City of Hamilton

CITY COUNCIL
ADDENDUM

19-021

Wednesday, November 27, 2019, 5:00 P.M.

Council Chambers, Hamilton City Hall

71 Main Street West

---

5. COMMUNICATIONS

*5.5 Correspondence from Art Quinn respecting Bi Weekly Garbage Collection

Recommendation: Be received and referred to the consideration of Item (j)(i) of Public Works Committee Report 19-016.

6. COMMITTEE REPORTS

*6.6 General Issues Committee (2020 Rate Budget) Report 19-025 - November 25, 2019

8. NOTICES OF MOTIONS

*8.1 Verbal Updates

*8.2 Distribution of Federal and/or Provincial Ministry or Provincial Officer Orders

*8.3 Reconsideration of Item 26 of General Issues Committee Report 19-001, which was approved by Council on January 23, 2019 and Item 9 of General Issues Report 19-012, which was approved by Council on June 26, 2019

respecting the Potential Regulatory Litigation

*8.4 Reconsideration of Item 9 of General Issues Report 19-015, which was approved by Council on September 11, 2019 and Item 11 of General Issues Report 19-020, which was approved by Council on October 23, 2019

respecting the Potential Regulatory Litigation

9. PUBLICLY RELEASED DOCUMENTS

*9.1 APPENDIX “A” to Report PW19008(e)/LS19004(e) – Calder Engineering Chedoke Creek Inspection Report – July 19, 2018

*9.2 APPENDIX “C” to Report PW19008(e)/LS19004(e) – Quantification of Volume and Contaminant Loadings – Hatch, September 28, 2018

*9.3 APPENDIX “D” to Report PW19008(e)/LS19004(e) – Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report – Wood, January 24, 2019

*9.4 APPENDIX “E” to Report PW19008(e)/LS19004(e) – Implementation and Costing Report – Wood, January 24, 2019

*9.5 APPENDIX “F” to Report PW19008(e)/LS19004(e) – Peer Review Report – SLR Consulting (Canada) Ltd. – May 15, 2019

*9.6 APPENDIX “G” to Report PW19008(e)/LS19004(e) – Wood response to the SLR Peer Review Report – Wood – May 23, 2019

*9.7 APPENDIX “H” to Report PW19008(e)/LS19004(e) – CSO Facilities Inspection Report – Hatch, November 30, 2018

*9.8 APPENDIX “I” to Report PW19008(e)/LS19004(e) – CSO Facilities Operations and Maintenance Plan – Hatch, January 31, 2019

*9.9 APPENDIX “J” to Report PW19008(e)/LS19004(e) – Ministry of Environment, Conservation and Parks Order #1-J25YB, August 2, 2018

*9.10 APPENDIX “K” to Report PW19008(e)/LS19004(e) – Ministry of Environment, Conservation and Parks Order #1-J3XAY, November 14, 2019

10. PRIVATE AND CONFIDENTIAL

*10.3 Potential Regulatory Litigation Update (PW19008(e)/LS19004(e)) (City Wide) (distributed under separate cover)

Pursuant to Section 8.1, Sub-sections (e), (f) and (k) of the City's Procedural By-law 18-270, and Section 239(2), Sub-sections (e), (f) and (k) of the *Ontario Municipal Act, 2001*, as amended, as the subject matter pertains to litigation or potential litigation, including matters before administrative tribunals, affecting the municipality or local board; the receiving of advice that is subject to solicitor-client privilege, including communications necessary for that purpose; and, a position, plan, procedure, criteria or instruction to be applied to any negotiations carried on or to be carried on by or on behalf of the municipality or local board.

*10.4 ATU Bargaining Update (no copy)

Pursuant to Section 8.1, Sub-sections (d) of the City's Procedural By-law 18-270, and Section 239(2), Sub-sections (d) of the *Ontario Municipal Act, 2001*, as amended, as the subject matter pertains to labour relations or employee negotiations.

11. BY-LAWS AND CONFIRMING BY-LAW

*11.9 288

To Amend the Sanitary Surcharge and Wastewater Abatement By-law No. 03-272 and Implement the 2020 Fees and Charges

Ward: City Wide

*11.10 289

To Amend the Sewer and Drain By-law No. 06-026, and Implement the 2020 Fees and Charges

Ward: City Wide

*11.11 290

To Amend the Waterworks By-law No. R84-026 and Implement the 2020 Fees and Charges

Ward: City Wide

*11.12 291

A By-law to Establish the 2020 Water and Wastewater/Storm Fees and Charges for Services, Activities and Use of Property Provided by the City of Hamilton

Ward: City Wide

GENERAL ISSUES COMMITTEE
(2020 RATE BUDGET)
REPORT 19-025

9:30 a.m.
Monday, November 25, 2019
Council Chambers
Hamilton City Hall
71 Main Street West

Present: Deputy Mayor M. Wilson
Councillors J. Farr, N. Nann, C. Collins, T. Jackson, E. Pauls, J.P. Danko, B. Clark, M. Pearson, L. Ferguson, A. VanderBeek

Absent: Mayor F. Eisenberger – Other City Business
Councillors B. Johnson, J. Partridge and S. Merulla – Other City Business
Councillor T. Whitehead – Personal

THE GENERAL ISSUES COMMITTEE PRESENTS REPORT 19-025 AND RESPECTFULLY RECOMMENDS:

1. Alectra Utilities Water, Wastewater and Storm 2019 Service Activity Report (FCS19069) (City Wide) (Item 8.1)

That Report FCS19069, respecting Alectra Utilities Water, Wastewater and Storm 2019 Service Activity Report, be received.

2. 2020 Recommended Water, Wastewater and Stormwater Budget (FCS19070) (City Wide) (Item 8.2)

(a) That the metered water consumption charges for residential properties in the City of Hamilton be imposed at the following rates, effective January 1, 2020:

Monthly Water Consumption (m3)	Rate ($/m3)
0 – 10	0.83
10 +	1.64

(b) That the metered water consumption charge for commercial, industrial, institutional and multi-residential (bulk meter) properties in the City of Hamilton be imposed at the rate of $1.64 per cubic metre, effective January 1, 2020;

(c) That daily water fixed charges for all properties in the City of Hamilton be imposed at the following rates, effective January 1, 2020:

Meter Size	Daily Water Rate
15 mm	$0.37
16 mm	$0.37
20 mm	$0.37
21 mm	$0.37
25 mm	$0.93
38 mm	$1.85
50 mm	$2.96
75 mm	$5.92
100 mm	$9.25
150 mm	$18.50
200 mm	$29.60
250 mm	$42.55
300 mm	$62.90

(d) That the wastewater / storm treatment charges for residential properties in the City of Hamilton be imposed at the following rates, effective January 1, 2020:

Monthly Water Consumption (m3)	Rate ($/m3)
0 – 10	0.88
10 +	1.75

(e) That the wastewater / storm treatment charge for all commercial, industrial, institutional and multi-residential (bulk meter) properties in the

City of Hamilton be imposed at the rate of $1.75 per cubic metre, effective January 1, 2020;

(f) That daily wastewater /storm fixed charges for all properties in the City of Hamilton be imposed at the following rates, effective January 1, 2020:

Meter Size	Daily Wastewater / Storm Rate
15 mm	$0.39
16 mm	$0.39
20 mm	$0.39
21 mm	$0.39
25 mm	$0.98
38 mm	$1.95
50 mm	$3.12
75 mm	$6.24
100 mm	$9.75
150 mm	$19.50
200 mm	$31.20
250 mm	$44.85
300 mm	$66.30

(g) That the residential non-metered annual water rate be imposed at the flat rate of $594.95 per annum, effective January 1, 2020;

(h) That the residential non-metered annual wastewater / storm rate be imposed at the flat rate of $638.75 per annum, effective January 1, 2020;

(i) That the residential combined non-metered annual water and wastewater / storm rate be imposed at the flat rate of $1,233.70 per annum, effective January 1, 2020;

(j) That the Private Fire Line rates be imposed at the following rates, effective January 1, 2020:

Connection Size		Monthly Rate
mm	inches	
25	1.0	$3.60
38	1.5	$8.28
50	2.0	$14.40
75	3.0	$32.40
100	4.0	$57.60

150	6.0	$129.60
200	8.0	$230.40
250	10.0	$230.40
300	12.0	$230.40

(k) That the 2020 Water, Wastewater and Storm Proposed User Fees and Charges be imposed as per Appendix "A", as amended, to Report 19-025, effective January 1, 2020;

(l) That charges for raw water supplied to 690 Strathearne Avenue North by the City of Hamilton be imposed at the following rates, effective January 1, 2020:

(i) metered raw water at the rate of $0.123 per cubic metre;

(ii) daily raw water fixed charges at the following rates:

Meter Size	Daily Rate
200 mm	$31.20

(iii) 2020 annual fee of $18,500 for the purpose of a private raw water pipeline owned by AMLPC to convey raw water supplied by the City to 690 Strathearne Avenue North;

(m) That the 2020 Water, Wastewater and Stormwater Rate Supported Operating Budget in the amount of $233,011,802 be approved as per Appendix "B", as amended, to Report 19-025;

(n) That the long-term financing plan for the Water, Wastewater and Stormwater programs and related rate increases required to meet sustainable financing as identified in the 2020-2029 Water, Wastewater and Stormwater Rate Supported Operating Budget forecast (Appendix "B", as amended, to Report 19-025) be approved, in principle;

(o) That the 2020 Water, Wastewater and Stormwater Rate Supported Capital Budget and Financing Plan in the amount of $329,981,000 be approved as per Appendices "C", "D", as amended, and "F", to Report 19-025;

(p) That the 2020-2029 Water, Wastewater and Stormwater Rate Supported Capital Budget forecast and financing plan (Appendix "G" to Report 19-025) be approved, in principle;

(q) That the City Solicitor be authorized and directed to prepare, for Council approval, all necessary by-laws respecting the 2020 water and wastewater / storm user fees, charges and rates set out in recommendations (a) through (l) of Report FCS19070;

(r) That the additional 12.0 Full Time Equivalent Rate Supported Staffing be approved as per Appendix "H", as amended, to Report 19-025;

(s) That the General Manager, Finance and Corporate Services, be authorized to negotiate and confirm the terms and placement of all debenture issue(s), and / or private placement debenture issue(s), in either a public or private market and / or bank loan agreements and debenture issue(s) and / or variable interest rate bank loan agreements and debenture issue(s), in an amount not to exceed $83,678,000 as attached in Appendices "C", "D", as amended, and "E" to Report 19-025, which includes $16,900,000 in Rate Supported municipal debt and $66,778,000 in Rate Supported Development Charges municipal debt;

(t) That the General Manager, Finance and Corporate Services, be authorized to engage the services of all required professionals to secure the terms and issuance of the debenture issue(s) described in subsection (s) including, but not limited to, external legal counsel, fiscal agents and Infrastructure Ontario's Loan Program;

(u) That the General Manager, Finance and Corporate Services, Mayor and City Clerk are each authorized and directed to enter into and / or execute, on behalf of the City of Hamilton, all agreements and necessary ancillary documents requiring their respective signatures, to secure the terms and issuance of the debenture issue(s) described in subsections (s) and (t), in a form satisfactory to the City Solicitor;

(v) That the Mayor and City Clerk are authorized and directed to enter into and / or execute, on behalf of the City of Hamilton, all agreements and necessary ancillary documents not requiring any specific signing authority, to secure the terms and issuance of the debenture issue(s) described in subsections (s) and (t), in a form satisfactory to the City Solicitor and with content acceptable to the General Manager, Finance and Corporate Services; and,

(w) That all necessary By-Law(s) be passed to authorize the debenture issue(s) negotiated, placed and secured, as they relate to the 2020 Water, Wastewater and Stormwater Budget, in accordance with subsections (s) and (t) to Report FCS19070.

FOR INFORMATION:

(a) APPROVAL OF AGENDA (Item 2)

The Committee Clerk advised of the following change to the agenda:

1. DELEGATION REQUESTS (Item 5)

   (i) Don McLean, respecting Item 8.2 on this agenda – Report FCS19070 - 2020 Recommended Water, Wastewater and Stormwater Budget.

The agenda for the November 25, 2019 General Issues Committee (Rate Budget) meeting was approved, as amended.

(b) DECLARATIONS OF INTEREST (Item 3)

There were no declarations of interest.

(c) PUBLIC HEARING / DELEGATIONS (Item 7)

(i) Don McLean, respecting Item 8.2 on this agenda – Report FCS19070 - 2020 Recommended Water, Wastewater and Stormwater Budget Item (Item 7.1)

Don McLean addressed Committee respecting Report FCS19070 - 2020 Recommended Water, Wastewater and Stormwater Budget.

The delegation, respecting Report FCS19070 - 2020 Recommended Water, Wastewater and Stormwater Budget, was received.

(d) STAFF PRESENTATIONS (Item 8)

(i) Alectra Utilities Water, Wastewater and Storm 2019 Service Activity Report (FCS19069) (City Wide) (Item 8.1)

Eileen Campbell, Vice President of Customer Service, Alectra Utilities, addressed Committee and provided a PowerPoint presentation respecting Report FCS19069 - Alectra Utilities Water, Wastewater and Storm 2019 Service Activity Report, and answered questions of Committee.

The presentation, respecting Report FCS19069 - Alectra Utilities Water, Wastewater and Storm 2019 Service Activity Report, was received.

A copy of the presentation is available on the City's website at www.hamilton.ca or through the Office of the City Clerk.

For disposition of this matter, please refer to Item 1.

(ii) 2020 Recommended Water, Wastewater and Stormwater Budget (FCS19070) (City Wide) (Item 8.2)

Andrew Grice, Director of Hamilton Water; and, Brian McMullen, Director, Financial Planning & Policy, provided a PowerPoint presentation respecting Report FCS19070 - 2020 Recommended Water, Wastewater and Stormwater Budget, and answered questions of Committee.

The presentation, respecting Item FCS19070 - 2020 Recommended Water, Wastewater and Stormwater Budget, was received.

A copy of the presentation is available on the City's website at www.hamilton.ca or through the Office of the City Clerk.

The following Deferral Motion was DEFEATED:

(1) Enhanced Inspections and Monitoring - Hamilton Water and Wastewater

That the Motion, respecting Enhanced Inspections and Monitoring - Hamilton Water and Wastewater, be DEFERRED to the next GIC Rate Budget meeting.

The following Motion CARRIED, and the amendments were included in the recommendations of Report FCS19070, and were also reflected in the appropriate appendices, for Council's consideration:

WHEREAS, Hamilton Water operates 2 wastewater treatment plants, 71 wastewater pumping stations, 9 combined sewer overflow tanks, 1 water treatment plant, 21 water pumping stations, 13 reservoirs, 7 water towers, and 4 well systems, and;

WHEREAS, Hamilton Water is heavily reliant on automated systems to remotely monitor facility and process operations, including the identification of operational problems.

THEREFORE, BE IT RESOLVED:

(a) That Appendix "F" to Report FCS19070, respecting 2020 Recommended Water, Wastewater and Stormwater Budget, be amended by adding 5 additional Full Time Equivalent Rate Supported staff consisting of the following:

  (i) 4 (four) Maintenance Operators to improve the routine physical inspection and preventative maintenance programs for Hamilton Water infrastructure including water and wastewater treatment plants, pumping stations, reservoirs, water towers, well systems and combined sewer overflow tanks, at a gross annual cost of $383,000;

  (i) 1 (one) Water Quality Technologist to sample and analyse water and wastewater quality, and equipment/process related data, at a gross annual cost of $114,000;

(b) That staff be directed to report back to the Public Works Committee 1 (one) year after implementation of the additional 5 FTEs, for the maintenance of the water and wastewater facilities/equipment and water quality control, with information regarding the program improvements and the associated benefits that have been realized;

(c) That staff be directed to include, in the new real time public notice protocol, the 14 monitored CSO overflow points for discharge to the natural environment; and,

(d) That staff be directed to report back to the Public Works Committee in in 6 months with a matrix, stakeholder / partnership arrangements and testing locations, as it relates to enhanced inspections and monitoring for Hamilton water and wastewater.

The following Motion CARRIED, and the amendments were included in the recommendations of Report FCS19070, and were also reflected in the appropriate appendices, for Council's consideration:

WHEREAS, the City's 2019 Development Charge (DC) Background Study in Table F-3 in the Airport Employment Growth District (AEGD) section had listed Project ID MH22-S-19 (HC019 and HC018 Upgrade Strategy) in the amount of $10.9M (100% growth - split of 63% residential and 37% non-residential, linear wastewater);

WHEREAS, City Council, at its meeting of December 13, 2018, had approved $11M be added to the City's 2019 Rates Capital Budget (funded $6.93M from the City's Linear Wastewater Residential DC Reserve 110340 and $4.07M from the City's Linear Wastewater Non-Residential DC Reserve 110341); and,

WHEREAS, City staff and Engineering Consultants GM BluePlan Engineering Limited have upgraded the strategy for 2020 to maximize the wastewater capacity as it relates to the proposed developments in the AEGD and surrounding developments;

THEREFORE, BE RESOLVED:

That increased funding in the amount of $4M be added to the 2020 Recommended Water, Wastewater and Stormwater Capital Budget (Project ID 5161967123 – AEGD Growth Initiatives); increasing the Rate Supported 2020 Capital Budget Recommended amount from $325,981,000 to $329,981,000, to be funded as follows:

(i) $2,520,000 from the City's Linear Wastewater Residential DC Reserve 110340; and,

(ii) $1,480,000 from the City's Linear Wastewater Non-Residential DC Reserve 110341.

For further disposition of this matter, please refer to Item 2.

(f) ADJOURNMENT (Item 5)

There being no further business, the General Issues Committee adjourned at 1:27 p.m.

Respectfully submitted,

Deputy Mayor M. Wilson
Chair, General Issues Committee

Stephanie Paparella
Legislative Coordinator,
Office of the City Clerk

CITY OF HAMILTON
2020 WATER AND WASTEWATER/STORM FEES AND CHARGES
Effective January 1, 2020

A) Daily Water & Wastewater/Storm Fixed Charges

The fixed daily charge is not related to the direct costs of consumption and are not dependent upon or related to the amount of consumption incurred. The fixed charges are intended to offset the fixed costs of maintaining the water, wastewater and storm systems.

Meter Size	Water Rate	Wastewater/ Storm Rate
15 mm	$ 0.37	$ 0.39
16 mm	$ 0.37	$ 0.39
20 mm	$ 0.37	$ 0.39
21 mm	$ 0.37	$ 0.39
25 mm	$ 0.93	$ 0.98
38 mm	$ 1.85	$ 1.95
50 mm	$ 2.96	$ 3.12
75 mm	$ 5.92	$ 6.24
100 mm	$ 9.25	$ 9.75
150 mm	$ 18.50	$ 19.50
200 mm	$ 29.60	$ 31.20
250 mm	$ 42.55	$ 44.85
300 mm	$ 62.90	$ 66.30

B) Metered Water Consumption Charges

Water consumption shall be charged on a per cubic metre basis at the rates indicated in the table below. The total monthly Water Consumption Charge is the sum of usage in all blocks at the rate for each block.

		Residential	Multi-Residential, Commercial, Institutional & Industrial
Consumption Block	Monthly Water Consumption (m3)	Rate ($/m3)	Rate ($/m3)
1	0-10	0.83	1.64
2	>10	1.64	1.64

C) Wastewater/Storm Treatment Charges

Wastewater/Storm Treatment Charges are based on metered water consumption and the cost of wastewater collection and treatment, and stormwater management. Charges are on a per cubic metre basis at the rates indicated in the table below. The total monthly Wastewater/Storm Treatment Charge is the sum of usage in all blocks at the rate for each block.

		Residential	Multi-Residential, Commercial, Institutional & Industrial
Treatment Block	Monthly Water Consumption (m3)	Rate ($/m3)	Rate ($/m3)
1	0-10	0.88	1.75
2	>10	1.75	1.75

D) Non-Metered Annual Water & Wastewater/Storm Rate

Flat Rate Water Customers Annual Rate: $594.95

Flat Rate Wastewater/Storm Customers Annual Rate: $638.75

Combined Flat Rate Water & Wastewater/Storm Customers Annual Rate: $1,233.70

City of Hamilton - 2020 Private Fire Line Rates

This service shall consist of permanent unmetered connections to the main for the purpose of supplying water to private fire protection systems such as automatic sprinkler systems, standpipes and private hydrants. This service shall also include reasonable quantities of water used for testing check valves and other backflow protection devices.

Unmetered Service

Size of Connection		Monthly Rate
mm	inches	
25	1	$ 3.60
38	1.5	$ 8.28
50	2	$ 14.40
75	3	$ 32.40
100	4	$ 57.60
150	6	$ 129.60
200	8	$ 230.40
250	10	$ 230.40
300	12	$ 230.40

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

For Billing Purposes: M - F: 7:00am - 4:30pm
Regular Hours: M - F: 4:30pm - 7:00am, Weekends and Holidays

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 Including HST (if applicable)	2020 Proposed Fee	HST (y/n)	2020 Including HST (if applicable)	% Fee Change	Basis for Fee Increase or Decrease
				WATER DISTRIBUTION						
R84-026	510220	47220	1	**Water Meter Permit Fee** Note: Charged for first-time meter installations. Includes supply and installation of water meter and remote reading device by City and related inspection.						
			1a)	16mm Displacement	$359.70	$359.70	n	$359.70	0.0%	Current fee achieves full cost recovery
			1b)	20mm Displacement	$404.60	$404.60	n	$404.60	0.0%	Current fee achieves full cost recovery
			1c)	21mm Displacement	$404.60	$404.60	n	$404.60	0.0%	Current fee achieves full cost recovery
			1d)	25mm Displacement	$559.40	$559.40	n	$559.40	0.0%	Current fee achieves full cost recovery
			1e)	38mm Displacement	$886.76	$905.08	n	$905.08	2.1%	To achieve full cost recovery
			1f)	50mm Displacement	$1,218.80	$1,218.80	n	$1,218.80	0.0%	Current fee achieves full cost recovery
			1g)	50mm Turbine	$1,384.60	$1,409.67	n	$1,409.67	1.8%	To achieve full cost recovery
			1h)	50mm Compound	$3,316.40	$3,316.40	n	$3,316.40	0.0%	Current fee achieves full cost recovery
			1i)	100mm Turbine	$3,870.13	$3,870.13	n	$3,870.13	0.0%	Current fee achieves full cost recovery
			1j)	100mm Compound	$5,206.07	$5,304.84	n	$5,304.84	1.9%	To achieve full cost recovery
			1k)	100mm Fire Service Turbine	$6,637.49	$6,759.21	n	$6,759.21	1.8%	To achieve full cost recovery
			1l)	100mm Fire Service Compound	$8,624.85	$8,787.29	n	$8,787.29	1.9%	To achieve full cost recovery
			1m)	100mm Magnetic Flow Meter (Must be approved by Supervisor of Meter Operations)	$8,899.76	$9,067.33	n	$9,067.33	1.9%	To achieve full cost recovery
			1n)	100mm Fire Rated Magnetic Flow Meter (Must be approved by Supervisor of Meter Operation	$9,297.22	$9,472.19	n	$9,472.19	1.9%	To achieve full cost recovery
			1o)	150mm Turbine	$7,467.78	$7,608.67	n	$7,608.67	1.9%	To achieve full cost recovery
			1p)	150mm Compound	$10,226.88	$10,419.16	n	$10,419.16	1.9%	To achieve full cost recovery
			1q)	150mm Fire Service Turbine	$11,028.42	$11,235.65	n	$11,235.65	1.9%	To achieve full cost recovery
			1r)	150mm Magnetic Flow Meter (Must be approved by Supervisor of Meter Operations)	$11,186.31	$11,396.47	n	$11,396.47	1.9%	To achieve full cost recovery
			1s)	150mm Fire Rated Magnetic Flow Meter (Must be approved by Supervisor of Meter Operation	$12,334.54	$12,566.10	n	$12,566.10	1.9%	To achieve full cost recovery
			1t)	150mm Fire Service Compound	$13,954.24	$14,215.97	n	$14,215.97	1.9%	To achieve full cost recovery
			1u)	200mm Turbine	$8,998.80	$9,187.68	n	$9,187.68	2.1%	To achieve full cost recovery
			1v)	200mm Compound	$12,097.96	$12,344.57	n	$12,344.57	2.0%	To achieve full cost recovery
			1w)	200mm Magnetic Flow Meter (Must be approved by Supervisor of Meter Operations)	$12,041.98	$12,268.08	n	$12,268.08	1.9%	To achieve full cost recovery
			1x)	200mm Fire Rated Magnetic Flow Meter (Must be approved by Supervisor of Meter Operation	$13,160.41	$13,407.34	n	$13,407.34	1.9%	To achieve full cost recovery
			1y)	200mm Fire Service Turbine	$14,171.75	$14,437.52	n	$14,437.52	1.9%	To achieve full cost recovery
			1z)	200mm Fire Service Compound	$19,092.63	$19,450.06	n	$19,450.06	1.9%	To achieve full cost recovery
			1aa)	250mm Turbine	$15,496.05	$15,785.99	n	$15,785.99	1.9%	To achieve full cost recovery
			1ab)	250mm Magnetic Flow Meter (Must be approved by Supervisor of Meter Operations)	$14,415.75	$14,686.07	n	$14,686.07	1.9%	To achieve full cost recovery
			1ac)	250mm Fire Rated Magnetic Flow Meter (Must be approved by Supervisor of Meter Operation	$17,063.33	$17,382.96	n	$17,382.96	1.9%	To achieve full cost recovery
			1ad)	250mm Fire Service Turbine	$19,312.34	$19,673.87	n	$19,673.87	1.9%	To achieve full cost recovery
			1ae)	250mm Fire Service Compound	$24,832.75	$25,297.11	n	$25,297.11	1.9%	To achieve full cost recovery
			1af)	Radio Remote Read Equipment Installation	$209.80	$214.63	n	$214.63	2.3%	To achieve full cost recovery
R84-026	510220	45519	2	**Water Meter Removal Fee** Note: Cost to remove a meter prior to the building being demolished and/or the water service being decommissioned or abandoned. Failure to have the meter removed prior to the building being demolished will incur a meter replacement cost charge. *Does not include a turn water off fee, which is required and charged separately as per Section 14 of this schedule.*						
			2a)	16mm Displacement	$123.62	$112.87	y	$127.54	3.2%	To achieve full cost recovery
			2b)	20mm Displacement	$123.62	$112.87	y	$127.54	3.2%	To achieve full cost recovery
			2c)	21mm Displacement	$123.62	$112.87	y	$127.54	3.2%	To achieve full cost recovery
			2d)	25mm Displacement	$123.62	$112.87	y	$127.54	3.2%	To achieve full cost recovery
			2e)	38mm - 250mm Meters (cost depends on size, labour, and meter location)	Cost + 10% OH	Cost + 10% OH	y	Cost + 10% OH	N/A	
R84-026	510220	45519	3	**Water Meter Inspection Services** Note: Cost for customer requested service relating to meter investigation						
			3a)	Regular Hours Inspection	$123.70	$115.86	y	$130.92	5.8%	To achieve full cost recovery
			3b)	After Hours Inspection	$161.95	$151.73	y	$171.45	5.9%	To achieve full cost recovery

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call (905) 546-4426 between 8:30am - 4:30pm

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

For Billing Purposes M - F: 7:00am - 4:30pm
Regular Hours: M - F: 4:30pm - 7:00am, Weekends and Holidays

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 Including HST (if applicable)	2020 Proposed Fee	HST (y/n)	2020 Including HST (if applicable)	% Fee Change	Basis for Fee Increase or Decrease
R84-026	510220	45608	4	**Replacement Cost for Lost Meter** Note: Cost to replace a meter that has been lost, stolen or damaged. Includes meter, installation and administrative costs.						
			4a)	15mm Displacement	$244.00	$221.75	y	$250.58	2.7%	To achieve full cost recovery
			4b)	16mm Displacement	$244.00	$221.75	y	$250.58	2.7%	To achieve full cost recovery
			4c)	20mm Displacement	$379.31	$342.24	y	$386.73	2.0%	To achieve full cost recovery
			4d)	21mm Displacement	$379.31	$342.24	y	$386.73	2.0%	To achieve full cost recovery
			4e)	25mm Displacement	$436.70	$393.97	y	$445.19	1.9%	To achieve full cost recovery
			4f)	38mm Displacement	$1,205.02	$1,082.62	y	$1,223.36	1.5%	To achieve full cost recovery
			4g)	50mm Turbine	$1,465.95	$1,297.30	y	$1,465.95	0.0%	Current fee achieves full cost recovery
			4h)	50mm Displacement	$1,804.05	$1,596.50	y	$1,804.05	0.0%	Current fee achieves full cost recovery
			4i)	50mm Compound	$2,338.65	$2,069.60	y	$2,338.65	0.0%	Current fee achieves full cost recovery
			4j)	100mm Turbine	$3,688.50	$3,264.16	y	$3,688.50	0.0%	Current fee achieves full cost recovery
			4k)	100mm Compound	$5,959.20	$5,273.63	y	$5,959.20	0.0%	Current fee achieves full cost recovery
			4l)	100mm Fire Service Turbine	$8,047.63	$7,212.18	y	$8,149.76	1.3%	To achieve full cost recovery
			4m)	100mm Fire Service Compound	$9,947.30	$8,855.57	y	$10,006.80	0.6%	To achieve full cost recovery
			4n)	100mm Magnetic Flow Meter	$10,972.29	$9,855.25	y	$11,136.43	1.5%	To achieve full cost recovery
			4o)	100mm Fire Rated Magnetic Flow Meter	$11,229.75	$10,290.10	y	$11,627.81	3.5%	To achieve full cost recovery
			4p)	150mm Turbine	$6,787.25	$6,006.42	y	$6,787.25	0.0%	Current fee achieves full cost recovery
			4q)	150mm Compound	$10,328.00	$9,139.82	y	$10,328.00	0.0%	Current fee achieves full cost recovery
			4r)	150mm Fire Service Turbine	$12,234.06	$10,968.91	y	$12,394.87	1.3%	To achieve full cost recovery
			4s)	150mm Fire Service Compound	$15,540.23	$13,949.23	y	$15,762.63	1.4%	To achieve full cost recovery
			4t)	150mm Magnetic Flow Meter	$12,255.20	$10,918.06	y	$12,337.41	0.7%	To achieve full cost recovery
			4u)	150mm Fire Rated Magnetic Flow Meter	$13,611.70	$12,170.80	y	$13,753.00	1.0%	To achieve full cost recovery
			4v)	200mm Turbine	$7,340.19	$6,570.69	y	$7,424.88	1.2%	To achieve full cost recovery
			4w)	200mm Compound	$11,551.00	$10,222.12	y	$11,551.00	0.0%	Current fee achieves full cost recovery
			4x)	200mm Fire Service Turbine	$16,119.89	$14,454.48	y	$16,333.56	1.3%	To achieve full cost recovery
			4y)	200mm Fire Service Compound	$21,679.46	$19,466.10	y	$21,996.69	1.5%	To achieve full cost recovery
			4z)	200mm Magnetic Flow Meter	$14,696.83	$13,177.47	y	$14,890.54	1.3%	To achieve full cost recovery
			4aa)	200mm Fire Rated Magnetic Flow Meter	$16,050.38	$14,395.02	y	$16,266.37	1.3%	To achieve full cost recovery
			4ab)	250mm Turbine	$12,754.60	$11,424.07	y	$12,909.20	1.2%	To achieve full cost recovery
			4ac)	250mm Magnetic Flow Meter	$14,766.00	$13,336.65	y	$15,070.41	2.1%	To achieve full cost recovery
			4ad)	250mm Fire Rated Magnetic Flow Meter	$17,726.90	$16,225.00	y	$18,334.25	3.4%	To achieve full cost recovery
			4ae)	250mm Fire Service Turbine	$20,293.29	$18,219.75	y	$20,588.32	1.5%	To achieve full cost recovery
			4af)	250mm Fire Service Compound	$29,046.50	$25,704.87	y	$29,046.50	0.0%	Current fee achieves full cost recovery
			4ag)	50mm Strainer	$462.97	$419.15	y	$473.64	2.3%	To achieve full cost recovery
			4ah)	100mm Strainer	$858.46	$775.66	y	$876.50	2.1%	To achieve full cost recovery
			4ai)	150mm Strainer	$1,374.34	$1,240.69	y	$1,401.98	2.0%	To achieve full cost recovery
			4aj)	200mm Strainer	$2,336.25	$2,107.80	y	$2,381.81	2.0%	To achieve full cost recovery
			4ak)	250mm Strainer	$3,993.11	$3,533.73	y	$3,993.11	0.0%	Current fee achieves full cost recovery
R84-026	510220	45690	5	**Bench Testing Water Meters** Note: Cost to have a water meter tested for accuracy. If the meter tests within the accuracy standards as set out by AWWA then the property owner is responsible for the cost of the test and the replacement cost of the water meter; otherwise cost borne by the City. Fee includes removal of existing meter and installation of replacement meter.						
			5a)	15 mm & 16 mm Diameter	$348.80	$314.56	y	$355.45	1.9%	To achieve full cost recovery
			5b)	16-25mm Diameter - Test where meter has been removed from service within prior 90 days	$144.19	$130.39	y	$147.34	2.2%	To achieve full cost recovery
			5c)	20 mm Diameter	$400.27	$362.87	y	$410.04	2.4%	To achieve full cost recovery
			5d)	25 mm Diameter	$457.67	$414.60	y	$468.50	2.4%	To achieve full cost recovery
			5e)	38 mm Diameter	$994.38	$914.18	y	$1,033.02	3.9%	To achieve full cost recovery
			5f)	50 mm Diameter	$1,742.55	$1,542.08	y	$1,742.55	0.0%	Current fee achieves full cost recovery
			5g)	100 mm plus diameter (In Situ testing)	$1,014.29	$930.42	y	$1,051.37	3.7%	To achieve full cost recovery

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call (905) 546-4426 between 8:30am - 4:30pm

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

For Billing
Purposes M - F: 7:00am - 4:30pm
Regular Hours: M - F: 4:30pm - 7:00am, Weekends and Holidays

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 Including HST (If applicable)	2020 Proposed Fee	HST (y/n)	2020 Including HST (If applicable)	% Fee Change	Basis for Fee Increase or Decrease
10-103	510220	45644	6	**Backflow Prevention Program**						
				Note: Costs for contractor registration fee, administration fees for processing backflow prevention test reports and survey forms.						
			6a)	Annual Program Registration Fee	$150.89	$134.96	y	$152.51	1.1%	To achieve full cost recovery
			6b)	Test Report receipt and processing (per submission of each test report)	$72.61	$64.26	y	$72.61	0.0%	Current fee achieves full cost recovery
			6c)	*Cross Connection Survey Form processing (per form upon submission)*	$179.16	$160.28	y	$181.12	1.1%	To achieve full cost recovery
			6d)	Backflow Prevention Device Investigation - Regular Hours	$159.10	$142.12	y	$160.60	0.9%	To achieve full cost recovery
			6e)	Backflow Prevention Device Investigation - After Hours	$233.80	$206.90	y	$233.80	0.0%	Current fee achieves full cost recovery
R84-026	514330	45590	7	**Construction Water**						
				Note: Charge for unmetered water used for construction prior to meter installation. Paid at the time of submitting building permit payment.						
			7a)	*Single Residential (per lot or townhouse)*	$95.05	$100.00	n	$100.00	5.2%	Equal to variable water rate increase
			7b)	Multi-residential (per apartment/condo unit)	$44.45	$46.75	n	$46.75	5.2%	Equal to variable water rate increase
			7c)	Industrial/Commercial/Institutional ($/1,000 sqft of building area or $/ha where no structure is constructed)	$31.20	$32.80	n	$32.80	5.1%	Equal to variable water rate increase
			8	**Hydrant\Road Adaptor Fees**						
				Note: Costs to install or remove water meter & backflow prevention device. When moving a *hydrant\road adaptor from one site to another for the same customer, both removal &* installation fees apply. This service requires a usage deposit and a damage deposit.						
R84-026	514330	41208	8a)	Usage Cost (Metered Hauled Water Rate/m³)	$2.35	$2.45	n	$2.45	4.3%	Rate is 1.5x volumetric water rate
R84-026	514330	41209	8b)	Hydrant\Road Adaptor Connection/Disconnection Fee (Regular Hours-Fee for Both Services)	$145.90	$146.94	n	$146.94	0.7%	To achieve full cost recovery
R84-026	514330	41209	8c)	Hydrant\Road Adaptor Connection/Disconnection Fee (After Hours/Emergency-Fee for Both S	$274.40	$276.71	n	$276.71	0.8%	To achieve full cost recovery
R84-026	514330	41209	8d)	Non-Refundable Usage Deposit	$300.00	$300.00	n	$300.00	0.0%	Deposit rounded to the nearest $100
R84-026	514330	41209	8e)	Security/Damage Deposit	$6,000.00	$6,000.00	n	$6,000.00	0.0%	Deposit rounded to the nearest $100
R84-026	514330	41209	8f)	Hydrant\road adaptor rental fee for initial 7 days	$81.30	$82.56	n	$82.56	1.5%	To achieve full cost recovery
R84-026	514330	41209	8g)	Per Diem hydrant\road adaptor rental fee after initial 7 days	$6.02	$6.13	n	$6.13	1.8%	To achieve full cost recovery
R84-026	514330	47244	9	**Private Water Station Agreement Fees**						
				Annual Renewal	$357.80	$386.22	n	$386.22	7.9%	To achieve full cost recovery
R84-026	514330	47232	10	**Water Haulage Fees**						
			10a)	Annual Water Haulage Permit Fee	$64.78	$57.44	y	$64.91	0.2%	No cards issued, Online Registration
				Note: Annual license fee to utilize the City's public filling stations.						
			10b)	Account review	$99.08	$87.91	y	$99.34	0.3%	To achieve full cost recovery
				Note: Costs charged for administrative services to provide customer account information for personal or taxation purposes.						
R84-026	510220	45519	11	**General Administration Fees**						
			11a)	General Administrative Requests (per hour)/Report Requests	$77.64	$69.16	y	$78.15	0.7%	To achieve full cost recovery
			11b)	Permit Cancellation administrative fee	$46.36	$41.14	y	$46.49	0.3%	To achieve full cost recovery
			11c)	Permit Renewal Fee	$46.36	$41.14	y	$46.49	0.3%	To achieve full cost recovery
			11d)	Lead Line Replacement Loan Application Fee	$58.04	$51.60	y	$58.31	0.5%	To achieve full cost recovery
			11e)	Monthly AMI Manual Meter Read Fee	$3.39	$3.00	y	$3.39	0.0%	Current fee achieves full cost recovery
			11f)	Water Shut-off Admin Fee	$22.60	$20.00	y	$22.60	0.0%	Current fee achieves full cost recovery
			11g)	Water Shut-off Notice on Door	$28.25	$28.25	y	$31.92	13.0%	To achieve full cost recovery

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call (905) 546-4426 between 8:30am - 4:30pm

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

For Billing Purposes: M - F: 7:00am - 4:30pm
Regular Hours: M - F: 4:30pm - 7:00am, Weekends and Holidays

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 Including HST (if applicable)	2020 Proposed Fee	HST (y/n)	2020 Including HST (if applicable)	% Fee Change	Basis for Fee Increase or Decrease
R84-026			12	**Water Inspection Services** Note: Costs associated with various permit and inspection services related to water services for properties.						
	514330	47235	12a)	Private Water Service Repair/Replacement Inspection (Reg Hours - Max 1 Hour Total	$105.06	$93.45	y	$105.60	0.5%	Cost recovery - .01 for CS processing
	514330	47235	12b)	Private Water Service Repair/Replacement Inspection (After Hours /Emerg - Max 1 Hour	$177.60	$158.36	y	$178.95	0.8%	Cost recovery + .01 for CS processing
	514330	45690	12c)	Water Service Abandonment Inspection (Regular Hours - Max 1 Hour Total Labour)	$93.73	$83.47	y	$94.32	0.6%	To achieve full cost recovery
	514330	45690	12d)	Water Service Abandonment Inspection (After Hours / Emergency - Max 1 Hour Total	$166.32	$148.36	y	$167.65	0.8%	To achieve full cost recovery
	514330	45690	12e)	Water Service Inspection for Demolition (Regular Hours - Max 1 Hour Total Labour)	$93.73	$83.47	y	$94.32	0.6%	To achieve full cost recovery
	514330	45690	12f)	Water Service Inspection for Demolition (After Hours / Emergency - Max 1 Hour Total	$166.32	$148.36	y	$167.65	0.8%	To achieve full cost recovery
	514330	45690	12g)	Missed or Cancelled Inspection	$68.25	$60.65	y	$68.53	0.4%	To achieve full cost recovery
R84-026	514330	45690	13	**Upsize Public Portion Water Service from 20mm to 25mm** Note: Charge for upsizing a public portion water service from 20mm to 25mm, when a public portion water service replacement is already being completed by the City.	$150.00	$155.00	n	$155.00	3.3%	To achieve full cost recovery
R84-026	514330	45679	14	**Turning Water Off or On** Note: Turning water off at the curb to enable a property owner to complete internal plumbing repairs, or a private water service repair or replacement, and then turning the water back on.						
			14a)	Turning Water On/Off (Regular Hours)	$123.35	$124.10	n	$124.10	0.6%	Cost recovery - .02 for CS processing
			14b)	Turning Water On/Off (After Hours/Emergency)	$206.70	$208.25	n	$208.25	0.7%	Cost recovery - .01 for CS processing
			14c)	Turning Water On/Off During the Same Visit (Regular Hours - Max 1/2 Hour Total Labour)	$82.95	$83.47	n	$83.47	0.6%	To achieve full cost recovery
			14d)	Labour)	$113.35	$114.13	n	$114.13	0.7%	To achieve full cost recovery
			14e)	Non-compliance Turn Water Off	$82.95	$83.47	n	$83.47	0.6%	To achieve full cost recovery
			14f)	Non-compliance Turn Water On	$82.95	$83.47	n	$83.47	0.6%	To achieve full cost recovery
R84-026	514330	45636	15	**Hydrant Flow Test / Water Quality Flushing** Note: Cost to operate a City Fire Hydrant(s) for a maximum of 1 hour total labour.	$103.94	$106.29	y	$120.11	15.6%	Labour inc .3 hrs for cost recovery
R84-026	514330	45690	16	**Water Quality/Quantity Service Calls** Note: Cost for a service call to investigate a water quality/quantity complaint and the issue resides on private property. No charge for water quality/quantity complaints related to issues originating from the City's distribution system. Missed appointments will be billed the corresponding service call rate.						
			16a)	Service Call (Regular Hours - Max 1 Hour Total Labour)	$93.73	$83.47	y	$94.32	0.6%	To achieve full cost recovery
			16b)	Service Call (After Hours - Max 1 Hour Total Labour)	$166.32	$148.36	y	$167.65	0.8%	To achieve full cost recovery
R84-026	510290	45690	17	**Hydrant Repair, Replace or Relocate** Note: Cost to repair, replace, or relocate a City Fire Hydrant including labour, parts, materials, equipment, and permanent restoration.	Cost + 33% OH	Cost + 33% OH	y	Cost + 33% OH	N/A	To achieve full cost recovery
R84-026	514330	45690	18	**Watermain Shutdowns** Note: Costs associated with isolating a watermain to facilitate third party work.						
			18a)	Watermain Shutdown / Recharge (Regular Hours-Maximum 1 Hour Total Labour)	$128.07	$129.11	n	$129.11	0.8%	To achieve full cost recovery
			18b)	Watermain Shutdown / Recharge (After Hours / Emergency-Maximum 1 Hour Total Labour)	$230.54	$232.49	n	$232.49	0.8%	To achieve full cost recovery
R84-026	510350	45408	19	**Environmental Records Search PRISM Reports related to soil contamination**	$177.04	$159.80	y	$180.58	2.0%	2% allowed for inflation
				Reports - Environmental Assessments and Master Plans	$17.40	$15.71	y	$17.75	2.0%	2% allowed for inflation
				- plus fee per page	$0.11	$0.10	y	$0.12	2.0%	2% allowed for inflation
R84-026	514330	45690	20	**Miscellaneous Water Distribution System Repair** Note: Cost for the City to repair damage to the water distribution system caused by a third party. Costs include labour, parts, materials, equipment, and permanent restoration.	Cost + 33% OH	Cost + 33% OH	y	Cost + 33% OH	N/A	To achieve full cost recovery
R84-026	514330	45690	21	**Additional Labour Charges** Note: Additional labour charge for all services/calls that exceed the allotted labour time. Costs are for a single Water Distribution Operator in minimum increments of 30 minutes.						
			21a)	1/2 Hour Additional Labour (Regular Hours)-Water Distribution Operator	$25.50	$22.83	y	$25.80	1.2%	Cost recovery + .01 for CS processing
			21b)	1/2 Hour Additional Labour (After Hours)-Water Distribution Operator	$38.25	$34.25	y	$38.70	1.2%	Cost recovery + .02 for CS processing
			21c)	1/2 Hour Additional Labour (Regular Hours)-Water Distribution Operator	$22.55	$22.82	n	$22.82	1.2%	To achieve full cost recovery
			21d)	1/2 Hour Additional Labour (After Hours)-Water Distribution Operator	$33.85	$34.23	n	$34.23	1.1%	To achieve full cost recovery

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call (905) 546-4426 between 8:30am - 4:30pm

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

For Billing Purposes
Regular Hours: M - F: 7:00am - 4:30pm
After Hours: M - F: 4:30pm - 7:00am, Weekends and Holidays

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 including HST (if applicable)	2020 Proposed Fee	HST (y/n)	2020 including HST (if applicable)	% Fee Change	Basis for Fee Increase or Decrease
				COLLECTION SYSTEM INSPECTION & MAINTENANCE						
06-026			1	**Wastewater Inspection Services** Note: Costs associated with various permit and inspection services related to sewer laterals for properties.						
	516175	47230	1a)	Private Sewer Lateral Repair/Replacement Inspection (Regular Hours - Maximum 1 Hour Total Labour)	$108.50	$96.68	y	$109.25	0.7%	To achieve full cost recovery
	516175	47230	1b)	Private Sewer Lateral Repair/Replacement Inspection (After Hours / Emergency - Maximum 1 Hour Total Labour)	$229.90	$205.40	y	$232.10	1.0%	Cost recovery - .02 for CS processing
	516175	45690	1c)	Missed or Cancelled Inspection	$78.16	$69.50	y	$78.54	0.5%	To achieve full cost recovery
	516175	45690	1d)	Mainline Sewer Inspection	Cost + 33% OH	Cost + 33% OH	y	OH	N/A	To achieve full cost recovery
				Note: CCTV inspection of mainline sewers (storm, sanitary or combined). Cost based on linear meter inspection.						
06-026	516175	45690	2	**Sewer Related Service Calls** Note: Cost for a service call to investigate a sewer related complaint and the issue resides on private property. No charge for sewer complaints related to issues originating from the City's sewer system. Missed appointments will be billed the corresponding						
			2a)	Service Call (Regular Hours - Maximum 1 Hour Total Labour)	$96.72	$86.11	y	$97.30	0.6%	To achieve full cost recovery
			2b)	Service Call (After Hours - Maximum 1 Hour Total Labour)	$194.53	$173.70	y	$196.28	0.9%	To achieve full cost recovery
06-026	516175	45690	3	**Sewer Lateral Cleaning and Investigation Fees** Note: When a property owner qualifies for the Sewer Lateral Management Program and chooses to hire their own Plumbing Contractor, these prices represent the maximum amounts that will be reimbursed to the property owner for the sewer lateral cleaning and investigation services performed by the independent Plumbing Contractor						
			3a)	Complete Sewer Lateral Investigation - Regular Hours	$449.69	$405.91	y	$458.68	2.0%	Lower Contract Costs
			3b)	Complete Sewer Lateral Investigation - After Hours	$496.71	$448.36	y	$506.65	2.0%	Lower Contract Costs
			3c)	Partial Sewer Lateral Cleaning - Regular Hours	$146.96	$132.65	y	$149.89	2.0%	Lower Contract Costs
			3d)	Partial Sewer Lateral Cleaning - After Hours	$205.74	$185.71	y	$209.85	2.0%	Lower Contract Costs
			3e)	Abandoned Sewer Lateral Investigation - Regular Hours	$235.13	$212.24	y	$239.83	2.0%	Lower Contract Costs
			3f)	Abandoned Sewer Lateral Investigation - After Hours	$293.91	$265.30	y	$299.79	2.0%	Lower Contract Costs
06-026	516175	45690	4	**Miscellaneous Wastewater Collection System Repair** Note: Cost for the City to repair damage to the wastewater collection system caused by a third party. Costs include labour, parts, materials, equipment, and permanent restoration.	Cost + 33% OH	Cost + 33% OH	y	Cost + 33% OH	N/A	To achieve full cost recovery
06-026	516175	45690	5	**Additional Labour Charges** Note: Additional labour charge for all services/calls that exceed the allotted labour time. Costs are for a single Wastewater Collection Operator or Contract Inspector in minimum increments of 30 minutes.						
			5a)	1/2 Hour Additional Labour (Regular Hours) - Wastewater Collection	$24.45	$21.90	y	$24.75	1.2%	To achieve full cost recovery
			5b)	1/2 Hour Additional Labour (After Hours) - Wastewater Collection	$36.70	$32.83	y	$37.10	1.1%	Cost recovery - .02 for CS processing

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call (905) 546-4426 between 8:30am - 4:30pm

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

Dept ID	Account #	Ref #	Service Offered	2019 including HST (if applicable)	2020 Proposed Fee	HST (y/n)	2020 including HST (if applicable)	% Fee Change	Basis for Fee Increase or Decrease
			LABORATORY SERVICES						
510250	45519		**Inorganic Tests:**						
		1	**Solids**						
		1a)	Total Suspended Solids (TSS)	$24.52	$21.70	y	$24.52	0.0%	Current fee achieves full cost recovery
		1b)	TSS plus Volatile Suspended Solids (VSS)	$24.52	$21.70	y	$24.52	0.0%	Current fee achieves full cost recovery
		1c)	Total Solids (TS)	$21.36	$19.10	y	$21.58	1.1%	To achieve full cost recovery
		1d)	TS plus Volatile Solids (VS)	$22.15	$20.10	y	$22.71	2.6%	To achieve full cost recovery
		1e)	Total Dissolved Solids	$0.00	$32.00	y	$36.16		New
		2	**Skalar**						
		2a)	Total Cyanide	$37.40	$34.40	y	$38.87	3.9%	To achieve full cost recovery
		2b)	Phenolics	$34.92	$31.80	y	$35.93	2.9%	To achieve full cost recovery
		2c)	Total Kjeldhal Nitrogen (TKN)	$35.48	$31.40	y	$35.48	0.0%	Current fee achieves full cost recovery
		2d)	Ammonia	$39.10	$34.60	y	$39.10	0.0%	Current fee achieves full cost recovery
		2e)	Dissolved Organic Carbon	$38.53	$34.30	y	$38.76	0.6%	To achieve full cost recovery
		2f)	Total Organic Carbon	$38.53	$34.30	y	$38.76	0.6%	To achieve full cost recovery
		2g)	Reactive Silica	$31.30	$28.80	y	$32.54	4.0%	To achieve full cost recovery
510250	45519	3	**Ion Chromatography (IC Scan)**	$56.95	$50.40	y	$56.95	0.0%	Current fee achieves full cost recovery
510250	45519	4	**PC Titrate**						
		4a)	pH	$18.19	$16.50	y	$18.65	2.5%	To achieve full cost recovery
		4b)	Alkalinity	$18.08	$16.40	y	$18.53	2.5%	To achieve full cost recovery
		4c)	Conductivity	$18.08	$16.40	y	$18.53	2.5%	To achieve full cost recovery
		4d)	Fluoride	$27.46	$24.80	y	$28.02	2.1%	To achieve full cost recovery
		5	Turbidity	$27.69	$24.70	y	$27.91	0.8%	To achieve full cost recovery
		6	UV Transmittance	$28.59	$25.30	y	$28.59	0.0%	Current fee achieves full cost recovery
		7	Color Apparent	$25.20	$22.90	y	$25.88	2.7%	To achieve full cost recovery
		8	Color True	$25.20	$22.90	y	$25.88	2.7%	To achieve full cost recovery
		9	O Phosphate	$0.00	$26.70	y	$30.17		New
		10	Chemical Oxygen Demand (COD)	$42.83	$37.90	y	$42.83	0.0%	Current fee achieves full cost recovery
		11	Biochemical Oxygen Demand (BOD)	$42.60	$37.70	y	$42.60	0.0%	Current fee achieves full cost recovery
		12	Volatile Acid	$42.15	$37.30	y	$42.15	0.0%	Current fee achieves full cost recovery
			Microbiology Tests:						
510250	45519	13	Total Coliform/E coli	$24.75	$25.70	y	$29.04	17.4%	To achieve full cost recovery
510250	45519	14	EC	$30.96	$28.60	y	$32.32	4.4%	To achieve full cost recovery
510250	45519	15	Heterotrophic Plate Count	$29.04	$26.70	y	$30.17	3.9%	To achieve full cost recovery
510250	45519	16	Micro Examination	$152.89	$137.30	y	$155.15	1.5%	To achieve full cost recovery
510250	45519	17	Microcystin		$515.00	y	$581.95		New
			Metals:						
510250	45519	18	**ICP OES**						
		18a)	ICP OES Scan (Wastewater)	$65.09	$58.20	y	$65.77	1.0%	To achieve full cost recovery
		18b)	Total Phosphorous	$30.40	$27.70	y	$31.30	3.0%	To achieve full cost recovery
		18c)	Total Dissolved Phosphorous	$30.40	$27.70	y	$31.30	3.0%	To achieve full cost recovery
510250	45519	19	**ICP MS**						
		19a)	ICP MS Scan	$65.09	$58.20	y	$65.77	1.0%	To achieve full cost recovery
510250	45519	20	**AA**						
		20a)	Mercury	$51.64	$45.70	y	$51.64	0.0%	Current fee achieves full cost recovery
510250	45519	21	**Organics**						
		21a)	Caffeine		$124.60	y	$140.80		New
510250	45519	22	Additional Fees						
		22a)	Weekend surcharge		$100.00	y	$113.00		New

