flowing full after a small storm event. Photo taken AFTER ½" of rainfall (June 2015).

Site Grading – Golfway and Galos Developments



Site Grading – Golfway and Galos Developments



Basement flooding in Golfway and Galos Development is considered to be mainly caused by site grading

Basement Flooding

Basement flooding problems in other Municipalities largely due to climate changes and significant I/I entering system

- Essex
- Amherstburg
- LaSalle
- Windsor
- Bigger Cities – Toronto, etc.

THE WINDSOR STAR

NEWS

NEWS

LaSalle homeowners irate after repeated basement flooding



Mike Magri, left, and Lily Magri wait at LaSalle Council meeting Tuesday July 28, 2015. Several were hoping to speak to council regarding recent flooding, causing damage to their homes. The five dealt with flooding on two occasions. (NICK BRANCACCIO/The Windsor Star)

THE WINDSOR STAR

NEWS

Windsor grapples with flood damage after record-level rain hits region (With video)



Windsor grapples with flood damage after record-level rain hits region (With video)

Stella Sodade checks out the flood damage to the basement of her Southwood Lakes home in Windsor, ON. on Tuesday, July 12, 2014. (DAN JANISSE/The Windsor Star)

CBCnews | Windsor

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Amherstburg cleans up after flooding

CBC News Posted: Aug 09, 2011 11:20 AM ET | Last Updated: Aug 09, 2011 4:06 PM ET



Heavy rains drenched Amherstburg, Ont., and left some basements and parts of town under water.



What is Inflow and Infiltration?

Inflow

Water from rainfall or snow melt that enters the sewage system through **direct sources** such as yard, roof and downspouts, illegal cross-connections with sanitary sewers, foundation drains, and manhole covers.

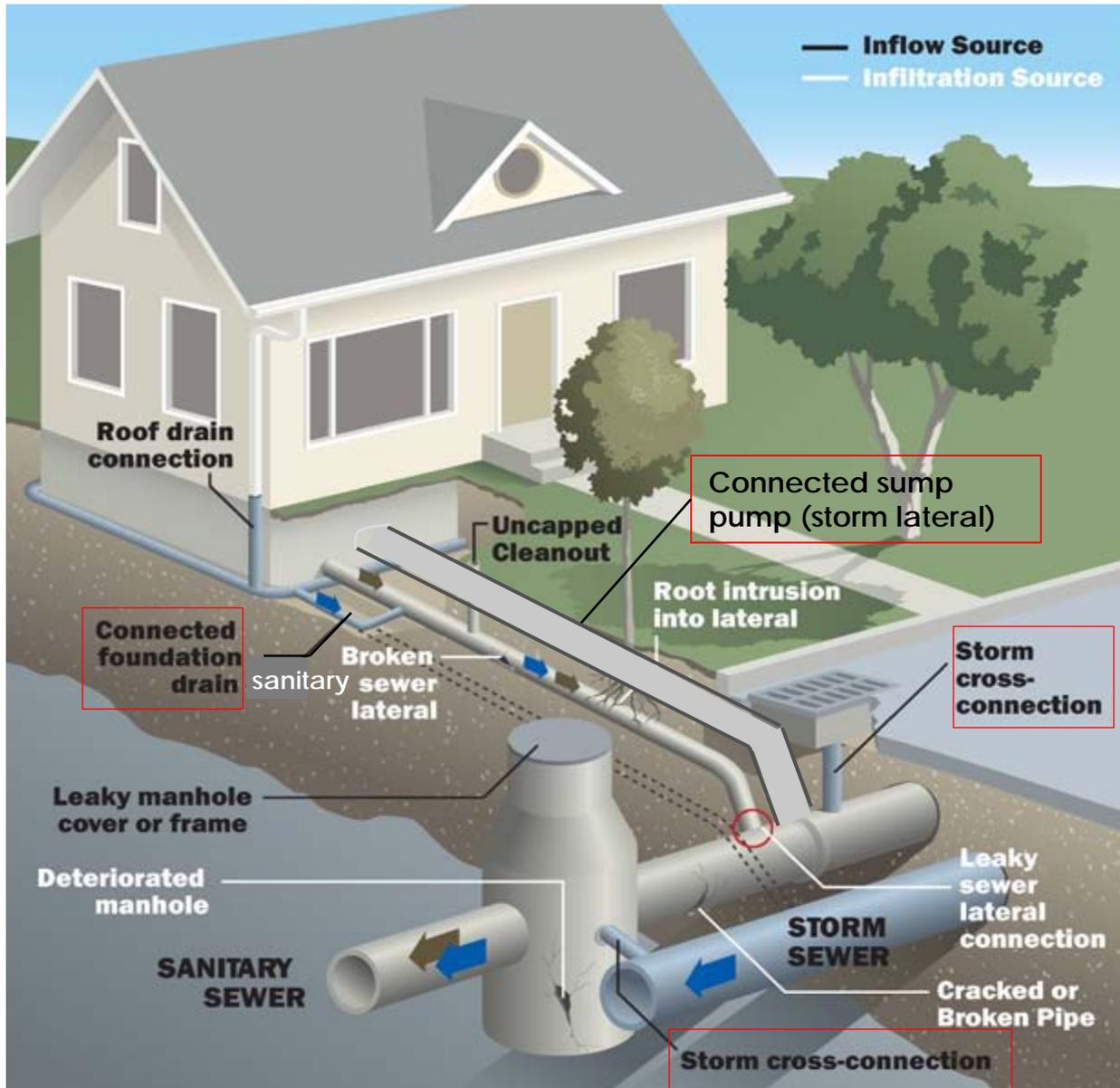


Infiltration

Groundwater that enters through holes and cracks in manholes, laterals, and sewer pipes



