



Rainfall Event of July 16, 2021



July 16, 2021 Rainfall Event

- The Town received up to 90 mm of rain in 27 hours
 - With 71 mm falling in 6-hours (10:00 am to 4:00 pm)
- At the peak of the storm it registered just under a 1:50 Year Storm Event



St. Gregory's
Street looking
west



July 16, 2021 Rainfall Event

- St. Mark's Street looking north



July 16, 2021 Rainfall Event

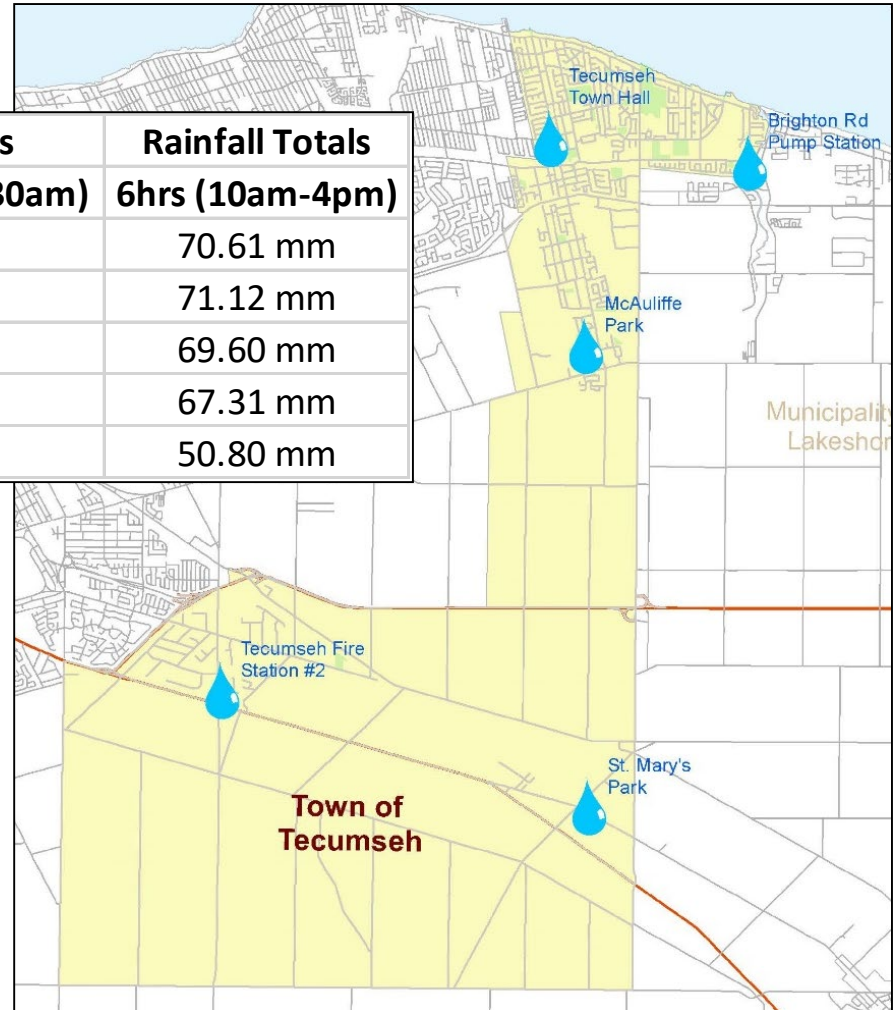
- St. Anne's Street looking south at Intersection Road



July 16, 2021 Rainfall Event

Tecumseh's Rain Gauges

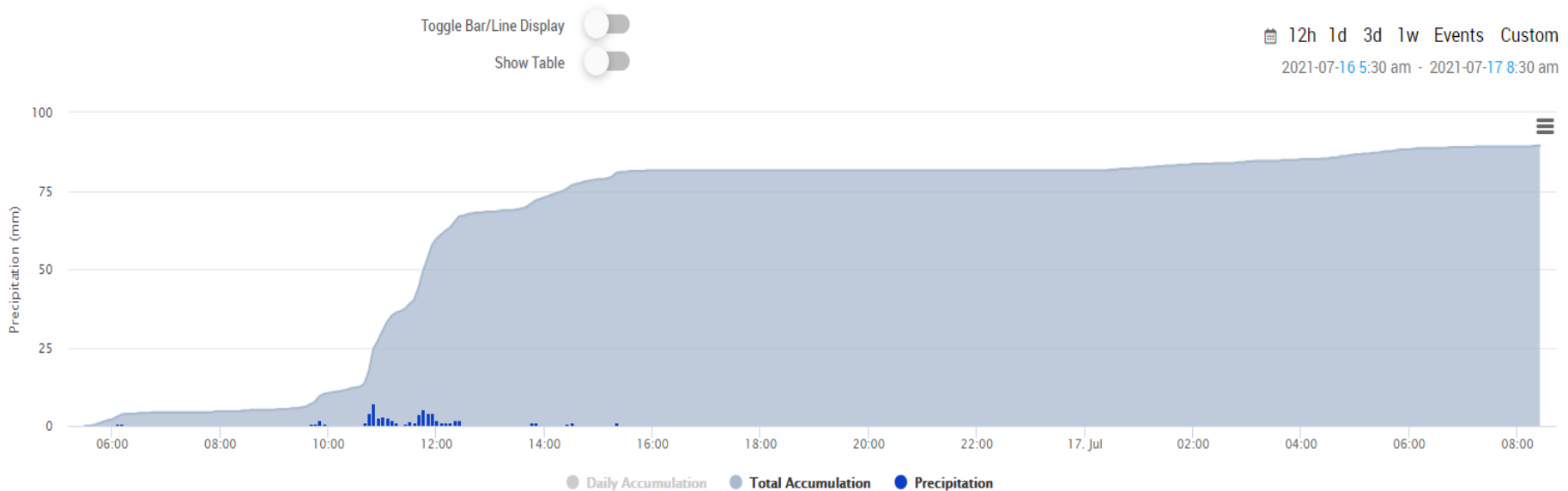
Rain Gauge Location	Rainfall Totals	Rainfall Totals
	27hrs (5:30am-8:30am)	6hrs (10am-4pm)
1) Town Hall	87.38 mm	70.61 mm
2) Brighton Pump Station	89.40 mm	71.12 mm
3) McAuliffe Park	85.35 mm	69.60 mm
4) Fire Station #2 (Oldcastle)	84.33 mm	67.31 mm
5) St. Mary's Park (Maidstone)	71.12 mm	50.80 mm