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call 905 546 2424 ext 5834

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 Including HST (if applicable)	2020 Proposed Fee	HST (y/n)	2020 Including HST (if applicable)	% Fee Change	Basis for Fee Increase or Decrease
				ENVIRONMENTAL MONITORING & ENFORCEMENT *To Regulate the Discharge of any Matter into the Sanitary,* Combined, and Storm Sewer Systems.						
14-090	516175	47232	1	**Annual Permit to Discharge Hauled Sewage** Note: Cost for administration and processing of annual permits required to haul sewage within Hamilton	$324.00	$329.00	n	$329.00	1.5%	To achieve full cost recovery
			2	**Discharge fees for Hauled Sewage generated:** **Inside the City - Compliant** Note: Cost per truck full of sewage containing materials within Sewer Use By-law limits						
14-090	516175	41314	2a)	up to 1000 imperial gallons (4.54 m3) or any part thereof	$49.15	$50.15	n	$50.15	2.0%	To achieve full cost recovery
14-090	516175	41314	2b)	greater than 1000 (4.54 m3) but less than or equal to 3500 Imperial gallons (15.9m3)	$49.15	$50.15	n	$50.15	2.0%	Has to remain a multiple of $49.15
14-090	516175	41314	2c)	greater than 3500 (15.9 m3) but less than or equal to 5000 Imperial gallons (22.7 m3)	$98.30	$100.30	n	$100.30	2.0%	Has to remain a multiple of $49.15
14-090	516175	41314	2d)	greater than 5000 (22.7 m3) but less than or equal to 8000 Imperial gallons (36.3 m3)	$147.45	$150.45	n	$150.45	2.0%	Has to remain a multiple of $49.15
14-090	516175	41314	2e)	greater than 8000 (36.3 m3) but less than or equal to 10000 Imperial gallons (45.43 m3)	$196.60	$200.60	n	$200.60	2.0%	Has to remain a multiple of $49.15
			3	***Discharge fees for Hauled Sewage generated:*** **Inside the City - Non-Compliant** Note: Cost per truck full of sewage containing materials that exceed one or more Sewer Use By-law limits						
14-090	516175	41314	3a)	*up to 1000 imperial gallons (4.54 m3) or any part thereof*	$49.15	$50.15	n	$50.15	2.0%	To achieve full cost recovery
14-090	516175	41314	3b)	greater than 1000 (4.54 m3) but less than or equal to 3500 Imperial gallons (15.9m3)	$98.30	$100.30	n	$100.30	2.0%	Has to remain a multiple of $49.15
14-090	516175	41314	3c)	greater than 3500 (15.9 m3) but less than or equal to 5000 Imperial gallons (22.7 m3)	$147.45	$150.45	n	$150.45	2.0%	Has to remain a multiple of $49.15
14-090	516175	41314	3d)	greater than 5000 (22.7 m3) but less than or equal to 8000 Imperial gallons (36.3 m3)	$245.75	$250.75	n	$250.75	2.0%	Has to remain a multiple of $49.15
14-090	516175	41314	3e)	greater than 8000 (36.3 m3) but less than or equal to 10000 Imperial gallons (45.43 m3)	$294.90	$300.90	n	$300.90	2.0%	Has to remain a multiple of $49.15
14-090	516175	41314	4	**Holding Tanks for Recreational Vehicles** Note: Cost for Recreational Vehicles (RV's) to dump sewer waste at the Mountain Transfer Station	$8.50	$8.50	n	$8.50	0.0%	Current fee achieves full cost recovery
			5	**Overstrength Discharge Fees** Note: Cost per kilogram of each specified parameter that is in excess of Sewer Use By-law limits, and subject to a Sewer Discharge Permit						
14-090	516080	41315	5a)	Biochemical Oxygen Demand (charge per kg)	$0.78	$0.78	n	$0.78	0.0%	Current fee achieves full cost recovery
14-090	516080	41315	5b)	Total suspended solids (charge per kg)	$0.63	$0.63	n	$0.63	0.0%	Current fee achieves full cost recovery
14-090	516080	41315	5c)	Oil & grease (animal/vegetable) (charge per kg)	$0.66	$0.44	n	$0.44	-33.2%	Decrease reflecting rate review
14-090	516080	41315	5d)	Total Kjeldahl Nitrogen (charge per kg)	$2.39	$1.00	n	$1.00	-58.1%	Decrease reflecting rate review
14-090	516080	41315	5e)	Total Phosphorus (charge per kg)	$1.68	$1.78	n	$1.78	6.1%	To achieve full cost recovery
14-090	516080	41317	6	**Surcharge Discharge Fee (charge per m3)**	$1.68	$1.75	n	$1.75	4.2%	Equal to variable wastewater rate increase

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call 905-540-5190 or email sewerusebylaw@hamilton.ca

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 Including HST (If applicable)	2020 Proposed Fee	HST (y/n)	2020 Including HST (If applicable)	% Fee Change	Basis for Fee Increase or Decrease
			7	**Application Fees for Sewer Discharge Permits** NOTE: *Fee to be paid upon application for Sewer Discharge Permit*						
14-090	510260	45519	7a)	Application Fee	$697.32	$629.34	y	$711.15	2.0%	Increase due to incorporating 7b) and 7c) fees into Application Fee
14-090	510260	45519	7b)	*Wastewater Characterization deposit (optional)*	$500.00	$500.00	n	$500.00	0.0%	
14-090	510260	45519	7c)	Amendment Fee (all permit types)	$327.34	$295.47	y	$333.88	2.0%	To achieve full cost recovery
			8	**Administrative Fees for Sewer Discharge Permits** Note: Multiple permit holders pay the higher administration fee (for example, if the permit holder has both an Overstrength Discharge Permit and a Compliance Program Permit, they will pay $810.00 per quarter						
14-090	510260	45532	8a)	Overstrength Discharge Permit (charged quarterly)	$427.00	$435.00	n	$435.00	1.9%	Lab/equip. costs up in 2018. Previous 2015, 2012
14-090	510260	45532	8b)	Sanitary Discharge Permit (charged quarterly)	$427.00	$435.00	n	$435.00	1.9%	Lab/equip. costs up in 2018. Previous 2015, 2012
14-090	510260	45532	8c)	Chloride Discharge Permit (charged quarterly)	$427.00	$435.00	n	$435.00	1.9%	Lab/equip. costs up in 2018. Previous 2015, 2012
14-090	510260	45532	8d)	Compliance Discharge Permit (charged quarterly)	$1,050.00	$1,071.00	n	$1,071.00	2.0%	Lab/equip. costs up in 2018. Previous 2015, 2012
14-090	510260	45532	8e)	Conditional Discharge Permit (charged quarterly)	$1,050.00	$1,071.00	n	$1,071.00	2.0%	Lab/equip. costs up in 2018. Previous 2015, 2012
14-090	510260	45519	9	**Information Requests** Note: Fee per property for records search related to Sewer Use By-law historical violations	$167.13	$150.86	y	$170.47	2.0%	To achieve full cost recovery
14-090	510260	45532	10	**Wastewater Sampling (optional)** *Note: Per unit costs to conduct wastewater sampling to determine permit conditions and limits*						
			10a)	Wastewater Sampling Vehicle Fee (per kilometer)	$1.34	$1.21	y	$1.37	1.7%	To achieve full cost recovery
			10b)	Wastewater Sampling Equipment Fee (per day)	$43.96	$39.68	y	$44.84	2.0%	To achieve full cost recovery
			10c)	Wastewater Sampling Technician Fee (per hour) Mon - Fri	$55.44	$50.04	y	$56.55	2.0%	EMT position - replaced by RFT one pay grade higher
			10d)	Wastewater Sampling Technician Fee (per hour) Sat	$83.16	$75.06	y	$84.82	2.0%	EMT position - replaced by RFT one pay grade higher
			10e)	Wastewater Sampling Technician Fee (per hour) Sun	$110.86	$100.07	y	$113.08	2.0%	EMT position - replaced by RFT one pay grade higher

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call 905-540-5190 or email sewerusebylaw@hamilton.ca

2020 PROPOSED USER FEES AND CHARGES

PUBLIC WORKS
HAMILTON WATER

Dept. By-Law #	Dept ID	Account #	Ref #	Service Offered	2019 including HST (if applicable)	2020 Proposed Fee	HST (y/n)	2020 including HST (if applicable)	% Fee Change	Basis for Fee Increase or Decrease
				ENVIRONMENTAL MONITORING & ENFORCEMENT **Fees related to the Wastewater Abatement Program**						
03-272	510260	45532	1	Application Fee (plus cost recovery for peer review if	**$423.19**	**$374.50**	y	**$423.19**	**0.0%**	Current fee achieves full cost recovery
03-272	510260	45532	2	Annual Administration Fee	**$805.46**	**$745.30**	y	**$842.19**	**4.6%**	To achieve full cost recovery

Costs not specifically addressed in the schedule will be invoiced at Actual Cost plus overhead
For general inquiries, please call 905-540-5190 or email sewerusebylaw@hamilton.ca

CITY OF HAMILTON

2020 HAMILTON WATER OPERATING BUDGET

COMBINED WATER, WASTEWATER AND STORM

	2019 RESTATED BUDGET	2019 PROJECTED ACTUAL	2020 REQUESTED BUDGET	CHANGE 2019 PROJECTED ACTUAL / 2019 RESTATED BUDGET		CHANGE 2020 REQUESTED / 2019 RESTATED BUDGET	
OPERATING EXPENDITURES:	$	$	$	$	%	$	%
Divisional Administration & Support	2,242,620	2,242,620	1,408,041	(0)	(0.0%)	(834,579)	(37.2%)
Woodward Upgrades	1,524,540	1,524,540	1,108,390	-	0.0%	(416,150)	(27.3%)
Customer Service	421,610	421,610	254,823	-	0.0%	(166,787)	(39.6%)
Outreach & Education	1,350,860	1,300,860	1,239,577	50,000	3.7%	(111,283)	(8.2%)
Service Co-ordination	4,251,610	3,785,610	3,745,588	466,000	11.0%	(506,022)	(11.9%)
Engineering Systems & Data Collection	1,286,870	1,286,870	1,351,831	-	0.0%	64,961	5.0%
Compliance & Regulations	871,210	871,210	976,984	-	0.0%	105,774	12.1%
Laboratory Services	3,527,640	3,527,640	3,660,204	-	0.0%	132,564	3.8%
Environmental Monitoring & Enforcement	1,818,020	1,818,020	1,778,256	-	0.0%	(39,764)	(2.2%)
Water Distribution & Wastewater Collection	21,369,840	21,369,840	22,511,201	-	0.0%	1,141,361	5.3%
Plant Operations & Maintenance	41,383,390	39,383,390	33,449,649	2,000,000	4.8%	(7,933,741)	(19.2%)
Capital Delivery	1,859,660	1,859,660	1,595,011	-	0.0%	(264,649)	(14.2%)
Sustainable Initiatives	1,497,370	1,497,370	1,431,094	-	0.0%	(66,276)	(4.4%)
Infrastructure Planning & System Design	2,314,770	2,314,770	1,877,476	-	0.0%	(437,294)	(18.9%)
Wastewater Abatement Program	1,150,000	1,150,000	1,150,040	-	0.0%	40	0.0%
Alectra Utilities Service Contract	5,700,000	5,400,000	5,600,000	300,000	5.3%	(100,000)	(1.8%)
Corporate & Departmental Support Services	6,432,040	6,432,040	6,977,580	-	0.0%	545,540	8.5%
Utilities Arrears Program	500,000	500,000	500,080	-	0.0%	80	0
Sewer Lateral Management Program	500,000	500,000	414,738	-	0.0%	(85,262)	(0)
Hamilton Harbour Remedial Action Plan	395,000	395,000	382,550	-	0.0%	(12,450)	(3.2%)
Protective Plumbing Program (3P)	1,250,000	885,034	1,250,000	364,966	29.2%	-	0.0%
Financial Charges	177,000	177,000	86,019	-	0.0%	(90,981)	(51.4%)
	101,824,050	98,643,084	92,749,132	3,180,966	3.1%	(9,074,918)	**(8.9%)**
Capital and Reserve Recoveries	(6,099,580)	(6,099,580)	(6,029,550)	0	(0.0%)	70,030	(1.1%)
Sub-Total	**95,724,470**	**92,543,504**	**86,719,582**	**3,180,966**	**3.3%**	**(9,004,888)**	**(9.4%)**
Capital and Reserve Impacts on Operating							
Contributions to Capital							
Water Quality Initiatives	51,762,000	51,762,000	50,296,000	-	-	(1,466,000)	(2.8%)
Wastewater	42,837,000	42,837,000	52,673,000	-	-	9,836,000	23.0%
Stormwater	3,205,000	3,205,000	15,685,000	-	-	12,480,000	389.4%
Sub-Total Contributions to Capital	**97,804,000**	**97,804,000**	**118,654,000**	**-**	**-**	**20,850,000**	**21.3%**
Contributions for DC Exemptions							
Water Quality Initiatives	2,547,000	2,547,000	2,240,000	-	-	(307,000)	(12.1%)
Wastewater	4,590,000	4,590,000	4,080,000	-	-	(510,000)	(11.1%)
Stormwater	1,863,000	1,863,000	1,680,000	-	-	(183,000)	(9.8%)
Sub-Total Contributions for DC Exemptions	**9,000,000**	**9,000,000**	**8,000,000**	**-**	**-**	**(1,000,000)**	**(11.1%)**

CITY OF HAMILTON

2020 HAMILTON WATER OPERATING BUDGET

COMBINED WATER, WASTEWATER AND STORM

	2019 RESTATED BUDGET	2019 PROJECTED ACTUAL	2020 REQUESTED BUDGET	CHANGE 2019 PROJECTED ACTUAL / 2019 RESTATED BUDGET		CHANGE 2020 REQUESTED / 2019 RESTATED BUDGET	
OPERATING EXPENDITURES:	$	$	$	$	%	$	%
Capital Debt Charges							
Water Quality Initiatives	9,762,487	7,537,276	8,593,943	2,225,211	22.8%	(1,168,544)	(12.0%)
Wastewater	10,120,380	8,460,849	11,514,374	1,659,531	16.4%	1,393,994	13.8%
Stormwater	3,950,054	2,371,561	3,399,997	1,578,493	40.0%	(550,057)	(13.9%)
DC Debt Charges Recoveries	(4,467,237)	(904,431)	(3,826,205)	(3,562,806)	79.8%	641,032	(14.3%)
Sub-Total Debt Charges	**19,365,685**	**17,465,255**	**19,682,108**	**1,900,430**	**9.8%**	**316,424**	**1.6%**
Sub-Total Capital Financing	**126,169,685**	**124,269,256**	**146,336,108**	**1,900,430**	**1.5%**	**20,166,424**	**16.0%**
Reserve Transfers	**365,324**	**365,324**	**(43,888)**	**0**	**0.0%**	**(409,212)**	**(112.0%)**
Sub-Total Capital and Reserve Impacts on Operating	**126,535,009**	**124,634,580**	**146,292,220**	**1,900,430**	**1.5%**	**19,757,211**	**15.6%**
TOTAL EXPENDITURES	**222,259,479**	**217,178,084**	**233,011,802**	**5,081,395**	**2.3%**	**10,752,323**	**4.8%**
REVENUES:							
Rate Revenue							
Residential	97,938,766	98,938,766	102,226,242	1,000,000	1.0%	4,287,476	4.4%
Industrial/Commercial/Institutional/Multi-res	107,752,759	108,752,759	112,557,622	1,000,000	0.9%	4,804,863	4.5%
Haldimand	2,353,282	2,353,282	2,476,307	-	0.0%	123,025	5.2%
Halton	247,782	247,782	259,593	-	0.0%	11,811	4.8%
Raw Water	150,000	120,000	125,000	(30,000)	(20.0%)	(25,000)	(16.7%)
Non-Metered	580,000	1,700,000	580,000	1,120,000	193.1%	-	0.0%
Private Fire Lines	1,550,000	1,750,000	1,850,000	200,000	12.9%	300,000	19.4%
Hauler / 3rd Party Sales	1,225,000	1,225,000	1,225,000	-	0.0%	-	0.0%
Overstrength Agreements	2,249,480	3,098,294	2,892,902	848,814	37.7%	643,422	28.6%
Sewer Surcharge Agreements	5,200,000	5,200,000	5,806,726	-	0.0%	606,726	11.7%
Sub-Total Utility Rates	**219,247,069**	**223,385,883**	**229,999,392**	**4,138,814**	**1.9%**	**10,752,323**	**4.9%**
Non-Rate Revenue							
Local Improvement Recoveries	275,850	275,850	275,850	-	-	-	-
Permits / Leases / Agreements	1,365,050	1,365,050	1,365,050	-	-	-	0.0%
Investment Income	450,000	450,000	450,000	-	0.0%	-	-
General Fees and Recoveries	921,510	921,510	921,510	-	0.0%	-	0.0%
Sub-Total Non-Rate Revenue	**3,012,410**	**3,012,410**	**3,012,410**	**-**	**0.0%**	**-**	**0.0%**
TOTAL REVENUES	**222,259,479**	**226,398,293**	**233,011,802**	**4,138,814**	**1.9%**	**10,752,323**	**4.8%**
NET EXPENDITURES	**-**	**(9,220,209)**	**-**	**9,220,209**	**-**	**-**	**-**

CITY OF HAMILTON
2020 - 2023 WATER, WASTEWATER AND STORM OPERATING BUDGET
COMBINED WATER, WASTEWATER AND STORM

	2019 RESTATED BUDGET	2020 REQUESTED BUDGET	2021 PROJECTED BUDGET	2022 PROJECTED BUDGET	2023 PROJECTED BUDGET	CHANGE 2020 REQUESTED / 2019 RESTATED BUDGET		CHANGE 2021 PROJECTED / 2020 REQUESTED BUDGET		CHANGE 2022 PROJECTED / 2021 PROJECTED BUDGET	
	$	$	$	$	$	$	%	$	%	$	%
OPERATING EXPENDITURES:											
Divisional Administration & Support	2,242,620	1,408,041	1,436,202	1,464,926	1,494,224	(834,579)	(37.2%)	28,161	2.0%	28,724	2.0%
Woodward Upgrades	1,524,540	1,108,390	1,130,558	1,153,169	1,176,232	(416,150)	(27.3%)	22,168	2.0%	22,611	2.0%
Customer Service	421,610	254,823	259,919	265,118	270,420	(166,787)	(39.6%)	5,096	2.0%	5,198	2.0%
Outreach & Education	1,350,860	1,239,577	1,264,369	1,289,656	1,315,449	(111,283)	(8.2%)	24,792	2.0%	25,287	2.0%
Service Co-ordination	4,251,610	3,745,588	3,820,500	3,896,910	3,974,848	(506,022)	(11.9%)	74,912	2.0%	76,410	2.0%
Engineering Systems & Data Collection	1,286,870	1,351,831	1,378,868	1,406,445	1,434,574	64,961	5.0%	27,037	2.0%	27,577	2.0%
Compliance & Regulations	871,210	976,984	996,524	1,016,454	1,036,783	105,774	12.1%	19,540	2.0%	19,930	2.0%
Laboratory Services	3,527,640	3,660,204	3,733,408	3,808,076	3,884,238	132,564	3.8%	73,204	2.0%	74,668	2.0%
Environmental Monitoring & Enforcement	1,818,020	1,778,256	1,813,821	1,850,098	1,887,099	(39,764)	(2.2%)	35,565	2.0%	36,276	2.0%
Water Distribution & Wastewater Collection	21,369,840	22,511,201	22,961,425	23,420,654	23,889,067	1,141,361	5.3%	450,224	2.0%	459,229	2.0%
Plant Operations & Maintenance	41,383,390	33,449,649	34,118,642	34,801,015	35,497,035	(7,933,741)	(19.2%)	668,993	2.0%	682,373	2.0%
Capital Delivery	1,859,660	1,595,011	1,626,911	1,659,449	1,692,638	(264,649)	(14.2%)	31,900	2.0%	32,538	2.0%
Sustainable Initiatives	1,497,370	1,431,094	1,459,716	1,488,910	1,518,688	(66,276)	(4.4%)	28,622	2.0%	29,194	2.0%
Infrastructure Planning & System Design	2,314,770	1,877,476	1,915,026	1,953,326	1,992,393	(437,294)	(18.9%)	37,550	2.0%	38,301	2.0%
Wastewater Abatement Program	1,150,000	1,150,040	1,173,041	1,196,502	1,220,432	40	0.0%	23,001	2.0%	23,461	2.0%
Alectra Utilities Service Contract	5,700,000	5,600,000	5,712,000	5,826,240	5,942,765	(100,000)	(1.8%)	112,000	2.0%	114,240	2.0%
Corporate & Departmental Support Services	6,432,040	6,977,580	7,117,132	7,259,474	7,404,664	545,540	8.5%	139,552	2.0%	142,343	2.0%
Utilities Arrears Program	500,000	500,080	510,082	520,283	530,689	80	0.0%	10,002	2.0%	10,202	2.0%
Sewer Lateral Management Program	500,000	414,738	423,033	431,493	440,123	(85,262)	(17.1%)	8,295	2.0%	8,461	2.0%
Hamilton Harbour Remedial Action Plan	395,000	382,550	390,201	398,005	405,965	(12,450)	(3.2%)	7,651	2.0%	7,804	2.0%
Protective Plumbing Program (3P)	1,250,000	1,250,000	1,275,000	1,300,500	1,326,510	-	0.0%	25,000	2.0%	25,500	2.0%
Financial Charges	177,000	86,019	87,739	89,494	91,284	(90,981)	(51.4%)	1,720	2.0%	1,755	2.0%
	101,824,050	92,749,132	94,604,115	96,496,197	98,426,121	(9,074,918)	(8.9%)	1,854,983	2.0%	1,892,082	2.0%
Capital and Reserve Recoveries	(6,099,580)	(6,029,550)	(6,150,141)	(6,273,144)	(6,398,607)	70,030	(1.1%)	(120,591)	2.0%	(123,003)	2.0%
Sub-Total	**95,724,470**	**86,719,582**	**88,453,974**	**90,223,053**	**92,027,514**	**(9,004,888)**	**(9.4%)**	**1,734,392**	**2.0%**	**1,769,079**	**2.0%**
Capital and Reserve Impacts on Operating											
Contributions to Capital											
Water Quality Initiatives	51,762,000	50,296,000	52,953,000	56,553,000	63,516,000	(1,466,000)	(2.8%)	2,657,000	5.3%	3,600,000	6.8%
Wastewater	42,837,000	52,673,000	55,057,000	54,249,000	54,174,000	9,836,000	23.0%	2,384,000	4.5%	(808,000)	(1.5%)
Stormwater	3,205,000	15,685,000	14,382,000	15,775,000	15,975,000	12,480,000	389.4%	(1,303,000)	(8.3%)	1,393,000	9.7%
Sub-Total Contributions to Capital	**97,804,000**	**118,654,000**	**122,392,000**	**126,577,000**	**133,665,000**	**20,850,000**	**21.3%**	**3,738,000**	**3.2%**	**4,185,000**	**3.4%**
Contributions for DC Exemptions											
Water Quality Initiatives	2,547,000	2,240,000	2,240,000	2,240,000	2,240,000	(307,000)	(12.1%)	-	0.0%	-	0.0%
Wastewater	4,590,000	4,080,000	4,080,000	4,080,000	4,080,000	(510,000)	(11.1%)	-	0.0%	-	0.0%
Stormwater	1,863,000	1,680,000	1,680,000	1,680,000	1,680,000	(183,000)	(9.8%)	-	0.0%	-	0.0%
Sub-Total Contributions for DC Exemptions	**9,000,000**	**8,000,000**	**8,000,000**	**8,000,000**	**8,000,000**	**(1,000,000)**	**(11.1%)**	-	**0.0%**	-	**0.0%**
Debt Charges											
Water Quality Initiatives	9,762,487	8,593,943	13,081,230	19,120,697	22,771,434	(1,168,544)	(12.0%)	4,487,287	52.2%	6,039,467	46.2%
Wastewater	10,120,380	11,514,374	18,224,240	24,836,447	29,106,256	1,393,994	13.8%	6,709,866	58.3%	6,612,207	36.3%
Stormwater	3,950,054	3,399,997	4,917,875	5,719,347	6,438,841	(550,057)	(13.9%)	1,517,878	44.6%	801,472	16.3%
DC Debt Charges Recoveries	(4,467,237)	(3,826,205)	(10,928,162)	(17,429,536)	(21,372,836)	641,032	(14.3%)	(7,101,957)	185.6%	(6,501,374)	59.5%
Sub-Total Debt Charges	**19,365,685**	**19,682,108**	**25,295,182**	**32,246,955**	**36,943,695**	**316,424**	**1.6%**	**5,613,074**	**28.5%**	**6,951,772**	**27.5%**
Sub-Total Capital Financing	**126,169,685**	**146,336,108**	**155,687,182**	**166,823,955**	**178,608,695**	**20,166,424**	**16.0%**	**9,351,074**	**6.4%**	**11,136,772**	**7.2%**
Reserve Transfers	365,324	(43,888)	(402,492)	(370,598)	(393,081)	**(409,212)**	**(112.0%)**	**(358,604)**	**817.1%**	**31,893**	**(7.9%)**
Sub-Total Capital and Reserve Impacts on Operating	**126,535,009**	**146,292,220**	**155,284,690**	**166,453,356**	**178,215,614**	**19,757,211**	**15.6%**	**8,992,470**	**6.1%**	**11,168,666**	**7.2%**
TOTAL EXPENDITURES	**222,259,479**	**233,011,802**	**243,738,664**	**256,676,409**	**270,243,128**	**10,752,323**	**4.8%**	**10,726,862**	**4.6%**	**12,937,745**	**5.3%**

CITY OF HAMILTON
2020 - 2023 WATER, WASTEWATER AND STORM OPERATING BUDGET
COMBINED WATER, WASTEWATER AND STORM

	2019 RESTATED BUDGET	2020 REQUESTED BUDGET	2021 PROJECTED BUDGET	2022 PROJECTED BUDGET	2023 PROJECTED BUDGET	CHANGE 2020 REQUESTED / 2019 RESTATED BUDGET		CHANGE 2021 PROJECTED / 2020 REQUESTED BUDGET		CHANGE 2022 PROJECTED / 2021 PROJECTED BUDGET	
	$	$	$	$	$	$	%	$	%	$	%
REVENUES:											
Rate Revenue											
Residential	97,938,766	102,226,242	107,533,183	113,624,568	120,099,836	4,287,476	4.4%	5,306,940	5.2%	6,091,385	5.7%
Industrial/Commercial/Institutional/Multi-res	107,752,759	112,557,622	117,408,155	123,603,330	130,095,258	4,804,863	4.5%	4,850,533	4.3%	6,195,175	5.3%
Haldimand	2,353,282	2,476,307	2,591,366	2,739,374	2,931,659	123,025	5.2%	115,058	4.6%	148,008	5.7%
Halton	247,782	259,593	269,837	284,866	303,990	11,811	4.8%	10,245	3.9%	15,029	5.6%
Raw Water	150,000	125,000	128,750	132,613	136,591	(25,000)	(16.7%)	3,750	3.0%	3,863	3.0%
Non-Metered	580,000	580,000	580,000	610,000	640,000	-	0.0%	-	0.0%	30,000	5.2%
Private Fire Lines	1,550,000	1,850,000	1,924,000	2,000,960	2,080,998	300,000	19.4%	74,000	4.0%	76,960	4.0%
Hauler / 3rd Party Sales	1,225,000	1,225,000	1,261,750	1,299,603	1,325,709	-	0.0%	36,750	3.0%	37,853	3.0%
Overstrength Agreements	2,249,480	2,892,902	2,979,689	3,069,080	3,130,461	643,422	28.6%	86,787	3.0%	89,391	3.0%
Sewer Surcharge Agreements	5,200,000	5,806,726	5,980,928	6,160,356	6,283,563	606,726	11.7%	174,202	3.0%	179,428	3.0%
Sub-Total Utility Rates	**219,247,069**	**229,999,392**	**240,657,657**	**253,524,748**	**267,028,066**	**10,752,323**	**4.9%**	**10,658,265**	**4.6%**	**12,867,091**	**5.3%**
Non-Rate Revenue											
Local Improvement Recoveries	275,850	275,850	275,850	275,850	275,850	-	0.0%	-	0.0%	-	0.0%
Permits/Leases/Agreements	1,365,050	1,365,050	1,406,002	1,448,182	1,463,627	-	0.0%	40,952	3.0%	42,180	3.0%
Investment Income	450,000	450,000	450,000	450,000	450,000	-	0.0%	-	0.0%	-	0.0%
General Fees and Recoveries	921,510	921,510	949,155	977,630	1,025,585	-	0.0%	27,645	3.0%	28,475	3.0%
							0.0%		0.0%		0.0%
Sub-Total Non-Rate Revenue	**3,012,410**	**3,012,410**	**3,081,007**	**3,151,662**	**3,215,062**	**-**	**0.0%**	**68,597**	**2.3%**	**70,655**	**2.3%**
TOTAL REVENUES	**222,259,479**	**233,011,802**	**243,738,664**	**256,676,409**	**270,243,128**	**10,752,323**	**4.8%**	**10,726,862**	**4.6%**	**12,937,745**	**5.3%**
NET EXPENDITURES	**-**	**-**	**-**	**-**	**-**	**(0)**	**-**	**(0)**	**-**	**0**	**-**

CITY OF HAMILTON
2020-2029 WATER, WASTEWATER & STORM OPERATING BUDGET
COMBINED WATER, WASTEWATER AND STORM
($ 000'S)

	2019 Restated	2020 Requested	2021 Forecast	2022 Forecast	2023 Forecast	2024 Forecast	2025 Forecast	2026 Forecast	2027 Forecast	2028 Forecast	2029 Forecast
OPERATING EXPENDITURES											
OPERATING COSTS	91,224	82,720	84,224	84,494	86,181	87,901	89,655	91,444	93,269	95,128	97,124
BIO-SOLIDS	4,500	4,000	4,230	4,129	4,215	4,302	4,392	4,484	4,578	4,676	4,676
TERTIARY TREATMENT	-	-	-	1,600	1,632	1,665	1,698	1,732	1,767	1,802	1,838
TOTAL OPERATING COSTS	**95,724**	**86,720**	**88,454**	**90,223**	**92,028**	**93,868**	**95,745**	**97,660**	**99,614**	**101,606**	**103,638**
CAPITAL & RESERVE IMPACTS ON OPERATING											
Contributions to Capital											
Water	51,762	50,296	52,953	56,553	63,516	73,300	84,611	83,417	72,832	90,002	107,861
Wastewater	42,837	52,673	55,057	54,249	54,174	52,379	58,704	63,479	67,164	68,470	65,440
Stormwater	3,205	15,685	14,382	15,775	15,975	17,595	9,875	16,385	37,430	34,735	35,215
Sub-total Contributions to Capital	**97,804**	**118,654**	**122,392**	**126,577**	**133,665**	**143,274**	**153,190**	**163,281**	**177,426**	**193,207**	**208,516**
Contributions for DC Exemptions											
Water	2,547	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240	2,240
Wastewater	4,590	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080	4,080
Stormwater	1,863	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680	1,680
Sub-total Contributions to Capital	**9,000**	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**	**8,000**
Debt Charges											
Water	9,762	8,594	13,081	19,121	22,771	24,378	26,861	29,864	30,861	30,665	30,561
Wastewater	10,120	11,514	18,224	24,836	29,106	30,401	30,518	34,295	41,345	47,498	51,136
Stormwater	3,950	3,400	4,918	5,719	6,439	6,775	6,728	6,681	6,690	6,705	6,778
DC Debt Charges Recoveries	(4,467)	(3,826)	(10,928)	(17,430)	(21,373)	(23,098)	(25,025)	(31,460)	(41,112)	(49,540)	(53,306)
Sub-total Debt Charges	**19,366**	**19,682**	**25,295**	**32,247**	**36,944**	**38,456**	**39,082**	**39,380**	**37,784**	**35,328**	**35,169**
Reserve Transfers	**365**	**(44)**	**(402)**	**(371)**	**(394)**	**(353)**	**(304)**	**(282)**	**(313)**	**(318)**	**147**
Sub-Total Capital & Reserve Impacts on Operating	**126,535**	**146,292**	**155,285**	**166,453**	**178,215**	**189,377**	**199,968**	**210,379**	**222,897**	**236,217**	**251,832**
TOTAL EXPENDITURES	222,259	233,012	243,739	256,676	270,243	283,245	295,714	308,039	322,511	337,823	355,470
REVENUES											
Residential	97,939	102,226	107,533	113,625	120,100	126,815	134,051	141,659	149,749	157,939	166,460
Industrial/Commercial/Institutional/Multi-res	107,753	112,558	117,408	123,603	130,095	135,830	140,539	144,771	150,606	157,123	165,607
Haldimand	2,353	2,476	2,591	2,739	2,932	3,074	3,179	3,241	3,351	3,507	3,687
Halton	248	260	270	285	304	318	331	340	351	367	385
Raw Water	150	125	129	133	137	141	145	149	154	158	163
Non-Metered	580	580	580	610	640	670	700	730	760	790	820
Private Fire Lines	1,550	1,850	1,924	2,001	2,081	2,164	2,251	2,341	2,434	2,532	2,633
Hauler / 3rd Party Sales	1,225	1,225	1,262	1,300	1,326	1,352	1,379	1,407	1,435	1,464	1,493
Overstrength Agreements	2,249	2,893	2,980	3,069	3,130	3,193	3,257	3,322	3,389	3,456	3,525
Sewer Surcharge Agreements	5,200	5,807	5,981	6,160	6,284	6,409	6,537	6,668	6,802	6,938	7,076
Non-Rate Revenue	3,012	3,012	3,081	3,152	3,215	3,279	3,345	3,411	3,480	3,549	3,620
TOTAL REVENUES	**222,259**	**233,012**	**243,739**	**256,676**	**270,243**	**283,245**	**295,714**	**308,039**	**322,511**	**337,823**	**355,470**
NET EXPENDITURES	-	-	-	-	-	-	-	-	-	-	-
Rate Increase	**4.66%**	**4.11%**	**4.28%**	**4.50%**	**4.55%**	**4.41%**	**4.46%**	**4.41%**	**4.54%**	**4.34%**	**4.37%**
RESIDENTIAL BILL (200m³ p.a.)	**$ 722.90**	**$ 752.60**	**$ 784.80**	**$ 820.10**	**$ 857.40**	**$ 895.20**	**$ 935.10**	**$ 976.30**	**$ 1,020.60**	**$ 1,064.85**	**$ 1,111.35**

City of Hamilton
Water System
2020 Capital Budget Project List
(000's)

Appendix "C" to Item 2 of GIC Report 19-025 Page 1 of 3

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources: From Operating	Financing Sources: Debt
Annual Projects														
City Wide	4032058001	Consultation and Accommodation		30	-	-	-	-	-	-	-	30	30	-
City Wide	5142001099	Engineering Services Staffing Costs - Water		4,700	-	-	-	-	-	-	-	4,700	4,700	-
City Wide	5142060711	PW Capital Water Consumption Program		180	-	-	-	-	-	-	-	180	180	-
	Sub-Total Annual Projects			**4,910**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4,910**	**4,910**	**-**
Building - New Construction														
City Wide	5142066350	WTP Chlorine Chemical Building		2,250	-	-	-	-	-	-	-	2,250	2,250	-
	Sub-Total Building - New Construction			**2,250**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,250**	**2,250**	**-**
Coordinated - Replacement Projects														
1	5142070006	Hillcrest - Chedoke to end - Road Restoration		60	-	-	-	-	-	-	-	60	60	-
4	5142070018	Roxborough - Kenilworth to Strathearne (Homeside Neighbourhood) - Road Restoration		700	-	-	-	-	-	-	-	700	700	-
1	5142071306	Hillcrest - Chedoke to end		120	-	-	-	-	-	-	-	120	120	-
4	5142071315	Delena / Beland / Dunsmure		150	-	-	-	-	-	-	-	150	150	-
4	5142071318	Roxborough - Kenilworth to Strathearne (Homeside Neighbourhood)		770	-	-	-	-	-	-	-	770	770	-
	Sub-Total Coordinated - Replacement Projects			**1,800**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,800**	**1,800**	**-**
Coordinated - Upgrade Projects														
3	5141971313	Sherman - King to south end (LRT Enabling Project)		1,130	1,000	-	-	-	-	-	-	130	130	-
3	5141971314	Wentworth - Wilson to King (LRT Enabling Project)		370	330	-	-	-	-	-	-	40	40	-
4	5141971315	Main - Delena to Normanhurst & Normanhurst - Main to Queenston (LRT Enabling Project)		4,800	4,800	-	-	-	-	-	-	-	-	-
4	5142070015	Main - Delena to Normanhurst & Normanhurst - Main to Queenston (LRT Enabling Project)		300	-	-	-	-	-	-	-	300	300	-
	Sub-Total Coordinated - Upgrade Projects			**6,600**	**6,130**	**-**	**-**	**-**	**-**	**-**	**-**	**470**	**470**	**-**
Demolition														
2	5142067420	St. Joseph's Tank Pulsation Dampener (HD002STK)		60	-	-	-	-	-	-	-	60	60	-
	Sub-Total Demolition			**60**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**60**	**60**	**-**
Development Projects														
15	5142080080	Dundas - 575m w/o Evans to 210 w/o Evans		410	-	-	410	-	-	-	-	-	-	-
	Sub-Total Development Projects			**410**	**-**	**-**	**410**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Master Plan														
City Wide	5141555264	City-Wide Water Master Plan		300	-	-	270	-	-	-	-	30	30	-
City Wide	5142055010	Water Systems Planning Program		300	-	-	-	-	-	-	-	300	300	-
	Sub-Total Master Plan			**600**	**-**	**-**	**270**	**-**	**-**	**-**	**-**	**330**	**330**	**-**
Master Plan - Horizontal Assets														
11	5142096250	Airport Lands External Water Servicing (Feedermain) (W-27)	*	1,080	-	223	857	-	-	-	-	-	-	-
12	5142096520	Garner Road Trunk Watermain - Southcote to Wilson (W-09)	*	3,390	-	-	3,390	-	-	-	-	-	-	-

City of Hamilton
Water System
2020 Capital Budget Project List
(000's)

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources: From Operating	Financing Sources: Debt
1	5142096850	Locke St Trunk Watermain - Main to Barton (W-19)	*	2,200	-	-	2,200	-	-	-	-	-	-	-
		Sub-Total Master Plan - Horizontal Assets		**6,670**	-	**223**	**6,447**	-	-	-	-	-	-	-
Master Plan - Vertical Assets														
11	5141495551	PD7 (Upper Stoney Creek/Glanbrook) Elevated Reservoir (W-23)	*	610	-	-	610	-	-	-	-	-	-	-
13	5141595553	PS HD12A (Governors @ Huntingwood) Rebuild with Capacity Upgrade & Standby Power Installation (W-04)		550	-	-	413	-	-	-	-	137	137	-
13	5141695883	PS HD016 (York and Valley) Capacity Upgrade, Standby Power & Building Expansion (W-26) (CASH FLOWED)		780	-	-	701	-	-	-	-	79	79	-
5	5141795850	Greenhill PS HD04B & HD05A Upgrades (W-28) (CASH FLOWED)	*	220	-	-	165	-	-	-	-	55	55	-
City Wide	5142695552	P.S. HD07A - New District 7 (Elfrida area) Pumping Station (W-21)	*	170	-	-	170	-	-	-	-	-	-	-
		Sub-Total Master Plan - Vertical Assets		**2,330**	-	-	**2,059**	-	-	-	-	**271**	**271**	-
Outstations-Sustainable Asset Mgt (SAM)														
12	5141667421	Glancaster Rd & Hwy 53 Pumping Station (HD018) Upgrades (CASH FLOWED)		660	-	-	-	-	-	-	-	660	660	-
14	5141767650	New Greensville Communal Well		150	-	-	-	-	-	-	-	150	150	-
12	5142067450	Lee Smith Reservoir (HDR00) Upgrades		280	-	-	-	-	-	-	-	280	280	-
City Wide	5142067752	Water Outstation Inspections - Asset Management		660	-	-	-	-	-	-	-	660	660	-
		Sub-Total Outstations-Sustainable Asset Mgt (SAM)		**1,750**	-	-	-	-	-	-	-	**1,750**	**1,750**	-
Plant - Sustainable Asset Mgt (SAM)														
4	5141166110	Water Treatment Plant - Process Upgrades (CASH FLOWED)		4,950	-	-	-	-	-	-	-	4,950	4,950	-
4	5141567575	High Lift Pumping Station (HLPS) Improvements - Phase 2 (CASH FLOWED)		550	-	-	-	-	-	-	-	550	550	-
City Wide	5142066310	WTP Pre-Treatment Isolation Valves		280	-	-	-	-	-	-	-	280	280	-
		Sub-Total Plant - Sustainable Asset Mgt (SAM)		**5,780**	-	-	-	-	-	-	-	**5,780**	**5,780**	-
Plant - Water Quality Initiatives (WQI)														
City Wide	5142069075	City Environmental Lab Improvements Program		150	-	-	-	-	-	-	-	150	150	-
		Sub-Total Plant - Water Quality Initiatives (WQI)		**150**	-	-	-	-	-	-	-	**150**	**150**	-
Rehabilitation Project														
City Wide	5141761777	Beach Trunkmain Rehab		1,200	-	-	-	-	-	-	-	1,200	1,200	-
City Wide	5142057626	Critical Watermain Inspection Program		660	-	-	-	-	-	160	-	500	500	-
City Wide	5142060750	Unscheduled Valve, Hydrant, Watermain & Misc Water Replace Program		3,000	-	-	-	-	-	-	-	3,000	3,000	-
3	5142061305	Burlington Trunkmain Repairs		910	-	-	-	-	-	460	-	450	450	-
City Wide	5142061502	Water Meter - Installation/Replacement/Repair - General Maintenance		2,920	-	-	-	640	-	-	-	2,280	2,280	-
		Sub-Total Rehabilitation Project		**8,690**	-	-	-	**640**	-	**620**	-	**7,430**	**7,430**	-
Replacement Project														
10	5141961341	Pineland/Teal/Community/Garden/South Service		1,680	-	-	-	-	-	-	-	1,680	1,680	-
City Wide	5142060080	Valve Replacement Program		3,700	-	-	-	-	-	300	-	3,400	3,400	-
1, 2	5142061302	Barton - Locke to Caroline & Locke - York to Barton		1,000	-	-	-	-	-	-	-	1,000	1,000	-

City of Hamilton
Water System
2020 Capital Budget Project List
(000's)

Appendix "C" to Item 2 of GIC Report 19-025 Page 3 of 3

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources: From Operating	Financing Sources: Debt
5	5142061310	Woodward Greenhill Transmission Main Pipeline repair on Summercrest		500	-	-	-	-	-	-	-	500	500	-
	Sub-Total Replacement Project			**6,880**	**-**	**-**	**-**	**-**	**-**	**300**	**-**	**6,580**	**6,580**	**-**
Restorations														
City Wide	5142011101	Road Restoration Program		5,400	-	-	-	-	-	-	-	5,400	5,400	-
	Sub-Total Restorations			**5,400**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5,400**	**5,400**	**-**
Technical Services Projects														
City Wide	4031957944	PW Asset Management (PW-AM) System Implementation		1,000	-	-	-	-	-	-	-	1,000	1,000	-
City Wide	4032055522	State of the Infrastructure - Asset Management		100	-	-	-	-	-	100	-	-	-	-
City Wide	4032055588	O.Reg. 588/17 Compliance - Asset Management Plan Development		75	-	-	-	-	-	-	-	75	75	-
City Wide	5142049555	QA-QC Service Contract Program		140	-	-	-	-	-	-	-	140	140	-
City Wide	5142055022	Engineering Consultant Watermain Projects		300	-	-	-	-	-	-	-	300	300	-
City Wide	5142055425	Prestressed Concrete Cylinder Pipe Condition Assessment Inspection Program		400	-	-	-	-	-	-	-	400	400	-
City Wide	5142055556	Mapping Update Program		40	-	-	-	-	-	-	-	40	40	-
City Wide	5142055851	Water Efficiency Plan/Program		110	-	-	-	-	-	-	-	110	110	-
City Wide	5142057545	Water - Computer Model		280	-	-	-	-	-	-	-	280	280	-
City Wide	5142060577	Metallic Watermain Condition Assessment Program		630	-	-	-	-	-	-	-	630	630	-
	Sub-Total Technical Services Projects			**3,075**	**-**	**-**	**-**	**-**	**-**	**100**	**-**	**2,975**	**2,975**	**-**
Upgrade Projects														
City Wide	5142062073	Field Data Systems Program		110	-	-	-	-	-	-	-	110	110	-
City Wide	5142062078	Substandard Water Service Replacement Program		2,750	-	-	-	-	-	-	-	2,750	2,750	-
	Sub-Total Upgrade Projects			**2,860**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,860**	**2,860**	**-**
Vehicles-New														
City Wide	5141851810	Fleet Additions		1,630	-	-	-	-	-	-	-	1,630	1,630	-
	Sub-Total Vehicles-New			**1,630**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,630**	**1,630**	**-**
Water Quality Initiatives (WQI)														
City Wide	5141966911	Woodward WTP - Biological Filtration Pilot Study		250	-	-	-	-	-	-	-	250	250	-
	Sub-Total Water Quality Initiatives (WQI)			**250**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**250**	**250**	**-**
Watermain Lining														
City Wide	5142060072	Watermain Structural Lining		5,400	-	-	-	-	-	-	-	5,400	5,400	-
	Sub-Total Watermain Lining			**5,400**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5,400**	**5,400**	**-**
Total All Projects				**67,495**	**6,130**	**223**	**9,186**	**640**	**-**	**1,020**	**-**	**50,296**	**50,296**	**-**

**** DC Debt***

City of Hamilton
Wastewater System
2020 Capital Budget Project List
(000's)

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources	
													From Operating	Debt
Annual Projects														
City Wide	4032058001	Consultation and Accommodation		30	-	-	-	-	-	-	-	30	30	-
City Wide	5162001099	*Engineering Services Staffing Costs - Wastewater*		4,700	-	-	-	-	-	-	-	4,700	4,700	-
City Wide	5162060711	PW Capital Water Consumption Program		180	-	-	-	-	-	-	-	180	180	-
8	5162061006	Inverness Ave E - Combined Major Trunk Rehabilitation		200	-	-	-	-	-	200	-	-	-	-
	Sub-Total Annual Projects			**5,110**	**-**	**-**	**-**	**-**	**-**	**200**	**-**	**4,910**	**4,910**	**-**
Building - New Construction														
City Wide	5161667421	New Haulage Receiving Station		550	-	-	-	-	-	-	-	550	550	-
	Sub-Total Building - New Construction			**550**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**550**	**550**	**-**
Computer Software Purchases														
City Wide	5162057545	Wastewater Computer Model Update & Maintenance		660	-	-	-	-	-	-	-	660	660	-
	Sub-Total Computer Software Purchases			**660**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**660**	**660**	**-**
Coordinated - Network Extension Projects														
9	5162080089	Rymal - Fletcher to Upper Centennial	*	5,330	-	-	5,330	-	-	-	-	-	-	-
	Sub-Total Coordinated - Network Extension Projects			**5,330**	**-**	**-**	**5,330**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Coordinated - Replacement Projects														
1	5162071006	Hillcrest - Chedoke to end		60	-	-	-	-	-	-	-	60	60	-
	Sub-Total Coordinated - Replacement Projects			**60**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**60**	**60**	**-**
Coordinated - Upgrade Projects														
4	5162071315	Main -Queenston Traffic Circle to Delena & Rosewood (LRT Enabling Project)		1,160	-	-	-	-	-	-	-	1,160	1,160	-
	Sub-Total Coordinated - Upgrade Projects			**1,160**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,160**	**1,160**	**-**
Development Projects														
4	5162080961	Roxborough Park Intensification		1,500	-	-	1,500	-	-	-	-	-	-	-
	Sub-Total Development Projects			**1,500**	**-**	**-**	**1,500**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Maintenance Projects														
5, 6	5161968920	Fennell/Greenhill Drop Shaft		500	-	-	-	-	-	-	-	500	500	-
	Sub-Total Maintenance Projects			**500**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**500**	**500**	**-**
Master Plan														
City Wide	5161555264	City-Wide Wastewater Master Plan		300	-	-	270	-	-	-	-	30	30	-
City Wide	5162055010	Wastewater Systems Planning Program		380	-	-	-	-	-	-	-	380	380	-
	Sub-Total Master Plan			**680**	**-**	**-**	**270**	**-**	**-**	**-**	**-**	**410**	**410**	**-**
Master Plan - Horizontal Assets														
11	5161696452	Airport Lands Dickenson Rd Trunk Sewer (WW-27, WW-26, WW-28) (CASH FLOWED)	*	26,800	-	-	26,800	-	-	-	-	-	-	-
	Sub-Total Master Plan - Horizontal Assets			**26,800**	**-**	**-**	**26,800**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

City of Hamilton
Wastewater System
2020 Capital Budget Project List
(000's)

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources	
													From Operating	Debt
Master Plan - Vertical Assets														
15	5161796786	First Street (Waterdown Sanitary) PS Upgrade DC014		1,050	-	-	640	-	-	-	-	410	410	-
City Wide	5162055050	Municipal Class EA Studies		400	-	-	-	-	-	-	-	400	400	-
City Wide	5162095800	Flooding & Drainage Master Plan Capital Improvements		880	-	-	-	-	-	-	-	880	880	-
	Sub-Total Master Plan - Vertical Assets			**2,330**	**-**	**-**	**640**	**-**	**-**	**-**	**-**	**1,690**	**1,690**	**-**
Outstations-Sustainable Asset Mgt (SAM)														
12	5161267270	Ancaster Wastewater Outstations Upgrades		110	-	-	-	-	-	-	-	110	110	-
13	5161267273	Dundas Wastewater Outstations Upgrades		600	-	-	-	-	-	-	-	600	600	-
12, 13, 15	5161667622	FC001, DC009 & HC011 Wastewater Pumping Stations Upgrades		1,500	-	-	-	-	-	-	-	1,500	1,500	-
4	5161767420	Parkdale Avenue HC001 Wastewater Pumping Station Upgrades		10	-	-	-	-	-	-	-	10	10	-
11	5161967123	AEGD Infrastructure Growth Initiative (English Church Road Area)		4,000	-	-	4,000	-	-	-	-	-	-	-
5	5162067065	Eastport Drive SPS (HC017) Upgrades		390	-	-	-	-	-	-	-	390	390	-
15	5162067275	FC001 Elgin Street Sewage Pumping Station		550	-	-	-	-	-	-	-	550	550	-
4, 12, 15	5162067375	Minor Upgrades to SPS Outstations		170	-	-	-	-	-	-	-	170	170	-
12	5162067425	Hillside SPS (DC006) Upgrades		280	-	-	-	-	-	-	-	280	280	-
City Wide	5162067752	Wastewater Outstation Inspections - Asset Management Program		520	-	-	-	-	-	-	-	520	520	-
	Sub-Total Outstations-Sustainable Asset Mgt (SAM)			**8,130**	**-**	**-**	**4,000**	**-**	**-**	**-**	**-**	**4,130**	**4,130**	**-**
Plans/Studies														
City Wide	5162055801	Woodward WWTP Facility Plan		350	-	-	-	-	-	-	-	350	350	-
City Wide	5162062543	CSO Characterization Program		450	-	-	-	-	-	-	-	450	450	-
	Sub-Total Plans/Studies			**800**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**800**	**800**	**-**
Plant - Sustainable Asset Mgt (SAM)														
City Wide	5161966102	Woodward WWTP - Expansion (CASH FLOWED)	*	1,750	-	-	1,750	-	-	-	-	-	-	-
City Wide	5161966511	Woodward WWTP - Digester #5 (CASH FLOWED)		2,500	-	-	-	-	-	-	-	2,500	2,500	-
City Wide	5162066311	Woodward WWTP - Digester #3 (CASH FLOWED)		250	-	-	-	-	-	-	-	250	250	-
City Wide	5162066813	Dundas WWTP - Health & Safety Immediate Needs		4,900	-	-	-	-	-	1,150	-	3,750	3,750	-
City Wide	5162067420	Main & King CSO Rehabilitation		350	-	-	-	-	-	-	-	350	350	-
	Sub-Total Plant - Sustainable Asset Mgt (SAM)			**9,750**	**-**	**-**	**1,750**	**-**	**-**	**1,150**	**-**	**6,850**	**6,850**	**-**
Plant - Wastewater Investment Needs (WINS)														
City Wide	5160866801	Woodward WWTP - Clean Harbour (CASH FLOWED)	*	100,631	65,736	-	5,096	12,120	-	-	-	17,679	2,579	15,100
City Wide	5160966910	Woodward WWTP - Biosolids Management Facility	*	28,030	14,300	-	2,590	11,140	-	-	-	-	-	-
City Wide	5162069075	City Environmental Lab Improvements Program		150	-	-	-	-	-	-	-	150	150	-
	Sub-Total Plant - Wastewater Investment Needs (WINS)			**128,811**	**80,036**	**-**	**7,686**	**23,260**	**-**	**-**	**-**	**17,829**	**2,729**	**15,100**
Rehabilitation Project														
12	5161960942	Ancaster Sewage Works Pipeline CIPP Rehab - CASH FLOW		500	-	-	-	-	-	-	-	500	500	-
5	5162060044	Battlefield Creek Major Trunk Cleaning & Condition Assessment		250	-	-	-	-	-	-	-	250	250	-