Sources of Inflow and Infiltrations



Chronology of Events and Activities

Date	Events/Activities
Jan, 2015	The Town retained Stantec to study basement flooding and formed a flooding advisory committee.
Feb, 2015	Basement flooding questionnaire prepared and distributed to Town Flooding Committee. Received approx. 12% responses (240 out of 2000 residents).
Mar-present, 2015	Flow monitoring to identify potential inflow and infiltrations (I&I) and collect data for sewer modeling
Apr-May, 2015	Inspected all manholes (approx. ` 500), and submitted inspection report documented findings
June, 2015	Fog testing of 5,480 m sewer to find potential I&I
June-July, 2015	CCTV of 6,300 m to inspect sewer an find potential I&I
May-Aug, 2015	Sewer modeling study, prepared a report documented areas of limited sewer capacity and proposed alternatives for improvements

2 Flow Monitoring Program

Flow Monitoring Program

Purpose

- *Locate and prioritize areas with excessive inflow and infiltration*
- *Utilize the flow monitoring data to calibrate the sanitary sewer system model.*

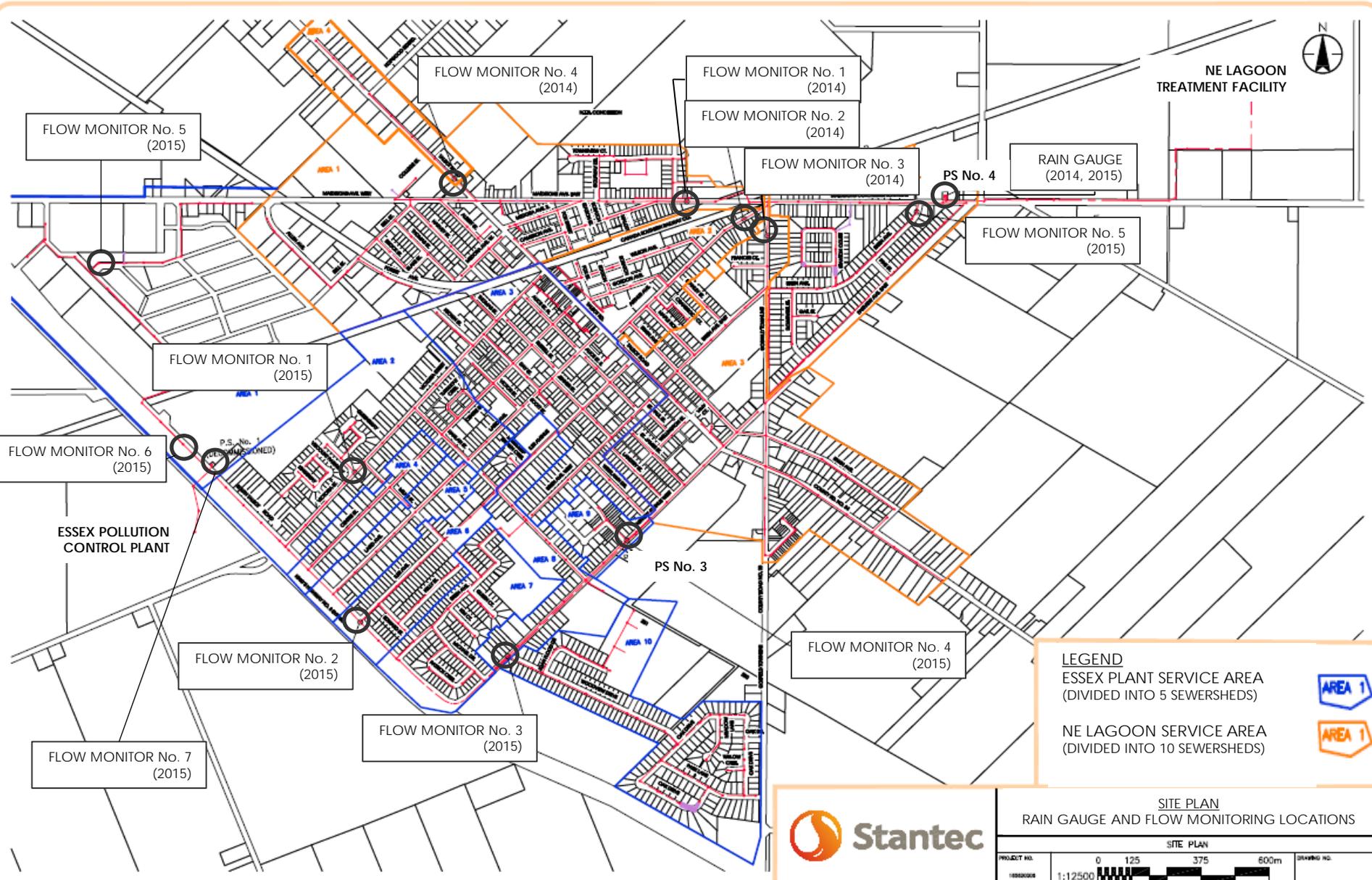
Year 2014

- Four (4) sites in the Northeast Lagoon service area between March 2014 and June 2014.

Year 2015

- Five (5) sites in the Essex Plant service area between March 2015 to June 2015
- Three (3) more sites in the Essex Plant service area from June 2015 and expected to end in October 2015.

Figure 4: Rainfall and Flow Monitoring Locations



SITE PLAN
RAIN GAUGE AND FLOW MONITORING LOCATIONS

PROJECT NO.	0 125 375 600m	DRAWING NO.	
15820008	1:12500		

Flow Monitoring Program

SUMMARY OF SYSTEM-WIDE I/I RESULTS

- Typically sanitary sewers in Ontario are designed to accommodate an infiltration allowance between 0.20 L/s/ha to 0.28 L/s/ha

Table 1: Summary of NE Lagoon Service Area Inflow and Infiltration

Event No.	Rainfall Event	Rainfall Depth (mm)	Duration (hr)	Peak I/I Rate (L/s/ha)
1.	Apr-3, 2014	25	25	0.15
2.	Apr-28, 2014	20	12	0.15
3.	May-12, 2014	48	22	0.34
4.	May-27, 2014	32	9	0.28
5.	Jun-18, 2014	64	17	0.19

Exceedances

Table 2: Summary of Essex Plant Service Area Inflow and Infiltration

Event No.	Rainfall Event Start Date	Rainfall Depth (mm)	Duration (hr)	Peak I/I Rate (L/s/ha)
1.	Apr-3, 2015	17	17	0.20
2.	Apr-7, 2015	48	19	0.61
3.	Apr-28, 2015	100	25	0.75
4.	May-12, 2015	62	26	0.72

Exceedances

Flow Monitoring Program

Redacted Pending Additional Content Review

3 Manhole Inspections

Manhole Inspections

Purpose:

- Manholes are considered to be one of the significant sources of I/I.