July 16, 2021 Rainfall Event

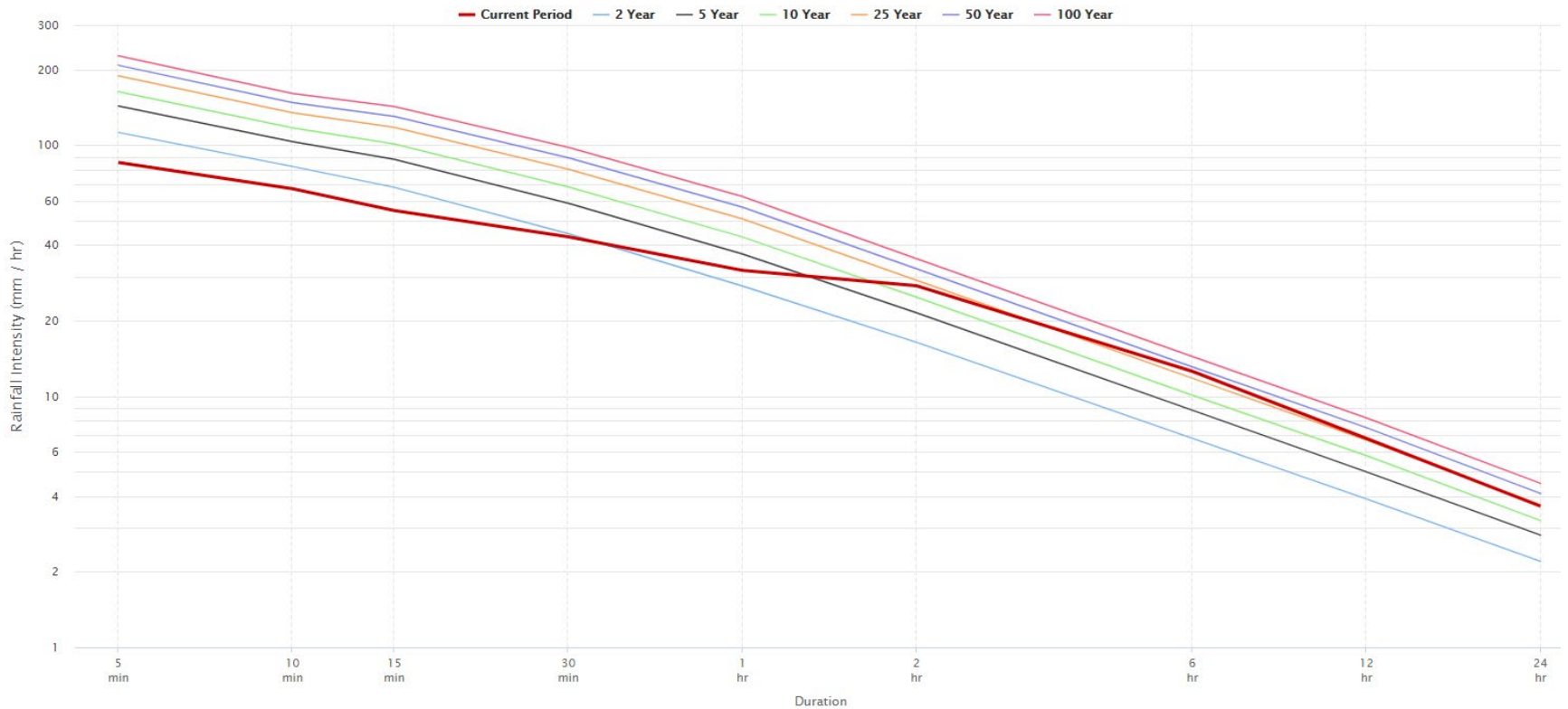
- Brighton Pumping Station Rain Gauge – Precipitation