City of Hamilton
Wastewater System
2020 Capital Budget Project List
(000's)

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources: From Operating	Financing Sources: Debt
City Wide	5162060302	Emergency Repairs - Cross Connections Program		700	-	-	-	-	-	-	-	700	700	-
City Wide	5162060390	Wastewater System Lining Program		4,050	-	-	-	-	-	-	-	4,050	4,050	-
City Wide	5162060522	Sewer Lateral Management Program (WWC)		4,250	-	-	-	-	-	-	-	4,250	4,250	-
City Wide	5162060533	Trenchless Manhole Rehabilitation		70	-	-	-	-	-	-	-	70	70	-
City Wide	5162060574	Pre-Construction Mainline Condition Assessment		500	-	-	-	-	-	-	-	500	500	-
City Wide	5162060575	Mainline Sewer Condition Assessment Program		1,640	-	-	-	-	-	-	-	1,640	1,640	-
City Wide	5162060576	Sewer Lateral Condition Assessment Program		540	-	-	-	-	-	-	-	540	540	-
City Wide	5162060577	Mainline Sewer Condition Assessment for Compliance & Regulations		100	-	-	-	-	-	-	-	100	100	-
5, 9	5162061051	Satellite City Trunk Sewer Rehabilitation		8,750	-	-	-	-	-	-	-	8,750	6,950	1,800
	Sub-Total Rehabilitation Project			**21,350**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**21,350**	**19,550**	**1,800**
Repairs														
City Wide	5162060820	Open Cut Repairs for CIPP Program		500	-	-	-	-	-	-	-	500	500	-
	Sub-Total Repairs			**500**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**500**	**500**	**-**
Replacement Project														
City Wide	5162061444	Sewer Lateral Replace/Rehab Program		3,600	-	-	-	-	-	-	-	3,600	3,600	-
City Wide	5162061740	Unscheduled Manhole and Sewermain Replacement Program		500	-	-	-	-	-	-	-	500	500	-
City Wide	5162071015	Sewer Lateral Replacement for Co-ordinated Projects		270	-	-	-	-	-	-	-	270	270	-
City Wide	5162071074	Contingency for Unscheduled Works Program		180	-	-	-	-	-	-	-	180	180	-
	Sub-Total Replacement Project			**4,550**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4,550**	**4,550**	**-**
Restorations														
City Wide	5162011101	Road Restoration Program		1,800	-	-	-	-	-	-	-	1,800	1,800	-
	Sub-Total Restorations			**1,800**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,800**	**1,800**	**-**
Technical Services Projects														
City Wide	4032055522	State of the Infrastructure - Asset Management		100	-	-	-	-	-	100	-	-	-	-
City Wide	4032055588	O.Reg. 588/17 Compliance - Asset Management Plan Development		75	-	-	-	-	-	-	-	75	75	-
City Wide	5162049555	QA-QC Service Contract Program		140	-	-	-	-	-	-	-	140	140	-
City Wide	5162055022	Engineering Consultant Sewermain Projects		300	-	-	-	-	-	-	-	300	300	-
City Wide	5162055556	Mapping Update Program		40	-	-	-	-	-	-	-	40	40	-
City Wide	5162055878	Forcemain Condition Assessment Program		270	-	-	-	-	-	-	-	270	270	-
City Wide	5162055880	Inflow & Inflitration Studies and Flow Monitoring Program		500	-	-	251	-	-	-	-	249	249	-
	Sub-Total Technical Services Projects			**1,425**	**-**	**-**	**251**	**-**	**-**	**100**	**-**	**1,074**	**1,074**	**-**
Upgrade Projects														
City Wide	5162062073	Field Data Systems Program		110	-	-	-	-	-	60	-	50	50	-
	Sub-Total Upgrade Projects			**110**	**-**	**-**	**-**	**-**	**-**	**60**	**-**	**50**	**50**	**-**
Water Quality Initiatives (WQI)														
City Wide	5161468422	Randle Reef Sediment Remediation (CASH FLOWED)		550	-	-	-	-	-	-	-	550	550	-

City of Hamilton
Wastewater System
2020 Capital Budget Project List
(000's)

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources: From Operating	Financing Sources: Debt
		Sub-Total Water Quality Initiatives (WQI)		**550**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**550**	**550**	**-**
Waterfront Initiatives														
City Wide	5162055800	Sewer Outfall Monitoring Study		150	-	-	-	-	-	-	-	150	150	-
		Sub-Total Waterfront Initiatives		**150**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**150**	**150**	**-**
Total All Projects				**222,606**	**80,036**	**-**	**48,227**	**23,260**	**-**	**1,510**	**-**	**69,573**	**52,673**	**16,900**
			**** DC Debt***											

Appendix "E" to Item 2 o f GIC Report 19-025

City of Hamilton
Storm Water Management
2020 Capital Budget Project List
(000's)

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources: From Operating	Financing Sources: Debt
Annual Projects														
City Wide	4032058001	Consultation and Accommodation		30	-	-	-	-	-	-	-	30	30	-
City Wide	5182001099	Engineering Services Staffing Costs - Storm		1,100	-	-	-	-	-	-	-	1,100	1,100	-
	Sub-Total Annual Projects			**1,130**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,130**	**1,130**	**-**
Building - New Construction														
5	5182067875	Beach Strip Stormwater Pumping Stations (CASH FLOWED)		300	-	-	-	-	-	-	-	300	300	-
	Sub-Total Building - New Construction			**300**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**300**	**300**	**-**
Coordinated - Network Extension Projects														
9	5182080089	Rymal - Fletcher to Upper Centennial		1,100	-	-	935	-	-	-	-	165	165	-
	Sub-Total Coordinated - Network Extension Projects			**1,100**	**-**	**-**	**935**	**-**	**-**	**-**	**-**	**165**	**165**	**-**
Coordinated - Replacement Projects														
13, 14	5182070001	Highway 8 - Woodley's Lane to Hillcrest - Road Restoration		920	-	-	-	-	-	-	-	920	920	-
13	5182070002	Highway 8 - Hillcrest to Park - Road Restoration		660	-	-	-	-	-	-	-	660	660	-
13	5182072293	Highway 8 - Hillcrest to Park		300	-	-	-	-	-	-	-	300	300	-
13, 14	5182072295	Highway 8 - Woodley's Lane to Hillcrest		1,590	-	-	-	-	-	530	-	1,060	1,060	-
	Sub-Total Coordinated - Replacement Projects			**3,470**	**-**	**-**	**-**	**-**	**-**	**530**	**-**	**2,940**	**2,940**	**-**
Coordinated - Upgrade Projects														
15	5182072092	Cedar / Fern / Braeheid		100	-	-	-	-	-	-	-	100	100	-
	Sub-Total Coordinated - Upgrade Projects			**100**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**100**	**100**	**-**
Development Projects														
8	5181480486	SWMP - St. Elizabeth Ponds		200	-	-	200	-	-	-	-	-	-	-
15	5182080082	SWMP - W19 (Parkside Hills Phase 2)	*	3,740	-	-	3,740	-	-	-	-	-	-	-
9	5182080086	SWMP - SM2 (Red Hill Phase 3/4)	*	4,120	-	-	4,120	-	-	-	-	-	-	-
11	5182080087	SWMP - B-10 (Lancaster Subdivision)	*	9,960	-	-	9,960	-	-	-	-	-	-	-
City Wide	5182080090	Storm Water Management Program		4,000	-	-	4,000	-	-	-	-	-	-	-
	Sub-Total Development Projects			**22,020**	**-**	**-**	**22,020**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Maintenance Projects														
15	5182074950	Watercourse and Drainage Channel Maintenance		810	-	-	-	-	-	-	-	810	810	-
City Wide	5182074951	Shoreline Protection Program		400	-	-	-	-	-	-	-	400	400	-
	Sub-Total Maintenance Projects			**1,210**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,210**	**1,210**	**-**
Master Plan - Vertical Assets														
City Wide	5182095800	Flooding & Drainage Master Plan Capital Improvements		880	-	-	-	-	-	-	-	880	880	-
	Sub-Total Master Plan - Vertical Assets			**880**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**880**	**880**	**-**
Operations & Maintenance														
15	5181972940	Evans Road Culvert Twinning		540	-	-	-	-	-	-	-	540	540	-

City of Hamilton
Storm Water Management
2020 Capital Budget Project List
(000's)

City Ward	Project Number	Project Description	DC Debt	Gross Costs	Grants And Subsidies	Other External Revenue	Dev Charges (Inc Debt)	Reserves	WIP Reserves	WIP Other / Other Internal	WIP Debt	Net Cost	Financing Sources: From Operating	Financing Sources: Debt
15	5182017040	Highway 97 - Culvert Improvement Project		180	-	-	-	-	-	-	-	180	180	-
City Wide	5182060622	SWM Facility Maintenance Program		1,700	-	-	-	-	-	-	-	1,700	1,700	-
10, 11, 12, 13, 14,	5182060722	Municipal Drain Program		610	-	370	-	-	-	-	-	240	240	-
		Sub-Total Operations & Maintenance		**3,030**	**-**	**370**	**-**	**-**	**-**	**-**	**-**	**2,660**	**2,660**	**-**
Programs & Contracts T.O.M.														
City Wide	5182017152	Right of Way Drainage Program		1,400	-	-	-	-	-	-	-	1,400	1,400	-
City Wide	5182017458	Catch Basin Replacement/Rehabilitation Program		500	-	-	-	-	-	-	-	500	500	-
		Sub-Total Programs & Contracts T.O.M.		**1,900**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,900**	**1,900**	**-**
Rehabilitation Project														
City Wide	5182060533	Trenchless Manhole Rehabilitation		70	-	-	-	-	-	-	-	70	70	-
13	5182061046	Osler Dr Outfall @ Grant Blvd		100	-	-	-	-	-	-	-	100	100	-
		Sub-Total Rehabilitation Project		**170**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**170**	**170**	**-**
Replacement Project														
City Wide	5181767723	Pumping Stations		600	-	-	-	-	-	-	-	600	600	-
City Wide	5182017549	Concrete Box Culvert Rehab/Repair - T.O.M.		250	-	-	-	-	-	-	-	250	250	-
City Wide	5182017550	*Concrete Box Culvert Rehab/Repair - Engineering Services*		250	-	-	-	-	-	-	-	250	250	-
City Wide	5182061740	Unscheduled Manhole and Sewermain Replacement Program		50	-	-	-	-	-	-	-	50	50	-
		Sub-Total Replacement Project		**1,150**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,150**	**1,150**	**-**
SERG														
13	5181823155	South St E and East St S in Dundas Drainage Improvement - SERG		110	-	-	-	-	-	-	-	110	110	-
11	5181872295	SERG - Winona Area Drainage Improvements		100	-	-	-	-	-	-	-	100	100	-
City Wide	5182055421	Stormwater System Planning Program		380	-	-	-	-	-	-	-	380	380	-
5	5182155101	SERG - Stoney Creek & Battlefield Creek Flood and Erosion Control		250	-	-	-	-	-	-	-	250	250	-
		Sub-Total SERG		**840**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**840**	**840**	**-**
Technical Services Projects														
City Wide	4032055522	State of the Infrastructure - Asset Management		100	-	-	-	-	-	100	-	-	-	-
City Wide	4032055588	O.Reg. 588/17 Compliance - Asset Management Plan Development		50	-	-	-	-	-	-	-	50	50	-
City Wide	5181555422	City Wide GRIDS II Stormwater Master Plan		300	-	-	240	-	-	-	-	60	60	-
City Wide	5182049555	QA-QC Service Contract Program		140	-	-	-	-	-	-	-	140	140	-
City Wide	5182055556	Mapping Update Program		40	-	-	-	-	-	-	-	40	40	-
City Wide	5182057545	Stormwater Computer Model		1,080	-	-	-	-	-	-	-	1,080	1,080	-
		Sub-Total Technical Services Projects		**1,710**	**-**	**-**	**240**	**-**	**-**	**100**	**-**	**1,370**	**1,370**	**-**
Upgrade Projects														
City Wide	5182055825	Stormwater Drainage Analysis and Conceptual Design for Road Corridor Upgrades		760	-	-	-	-	-	-	-	760	760	-
City Wide	5182062073	Field Data Systems Program		110	-	-	-	-	-	-	-	110	110	-
		Sub-Total Upgrade Projects		**870**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**870**	**870**	**-**
Total All Projects				**39,880**	**-**	**370**	**23,195**	**-**	**-**	**630**	**-**	**15,685**	**15,685**	**-**

DC Debt

CITY OF HAMILTON
2020 Rate Program Capital Budget Summary
($000'S)

	Gross Costs	Subsidy/ Other Revenues	Development Charges	WIP / Other Internal Sources	Reserves	Net Cost	Financing Source: Contribution From Operating	Financing Source: External Borrowings (Debentures)
2020 Sustainable Asset Management Strategy (SAM)								
Rehabilitation, Replacement & Upgrade Projects	76,010	370	-	560	-	75,080	58,690	1,800
Projects Coordinated with Roads Program	16,330	6,130	-	1,150	640	8,410	23,300	-
S.E.R.G. Projects	840	-	-	-	-	840	840	-
Treatment Plant/Outstations Projects	19,830	-	1,750	1,150	-	16,930	16,630	-
Treatment Plant/Outstations Projects-WQI	950	-	-	-	-	950	950	-
Watermin Lining	5,400	-	-	-	-	5,400	5,400	-
Sub-Total	**119,360**	**6,500**	**1,750**	**2,860**	**640**	**107,610**	**105,810**	**1,800**
Wastewater Investments Needs Strategies (WINS)								
Treatment Plant/Outstations Projects	128,811	80,036	7,686	-	23,260	17,829	2,729	15,100
Sub-Total	**128,811**	**80,036**	**7,686**	**-**	**23,260**	**17,829**	**2,729**	**15,100**
Master Plan								
Horizontal and Vertical Assets	39,010	223	35,946	-	-	2,841	2,841	-
Technical Service Projects	8,440	-	1,031	300	-	7,109	7,109	-
Sub-Total	**47,450**	**223**	**36,977**	**300**	**-**	**9,950**	**9,950**	**-**
Development Program								
Development\Extension Projects	34,360	-	30,195	-	4,000	165	165	-
Sub-Total	**34,360**	**-**	**30,195**	**-**	**4,000**	**165**	**165**	**-**
Total	**329,981**	**86,759**	**76,608**	**3,160**	**27,900**	**135,554**	**118,654**	**16,900**

CITY OF HAMILTON
2020 - 2029 WATER / WASTEWATER / STORM CAPITAL FINANCING PLAN
($'s)

	Restated 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2020 - 2029
NET EXPENDITURES FORECAST												
WASTEWATER (NET)	42,837,000	69,573,000	83,757,000	81,749,000	55,374,000	52,379,000	58,704,000	63,479,000	68,364,000	68,470,000	65,440,000	667,289,000
WATER (NET)	66,103,000	50,296,000	72,253,000	73,753,000	63,516,000	81,700,000	97,211,000	84,917,000	72,832,000	90,002,000	107,861,000	794,341,000
STORM (NET)	3,205,000	15,685,000	14,382,000	15,775,000	15,975,000	17,595,000	9,875,000	16,385,000	38,630,000	34,735,000	35,215,000	214,252,000
TOTAL NET EXPENDITURES	112,145,000	135,554,000	170,392,000	171,277,000	134,865,000	151,674,000	165,790,000	164,781,000	179,826,000	193,207,000	208,516,000	1,675,882,000
SOURCE OF FINANCING												
DEBT ISSUES	14,341,000	16,900,000	48,000,000	44,700,000	1,200,000	8,400,000	12,600,000	1,500,000	2,400,000	0	0	135,700,000
TRANSFER FROM OPERATING	97,804,000	118,654,000	122,392,000	126,577,000	133,665,000	143,274,000	153,190,000	163,281,000	177,426,000	193,207,000	208,516,000	1,540,182,000
TOTAL CAPITAL FINANCING	112,145,000	135,554,000	170,392,000	171,277,000	134,865,000	151,674,000	165,790,000	164,781,000	179,826,000	193,207,000	208,516,000	1,675,882,000
OPERATING BUDGET IMPACT												
TRANSFER FROM OPERATING	97,804,000	118,654,000	122,392,000	126,577,000	133,665,000	143,274,000	153,190,000	163,281,000	177,426,000	193,207,000	208,516,000	1,540,182,000
DC EXEMPTION FUNDING	9,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	8,000,000	80,000,000
DEBT CHARGES (NET)	19,365,685	19,682,108	25,295,182	32,246,955	36,943,695	38,456,182	39,081,885	39,379,712	37,784,300	35,328,058	35,168,939	339,367,017
TOTAL CAPITAL FINANCING COSTS	126,169,685	146,336,108	155,687,182	166,823,955	178,608,695	189,730,182	200,271,885	210,660,712	223,210,300	236,535,058	251,684,939	1,959,549,017

CITY OF HAMILTON
2020- 2029 CAPITAL FINANCING CHARGES - RATE PROGRAMS
($'s)

	Restated 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2020 - 2029
Wastewater												
Existing External Debt Charges	8,259,325	8,295,616	8,121,035	7,948,226	7,728,980	7,506,821	7,327,765	7,150,424	6,588,871	5,190,079	5,060,580	70,918,397
Existing - Recovery from DC's	-253,901	-271,296	-268,136	-264,824	-215,275	-165,624	-161,917	-158,163	-154,298	-150,383	-146,404	-1,956,321
New External Debt Charges - Funded from Rates	445,234	1,229,884	4,258,071	7,796,872	10,010,967	10,484,564	10,484,564	10,484,564	10,542,369	10,600,174	10,600,174	86,492,202
New External Debt Charges - Funded from DC's	1,415,821	1,988,874	5,845,134	9,091,350	11,366,309	12,410,086	12,705,379	16,660,054	24,213,931	31,707,626	35,475,737	161,464,479
Recovery from DC's	-1,415,821	-1,988,874	-5,845,134	-9,091,350	-11,366,309	-12,410,086	-12,705,379	-16,660,054	-24,213,931	-31,707,626	-35,475,737	-161,464,479
Contribution to Capital	42,837,000	52,673,000	55,057,000	54,249,000	54,174,000	52,379,000	58,704,000	63,479,000	67,164,000	68,470,000	65,440,000	591,789,000
DC Exemption Funding	4,590,000	4,080,000	4,080,000	4,080,000	4,080,000	4,080,000	4,080,000	4,080,000	4,080,000	4,080,000	4,080,000	40,800,000
Subtotal	55,877,658	66,007,204	71,247,970	73,809,274	75,778,672	74,284,760	80,434,412	85,035,824	88,220,941	88,189,871	85,034,351	788,043,278
% Incr (Decr) from Previous Year	-3%	18%	8%	4%	3%	-2%	8%	6%	4%	0%	-4%	
Water												
Existing External Debt Charges	7,409,901	7,379,737	7,217,846	7,054,799	6,880,544	6,702,952	6,534,526	6,369,135	5,187,000	4,053,873	3,949,285	61,329,697
Existing - Recovery from DC's	-58,344	-62,618	-61,954	-61,251	-48,216	-35,154	-34,358	-33,548	-32,712	-31,863	-31,000	-432,675
New External Debt Charges - Funded from Rates	1,434,561	858,711	3,505,837	6,981,506	9,527,473	10,790,821	11,802,416	12,481,629	12,553,885	12,553,885	12,553,885	93,610,049
New External Debt Charges - Funded from DC's	918,025	355,495	2,357,547	5,084,391	6,363,418	6,883,931	8,524,331	11,013,175	13,120,506	14,057,619	14,057,619	81,818,030
Recovery from DC's	-918,025	-355,495	-2,357,547	-5,084,391	-6,363,418	-6,883,931	-8,524,331	-11,013,175	-13,120,506	-14,057,619	-14,057,619	-81,818,030
Contribution to Capital	51,762,000	50,296,000	52,953,000	56,553,000	63,516,000	73,300,000	84,611,000	83,417,000	72,832,000	90,002,000	107,861,000	735,341,000
DC Exemption Funding	2,547,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	2,240,000	22,400,000
Subtotal	63,095,118	60,711,831	65,854,728	72,768,055	82,115,801	92,998,619	105,153,583	104,474,216	92,780,173	108,817,895	126,573,170	912,248,071
% Incr (Decr) from Previous Year	32%	-4%	8%	10%	13%	13%	13%	-1%	-11%	17%	16%	
Storm												
Existing External Debt Charges	2,152,705	2,303,036	2,261,712	2,218,943	2,174,438	2,128,860	2,081,704	2,034,189	1,985,472	1,936,291	1,886,251	21,010,897
Existing - Recovery from DC's	-185,049	-205,023	-201,408	-197,617	-193,636	-189,538	-185,295	-180,997	-176,573	-172,090	-167,535	-1,869,711
New External Debt Charges - Funded from Rates	161,253	154,060	462,180	770,300	1,078,421	1,232,481	1,232,481	1,232,481	1,290,286	1,348,091	1,463,702	10,264,482
New External Debt Charges - Funded from DC's	1,636,096	942,901	2,193,983	2,730,104	3,185,982	3,413,921	3,413,921	3,413,921	3,413,921	3,420,825	3,427,730	29,557,207
Recovery from DC's	-1,636,096	-942,901	-2,193,983	-2,730,104	-3,185,982	-3,413,921	-3,413,921	-3,413,921	-3,413,921	-3,420,825	-3,427,730	-29,557,207
Contribution to Capital	3,205,000	15,685,000	14,382,000	15,775,000	15,975,000	17,595,000	9,875,000	16,385,000	37,430,000	34,735,000	35,215,000	213,052,000
DC Exemption Funding	1,863,000	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000	1,680,000	16,800,000
Subtotal	7,196,909	19,617,074	18,584,484	20,246,626	20,714,223	22,446,802	14,683,890	21,150,672	42,209,185	39,527,292	40,077,419	259,257,668
% Incr (Decr) from Previous Year	-37%	173%	-5%	9%	2%	8%	-35%	44%	100%	-6%	1%	
TOTAL FINANCING CHARGES	126,169,685	146,336,108	155,687,182	166,823,955	178,608,695	189,730,182	200,271,885	210,660,712	223,210,300	236,535,058	251,684,939	1,959,549,017
% Incr (Decr) from Previous Year	8%	16%	6%	7%	7%	6%	6%	5%	6%	6%	6%	
Total Rate Funded Debt Charges	19,365,685	19,682,108	25,295,182	32,246,955	36,943,695	38,456,182	39,081,885	39,379,712	37,784,300	35,328,058	35,168,939	339,367,017
Total DC Funded Debt Charges	4,467,237	3,826,205	10,928,162	17,429,536	21,372,836	23,098,254	25,025,199	31,459,858	41,111,941	49,540,406	53,306,025	277,098,424

HAMILTON WATER
2020 RATE SUPPORTED STAFFING SUMMARY

Deptid	Deptid Description	2019 REQUESTED	2019* RESTATED	2020 MAINTENANCE	2020 PROGRAM CHANGES	2020 REQUESTED	2020 REQUESTED vs. 2019 RESTATED
510200	Director Hamilton Water	3.00	3.00	3.00	0.00	3.00	0.00
510203	WWW Operations Director	2.00	2.00	2.00	0.00	2.00	0.00
510205	Woodward Upgrades	11.00	11.00	11.00	**4.00**	15.00	4.00
510210	Customer Service & Community Outreach	2.00	2.00	2.00	0.00	2.00	0.00
510215	Education & Outreach	5.65	5.65	5.65	0.00	5.65	0.00
510220	Service Co-ordination	21.00	21.00	21.00	0.00	21.00	0.00
510230	Engineering Systems & Data Collection	9.00	9.00	9.00	0.00	9.00	0.00
510240	Compliance & Regulations	7.00	7.00	7.00	0.00	7.00	0.00
510250	Laboratory Services	26.00	26.00	26.00	0.00	26.00	0.00
510260	Environmental Monitoring & Enforcement	13.00	13.00	13.00	0.00	13.00	0.00
510270	Water Distribution (WD) & Wastewtr Collection (WWC) *	6.00	12.00	12.00	**6.00**	18.00	6.00
510275	WD & WWC Contracts	20.00	20.00	20.00	0.00	20.00	0.00
510280	WD & WWC Construction	23.00	23.00	23.00	0.00	23.00	0.00
510285	WD & WWC Maintenance	20.00	20.00	20.00	0.00	20.00	0.00
510290	WD & WWC Operations	20.00	20.00	20.00	0.00	20.00	0.00
510300	WWW Planning & Capital Director	2.00	2.00	2.00	0.00	2.00	0.00
510305	Sustainable Initiatives	7.00	7.00	7.00	0.00	7.00	0.00
510310	Plant Operations & Maintenance	8.00	8.00	8.00	0.00	8.00	0.00
510320	Plant Maintenance	35.00	35.00	35.00	0.00	35.00	0.00
510330	Plant Operations	37.00	37.00	37.00	0.00	37.00	0.00
510340	Capital Delivery	13.00	13.00	13.00	0.00	13.00	0.00
510350	Infrastructure Planning and System Design	17.00	17.00	17.00	**2.00**	19.00	2.00
	Total RATE Supported Staff	**307.65**	**313.65**	**313.65**	**12.00**	**325.65**	**12.0**

Note: * Stormwater portfolio moved from Transportation Operations & Maintenance to HW after the budget was approved in 2019

2020 Rate Budget - Business Case Summary

DEPARTMENT: Public Works

DIVISION	SERVICE / PROGRAM	DESCRIPTION OF PROGRAM ENHANCEMENT	2020 IMPACT $ GROSS	2020 IMPACT $ NET	FTE Impact	ANNUALIZED IMPACT $ NET
Hamilton Water	Woodward Upgrades Operational Support	Maintenance Operators required to support Woodward Upgrades Project	$ 440,000	$ -	4.00	$ -
Hamilton Water	Water & Wastewater Systems Planning	Project Manager Stormwater & Data Modeller Tech for stormwater systems infrastructure planning, computer modelling and related data analysis	$ 246,000	$ -	2.00	$ -
Hamilton Water	Water Distribution	A 7th Supervisor was approved on a temporary basis in 2017 and requested to report back in 2020 NOTE: Council approved a 3 year temporary assignment and requested we report back in 2020	$ 139,000	$ -	1.00	$ -
Divn Subtotal			**$ 825,000**	**$ -**	**7.00**	**$ -**
DEPARTMENT TOTAL			**$ 825,000**	**$ -**	**7.00**	**$ -**

TOTAL NET Impact = net annualized (full year) amount - please state under "Description of Program Enhancement" if other revenue sources will be used to offset the cost of the program change (therefore identify gross cost); also please identify if 2020 calendar (part-year) impact is significantly different due to delayed implementation.

CITY OF HAMILTON
NOTICE OF MOTION

Council: November 27, 2019

MOVED BY COUNCILLOR M. WILSON…......……………..…………..……….

Verbal Updates

WHEREAS Council has no record of the content of a verbal update;

THEREFORE BE IT RESOLVED:

That staff be directed to discontinue the practice of providing verbal updates without an accompanying summary document which outlines the points covered.

CITY OF HAMILTON

NOTICE OF MOTION

Council: November 27, 2019

MOVED BY COUNCILLOR B. CLARK……......……………..…………..……….

Distribution of Federal and/or Provincial Ministry or Provincial Officer Orders

That staff be directed to develop a policy and/or protocol for approval by council that when any federal and/or provincial ministry or provincial officer orders are received by management/staff, the actual orders or copies of the orders are to be immediately forwarded to City Council and such orders or copies of orders are to be displayed in a prominent place on the City web site.

CITY OF HAMILTON
NOTICE OF MOTION

Council: November 27, 2019

MOVED BY COUNCILLOR M. WILSON…......…………....…………..……….

Reconsideration of Item 26 of General Issues Committee Report 19-001, which was approved by Council on January 23, 2019 and Item 9 of General Issues Report 19-012, which was approved by Council on June 26, 2019 respecting the Potential Regulatory Litigation

That Item 26 of General Issues Committee Report 19-001, which was approved by Council on January 23, 2019 and Item 9 of General Issues Report 19-012, which was approved by Council on June 26, 2019 respecting the Potential Regulatory Litigation, and reads as follows, be reconsidered:

Item 26 of General Issues Report 19-001 (January 16, 2019) Council January 23, 2019:

26. Potential Regulatory Litigation (PW19008/LS19004) (City Wide) (Item 14.8)

(a) That Report PW19008/LS19004, respecting Potential Regulatory Litigation, be received; and,

(b) That Report PW19008/LS19004, respecting Potential Regulatory Litigation, remain confidential.

Item 9 of General Issues Report 19-012 (June 19, 2019) Council June 26, 2019:

9. Potential Regulatory Litigation Update (PW19008(a)/LS19004(a)) (City Wide) (Item 14.2)

That Report PW19008(a)/LS19004(a), respecting a Potential Regulatory Litigation Update, remain confidential.

CITY OF HAMILTON
NOTICE OF MOTION

Council: November 27, 2019

MOVED BY COUNCILLOR J.P. DANKO..…......……………..…………..……….

Reconsideration of Item 9 of General Issues Report 19-015, which was approved by Council on September 11, 2019 and Item 11 of General Issues Report 19-020, which was approved by Council on October 23, 2019 respecting the Potential Regulatory Litigation

That Item 9 of General Issues Report 19-015, which was approved by Council on September 11, 2019 and Item 11 of General Issues Report 19-020, which was approved by Council on October 23, 2019 respecting the Potential Regulatory Litigation, and reads as follows, be reconsidered:

Item 9 of General Issues Report 19-015 (September 4, 2019) Council September 11, 2019:

9. Potential Regulatory Litigation Update (PW19008(b)/LS19004(b)) (City Wide) (Item 14.5)

(a) That the direction provided to staff in Closed Session, respecting Report PW19008(b)/LS19004(b), regarding the Potential Regulatory Litigation Update, be approved; and,

(b) That Report PW19008(b)/LS19004(b), respecting Potential Regulatory Litigation Update, remain confidential and not be released as a public document.

Item 11 of General Issues Report 19-020 (October 16, 2019) Council October 23, 2019:

11. Potential Regulatory Litigation Update (PW19008(c)/LS19004(c)) (City Wide) (Item 14.2)

(a) That the direction provided to staff in Closed Session respecting Report PW19008(c)/LS19004(c) – Potential Regulatory Litigation Update, be approved; and,

(b) That Report PW19008(c)/LS19004(c), respecting a Potential Regulatory Litigation Update, remain confidential.

Calder Engineering Ltd.

PUBLICLY RELEASED BY COUNCIL ON NOVEMBER 27, 2019

19 July 2018

City of Hamilton
77 James Street North, Suite 400
Hamilton, Ontario
L8R 2K3

Attention: **Mr. Bhajan Sarker, P.Eng.**
Project Manager, Water & Wastewater Systems Planning

Reference: **Glen Road Inspection and Monitoring Program**

Dear Bhajan:

Further to our proposal of 02 July 2018 a walk through inspection of the storm sewer pipe which conveys Chedoke Creek underneath Main Street, King Street and Tope Crescent. The inspection included the following components:

- Walk-through inspection of both sides of the twin box;
- Collection of samples the upstream, mid-point and downstream ends of both culverts;
- For each connection observed along the way:
  - Record approximate station/distance and note to point of reference (station 0+00)
  - Take a sample if any flowing water from the connection and deliver to lab for analysis
  - Photos of all connections
  - Note any evidence of any sanitary waste content in discharge; or ñclearò or dry. If evidence of sanitary connection, report same day for City action.
  - Record any abnormalities related to water quality impact
- Deliver a report of findings including images/videos, lab data.

The inspection work was completed on 18 July 2018 commencing at 9:40am. The inspection was completed by entering from the North end of the west pipe, exiting at the south end, and entering the south end of the east pipe. Flow rates and pipe sizes noted during the inspection are visual estimates only. The following pipes identified during the inspection:

<u>West Pipe Inspection (North to South)</u>

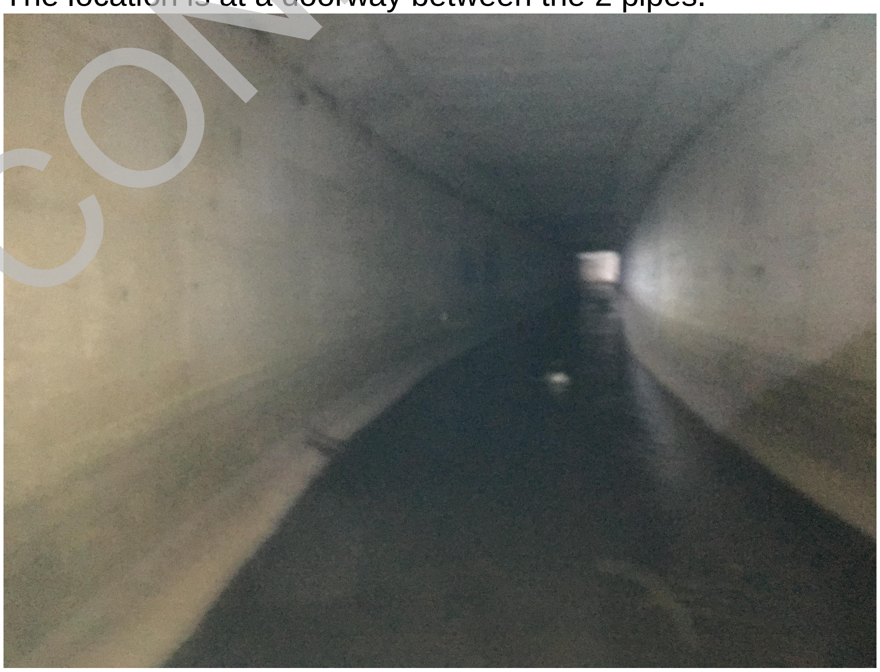
1. East Pipe ï North End
   Flow: Flow appeared to be coming from the downstream and was variable based on the strength of the winds. Prevailing winds were from the North.
   Sample: Yes ï Bottle Set 1

2. West Pipe ï North End
   Flow: Flow appeared to be coming from the downstream and was variable based on the strength of the winds. Prevailing winds were from the North.
   Sample: Yes ï Bottle Set 2

3. Manhole (HE09B118) - Glen Road Overflow: 31.4m from the North End
   Flow: No flow
   Sample: No Sample Taken
   The overflow occurs at a manhole located on the west side of the pipe. The inlet pipe is approximately 4 meters above the invert of the Creek. There is significant sewer debris on the manhole steps and safety grate. Some of the manhole steps are missing and the safety grates look to be severely corroded and may not open. Maintenance work is recommended.

4. Storm Sewer: 97.3m from the North End
   Flow: 0.2 lps ï Clear Water
   Sample: Yes ï Bottle Set 3
   The pipe is a 300mm diameter storm sewer entering the sewer at the pipe obvert.

5. Chedoke Creek: 194m from the North End
   Flow: 100 lps ï Clear Water
   Sample: Yes ï Bottle Set 4
   The location is at a doorway between the 2 pipes.



6. Chedoke Creek: Inlet (South End) 364m from the North End
   Flow: 100 lps ï Clear Water
   Sample: Yes ï Bottle Set 5
   Sample collected from the invert of a plastic lined diversion channel constructed by the contractor which is undertaking work on the channel.

East Pipe Inspection (South to North)

No flow was entering the east pipe at the upstream end. All flow was diverted to the west pipe by the contractor. The floor of the pipe was dry until approximately 100m when backwater effects from the downstream confluence with the west pipe and the Main King diversion channel.

7. Storm Sewer: 134m from the South End
   Flow: No Flow
   Sample: No Sample Taken
   The pipe is a 300mm diameter storm sewer entering at the pipe obvert on the East side of the pipe.

8. Manhole (HE09B057) ï 170m From the South End
   Flow: N/A
   Sample: N/A
   Located on the East Side of the pipe. This manhole could not be located from the surface.

9. Main King Diversion: 245m from the South End
Flow: 30 lps
Sample: Yes ï Bottle Sets 6 and 9 (duplicate taken)
The pipe is a 1.8m X 1.8m box. The water is cloudy with a sewage smell. There is no visible paper product in the flow or on the pipe walls. The pipe is approximately 0.6 m above the invert of the east pipe.

10. Manhole (HE09T003 and HE09E048) ï 248m From the South End
Flow: N/A
Sample: N/A
There is an overflow in this manhole from the sanitary sewer on Tope Crescent. There is some sanitary debris on the manhole steps.

11. Storm Sewer ï 251m From the South End
Flow: <0.1lps
Sample: Yes ï Bottle Set 11
The pipe is a 900mm CSP with some corrosion on the invert. The water is clear with no indication of sanitary influence.

13. Storm Sewer ï 367m From the South End
Flow: <0.1
Sample: Yes ï Bottle Set 10
The pipe is a 1500mm CSP with some corrosion on the invert. The water is clear with no indication of sanitary influence.

Chedoke Creek Flow Observations

1. There is no flow in the east pipe upstream of the confluence with the Main/King Diversion.
2. Chedoke Creek is entirely contained in the west pipe between the upstream end and the confluence with the Main/King. This is the result of construction diversion works upstream.
3. Both pipes (East and West) are joined together for a 15m section (no separating wall) at the confluence with the Main King and water from the West pipe (Chedoke Creek) mixes with flow in the East Pipe (Main King).
4. There are doorways between the east and west pipes. The doorways are elevated with a 0.45m wall keeping base flow separate in the 2 pipes.
5. Flow in both pipes downstream of the Main King confluence are mixed.

GIS Considerations

Manholes HE09B058 and HE09B059 do not exist. Manholes HE09T003 and HE09E048 are the same manhole.

The CSP pipes identified during the inspection are not shown on the GIS mapping.

If you have any questions or require clarification regarding any of the information contained herein please contact the undersigned at (905) 857-7600.

Yours Sincerely,
CALDER ENGINEERING LTD.

William A. Dainty, P.Eng.
Principal

HATCH

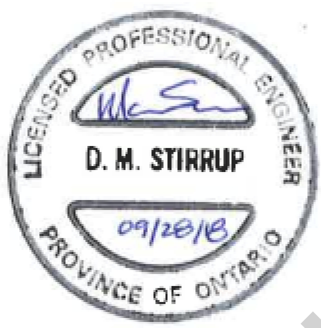
PUBLICLY RELEASED BY COUNCIL ON NOVEMBER 27, 2019

Final Report for

Wood Group / City of Hamilton

Quantification of Volume and Contaminant Loadings

September 28, 2018



Wood Group / City of Hamilton
Quantification of Volume and Contaminant Loadings

Contact:
Mark Stirrup - Principal Project Manager, Associate

Address:
5035 South Service Rd, Sixth Floor
Burlington, Ontario, Canada L7L 6M9
Tel: +1 (905) 315 3500
www.hatch.com

September 28, 2018

Table of Contents

1. Introduction and Background

On August 2, 2018, the Ministry of Environment, Conservation and Parks (MECP) issued Provincial Officer's Order #1-J25YB (hereinafter referred to as the Order) to the City in relation to the discharge of untreated wastewater to the environment. The Order requires the City to retain the services of a qualified consultant to complete certain work.

This report addresses MECP Order Item 1(a), which requires the quantification of spill volume and contaminant loadings associated with the sewage discharged from the Main/King Combined Sewer Overflow (CSO) facility to Chedoke Creek between January 28, 2014 and July 18, 2018.

2. Quantification of Spill Volume

The first part of MECP Order Item 1(a) involves the quantification of the spill volume.

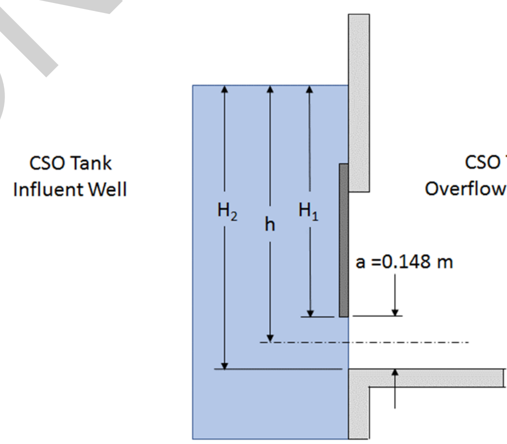
The discharge to the creek was the result of CSO tank inflows passing through a partially open maintenance by-pass gate in the CSO tank influent well[1]. It is assumed, for the purposes of these calculations, that sometime in January 2018, a second flow control gate located outside the CSO tank influent well failed in the closed position. The failure of this second gate increased the amount of flow diverted towards and under the first gate, increasing the volume of the discharge to the creek.

Prior to the second gate failure, historical data from the City's Supervisory Control and Data Acquisition System (SCADA) and a review of historical rainfall data indicate that the discharge to the creek occurred only during wet weather flow (WWF) conditions, mainly due to rainfall events, or in some cases (in late winter/early spring), due to snowmelt and/or elevated groundwater infiltration entering the contributing sewage collection system. After the second gate failure, the SCADA records and a review of historical rainfall data indicate that discharges to the creek began to also occur during dry weather flow (DWF) conditions.

2.1 Methodology

The key piece of information to allow estimation of the spill volume is the historical sewage level data collected in the CSO tank wet well by the City's SCADA system. This data can be used to estimate the sewage level in the adjacent CSO tank influent well where the first gate is located, since the two chambers are hydraulically interconnected and the levels will be the same.

The discharge under the maintenance by-pass gate comprises three different types of flow.



[1] *The gate was found to be 4.94% open, which equates to a 0.148 m high gate opening. This measurement is being used for purposes of the calculations set out in this report.*

Referring to the figure above:

1) When the upstream depth of sewage above the bottom of the gate opening (H_2) is greater than 5 times the gate opening height (a = 0.148 m, so H_2 > 0.740 m), the opening acts as a Small Rectangular Orifice, and Bernoulli's equation applies, as described by the following equation:

$$Q = C_d ab(2gh)^{1/2}$$

Where: C_d = Orifice Discharge Coefficient = $0.6\,\dfrac{(H_2 - a)^{0.072}}{(H_2 + 15a)^{0.072}}$ (1)

a = Gate Opening Height = 0.148 m

b = Gate Opening Width = 3.0 m

h = Depth of Sewage above centerline of Gate Opening (m)

H_2 = Depth of Sewage above bottom of Gate Opening (m)

g = Gravitational Constant = 9.81 m/sec^2

2) When the upstream depth of sewage above the bottom of the gate opening (H_2) is between the top of the gate opening and 5 times the gate opening height (so 0.148 m < H_2 < 0.740 m), the opening acts as a Large Rectangular Orifice, and the following variation of Bernoulli's equation applies:

$$Q = \frac{2}{3} C_d b(2g)^{1/2}(H_2^{3/2} - H_1^{3/2}) \qquad (2)$$

Where: C_d = Orifice Discharge Coefficient = $0.6\,\dfrac{(H_2 - a)^{0.072}}{(H_2 + 15a)^{0.072}}$

b = Gate Opening Width = 3.0 m

H_2 = Depth of Sewage above bottom of Gate Opening (m)

H_1 = Depth of Sewage above top of Gate Opening (m)

g = Gravitational Constant = 9.81 m/sec^2

3) When the upstream depth of sewage above the bottom of the gate opening (H_2) is less than the top of the gate opening (so H_2 < 0.148 m), the opening no longer acts as an orifice, but acts as a Sharp-nosed Broad-crested Weir, and the following equation applies:

$$Q = C_d b g^{1/2} H_2^{3/2} \qquad (3)$$

Where: C_d = Weir Discharge Coefficient = 0.462

b = Gate Opening Width = 3.0 m

H_2 = Depth of Sewage above bottom of Gate Opening (m)

g = Gravitational Constant = 9.81 m/sec^2

2.2 Results

The historical CSO tank wet well sewage level data from SCADA, and the above equations and parameters, were entered into an Excel spreadsheet, and discharge volumes were calculated for the period from January 28, 2014 to July 18, 2018. The results of the spill volume calculations are presented in Table 1 below.

Table 1: Estimated Spill Volume for Period from January 28, 2014 to July 18, 2018

Gate Flow Component	WWF Spill Volume 2014 - 2018 (GL)	DWF Spill Volume 2018 (GL)	Total Spill Volume 2014 - 2018 (GL)
From Equation (1) For $H_2 > 0.740$ m	11.7	0.1	11.8
From Equation (2) For $0.148\text{ m} < H_2 < 0.740$ m	8.8	2.6	11.4
From Equation (3) For $H_2 < 0.148$ m	0.6	0.2	0.8
Total Spill Volume	21.1	2.9	24.0

The Total Spill Volume for the period from January 28, 2014 to July 18, 2018 is therefore estimated to be 24.0 GL (Giga-Litres), and of this total, 21.1 GL is estimated to have occurred during WWF conditions, and 2.9 GL during DWF conditions.

We understand that this amount is greater than that reported by the City of Hamilton to the MECP on July 27, 2018, but that calculation did not have the benefit of the detailed analysis applied in this report; and this analysis is more conservative and likely overestimates the volume.

2.3 Key Assumptions and Limitations

Some key assumptions and limitations related to the estimated spill volume include:

+ The Main/King CSO tank is designed to overflow in significant events once the tank is filled to capacity. Approved CSO tank overflows that might otherwise have happened during significant WWF events from January 28, 2014 to July 18, 2018 (i.e. if the flows under the gate had instead entered and filled the tank to capacity) have not been subtracted from the estimated total spill volume presented above. Accounting for such approved CSO tank overflows would reduce the estimated total spill volume presented in this report.
+ Small openings such as the one under the maintenance bypass gate can become blocked by floating debris in the sewage on the upstream side of the gate, which can at least temporarily reduce the rate of flow under the gate. The total spill volume estimate presented above assumes no such blockages occurred during the period from January 28, 2014 to July 18, 2018. Accounting for such blockages would reduce the estimated total spill volume presented in this report.

- The spill volume calculations assume free flow through the gate opening with no controlling water level on the downstream side of the gate. This is a reasonable assumption given that there were no measured overflows from the CSO tank contributing flows to the overflow chamber on the downstream side of the gate. Having said this, there is a possibility that very high water levels in Chedoke Creek (e.g. occurring during significant WWF events) could create some level of backwater on the downstream side of the gate, which would reduce the flow rate under the gate. The estimated total spill volume presented above assumes this did not occur during the period from January 28, 2014 to July 18, 2018. Accounting for such obstructions to the flow would reduce the estimated total spill volume presented in this report.

3. Quantification of Contaminant Loadings from Spill

The second part of MECP Order Item 1(a) involves the quantification of contaminant loadings associated with the spill, based upon the estimated DWF and WWF spill volumes and available DWF and WWF water quality sampling data.

3.1 Methodology

Contaminant loadings have been estimated by multiplying the DWF and WWF spill volume estimates above by representative event mean concentrations (EMCs) for each selected pollutant parameter, developed using historical water quality data collected by the City.

Since some of the spill volume occurred during DWF conditions and some during WWF, and since the strength of the sewage entering the CSO tank wet well would be expected to vary significantly between DWF and WWF (where the latter will typically be more dilute, at least for organic and bacterial pollutant parameters), we determined two separate EMCs for each pollutant parameter, one to represent average DWF conditions, and one to represent average WWF/CSO conditions.

For DWF conditions, the following information was used:

- Daily historical pollutant concentration data for the Woodward Avenue Wastewater Treatment Plant (WWTP) influent stream, covering the period from January 28, 2014 to July 18, 2018; including the following parameters: Total Suspended Solids (TSS), Total Phosphorus (TP), Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), and Carbonaceous Biochemical Oxygen Demand (cBOD).
- Single DWF water quality sample taken just upstream of the Main/King CSO Tank on September 6, 2018, including the same parameters as listed above (TSS, TP, Ammonia, TKN, and cBOD).

For WWF conditions, the following information was used:

- Pollutant concentration data for the Main/King CSO tank influent stream, collected during the period from 2002 to 2006, including the following parameters: Total Suspended Solids (TSS), Total Phosphorus (TP), Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), and Carbonaceous Biochemical Oxygen Demand (cBOD).
- Pollutant concentration data for other nearby CSO facilities (including the Royal Avenue, McMaster/Ewen, Bayfront Park, and Eastwood Park CSO tanks), for the period from January 28, 2014 to July 18, 2018, including the same parameters as listed above (TSS, TP, Ammonia, TKN, and cBOD).

To develop the contaminant loading estimates, a series of analyses and calculations were performed. First, historical rainfall records, Woodward WWTP inflows, and Main/King CSO tank wet well levels were analyzed and corroborated to identify periods of DWF and WWF occurring at the Woodward WWTP and Main/King CSO tank from January 28, 2014 to July 18, 2018. The identified DWF and WWF periods were then used to develop separate representative average pollutant concentrations (EMCs) for both DWF and WWF conditions, which are highlighted in green in Table 2. The table also presents some other available DWF and WWF pollutant data, which were used to confirm the applicability of the final selected DWF and WWF EMC values for each pollutant.

Woodward WWTP influent data were used to develop the EMCs for the Main/King DWF conditions since DWF data is not collected in the Main/King CSO tank influent well, nor is it required to be. The single DWF sample taken on a dry day just upstream of the Main/King CSO tank on September 6, 2018 was used simply to confirm the applicability of the Woodward WWTP DWF influent data. As evident from Table 2, the results of this single DWF sample are consistent with the average DWF EMCs developed from the Woodward WWTP influent data.

In our opinion, it is more accurate to use the 2002-2006 WWF Main/King CSO tank data instead of the time-specific data from the other CSO facilities, to quantify the contaminant loadings. Having said this, the selected WWF EMCs for the Main/King CSO tank were compared to those from the other facilities. The EMCs for the Main/King CSO tank are consistent with those from the Eastwood Park CSO Tank (which is intuitive when considering the more commercial/ industrial land uses within their contributing catchments), but are generally higher than those for the other three CSO tanks (with at least the Royal and McMaster facilities generally serving more residential catchments). Based on the above, the final contaminant loading estimates presented below are likely overestimated.

Table 2: Estimated Average DWF/WWF Pollutant Concentrations

Sample Description	TSS (mg/L)	TP (mg/L)	Ammonia (mg/L)	TKN (mg/L)	cBOD (mg/L)
DWF Data					
Average DWF Conc. From WWTP Influent	266	4.52	21.6	34.7	173
Main/King DWF Single Sample	154	3.86	22.2	45.4	135
WWF Data					
Average WWF Conc. Main/King CSO Influent	76	1.61	4.58	10.0	41.3
Average WWF Conc. Royal CSO Influent	229	0.64	0.41	2.5	15.7
Average WWF Conc. McMaster CSO Influent	73	0.99	2.00	4.9	29.2
Average WWF Conc. Bayfront CSO Influent	66	0.67	1.22	4.0	29.9
Average WWF Conc. Eastwood CSO Influent	113	2.06	5.64	11.9	78.1

3.2 Results

Finally, the selected DWF and WWF EMC values from Table 2 were multiplied by their respective estimated DWF and WWF spill volumes from Table 1, to develop estimates of Total Contaminant Loadings for each selected pollutant parameter. The results of this final calculation are presented in Table 3.

