



Etobicoke Exfiltration System: Monitoring and Evaluation

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Presentation Outline

- Summary of 1994 – 1995 Candaras Associates study
- Summary of 1996-1998 SWAMP Study
- Follow up monitoring in 2013 and 2014
- Other exfiltration system designs

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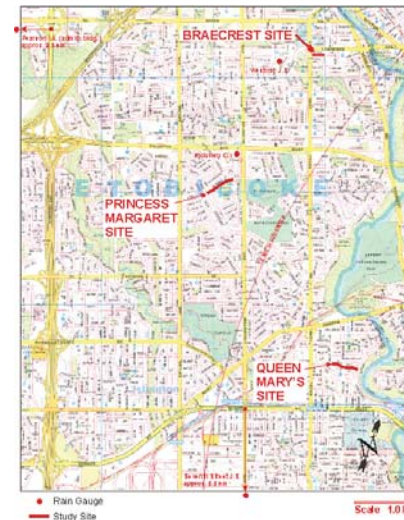


Performance Assessments

- Exfiltration system – Princess Margaret Blvd
- Exfiltration system – Queen Mary Drive
- Filtration System on Braecrest Avenue

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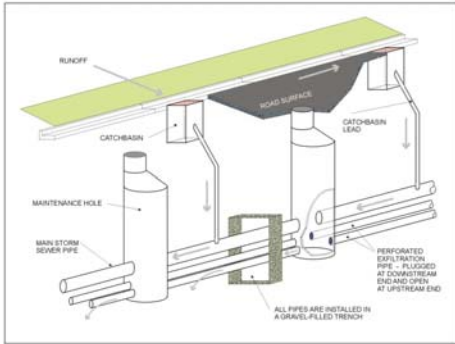


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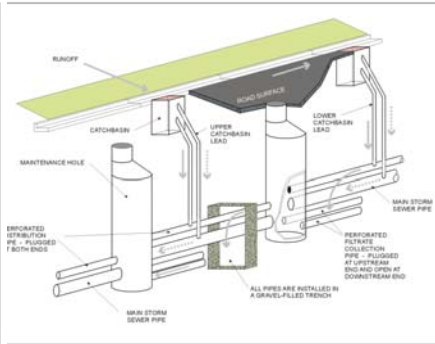