Precipitation - Tecumseh - Brighton Pumping Station



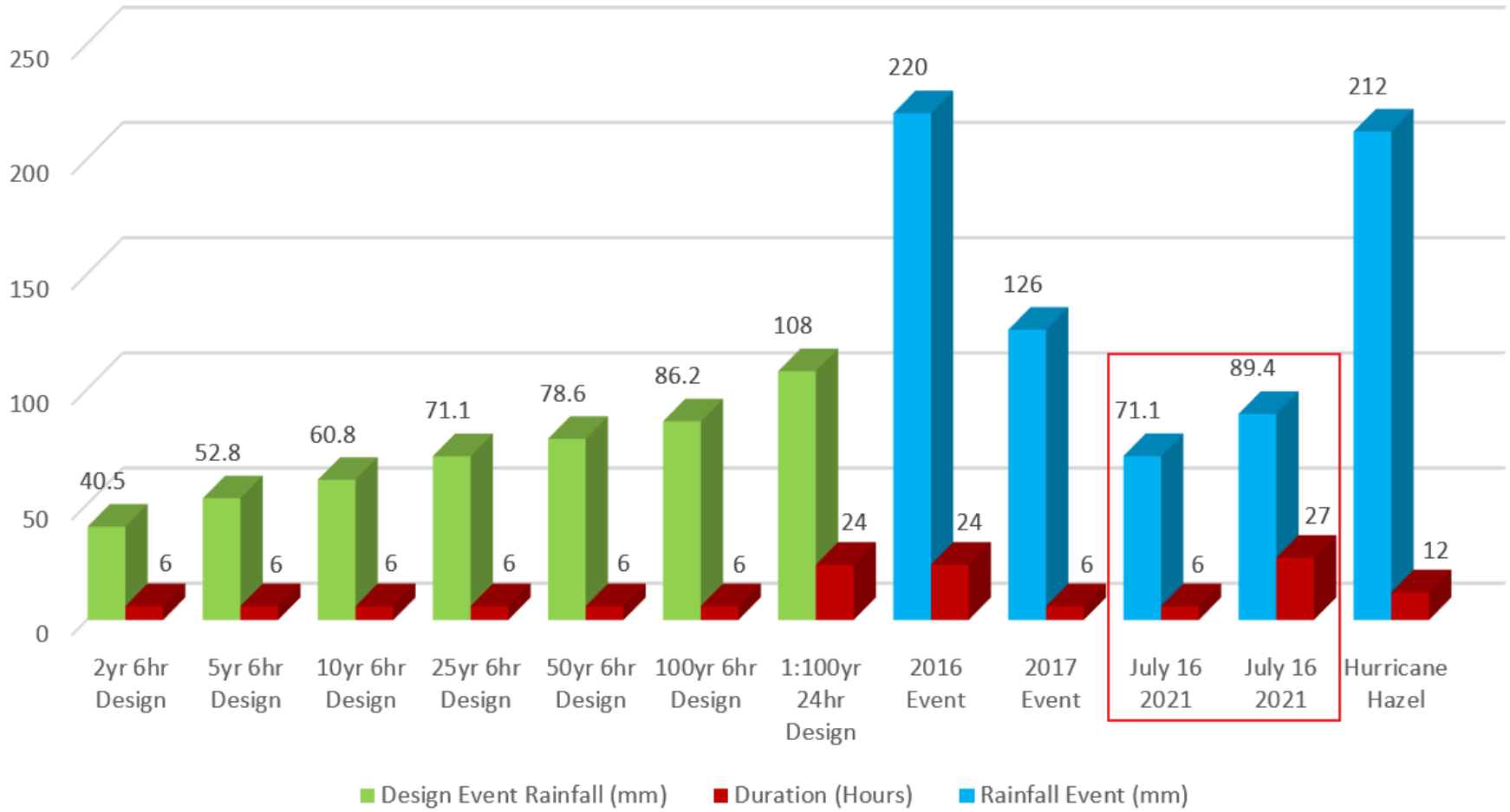
July 16, 2021 Rainfall Event

- Brighton Pumping Station Rain Gauge – IDF Curve



July 16, 2021 Rainfall Event

Design Events vs Rainfall Events



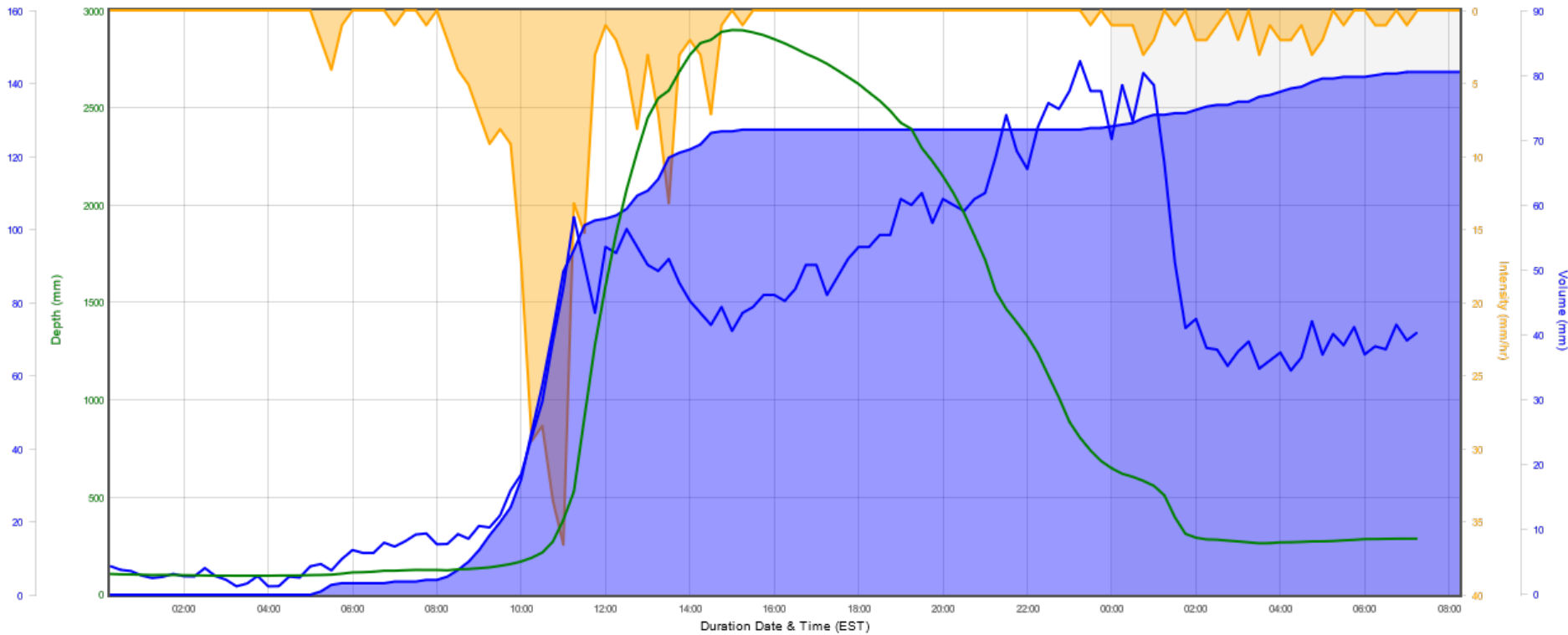
■ Design Event Rainfall (mm) ■ Duration (Hours) ■ Rainfall Event (mm)