Table 3: Estimated Contaminant Loadings for Period from January 28, 2014 to July 18, 2018

Flow Component	Spill Volume (GL)	Estimated Total Contaminant Loading (Tonnes)				
		TSS	TP	Ammonia	TKN	cBOD
DWF (2018)	2.9	771	13	63	101	502
WWF (2014-2018)	21.1	1,604	34	96	211	871
TOTAL (2014-2018)	24.0	2,375	47	159	312	1,373

PUBLICLY RELEASED BY COUNCIL ON NOVEMBER 27, 2019

MECP Order # 1-J25YB Item 1b
Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation *Report*

Hamilton, Ontario
Project # TPB188127

Prepared for:

City of Hamilton

71 Main Street West, Hamilton, Ontario L8P 4Y5

January 24, 2019

MECP Order #1-J25YB Item 1b Chedoke Creek Natural Environment and Sediment Quality Assessment Remediation *Report*

Hamilton, Ontario
Project # TPB188127

Prepared for:

City of Hamilton
71 Main Street West, Hamilton, Ontario L8P 4Y5

Prepared by:

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road
Burlington, Ontario, L7N 3W5
Canada
T: (905) 335 2353

Date January 24, 2019

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road
Burlington, Ontario, L7N 3W5
Canada
T: (905) 335 2353
www.woodplc.com

January 24, 2019

Mr. Mani Seradj, P.Eng.
Project Manager – Watershed Management
Water and Waste Water Systems Planning

City of Hamilton
71 Main Street West
Hamilton, ON L8P 4Y5

Re: MECP Order # 1-J25YB Item 1b
Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report, City of Hamilton

Dear Sir,

Wood Environment & Infrastructure Solutions (Wood) is pleased to submit the attached report for the City of Hamilton for its submission to the Ministry of the Environment, Conservation, and Parks (MECP) in partial fulfilment of Provincial Officer's Order # 1-J25YB. Should you have any comments or question, please feel free to contact any of the undersigned.

Sincerely,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Per: Lance Lumbard, MS, MBA, CLP
Senior Scientist

Per: Ron Scheckenberger, M.Eng., P.Eng.
Principal Consultant

Per: Dale Klodnicki, M.E.Sc., C.E.T.
Senior Aquatic Ecologist

Per: Brian Bishop, M.Eng. P.Eng.,
Senior Associate

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms

BOD	Biochemical oxygen demand (5-day)
Chl-a	Chlorophyll-a (corrected for pheophytins)
CPUA	Catch per unit area
cfu	Colony-forming unit
CSO	Combined sewer overflow
DO	Dissolved oxygen
E. coli	Escherichia coli
EC	Environment Canada
EPT	Ephemeroptera, Plecoptera and Trichoptera taxonomic groups
HBI	Hilsenhoff Biotic Index
LEL	Lowest effect level (PSQG)
MECP	Ministry of the Environment, Conservation and Parks
mg/L	Milligrams per litre
MOE	Ontario Ministry of the Environment
OBBN	Ontario Benthos Biomonitoring Network
PAHs	Polynuclear Aromatic Hydrocarbons
PSQG	Provincial Sediment Quality Guidelines
QA/QC	Quality Assurance / Quality Control
qPCR	Quantitative polymerase chain reaction
RBG	Royal Botanical Gardens
SEL	Severe effect level (PSQG)
SU	Standard units (for pH)
TID	Total invertebrate density
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
ug/L	Micrograms per litre

1.0 Introduction

Wood Environment & Infrastructure Solutions (Wood) has been retained by the City of Hamilton to provide services specifically related to the assessment of the combined sewer overflow (CSO) event into Chedoke Creek for the period of January, 2014 to July, 2018. Wood has evaluated remediation requirements for the Chedoke Creek, along with the preparation of a Conceptual Remedial Action Plan, as required by the Ministry of the Environment, Conservation and Parks (MECP) Provincial Officer's Order (# 1-J25YB). This report provides the findings of the sediment quality and characterization field studies, biota sampling surveys (benthic invertebrates and aquatic habitat) and analysis of existing data (fish community and water quality), as well, the report presents a Conceptual Remedial Action Plan, including alternatives assessment and recommendations.

2.0 Methodology

2.1 Sediment Quality and Characterization

The ultimate goal of the sediment quality and characterization assessment has been to provide information and interpretation of the current status of the sediment deposited in Chedoke Creek, and to support remediation design alternatives. In particular, the sediment characterization study has supported the assessment of the spatial extent of existing conditions and wastewater pollution in the creek. The sediment characterization and quality assessment provided in this report pertain to the existing soft sediments within the creek and do not solely represent impacts attributable to the combined sewer overflow (CSO) event from the Main/King CSO facility for the period of January 2014 to July 2018. Meaning, the data analysis and results describe the existing conditions which inherently include other confounding factors such as other sources of contaminants (e.g., other CSOs and urban runoff). To this end, the scope of work has been established to collect data in a manner to provide an understanding of the following:

- Relative sediment depth (i.e., sediment stratigraphy, depth to parent material, to assist in extrapolation of sediment quantity);
- Current bathymetry;
- Sediment consistency (i.e., material properties);
- Sediment quality analysis; and
- Extent of impact

The sediment quality analysis has provided an initial level of screening with respect to the potential for disposal under Ontario Regulation (O.Reg.) 153/04 Records of Site Condition – Part XV.1 of the *Environmental Protection Act*, specifically comparing to Table 1 background site conditions for sediment. The sediment quality data were also compared to the Provincial Sediment Quality Guidelines (PSQGs) within the context of aquatic biota health.

The PSQGs are guidelines which promote the protection of aquatic life and are based on sound scientific information. The PSGQ lowest effect limit values are equal to the O. Reg. 153/04 values. According to the PSQG document, three levels of effects are prescribed that reflect potential chronic and long-term effects of contaminants on benthic invertebrates; the three levels are:

- **No effect Level:** fish and sediment-dwelling organisms are not affected by chemicals in the sediment; the sediment is considered clean;

- **Lowest effect level (LEL):** level of sediment contamination that can be tolerated by the majority of the sediment-dwelling benthic invertebrates; the sediment is considered to be clean to marginally contaminated; and
- **Severe effect level (SEL):** level of sediment contamination at which pronounced disturbance of the sediment-dwelling community can be expected; the sediment is considered heavily contaminated.

2.1.1 Sediment Thickness, Characterization and Bathymetry

Sediment core and/or grab sampling has been conducted within Chedoke Creek at ten (10) locations. The core sample locations shown on Figure 2-1 include two locations (C1 and C2) where a single location of accumulated sediment was sampled (three core tubes each), whereas the remaining core sample locations included three (3) replicate samples (three core tubes per replicate sample) collected across each transect (east, centre and right replicate sample locations). Samples have been collected from depositional areas. The transects have been positioned equidistant from each other, except for the closer spacing near the culvert outlet. Transects have been positioned starting from the upstream limit of the sample area, down to the outlet of the creek to Cootes Paradise, near Princess Point.

Sediment cores have been collected using a manually-driven core sampler for discrete interval sediment sampling down to the parent material (and/or refusal) where possible. Sediment aliquots have been extruded from the cores at each of these locations in incremental strata (0 to 15 centimeters [cm], 15 to 30 cm and >30 cm). Photographs of complete cores have been taken and catalogued for further visual interpretation as necessary (Appendix A2). Cores have been separated into individual containers (amber glass jars) for analysis to provide depth related assessment of parameters of interest.

Sediment grab samples have been taken using a petite ponar dredge sampler, collecting material from the bioactive sediment strata (upper 10 cm). These samples have been collected for particle size analysis and co-located with the benthic invertebrate community samples as described in Section 2.2.1.

Soft sediment depth has been identified through reaching refusal with the manually-driven sampler at coring transects and has been recorded to provide an indication of bathymetric condition and an estimate of soft sediment volume (Appendix B2). The total water depth was measured from surface to sediment-water interface, and the total depth of sediment to refusal was also documented at each replicate sample location. The substrate encountered at refusal was typically a hardpacked, fine sand or clay material at all coring locations, thereby allowing measurement of the soft sediments full thickness. To be clear, the incremental sample representing the >30 cm strata included a portion of the refusal material at the bottom of the core that was homogenized with the overlying soft sediment. The shallow conditions throughout much of the creek precluded the use of conventional sonar bathymetry which would have been unsuitable (impossible nearshore) and less accurate than the manually measured depths. A summary of the total water depth and soft sediment thickness is provided in Appendix B (Table B1-1).

2.1.2 Sediment Quality

Sediment samples have been collected and retained in laboratory provided amber glass jars and food grade plastic bags (particle size and genetic analysis), pre-labelled with the sample ID, date and time of collection, as well as required analysis. A laboratory provided chain of custody has been submitted with each sample shipment thereby ensuring all samples have been tracked and logged per laboratory quality assurance and control practices.

Sediment core aliquots and grab samples have been kept cool and transported to the laboratory for analysis of the following parameters:

- qPCR – genetic analysis of sediment that identifies the relative abundance (%) of municipal sewage-based bacteria in the sample for comparison to natural sources of bacteria;
- Ammonia (NH3+NH4);
- Total Kjeldahl Nitrogen (TKN);
- Total Phosphorus;
- Total Metals (including: zinc, lead, copper); and
- O.Reg 153/04 Polycyclic Aromatic Hydrocarbons (PAH).

Sediment grab samples have also been analyzed for the following parameters:

- Sediment grain size analysis; and
- Pore water analysis for biochemical oxygen demand (BOD), faecal coliforms and dissolved oxygen (DO).

2.2 Natural Environment

The purpose of collecting natural environment (biological) information has been to assess the current condition of Chedoke Creek within the context of aquatic ecology. The information is intended to serve as a baseline for future assessment of potential improvements, following the implementation of remediation options. The biological study has been conducted consistent with a longitudinal gradient approach (sampling from upstream to downstream) in Chedoke Creek to identify the potential change in aquatic community health. The biological assessment has been conducted to target two main groups of biota: benthic invertebrates and fish. The fish community was not sampled as part of this study, however benthic invertebrate sample collection was conducted, as described in the following. These community data have been complemented by the collection of general habitat features and analysed within the context of the sediment quality and grain size data, collected as part of the sediment characterization (Section 2.1.2).

2.2.1 Benthic Invertebrate Community

Benthic invertebrate sampling has been conducted in tandem with sediment quality assessments. Sampling has been conducted at seven (7) sampling transects co-located with the sediment grab sampling transects (Figure 2-1). Benthic invertebrates have been sampled from each of 3 replicate grabs within each transect. This approach has provided a total of 21 samples for analysis by an accredited invertebrate taxonomist. Information collected at each sampling station has included a description of benthic habitat (water depth, observed water velocity, substrate type, aquatic vegetation and available cover).

Sampling at each station has been conducted using a petite ponar dredge sampler. Each replicate grab sample has been individually sieved in the field (using 500 micron [µm] mesh sieve bucket), as per the Ontario Benthos Biomonitoring Network (OBBN): Protocol Manual (MOE 2007). Samples have been preserved in the field (using 10% buffered formalin) and analyzed by an experienced taxonomist following accepted protocols and quality assurance and control measures (EC 2012). All invertebrates have been identified to the lowest practical level. In addition, a voucher collection has been compiled from each area sampled, for future reference or for confirmation by a second trained taxonomist (if required). Benthic invertebrate community metrics of interest for analysis have included the following:

- Total invertebrate density (TID);

- Taxon richness;
- Simpson's Evenness Index;
- Simpson's Diversity Index;
- Proportion of individuals belonging to the Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) [% EPT];
- Hilsenhoff Biotic Index (HBI) was also calculated for each transect, as it provides an estimate of the overall tolerance of the invertebrate community to organic pollution;
- Taxa density; and
- Taxa proportion.

TID has been reported as the total number of all individuals of all taxonomic categories expressed per unit area (individuals per square metre). Area has been based on the dimensions of the collection equipment (Petite Ponar; 0.023 m^2). A total invertebrate density value has been calculated for each replicate sample location.

Taxonomic richness has been reported as the total number of taxa groups at each sample station, based on the lowest practical level of taxonomic identification. Taxonomic richness is directly related to diversity and health of the invertebrate community. The TID and richness calculations can reveal ecologically relevant aspects of the benthic community. For example, stations with high invertebrate density and low richness may suggest the existing conditions can support a small niche of specialized taxa, reflect homogeneous habitat conditions, and may be indicative of a benthic invertebrate community with predominantly stress tolerant taxa. Whereas, high TID and richness can reflect a heterogeneous habitat with a broad range of stress tolerant and intolerant taxa. Taxonomic richness is also used to calculate other invertebrate community metrics such as Simpson's Evenness discussed below (Smith & Wilson, 1996).

Simpson's Diversity Index is a descriptor of both the abundance patterns and taxonomic richness of the community (EC, 2012). This is a common metric included in benthic biomonitoring programs and can support assessments in conjunction with the other metrics included in this study. Simpson's diversity index is heavily weighted towards the most abundant species in the sample, while being less sensitive to species richness. This measure has been calculated by determining the proportion of individuals that each taxonomic group at a sample location contributes to the total number of individuals at the sample location. This index represents the probability that two individuals randomly selected from a sample will belong to different families. Simpson's diversity ranges from zero to one, with higher values representing greater diversity. Simpson's diversity index has been calculated according to Krebs (1985):

$$D = 1 - \sum_{i=1}^{s} (p_i)^2$$

where:	D	=	Simpson's index of diversity
	s	=	the total number of taxa (group) at the station
	pi	=	the proportion of the i th taxon (group) at the station

Simpson's Evenness Index is similar to Simpson's Index of Diversity but is a measure of how the abundance of individuals are distributed within the taxonomic groups inhabiting the sample location. Evenness refers to how evenly taxa are distributed within the community. Evenness ranges between zero and one; a community with a high number of individuals of one group and few of other groups has low evenness and a low evenness value closer to zero. Evenness was calculated according to Smith and Wilson (1996):

$$E = 1 / \sum_{i=1}^{s} (p_i)^2 / S$$

where: E = Evenness
p_i = the proportion of the i^{th} taxon (group) at the station
S = the total number of taxa (group) at the station

The HBI estimates the overall tolerance of the benthic invertebrate community in a sampled area, weighted by the relative abundance of each taxonomic group (family, genus, etc.). Organisms have been assigned a tolerance number from 0 to 10 pertaining to that group's known sensitivity to organic pollutants; 0 being most sensitive, 10 being most tolerant. The HBI has been calculated according to Hilsenhoff (1988):

$$HBI = \frac{\sum n_i x a_i}{N}$$

where: n = number of specimens in taxa i
a = tolerance value of taxa i
N = the total number of specimens in the sample

The assessment of these endpoints has provided a basis of understanding for the geographic distribution of organic pollution and a baseline condition for comparison to future remediation scenarios.

2.2.2 Fish Community

Annual fish community sampling has been undertaken by the Royal Botanical Gardens (RBG) since 2001 utilizing two (2) 50 metre (m) electrofishing survey transects (C1 and C2) located in Chedoke Creek upstream of the confluence with Cootes Paradise (Figure 2-1). Two other sample transect locations positioned near the outlet of the creek, and further afield within Cootes Paradise, were sampled annually and provide context for comparison to creek transect as part of the data analysis and review. The available data include total catch by species for each transect, however, electrofishing seconds were not provided for the full period of record. Fish community data have been used to calculate the catch per unit area (number of fish per 50 m transect), species richness, total catch, as well as the relative proportion of generalist, piscivore and specialist species within each catch, and the relative proportion of stress tolerant, intolerant and intermediate species within each catch, as an indication of community complexity. These data have been reported for the current condition of Chedoke Creek as a general indicator of health, and to provide a baseline for comparison to the same metrics following remedial actions.

2.2.3 Aquatic Habitat

Aquatic habitat can be described in numerous ways, including observations of stream morphology, substrate composition, in-stream cover, aquatic macrophyte species and presence, and riparian habitats. During the initial reconnaissance site visit (September 5, 2018), it was determined that qualitative observations of the existing creek habitat would be conducted during the sediment and benthic invertebrate sampling event. These observations were then recorded on field sampling notes and habitat features were documented using photographs provided within Appendix A of this report.

2.3 Water Quality Assessment Methods

Various entities including McMaster, Zenon, City of Hamilton, Hamilton Environmental Lab, RBG, and Hamilton Conservation Authority (HCA) have been collecting water quality data within Chedoke Creek and downstream in Cootes Paradise for decades. The water quality data supplied by these organizations provide a means of assessing the aquatic ecosystem health based on various chemical, physical, and biological characteristics of the water, as well as impacts that may be associated with sources of contamination. Through this investigation, Wood reviewed and analysed the available water quality data between 1999 and 2018 for stations in Chedoke Creek and Cootes Paradise. The stations evaluated in included CP-11 (the first station downstream of the Main/King CSO); stations CC-2, CC-3, and CC-9 (upstream of the Main/King CSO); and stations CP-1, CP-2, and CP-20 (within Cootes Paradise). Figures 4-5.1 and 4-5.2 indicate the locations of these stations.

Water quality data are available for numerous parameters, however, total phosphorus (TP) and Escherichia coli (E. coli) were chosen as representative water quality parameters and were used to compare station CP-11 with upstream conditions (CC-2, CC-3, and CC-9) and conditions in Cootes Paradise (CP-1, CP-2, and CP-20). Both parameters are often used to indicate changes in water quality and to assess potential impairments associated specifically with sewer overflows. Additional water quality parameters including pH, ammonia, dissolved oxygen (DO), chlorophyll-a (Chl-a), and total suspended solids (TSS) were also reviewed for CP-11 and Cootes Paradise stations CP-1, CP-2, and CP-20.

Water quality data, including data collected from Chedoke Creek and Cootes Paradise stations, are often subject to a wide range of variability with a limited number of collection events spaced at irregular intervals. The limited temporal resolution of Chedoke Creek and Cootes Paradise station data requires careful consideration and use of the appropriate statistical tools. The statistical methods utilized to evaluate the available water quality are provided in the following.

The Mann-Whitney U non-parametric statistical test was selected for evaluation of Chedoke Creek and Cootes Paradise data because it is robust against outliers and large data gaps, and data are not required to conform to a particular distribution for non-parametric analyses. The Mann-Whitney U test calculates the statistical significance of the difference in median concentrations between two periods. For the purposes of the Mann-Whitney U test, data from station CP-11 was divided into the period before and after the gate 1 opening. The time periods evaluated included the period from January 5, 2009 to September 24, 2012 and the period between May 26, 2014 and September 27, 2018. No data were available for the period between September 24, 2012 and May 26, 2014. P-values less than 0.05 indicate statistical significance and further indicates that the two datasets are significantly different from one another.

Insufficient data exist to employ the Mann-Whitney U test to compare the period prior to the start of the gate opening event with the periods after gate 1 was open, after gate 2 had failed, and the period following the correct adjustment of both gates. Therefore, additional analyses of median values of TP, E. coli, and other water quality data were performed on an objective basis, to include four distinct time periods coinciding with the operational conditions of the Main/King CSO. The first period included the available data collected between January 5, 2009 and January 27, 2014 and includes a data gap from September 25, 2012 through January 27, 2014. The second period begins January 28, 2014 with the gate opening and ends December 31, 2017, prior to the failure of gate 2. The third period was evaluated for the data collected between January 1, 2018 and July 18, 2018 when gate 1 was open and gate 2 had failed. The fourth period began after both gates had been adjusted for proper operation on July 18, 2018 and included available data through September 2018.

Figure 2-1: Sediment, Benthic Invertebrate and Fish Sample Locations

3.0 Results and Interpretation – Sediment Quality and Characterization

3.1 Sediment Thickness and Characterization

Soft sediment thickness across the sample location transects showed greater accumulation of sediments along the west shoreline throughout the creek. Measured sediment thickness ranged from 0.10 to 0.70 m (mean thickness 0.37 m) along the west shoreline compared to 0.04 to 0.59 m (mean thickness 0.26) along the east shoreline and 0.03 to 0.66 m (mean thickness 0.32 m), near the centre of the creek. In general, the upstream sample locations including C-1, C-2, G-1 and G2 contained less soft sediment (thickness range 0.06 to 0.37 m) compared to the most downstream sample locations C-5/G-6 and C-6/G-7 (thickness range 0.44 to 0.70 m).

A photographic record of each sample transect, grab samples and homogenized samples is provided in Appendix A1, with representative photographs of sediment cores at each coring location provided in Appendix A2. Data regarding field sampling observations, water depth and soft sediment thickness measurements and laboratory sediment quality analyses are provided in Appendix B1. Soft sediment thickness and bathymetry figures are provided in Appendix B2.

The produced sediment thickness mapping is based on irregular and sparse data collection efforts, which were primarily focused on providing sediment chemistry and sediment quality data and not a detailed map of the thickness of deposited material. Future regular and thorough sediment thickness data collection efforts will provide a clearer representation, which may result in changes to the final volume of soft sediment material estimates within the creek.

The upper strata (0 to 15 cm) sample aliquots are commonly composed of fine grained sediments (silt, clay, fine sand), with some coarse-grained sands and cobble present near the bottom of the strata. These samples are loosely consolidated, less firm than pudding consistency. Some upper strata samples were described in the field as having a strong metallic or petro-chemical odour, and most were dark in colour (black or brown). A summary of the field sampling observations and measurements is provided in Appendix B (Table B1-1).

The mid-strata (15 to 30 cm) sample aliquots are a mix of fine and coarse-grained sediments. These mid-strata samples are mostly well-consolidated material that maintained the core tube shape when extruded into the sample bowl. Colour ranges from black to brown to grey and orange, with some samples described as having a metallic or petro-chemical odour, like the surface strata samples.

The lower strata (>30 cm) sample aliquots are also a mix of fine and coarse-grained sediments, with a greater proportion of coarse-grained constituents observed. These samples were well-consolidated and colour typically ranged from brown to orange and grey, with some samples described as having a metallic or petro-chemical odour. This colour suggests parent material was encountered, as it resembles the red clay found throughout the Niagara escarpment region.

Particle size data from the grab sample locations (0 to 10 cm) are presented in Figure 3-1 and Appendix B1 (Table B1-3). The particle size data show higher percentage of coarse material are present in the upstream sample locations (G1 to G3), with higher proportions of fine-grained material (silt and clay) in the downstream locations where deeper sediment depths are observed.

3.2 Sediment Quality

BOD, Bacteria and Faecal Coliforms

Natural organic detritus and organic waste from waste water treatment plants and agricultural and urban runoff, acts as a food source for water-borne bacteria. Bacteria decompose these organic materials using dissolved oxygen (DO), thus reducing the DO present for fish and other aquatic biota (e.g., invertebrates). Biochemical oxygen demand (BOD) is a measure of the amount of oxygen that bacteria will consume while decomposing organic matter under aerobic conditions. When effluent (e.g., Main/King CSO) containing high BOD levels are discharged to a receiver (e.g., Chedoke Creek), this effluent accelerates bacterial growth in the receiver and consumes the available oxygen. The reduction of DO concentrations in the water column can persist as long as the BOD-rich effluent is discharged. Once the discharge stops, the receiver generally re-aerates due to atmospheric mixing and during algal photosynthesis when oxygen is released into the water. However, as long as organic sediments are present, the BOD at the water/sediment interface will likely be high compared to mineral sand or other inorganic material that does not consume as much oxygen. During low flow conditions, the BOD of the sediment can continue to impact the DO concentration in the water column. This is particularly true when algal cells are consuming oxygen during respiration when no sunlight is available. Sediment BOD and algal respiration can have dramatic impacts to water column DO prior to sunrise. These effects are magnified during warmer conditions when the DO carrying capacity of water is lower and biological activity is accelerated.

The highest porewater BOD results were found at sample transect C-5/G-6 immediately upstream of the Princess Point bridge, as shown on Figure 3-2, with the next highest BOD value observed at the G-3 sample transect located upstream of the Kay Drage Park bridge. These results indicate organic compounds are present in higher amounts at these sample locations and therefore require more oxygen for microbial metabolism, which typically suggests impaired environmental quality. The area of Chedoke Creek at transects G-3 and C-5/G-6 also contained the highest amount of organic material, which coincides with field observations indicating slower water velocities and increased settling of suspended solids at these locations.

The DO concentrations for these locations are also shown on Figure 3-2, with a longitudinal gradient of higher concentration upstream and lower concentration downstream. These higher upstream DO concentrations are likely attributable to the faster flowing water and associated habitat within the area near the culvert outlet, that have less sediment accumulation compared to the slower moving water in the downstream reaches, as discussed further in Section 4.3. Low dissolved oxygen concentration associated with the organic sediments in Chedoke Creek likely reduces the diversity of benthic invertebrates and favours a few tolerant species. This, in turn, limits the available food sources for fish (ref. Section 4.1).

The bacteroidetes and faecal coliform sample results show the highest concentrations were found at the C-3/G-5 sample transect, downstream of the Kay Drage Park bridge (Figure 3-3). Faecal coliform in surface waters are present due to fecal excrement of humans (sewage releases), livestock and wildlife. The qPCR results show the highest human and total bacteroidetes were present in the surface strata (0 to 15 cm) at the C-3C replicate sample located near the west shoreline shows. Concentrations in the mid-strata aliquot (15 to 30 cm) of C-3C were also higher than most other mid-strata samples. The bacteroidetes and faecal coliform results from the downstream sample transects show lower concentrations, with most of the lowest values at the C-6/G-7 sample location within Cootes Paradise (further from the Main/King CSO source).

Unlike chemical contaminants, bacterial indicator species (i.e., faecal coliform) of potential pathogenic contamination are normally not persistent outside of a living host and the current concentrations will likely continue to decline during periods when no sewage discharge is occurring. However, pathogenic contamination of the sediments within Chedoke Creek may present an ongoing risk to human health. The persistence of potential human pathogens is unknown and avoidance of direct contact with the sediments is recommended. It should be noted that permitted CSOs which may periodically discharge to Chedoke Creek continue to present an ongoing potential source of faecal coliform bacteria and potentially pathogenic organisms.

Nutrients

Nutrient contamination from nitrogen and phosphorus-rich organic sediments and other sources (e.g. inorganic fertilizers) is an ecological concern within Chedoke Creek and downstream receiving waters. Growth of planktonic and epiphytic algal species is often accelerated by external (stormwater) and internal (sediment) sources of nitrogen, phosphorus, or both. An over-abundance of algae tends to limit light penetration thereby precluding growth of submerged and emergent plant species which may provide habitat and sediment stabilization. Phosphorus tends to be the nutrient limiting algal growth in freshwater systems. External sources of nutrients are the most difficult to control and represent an ongoing source of potential contamination within Chedoke Creek and downstream, regardless of the operational condition of the Main/King CSO. Furthermore, external nutrients other than those contributed by the Main/King CSO have likely been contributing to water quality problems within Chedoke Creek and its downstream receiving waters for decades.

Sediment quality nutrients of interest include ammonia+ammonium, total phosphorus and total Kjeldahl nitrogen (TKN), all of which were found in the highest concentration within the surface strata (0 to 15 cm) at the C-3/G-5 sample transect, specifically the C-3C sample location (Figure 3-4). The next highest surface strata nutrient concentrations were found at the C-4C sample location, and both locations were positioned near the west shoreline, in areas of soft organic sediment. These sample locations were situated between the Kay Drage Park and Princess Point bridges, showing higher nutrient concentrations are present within this reach and are mostly higher than the surface strata within the Cootes Paradise sample location (C-6/G-7). Nearly all TKN concentrations in surface strata were above the PSQG LEL (550 µg/g), suggesting these sediments contain a level of contamination that can be tolerated by the majority of sediment-dwelling organisms, but not necessarily stress-intolerance taxa as discussed in Section 4.1. Total phosphorus concentrations in all sediment strata samples were greater than the PSQG LEL (600 µg/g) between transects C-4 and C-6/G-7, with the highest concentrations observed at transect C-5/G-6. The phosphorus SEL (2,000 µg/g) was not exceeded by any sample concentration.

Previous sediment quality studies conducted by the RBG in 2006 and 2013 documented nutrient parameters at two locations (CC-1 and CC-2) positioned further northwest from the 2018 C-6/G-7 sample location (Figure 2-1). RBG sediment sample collection protocols differed from those followed during the 2018 study; however, comparison between study results provides a qualitative context of nutrient concentrations in the upper strata sediments within Cootes Paradise. Sediment TKN concentrations at the RBG locations were similarly elevated above the PSQG LEL. For example, the 2006 and 2013 RBG TKN concentrations ranged from 1,250 to 1,390 µg/g at station CC-1 and from 1,010 to 1,330 µg/g at station CC-2, both greater than the PSQG LEL (550 µg/g). These results were all greater than the TKN concentrations measured at the 2018 C-6/G-7 location (900 to 1,000 µg/g) and were comparable to the TKN concentrations of the 0 to 15 cm strata between transects C-3/G-5 and C-5/G-6 (Figure 3-4). This suggests that TKN enrichment has occurred downstream in Cootes Paradise prior to the event, but it remains unclear when, or how, the enrichment occurred.

The RBG total phosphorous concentrations in 2006 and 2013 were 1,100 µg/g for both years at station CC-1 and ranged from 1,100 to 920 µg/g at station CC-2 between 2006 and 2013 (RBG 2013). These results were all above the PSQG LEL (600 µg/g), but greater than the 2018 total phosphorus concentrations measured at C-6/G-7 (778 to 814 µg/g) which is the closest 2018 sample location to the RBG stations. The total phosphorus concentrations measured in upper strata between transects C-3/G-5 and C-5/G-6 within the creek had concentrations within the range of the 2006 and 2013 results (2018 TP range 642 to 1,622 µg/g). This also suggests that total phosphorus enrichment has occurred downstream in Cootes Paradise prior to the event, but the means and timeframe of enrichment remain unclear.

The mid and lower strata aliquot sample results show nutrient concentrations were mostly higher than the surface strata concentrations at sample transects C-5/G-6 and C-6/G-7 (Figure 3-4). These nutrient concentrations within deeper sediment strata suggest legacy nutrient enrichment has occurred where sediments have accumulated in the slower-flowing, lower reaches of the creek and within Cootes Paradise.

It is important to note that while nutrient concentrations are high in most samples collected from less than 30 cm in depth, portions of the creek that were sandy (C-1 through C-3) and deep (> 30 cm) had the lowest total Kjeldahl nitrogen and total phosphorus concentrations. Deeper sediment samples (> 30 cm) collected downstream of C-3 were generally nutrient-enriched which is consistent with the depth of soft sediments in these areas. Presumably, a sandy sediment stratum with lower nutrient concentrations exists downstream of C-3, but further sampling at deeper intervals would be needed to identify the vertical elevation of this layer.

Metals

Metal concentrations were compared to the PSQG and O. Reg. 153/04 values. As noted earlier, the PSQGs are guidelines which promote the protection of aquatic life using LEL values (equal to the O. Reg. 153/04 concentrations), as well as the PSQG SEL criteria that indicate levels of sediment contamination at which pronounced disturbance of the sediment-dwelling biota community can be expected. The O. Reg. 153/04 sediment quality parameters per Table 1 of the Regulation (MOE 2011) are used to inform disposal options for contaminated sediments that include metals and polynuclear aromatic hydrocarbons (PAHs). The metal concentrations of soft sediments within the creek do not solely represent impacts attributable to the discharge event and include other confounding factors such as other sources of contaminants (e.g., other CSOs and urban runoff) however isolating these sources with the current data is not considered feasible.

Most of the highest heavy metal concentrations of interest (Cu, Pb and Zn) within surface strata (0 to 15 cm) were found between the C-3/G-5 and C-5/G-6 sample transects (Figure 3-5) which were similar to the results found for other parameters. Other metals with O. Reg. 153/04 and PSQG sediment quality values include arsenic, cadmium, cobalt, chromium, nickel and silver. Graphs of these metals and their respective regulation values are provided in Appendix B1.

The surface strata metal concentrations between the C-3/G-5 and C-5/G-6 sample transects were generally greater than the upstream or furthest downstream sample results. Overall, the deeper sediments contained higher concentrations of these metals at transect C-4 and further downstream. The C-5C sample location positioned near the west shoreline, upstream of the Princess Point bridge contained the highest mid and lower-strata metal concentrations. Unlike nutrients, metals pose a direct toxicity to living organisms and removal of soft sediment material containing these metals would likely be beneficial to the ecological conditions within Chedoke Creek and downstream.

Concentrations of copper, lead and zinc were generally greater than their respective PSQG LELs, but mostly below the SEL values (Figure 3-5). Arsenic, cadmium, chromium and silver concentrations were generally below the PSQG LEL values in the upstream locations as discussed in the following.

Arsenic, chromium and nickel concentrations are shown on Figure B1-2 for comparison to their respective O. Reg. 153/04 values. The arsenic and chromium concentrations for sample locations C-1 through C-3 are mostly below the regulation value, with concentrations greater than the regulation at sample locations C-4 through C-6. Nickel concentrations in the upper strata samples (0 to 15 cm) are all greater than the regulation value, with most of the mid and lower strata samples also greater than the regulation value. In general, most sediment quality parameters concentrations compared to PSQG LEL and O. Reg. 153/04 values show the highest concentrations in the downstream sample locations between sample transects C-4 and C-6. This likely is in part due to the increase in depositional conditions as noted in the particle size distribution results. This inherently means smaller sediment particles require slower water velocities to facilitate settlement out of the water column, as such the predominance of fine sediment particle size (e.g., silt and clay) shows the downstream sample locations are depositional. Increased metal concentrations are typically associated with fine particle size compared to coarse substrates (sand and gravel) observed in the upstream sample locations (C-1 through C-3).

Cobalt was the only metal concentration consistently below the PSQG LEL and O. Reg. 153/04 value, with the highest concentration (22 µg/g) being less than half the LEL value (50 µg/g). The cadmium and silver concentrations were mostly below their respective regulation values for sample locations C-1 through C-3 and replicate sample C-4A (near east shoreline). Cadmium and silver were above the PSQG LEL and O. Reg. 153/04 value for most of the strata sampled between transect C-4 and C-6 as shown on Figure B1-1.

Most PAH concentrations were greater than their respective O. Reg. 153/04 values as summarized in Appendix B (Table B1-2). Anthracene had the fewest regulation exceedances, and most of the mid and lower strata sample concentrations were consistently greater than the regulation values. The PAH results have been used to determine disposal options for removed (dredged) sediment, as further discussed in Section 5.0. Additional sampling at deeper intervals is necessary to refine this analysis and determine whether these exceedances exist below the organic layer. As noted, the PAH concentrations of soft sediments within the creek do not solely represent impacts attributable to the discharge event and include other confounding factors such as other sources of contaminants (e.g., other CSOs and urban runoff), however isolating these sources with the current data is not considered feasible.

Previous sediment quality studies conducted by the RBG in 2006 and 2013 also documented metal concentrations at the two locations noted in the nutrient discussion earlier. Cadmium, copper, iron, lead and zinc concentrations were greater than the PSQG LEL concentrations for all samples (CC-1 and CC-2); however, no concentrations exceeded the respective PSQG SEL values. Arsenic concentrations in 2006 at CC-1 and CC-2 were equal to the PQSG LEL (6 µg/g) and were below the LEL in 2013, 5.6 and 5.2 µg/g, respectively. All upper strata arsenic concentrations in the 2018 study were below the PSQG LEL. The RBG 2006 studies also documented PAH concentrations at the CC-1 and CC-2 sample locations (no PAH sampling conducted in 2013). The RBG 2006 PAH results show sediment sampled at CC-1 contained PAH concentrations less than the respective O. Reg. 153/04 values. PAH concentrations at RBG location CC-2, positioned further offshore than CC-1 within Cootes Paradise, were equal to, or greater than, many of the O. Reg. 153/04 values. All 2006 PAH concentrations were less than the 2018 PAH concentrations observed at the Chedoke Creek sample locations, including location C-6 positioned immediately downstream of the creek outlet into Cootes Paradise.

The 2018 results suggest legacy metal enrichment has occurred (prior to the Main/King CSO event), and removal may be beneficial. However, it is important to note other potential sources of metal enrichment are ongoing and likely occurred prior to the discharge event. These include, but are not considered limited to, other operating CSOs (e.g. Royal Tank) located upstream, the storm water drainage from the adjacent highway infrastructure and runoff from upstream urban environs (i.e., extensive roadway network) discharging to the creek, as well as other upstream sources (e.g., industrial and landfill sources). As noted earlier, establishing a clear distinction between legacy and event-based contamination is not considered feasible with the available data.

Similar to the nutrient-enrichment discussion above, the observed metal concentrations are lower in the sandier portions of the creek, above the C-3 sample location. The metal concentrations evaluated in sample locations downstream of C-3 are likely more representative of the organic material within Chedoke Creek. Additional sampling at deeper intervals would be necessary to determine whether metal concentrations decrease below the organic layer.

Radioisotopic Dating of Sediments

The physical and chemical characterizations discussed in this section suggest that some of the organic material within Chedoke Creek may be associated with the 2014-2018 discharge event. However, as noted, the sediments within Chedoke Creek are likely to have been derived from many different sources and time periods. The Main/King CSO and other permitted CSO systems also released sewage and stormwater to Chedoke Creek prior to the event, and continue to do so. The sediment characteristics from the prior discharge events are likely to be similar to, and indistinguishable from, the 2014-2018 Main/King CSO discharge event. The complex origin and fate of sediments within Chedoke Creek are likely to prevent a definitive means of identifying the sediments specifically associated with the 2014-2018 Main/King CSO discharge event. In certain cases, radioisotope data may be useful for classifying sediments based on their deposition periods. Wood has provided a brief summary of the potential to employ this this technology below.

The vertical distribution of several short-lived radioistopes in sediments can be used in some aquatic systems to estimate the sedimentation rate and thereby the age of sediment strata. For example, measurements of beryllium-7 (^{7}Be, half-life 53 d), lead-210 (^{210}Pb, half-life 22.3 y), and cesium-137 (^{137}Cs) have been used to date sediments over time-spans up to approximately 100 years (USGS 1998). ^{210}Pb can also be used to estimate age of sediments up to approximately 100 years. However, sediment redistribution can flatten or interrupt the ^{210}Pb profile. In this case, the basic models to interpret ^{210}Pb profiles are not accurate (Appleby 1998). The irregular channel morphology, minimal water depth and widely varying flows within Chedoke Creek likely result in substantial mixing and transport of especially the fine-grained and organic sediments that retain ^{210}Pb. These processes would prevent the formation of interpretable ^{210}Pb profiles. For this reason, Wood does not recommend attempts to apply radioisotopic dating methodologies to distinguish sediments deposited prior to, versus during, the 2014 – 2018 discharge event.

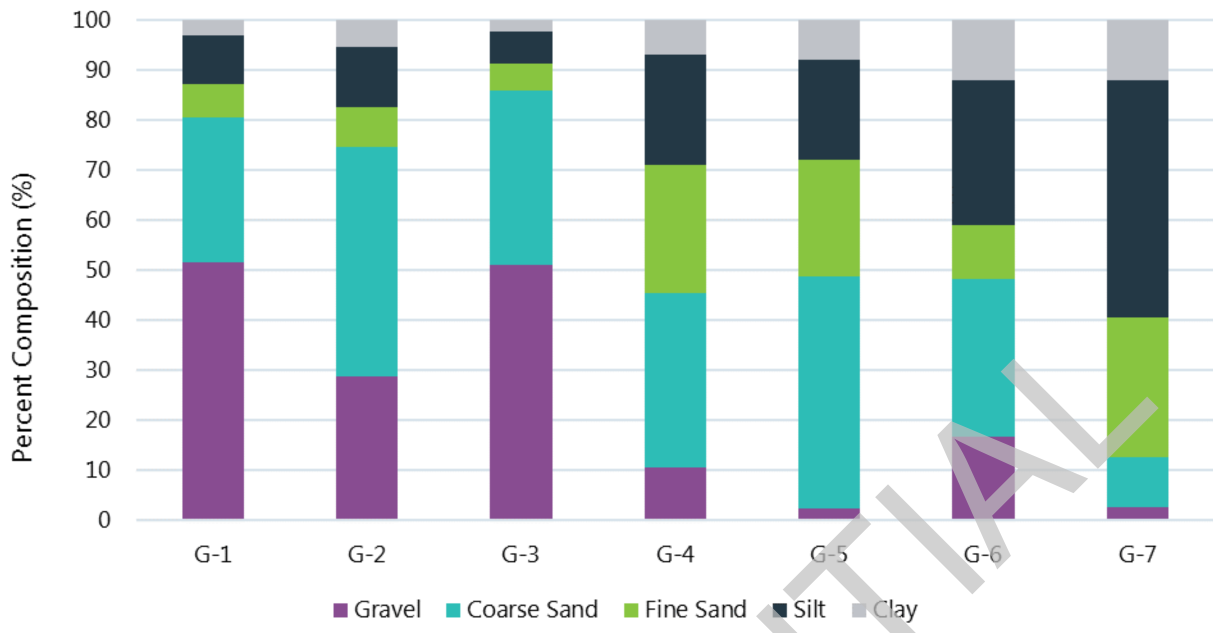


Figure 3-1: Sediment Particle Size Distribution by Grab Sample Location

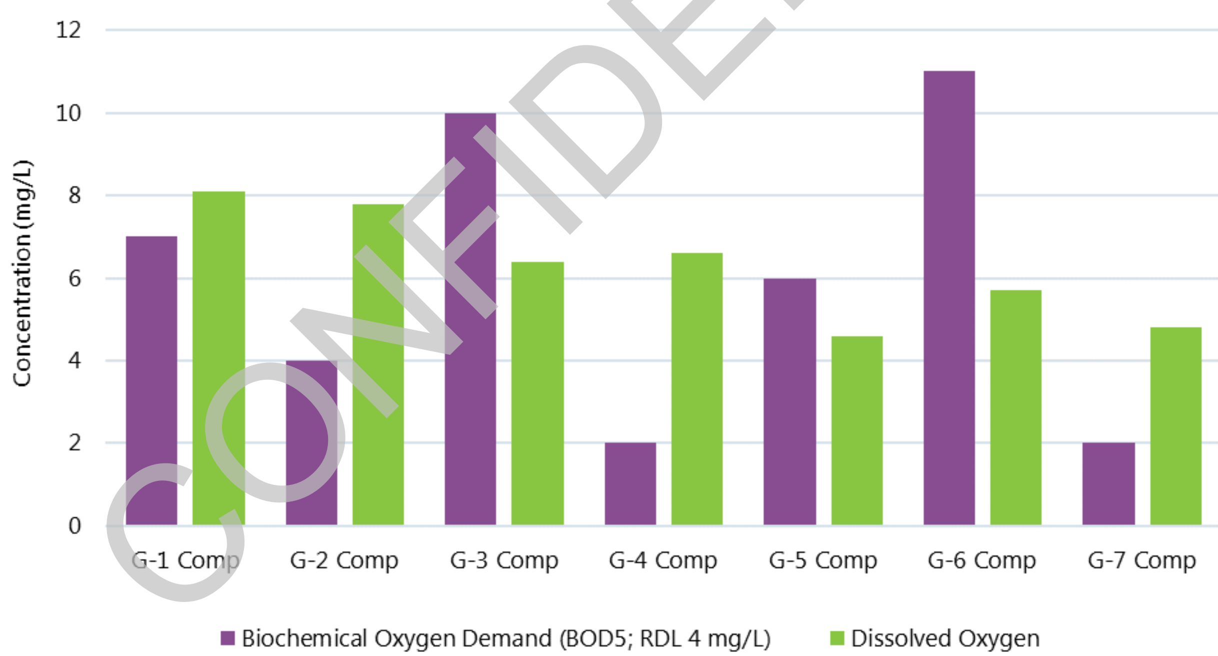


Figure 3-2: Sediment Biochemical Oxygen Demand and Dissolved Oxygen by Grab Sample Location

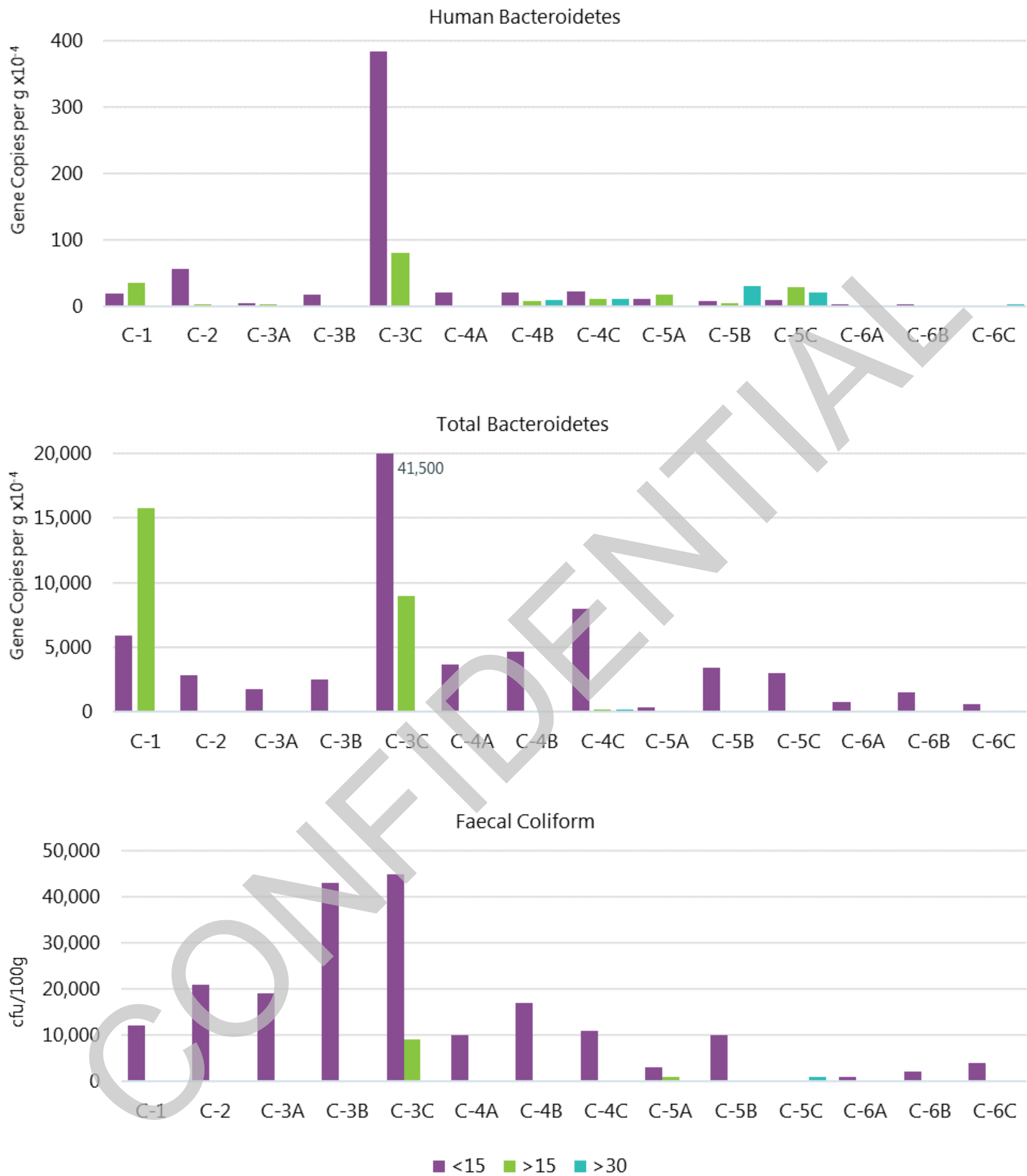


Figure 3-3: Sediment Bacteroidetes and Faecal Coliform by Core Sample Location

Note: The position of replicate samples within the creek are identified using A – near east bank, B – mid channel, C – near west bank.

Figure 3-4: Sediment Nutrient Concentrations – NH3+NH4, P, TKN by Core Sample Location

Note: The position of replicate samples within the creek are identified using A – near east bank, B – mid channel, C – near west bank.

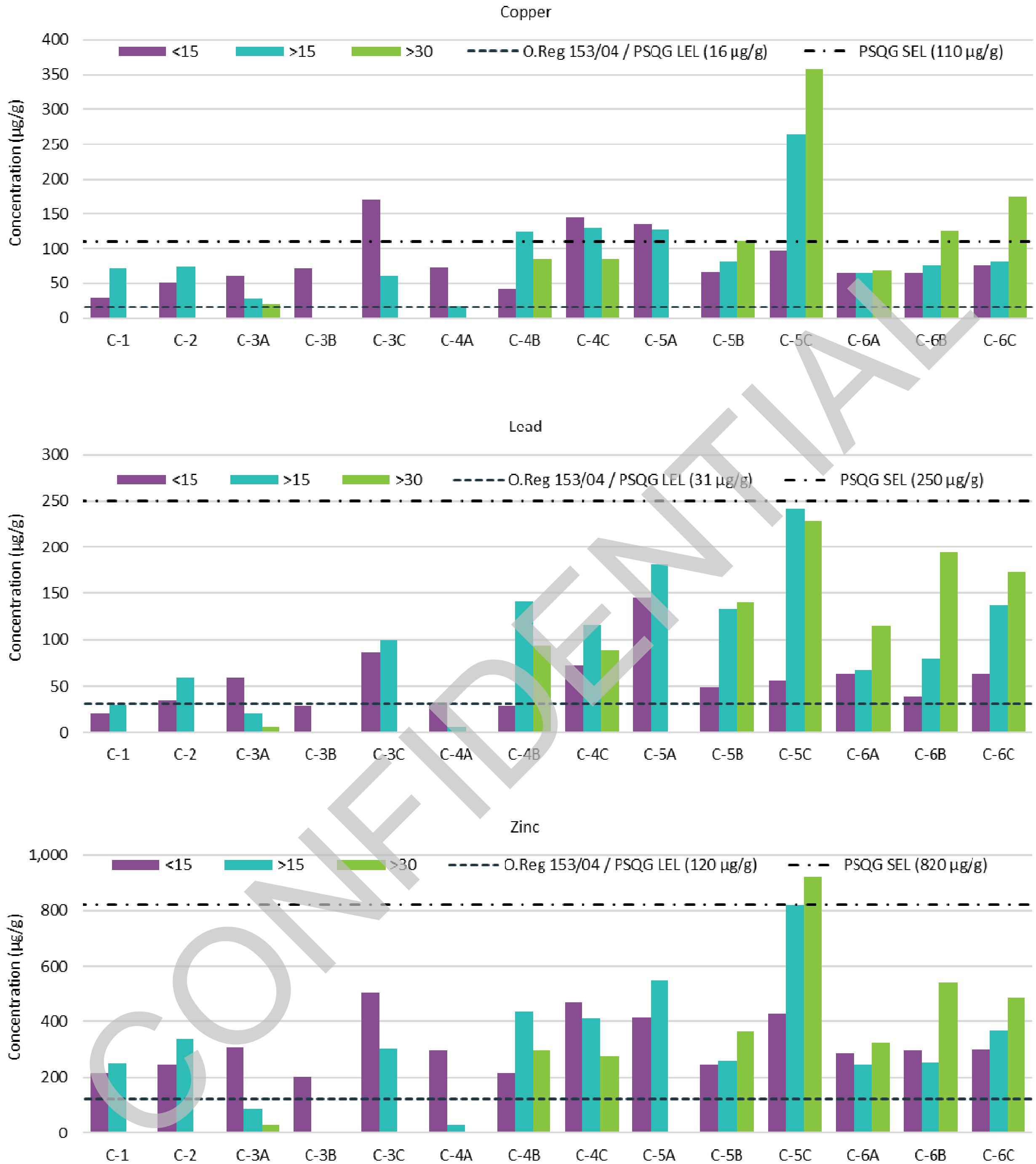


Figure 3-5: Sediment Metal Concentrations – Cu, Pb, Zn by Core Sample Location

Note: The position of replicate samples within the creek are identified using A – near east bank, B – mid channel, C – near west bank.

4.0 Results and Interpretation – Natural Environment

4.1 Benthic Invertebrate Community

Benthic macroinvertebrates are mainly exposed to contaminants in the surface water, meaning the tube-dwelling organisms that actively circulate overlying water through their tubes and those deposit feeders that are active bioturbators, effectively mixing the upper strata of the sediments (Warren et al., 1998; Hare et al., 2001; Wang et al., 2000 and 2001). However, organisms that do not pump overlying water through their tubes or burrows may take up significant amounts of contaminants from digested sediments and predators of those species will accumulate contaminants from their prey (Lee et al., 2000; Ahrens et al., 2001). Additionally, deposit feeders are typically less sensitive to toxicants than those that are exposed mainly via surface water, and higher abundance of these 'tolerant' taxa are used to indicate environmental degradation. For example, higher proportions of the benthic invertebrate community represented by generally stress-tolerant taxa including oligochaetes (aquatic worms) and chironomids (non-biting midges), as well as low taxa diversity and evenness, as discussed in the following shows Chedoke Creek represents an environmentally degraded system. Benthic macroinvertebrate community data within Chedoke Creek were not available prior to the discharge event for pre-discharge event comparison. As such, the 2018 benthic macroinvertebrate community data provide a measurement of the existing conditions and do not solely represent impacts attributable to the discharge event. Other confounding factors such as other sources of contaminants (e.g., other CSOs and urban runoff) have likely contributed to the environmentally degraded state of the creek, however as noted earlier, establishing a clear distinction as to the attributable sources is not considered feasible with the available data.