Exfiltration and Filtration Systems



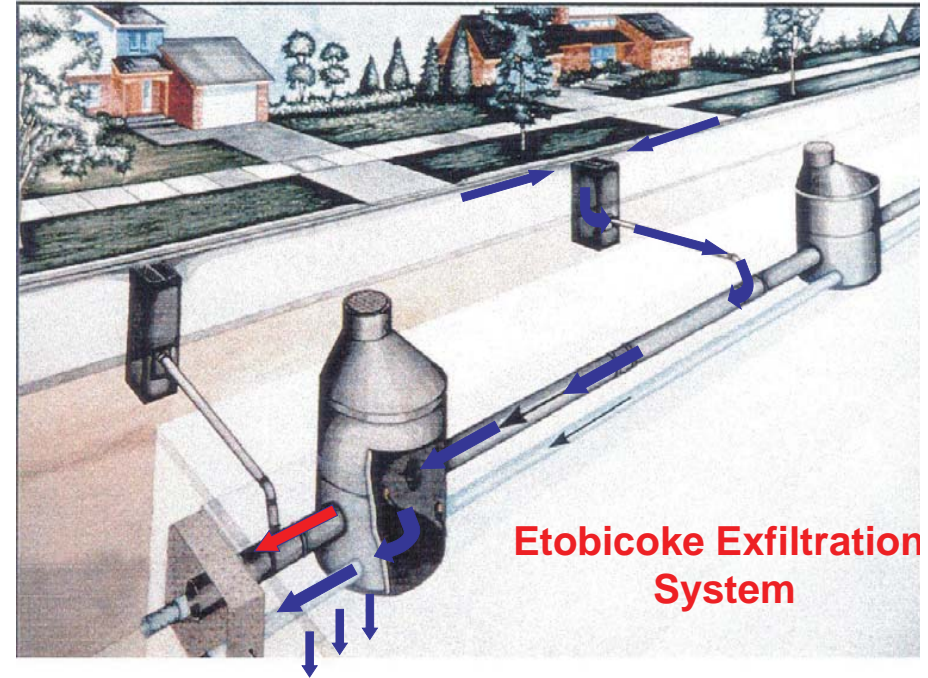
Exfiltration System

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Filtration System

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Princess Margaret Blvd Site



— Exfiltration sewer system
- - - Conventional storm sewer

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Princess Margaret Blvd Site Characteristics and System Design

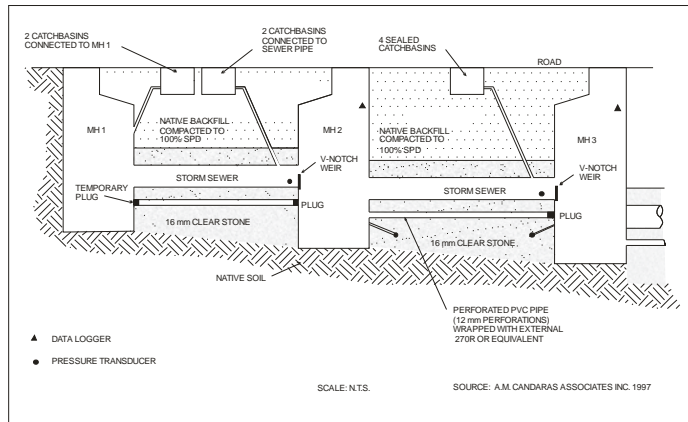
- 30.5 ha low density residential
- Clay to clay silt till over silty sand
- No groundwater interference
- Design storm was 15 mm, 1 hour AES storm, which was thought to be equivalent to the 90th percentile event
- Peak rainfall intensity = 56 mm/h or 4.7 mm/5 minutes

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Candaras Associates Study Princess Margaret Blvd



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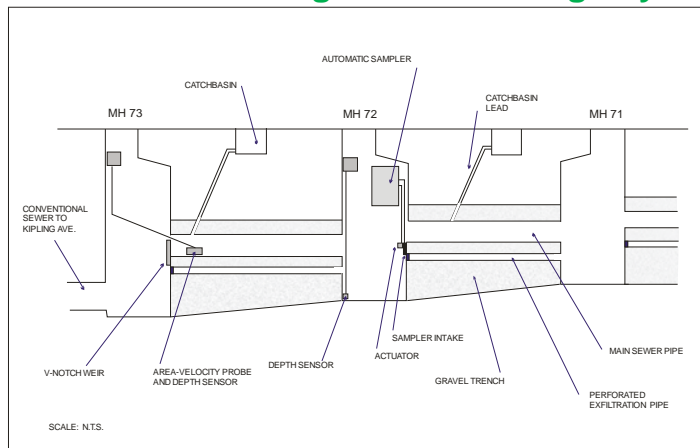


Candaras Associates Study Princess Margaret Results

Date	Event Size	Peak Inflow	Peak Outflow	Trench Peak Water Level Upstream	Trench Peak Water Level Downstream	Water Level at which overflow occurs
May 26, 1994	28 mm over 22.5 hours	9.7 L/s	0.3 L/s	0 mm	65 mm	650 mm
May 31, 1994	11 mm over 0.5 hours	8.1 L/s	1.5 L/s	0 mm	5 mm	650 mm
June 24, 1994	24 mm over 24 hours	2.2 L/s	0.1 L/s	0 mm	3 mm	650 mm
Oct 5-6, 1995	63 mm over 18 hours	10 L/s	3.3 L/s	380 mm	500 mm	650 mm



SWAMP Study Princess Margaret Monitoring Lay-out



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SWAMP Study Princess Margaret Results: 1996 - 1998