July 16, 2021 Rainfall Event

- Sanitary Flow Monitor – Dillon Drive (Little River/St. Thomas)

■ RG1 Intensity(mm/hr)
■ RG1 Volume(mm)
■ TE464 Flow(l/s)
■ TE464 Depth(mm)
 Pipe Size: 457.2mm



Type:	Maximum Depth(mm)	Minimum Depth(mm)	Average Depth(mm)	Maximum Velocity(m/s)	Minimum Velocity(m/s)	Average Velocity(m/s)	Maximum Flow(l/s)	Minimum Flow(l/s)	Average Flow(l/s)
Value:	2899.15	97.47	986.43	0	0	NaN	146.11	2.3	65.91
Date:	07/16/2021	07/16/2021	---	n/a	n/a	---	07/16/2021	07/16/2021	---



July 16, 2021 Rainfall Event

- An intense, high volume of rain fell in 6-hours on July 16th.
- Certain areas of Town received 14mm on the evening of July 15th which could have impacted the moisture content of the soils.
- The rainfall exceeded the capacity of the storm sewer system which resulted in surface and road flooding throughout the Town.
- Storm water flows entered into the sanitary system which resulted in the system surcharging.
- Street flooding is an integral part of the design for storm sewer systems.
- Designing infrastructure larger than a 1:2 or 1:5 Year Event is unfeasible and impractical.



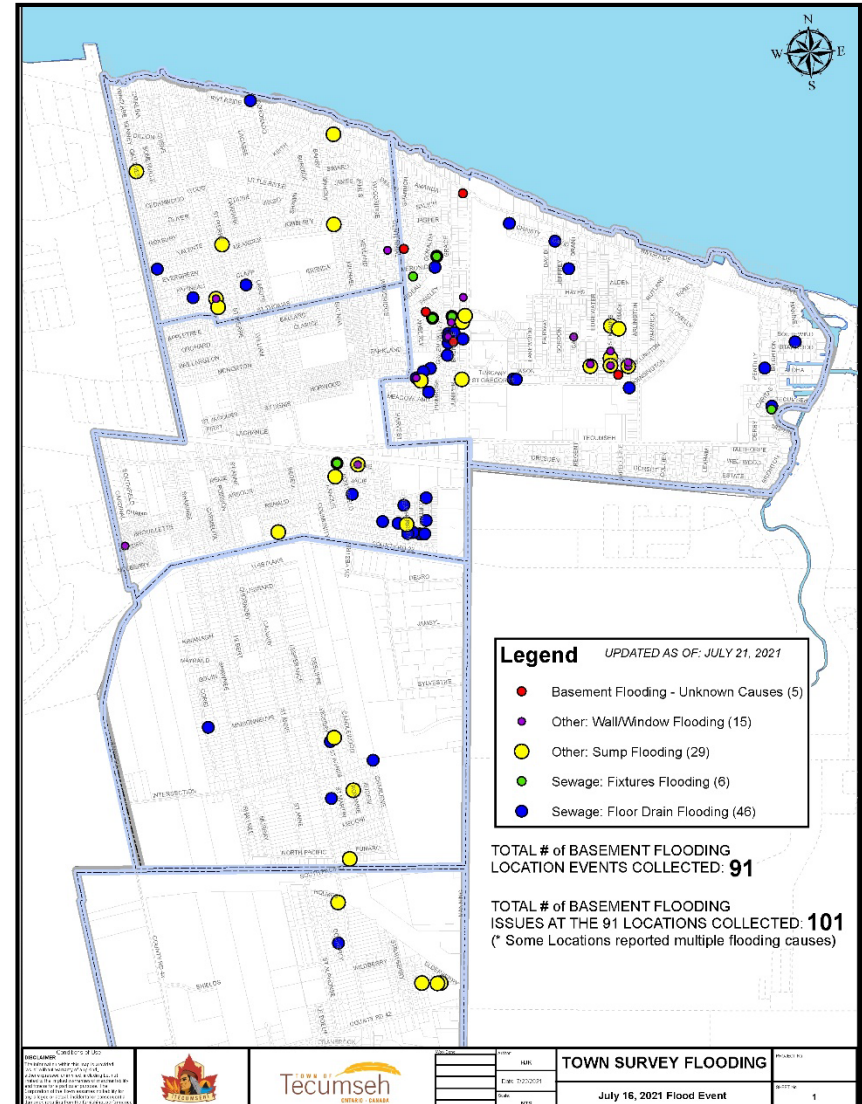
Town Operations during the Rainfall Event