Work Completed:

- Visual inspection was conducted in March 2015 to investigate the condition of the Town's approximately 500 sanitary manholes.

Manhole Inspections (cont'd)



Figure 5: Inflow and infiltration entering sewer system (A, B, C, D)

Manhole Inspections

Results: Engineer

- Majority of manholes were in acceptable condition
- Some manholes were found to require repair/rehabilitation



4 CCTV and Smoke Testing

CCTV Inspection and Smoke Testing

Purpose

- To investigate sewer system defects & cross-connections between storm and sanitary systems

Important to Note:

- CCTV and smoke testing will **NOT** find any private cross-connections inside households

Work Completed

- Smoke testing of approximately 5,480 m of sanitary sewers
- CCTV inspection of approximately 6,300 m of various diameter sewers

Smoke Testing

Results:

- Some storm water directly discharge into sanitary sewer, and some defects observed (mostly related to cleanout caps)

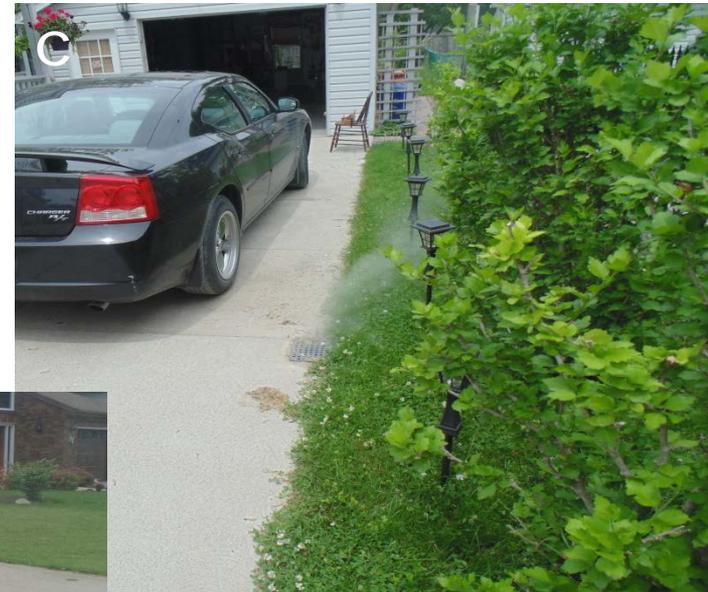


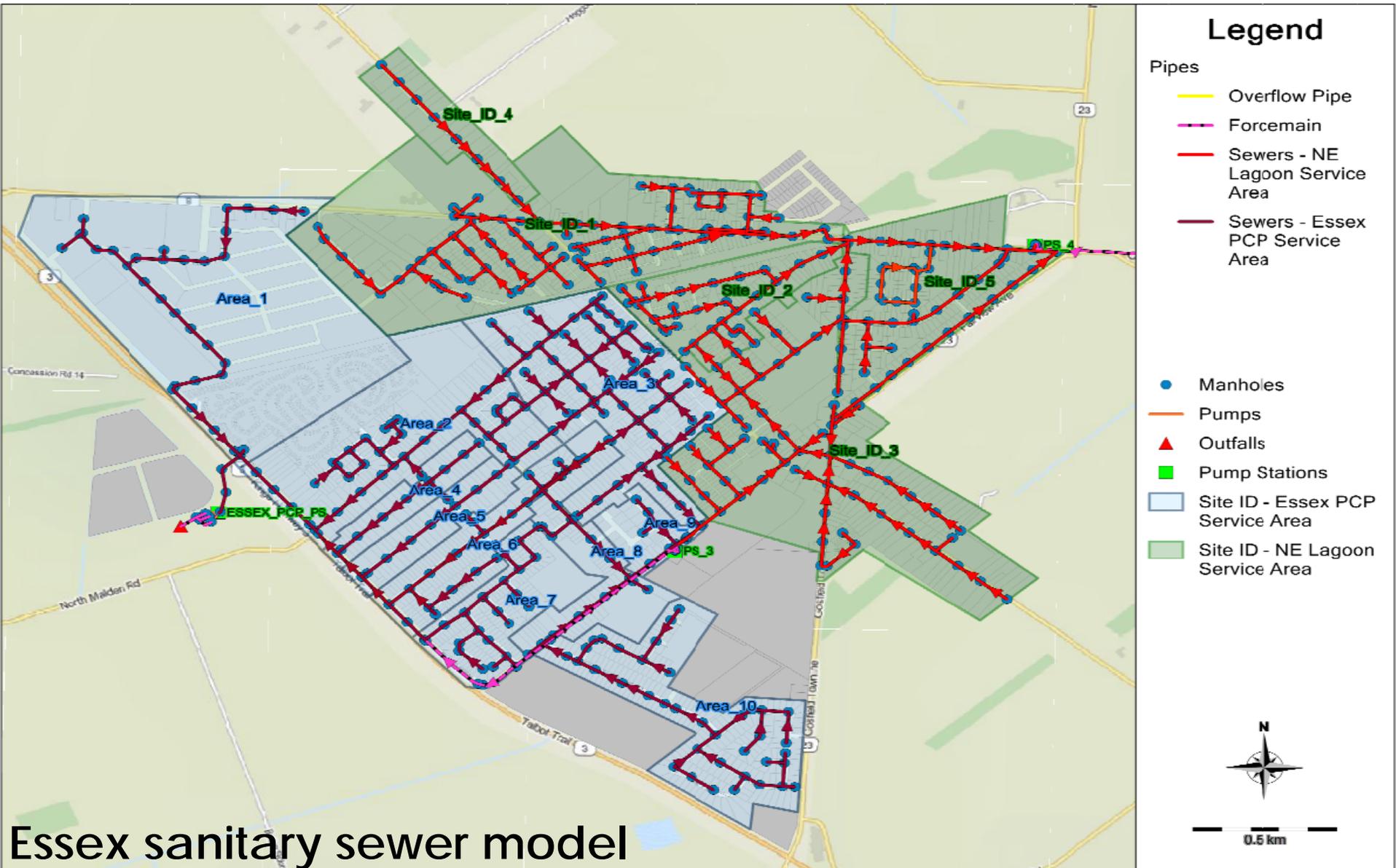
Figure 7: Heavy fog from cleanouts (A, B) and driveway drain (C)