The benthic invertebrate community metrics of interest are graphically shown on Figures 4-1 and 4-2, with tabular summaries provided in Appendix C (Tables C-1 and C-2). Taxa richness and TID were generally higher at the upstream sample locations and lower at the downstream reaches (Figure 4-1). Aquatic habitat within the subject creek reach is discussed in Section 4.3; however, it is important to note the upstream sample locations contained higher proportions of coarse substrate particles, as well as micro-habitat heterogeneity than the downstream sample transects. Differences in habitat complexity are known to influence community metrics, such as taxa richness.

Simpson's Diversity Index represents the probability that two individuals randomly selected from a sample will belong to different taxa groups. Mean diversity index values ranged from 0.05 to 0.49, showing low to moderate diversity existed within these sample transects (Figure 4-1).

Simpson's Evenness Index mean values ranged from 0.35 to 0.80, showing moderate to high evenness, indicating the community contains a moderate number of individuals of one group and comparable proportions of individuals belonging to other groups (Figure 4-1).

The HBI is an inference to water quality based on the tolerance levels of invertebrate taxa. The HBI values (0 to 10) range from potentially excellent water quality at index values between 0.00 and 3.75 to potentially very poor quality of water at index values between 7.26 and 10.00 (Hilsenhoff 1988). Mean HBI values for the Chedoke Creek samples ranged from 6.0 to 6.2, meaning the benthic invertebrate community tolerance level suggests fairly poor water quality (per the HBI water quality categories) typically associated with high concentrations of organic pollutants (Figure 4-2).

Taxa density and proportions have been calculated using five (5) taxonomic groups; Tubificidae, Isopoda, Chironominae, Orthocladinae and Other taxa (those taxa contributing less than 5% density or relative proportion to the community). The tubificids were found in the highest densities at sample transects G-2 and G-3, whereas chironomids were most abundant at transects G-3 and G-7 (Figure 4-2). The taxa proportion analysis has shown decreasing tubificid proportions with increasing chironomid proportions from upstream to downstream (Figure 4-2). Both taxa groups are tolerant to environmental stress and prefer fine-grained sediments, like those found in Chedoke Creek, and dominance of these groups can be an indicator of impaired environmental quality and their abundance could be attributed to the scarcity of supportive habitat, in addition to degraded conditions in the water column and sediment (i.e. habitat).

4.2 Fish Community

The fish community survey data provided by the RBG are summarized in Appendix C (Table C-3). These data show both indigenous and non-indigenous fish species are present within the subject creek. The non-indigenous species include Common Carp, Goldfish (hybrids of these species), Round Goby, Rudd and White Perch. Most species encountered during the surveys prefer warm water, with some species belonging to the cool water thermal guild. The catch per unit area (CPUA) was calculated as the number of fish caught per 50 m transect each year. It is understood that the electrofishing seconds varied among years (not available for the full period of record) and the total seconds was typically greater when more fish were present (collected); however, the CPUA provides a surrogate comparison among sample transects to show trends over time (Figure 4-3). The RBG fish community sampling commonly occurred in August within the period of record and the most recent data were collected August 24, 2018 after the CSO gate was closed. As such, the 2018 data, as well as subsequent fish community monitoring may show changes in community structure related to post-CSO event fish community data. The CPUA results for C1 are more variable than C2, with both sample transect data showing a decline from 2015 to 2017 that is also shown for transect M5 near the outlet of Chedoke Creek. Transect B2 data show most lower CPUA values and is located further afield into Cootes Paradise. The CPUA results for C1 and C2 both show some increase between 2017 and 2018 (Figure 4-3). Overall fish abundance generally declines as a response to environmental degradation (Fausch et al. 1990).

The fish species richness results show generally lower values from 2014 to 2017 compared to the 2001 to 2011 period (Figure 4-3). Richness increased between 2017 and 2018 at C1 and C2; however, continued to decrease at M5. These species richness results are influenced by lower CPUA values, since less common or abundant species are not detected.

The relative proportion of fish species tolerant of environmental stress (degradation) is shown in Figure 4-3. Tolerant species commonly include carps, suckers, sunfishes and basses, with the transect-specific species list provided in Appendix C (Table C-3). Trends throughout the period of record show an increase of stress tolerant species in 2014/2015 at the C1, C2 and M5 transects, with a decrease from peak proportions at all transects in 2018 (Figure 4-3). Transect C1 showed the greatest difference between 2017 and 2018, with the relative proportion of tolerant fish species reported at 88.9% to 32.7%, respectively.

The relative proportion of trophic guilds shows an increase in generalist species during 2014 and 2015, with a decline from 2016 to 2018 but higher proportions than previously recorded (Figure 4-4). The increased proportion of trophic generalist species is a known fish community response to environmental degradation (Fausch et al. 1990). An inverse trend in the proportion of specialist species is shown with a decline during 2014 and 2015, followed by an increase in 2016, and the most recent (2018) results are still below historic values. The relative proportion of piscivore species at transects C1 and C2 within the creek has increased recently (2017 to 2018), possibly suggesting recent improvement of environmental quality, since the proportion of top-piscivores are indicative of healthy fish communities.

In general, the fish community survey data show changes typically indicative of environmental stresses during the discharge event time period; however, some recent (2018) data suggest improvement in these community metrics and future monitoring will be required to confirm these early trends.

4.3 Aquatic Habitat

Field observations at each sample locations included photographs facing upstream and downstream, as well as examples of in-stream cover, structures or riparian habitat. The upstream reaches of the subject Chedoke Creek reach near the culvert outlet contained sample locations G-1, G-2, C-1 and C-2 (Figure 2-1). The G-1 sample location was positioned on the concrete culvert apron that extends downstream, as part of the wingwall structure. Sediment was accumulated in a localized deposit along the west bank, which extended downstream to the C-1 and C-2 sample locations. No in-stream cover was noted on the concrete apron, and fish were not observed in this area.

The C-1, C-2 and G-2 sample locations were positioned downstream of the concrete apron, with steep sloping banks, flat bottom morphology, and boulders noted throughout the channel. The east bank included an armour stone retaining wall and newly replanted riparian vegetation. The thalweg meandered from the east to west side of the creek within this reach, and most of the flow travelled along a channel near the west bank. Some in-stream coarse woody debris (logs) were observed, as well as anthropogenic debris (garbage, lay-flat hose and geotextile cloth) throughout the channel. One dead Rudd (*Scardinius erythrophthalmus*), a non-indigenous fish species, was noted along the east bank and this species' presence in Chedoke Creek has been documented during the RBG fish community surveys in 2017.

Sample location G-3 was positioned near the downstream extent of the observable elevation changes (i.e. moving water versus flat water) and some flow was apparent at this transect. The east bank had a gradual slope, with a steep sloping west bank and most of the stream flow travelling near that side. Overhanging mature trees along the west bank provide cover and in-stream structure was available at fallen trees/logs and root systems exposed by erosion.

Sample location G-4 was positioned downstream of the Hamilton Conservation Authority CP-11 Outlet water quality monitoring station (culvert outlet). The east bank was comprised of armour stone blocks and coarse aggregate (gravel) with steep sloping sides. Stream flow (velocity) was not observed at this location since this area is likely at the same elevation as Cootes Paradise. The west bank had mature overhanging trees and a gradual sloping bank, with occasional boulders noted throughout the channel. Occasionally adult Common Carp were encountered in this reach due to the shallow conditions (easily seen), but no small-bodied fish or other individuals were noted.

Sample location G-3/G-5 was positioned downstream of the Kay Drage Park bridge. A surface layer of green algae (resembling cyanobacteria; "blue-green algae") was observed mostly near the west bank, but the bloom also extended across the channel at other locations between this transect and the Princess Point bridge. Armour stone blocks were present on both banks, however, the steeper sloping east side had less near-shore vegetation overhanging the creek compared to the riparian vegetation growing close to the edge of water along the west bank. Fallen trees were observed near this sample location, as well as plywood and lumber debris.

Sample location C-4 was positioned mid-way between the Kay Drage Park bridge (near transect C-3/G-5) and the Princess Point bridge (near transect C-5/G-6), immediately upstream of a corrugated steel pipe culvert outlet from the east bank. Both banks contained armour stone blocks and a steep sloping near-shore bottom. Riparian vegetation provided overhanging cover and some in-stream structure.

Sample location C-5/G-6 was positioned upstream of the Princess Point bridge, with armour stone blocks lining the east bank and a gradual sloping bottom along the west bank. The replicate sample near the east side was not wadeable, and the riparian vegetation provided overhanging and some in-stream cover along both banks. Fish were observed feeding at the water surface but could not be identified.

Sample location C-6/G-7 was positioned within Cootes Paradise, west of the main flow path. This location had a shallow water depth (0.25 m) with coarse woody debris observed nearby. The three samples were collected around the boat (port side, starboard side and in front of bow) as this location was not within the channel. Consequently, habitat observations were made in the surrounding area. Adult Common Carp were encountered while accessing this location and small-bodied fish species were also observed feeding at the water surface.

The aquatic habitat 2018 field observations have documented creek morphology, in-stream cover, structures and riparian habitat in order to support interpretation of the sediment quality and biota data collected within Chedoke Creek. These observations have documented the existing conditions and inherently do not solely represent potential impacts to habitat attributable to the discharge event. Other confounding factors such as other sources of contaminants (e.g., other CSOs and urban runoff) have likely also contributed to the aquatic habitat conditions within the creek, however as noted earlier, establishing a clear distinction as to the attributable sources is not considered feasible with the available data.

4.4 Water Quality Assessment

Water quality sampling locations within Chedoke Creek, Cootes Paradise, and the surrounding areas are shown in Figures 4-5.1 and 4-5.2. The statistical analyses discussed in Section 2.3 were conducted using data from the Cootes Paradise Glen Road outfall station (CP-11) near the confluence of Chedoke Creek and Cootes Paradise, three stations upstream of the Main/King CSO (CC-2, CC-3, CC-9), and three stations within Cootes Paradise (CP-1, CP-2 and CP-20). The period of record (POR) considered for the long term analyses varies by station but was approximately 4 years before (pre-2014 period between 2009-2012) and 4 years after the start (post-2014 period between 2014 and 2018) of the event. Actual dates for each analysis are provided with each respective figure and no data were available for the year 2013. The detailed POR for all data used in analysis is included in Table 4-1.

The available time series data for stations CP-11 in Chedoke Creek and CP-1, CP-2, and CP-20 in Cootes Paradise suggest elevated TP and E. coli concentrations at CP-11 beginning in 2014 with concentrations increasing through mid-2018 (Figures 4-6 and 4-7). Following the end of the event in July 2018, both TP and E. coli concentration returned to conditions similar to pre-2014. Peak E. coli concentrations at station CP-1 appeared to increase between 2014 and 2018 but there was no apparent change in TP or E. coli concentration at stations CP-2 or CP-20. While CP-2 and CP-20 are not normally downstream of Chedoke Creek, they may exhibit similar conditions to CP-1 during low flow and periods of reverse flow due to wind-driven seiche from Lake Ontario.

Median TP concentrations at station CP-11 for pre-2014 and post-2014 were 0.19 mg/L and 0.42 mg/L, respectively as shown in Figure 4-8. The Mann-Whitney test showed the difference in TP concentration medians to be statistically significant, indicating that the post-2014 TP median concentration was greater than pre-2014. Figure 4-9 indicates the median E. coli concentration for pre-2014 (510 cfu/100 mL) was significantly lower than the post-2014 median value (12,300 cfu/100 mL). The results of the Mann-Whitney U test indicate that a potential step trend change occurred for both parameters, with concentrations of TP and E. coli being significantly higher after January 2014.

The plots in Figures 4-10 and 4-11 show that concentrations of both TP and E. coli were substantially higher at station CP-11 than in the upstream stations at CC-2, CC-3, and CC-9, until the end of the spill event. The maximum concentrations at station CP-11 tended to occur during mid-summer dry periods, when there was less rainfall and snowmelt to dilute the concentrations from the Main/King CSO. After July 18, 2018, the station CP-11 TP concentrations decreased by nearly an order of magnitude (i.e. 90% reduction) from values approaching 3 mg/L to concentrations similar to values observed at the upstream stations, which were below 0.3 mg/L. The reduction in E.coli concentration was more pronounced with a decrease from nearly 5 million cfu/100 ml to a mean of approximately 5,700 cfu/100 ml. This represents a decrease of three orders of magnitude (i.e. 99.9% reduction) during the midsummer dry period following the end of the event and was similar to concentrations found at the upstream stations.

Figures 4-12 through 4-17 show the median concentrations for TP, E. coli, pH, ammonia, dissolved oxygen and TSS for station CP-11 during the four periods described in Section 2.3 The values are discussed here objectively since insufficient data are available to perform a more robust statistical analysis.

In general, the medians at station CP-11 for TP. E. coli, ammonia, and TSS, were lowest prior to 2014, increased between 2014 and 2017 increased again in early 2018, and decreased in late 2018. Median pH was highest prior to 2014, decreased between 2014 and 2017, decreased and again in early 2018, and increased in late 2018. Mean dissolved oxygen concentration was similar during the pre-2014 and 2014-2017 periods, decreased in early 2018 and increased in late 2018. It is important to note that interpretation of the medians from the 2018 period is difficult because many of these parameters are likely influenced by seasonality.

Figures 4-18 through 4-23 present TP, ammonia, TSS, dissolved oxygen (as % saturation), pH, and chlorophyll-a data from stations CP-1, CP-2, and CP-20 for the period between 2009-2018. All three downstream stations show a marked increase in dissolved oxygen in mid-2017 which may signify a concentrated algal bloom and the associated oxygen production. Ammonia concentration at the downstream station, CP-1, shows a peak in mid-2018 followed by a sharp decline. The ammonia concentrations observed at stations CP-2 and CP-20 for the 2014-2018 period do not appear substantially different than concentrations prior to 2014. The total suspended solids (TSS) concentration appears fairly similar between 2009 and 2018 at stations CP-1, CP-2 and CP-20. The available chlorophyll-a data are insufficient to provide an objective assessment of stations CP-1, CP-2, or CP-20 before, or after, 2014.

In summary, the water quality at station CP-11 near the confluence of Chedoke Creek and Cootes Paradise declined significantly after 2014 based on the available TP and E. coli concentration dataset. An analysis of median data since mid-2018 suggests a dramatic improvement in water quality at station CP-11 although additional data are necessary to evaluate the statistical significance. It is unclear whether the Cootes Paradise stations CP-1, CP-2, and CP-20, have been directly impacted by the Chedoke Creek discharge event. Dissolved oxygen concentrations collected from CP-1, CP-2 and CP-20 during 2017 suggest a significant algal bloom may have occurred during this time, however, there are insufficient chlorophyll-a data to confirm.

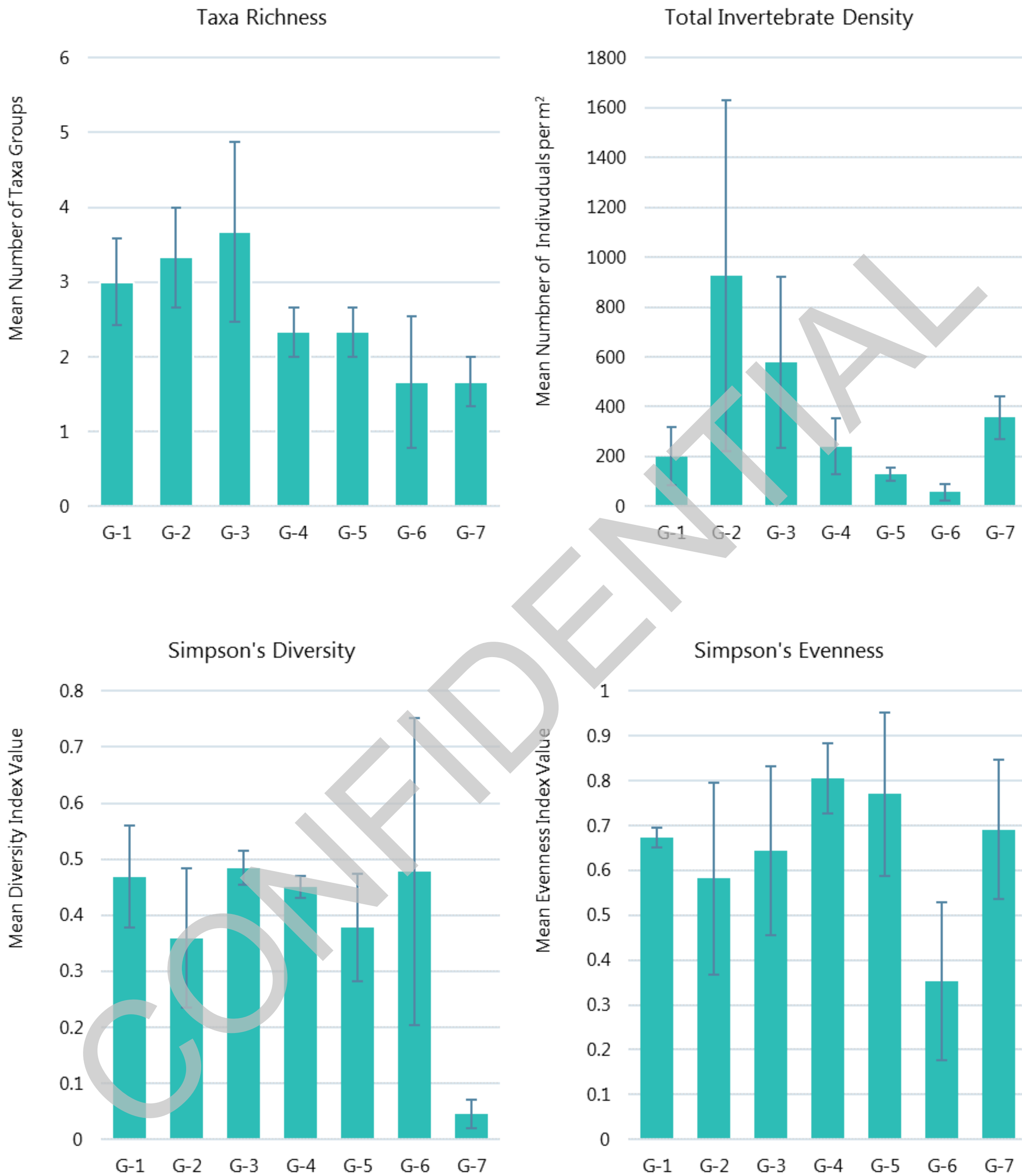


Figure 4-1: Benthic Invertebrate Community – Richness, Total Invertebrate Density, Diversity and Evenness

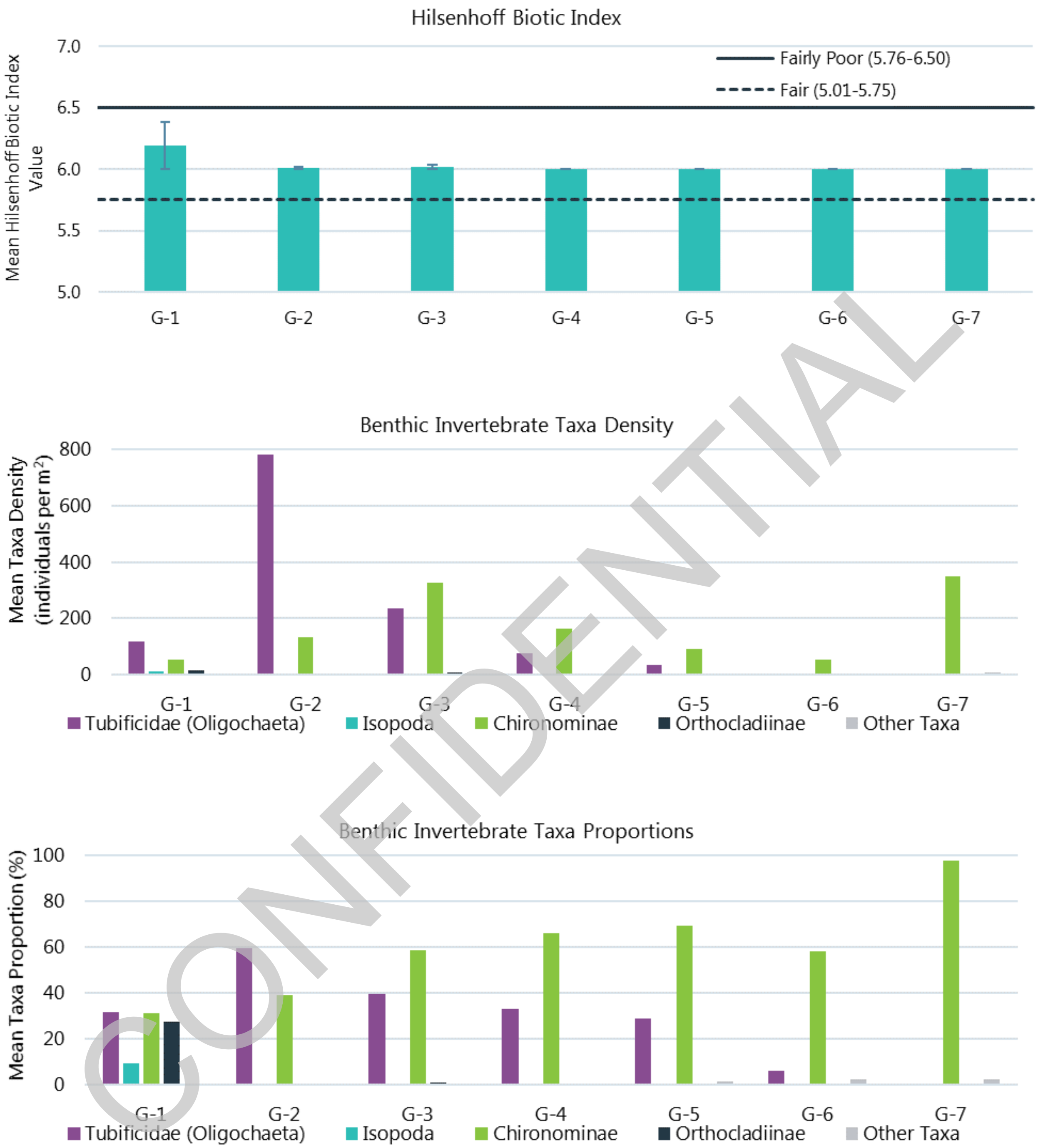


Figure 4-2: Benthic Invertebrate Community – HBI, Taxa Density and Taxa Proportion

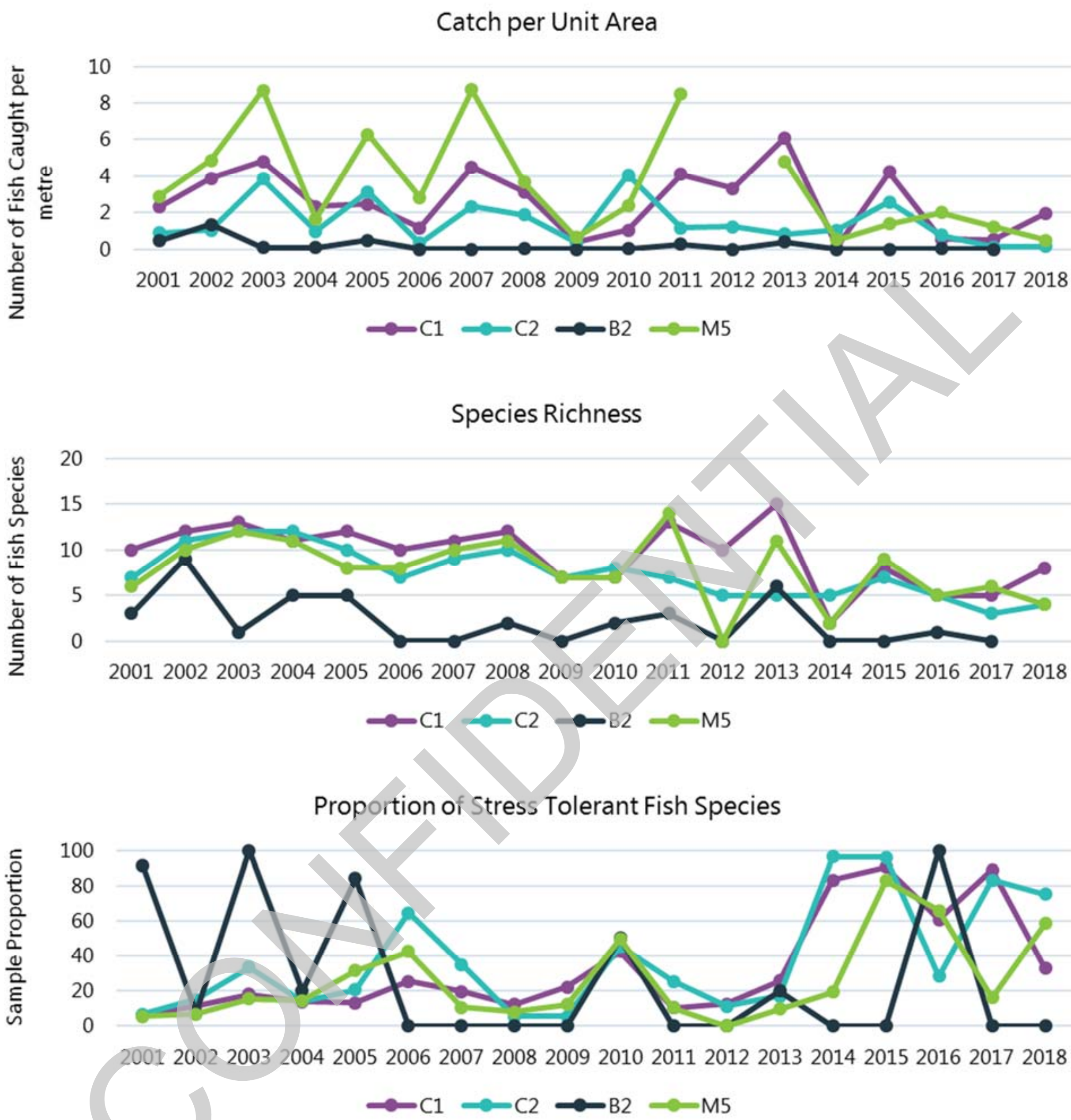


Figure 4-3: Fish Community – CPUA, Richness and Proportion of Stress Tolerant Species

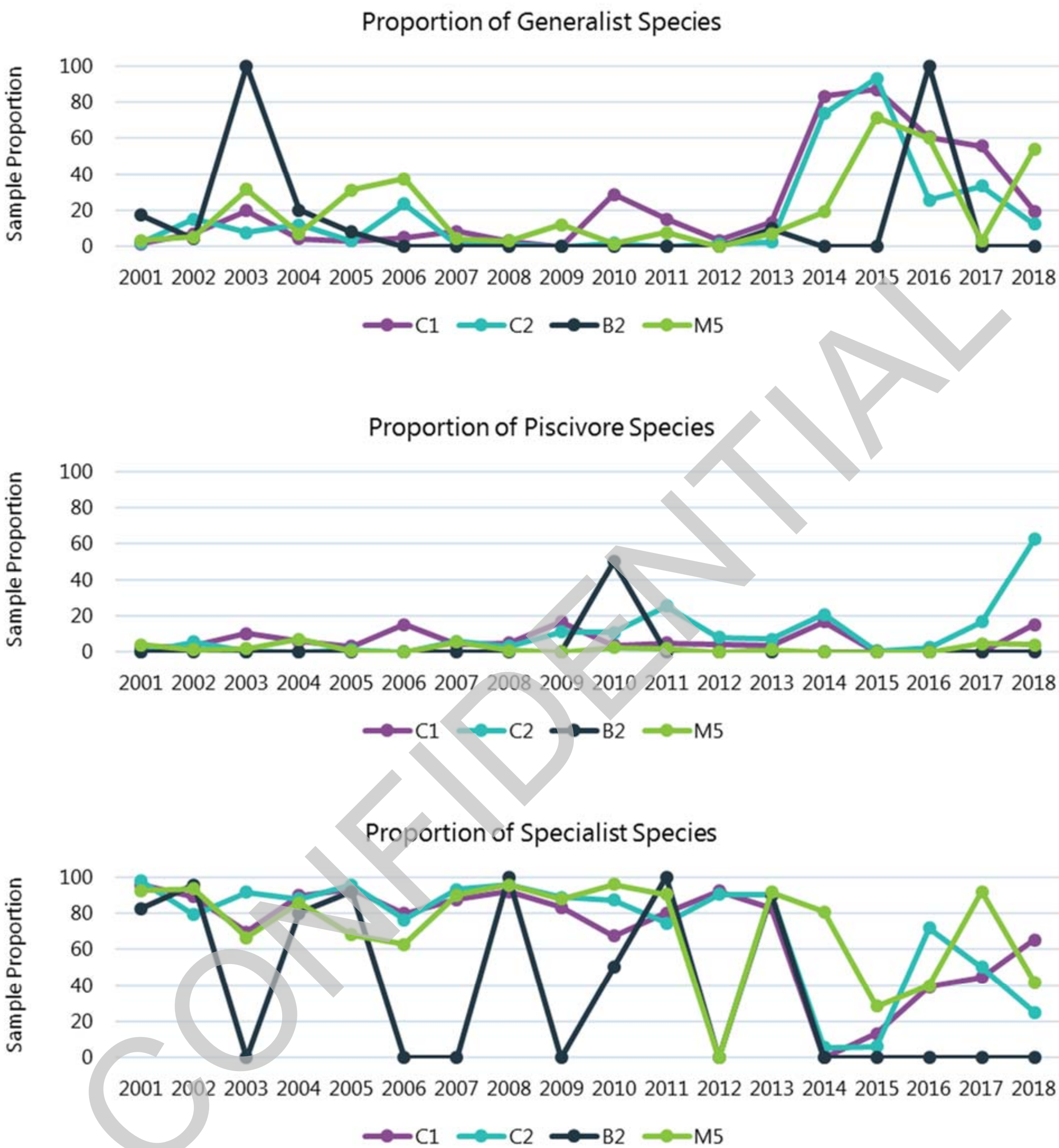
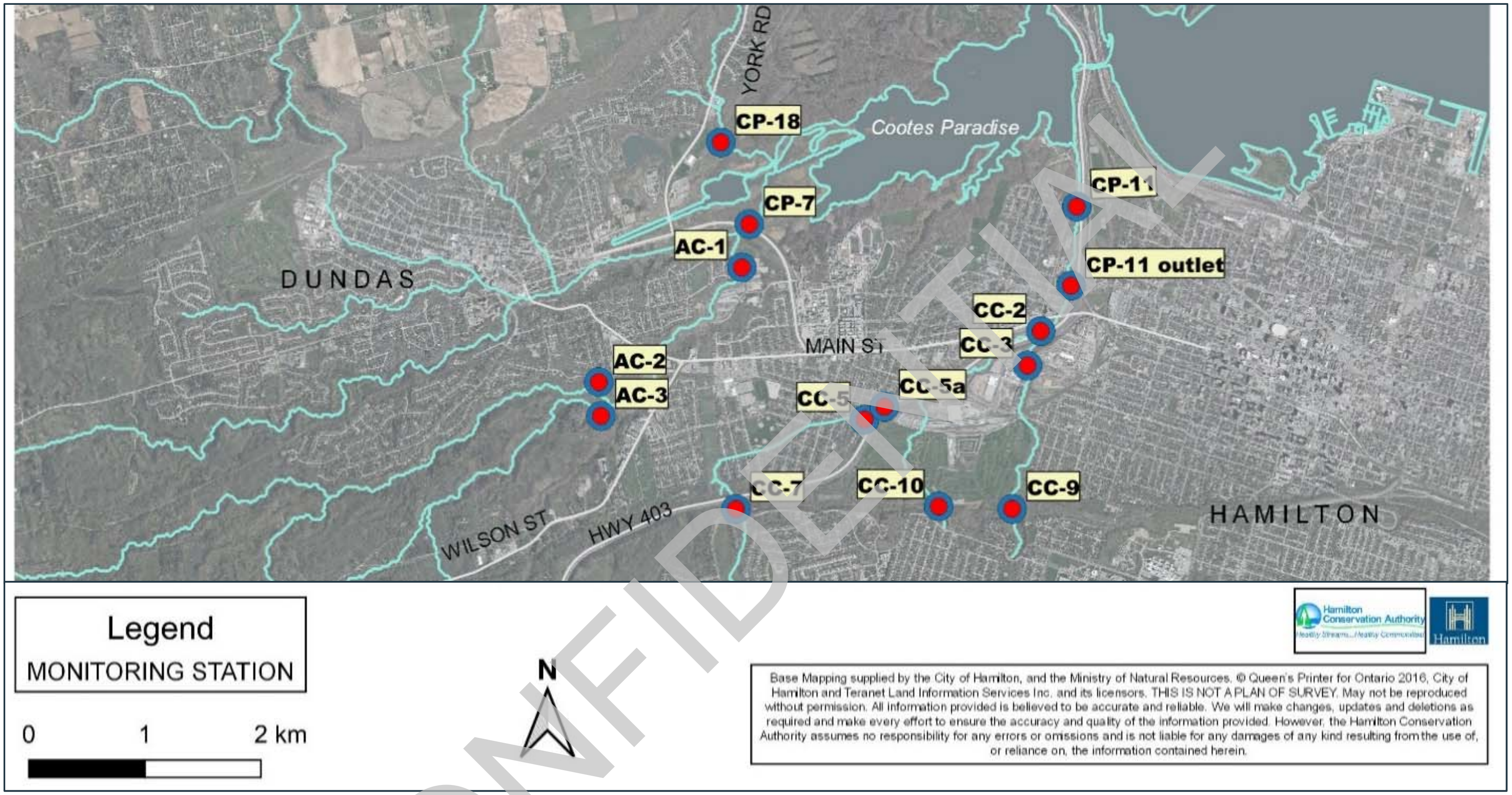


Figure 4-4: Fish Community – Proportion of Generalist, Piscivore and Specialist Species

wood.



Source: Figure provided by the City of Hamilton

Figure 4-5.1: Map of Chedoke Creek and Cootes (ref. HCA, City of Hamilton) Paradise Monitoring Stations

Note: Data used for analyses were from the affected station (CP-11) and upstream stations (CC-2, CC-3, and CC-9).

wood.

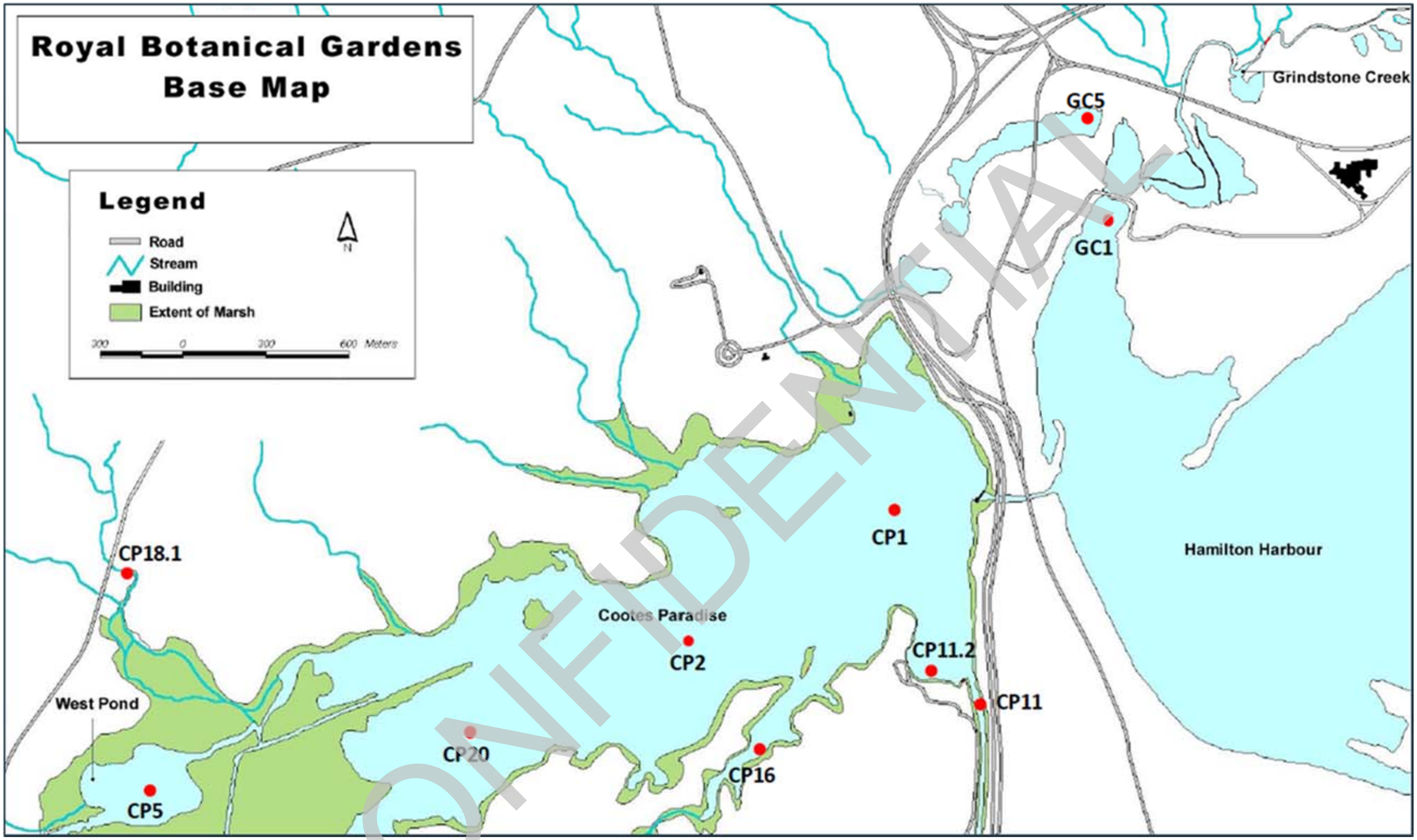


Figure 4-5.2: Map of Royal Botanical Gardens Monitoring Stations (Courtesy of Royal Botanical Gardens)

Note: Data used for analyses were from the affected station (CP11) and downstream stations (CP1, CP2, and CP20).

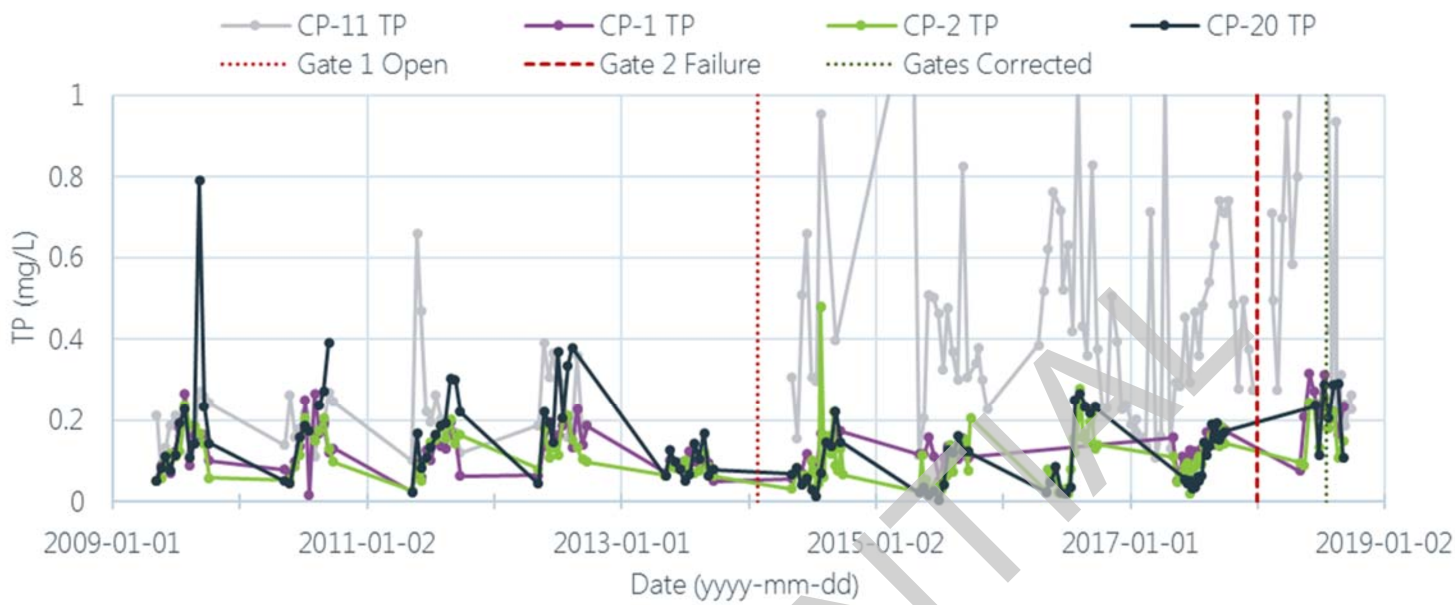


Figure 4-6: Total Phosphorus (TP) Time Series at CP-11 and Cootes Paradise Stations

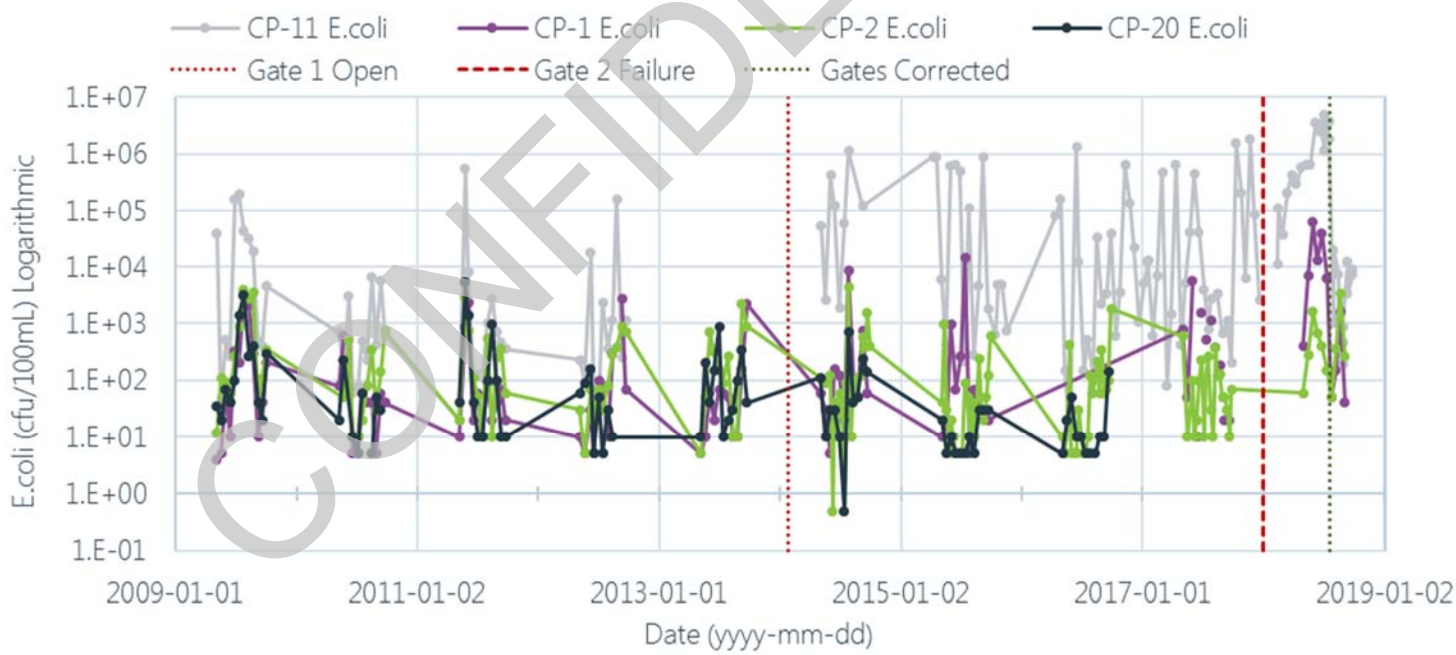


Figure 4-7: Escherichia coli (E. coli) Time Series at CP-11 and Cootes Paradise stations

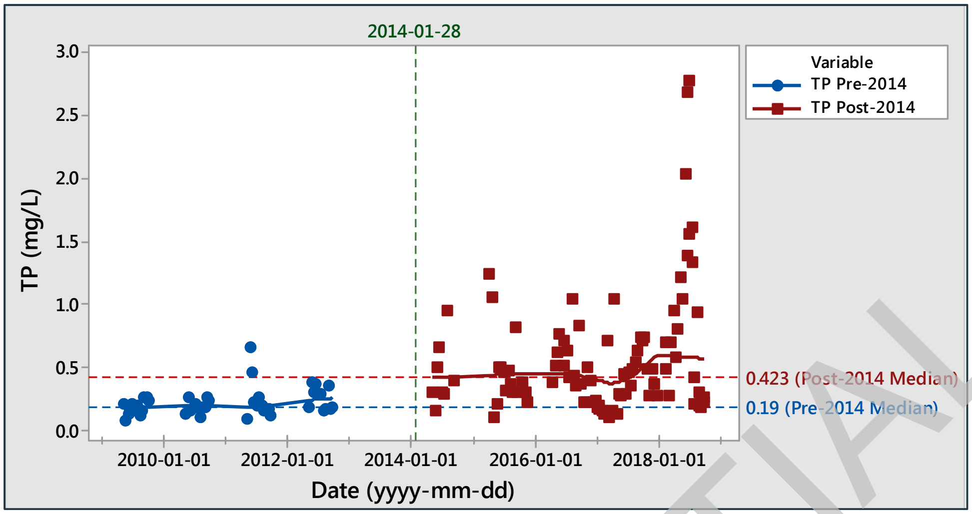


Figure 4-8: Mann-Whitney U Results for CP-11 TP Pre-2014 vs Post-2014 (p-value<0.0001)

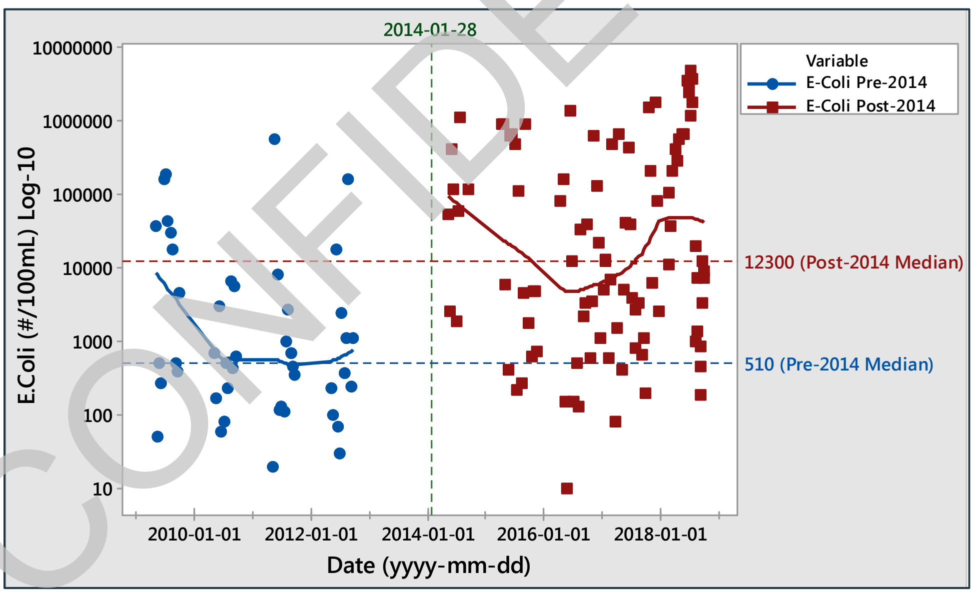


Figure 4-9: Mann-Whitney U Results for CP-11 E. coli Pre-2014 vs Post-2014 (p-value<0.0001)

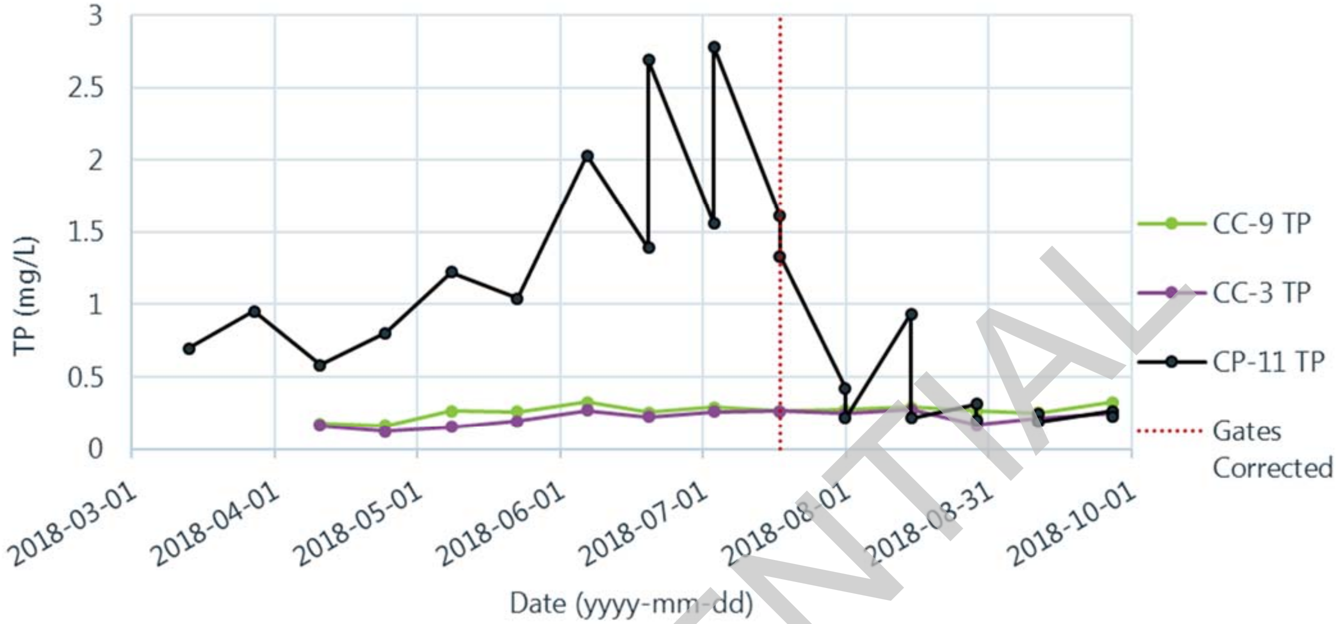


Figure 4-10: TP Concentrations in CP-11 and Upstream Stations

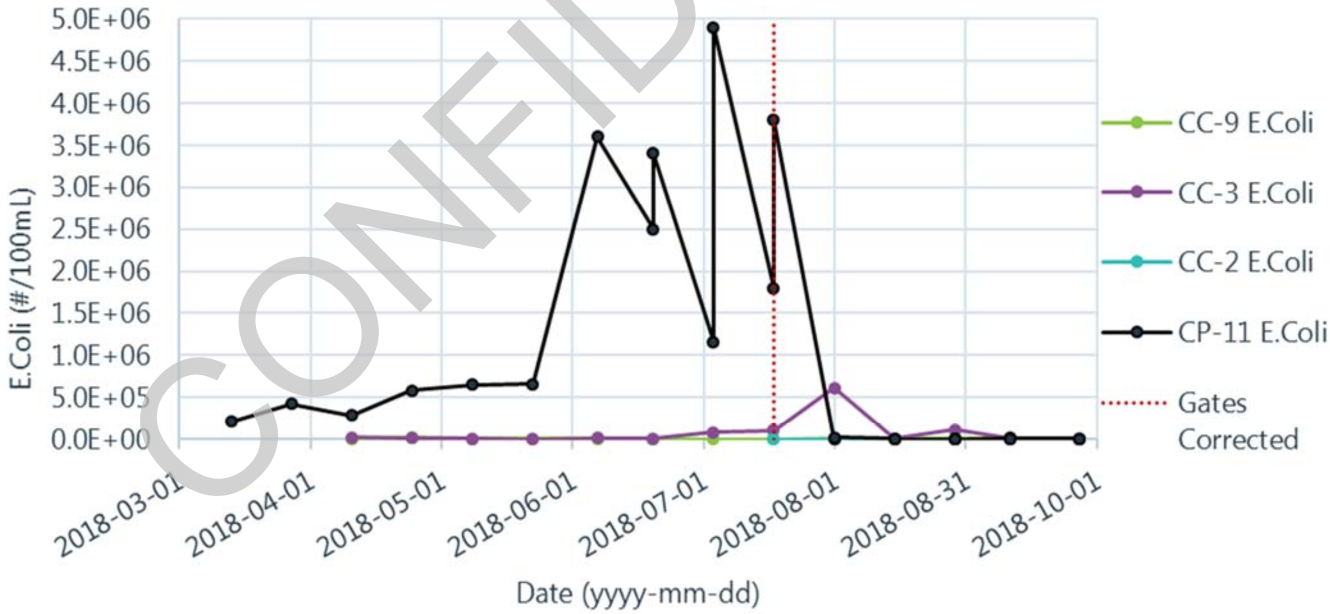


Figure 4-11: E. coli Concentrations in CP-11 and Upstream Stations

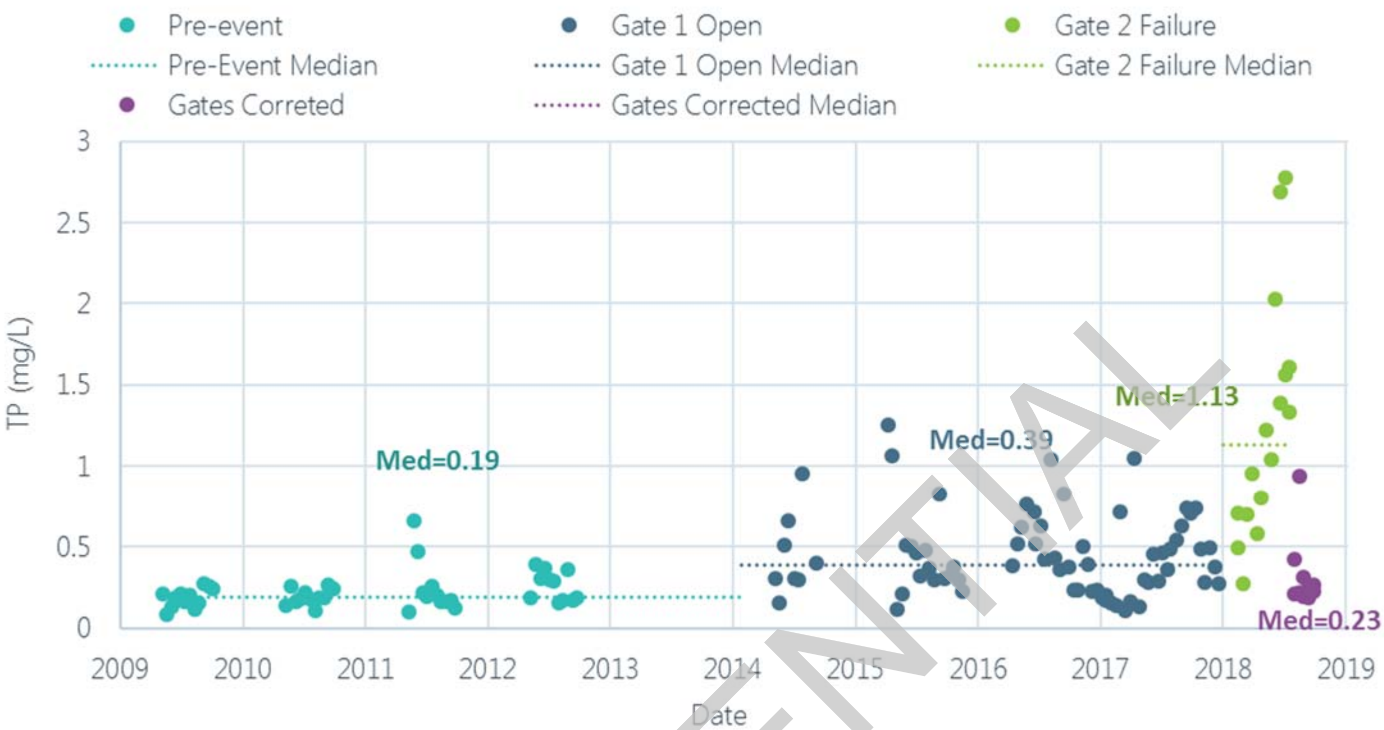


Figure 4-12: CP-11 TP Scatterplot with Medians for Event Time Periods

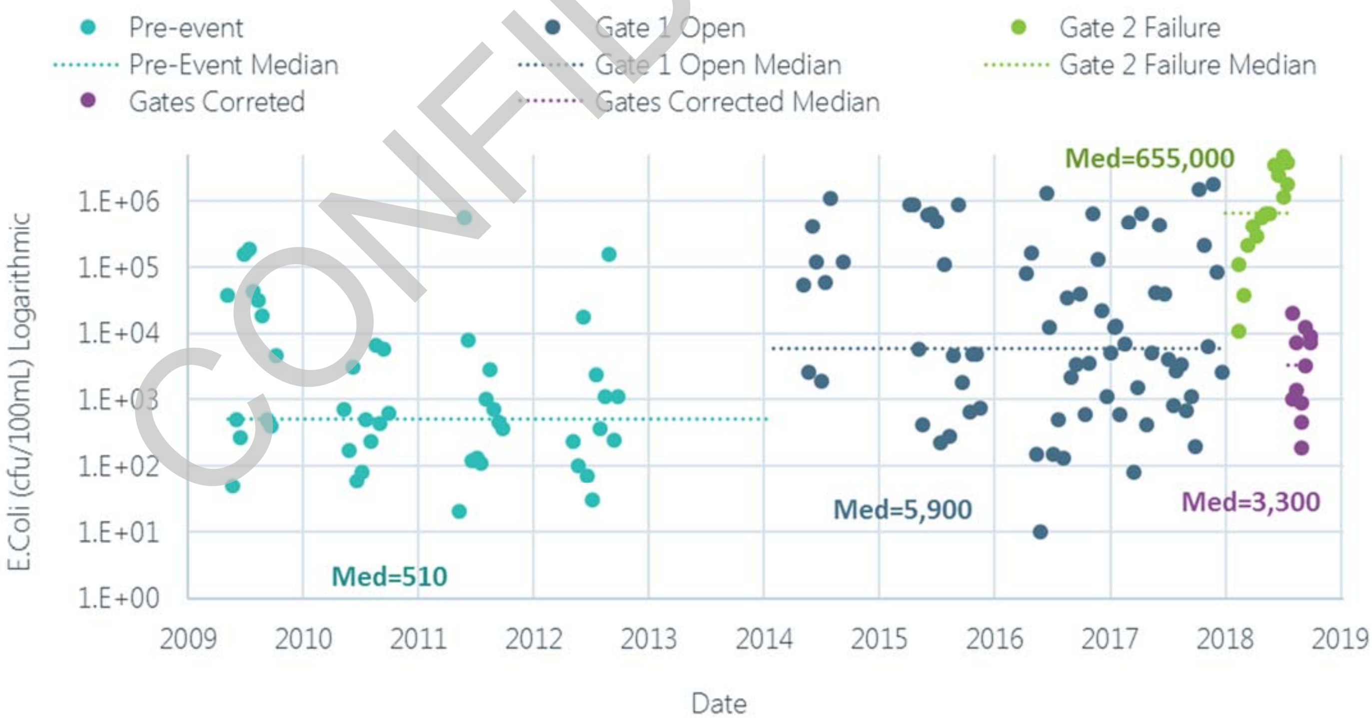


Figure 4-13: CP-11 E. coli Scatterplot with Medians for Event Time Periods

wood.