- All storm pumping stations were on, operational & pumping at capacity
- All sanitary pump stations were on, operational & pumping at capacity
- No blockages in storm & sanitary sewers
- Storm & sanitary sewers overwhelmed
- Public Works & Facilities staff on-site ensuring pumps were operational & clear of debris



Location of Basement Flooding

- Flooding of basements occurred primarily north of CR 42
- Basement flooding causes:
 - Water entering through walls & windows
 - Failed & overwhelmed residential sump pumps
 - Surcharged sanitary sewers
- Of the **91** reports of flooded basements:
 - **34** were attributable to sump pump failures or wall
 - **52** from floor drains or plumbing fixtures
 - **5** were of unknown cause



History of Significant Rain Events

Date of Event	Total Rainfall Event	Comments
September 1981	89.0 mm	Basement flooding reported in St. Clair Beach (SCB), Old Tecumseh and Tecumseh Hamlet
July 1983	82.0 mm	Basement flooding in SCB
February 1985	34.6 mm*	Basement flooding in SCB
February 1990	70.6 mm	Basement flooding in SCB
June 2010	89.8 mm	Basement flooding in SCB, Old Tecumseh and Tecumseh Hamlet
September 2011	86.0 mm	Basement flooding in SCB
July 2013	70 mm (in 4 hrs)	Basement flooding in Tecumseh Hamlet
September 2016	270 mm	Basement flooding in SCB, Old Tecumseh and Tecumseh Hamlet
August 2017	126 mm	Basement flooding in SCB, Old Tecumseh and Tecumseh Hamlet
August 2020	110.7 mm	Surface and street flooding in Oldcastle
July 2021	89.4 mm	Basement flooding in SCB, Old Tecumseh and Tecumseh Hamlet. Street flooding in Oldcastle

*Rainfall recorded at Windsor Airport – actual rainfall in SCB likely much higher