- No overflows in 1996 – 2 rain events above 15 mm
- No overflows in 1997 – 7 rain events above 15 mm
- 3 events caused overflow in 1998, no overflow from 2 events > 15 mm
 - 20.2 mm followed by 3.6 mm two days later
 - 14.9 mm followed by 11.9 mm the same day (26.8 mm total)
 - 15.3 mm, high intensity (9.7 mm in 5 minutes)
- 98% of rainfall runoff infiltrated
- Mean TSS concentrations in sewer were 164 mg/L and 81 mg/L in summer and winter, respectively

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SWAMP Study PM Large Event Summary

Date	Duration ¹ (min)	Total Depth (mm)	Maximum 5-minute (mm)	Maximum hour (mm)	Overflow MH 72
Oct. 18, '96	840	26.7	n/a	14.0	N
Nov. 7-8, '96	600	18.0	n/a	5.9	N
Aug. 15, '97	240	20.8	n/a	11.0	N
Aug. 20-21, '97	1,140	40.4	n/a	5.6	N
Sep. 10, '97	600	16.0	n/a	3.6	N
Nov. 1, '97	660	23.0	n/a	5.0	N
May 10-11, '98	2,885	42.8	0.5	3.6	N
June 11-13, '98	420	20.2	1.4	4.6	N
June 13, '98	55	3.6	0.7	2.8	Y
June 30, '98	170	26.8	4.2	10.7	Y
Sept. 6, '98	45	15.3	9.7	14.8	Y

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Queen Mary's Drive Site Characteristics and System Design

- 13.3 ha low density residential
- Sand and silty sand native soils
- Roof and foundation drains directly connected to sewer
- Groundwater at 1.2 m from surface

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Queen Mary's Drive Site

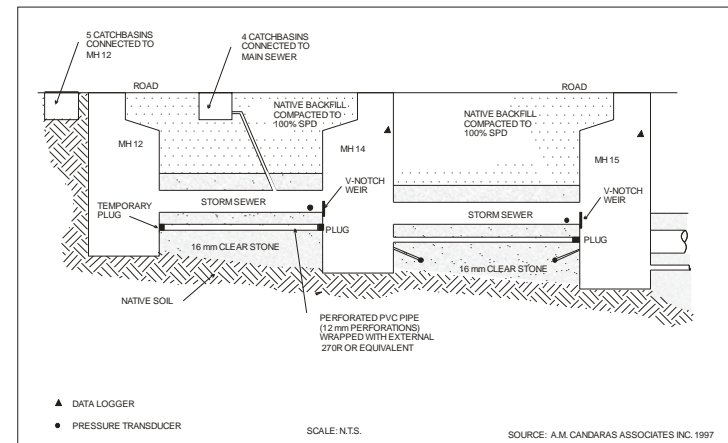


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Candaras Associates Study Queen Mary's Drive Study



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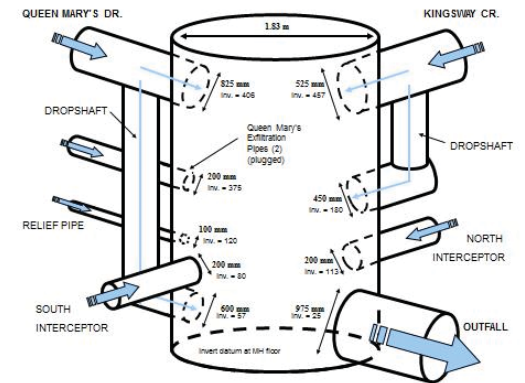
Candaras Associates Study Queen Mary's Drive Study Results

Date	Event Size	Peak Inflow	Peak Outflow	Trench Peak Water Level Upstream	Trench Peak Water Level Downstream	Water Level at which overflow occurs
Sept 25, 1994	19.1 mm over 6 hours	52 L/s	6.5 L/s	220 mm	180 mm	650 mm
Oct. 5-6, 1995	63 mm over 18 hours	17.5 L/s	10 L/s	150 mm	550 mm	650 mm