CCTV Inspection

Work Completed:

- CCTV inspection of approximately 6,300 m of various diameter sewers
- Focused on areas have significant I/I, including:
 - South Talbot Road
 - Victoria Ave
 - Kimball Dr
 - Iler Ave
 - Woodview Drive, Joan Flood Drive and Oak St
 - Townsview CT, Golfway Drive and Goodburn CT
 - Brien Ave and Stanton Court
- Results:
- Report given to Town detailing sewers requiring repair/rehabilitation

5 Modeling



Essex sanitary sewer model

Modeling

Purpose:

- Evaluate **what** area(s) of the network are causing sewer back-ups (operating over designed-capacity)?
- Evaluate **why** are these area(s) in the network operating over designed-capacity?
- Evaluate alternatives for improvements to increase capacity

Approach:

- Evaluate **dry weather** flow capacity
- Evaluate the **wet weather** capacity of the system under a variety of rainfall events

Infrastructure limiting capacity in the Essex Sanitary System:

- Gravity sewer pipes
- Pumping station pump capacity

Capacity Assessment: Dry Weather Flow

Gravity Sewers

- Sewers operated adequately under current dry weather loadings.
- Peak liquid level did not exceed 35% of pipe diameter in any pipe in the network at peak dry weather flow.

Pump Stations

- Capacity of all three (3) pump stations was adequate under current dry weather loadings.
- Capacity of pumps utilized was 15-25% of pumping capacity at peak dry weather flow.

Capacity Assessment

Wet Weather Flow: 2-year storms

(2-year storm = 1 ¾" rainfall over 12-hours)

Gravity Sewers

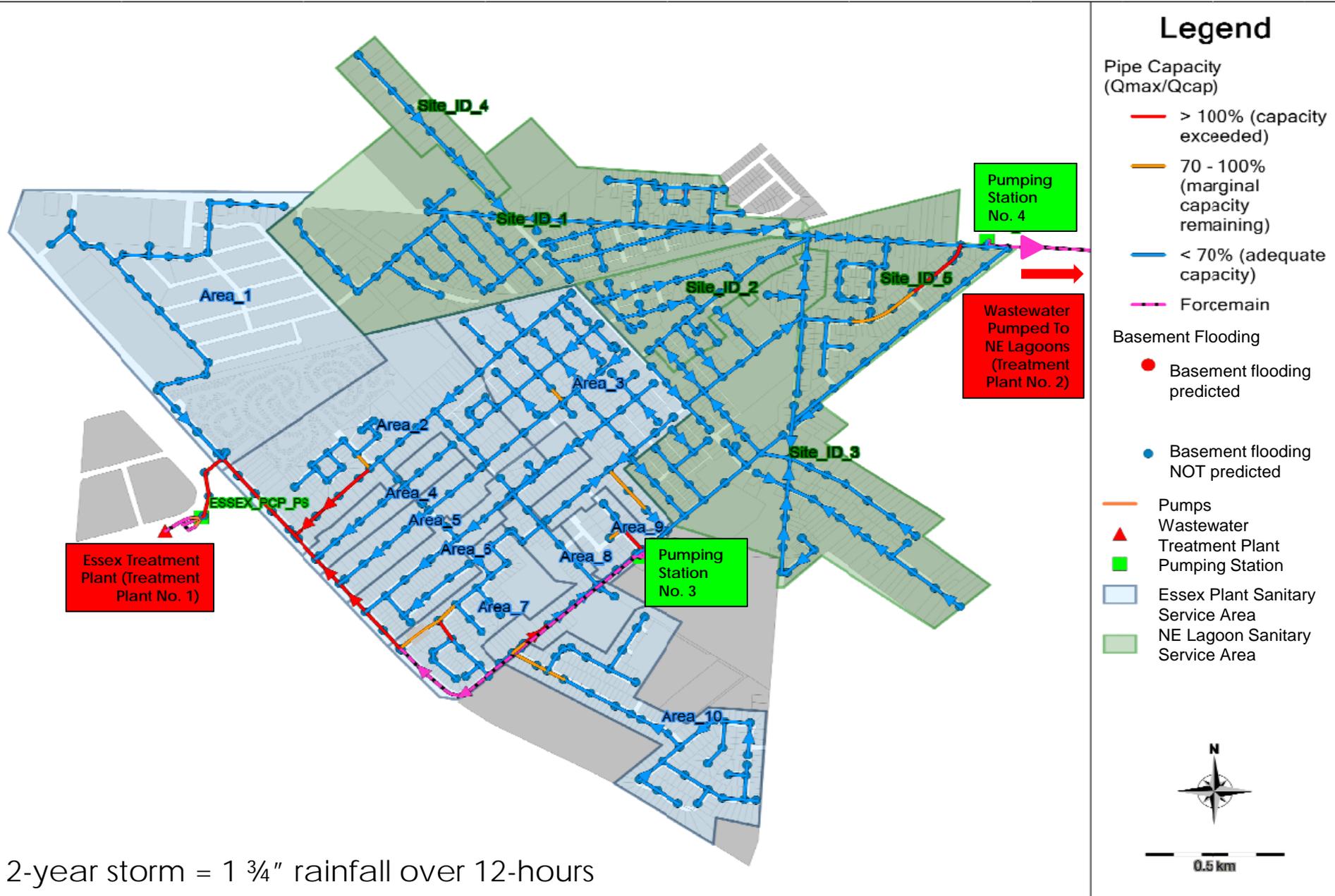
Essex Plant Service Area

- Pipe capacity limited along several portions of the network shown in next slide.