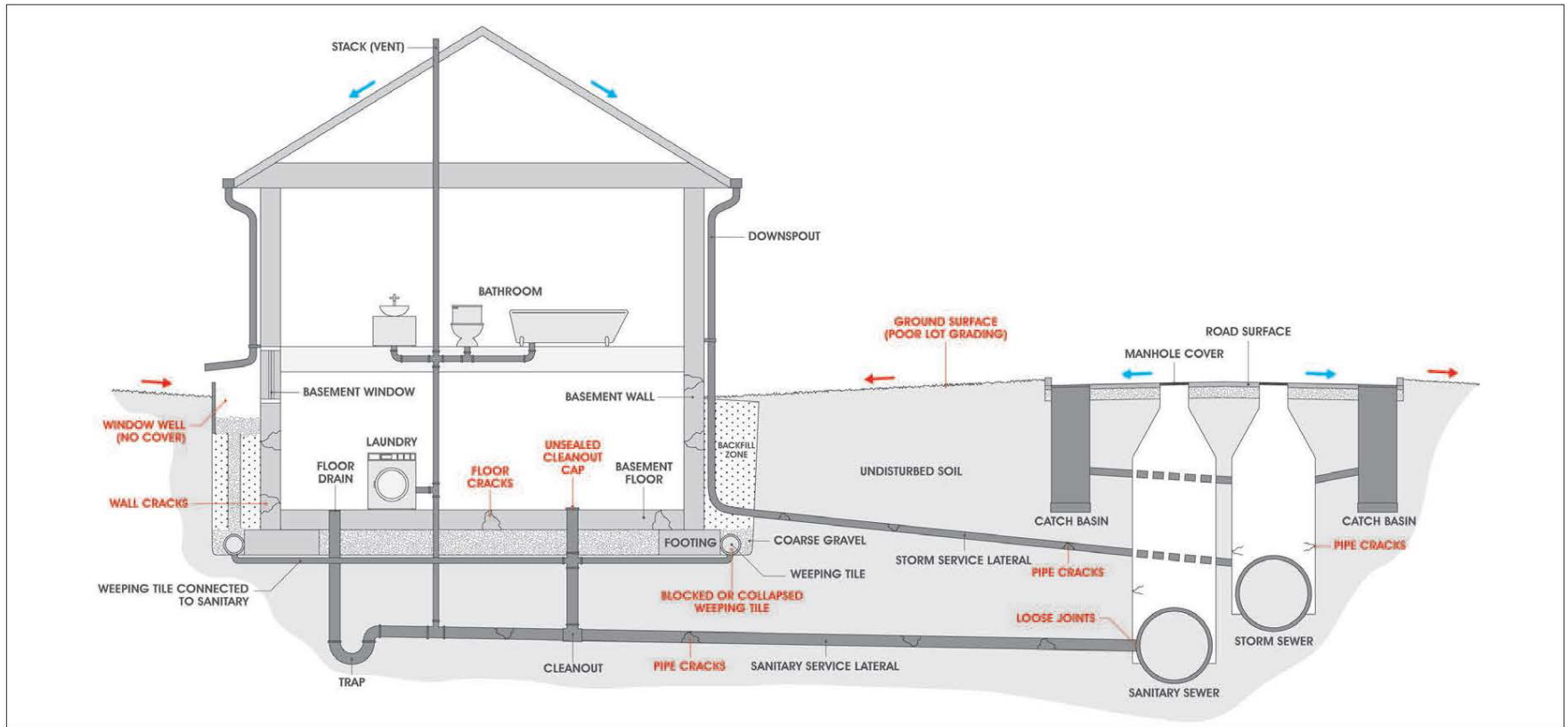


Causes of Basement Flooding

- Basements flood by many different ways during heavy rainfall events, such as:
 - Storm water overwhelming the sump pump
 - Sump pump failure due to power failure, overuse or malfunction
 - A blocked connection between the residence and the main sewer in the street
 - A back-up of wastewater (and storm water) through the sanitary sewer system (via. Floor drain).
 - Through cracks, holes, etc. in basement walls or floors
 - Overland flow through openings in the residence



How flooding can occur in a home



What to look for in this diagram

This diagram shows a home that is at risk of basement flooding from infiltration flooding, overland flooding and sewer backup. In this diagram:

- The cracks in the foundation wall and basement floor are unsealed.
- Downspouts are connected to the municipal sewer system or are discharging too close to the foundation.
- The yard is improperly graded and sloped toward the home.
- The weeping tiles are connected to the sanitary sewer lateral.

- The weeping tiles have not been maintained and are damaged.
- There is no backwater valve in place.
- The sewer laterals have not been maintained, are cracked and have loose joints.
- The storm sewer lateral has not been severed and is prone to exfiltration.
- The backfill area beside the foundation wall is uncapped.
- The sewer cleanout is uncapped and unsealed.
- There is no window well cover in place.

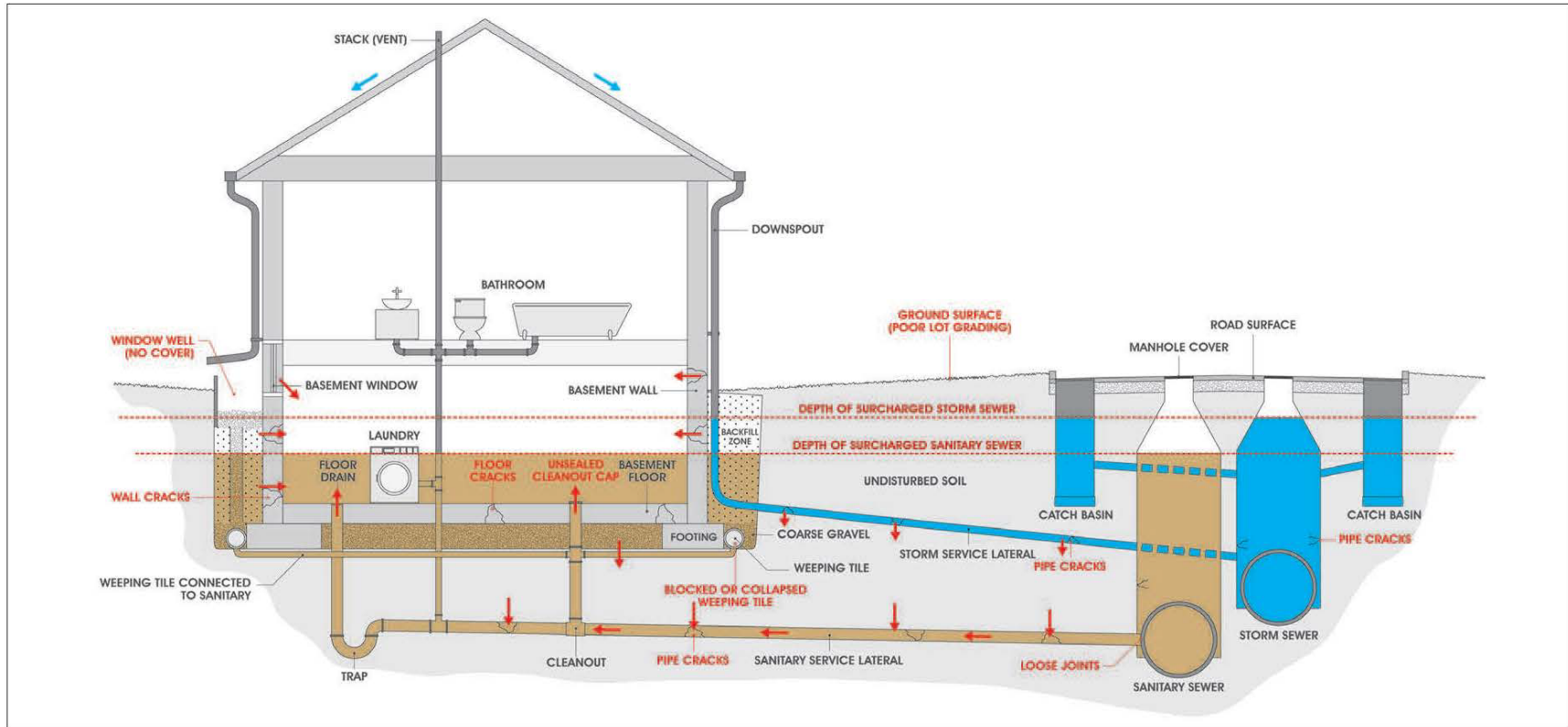


Causes of Sanitary Sewer Back-ups

- An excessive amount of inflow of storm water into the sanitary sewer system that causes the system to be overwhelmed and surcharged:
 - Infiltration into leaky sewers (public and private)
 - Inflow into sanitary manholes located on flooded roadways or low-lying areas
 - Inflow through cross connections of roof downspouts to sanitary sewers
 - Inflow through cross connections in homes (floor drains and foundation drains)
 - Foundation drains being directly connected to the sanitary sewer



Sewer Backup



What to look for in this diagram

This diagram shows how sewer backup can enter a home. In this diagram:

- The sanitary sewer is surcharging and pushing sewage back into the home through the sanitary sewer lateral.
- Sewage is entering the basement through plumbing fixtures, including the basement floor drain and the unsealed sewer cleanout.
- Because the weeping tiles are connected to the sanitary sewer, sewage has been forced into the weeping tiles and is infiltrating into the basement through cracks in the basement walls.