Results of SWAMP EES monitoring Queen Mary's Drive

- Inconclusive



Follow up Monitoring in 2013-14



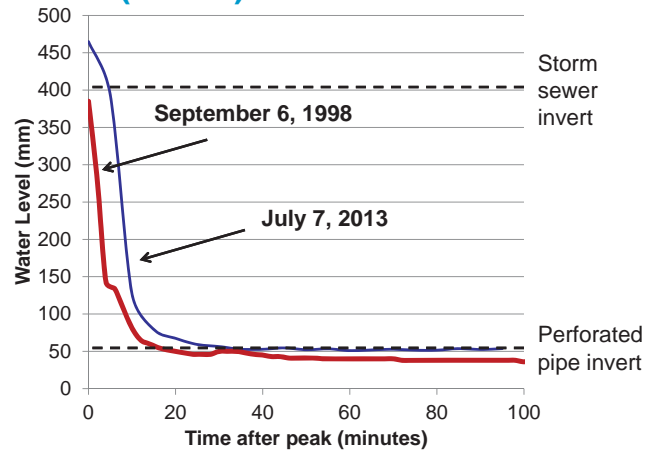
Princess Margaret Blvd Sewer Inspection





PM Water Level Drawdown Rate in 1998 and 2013 (MH 72)

- Limited maintenance
- Still infiltrating well after 14 years



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Princess Margaret Blvd

Large Event Summary

Date	Duration ¹ (hh:mm)	Total Depth (mm)	Maximum 5-minute (mm)	Overflow MH 72	Overflow MH 71
June 12, 2014	3:45	24.8	4.8	Y	Y
June 17, 2014	0:50	13.4	3.6	Y	Y
June 25, 2014	1:15	19.6	4.8	Y	Y
July 7, 2014	4:25	12.0	0.6	N	N
July 8, 2014	6:10	14.6	4.2	N	N
July 27, 2014	13:10	35.0	2.6	N	Y
August 12, 2014	1:50	10.0	1.4	N	Y
Sept 2, 2014	5:10	20.8	4.4	N	Y
Sept 5, 2014	10:55	25.2	0.8	N	Y
Sept 10, 2014	11:45	35	2.2	Y	Y
Sept 21, 2014	2:05	13	3.2	N	Y
Oct 3, 2014	12:50	16	3.6	N	Y
Nov 24, 2014	13:05	22.4	1.4	N	N



Queen Mary



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Queen Mary Sewer Inspection

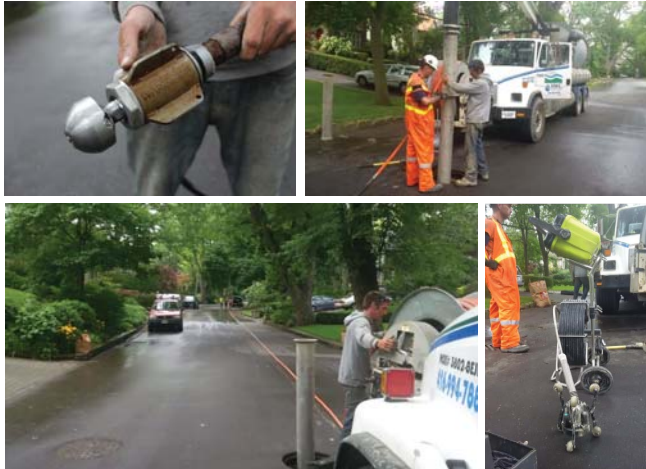


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Queen Mary Clean Out



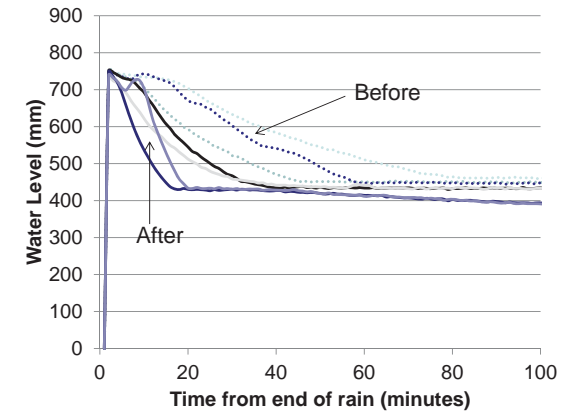
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Queen Mary Water Level Drawdown Before and After Maintenance