NE Lagoon Service Area

- Pipe capacity limited in the northeast portion of the sewershed.
- No basement flooding was predicted from 2-year storms.

Predicted effect of 2-year storm on sanitary sewer network



Legend

- Pipe Capacity (Qmax/Qcap)**
- > 100% (capacity exceeded)
 - 70 - 100% (marginal capacity remaining)
 - < 70% (adequate capacity)
 - - - Forcemain
- Basement Flooding**
- Basement flooding predicted
 - Basement flooding NOT predicted
- Pumps
 - ▲ Wastewater Treatment Plant
 - Pumping Station
 - Essex Plant Sanitary Service Area
 - NE Lagoon Sanitary Service Area

2-year storm = 1 ¾" rainfall over 12-hours

Capacity Assessment

Wet Weather Flow: 10-year storms

(10-year storm = 2 ½" rainfall over 12-hours)

Gravity Sewers

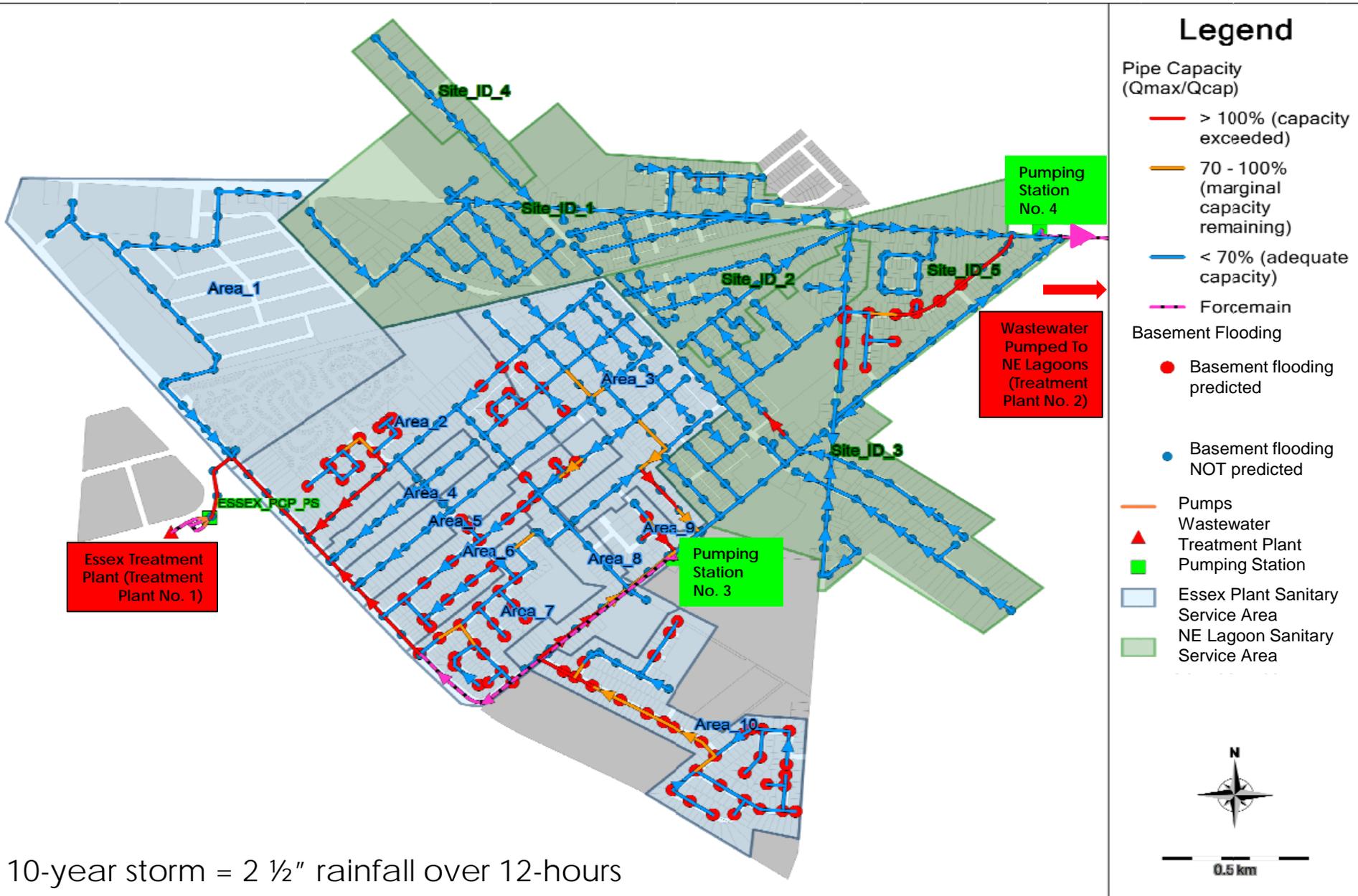
Essex Plant Service Area

- Storms equal to or exceeding 10-year return periods caused the majority of the Essex Plant service area to be surcharged.
- Basement flooding occurred in several portions of the network shown in next slide.

NE Lagoon Service Area

- Pipe capacity further limited in the northeast portion of the sewershed.
- Basement flooding was also prevalent in this subdivision.