- In this instance, the municipal storm sewer is also surcharging, and forcing storm sewage into the home's storm sewer lateral. High pressure storm sewage is exfiltrating from the storm sewer lateral and entering the sanitary sewer lateral, thereby increasing the amount of sewage that enters the basement.
- The home's sanitary sewer lateral is also in disrepair, and water is entering through cracks and loose joints.



Actions by Homeowners to Reduce the Risk of Basement Flooding

- Ensure ground and pavement surfaces around residence slope away from the building
- Properly install and maintain sump pumps
- Remove cross connections between sump pump, sanitary pipes or floor drains
- Install & maintain backwater valve or a sewage ejector pump
- Disconnect eaves trough downspouts from storm/sanitary piping
- Ensure there are no cracks in the storm water piping around the home
- Ensure there are no cracks or holes in the basement walls or floors that may allow water to enter the basement
- Provide backup power supply to the sump pump
- **Visit the Town's website for further information (www.Tecumseh.ca)**



Flood Prevention Subsidy Program

- The Town offers a financial subsidy to residents for:
 - Backwater Valve – 80% up to \$800
 - Foundation Drain Disconnection – 50% up to \$1,060

Year	Number of Applications (as of July 16, 2021)	
	Backwater Valve	Foundation Drain Disconnection
2012-2015	8	0
2016	263	31
2017	409	43
2018	68	6
2019	66	10
2020	19	11
2021	4	1
TOTALS	837	102
Est. Value	\$669,600	\$108,120



Why do roads flood so often?

- Storm sewers are designed to a 1:2 or a 1:5 Year Storm Event (equivalent to 40.5mm and 52.8mm over 6-hrs respectively) – based on historical data in the region
- Road flooding is expected during larger rain events that exceed the capacity of the storm sewers
- Most new subdivisions are designed to include temporary road storage (up to 1-ft (0.3m)) during major rain events as part of their storm water controls



How does development impact flooding?

- Any proposed developments are required to implement stormwater management controls to ensure there are no adverse impacts
 - Allowable release rate based on the capacity of the receiver (sewer/drain/creek)
 - Temporary on-site storage
 - Have regard to the 1:100 Year Rain Event
- Designed by Professional Engineers
 - Provincial Guidelines
 - Windsor/Essex Region Stormwater Management Standards (2019)
- The Town's Stormwater Master Plans and Modelling are essential tools
- Private stormwater facilities:
 - Surface storage in parking lots or swales
 - Underground storage chambers
 - Stormwater ponds (dry or wet)



Town Flood Mitigation Strategy

- Outlined in Council Report PWES-2018-17
 - Multifaceted plan to reduce the impact and lessen the extent of basement flooding associated with severe rainfall events
- 1) Completion of the Town's Development Manual
 - 2) Town-wide Site Plan Control
 - 3) Mandatory Sewage Ejector Pump Installations on New Homes
 - 4) Completion of Storm Drainage Master Plans
 - 5) Completion of the Windsor/Essex Region Stormwater Management Standards
 - 6) Completion of a Regional Climate Change Strategy (Climate Adaptation Plan)
 - 7) Installation of a Regional Weather Station Network (Rain Gauges)
 - 8) Completion of a Pump Station Emergency Response Plan



Town Flood Mitigation Strategy...Cont'd

- 9) Completion of a Shoreline Management Plan
- 10) Sanitary Sewer Rehabilitation (I&I Removal)
- 11) Increase in Sanitary Sewer Storage Capacity
- 12) Continued Flow Monitoring and Sanitary Sewer Modelling
- 13) Public Education and Awareness Program on Managing Risk of Basement Flooding
- 14) Mandatory Downspout Disconnection Program
- 15) Mandatory Foundation Drain Disconnection & Storm Sump Pump Installation Subsidy Program
- 16) Backwater Valve Installation Subsidy Program
- 17) Sewage Ejector Pump Installation Subsidy Program
- 18) Creation of an annual inspection program for private stormwater management facilities



Recent Actions by the Town

- The following list of storm and sanitary studies/projects spanning from 2004 to 2028 total \$79.81M
- 2004 Town of Tecumseh I&I Control Study (**\$0.2M**)
- 2008 County Road 22 Relief Sanitary Sewer & Outlet (**\$2.7M**)
- 2008 Water & Wastewater Master Plan (**\$0.2M**)
- 2008-2009 Brighton Road Storm Pump Station (**\$5.6M**)
- 2009, 2015 & 2021 Water & Wastewater Rate Studies (**\$0.06M**)
- 2010 Wastewater Assessment & Mitigation Plan *
- 2010-2011 Sanitary Sewer Assessment (**\$0.1M**)
- 2011-2013 Sanitary Sewage Collection System Improvements, Class EA (**\$0.25M**)