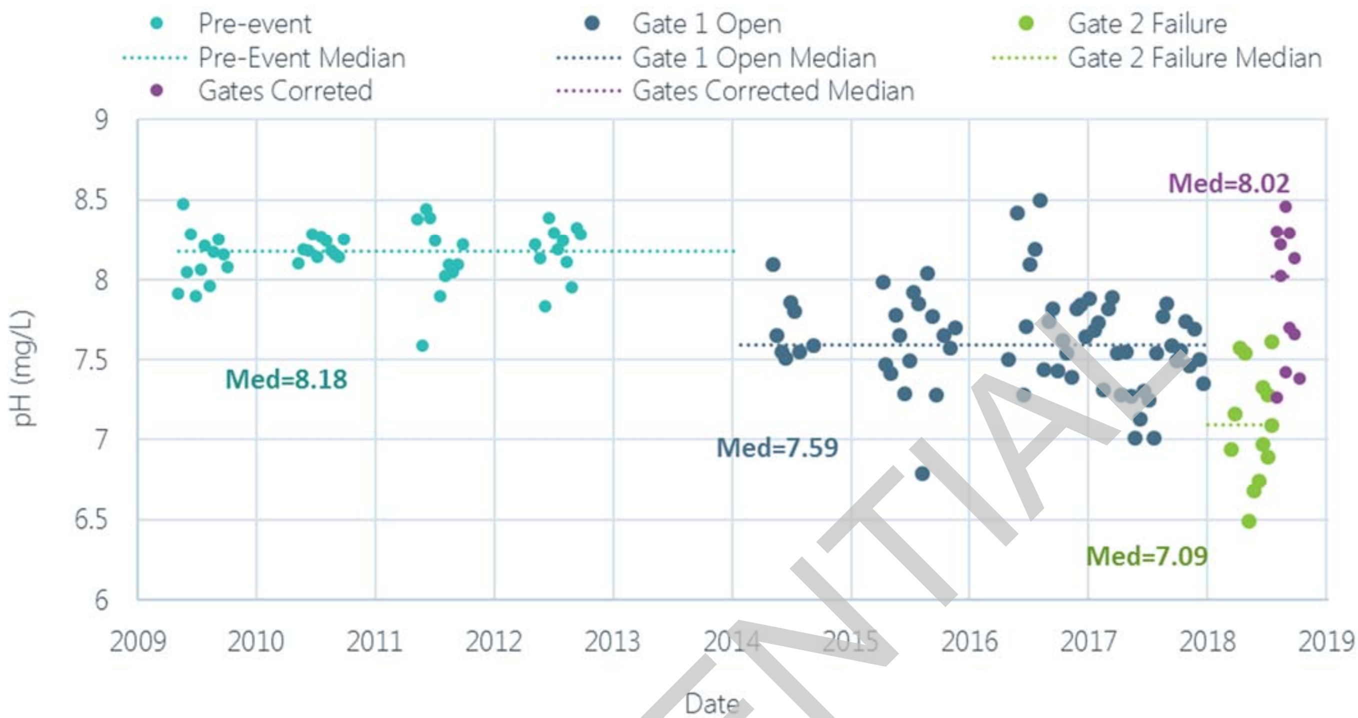


Figure 4-14: CP-11 pH Scatterplot with Medians for Event Time Periods

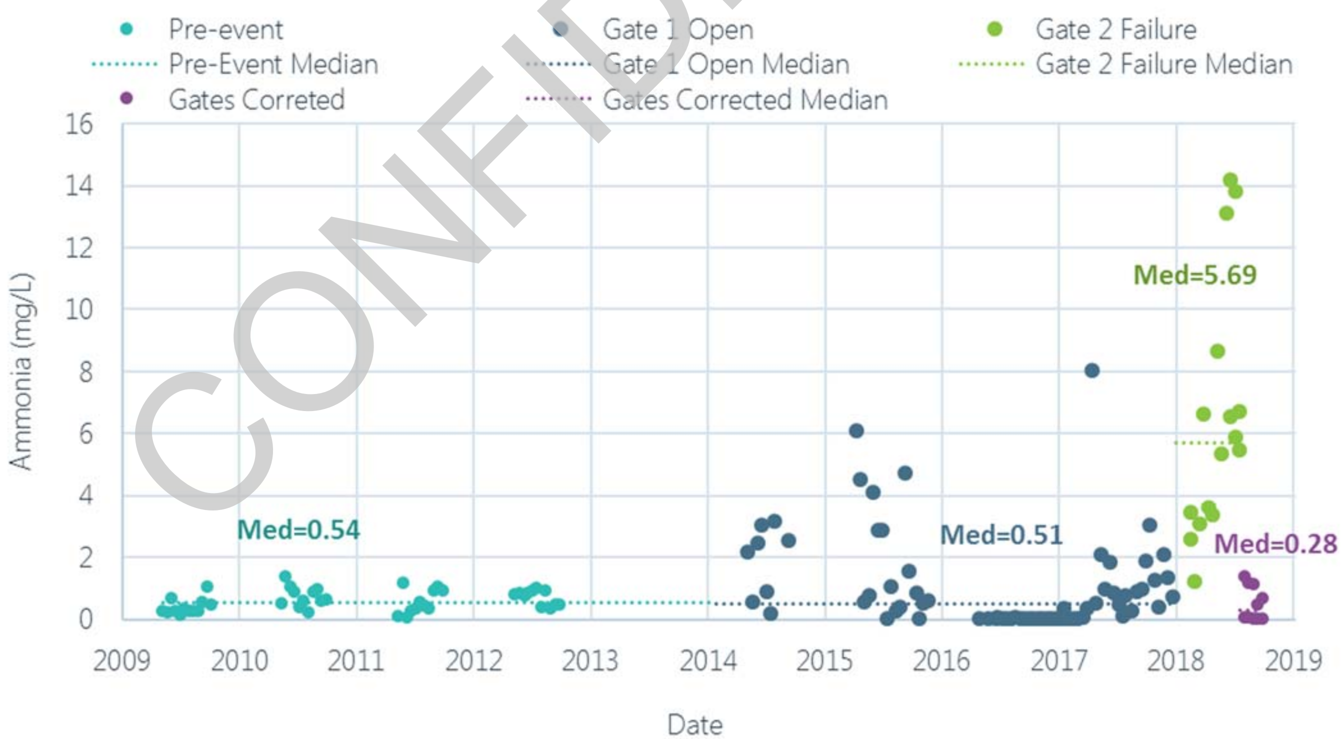


Figure 4-15: CP-11 Ammonia Scatterplot with Medians for Event Time Periods

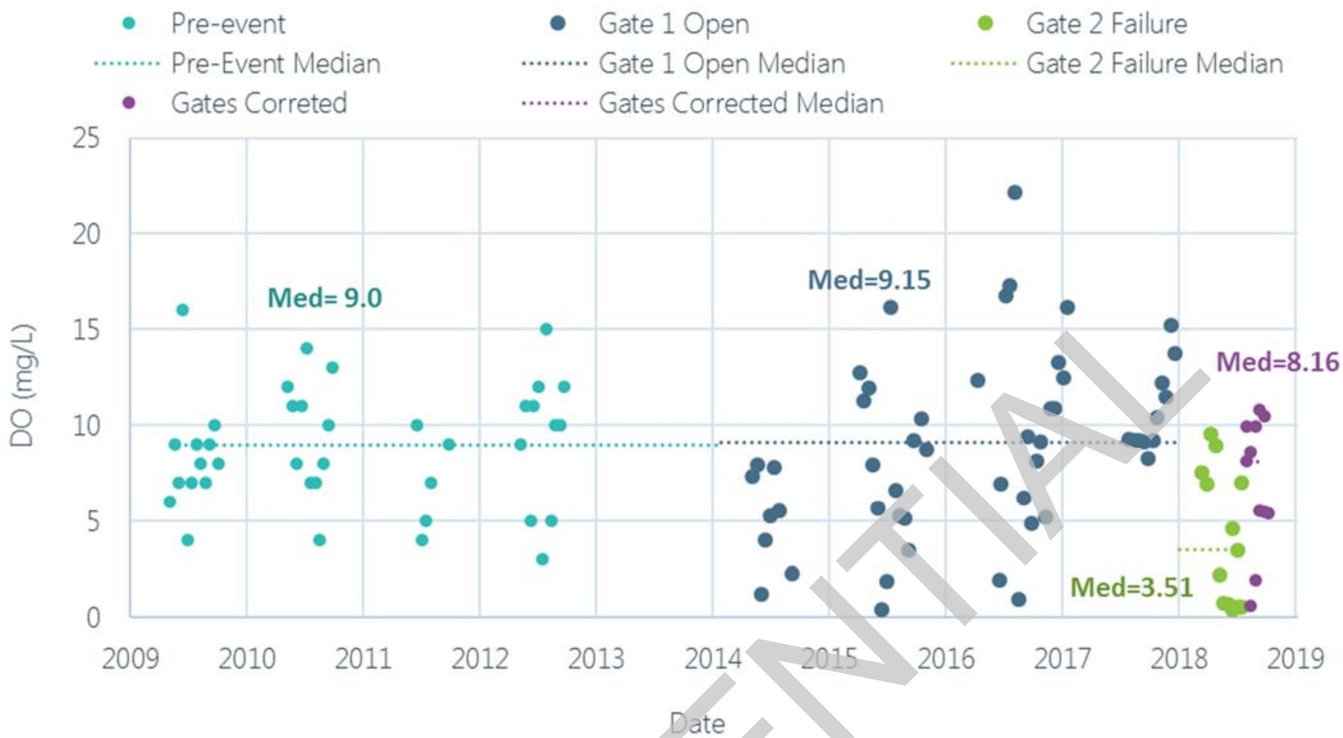


Figure 4-16: CP-11 Dissolved Oxygen (DO) Scatterplot with Medians for Event Time Periods

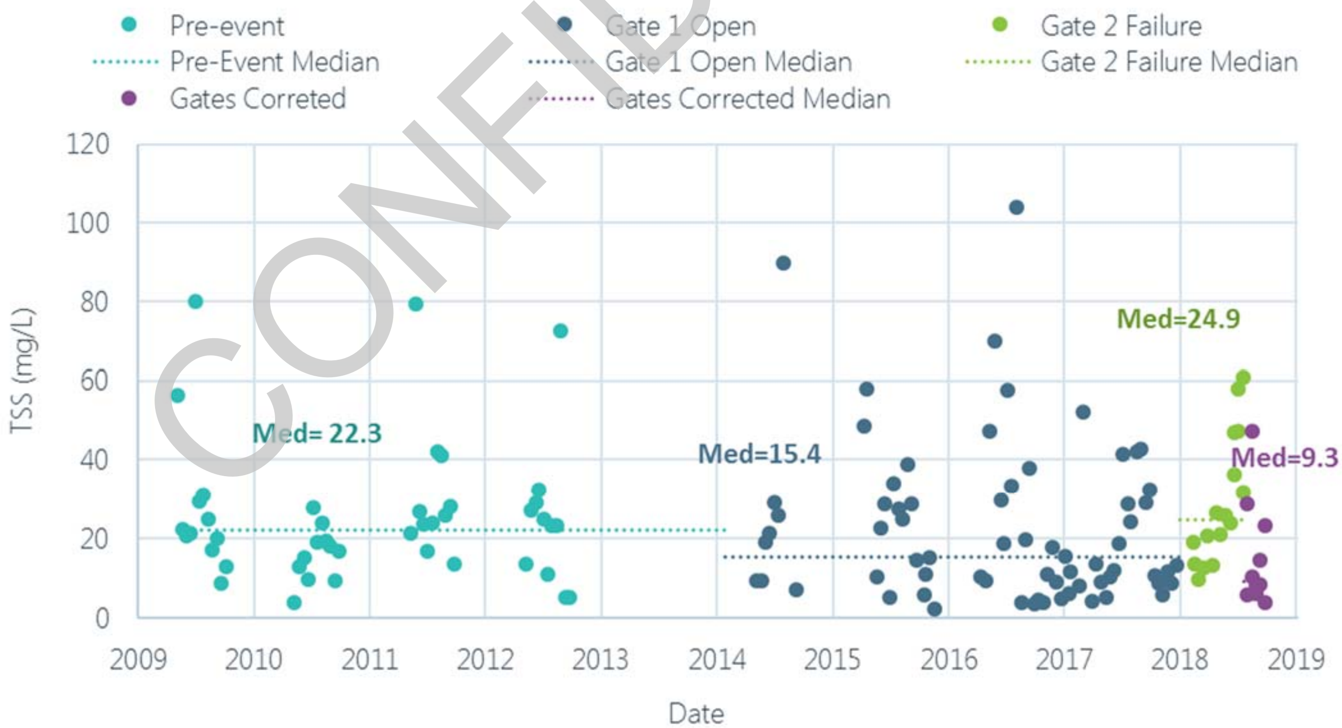


Figure 4-17: CP-11 Total Suspended Solids (TSS) Scatterplot with Medians for Event Time Periods

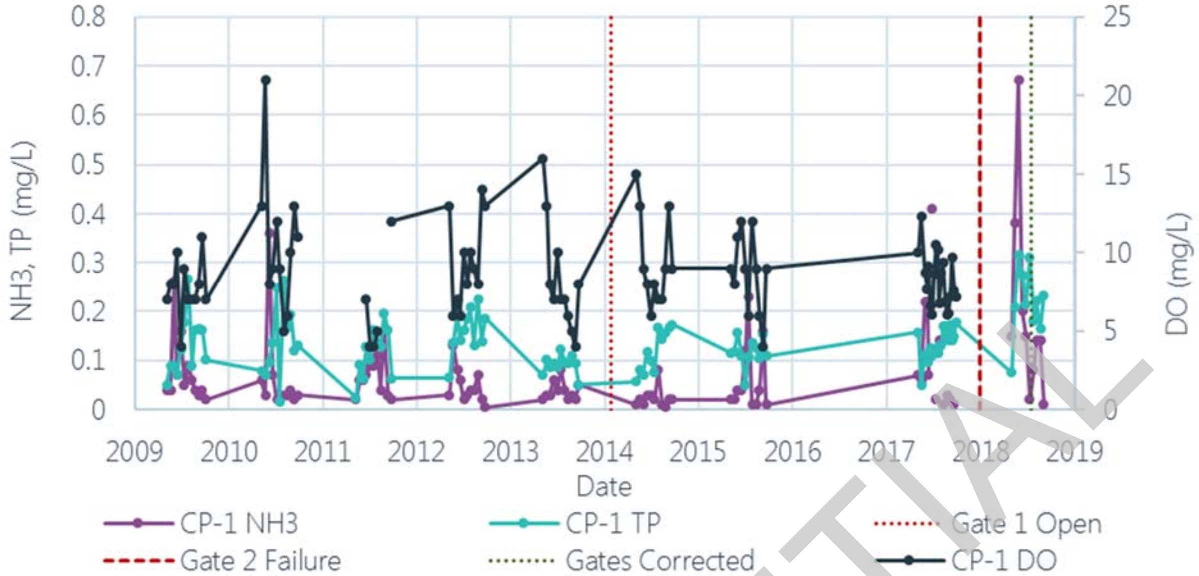


Figure 4-18: CP-1 Ammonia (NH3), Total Phosphorus (TP), and Dissolved Oxygen (DO)

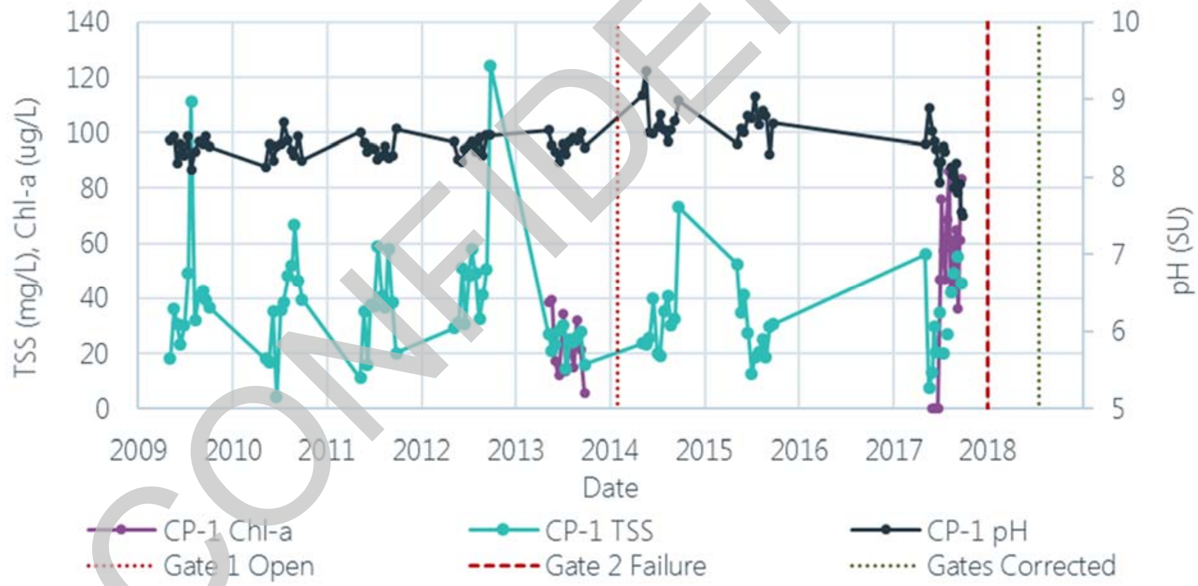


Figure 4-19: CP-1 Total Suspended Solids (TSS), Chlorophyll-a (Chl-a), and pH

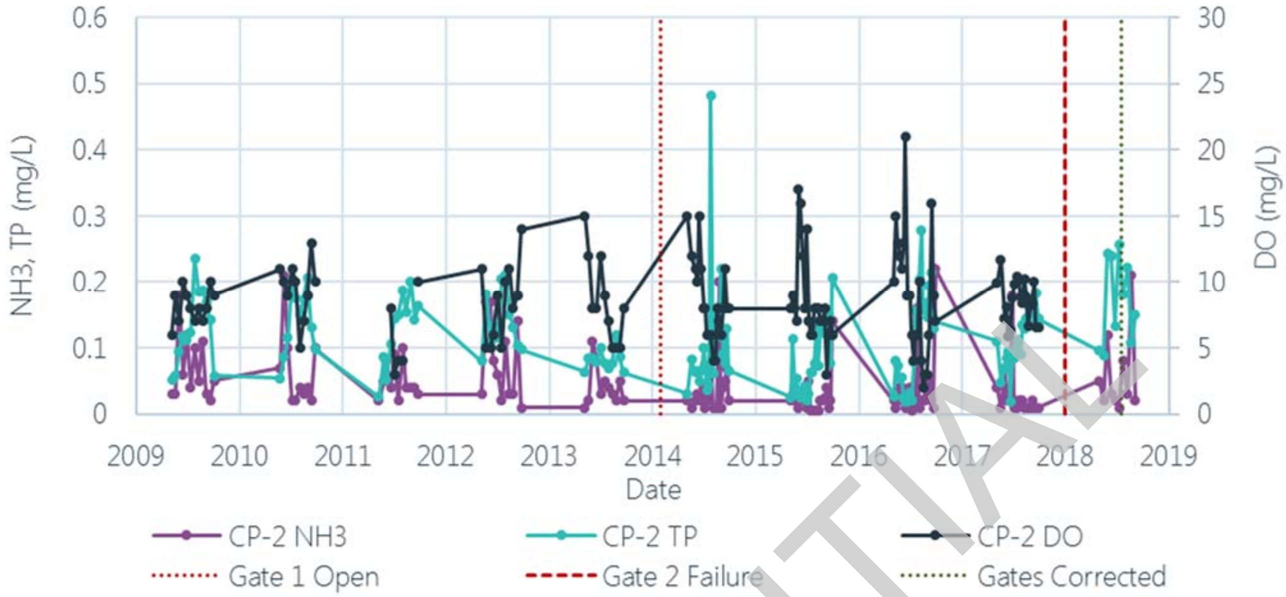


Figure 4-20: CP-2 Ammonia (NH3), Total Phosphorus (TP), and Dissolved Oxygen (DO)

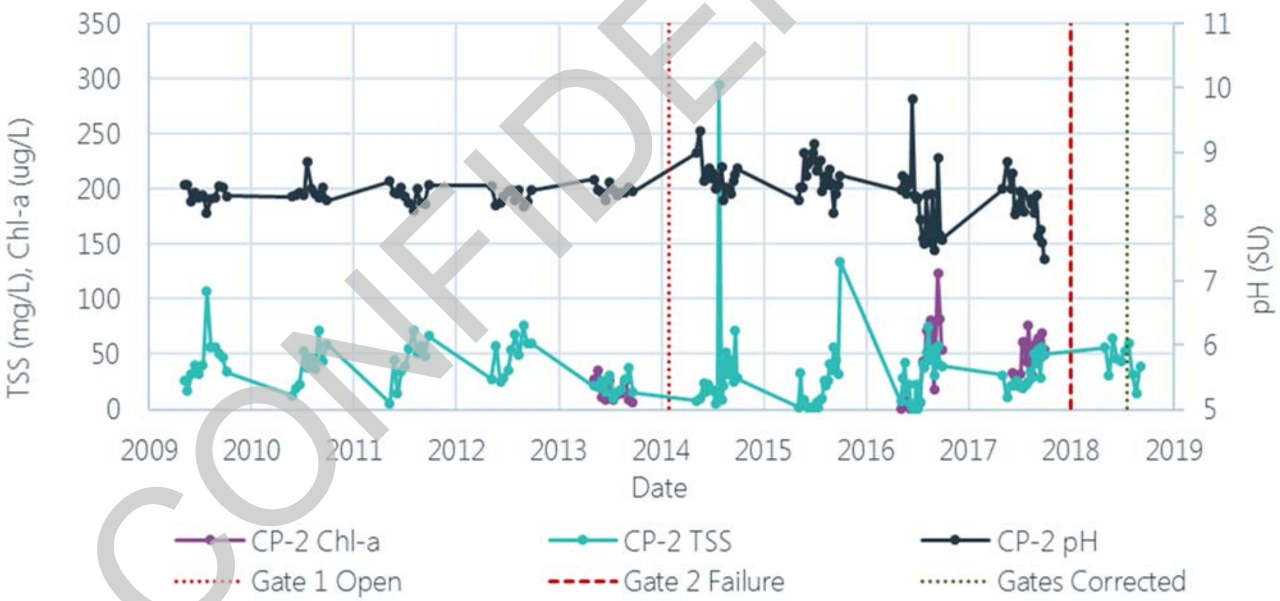


Figure 4-21: CP-2 Total Suspended Solids (TSS), Chlorophyll-a (Chl-a), and pH

wood.

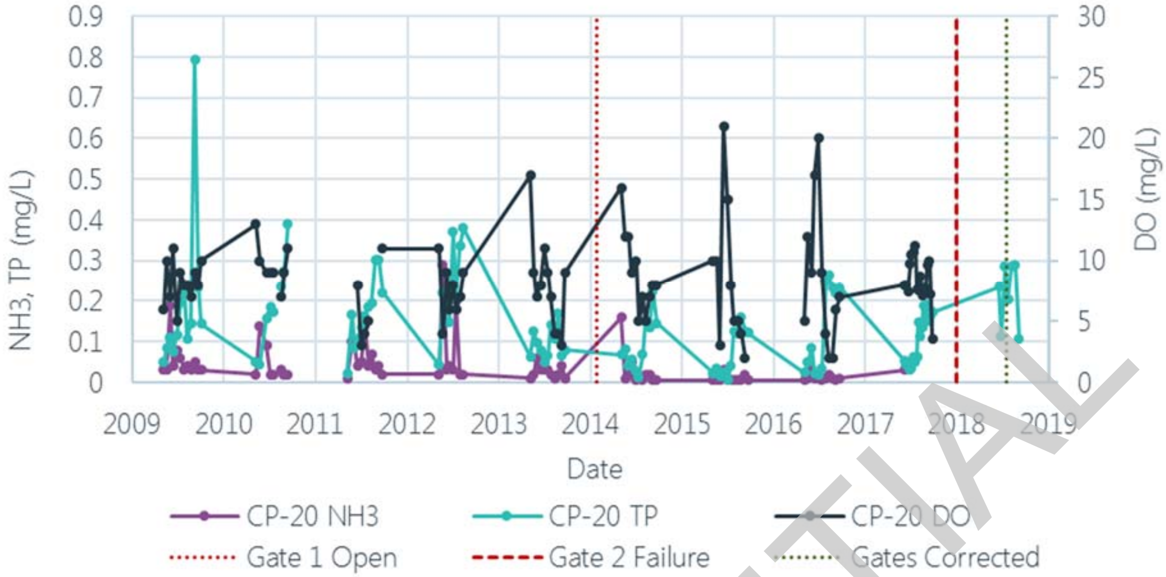


Figure 4-22: CP-20 Ammonia (NH3), Total Phosphorus (TP), and Dissolved Oxygen (DO)

Figure 4-23: CP-20 Total Suspended Solids (TSS), Chlorophyll-a (Chl-a), and pH

Table 4-1: Period of Record (POR) of Water Quality Data used in Assessment

Station	Parameter	Units	Start Date	End Date	N
CP-11	Total Phosphorus	mg/L	5/7/2009	9/27/2018	142
CP-11	Escherichia coli	cfu/100mL	5/7/2009	9/27/2018	143
CP-11	pH	SU	5/7/2009	10/10/2018	136
CP-11	Ammonia	mg/L	5/7/2009	9/27/2018	140
CP-11	Dissolved Oxygen	mg/L	5/7/2009	10/10/2018	116
CP-11	Chlorophyll-a (corrected)	ug/L	5/8/2013	5/8/2013	1
CP-11	Total Suspended Solids	mg/L	5/7/2009	9/27/2018	139
CP-1	Total Phosphorus	mg/L	5/6/2009	9/5/2018	108
CP-1	Escherichia coli	cfu/100mL	5/6/2009	9/5/2018	99
CP-1	pH	SU	5/6/2009	9/27/2017	96
CP-1	Ammonia	mg/L	5/6/2009	9/5/2018	100
CP-1	Dissolved Oxygen	% saturation	5/6/2009	9/27/2017	92
CP-1	Chlorophyll-a (corrected)	ug/L	5/7/2013	9/20/2017	28
CP-1	Total Suspended Solids	mg/L	5/6/2009	9/5/2018	100
CP-2	Total Phosphorus	mg/L	5/7/2009	9/5/2018	149
CP-2	Escherichia coli	cfu/100mL	5/7/2009	9/5/2018	149
CP-2	pH	SU	5/7/2009	9/27/2017	137
CP-2	Ammonia	mg/L	5/7/2009	9/5/2018	149
CP-2	Dissolved Oxygen	% saturation	5/7/2009	9/27/2017	133
CP-2	Chlorophyll-a (corrected)	ug/L	5/7/2013	9/27/2017	50
CP-2	Total Suspended Solids	mg/L	5/7/2009	9/5/2018	149
CP-20	Total Phosphorus	mg/L	5/7/2009	9/27/2017	107
CP-20	Escherichia coli	cfu/100mL	5/7/2009	9/21/2016	83
CP-20	pH	SU	5/7/2009	9/27/2017	98
CP-20	Ammonia	mg/L	5/7/2009	6/7/2017	84
CP-20	Dissolved Oxygen	% saturation	5/7/2009	9/27/2017	94
CP-20	Chlorophyll-a (corrected)	ug/L	5/8/2013	9/27/2017	39
CP-20	Total Suspended Solids	mg/L	5/7/2009	6/7/2017	84
CC-9	Total Phosphorus	mg/L	4/11/2018	9/27/2018	13
CC-9	Escherichia coli	cfu/100mL	4/11/2018	9/27/2018	13
CC-3	Total Phosphorus	mg/L	4/11/2018	9/27/2018	13
CC-3	Escherichia coli	cfu/100mL	4/11/2018	9/27/2018	13
CC-2	Total Phosphorus	mg/L	--	--	0
CC-2	Escherichia coli	cfu/100mL	7/18/2018	8/29/2018	4

5.0 Remedial Action Plan

5.1 Existing Conditions and Discharge Event Loading Estimates

Examination of existing conditions within Chedoke Creek indicates that a layer of organic material approximately 16 m wide with a mean thickness of approximately 0.27 m (+/-) is present along the roughly 1,275 m (+/-) creek bed between the Main King CSO and Cootes Paradise. Mean thickness has been used in this section for ease of discussion, however, sediment thickness is highly variable within Chedoke Creek in the study area and additional bathymetric data should be collected prior to implementation of any remediation project. The volume of organic material (defined as soft sediment as identified in Section 3) that is currently within Chedoke Creek is estimated to be approximately 5,600 m^3 (+/-). The organic sediments are underlain by firmer, sandier material. Chemical analysis indicates the organic material is nutrient-rich and bacteriological analysis indicates that it may be a potentially significant source of faecal coliform bacteria. In addition, the concentrations of metals and polyaromatic hydrocarbons (PAHs) are generally higher than the regulatory limits for standard sediment disposal.

As discussed in Section 3.2, metal and PAH concentrations were not measured in Chedoke Creek prior to the 2018 investigation. PAH concentrations, were lower in Cootes Paradise prior to the discharge event. However, metal concentrations were elevated downstream in Cootes Paradise prior to the discharge event suggesting that upstream sources of pollutants were present prior to the Main/King CSO discharge event. PAHs and metals are commonly associated with both wastewater and stormwater and multiple sources exist within Chedoke Creek watershed as discussed above.

Based on elevated concentrations of faecal coliform and nutrients, the soft sediments within Chedoke Creek may have been deposited over the duration of the discharge event, although as noted earlier, they may also be associated with CSO discharge prior to 2014. It has been estimated that a total suspended solids (TSS) load of over 2,375 tonnes was discharged to Chedoke Creek between 2014 and 2018. During low flow and low velocity conditions, much of the larger, heavier particulate material would likely have settled within portions of Chedoke Creek downstream of the Main King CSO. During higher flow and velocity conditions, some of the TSS load may have been mobilized and transported downstream to Cootes Paradise. Soft sediment collected from Chedoke Creek indicates moisture content of 40% or less, which suggests that this material is relatively dense and consistent with settling and consolidation of suspended particulate material in the discharge.

While dense organic sediments are present within Chedoke Creek, solids from the discharge event have likely settled over a range of in-situ conditions which may exist downstream of Chedoke Creek. The potential range of resulting in-situ sediment volume based on the total TSS discharged during the event (2,375 tonnes) can be estimated from the following table derived for wastewater sludges as described in Metcalf and Eddy (2004):

% solids*	Specific Gravity of Sludge	Estimated Volume of Sludge (m^3)
1	1.003	236,820
2	1.006	118,070
5	1.014	46,820
10	1.029	23,070
15	1.045	15,160
20	1.061	11,200
30	1.094	7,240
40	1.129	5,260

*Assumes specific gravity of solids is 1.4

The equation used to calculate the above specific gravity of sludge is as follows:

$$\frac{1}{S_{sl}} = \frac{P_s}{S_s} + \frac{P_w}{S_w}$$

S_{sl}=specific gravity of sludge
Ps= percent solids expressed as a decimal
S_s=specific gravity of solids, assume 1.4
P_w=percent water expressed as a decimal
S_w=specific gravity of water, assume 1.0

The equation used to calculate the estimated volume of sludge is as follows:

$$V = \frac{Ms}{\rho_w S_{sl} P_s}$$

V=volume, m^3
M_s=mass of dry solids, kg
ρ_w=specific weight of water, 10^3 kg/m^3
S_{sl}=Specific gravity of the sludge
P_s=percent solids expressed as a decimal

The sludge volume of 5,260 m^3 estimated using the total 2,375 tonnes of TSS loading at 40% solids is similar to the approximate in-situ volume of 5,600 m^3 discussed earlier. Solids content in the upper 15 cm of stations C-3 and C-4 ranged between 40 and 50% (Appendix B, Table B1-2a). Other locations were higher in solids content indicating that 40% is likely a conservative estimate. This suggests that the solid organic mass within Chedoke Creek is similar to the solids mass discharged during the spill event.

Total Kjeldahl nitrogen loading during the discharge event is estimated to be 312 tonnes. Based on the concentrations from samples collected in soft sediment, approximately 560 tonnes of total Kjeldahl nitrogen are present within Chedoke Creek.

Total phosphorus mass within the Chedoke Creek soft sediments is estimated to be 3.3 tonnes while total loading from the event is estimated to be 47 tonnes. Hence, less than ten percent of the TP remains in the sediment, suggesting that the balance of the mass may have been transported downstream as dissolved phosphorus. This is consistent with the relatively high concentrations of TP in the water column in Chedoke Creek and downstream in Cootes Paradise between 2014 and 2018.

Based on the coarse data collected for the preliminary analysis, it appears that both solids and total Kjeldahl nitrogen loading from the discharge event may be addressed by removing the soft sediments delineated within the subject reach of the Chedoke Creek, downstream of the Main King CSO. However, approximately 90% of the total phosphorus mass load appears to have be solubilized or transported downstream.

5.2 Alternatives Assessment

The Chedoke Creek alternatives assessment has involved analysis of a no-action alternative and further development of remediation options and a project scope based on the analysis of current (2018) conditions as previously described, and estimated pollutant loading during the event.

The ecological conditions within Chedoke Creek were likely degraded long before the beginning of the spill event in 2014. The 2013 aerial photography indicates that Chedoke Creek had no identifiable emergent or submerged aquatic vegetation between the Main King CSO discharge structure and Cootes Paradise prior to the event (Figures 5-1 through 5-3). Similar conditions existed in 2017, as shown in Figures 5-1 through 5-3. Changes since the 2014 condition are not immediately apparent in the aerial photography but, based on current (2018) conditions, as described in the foregoing, appear to be primarily related to the accumulation of organic sediments that have resulted in increased nutrient export, bacteriological contamination, low dissolved oxygen, and physical smothering, as well as habitat loss for those species dependent on sandy substrates. As discussed previously, it is not possible to determine the exact source of these pollutants and some of the material has likely been transported downstream of Chedoke Creek into Cootes Paradise and likely further into Hamilton Harbour. In addition, future accumulation and pollutant loading is likely since multiple CSOs and stormwater outfalls exist upstream.

5.2.1 No-Action Alternative

The no-action alternative was evaluated to consider the expected impacts if no remediation occurs within the subject reach of the Chedoke Creek. The no-action alternative is discussed below.

Section 4.4 indicated water quality improvements were apparent immediately following proper adjustment of the Main/King CSO gates. The degree of water quality improvement within the section of Chedoke Creek downstream of the Main/King CSO will depend largely on the contribution of upstream sources which will vary depending on runoff conditions. During low flow conditions, water quality within Chedoke Creek will likely be affected primarily by internal contributions (e.g., sediment nutrient flux and resuspension) and organic material deposited within the creek which may significantly degrade water quality leading to excessive planktonic algal growth and loss of submerged aquatic vegetation. However, during higher flows, much of the internal contribution from these organic sediments will be diluted and carried downstream. The organic material transported downstream may however continue to contribute to ongoing water quality problems within Cootes Paradise and Hamilton Harbour although the magnitude of the impacts may not be discernable from other sources of contaminants to these water bodies due to dilution. Additional CSO discharges are also likely during high flows which will also make it difficult to isolate potential impacts from the Main/King CSO spill event.

As discussed in Section 5.1, the estimated mass of organic material and TKN currently within Chedoke Creek is similar to the overall loading estimated for the duration of the spill event. Much of the TP from the spill event appears to have been transported downstream, but significant mass is still present within the creek. As noted earlier, the source of the material is not certain and conditions prior to the spill event suggest that the ecological conditions of Chedoke Creek had already been significantly impacted, so removal is not likely to restore Chedoke Creek. However, unless removed, the organic material currently in Chedoke Creek will likely result in additional loading to Cootes Paradise as it is transported and redeposited downstream. The overall impact of the loading will likely be relatively small compared to the total loading to Cootes Paradise and beyond from the surrounding watershed, however, the potential impact area will be much larger. Greater nutrient flux from sediments washed downstream would be likely since it would have more contact with the water column and may result in additional algal growth and loss of submerged aquatic vegetation. Therefore, the no-action alternative is not recommended.

5.2.2 Remediation Alternatives

The remediation alternatives focus on addressing the organic material within the subject reach of the Chedoke Creek, within the management unit boundaries defined on Figure 5-4. Regardless of the specific source of the organic sediments within Chedoke Creek, it appears that the solids and total nitrogen mass may be addressed by a remediation project within the current existing condition study boundaries.

Potential impairments from the organic material within Chedoke Creek can be addressed (in order from least, to most, effective), by physical capping; chemical inactivation (to bind bioavailable phosphorus), or by direct removal. An assessment of each of these alternatives is provided in the following sections; the advantages and disadvantages of the alternatives discussed in the following sections are also provided within Table 5-1 as they relate to functional effectiveness, environmental effectiveness, economics, and social benefits.

5.2.3 Physical Capping

Physical capping is accomplished by applying a cover of clean material on top of the contaminated sediment to effectively eliminate or reduce biogeochemical and physical interaction with the overlying water column. The type of material used depends on the pollutant and degree of isolation needed but ranges from bentonite clay, uncontaminated organic material to sand. Some remediation projects have successfully utilized cleaner organic material as a cover to reduce pesticide contamination (SJRWMD, 2016). Sand caps have been used effectively to improve water quality in canal systems where nutrient contamination has been problematic. However, this method is best suited for lentic systems where bottom conditions are relatively uniform and water depth is sufficient to reduce scouring, sediment transport, and resuspension. Irregular channel morphology, minimal water depth and periodic high flows within Chedoke Creek would provide highly variable settling velocities, which would limit the effectiveness of any attempt to effectively cap the existing organic material. In addition, dense material such as sand, would tend to displace the more fluid organic material thereby limiting the effectiveness of this alternative. Therefore, for these reasons, sediment capping is not recommended as the selected remediation alternative.

5.2.4 Chemical Inactivation

Chemical inactivation of sediment is utilized worldwide to reduce the release of phosphorus from sediments to the water column via processes such as diffusion and resuspension. Several methods can be utilized, but the primary chemicals applied are liquid aluminum sulfate (alum) and lanthanum-based clay mixes, such as Phoslock™. Of the two chemicals, Phoslock™ is the one typically selected for use in Canada due to regulatory agency concerns. Like capping, chemical inactivation is typically utilized in lentic systems with deeper water. This generally prolongs the effectiveness of the binding process and limits the release of sediment derived phosphorus. However, unlike capping, chemical inactivation treatments have a defined capacity to bind phosphorus, regardless of their ultimate disposition. Under dry and low flow conditions, Chedoke Creek could potentially be dammed and treated with Phoslock™ to provide sufficient contact for sediment nutrient inactivation. The prescribed phosphorus reduction would be achieved whether the chemical stays within Chedoke Creek or migrates downstream.

It is important to note that chemical inactivation specifically targets phosphorus, which is a primary nutrient of concern, but would likely result in very little impact (benefit) on nitrogen or other sources of potential waste-derived bacterial and pathogen contamination within Chedoke Creek. In addition, high flow conditions that occur within Chedoke Creek may scour the sediment surface causing the chemical amendment to be transported downstream. This would leave the remaining sediment exposed to the water column where it could continue to cause water quality impairments to Chedoke Creek. Given the flocculent nature of Phoslock™, it is unlikely that this material would stay in place during high flow. Although chemical inactivation would provide an effective means of overall phosphorus load reduction, it is not recommended as the selected remediation alternative since the intent is to remediate potential impacts from other constituents, in addition to phosphorus. This alternative would not address nitrogen loading or the biological oxygen demand of the organic sediments.

5.2.5 Direct Removal

Physical removal of the organic sediment within Chedoke Creek will directly address the three primary sources of potential impairment including nutrient contamination, bacteriological contamination, and habitat loss. Dredging can be accomplished either through mechanical means or by use of hydraulic dredge equipment. Hydraulic dredging is recommended in Chedoke Creek over mechanical means for several reasons. Mechanical dredging would not be practicable due to the limited width of the creek, the density of riparian vegetation, and lack of continuous access. Hydraulic dredging provides nearly complete containment of the dredge slurry along the pumping route, which reduces exposure of the sediments to the atmosphere that could cause odour or other problems, if the material were to be handled by an excavator. Additionally, the dredge slurry from a hydraulic dredge can be easily routed to the wastewater system for dewatering and ultimate treatment and disposal, thus avoiding potential issues related to dredged material storage, dewatering, and handling operations, which are generally space intensive and costly. Complete removal of this material by hydraulic dredging is recommended as the primary means of remediation. The recommended hydraulic dredge concept plan is further discussed in the following sections.

Table 5-1 Alternatives Assessment Summary

Alternative	Functional Effectiveness	Environmental Effectiveness	Economics	Social Benefits
No Action	Long-term breakdown or burying of organic sediment resulting in downstream transport and dilution	Existing contaminants may be transported downstream to Cootes Paradise and further downstream where they will be diluted but may still support excessive algal growth and other impairments	No capital cost	The City intends to restrict access to Chedoke Creek so there will be no direct social benefits from the no action alternative
Physical Capping	Possibly effective but depends on fluidity of soft sediments. May not remain in place.	Provides a barrier which limits contact with the water column and could provide stable substrate	Relatively expensive because this involves transportation and placement of large quantities of clean fill	The City intends to restrict access to Chedoke Creek so there will be no direct social benefits
Chemical Inactivation	Only effective at reducing phosphorus release	Promotes indirect water quality response as a result of decreased phosphorus load. However, 90% of phosphorus load is no longer in Chedoke Creek	Least expensive option, but does not address anything other than phosphorus load	Potential downstream water quality improvements, benefits to Chedoke Creek during low flow as long as chemical stays in place
Direct Removal	Removes the source of contamination	Restores the original creek bed and removes the contaminated organic layer while reducing the oxygen demand	Moderately expensive but nearby sewer mains create a significant economic advantage for disposal	The City intends to restrict access to Chedoke Creek so there will be no direct social benefits

5.3 Hydraulic Dredging of Targeted Organic Material

As noted, hydraulic dredging provides an efficient means to remove the target sediments down to a specific elevation without the need to disturb areas outside of the necessary dredge footprint. For the Chedoke Creek remediation effort, the dredging template is proposed to extend down approximately 15 to 20 cm below the natural sand or gravel bottom to ensure the targeted sediments are effectively removed. The proposed overdepth dredging (15 – 20 cm) is partially based on dredging industry standards and partially on the reasonable and practical pipeline size of the hydraulic dredge equipment that would likely be deployed in this remediation effort.

As noted, the volume of organic material that is currently considered to be within Chedoke Creek is estimated to be approximately 5,600 m^3 (+/-). It is recommended that an additional roughly 6,400 m^3 (+/-) of natural sand or gravel bottom be removed as sub-excavation to effectively capture migrated constituents. Therefore, the total proposed dredge volume is currently estimated to be 12,000 m^3 (+/-). Additional detailed pre- and post-dredge surveys will be required before project commencement and following project completion.

Given the importance of maintaining workable water depths for sediment removal by dredging, the approximately 1,275 m (+/-) channel will likely be divided into at least three sections or "management units." as shown in Figure 5-4. Management unit sizes and number will vary based on the size of the proposed hydraulic dredging equipment and pumps the selected contractor will mobilize to the site.

The first management unit is proposed to extend north from the outfall/plunge pool roughly 425 m (+/-) to point south of Macklin Street North as it enters Kay Drage Park. The second management unit would extend 320 m (+/-) from the end of the first unit and ends approximately 30 m north of the private road that connects Macklin Street North to Kay Drage Park. The third unit would likely extend north roughly 520 m (+/-) to the junction with Cootes Paradise.

At the northern end of each management section, starting with unit one, the selected contractor would install a cofferdam system. Before dredging, the water level in each management unit would be raised and maintained at an elevation 2 to 3 m above the top of the sediments to allow a hydraulic dredge to be deployed and operated. The majority of the needed additional water would be pumped south from Cootes Paradise, while some portion of that water will come from that discharged through the outfall/plunge pool and precipitation. Care must be taken not to raise the water levels to the point that could cause flooding, disrupt the operation of the outfall/plunge pool, or interfere with the recently installed leachate system outfall that lines a portion of the eastern bank of Chedoke Creek.

5.3.1 Conceptual Dredge Design

The conceptual dredging project is based on the best available information for current conditions as shown in Figure 5-4. Given the potential risks associated with public contact and need for special handling and disposal, standard methodology for upland dewatering and stockpiling of dredged solids (e.g., belt presses) is not recommended. Significant wastewater conveyance infrastructure is located near the project area, which provides a safe, convenient, and economic means of handling the dredge slurry from Chedoke Creek subject to meeting the provisions in the Sewer-Use By-Law.

Areas of approximately 1,000 m^2 or larger with potential hydraulic pipeline access to Chedoke Creek and direct access to a sanitary sewer line or sewer force main, which lay adjacent to Chedoke Creek, were reviewed as possible material handling locations. Only the Kay Drage Park project area met these criteria. Determining the final Kay Drage Park project area, operational creek heights, site layouts, etc. will require agreements with the City of Hamilton and users of the Kay Drage Park, additional data collection, and analysis of the proposed site Kay Drage Park area footprint. Following this site-specific data collection, it will be necessary to perform the necessary engineering design, acquire permits, and develop final tender and construction documents (plans and specifications).

As with most dredge projects, dredged material transportation, dewatering, and final placement of the dredged material are generally the most challenging and costly elements. Wood has identified a potential location for initial material management and dewatering within the Kay Drage Park (see Figure 5-4). The conceptual project details discussed in the following, assume that the Kay Drage Park area is available and suitable for the project needs.

During the dredging operation within each management unit, the hydraulic dredge is proposed to sweep the creek bottom and send a slurry of dredged material and mostly water to the temporary Kay Drage Park work yard area. The inflowing dredged slurry will be fed to a series of mechanical dewatering equipment (filter presses, sand shakers, hydrocyclones, etc.), of the contractor's choosing, to separate debris, gravel, sand, from the incoming slurry. The separated debris, gravel, and sand can then either be stored and used as needed; returned to the creek bottom; or used in future remediation projects within Cootes Paradise and the surrounding area. The remaining effluent, comprised of the targeted sediments and dredged water would then be routed (pumped) to the Woodward Wastewater Treatment Plant for final processing and disposal.