Predicted effect of 10-year storm on sanitary sewer network



Capacity Assessment: Wet Weather Flow

Pumping Stations

Table 3: Pump station wet weather capacity assessment

Parameter	Storm Event	Rainfall over 12-hours	NE Lagoon Service Area	Essex Plant Service Area	
Pumping Station			Pumping Station No. 4	Pumping Station No. 3	Essex Plant Pumping Station
Capacity of Station at Peak Flow (%)	2-yr	1 ¾"	36%	105%	91%
Capacity of Station at Peak Flow (%)	5-yr	2 ¼"	45%	110%	99%
Capacity of Station at Peak Flow (%)	10-yr	2 ½"	75%	120%	107%
Capacity of Station at Peak Flow (%)	25-yr	3 ¼"	66%	119%	106%
Capacity of Station at Peak Flow (%)	100-yr	3 7/8"	113%	120%	112%

Historical Rainfall Events

Table 4: Historical rainfall events in the Town of Essex where basement flooding has been reported

Event No.	Rainfall Event Start Date	Estimated Return Period (yrs)	Total Rainfall Depth (in)	Duration (hr)
1	August 11, 2014	> 10yr (<25yr)	2 7/8"	10-hour
2	May-30, 2015	> 25yr (<50yr)	3 3/4"	25-hour
3	Sept-3, 2015	> 25yr (<50yr)	3 3/8"	12-hour

Table 5: Rainfall event in the Town of Essex where basement flooding is predicted

Event No.	Estimated Return Period (yrs)	Total Rainfall Depth (in)	Duration (hr)
Predicted Basement Flooding Event	10yr	2 1/2"	12-hour

6 Findings and Improvements

Improvements to increase system capacity and minimize basement flooding.

Findings - Why Basement Flooding?

- I/I significantly higher than MOE value for typical sewer design
- CCTV and smoke test showing some storm water directly discharge into sanitary sewer
- Pumping Station No. 3 and Essex Plant pumping station can not handle wet weather flow due to significant amount of I/I
- At 2-year storm (1 ¾" over 12-hours) some sewers are operating over-capacity and sewer back-ups are beginning
- At 10-year storms (2 ½" over 12-hours) the sewer backups are causing the liquid level in the network to reach typical household basement elevation

Findings

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Improvements: Minimize Basement Flooding

- Three (3) alternatives will be discussed

Important to Note:

- These alternatives will not prevent rainwater from getting into the sanitary system
- Too many private storm cross-connections exist in the network to reduce the rainwater entering the system significantly enough to mitigate basement flooding
- Once repairs/rehabilitation of manholes, CCTV and smoke testing are completed it is still **NOT** likely this will reduce the rainwater entering the system significantly enough to mitigate basement flooding

Improvements Approach:

- Remove excessive I/I from the sanitary system and store or bypass at the treatment plant

Improvements – Minimize Basement Flooding

- Possible alternatives
 1. Existing Pumping Station upgrades
 2. Adding an additional Remote Pumping Station
 3. Sewer pipe improvements in locations that are over-capacity during storm events due to excessive I/I

Improvements – Minimize Basement Flooding

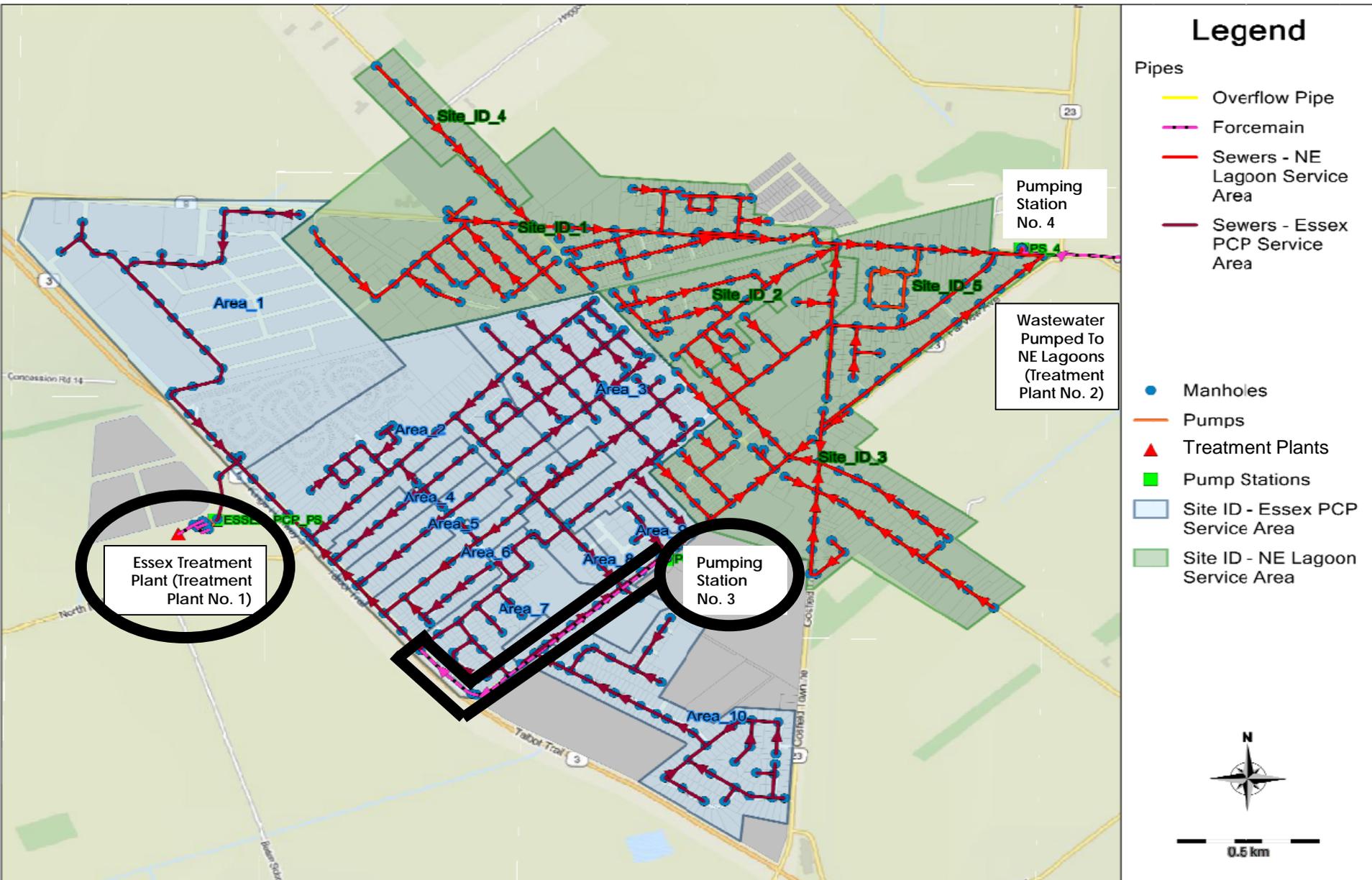
Alternative 1.