* Costs associated to implement this plan are accounted for in their individual studies and projects



Recent Actions by the Town...Cont'd

- 2012 Lesperance Road Twin Sanitary Sewer (**\$0.25M**)
- 2012-2021 Flood Prevention Subsidy Program (**\$0.8M**)
- 2012 Emergency Backup Power at Storm Pump Stations (**\$1.1M**)
- 2013-2014 Manning Road Storm Pump Station (**\$8.6M**)
- 2014 Lakewood Park Sanitary Pump Station & Storage Trunk (**\$4.3M**)
- 2014 Lakewood Park Storm Channel (**\$0.7M**)
- 2014-2018 Oldcastle Storm Sewer Replacements (**\$2.6M**)
- 2014-2021 Municipal Drain repairs and improvements (**\$6.0M**)
- 2015 Update to the Region's Intensity-Duration-Frequency (IDF) Curves (**\$0.01M**)
- 2015-2021 Miscellaneous Storm Pump Station Repairs (**\$0.3M**)
- 2016 Pump & Metering Station Condition Assessments (**\$0.1M**)



Recent Actions by the Town...Cont'd

- 2016-2021 Upper Little River Watershed Drainage and Stormwater Management Master Plan (**\$0.06M**)
- 2017-2019 Windsor/Essex Region Stormwater Management Standards (**\$0.01M**)
- 2017-2019 Water & Wastewater Master Plan Update (**\$0.15M**)
- 2017-2019 Storm Drainage Master Plan (**\$0.65M**)
- 2018 Flood Mitigation Strategy *
- 2018 Weather Station Network installation (**\$0.03M**)
- 2018 Cedarwood Sanitary Pump Station (**\$1.0M**)
- 2018-2019 Sanitary Sewer Rehabilitation (I&I Removal) (**\$3.6M**)
- 2018-2019 Sanitary Manholes: Rain Shields (**\$0.1M**)
- 2018-2021 Manning Road Improvements Phase 2 (**\$5.6M**)

* Initiatives completed in-house



Recent Actions by the Town...Cont'd

- 2019 Flood Response Plan *
- 2019-2021 Ongoing Lake Flooding Action Group Meetings *
- 2019-2021 Oldcastle Stormwater Management Plan (**\$0.45M**)
- 2019-2021 Sanitary Sewer Model Update (**\$0.25M**)
- 2019-2021 Endorsement of Service Lines Warranties of Canada Program *
- 2020 Tecumseh Road Sanitary Sewer (**\$2.2M**)
- 2020 Lake Flood Response Action Plan *
- 2020 Lake Flooding Emergency Flood Mitigation Works (**\$0.4M**)
- 2020-2021 Shoreline Management Plan (**\$0.4M**)
- 2020-2021 Stormwater Rate Study (**\$0.04M**)
- 2021 Purchase of High Water Rescue Vehicle (**\$0.21M**)

* Initiatives completed in-house



Recent Actions by the Town...Cont'd

- 2021-2022 Turkey Creek Watershed – Hydrologic & Hydraulic Modelling (**\$0.04M**)
- 2021-2022 Tecumseh Road Storm Sewer & Road Improvements (**\$4.0M**)
- 2021-2028 Disaster Mitigation & Adaptation Fund Projects (3 Storm Pump Stations) (**\$26.75M**)
- Continued Education on Basement Flooding Prevention *
- Continued Flow Monitoring of Sanitary Sewer System *
- All new subdivisions on sewage ejector pumps *

* Initiatives completed in-house



Successful Grant Applications: \$27.7M

- Municipal Infrastructure Investment Initiative (MIII) (**\$4.5M**)
 - 2008 Brighton Road Storm Pump Station
- Canada-Ontario Municipal Rural Infrastructure Fund (COMRIF) (**\$6.13M**)
 - 2012 Manning Road Storm Pump Station
- Municipalities For Climate Innovation (MCIP) (**\$0.175M**)
 - 2017-2019 Storm Drainage Master Plan
- Ontario Community Infrastructure Fund (OCIF) (**\$1.3M**)
 - 2018-2019 Sanitary Sewer Rehabilitation (I&I Removal)



Successful Grant Applications: \$27.7M

- Canada Water Wastewater Fund (CWWF) (**\$1.7M**)
 - 2018-2019 Sanitary Sewer Rehabilitation (I&I Removal)
- National Disaster Mitigation Program (NDMP), Intake 5 (**\$0.15M**)
 - 2019-2021 Oldcastle Stormwater Master Plan
- Ontario Community Infrastructure Fund (OCIF) (**\$3.03M**)
 - 2021 Manning Road Improvements, Phase 2
- Disaster Mitigation & Adaptation Fund (DMAF), Intake 3 (**\$10.7M**)
 - 2021-2028 Scully, St. Marks, P.J. Cecile Storm Pump Stations



Closing Statements

- The Town's past actions, proposed modifications and infrastructure improvements are significant; however, they alone will not guarantee that a basement flooding event will never occur again.
- We continue to encourage residents to take action to inspect & modify their properties to reduce the impact of heavy rainfall events.
- Visit the Town's website for further information on the Flood Prevention Subsidy Program, as well as publications on 'Reducing Basement Flooding' and how to 'Protect your Home from Basement Flooding'.
- The combined effect of all actions (public & private) will serve to reduce the impact of heavy rainfall events and lessen the extent of basement flooding associated with these events.