Preliminary calculations based only on the amount and types of sediments to be dredged, indicate that a dredge material management area (DMMA) would cover approximately 3,000 to 6,000 m^2 (+/-) and consist of several small temporary storage areas and a larger open work area. While additional storage area may prove to be beneficial to reduce overall transportation cost, it is not at this point considered necessary

Based on Wood's preliminary review of the upland areas available, the central or northern portions of Kay Drage Park will likely serve as the preferred location for the construction the DMMA within the Kay Drage Park area. Importantly, this location would allow for direct road access, movement of construction equipment, and direct hydraulic pipeline access for the transportation of the dredge slurry and the return of targeted sediments back to the Woodward Wastewater Treatment Plant for final processing and disposal.

5.3.2 DMMA Construction and Operation

As noted earlier, the DMMA will require direct hydraulic pipeline access from Chedoke Creek to the Woodward Wastewater Treatment Plant. The DMMA will require direct road access for the movement of construction equipment. The DMMA will ideally have a total temporary storage capacity of at least 5,000 m^3 (+/-) which would allow continuous dredging seven days a week during daylight hours. The DMMA site could be partially lighted to allow the selected contractor to continuously dewater and decant the dredged material seven days a week, 24 hours a day.

The slurry stream would be directed through the selected contractor's designed series of traditional mechanical dewatering techniques (e.g., hydrocyclones, filter presses) at the DMMA site. The coarse dredged material (gravel, sandy sediments, and debris) needs to be captured by the mechanical dewatering techniques and would be sorted, stacked, and temporarily stored. Afterwards, this coarse dredged material would be transported to the final disposal location (to be determined).

The remaining processed slurry stream would then be directed to the Wastewater Treatment Plant for final treatment and disposal. As the slurry stream leaves the mechanical dewatering area and travels to the Woodward Wastewater Treatment Plant, the selected contractor will have the opportunity to introduce chemical additives (flocculants or coagulants) to the slurry stream. Any flocculants or coagulants will require pre-approval through the permitting process, including the Sewer-Use By-Law. Notwithstanding, introducing chemical additives is not anticipated to be necessary. However, it may be deemed beneficial, following a complete review of the outlined process.

5.3.3 Natural Resources Impact Avoidance and Beneficial Placement

The dredge project should be designed to avoid unnecessary impacts to the existing ecosystem within the subject reach of the Chedoke Creek and downstream. Turbidity control is of primary concern with any dredge project. Hydraulic dredging is generally much less prone to turbidity issues than mechanical dredging because most of the disturbed material is entrained by the suction head. Turbidity will be controlled by the contractor using the cofferdam systems which will be arranged to maximize settling time within the work area prior to releasing discharges downstream.

The dredge and associated equipment will be staged, deployed, and operated in a way that limits disturbance of the riparian habitat. In most cases, it is likely that the dredge and associated equipment will be transferred to Chedoke Creek using a crane. Pipelines will be transported, installed, and fixed in place using a corridor that results in the least ecological disturbance.

Additional impact avoidance measures will be reviewed during the pre-design and detailed design stage. This review will also include an assessment of the pumping and sand removal process that will likely be an integral part of the overall dredge process stream. Ultimate placement of sandy material will be evaluated based on its physical and chemical properties.

Further details related to the preferred dredging process, and associated implementation details and considerations, along with permitting and costing, are outlined in Deliverable 1c.

Figure 5-1: 2013 and 2017 Imagery Chedoke Creek, Hamilton, Ontario Canada

Figure 5-2: 2013 and 2017 Imagery Chedoke Creek, Hamilton, Ontario Canada

Figure 5-3: 2013 and 2017 Imagery Chedoke Creek, Hamilton, Ontario Canada

Figure 5-4: Project Concept Sketch

6.0 References

Ahrens, M.J., Hertz, J., Lamoureux, E.M., Lopez, G.R., McElroy, A.E., Brownawell, B.J. 2001. The role of digestive surfactants in determining bioavailability of sediment-bound hydrophobicorganic contaminants to two deposit-feeding polychaetes. Mar. Ecol. Prog. Ser. 212, 145–157.

Appleby, P.G. 1998. Dating recent sediments by 210Pb: Problems and solutions. Proc. 2nd NKS/EKO-1 Seminar, Helsinki, 2-4 April 1997, STUK, Helsinki: 7-24.Environment Canada (EC). 2012. Metal Mining Technical Guidance for Environmental Effects Monitoring.

Environment Canada (EC). 2012. Metal Mining Technical Guidance for Environmental Effects Monitoring.

Fausch, K.D., J. Lyons, J.R. Karr, and P.L. Angermeier. 1990. Fish communities as indicators of environmental degradation. American Fisheries Society Symposium 8:123–144.

Hare, L., Tessier, A., Warren, L. 2001. Cadmium accumulation by invertebrates living at the sediment–water interface. Environ. Toxicol. Chem. 20, 880–889.

Hilsenhoff, W.L. 1998. Rapid Field Assessment of Organic Pollution with a Family-Level Biotic Index. Journal of the North American Benthological Society, Vol.7, No.1, pp.65-68.

Holmes, C. W. 1998. Short-Lived isotopic chronometers - A means of measuring decadal sedimentary dynamics. United States Geological Survey Fact Sheet FS-073-98.

Krebs, C.J. 1985. Ecology: the experimental analysis of distribution and abundance. 3rd Ed. New York (NY): Harper and Row.

Lee, B-G., Griscom, S.B., Lee, J-S., Choi, H.J., Koh, C-H., Luoma, S.N., Fisher, N.S. 2000. Influences of dietary uptake and reactive sulfides on metal bioavailability from aquatic sediments. Science 287, 282–284.

Ministry of the Environment (MOE). 2011. Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*. April 15, 2011. PIBS# 7382e01.

Ministry of the Environment (MOE). 2008. Guidelines for Identifying, Assessing and Managing Contaminated Sediments in Ontario: An Integrated Approach. May 2008. PBS# 6658e.

Ministry of the Environment (MOE). 2007. Ontario Benthos Biomonitoring Network.

Smith, B. and J.B. Wilson. 1996. A consumer's guide to evenness indices. Oikos, 76:70-82.

Tchobanoglous, G., Burton, F. L., Stensel, H. D., & Metcalf & Eddy. (2004). Wastewater Engineering: Treatment and Reuse. Boston: McGraw-Hill

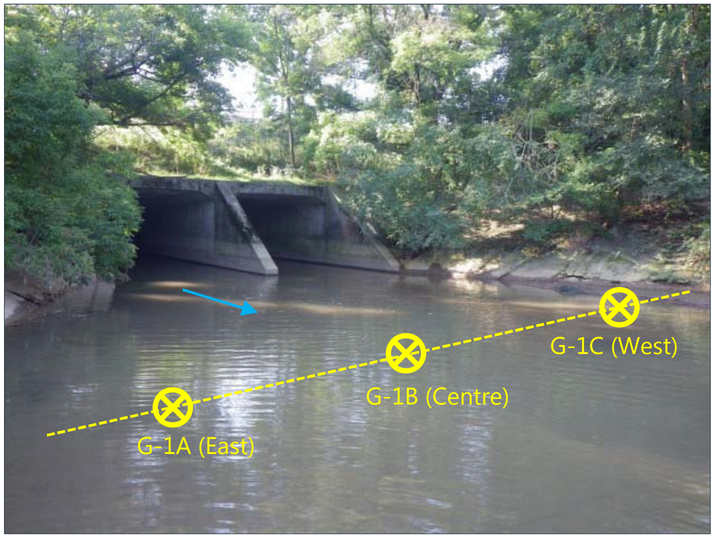
Wang, F., Tessier, A., Hare, L., Yan, N.D. 2000. Predicting cadmium concentrations in aquatic organisms in nature. In: The Society of Environmental Toxicology and Chemistry (SETAC) 21st annual meeting. November 12–16, 1999, Nashville, TN, USA.

Wang, F., Tessier, A., Hare, L. 2001. Oxygen measurements in the burrows of freshwater insects. Freshwater Biol. 46, 317–327.

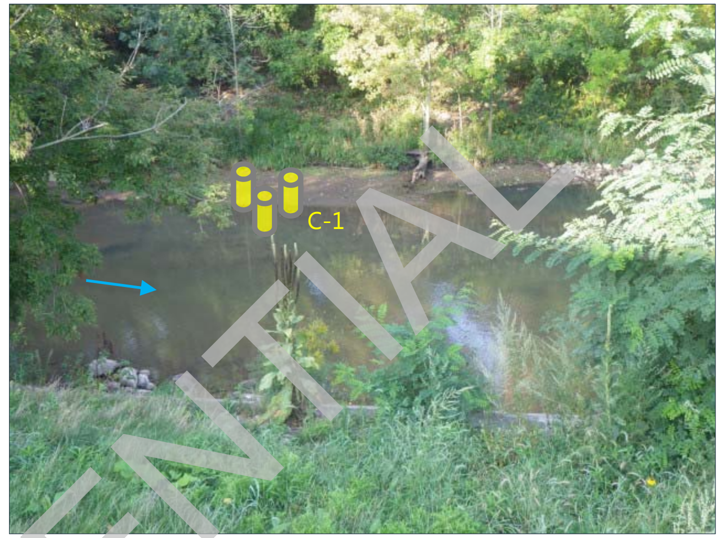
Warren, L.A., Tessier, A., Hare, L. 1998. Modelling cadmium accumulation by benthic invertebrates in situ: the relative contributions of sediment and overlying water reservoirs to organism cadmium concentrations. Limnol. Oceanogr. 43, 1442– 1454.

Appendix A

Sample Location Photo Record



Replicate grab locations at transect G-1 downstream of culvert.

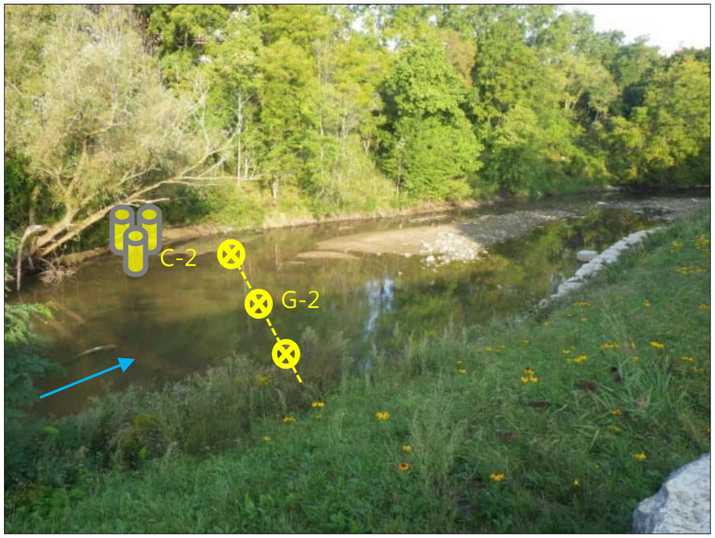


Core sampling location C-1 near west bank on concrete apron.

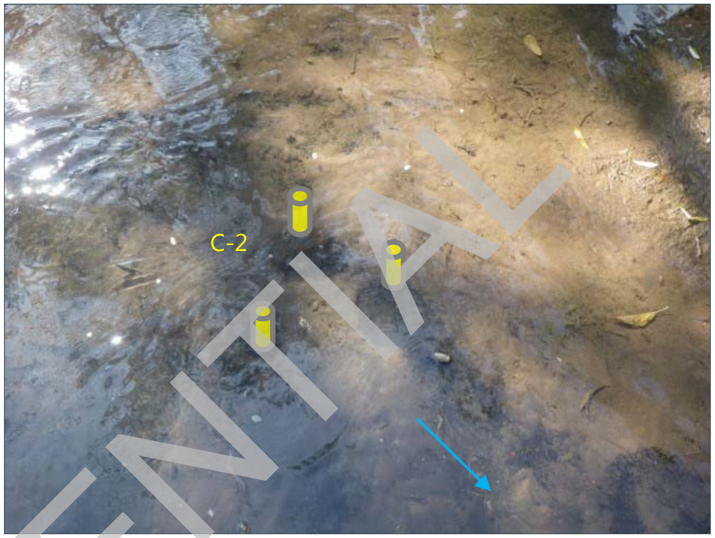
Core sample from C-1.

Sieved benthic invertebrate community grab sample from G-1.

Plate A1-1: Sample Location C1 and Transect G1



Grab sample G-2 transect and core sample C-2 location.



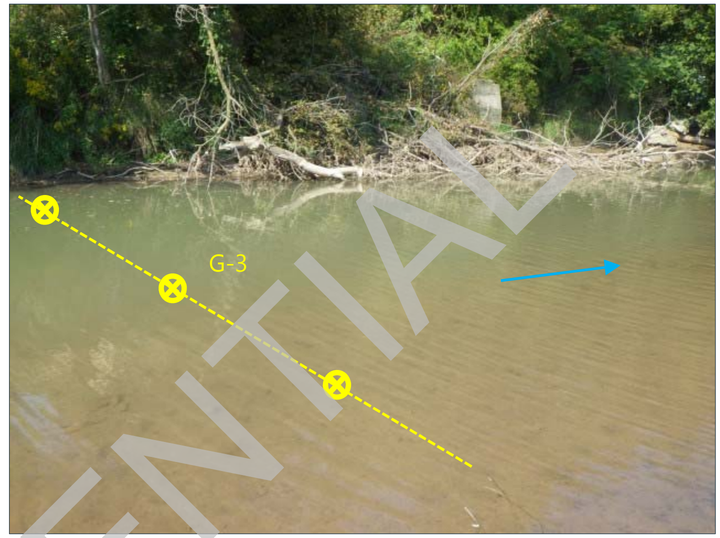
Core sample C-2 location, after cores were obtained.

C-2 core strata prior to homogenizing.


Sieved benthic invertebrate community grab sample from G-2.

Plate A1-2: Sample Location C-2 and Transect G-2


Facing upstream from the G-3 sample transect.



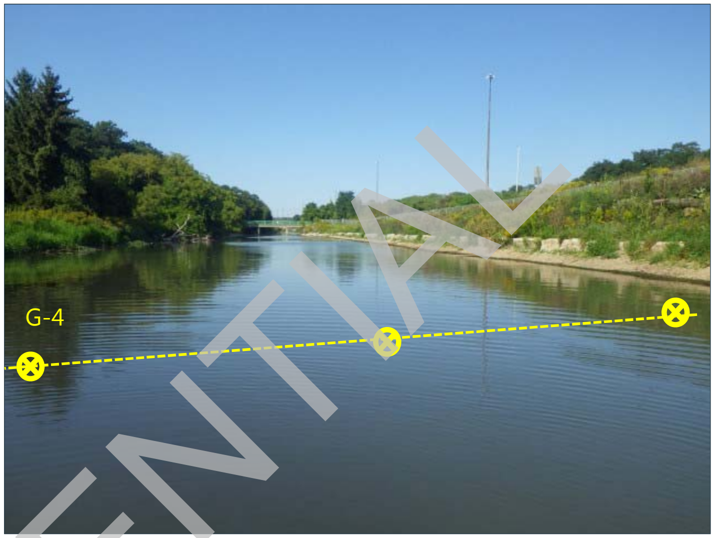
Facing across creek at G-3 sample transect from east bank.


Facing downstream, note silt curtain further downstream.


Sieved benthic invertebrate community grab sample from G-3.

Plate A1-3: Sample Transect G-3

Facing upstream from sample transect G-4, note culvert at left.



Facing downstream from sample transect G-4.

Facing culvert located upstream of sample transect on east bank.

Sieved benthic invertebrate community grab sample from G-4.

Plate A1-4: Sample Transect G-4

Facing upstream from sample transect C-3/G-5.

Facing across creek at sample transect C-3/G-5 from east bank.

Facing downstream from sample transect C-3/G-5.

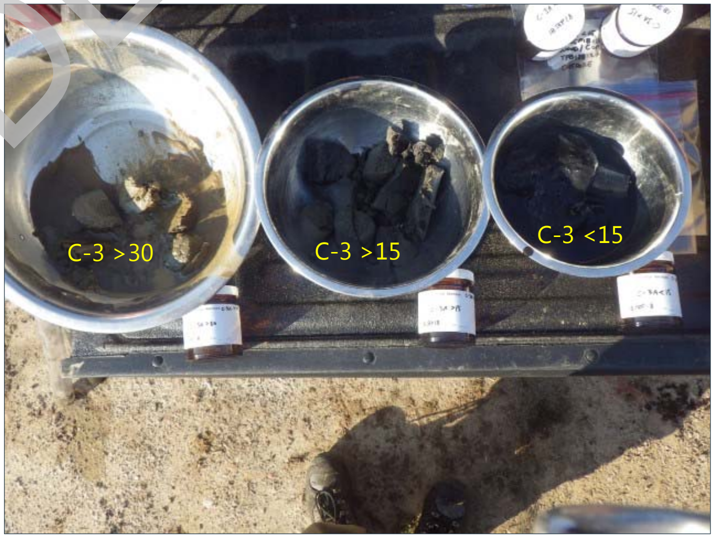
Algae bloom near west bank at sample transect C-3/G-5.

Plate A1-5: Sample Transect C-3/G-5

Facing upstream at sample transect C-3/G-5, note steep bank.

Example of core tubes with sample from C-3.

Benthic invertebrate sample prior to sieving.



C-3 core strata prior to homogenizing.

Plate A1-6: Sample Transect C-3/G-5

Facing upstream at sample transect C-4.

Facing downstream at sample transect C-4.

Facing across creek from west bank at C-4, note culvert.

C-4 core strata prior to homogenizing.

Plate A1-7: Sample Transect C-4

Facing upstream from east bank at C-5/G-6.

Facing across creek from east bank.

Facing downstream from east bank.

Example of east bank armour stone and willow riparian vegetation.

Plate A1-8: Sample Location C-5/G-6


Homogenized core sample.


Example of a core tube with sample from replicate near west bank.

C-5 core strata prior to homogenizing.

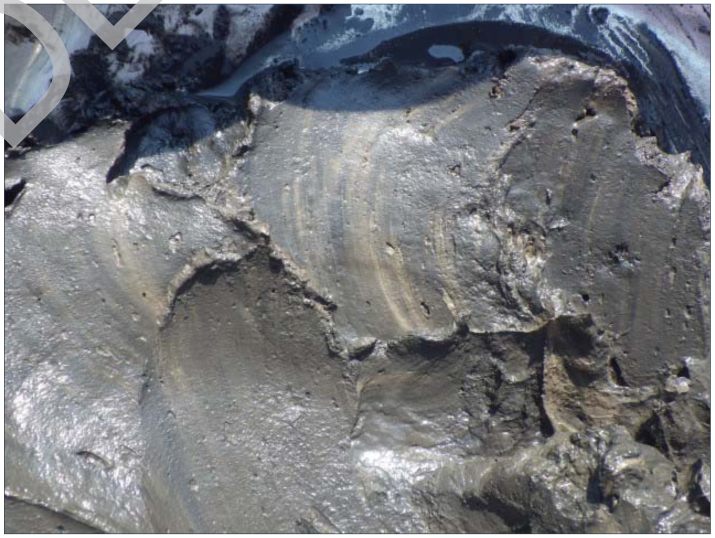
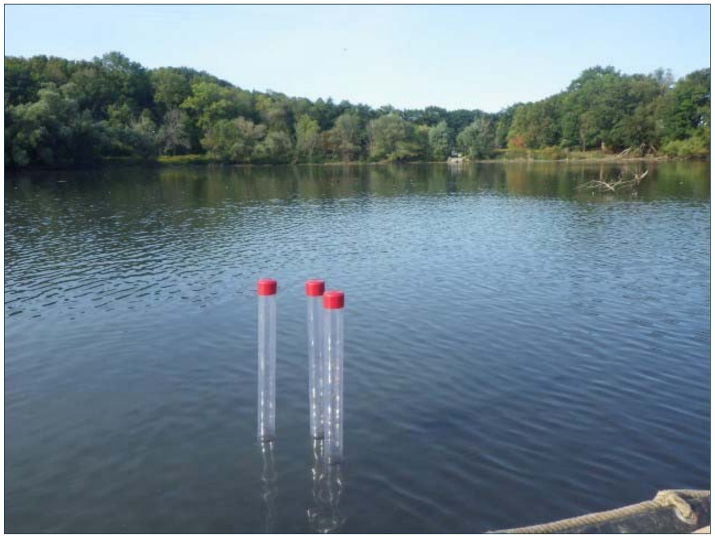

Mottling observed in lower strata during homogenization.

Plate A1-9: Sample Location C-5/G-6



Core tubes at C-6, facing public boat launch at park.

C-6 core strata prior to homogenizing.

Core tubes at C-6, facing outlet of Chedoke Creek.

Sieved benthic invertebrate community grab sample from G-7.

Plate A1-10: Sample Location C-6/G-7

Appendix A2

Core Sample Photo Record

Core tube at C-1, full depth profile.

C-1 core, upper strata.

Core tube at C-2, full depth profile.

C-2 core, upper strata.

Plate A2-1: Core Sample Locations C-1 and C-2

Core tubes at C-3 west, full depth profiles.

Core tubes at C-3 centre, full depth profile.

C-3 centre, upper strata.

C-3 centre, lower strata.

Plate A2-2: Core Sample Location C-3


Core tubes at C-4 west, full depth profiles.


Core tube at C-4 centre, full depth profile.

Core C-4 west, upper strata at sediment-water interface.

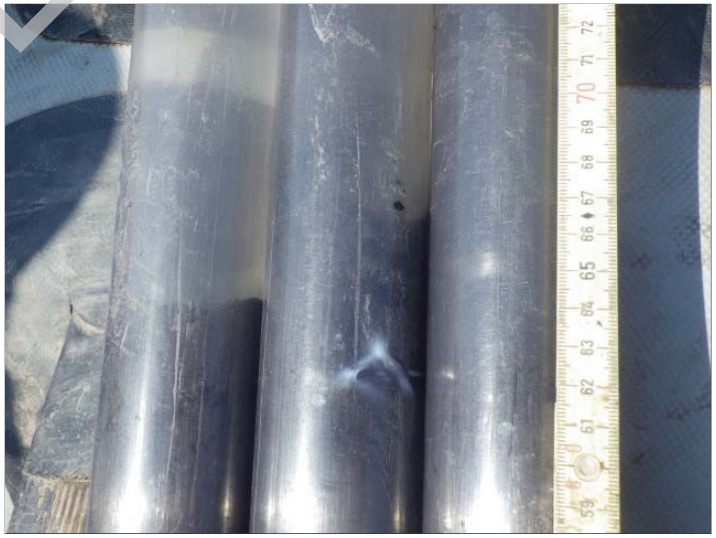
Core C-4 centre, mid-lower strata at horizon.

Plate A2-3: Core Sample Location C-4

Core tube at C-5 west, full depth profile.

Core tubes at C-5 centre, full depth profile.

Core C-5 west, upper strata at sediment-water interface.



Core C-5 centre, upper strata.

Plate A2-4: Core Sample Location C-5


Core tube at C-6, full depth profile.

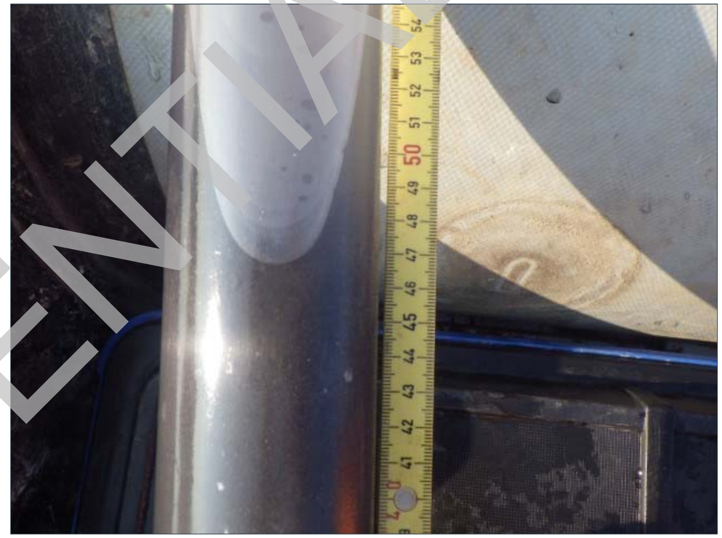

Core C-6, upper strata.

Plate A2-5: Core Sample Location C-6

Appendix B1

Field Observations and Data Analysis

Table B1-1 Field Sediment Sampling Observations Summary

Sample Transect	Position	UTM Easting	UTM Northing	Water Depth (m)	Sediment Thickness (m)	Field Observations / Comments
G-1	Centre	589751.55	4790591.21	0.25	0.06	Brown sed, coarse sand with gravel base
	East	589754.00	4790592.00	0.29	0.17	Red/brown sed, coarse grained base
	West	589749.04	4790590.31	0.10	0.12	Brown/black sed, metallic odour
C-1	West	589742.86	4790604.74	0.23	0.32	Brown/black sed, metallic odour
G-2	Centre	589743.48	4790624.03	0.26	0.09	Black, gravel with coarse sand and some fines
	East	589751.26	4790620.33	0.35	0.15	Black, gravel with coarse sand and few fines
	West	589733.69	4790628.93	0.04	0.37	Black/brown fines with detritus, metallic odour
C-2	West	589733.69	4790628.93	0.04	0.37	Black/brown fines with detritus, metallic odour
G-3	Centre	589733.63	4790729.78	0.65	0.05	Brown/black, fines
	East	589738.00	4790727.00	0.19	0.04	Brown/black, fines
	West	589729.19	4790732.24	0.90	0.10	Brown/black, fines, metallic odour
G-4	Centre	589801.00	4791008.00	0.43	0.03	Black, fine grained with strong petro odour
	East	589810.26	4791007.84	0.44	0.04	Black, fine grained with strong petro odour
	West	589790.63	4791007.95	0.47	0.13	Black, loosely consolidated, strong petro odour
C-3 / G-5	Centre	589815.41	4791293.16	1.02	0.41	Black muck, fine sand, brown base fine sand
	East	589823.72	4791292.47	0.96	0.30	Black muck, fine sand, brown base fine sand
	West	589807.26	4791293.95	0.45	0.34	Black much, fine black sand/muck base
C-4	Centre	589828.92	4791481.48	1.00	0.58	Black silty sand, mild petro odour
	East	589836.82	4791481.44	1.04	0.35	Black, silty sand, no odour
	West	589820.47	4791481.28	0.83	0.61	Black, silty sand, coarse sand base, petro odour
C-5 / G-6	Centre	589795.41	4791747.73	0.86	0.65	Black, loosely consolidated, strong petro odour
	East	589806.95	4791752.28	0.95	0.44	Black, fine-coarse sand, petro odour
	West	589784.56	4791743.55	0.48	0.70	Black, loosely consolidated, strong petro odour
C-6 / G-7	Bow	589717.75	4791923.38	0.25	0.66	Black, fine silty sand, strong perto odour
	Port	589720.75	4791923.38	0.25	0.59	Black, fine silty sand, strong perto odour
	Starboard	589714.75	4791923.38	0.25	0.65	Black, fine silty sand, strong perto odour

Notes:

1. Grab samples were comprised of the upper 0.10 m of soft sediment and the above table shows total soft sediment thickness at each sample transect and replicate sample position within the creek.
2. Sediment thickness values at grab locations were determined using a manually driven core tube pushed through the soft sediment to a depth of refusal per thickness determination protocols used at the core sample locations.
3. The collocated core and grab samples were collected at the same position within the creek, as such the water depth and soft sediment thickness measured during coring also represented the soft sediment thickness at the grab location.

Table B1-2a Sediment Quality Laboratory Results Summary

		Sample Transect	C-1		C-2	
		Location	N/A	N/A	N/A	N/A
Nutrients and Bacteria	**O.Reg 153/04 PSQG LEL †**	**PSQG SEL**	C-1<15	C-1>15	C-2<15	C-2>15
Faecal Coliform (cfu/100g)			12000	0	21000	0
NH3+NH4 (as N %)			0	0.02	0.02	0.02
TKN (as N %)	0.055 †	0.48	0.05	**0.06**	**0.1**	**0.08**
Total Phosphorus	600 †	2,000	598	**934**	**837**	**937**
Moisture Content (%)			27.1	37.8	31.1	28
Total Metals by ICPMS						
Antimony (Sb)			0	0	0	0
Arsenic (As)	6 †	33	3.6	4.7	4.6	6
Barium (Ba)			110	120	91	88
Beryllium (Be)			0.43	0.44	0.4	0.38
Boron (B)			17	16	15	13
Cadmium (Cd)	0.6 †	10	0.41	0.4	0.58	**1.1**
Chromium (Cr)	26 †	110	22	24	19	23
Cobalt (Co)	50		9.4	9.3	8.5	8.5
Copper (Cu)	16 †	110	**30**	**71**	**51**	**73**
Lead (Pb)	31 †	250	20	29	**34**	**59**
Molybdenum (Mo)			0.9	1.1	0.9	2.4
Nickel (Ni)	16 †	75	**23**	**23**	**20**	**21**
Selenium (Se)			0	0	0	0
Silver (Ag)	0.5		0.11	0.37	0.19	**1.2**
Thallium (Tl)			0.09	0.13	0.11	0.11
Uranium (U)			0.58	0.64	0.55	0.48
Vanadium (V)			18	19	17	18
Zinc (Zn)	120 †	820	**215**	**250**	**244**	**339**
PAHs						
Acenaphthene			1.49	0	0.26	0.28
Acenaphthylene			0	0	0	0
Anthracene	0.22		**4.69**	0.13	**0.43**	0.21
Benzo(a)anthracene	0.32		**6.6**	**0.85**	**1.79**	**1.27**
Benzo(a)pyrene	0.37		**6.01**	**0.87**	**1.71**	**1.36**
Benzo(b)fluoranthene			8.37	1.37	2.52	2.35
Benzo(ghi)perylene	0.17		**4.36**	**0.56**	**0.99**	**0.72**
Benzo(k)fluoranthene	0.24		**2.29**	**0.47**	**0.99**	**0.77**
Chrysene	0.34		**7.15**	**1.08**	**2.13**	**1.87**
Dibenzo(a,h)anthracene	0.06		**0.79**	**0.12**	**0.22**	**0.18**
Fluoranthene	0.75		**24.5**	**2.6**	**5.25**	**4.85**
Fluorene	0.19		**1.76**	0	**0.29**	**0.29**
Indeno(1,2,3-cd)pyrene	0.2		**3.45**	**0.5**	**0.9**	**0.68**
1-Methylnaphthalene			0	0	0	0.11
2-Methylnaphthalene			0	0	0	0.17
Methylnaphthalene, 2			0	0	0.16	0.28
Naphthalene			0	0	0.22	0.45
Phenanthrene	0.56		**16.5**	**1.2**	**3.63**	**4.39**
Pyrene	0.49		**18.9**	**2.09**	**4.06**	**3.69**

Table B1-2b Sediment Quality Laboratory Results Summary

Sample Transect			C-3					
Location			East			Centre	West	
Nutrients and Bacteria	**O.Reg 153/04 PSQG LEL †**	**PSQG SEL**	C-3A<15	C-3A>15	C-3A>30	C-3B<15	C-3C<15	C-3C>15
Faecal Coliform (cfu/100g)			19000	0	0	43000	45000	9000
NH3+NH4 (as N %)			0	0	0	0	0.04	0.02
TKN (as N %)	0.055 †	0.48	**0.08**	0.03	0	**0.06**	**0.19**	**0.06**
Total Phosphorus	600 †	2,000	**642**	**637**	563	**660**	**1622**	**929**
Moisture Content (%)			34.4	25.7	55.5	23.6	62.9	35.4
Total Metals by ICPMS								
Antimony (Sb)			0	0	0	0	0	0
Arsenic (As)	6 †	33	3.8	3.1	2.7	3.5	4.7	4.2
Barium (Ba)			69	40	34	85	120	80
Beryllium (Be)			0.28	0.24	0.21	0.33	0.44	0.31
Boron (B)			11	5	4	13	15	11
Cadmium (Cd)	0.6 †	10	**0.76**	**3.8**	0.07	0.39	**0.81**	**0.81**
Chromium (Cr)	26 †	110	16	12	7.3	26	**31**	26
Cobalt (Co)	50		6.4	6.2	5.1	7	8.6	6.9
Copper (Cu)	16 †	110	**60**	**29**	**20**	**71**	**170**	**61**
Lead (Pb)	31 †	250	**59**	20	6.1	28	**87**	**100**
Molybdenum (Mo)			0.6	0.3	0.2	0.7	2.4	1
Nickel (Ni)	16 †	75	16	15	10	**17**	**24**	**18**
Selenium (Se)			0	0	0	0	1	0
Silver (Ag)	0.5		0.3	0.46	0	0.37	**1.6**	0.47
Thallium (Tl)			0.12	0.08	0.06	0.11	0.23	0.13
Uranium (U)			0.46	0.43	0.32	0.58	0.88	0.53
Vanadium (V)			13	13	11	13	22	15
Zinc (Zn)	120 †	820	**310**	86	30	**202**	**505**	**305**
PAHs								
Acenaphthene			0	0	0	0.27	0	0.91
Acenaphthylene			0	0	0	0	0	0
Anthracene	0.22		0	0	0	**0.28**	0.12	**1.08**
Benzo(a)anthracene	0.32		**0.38**	0.12	0	**1.1**	**0.79**	**3.54**
Benzo(a)pyrene	0.37		**0.39**	0.12	0	**1.05**	**0.91**	**3.11**
Benzo(b)fluoranthene			0.71	0.21	0	1.64	1.76	4.96
Benzo(ghi)perylene	0.17		**0.23**	0	0	**0.44**	**0.54**	**1.23**
Benzo(k)fluoranthene	0.24		0	0.06	0	**0.63**	**0.52**	**1.48**
Chrysene	0.34		**0.5**	0.11	0	**1.34**	**1.23**	**4.04**
Dibenzo(a,h)anthracene	0.06		0	0	0	**0.12**	**0.13**	**0.35**
Fluoranthene	0.75		**1.1**	0.3	0	**3.7**	**2.56**	**10.3**
Fluorene	0.19		0	0	0	**0.26**	0	**1.04**
Indeno(1,2,3-cd)pyrene	0.2		0.2	0	0	**0.46**	**0.54**	**1.25**
1-Methylnaphthalene			0	0	0	0	0	0.28
2-Methylnaphthalene			0	0	0	0.1	0	0.37
Methylnaphthalene, 2			0	0	0	0.19	0.1	0.66
Naphthalene			0	0	0	0.24	0	1.2
Phenanthrene	0.56		0.39	0.06	0	**3.23**	**1.13**	**10**
Pyrene	0.49		**0.86**	0.25	0	**2.75**	**2.09**	**7.83**

Table B1-2c Sediment Quality Laboratory Results Summary

Sample Transect			C-4							
Location			East		Centre			West		
Nutrients and Bacteria	**O.Reg 153/04 PSQG LEL †**	**PSQG SEL**	C-4A <15	C-4A >15	C-4B <15	C-4B >15	C-4B >30	C-4C <15	C-4C >15	C-4C >30
Faecal Coliform (cfu/100g)			10000	0	17000	0	0	11000	0	0
NH3+NH4 (as N %)			0.01	0	0	0.01	0.01	0.03	0.02	0.01
TKN (as N %)	0.055 †	0.48	**0.1**	0.02	**0.06**	**0.07**	**0.06**	**0.16**	**0.09**	**0.08**
Total Phosphorus	600 †	2,000	**861**	**636**	**718**	**1140**	**909**	**1260**	**1090**	**881**
Moisture Content (%)			45.6	20.8	32.5	36	35.8	53.2	33	32.4
Total Metals by ICPMS										
Antimony (Sb)			0	0	0	0.8	1	0	1	0
Arsenic (As)	6 †	33	4.3	1.7	4.1	**6.8**	**7.1**	5.5	5.9	5.4
Barium (Ba)			80	16	70	217	145	141	201	143
Beryllium (Be)			0.35	0.16	0.32	0.52	0.48	0.46	0.39	0.41
Boron (B)			11	4	14	23	21	20	19	20
Cadmium (Cd)	0.6 †	10	**0.74**	0.09	0.56	**22**	**11**	**6.1**	**29**	**14**
Chromium (Cr)	26 †	110	22	6.3	19	**50**	**31**	**41**	**45**	**32**
Cobalt (Co)	50		7	3.5	6.8	14	13	11	13	11
Copper (Cu)	16 †	110	**72**	**18**	**42**	**124**	**85**	**145**	**129**	**86**
Lead (Pb)	31 †	250	**32**	6.2	28	**141**	**94**	**72**	**116**	**89**
Molybdenum (Mo)			1.2	0.1	0.8	1.1	0.9	1.8	1	0.8
Nickel (Ni)	16 †	75	**18**	7.5	**17**	**51**	**37**	**32**	**52**	**35**
Selenium (Se)			0	0	0	0	0	0.8	0	0
Silver (Ag)	0.5		**0.58**	0.06	0.27	**4.4**	**4.3**	**3.3**	**7.7**	**4.5**
Thallium (Tl)			0.16	0.04	0.12	0.15	0.14	0.2	0.11	0.11
Uranium (U)			0.64	0.3	0.48	0.67	0.6	0.76	0.55	0.58
Vanadium (V)			18	11	15	22	22	21	18	19
Zinc (Zn)	120 †	820	**298**	31	**215**	**437**	**300**	**472**	**412**	**275**
PAHs										
Acenaphthene			0	0	0	0.92	0.17	0.25	0.29	0.23
Acenaphthylene			0	0	0	0	0	0.11	0	0
Anthracene	0.22		0	0	0.15	**0.34**	0.21	**0.69**	**0.34**	**0.26**
Benzo(a)anthracene	0.32		**0.44**	0	**0.71**	**0.95**	**0.6**	**1.69**	**1.01**	**0.75**
Benzo(a)pyrene	0.37		**0.48**	0	**0.69**	**0.9**	**0.59**	**1.5**	**0.86**	**0.7**
Benzo(b)fluoranthene			1	0	1.26	1.6	0.96	2.79	1.5	1.18
Benzo(ghi)perylene	0.17		**0.37**	0	**0.41**	**0.51**	**0.37**	**0.77**	**0.44**	**0.41**
Benzo(k)fluoranthene	0.24		0.23	0	**0.3**	**0.5**	**0.31**	**0.7**	**0.47**	**0.32**
Chrysene	0.34		**0.66**	0	**0.89**	**1.23**	**0.7**	**2.01**	**1.02**	**0.88**
Dibenzo(a,h)anthracene	0.06		0	0	0	**0.13**	**0.09**	**0.2**	**0.11**	**0.1**
Fluoranthene	0.75		**1.41**	0	**2.12**	**2.95**	**1.51**	**4.5**	**2.76**	**1.98**
Fluorene	0.19		0	0	0.11	**0.6**	**0.25**	**0.47**	**0.54**	**0.36**
Indeno(1,2,3-cd)pyrene	0.2		**0.27**	0	**0.35**	**0.41**	**0.31**	**0.65**	**0.36**	**0.34**
1-Methylnaphthalene			0	0	0	0.85	0.29	0.15	0.73	0.47
2-Methylnaphthalene			0	0	0	1.07	0.44	0.15	0.84	0.74
Methylnaphthalene, 2			0	0	0	1.92	0.73	0.3	1.57	1.21
Naphthalene			0	0	0	0	0.06	0.14	0.14	0.07
Phenanthrene	0.56		**0.6**	0	**1.16**	**2.92**	**1.31**	**3.32**	**2.9**	**1.95**
Pyrene	0.49		**1.13**	0	**1.62**	**2.31**	**1.24**	**3.48**	**2.24**	**1.64**

Table B1-2d Sediment Quality Laboratory Results Summary

Sample Transect			C-5							
Location			East		Centre			West		
Nutrients and Bacteria	**O.Reg 153/04 PSQG LEL †**	**PSQG SEL**	C-5A <15	C-5A >15	C-5B <15	C-5B >15	C-5B >30	C-5C <15	C-5C >15	C-5C >30
Faecal Coliform (cfu/100g)			3000	1000	10000	0	0	0	0	1000
NH3+NH4 (as N %)			0.02	0.01	0	0	0.01	0.02	0.02	0.02
TKN (as N %)	0.055 †	0.48	**0.09**	**0.14**	0.05	0.02	**0.06**	**0.12**	**0.12**	**0.15**
Total Phosphorus	600 †	2,000	**978**	**1021**	**781**	**882**	**995**	**1120**	**1760**	**1820**
Moisture Content (%)			28.7	51.1	25.5	21.3	26.6	16.4	35.3	44.7
Total Metals by ICPMS										
Antimony (Sb)			1.3	1.1	0	0.9	1.3	0	1.9	1.7
Arsenic (As)	6 †	33	**12**	**16**	3.7	4.9	**6.2**	5.7	**9**	**9.1**
Barium (Ba)			210	265	85	143	209	134	398	397
Beryllium (Be)			0.57	0.85	0.36	0.34	0.39	0.45	0.51	0.51
Boron (B)			20	24	15	15	21	21	39	45
Cadmium (Cd)	0.6 †	10	**8.5**	**7.6**	**0.86**	**8.9**	**12**	**3.1**	**49**	**68**
Chromium (Cr)	26 †	110	**37**	**45**	20	**28**	**35**	**32**	**87**	**97**
Cobalt (Co)	50		11	12	7.9	11	15	10	22	21
Copper (Cu)	16 †	110	**136**	**127**	**66**	**82**	**111**	**97**	**265**	**358**
Lead (Pb)	31 †	250	**145**	**181**	**49**	**134**	**140**	**56**	**241**	**228**
Molybdenum (Mo)			2	3.3	0.9	0.6	0.7	1.5	1.3	1.5
Nickel (Ni)	16 †	75	**36**	**37**	**22**	**47**	**55**	**29**	**93**	**89**
Selenium (Se)			1	1.5	0	0	0	0.7	0.7	0.7
Silver (Ag)	0.5		**3**	**2.4**	**0.53**	**2.4**	**3.3**	**1.3**	**17**	**27**
Thallium (Tl)			0.17	0.25	0.13	0.1	0.11	0.2	0.17	0.18
Uranium (U)			0.59	0.81	0.56	0.46	0.51	0.69	0.73	0.78
Vanadium (V)			23	30	15	14	16	22	25	26
Zinc (Zn)	120 †	820	**414**	**546**	**244**	**258**	**364**	**428**	**818**	**922**
PAHs										
Acenaphthene			0	0	0	0.23	0	0	0.18	0.33
Acenaphthylene			0.18	0	0	0	0	0	0	0
Anthracene	0.22		**0.28**	0.14	0	**0.31**	0.13	0	**0.27**	**0.56**
Benzo(a)anthracene	0.32		**1.99**	**0.7**	**0.42**	**0.98**	**0.4**	**0.46**	**0.77**	**1.51**
Benzo(a)pyrene	0.37		**1.69**	**0.76**	**0.39**	**0.92**	0.34	**0.5**	**0.72**	**1.38**
Benzo(b)fluoranthene			2.16	1.04	0.63	1.28	0.54	0.96	1.35	2.37
Benzo(ghi)perylene	0.17		**0.98**	**0.6**	**0.31**	**0.59**	**0.24**	**0.38**	**0.45**	**0.89**
Benzo(k)fluoranthene	0.24		**0.72**	**0.37**	0	**0.45**	0	**0.25**	**0.34**	**0.6**
Chrysene	0.34		**1.76**	**0.72**	**0.47**	**1.06**	**0.42**	**0.68**	**0.96**	**1.75**
Dibenzo(a,h)anthracene	0.06		**0.26**	**0.14**	0	**0.13**	0	0	0	**0.21**
Fluoranthene	0.75		**2.99**	**1.3**	**1.15**	**2.74**	**0.97**	**1.44**	**2.39**	**4.37**
Fluorene	0.19		0.1	0.1	0	**0.27**	0.16	0	**0.44**	**0.67**
Indeno(1,2,3-cd)pyrene	0.2		**0.88**	**0.47**	**0.25**	**0.51**	0.19	**0.27**	**0.35**	**0.71**
1-Methylnaphthalene			0	0	0	0	0.12	0	0.42	0.89
2-Methylnaphthalene			0	0.12	0	0	0	0	0.33	1.05
Methylnaphthalene, 2			0.1	0.18	0	0.12	0.2	0	0.76	1.94
Naphthalene			0.15	0.18	0	0.13	0	0	0	0.17
Phenanthrene	0.56		**0.93**	**0.62**	**0.58**	**2.41**	**0.9**	**0.72**	**2.02**	**3.81**
Pyrene	0.49		**2.94**	**1.24**	**0.92**	**2.22**	**0.75**	**1.16**	**1.89**	**3.4**

Table B1-2e Sediment Quality Laboratory Results Summary

Sample Transect			C-6								
Location			East			Centre			West		
Nutrients and Bacteria	**O.Reg 153/04 PSQG LEL ✝**	**PSQG SEL**	C-6A <15	C-6A >15	C-6A >30	C-6B <15	C-6B >15	C-6B >30	C-6C <15	C-6C >15	C-6C >30
Faecal Coliform (cfu/100g)			1000	0	0	2000	0	0	4000	0	0
NH3+NH4 (as N %)			0	0.01	0.02	0	0	0.01	0	0.01	0.02
TKN (as N %)	0.055 ✝	0.48	**0.09**	**0.07**	**0.1**	**0.09**	0.05	**0.13**	**0.1**	**0.08**	**0.12**
Total Phosphorus	600 ✝	2,000	**814**	**827**	**1084**	**778**	**768**	**1444**	**809**	**1059**	**1370**
Moisture Content (%)			36.6	26.1	28.4	39.8	26	28.3	36.5	24.4	29.7
Total Metals by ICPMS											
Antimony (Sb)			0	0	0	0	0	1.4	0	0.8	1.5
Arsenic (As)	6 ✝	33	3.8	3.5	4.4	4.1	3.7	**6.9**	4.3	5.3	**6.6**
Barium (Ba)			82	80	127	88	70	228	85	136	237
Beryllium (Be)			0.36	0.29	0.34	0.36	0.3	0.45	0.37	0.4	0.43
Boron (B)			18	23	32	16	17	40	17	32	40
Cadmium (Cd)	0.6 ✝	10	**0.88**	**1.2**	**7.6**	**0.9**	**1.6**	**20**	**0.96**	**4.9**	**19**
Chromium (Cr)	26 ✝	110	23	21	**32**	**29**	18	**52**	23	**33**	**49**
Cobalt (Co)	50		7.5	6.9	9.8	7.7	6.7	15	7.9	11	16
Copper (Cu)	16 ✝	110	**64**	**65**	**69**	**64**	**76**	**126**	**76**	**81**	**175**
Lead (Pb)	31 ✝	250	**63**	**67**	**115**	**39**	**80**	**194**	**63**	**138**	**173**
Molybdenum (Mo)			0.9	0.6	0.6	1.1	0.6	1.2	0.9	0.8	0.9
Nickel (Ni)	16 ✝	75	**19**	**19**	**34**	**23**	**18**	**59**	**20**	**32**	**65**
Selenium (Se)			0	0	0	0	0	0	0	0	0
Silver (Ag)	0.5		0.44	**1.5**	**3.8**	0.46	**0.87**	**8.3**	**0.51**	**3.2**	**6.7**
Thallium (Tl)			0.14	0.1	0.1	0.16	0.1	0.15	0.15	0.12	0.12
Uranium (U)			0.5	0.42	0.46	0.57	0.43	0.58	0.56	0.52	0.53
Vanadium (V)			17	14	15	17	14	20	18	17	18
Zinc (Zn)	120 ✝	820	**285**	**245**	**324**	**300**	**253**	**540**	**303**	**368**	**489**
PAHs											
Acenaphthene			0	0	0.11	0	0	0.97	0	0.13	0.16
Acenaphthylene			0	0	0	0	0	0	0	0	0
Anthracene	0.22		0.13	0	0.18	0.14	0.14	**1.12**	0.14	0.2	**0.3**
Benzo(a)anthracene	0.32		**0.9**	**0.56**	**0.71**	**0.79**	**0.68**	**2.48**	**0.78**	**0.71**	**0.99**
Benzo(a)pyrene	0.37		**0.96**	**0.56**	**0.62**	**0.84**	**0.62**	**2.09**	**0.83**	**0.64**	**0.89**
Benzo(b)fluoranthene			1.66	0.93	0.98	1.33	1	2.92	1.46	0.96	1.3
Benzo(ghi)perylene	0.17		**0.68**	**0.39**	**0.37**	**0.55**	**0.36**	**1.2**	**0.47**	**0.52**	**0.66**
Benzo(k)fluoranthene	0.24		**0.44**	**0.28**	**0.32**	**0.54**	**0.3**	**1.11**	**0.39**	**0.34**	**0.52**
Chrysene	0.34		**1.26**	**0.71**	**0.77**	**1.06**	**0.76**	**2.51**	**1.05**	**0.8**	**1.1**
Dibenzo(a,h)anthracene	0.06		**0.13**	0	0	**0.11**	0	**0.27**	**0.11**	**0.1**	**0.14**
Fluoranthene	0.75		**2.68**	**1.44**	**1.67**	**2.19**	**1.66**	**6.15**	**2.12**	**1.83**	**2.5**
Fluorene	0.19		0	0	0.17	0	0.11	**1.06**	0	**0.23**	**0.33**
Indeno(1,2,3-cd)pyrene	0.2		**0.58**	**0.33**	**0.32**	**0.44**	**0.31**	**1.04**	**0.44**	**0.4**	**0.49**
1-Methylnaphthalene			0	0	0.11	0	0	0.65	0	0.22	0.27
2-Methylnaphthalene			0	0	0.14	0	0	0.51	0	0.21	0.28
Methylnaphthalene, 2			0	0	0.24	0	0	1.16	0	0.43	0.55
Naphthalene			0	0	0	0	0	0.44	0	0	0.1
Phenanthrene	0.56		**1.5**	0.52	**1.16**	**1**	**0.85**	**6.88**	**0.95**	**1.25**	**1.96**
Pyrene	0.49		**2.27**	**1.25**	**1.51**	**1.84**	**1.4**	**5.35**	**1.84**	**1.53**	**2.09**

Table B1-2f Sediment Quality Laboratory Results Summary

Sample Transect		PSQG SEL	G-1 Comp	G-2 Comp	G-3 Comp	G-4 Comp	G-5 Comp
Nutrients and Bacteria	**O.Reg 153/04 PSQG LEL †**						
Faecal Coliform (cfu/100g)			8000	16000	37000	38000	54000
NH3+NH4 (as N %)			0	0	0	0	0
TKN (as N %)	0.055 †	0.48	**0.09**	0.04	**0.06**	0.04	**0.08**
Total Phosphorus	600 †	2,000	**690**	**628**	**795**	**737**	**756**
Moisture Content (%)			21.8	22.2	25.1	30	40.6
Total Metals by ICPMS							
Antimony (Sb)			0	0	0	0	0
Arsenic (As)	6 †	33	3.8	3	3.9	3.6	3.9
Barium (Ba)			130	80	130	88	77
Beryllium (Be)			0.42	0.41	0.38	0.38	0.37
Boron (B)			17	17	15	14	13
Cadmium (Cd)	0.6 †	10	0.37	0.27	0.56	0.39	0.57
Chromium (Cr)	26 †	110	21	21	20	22	21
Cobalt (Co)	50		9.1	8.2	7.8	7.7	7.2
Copper (Cu)	16 †	110	**63**	**50**	**81**	**58**	**64**
Lead (Pb)	31 †	250	16	13	**50**	22	**42**
Molybdenum (Mo)			1.2	0.8	1.1	0.9	1.1
Nickel (Ni)	16 †	75	**22**	**21**	**21**	**20**	**21**
Selenium (Se)			0	0	0	0	0
Silver (Ag)	0.5		0.13	0.1	0.48	0.31	0.42
Thallium (Tl)			0.11	0.08	0.13	0.13	0.14
Uranium (U)			0.67	0.58	0.66	0.58	0.65
Vanadium (V)			18	16	18	16	17
Zinc (Zn)	120 †	820	**187**	**167**	**311**	**215**	**275**
PAHs							
Acenaphthene			0.83	0	0	0	0
Acenaphthylene			0	0	0	0	0
Anthracene	0.22		**0.99**	0.12	0	0	0.16
Benzo(a)anthracene	0.32		**2.96**	**0.38**	0.18	**0.34**	**0.68**
Benzo(a)pyrene	0.37		**2.4**	0.36	0.18	0.33	**0.68**
Benzo(b)fluoranthene			3.59	0.53	0.32	0.53	1.28
Benzo(ghi)perylene	0.17		**1.45**	**0.22**	0.13	**0.2**	**0.38**
Benzo(k)fluoranthene	0.24		**1.37**	0	0	0	**0.29**
Chrysene	0.34		**3.24**	**0.45**	0.26	**0.42**	**0.84**
Dibenzo(a,h)anthracene	0.06		**0.37**	0	0	0	0
Fluoranthene	0.75		**9.08**	**1.11**	0.59	**0.96**	**1.91**
Fluorene	0.19		**0.84**	0	0	0	0
Indeno(1,2,3-cd)pyrene	0.2		**1.34**	0.19	0.11	0.18	**0.32**
1-Methylnaphthalene			0.2	0	0	0	0
2-Methylnaphthalene			0.3	0	0	0	0
Methylnaphthalene, 2			0.49	0	0	0	0
Naphthalene			0.98	0	0	0	0
Phenanthrene	0.56		**9.53**	**0.73**	0.25	0.45	**0.94**
Pyrene	0.49		**6.75**	**0.85**	0.47	**0.76**	**1.48**

wood.