- Average water level drawdown rate roughly doubled after maintenance



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Queen Mary

Large Event Summary 2014

Date	Duration ¹ (hh:mm)	Total Depth (mm)	Maximum 5-minute (mm)	Overflow
June 12, 2014	3:45	24.8	4.8	Y
June 17, 2014	0:50	13.4	3.6	Y
June 25, 2014	1:15	19.6	4.8	Y
July 7, 2014	4:25	12.0	0.6	Y
July 8, 2014	6:10	14.6	4.2	Y
July 27, 2014	13:10	35.0	2.6	Y
August 12, 2014	1:50	10.0	1.4	Y
Sept 2, 2014	5:10	20.8	4.4	Y
Sept 5, 2014	10:55	25.2	0.8	Y
Sept 10, 2014	11:45	35	2.2	Y
Sept 21, 2014	2:05	13	3.2	Y
Oct 3, 2014	12:50	16	3.6	N
Nov 24, 2014	13:05	22.4	1.4	Y

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General Conclusions

- PM exfiltration system continues to meet design target
- Overflows often occurred due to limited through put capacity rather than inadequate trench storage availability
- Higher density of perforations and/or larger pipes to facilitate rapid conveyance of runoff into trench
- Improved pre-treatment within the catchbasin or manhole would help reduce clogging of perforated pipes
- Trench dams preventing flow between trench sections may need further consideration
- Maintenance frequency variable depending on design and catchment characteristics – inspections required every 5 years

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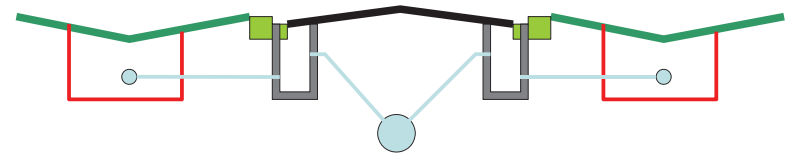
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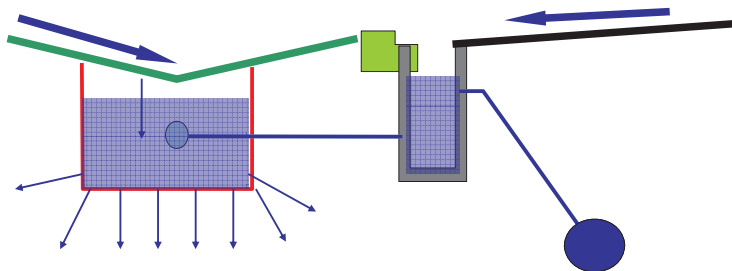
Other Exfiltration System Designs



Exfiltration system, North York

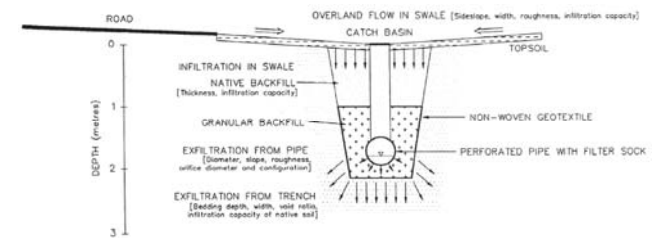


Exfiltration system, North York



Exfiltration Systems, Ottawa

- Curbless system with pretreatment through a grass swale
- After 20 years, and limited maintenance, the system continued to function very well



J.F. Sabourin & Associates, 2008



Edwards Gardens



Before



Biofilter system



Thank You

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