Pumping Station Improvements: Existing Pumping Stations

- Increase pumping capacity at Pumping Station No. 3
- Extend existing forcemain at Pumping Station No. 3 directly to the Essex Plant

- Introduce process modifications (including pumping capacity) to bypass flow at the Essex Plant to offline storage basins or to the outfall

Alternative 1: Locations of existing pumping station improvements



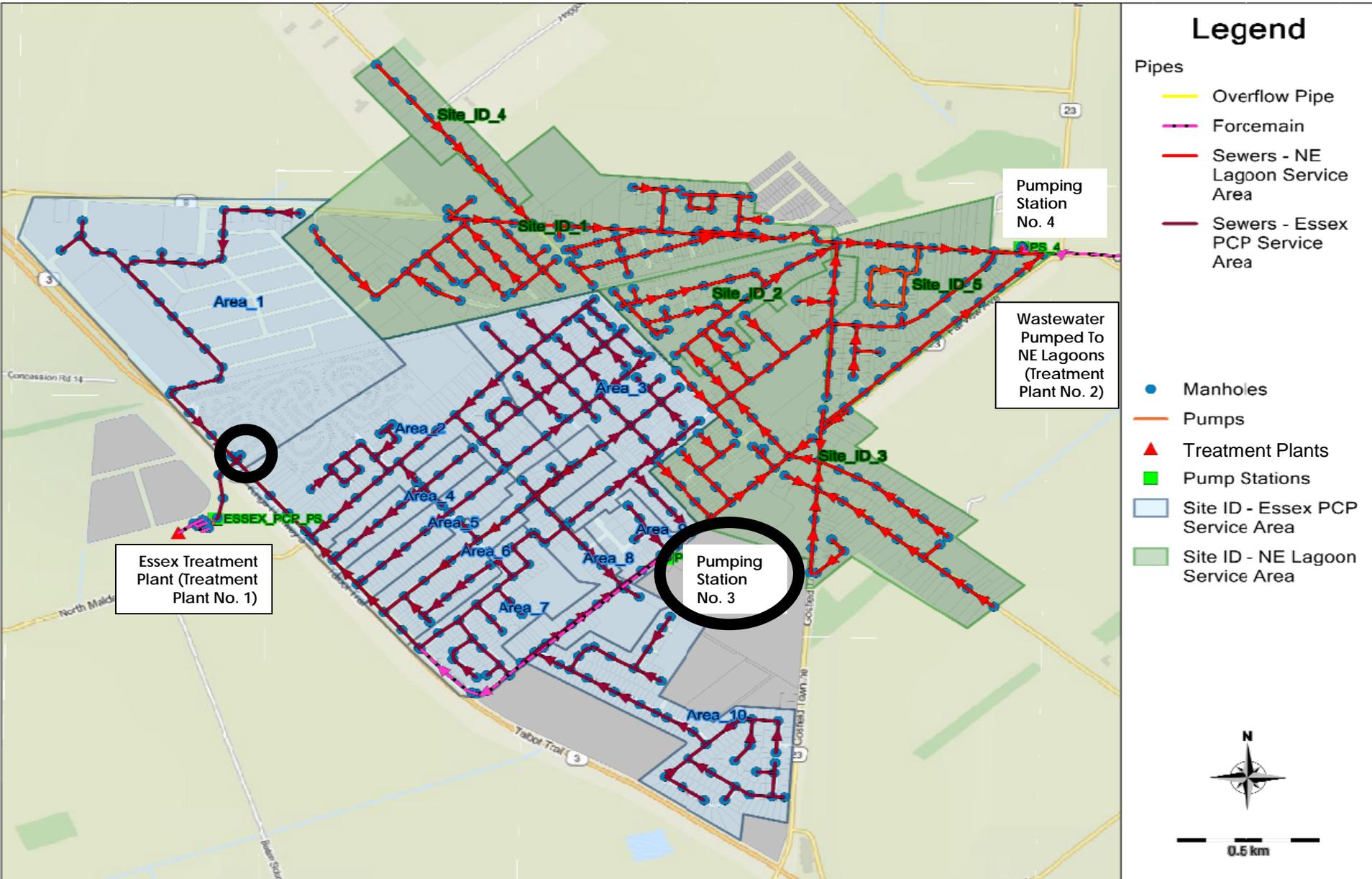
Improvements – Minimize Basement Flooding

Alternative 2.

Pumping Station Improvements – Adding an Additional Remote Pumping Station

- Construct an additional remote pumping station and pump excess flow directly to offline storage basins.
- Potential location could be the decommissioned Pumping Station No. 1.
- The existing building could be renovated and the existing forcemain could potentially be utilized to pump from the remote pumping station directly to offline storage basins.
- Decommissioned lagoons located on the north side of the Essex Plant would be retrofitted into offline storage basins.
- Increase pumping capacity at Pumping Station No. 3

Alternative 2: Location of additional remote pumping station

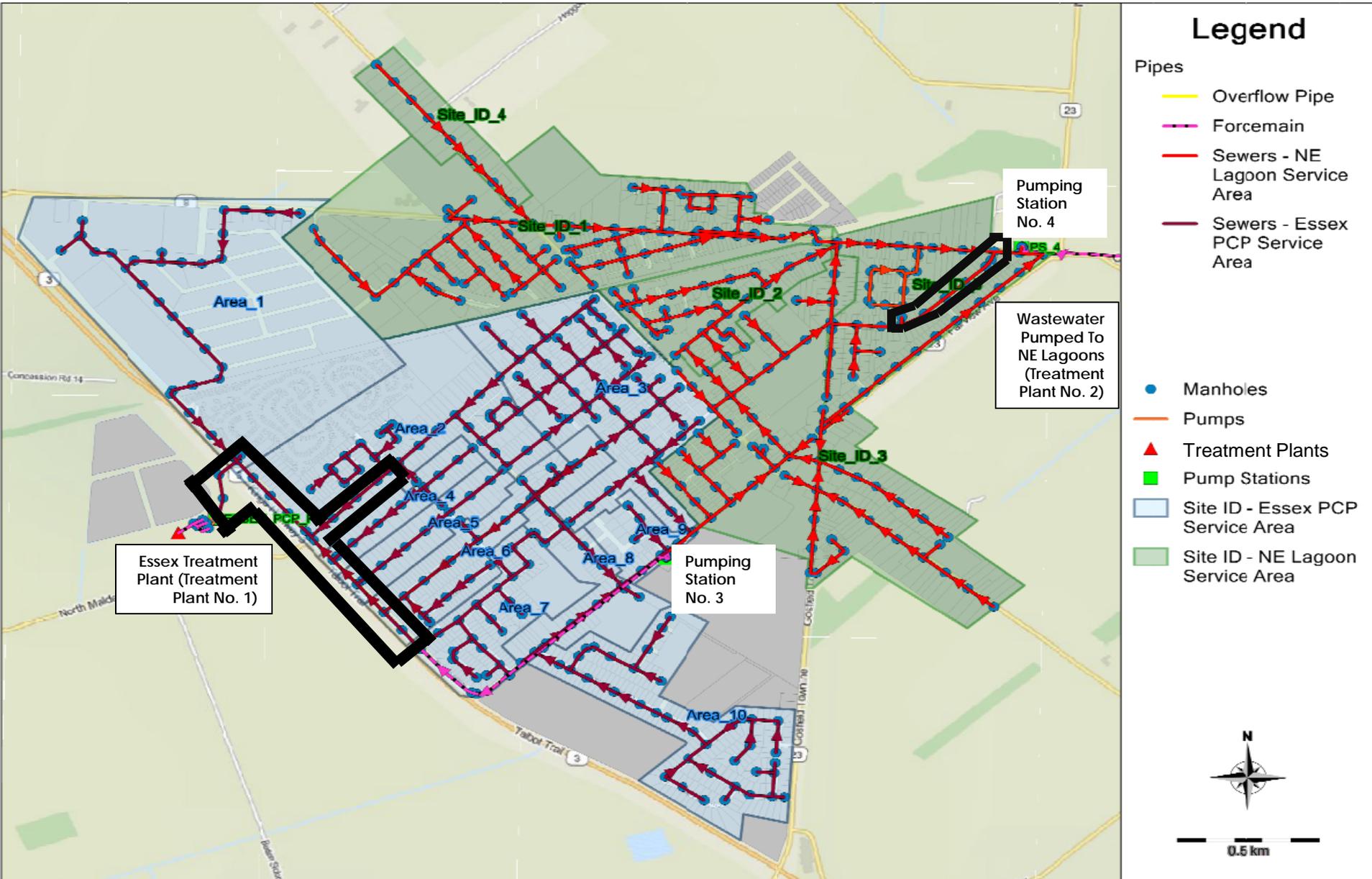


Improvements – Minimize Basement Flooding

3. Sewer pipe improvements in locations that are over-capacity due to excessive I/I

- South Talbot Rd interceptor sewer
- Victoria Ave trunk sewer between Viscount Pkwy and South Talbot Rd
- Brien Ave E trunk sewer between Stanton Ct and Maidstone Ave E
- Sewer pipe capacity could be increased through complete pipeline replacement or twinning next to the existing sewer pipe

Alternative 3: Locations of sewer pipe improvements



7 Recommendations

Recommendations

High priority for short term implementation in an effort to address the basement flooding

- **Alternative No. 1:**
- Upgrade Pumping Station No. 3
- Extend the existing forcemain at Pumping Station No. 3 directly to the Essex Plant
- Introduce process modifications (including pumping capacity) to bypass flow at the Essex Plant to offline storage basins or to the outfall
- Portions of other alternatives still being evaluated

On-going implementation of inflow and infiltration reduction program

- Town to continue to reduce I/I through repair/rehab programs
- Continue educating residents on utilization of private sanitary and storm sewer systems
- On-going partnership with ERCA and MOECC to develop accurate IDF curves for design of storm sewer system
- Flooding committee in final stages of preparing Basement Flooding Protection Subsidy Program to assist residents

Questions



BASEMENT FLOODING PROTECTION SUBSIDY PROGRAM

PROGRAM INFORMATION AND APPLICATION

Council approved a Basement Flooding Protection Subsidy Program (BFP) to assist homeowners.

The BFP is a program assists homeowners by way of a financial subsidy to install a sump pump and/or back-water valve (flood protection devices).

For the application and for further information about this program, please read the enclosed information.

Basement Flooding Protection Subsidy – Eligible Amounts

Install Backwater Valve(s) (Licensed plumber, permit required)

Up to 50% of cost, (\$750. maximum)

Install sump pump to disconnect foundation drains to floor drains

Up to 50% of cost, (\$750. maximum)

Install backwater valve and sump pump

Up to 50% of cost, (\$1,500 maximum)

Disputes with respect to qualifying work will be resolved by the Director of Municipal Services and/or the Chief Building Official or their designate.