Notes:

1. O.Reg.153/04 – Ontario Regulation 153/04: Records of Site Condition – Part XV.1 of the Environmental Protection Act, Ministry of the Environment, 2011: Table 1 Background Site Condition Sediment Standards.
2. PSQG – Provincial Sediment Quality Guidelines for the protection of fish and sediment-welling organisms Table 1; LEL ˖ – Lowest Effect Level, SEL – Severe Effect Level (MOE 2008).
3. Bold and shaded cells indicate exceedance of the O.Reg.153/04 / PSQG LEL value
4. Bold, underlined and shaded cells indicate exceedance of the O.Reg.153/04 and PSQG SEL value
5. All parameters measured in µg/g units unless otherwise stated

Table B1-3 Sediment Particle Size Distribution Summary

Particle Size	Grab Sample ID					
	G-1	G-2	G-3	G-4	G-5	G-6
Gravel	52	29	51	10	2	17
Coarse Sand	29	46	35	35	47	32
Fine Sand	7	8	5	26	23	11
Silt	10	12	6	22	20	29
Clay	3	5	2	7	8	12

Notes:
1. Particle size distribution results presented as percent contribution of each particle size fraction.

Table B1-4 qPCR Sediment Results

Sample ID	Human Associated Bacteroidetes			General Bacteroidetes		
	<15	15-30	>30	<15	15-30	>30
C-1	192	356	0	58800	158000	0
C-2	553	32.6	0	28200	480	0
C-3A	44.1	27.8	<5	17500	178	<5
C-3B	172	0	0	24900	0	0
C-3C	3850	800	0	415000	90000	0
C-4A	200	10	0	36800	16.4	0
C-4B	209	74.8	87.8	46700	644	458
C-4C	217	110	108	79800	1560	2130
C-5A	101	166	0	3390	150	0
C-5B	77	34.6	305	34300	200	321
C-5C	85.1	280	211	30200	874	1320
C-6A	22.3	4.1	3.55	7260	212	38.8
C-6B	32.3	<5	12	15200	559	42.3
C-6C	14	<5	26.1	6280	240	134
G-1 Comp	19	N/A	N/A	3300	N/A	N/A
G-2 Comp	87	N/A	N/A	19300	N/A	N/A
G-3 Comp	1120	N/A	N/A	143000	N/A	N/A
G-4 Comp	226	N/A	N/A	49500	N/A	N/A

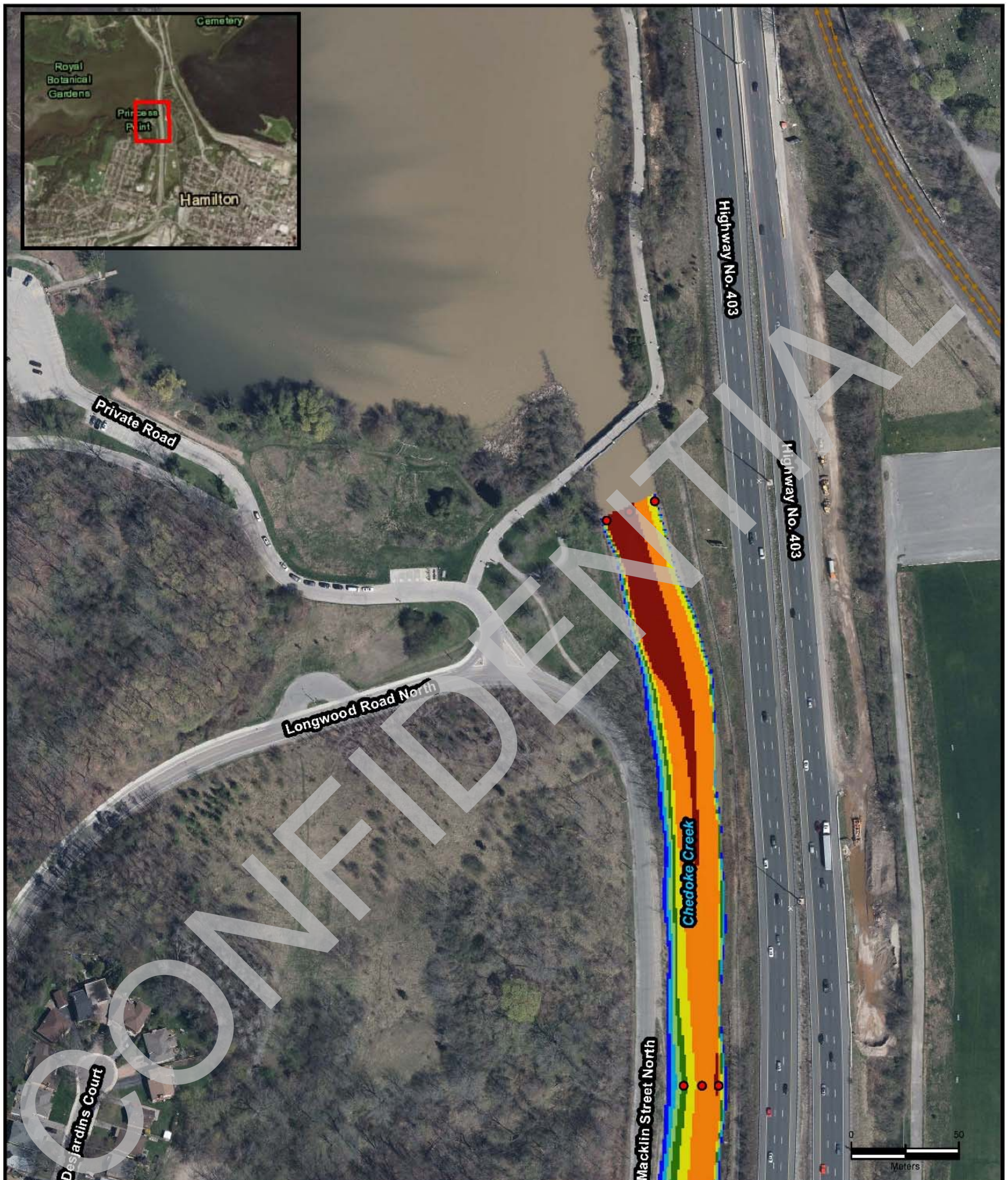
Notes:
1. Microbial Insights, Knoxville TN conducted the quantitative polymerase chain reaction (qPCR) analysis.
2. qPCR results expressed as the number of gene copies per gram E+04.
3. Incremental strata defined as 0 to 15 cm interval, 15 to 30 cm interval and greater than 30 cm interval.
4. Sample ID position within the creek identified as; A = east bank, B = centre and C = west bank.
5. Analysis for Canada Goose Bacteroidetes (CGBACT-1 and CGBACT-2) results were below the detection limit 1.00E+04 for all samples.

Figure B1-1: Sediment Metal Concentrations – Co, Cd, Ag by Core Sample Location

Figure B1-2: Sediment Metal Concentrations – As, Cr, Ni by Core Sample Location

Appendix B2

Sediment Thickness and Bathymetry Figures



Notes:
1- Project No.: TPB188127
2- Data Source - City of Hamilton 2017 Imagery, Wood, ESRI Imagery
3- This map is intended to be used for planning purposes only. It is not a survey.
Date: 11/08/2018
Revised:AB
Checked By:LL

Explanation of Features

- Railways
- Sediment Survey Points

Sediment Thickness (m)

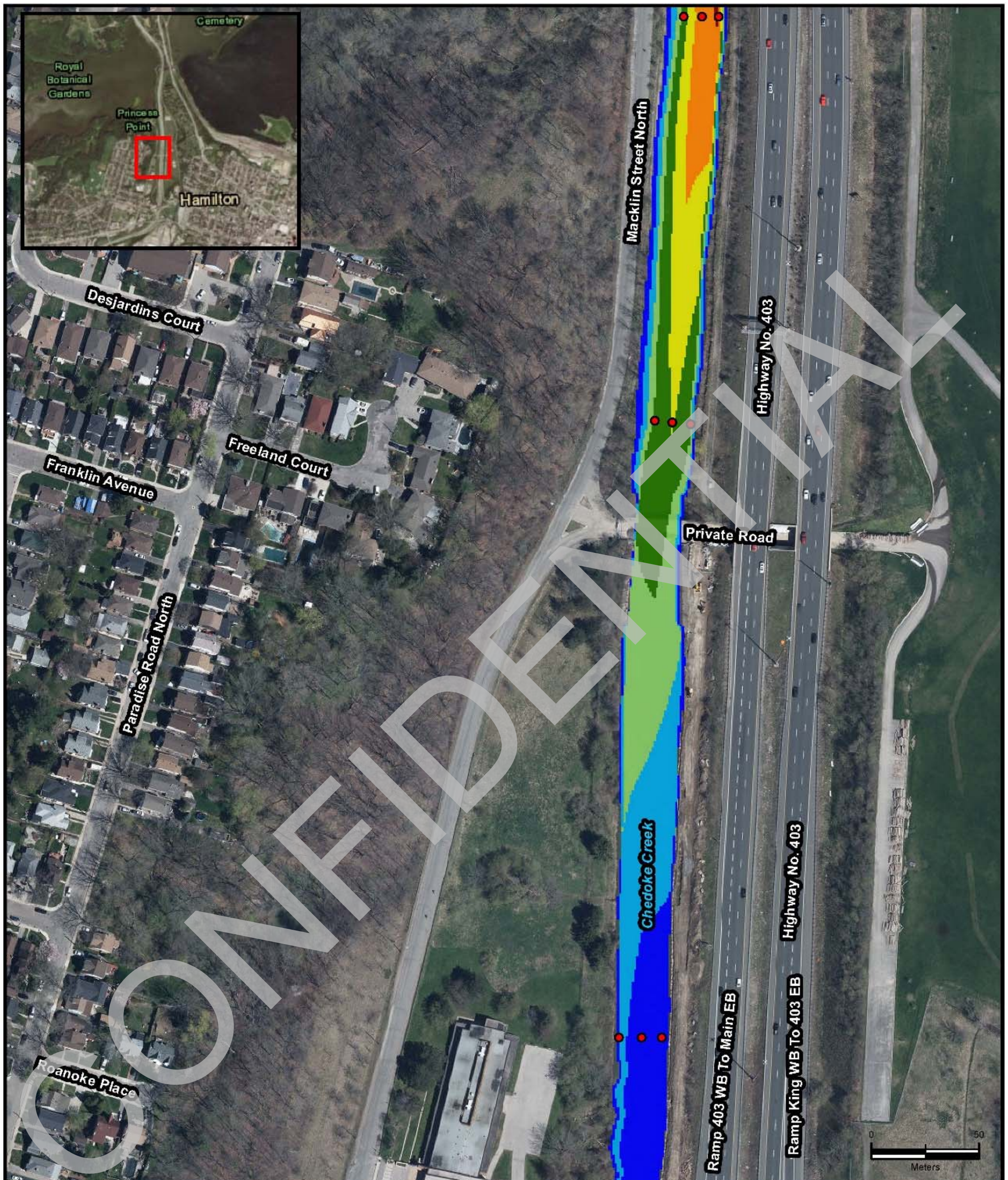
- 0 - 0.1
- 0.11 - 0.2
- 0.21 - 0.3
- 0.31 - 0.4
- 0.41 - 0.5
- 0.51 - 0.6
- 0.61 - 0.7

wood.

Figure B2-1a
Soft Sediment Thickness
Chedoke Creek
Hamilton, Ontario
Canada

Path: V:\TPB188127_Chedoke_Creek\MXD\2017_Imagery_B2-1A_sediment.mxd

wood.



Notes:
1- Project No.: TPB188127
2- Data Source - City of Hamilton 2017 Imagery, Wood, ESRI Imagery
3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 11/08/2018
Revised:AB
Checked By:LL

Explanation of Features

N

- Railways
- Sediment Survey Points

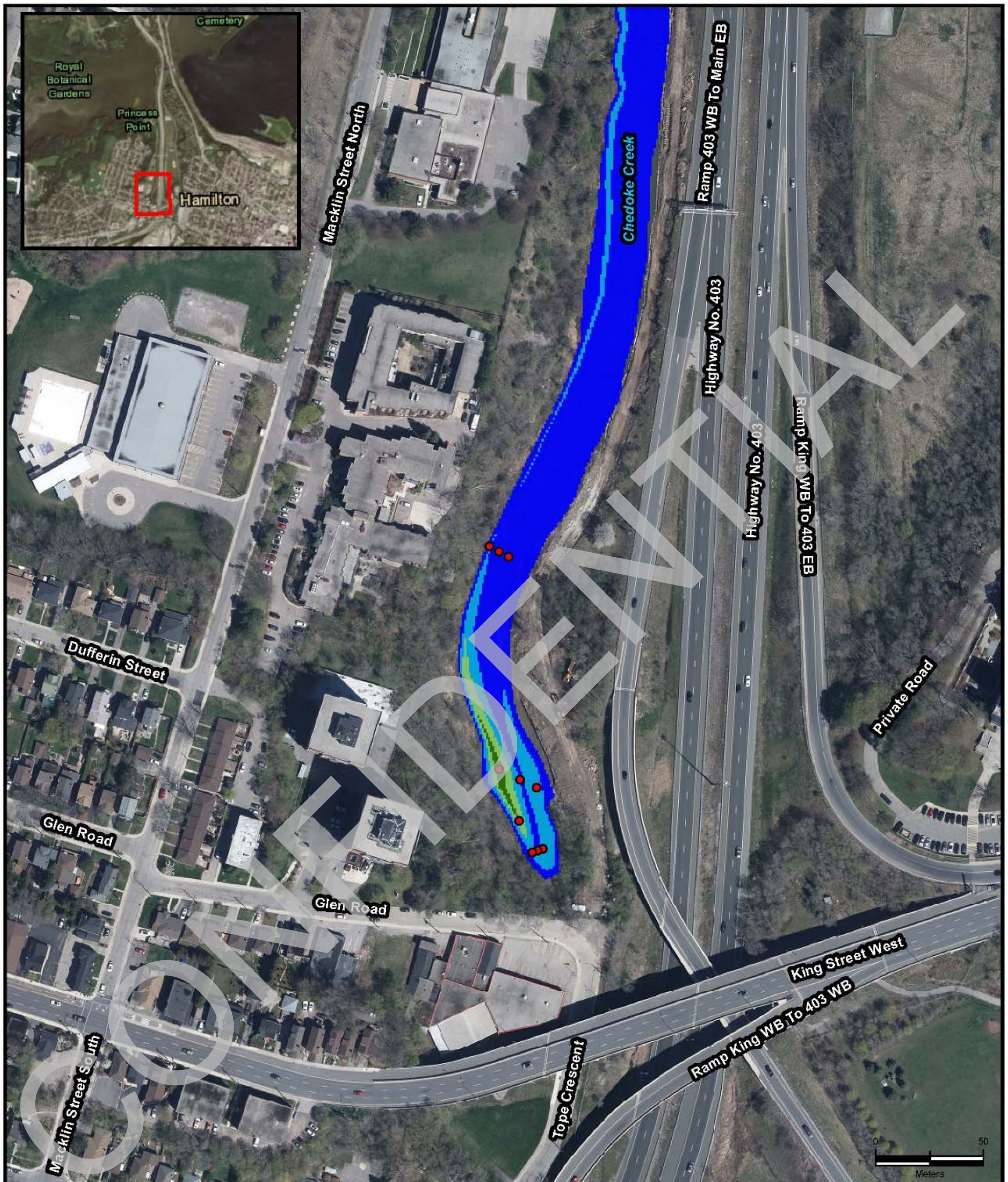
Sediment Thickness (m)

- 0 - 0.1
- 0.11 - 0.2
- 0.21 - 0.3
- 0.31 - 0.4
- 0.41 - 0.5
- 0.51 - 0.6
- 0.61 - 0.7

wood.

Figure B2-1b
Soft Sediment Thickness
Chedoke Creek
Hamilton, Ontario
Canada

Path: V:\TPB188127_Chedoke_Creek\MXD\2017_Imagery_B2-1B_sediment.mxd



Notes:
1- Project No.: TPB188127
2- Data Source - City of Hamilton 2017 Imagery, Wood, ESRI Imagery
3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 11/08/2018
Revised: AB
Checked By: LL

Explanation of Features

N

- Railways
- Sediment Survey Points

Sediment Thickness (m)

- 0 - 0.1
- 0.11 - 0.2
- 0.21 - 0.3
- 0.31 - 0.4
- 0.41 - 0.5
- 0.51 - 0.6
- 0.61 - 0.7

wood.

Figure B2-1c
Soft Sediment Thickness
Chedoke Creek
Hamilton, Ontario
Canada

Path: V:\TPB188127_Chedoke_Creek\MXD\2017_Imagery_B2-1C_sediment.mxd

wood.

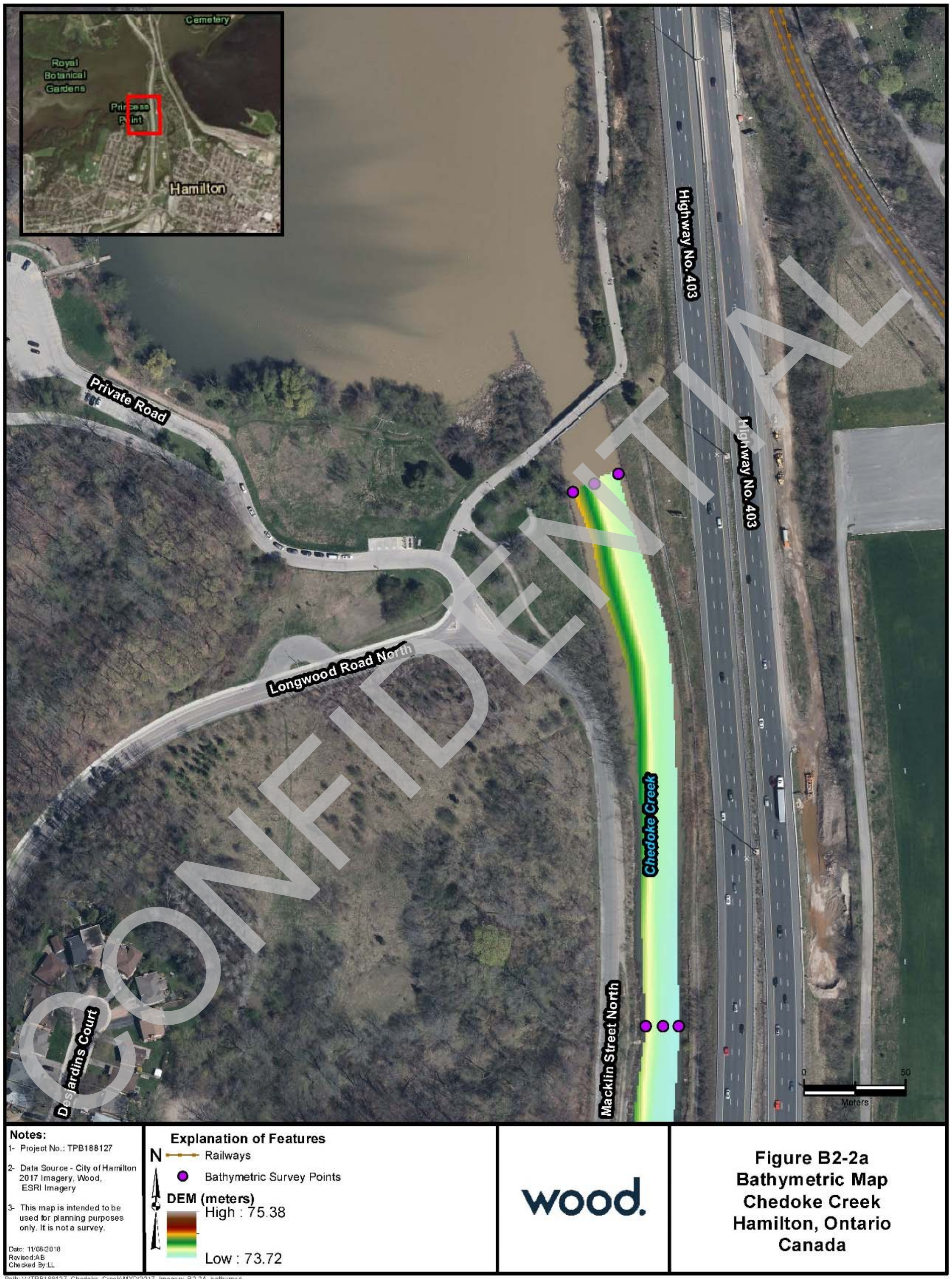
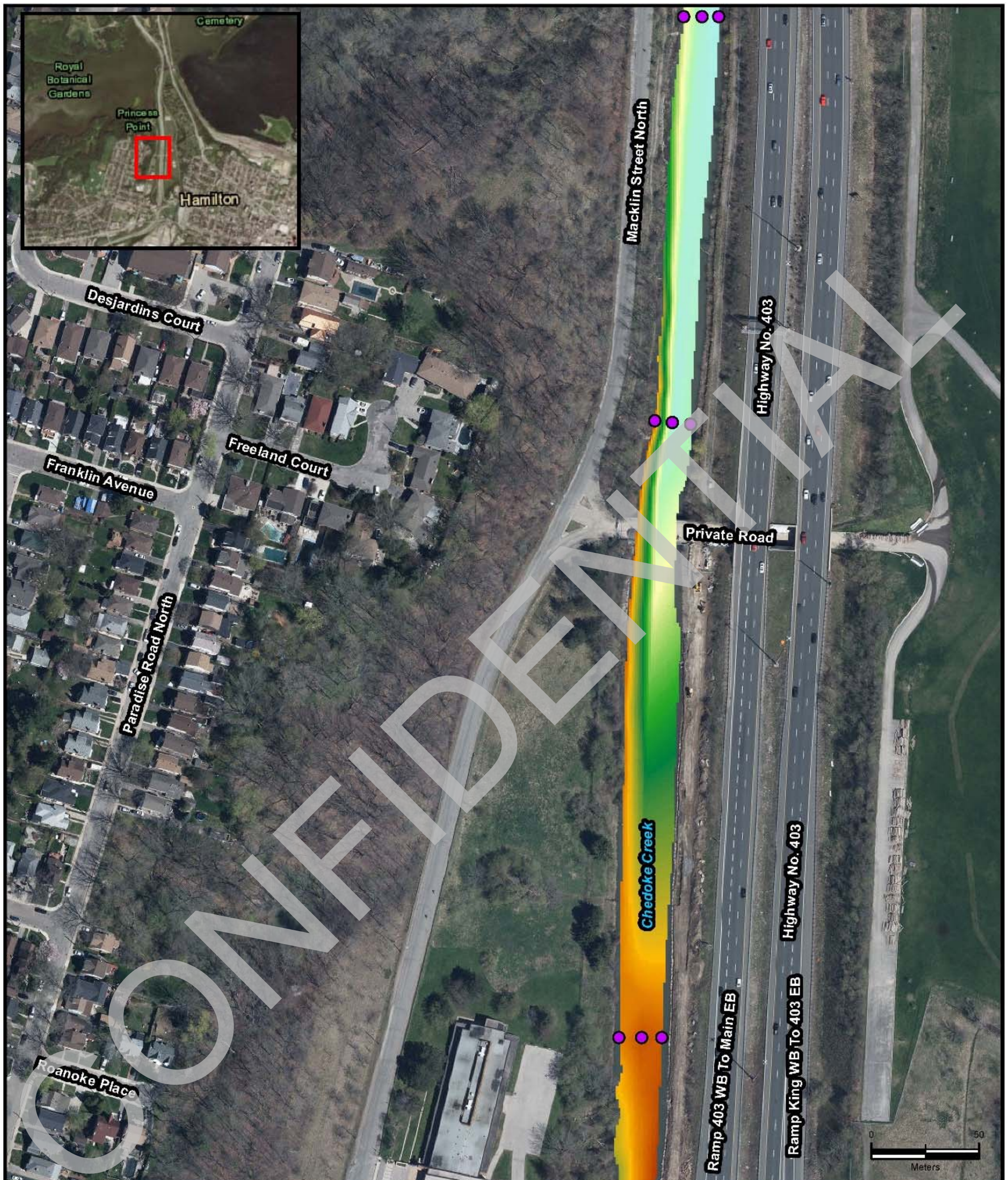


Figure B2-2a
Bathymetric Map
Chedoke Creek
Hamilton, Ontario
Canada

Path: V:\TPB188127_Chedoke_Creek\MXD\2017_Imagery_B2-2A_bathy.mxd

wood.



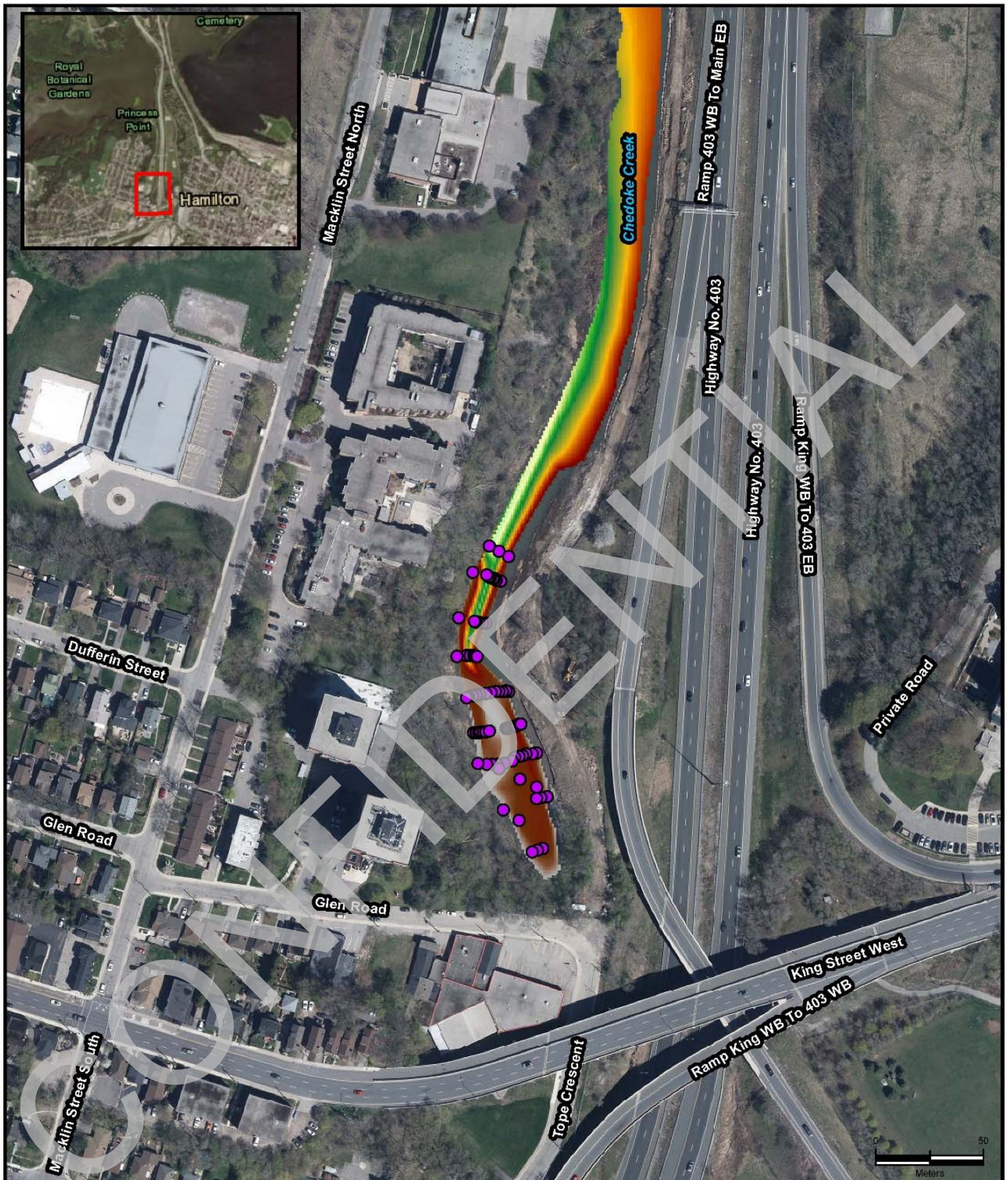
Notes:
1- Project No.: TPB188127
2- Data Source - City of Hamilton 2017 Imagery, Wood, ESRI Imagery
3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 11/08/2018
Revised:AB
Checked By:LL

Explanation of Features
Railways
Bathymetric Survey Points
DEM (meters)
High : 75.38
Low : 73.72

Figure B2-2b
Bathymetric Map
Chedoke Creek
Hamilton, Ontario
Canada

Path: V:\TPB188127_Chedoke_Creek\MXD\2017_Imagery_B2-2B_bathy.mxd



Notes:
1- Project No.: TPB188127
2- Data Source - City of Hamilton 2017 Imagery, Wood, ESRI Imagery
3- This map is intended to be used for planning purposes only. It is not a survey.

Date: 11/08/2018
Revised: AB
Checked By: LL

Explanation of Features

N

Railways

Bathymetric Survey Points

DEM (meters)
High : 75.38
Low : 73.72

wood.

Figure B2-2c
Bathymetric Map
Chedoke Creek
Hamilton, Ontario
Canada

Path: V:\TPB188127_Chedoke_Creek\MXD\2017_Imagery_B2-2C_bathy.mxd

wood.

Appendix C

Natural Environment Data Analysis

Table C-1a Benthic Invertebrate Community Metric Summary

Sample Transect	G-1			G-2			G-3			G-4		
Community Metric	**East**	**Centre**	**West**	**East**	**Centre**	**West**	**East**	**Centre**	**West**	**East**	**Centre**	**West**
Taxa Richness	**4**	**3**	**2**	**2**	**4**	**4**	**6**	**2**	**3**	**2**	**3**	**2**
Minimum	2			2			2			2		
Maximum	4			4			6			3		
Mean	3			3			4			2		
Standard Deviation	1.0			1			2			1		
Standard Error	0.6			0.7			1.2			0.3		
TID (individuals/m²)	**139**	**39**	**424**	**74**	**377**	**2325**	**1255**	**130**	**346**	**446**	**225**	**52**
Minimum	39			74			130			52		
Maximum	424			2325			1255			446		
Mean	201			925			577			241		
Standard Deviation	200			1222			597			197		
Standard Error	115			705			345			114		
Simpsons Diversity	**0.61**	**0.49**	**0.30**	**0.50**	**0.47**	**0.11**	**0.53**	**0.50**	**0.43**	**0.42**	**0.49**	**0.44**
Minimum	0.30			0.11			0.43			0.42		
Maximum	0.61			0.50			0.53			0.49		
Mean	0.47			0.36			0.48			0.45		
Standard Deviation	0.16			0.21			0.05			0.03		
Standard Error	0.09			0.12			0.03			0.02		
Simpsons Evenness	**0.65**	**0.66**	**0.71**	**1.00**	**0.47**	**0.28**	**0.35**	**1.00**	**0.58**	**0.86**	**0.65**	**0.90**
Minimum	0.65			0.28			0.35			0.65		
Maximum	0.71			1.00			1.00			0.90		
Mean	0.67			0.58			0.64			0.80		
Standard Deviation	0.04			0.37			0.33			0.13		
Standard Error	0.02			0.21			0.19			0.08		
Hilsenhoff Biotic Index	**6.58**	**6.00**	**6.00**	**6.00**	**6.03**	**6.00**	**6.05**	**6.00**	**6.00**	**6.00**	**6.00**	**6.00**
Minimum	6.00			6.00			6.00			6.00		
Maximum	6.58			6.03			6.05			6.00		
Mean	6.19			6.01			6.02			6.00		
Standard Deviation	0.34			0.02			0.03			0.00		
Standard Error	0.19			0.01			0.02			0.00		

Table C-1b Benthic Invertebrate Community Metric Summary

Sample Transect	G-5			G-6			G-7		
Community Metric	**East**	**Centre**	**West**	**East**	**Centre**	**West**	**East**	**Centre**	**West**
Taxa Richness	**3**	**2**	**2**	**0**	**3**	**2**	**2**	**2**	**1**
Minimum		2			0			1	
Maximum		3			3			2	
Mean		2			2			2	
Standard Deviation		1			2			1	
Standard Error		0.3			0.9			0.3	
TID (individuals/m^2)	**169**	**143**	**78**	**0**	**61**	**113**	**485**	**195**	**390**
Minimum		78			0			195	
Maximum		169			113			485	
Mean		130			58			356	
Standard Deviation		47			56			148	
Standard Error		27			33			85	
Simpsons Diversity	**0.19**	**0.50**	**0.44**	**1.00**	**0.36**	**0.07**	**0.05**	**0.08**	**0.00**
Minimum		0.19			0.07			0.00	
Maximum		0.50			1.00			0.08	
Mean		0.38			0.48			0.05	
Standard Deviation		0.17			0.47			0.04	
Standard Error		0.10			0.27			0.02	
Simpsons Evenness	**0.41**	**1.00**	**0.90**	**0.00**	**0.52**	**0.54**	**0.53**	**0.55**	**1.00**
Minimum		0.41			0.00			0.53	
Maximum		1.00			0.54			1.00	
Mean		0.77			0.35			0.69	
Standard Deviation		0.31			0.31			0.27	
Standard Error		0.18			0.18			0.15	
Hilsenhoff Biotic Index	**6.00**	**6.00**	**6.00**		**6.00**	**6.00**	**6.00**	**6.00**	**6.00**
Minimum		6.00			6.00			6.00	
Maximum		6.00			6.00			6.00	
Mean		6.00			6.00			6.00	
Standard Deviation		0.00			0.00			0.00	
Standard Error		0.00			0.00			0.00	

Table C-2 Benthic Invertebrate Taxa Proportion Summary

Taxa	G-1	G-2	G-3	G-4	G-5	G-6	G-7
Tubificidae (Oligochaeta)	32.0	59.7	39.6	33.3	29.0	6.0	0.0
Isopoda	9.4	0.4	0.5	0.0	0.0	0.0	0.0
Chironominae	31.2	39.3	58.8	66.0	69.3	58.2	97.6
Orthocladiinae	27.4	0.4	0.9	0.0	0.0	0.0	0.0
Other Taxa	0.0	0.2	0.2	0.6	1.7	2.4	2.4
Ceratopogonidae	0.0	0.0	0.0	0.0	0.0	0.0	2.4
Prodiamesinae	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Tanypodinae	0.0	0.0	0.0	0.0	1.7	0.0	0.0
Sphaeriidae	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Lymnaeidae (Gastropoda)	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Physidae (Gastropoda)	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Nematoda	0.0	0.0	0.1	0.0	0.0	2.4	0.0

Notes:
1. Values expressed as relative percent of total community proportion.
2. Grey shaded taxa are included in the "Other Taxa" relative community proportion values as these taxa contributed less than 5% to the overall community composition.

Table C-3a Fish Community Data Summary

Metric	Year	Sample Transect				Metric	Sample Transect			
		C1	C2	B2	M5		C1	C2	B2	M5
Catch per Unit Area (no. fish /50m)	2001	2.3	0.9	0.5	2.9	Total Catch (no. of fish)	115	45	23	145
	2002	3.9	1.1	1.4	4.9		195	53	68	243
	2003	4.8	3.8	0.1	8.7		241	192	5	435
	2004	2.3	1.0	0.1	1.7		117	50	5	84
	2005	2.5	3.1	0.5	6.3		123	157	25	315
	2006	1.2	0.3	0.0	2.8		59	17	0	142
	2007	4.5	2.3	0.0	8.7		225	117	0	437
	2008	3.2	1.9	0.0	3.7		158	94	2	184
	2009	0.4	0.4	0.0	0.7		18	18	0	33
	2010	1.0	4.1	0.0	2.4		52	203	2	119
	2011	4.1	1.2	0.3	8.5		205	59	14	424
	2012	3.3	1.2	0.0	N/A		166	62	0	N/A
	2013	6.1	0.8	0.4	4.8		305	41	20	241
	2014	0.1	1.1	0.0	0.5		6	53	0	26
	2015	4.2	2.6	0.0	1.4		212	129	0	70
	2016	0.6	0.8	0.0	2.0		28	39	1	100
	2017	0.5	0.1	0.0	1.2		27	6	0	62
	2018	2.0	0.2	N/A	0.5		98	8	N/A	24
Richness (no. fish species)	2001	10	7	3	6	Proportion Stress Tolerant Species (%)	6	7	91	6
	2002	12	11	9	10		11	15	7	7
	2003	13	12	1	12		18	33	100	15
	2004	11	12	5	11		14	14	20	14
	2005	12	10	5	8		13	20	84	31
	2006	10	7	0	8		25	65	0	42
	2007	11	9	0	10		20	35	0	11
	2008	12	10	2	11		12	5	0	8
	2009	7	7	0	7		22	6	0	12
	2010	7	8	2	7		42	45	50	50
	2011	13	7	3	14		10	25	0	10
	2012	10	5	0	0		13	11	0	N/A
	2013	15	5	6	11		26	17	20	10
	2014	2	5	0	2		83	96	0	19
	2015	8	7	0	9		91	96	0	83
	2016	5	5	1	5		61	28	100	66
	2017	5	3	0	6		89	83	0	16
	2018	8	4	N/A	4		33	75	N/A	58

Table C-3b Fish Community Data Summary

Metric	Year	Sample Transect C1	C2	B2	M5	Metric	Sample Transect C1	C2	B2	M5
Proportion Stress Intolerant Species (%)	2001	0.0	0.0	0.0	0.0	Proportion Generalist Species (%)	1.7	2.2	17.4	3.4
	2002	0.0	0.0	2.9	0.0		7.2	15.1	4.4	5.3
	2003	2.9	0.5	0.0	1.4		19.9	7.8	100.0	31.5
	2004	0.0	4.0	20.0	8.3		4.3	12.0	20.0	7.1
	2005	2.4	0.0	4.0	1.3		3.3	3.2	8.0	31.4
	2006	0.0	0.0	0.0	5.6		5.1	23.5	0.0	37.3
	2007	0.0	1.7	0.0	3.4		8.4	0.9	0.0	4.3
	2008	3.2	5.3	0.0	1.6		3.2	1.1	0.0	3.3
	2009	5.6	0.0	0.0	6.1		0.0	0.0	0.0	12.1
	2010	1.9	0.0	0.0	0.8		28.8	2.0	0.0	1.7
	2011	0.0	0.0	0.0	2.1		15.1	0.0	0.0	7.8
	2012	0.6	0.0	0.0	N/A		3.6	1.6	0.0	N/A
	2013	3.0	0.0	0.0	0.8		13.4	2.4	10.0	7.1
	2014	0.0	0.0	0.0	0.0		83.3	73.6	0.0	19.2
	2015	0.0	0.0	0.0	2.9		86.8	93.0	0.0	71.4
	2016	0.0	0.0	0.0	0.0		60.7	25.6	100.0	60.0
	2017	0.0	0.0	0.0	0.0		55.6	33.3	0.0	3.2
	2018	0.0	0.0	N/A	0.0		19.4	12.5	N/A	54.2
Proportion Piscivore Species (%)	2001	2.6	0.0	0.0	4.1	Proportion Specialist Species (%)	95.7	97.8	82.6	92.4
	2002	3.6	5.7	0.0	1.2		89.2	79.2	95.6	93.4
	2003	10.4	0.5	0.0	1.8		69.7	91.7	0.0	66.7
	2004	6.0	0.0	0.0	7.1		89.7	88.0	80.0	85.7
	2005	3.3	1.3	0.0	0.6		93.5	95.5	92.0	67.9
	2006	15.3	0.0	0.0	0.0		79.7	76.5	0.0	62.7
	2007	4.0	6.0	0.0	5.7		87.6	93.2	0.0	89.9
	2008	5.1	3.2	0.0	1.1		91.8	95.7	100.0	95.7
	2009	16.7	11.1	0.0	0.0		83.3	88.9	0.0	87.9
	2010	3.8	10.8	50.0	2.5		67.3	87.2	50.0	95.8
	2011	4.9	25.4	0.0	1.9		80.0	74.6	100.0	90.3
	2012	4.2	8.1	0.0	N/A		92.2	90.3	0.0	N/A
	2013	3.6	7.3	0.0	1.2		83.0	90.2	90.0	91.7
	2014	16.7	20.8	0.0	0.0		0.0	5.7	0.0	80.8
	2015	0.0	0.8	0.0	0.0		13.2	6.2	0.0	28.6
	2016	0.0	2.6	0.0	0.0		39.3	71.8	0.0	40.0
	2017	0.0	16.7	0.0	4.8		44.4	50.0	0.0	91.9
	2018	15.3	62.5	N/A	4.2		65.3	25.0	N/A	41.7

Limitations

Limitations

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
    a. The Standard Terms and Conditions which form a part of our Professional Services Contract;
    b. The Scope of Services;
    c. Time and Budgetary limitations as described in our Contract; and
    d. The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The conclusions presented in this report were based, in part, on visual observations of the Site and attendant structures. Our conclusions cannot and are not extended to include those portions of the Site or structures, which are not reasonably available, in Wood's opinion, for direct observation.
4. The environmental conditions at the Site were assessed, within the limitations set out above, having due regard for applicable environmental regulations as of the date of the inspection. A review of compliance by past owners or occupants of the Site with any applicable local, provincial or federal bylaws, orders-in-council, legislative enactments and regulations was not performed.
5. The Site history research included obtaining information from third parties and employees or agents of the owner. No attempt has been made to verify the accuracy of any information provided, unless specifically noted in our report.
6. Where testing was performed, it was carried out in accordance with the terms of our contract providing for testing. Other substances, or different quantities of substances testing for, may be present on-site and may be revealed by different or other testing not provided for in our contract.
7. Because of the limitations referred to above, different environmental conditions from those stated in our report may exist. Should such different conditions be encountered, Wood must be notified in order that it may determine if modifications to the conclusions in the report are necessary.
8. The utilization of Wood's services during the implementation of any remedial measures will allow Wood to observe compliance with the conclusions and recommendations contained in the report. Wood's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.
9. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or the part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set out therein.
10. This report is not to be given over to any third party for any purpose whatsoever without the written permission of Wood. Wood acknowledges that the City is bound by the *Municipal Freedom of Information and Protection of Privacy Act* (Ontario), as amended, and that the information provided to the Municipality in connection with this Agreement may be subject to disclosure in accordance with the provisions of that Act.
11. Provided that the report is still reliable, and less than 12 months old, Wood will issue a third-party reliance letter to parties that the client identifies in writing, upon payment of the then current fee for such letters. All third parties relying on Wood's report, by such reliance agree to be bound by our proposal and Wood's standard reliance letter. Wood's standard reliance letter indicates that in no event shall Wood be liable for any damages, howsoever arising, relating to third-party reliance on Wood's report. No reliance by any party is permitted without such agreement.

MECP Order # 1-J25Yb Item 1c
Implementation and Costing Report

Hamilton, Ontario
Project # TPB188127

Prepared for:

City of Hamilton
71 Main Street West, Hamilton, Ontario L8P 4Y5

January 24, 2019

Chedoke Creek
Implementation and Costing Report

City of Hamilton
Project # TPB188127

Prepared for:

City of Hamilton
71 Main Street West, Hamilton, Ontario L8P 4Y5

Prepared by:

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road, Suite 100
Burlington, ON L7N 3W5 Canada
T: 905-335-2353

1/24/2019

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road, Suite 100
Burlington, ON L7N 3W5 Canada
T: 905-335-2353
www.woodplc.com

January 24, 2019

Mani Seradj, M.A.Sc., P.Eng.
Project Manager – Watershed Management
Water and Waste Water Systems Planning

City of Hamilton
71 Main Street West
Hamilton, ON L8P 4Y5

Re: MECP Order # 1-J25YB Item Deliverable 1c – Implementation and Costing Report, City of Hamilton

Dear Sir:

Wood Environment & Infrastructure Solutions (Wood) is pleased to submit the attached report for the City of Hamilton to submit to the Ministry of the Environment, Conservation, and Parks (MECP) in partial fulfilment of Provincial Officer's Order # 1-J25YB.

We thank the City for its insights and support in preparing this document. Should you have any further comments, please feel free to contact any of the undersigned.

Sincerely,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Per: Lance Lumbard, MS, MBA, CLP
Senior Scientist

Per: Ron Scheckenberger, M.Eng., P.Eng.
Principal Consultant

Per: Dale Klodnicki, M.E.Sc., C.E.T.
Senior Aquatic Ecologist

Per: Brian Bishop, M.Eng. P.Eng.,
Senior Associate

P:\2018\Projects\TPB188127 - Chedoke Creek Action Plan\05_DEL\01_RPT-TECHMEM\18-12 Deliverable 1c\18-11-28 TPB188127_CoH_ Chedoke_Deliverable_Part1C.docx

Table of Contents

List of Appendices

1.0 Introduction

Wood Environment & Infrastructure Solutions (Wood) has been retained by the City of Hamilton to provide services specifically related to the assessment of the combined sewer overflow (CSO) event into Chedoke Creek for the period of January, 2014 to July, 2018 and the preparation of a Conceptual Remedial Action Plan, in response to the Ministry of the Environment, Conservation and Parks (MECP) Provincial Officer's Order (# 1-J25YB). This report provides an outline of an Implementation Plan for the preferred remediation alternative of physical removal of the organic sediment within Chedoke Creek as detailed in Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report . The Implementation Plan discusses the Process, anticipated Timelines, Approval Requirements, Construction Sequencing, Cost Estimates, and other Construction considerations.

2.0 Process

Currently, the assessment and remediation planning for the subject reach of the Chedoke Creek is being conducted in response to MECP Order # 1-J25YB. It is expected that the City of Hamilton will continue to consult with MECP on the various documents and information required as part of the Provincial Officer's Order. Over the course of this consultation, it is anticipated that a consensus will be reached on the form of the remedial action plan and associated implementation responsibilities. Notwithstanding the foregoing, it is recognized that the City of Hamilton, in addressing this Provincial Officer's Order, has been conducting the assessment in the absence of broad consultation with agencies, stakeholders and the public and it is fully expected that there will be requirements for broader engagement of stakeholders to this undertaking. Given the foregoing, it is expected that there would be benefits from conducting an Environmental Assessment of the problem and associated solutions. Further dialogue on this process and the application of a Municipal Class Environmental Assessment or Individual Assessment is recommended with MECP over the course of the review of the documents associated with the Provincial Officer's Order.

A key issue relates to the extended timelines associated with conducting such an assessment. The Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report indicated that sediment is resident in the subject reach of the Chedoke Creek. Notwithstanding, that report also notes that some of the organic material within the subject reach of the Chedoke Creek may be associated with the 2014 – 2018 discharge event, however it is acknowledged that the sediment within the Chedoke Creek is likely to have been derived from multiple sources, as outlined therein. That report also indicates that the longer this sediment is exposed to the environment the greater the risk of continued impairment. It is suggested that if the City of Hamilton and MECP agree that an Environmental Assessment is appropriate, that the reports prepared in response to the Provincial Officer's Order be used as the basis for the problem definition, system characterization, and alternative assessment, with some re-structuring to allow for context and compliance with the Provincial Environmental Assessment procedures. Given this approach, the primary action which will be required to fulfill the principles and objectives of the Environmental Assessment will involve more comprehensive stakeholder consultation.

The consultation is anticipated to include the following groups:

- Regulators
    - Ministry of the Environment, Conservation, and Parks (MECP)
    - Ministry of Natural Resources and Forestry (MNRF)
    - Hamilton Conservation Authority (HCA)
    - Ministry of Transportation Ontario (MTO)

  - Fisheries and Oceans Canada (DFO)
- Indigenous Communities
- Key Stakeholders
  - Royal Botanical Gardens (RBG)
- Interest Groups
  - Bay Area Restoration Council (BARC)Hamilton Harbour Remedial Action Plan (HHRAP)
  - HWD School Board (Vanier school immediately adjacent to remediation area)
- General Public
  - Park Users
  - Area Property Holders and residents

Given the unique characteristics and attributes of this undertaking (unplanned operational condition of municipal infrastructure), it will be important to consult with MECP on the appropriate process and schedule of undertakings, and whether this activity can be considered a "class" undertaking. Given that this matter is largely in response to a failure of municipal infrastructure, it is by extension considered that the Municipal Class EA is most appropriate, but as noted this should be confirmed with MECP. It is anticipated that the project could potentially be conducted as a Schedule B undertaking, in that impacts are expected to be "positive", as the project will be largely remedial in nature, hence the potential for adverse effects will be minimized.

In conducting an Environmental Assessment (subject to the MECP's concurrence), and using documents and information prepared in response to the Provincial Officer's Order, it is expected that the City of Hamilton can meet the requirements of the Environmental Assessment Act and thereby address the key principles of successful environmental planning, including:

- Consultation with effected parties early in, and throughout, the process, such that the planning process is a cooperative venture
- Consideration of a reasonable range of alternatives, both the functionally different alternatives to, and alternative methods of, implementing the solution
- Identification and consideration of the effects of each alternative on all aspects of the environment
- Systematic evaluation of alternatives in terms of their advantages and disadvantages to determine their net environmental effects
- Provision of clear and complete documentation of the planning process followed with respect to the project

3.0 Timelines

The timelines for implementation will be highly conditional on the decision related to conducting an Environmental Assessment and the associated level of study, through consultation with MECP. Given that significant work has been conducted to fulfil the requirements associated with the Provincial Officer's Order, a significant amount of information exists which can be reutilized as part of an Environmental Assessment. That said, there remains a requirement for considerable consultation with those parties cited in Section 2.0 and perhaps others, including the need for a minimum of two (2) formal points of consultation with the Public.

Furthermore, the level of input and commentary on the solutions from stakeholders and regulators cannot be predicted, nor can the ultimate solution be presupposed, hence there needs to be an allowance for a reasonable timeline for executing the work. The following provides an outline of reasonable timelines to execute the work as it is currently understood:

Class Environmental Assessment	8 to 12 months
Design	4 months
Approvals	6 months
Procurement / Tender and Construction	4 to 6 months
Total	**22 – 28 months**

While the timelines cited above are considered attainable, the various components to the undertaking need to occur in a expeditious manner, however given the engagement of the City to-date and the comprehensiveness of the information prepared in response to the Provincial Officer's Order, it is expected that these timelines will be attainable. As noted in earlier dialogue with City staff, construction would be best conducted in the Fall, early-Winter period, given that flow rates will be less flashy and management of sediment will generally be more predictable.

4.0 Approvals

The proposed remediation project as outlined in Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report is anticipated to require input and/or approvals from various regulators including but not limited to the HCA, MNRF, MECP, MTO, as well as DFO. The following provides an overview of the expected involvement for these regulators and associated timelines.

4.1 Hamilton Conservation Authority

The proposed project is within HCA jurisdiction and within a regulated area. As such, it is assumed a work permit application under the *Conservations Authorities Act* (CAA), based on HCA's Fill Regulations will be required. As an initial step, figures of the proposed work areas should be submitted to HCA to request their review to determine/confirm if the proposed activities require permitting under the CAA. A work permit application requires detailed design drawings, work plans and hydraulic calculations (specific to the short-term impacts associated with raising water levels), including how the activities are proposed to be constructed, as well as staging, site access and details regarding appropriate erosion and sediment control practices. Based on experience, a proponent should anticipate a two to three month review period for a work permit under the CAA from HCA.

Public lands include any lands under the control and management of the MNRF, referred to as Crown Lands, including the beds of most lakes and rivers in Ontario. A work permit under the *Public Lands Act* (PLA) is required for dredging shore lands, including removal of rocks/boulders from shore lands or the bottom of a lake or stream. In the Hamilton area, the HCA works with MNRF to review and approve work permits under the PLA to ensure that the requirements of the PLA and CAA are met, and the management of natural resources is achieved. The PLC work permit application process can be completed concurrently with the CAA work permit application for work in regulated areas, discussed above.

4.2 Ministry of Natural Resources and Forestry

As noted in Section 2.0, the City of Hamilton in consultation with MECP, will likely endeavour to conduct an Environmental Assessment (EA) for the project (Class or Individual). It is noteworthy that MNRF has a similar process related to resource stewardship which can be offered as guidance in this context but not used, as it would not allow for the municipal context related to infrastructure management, which is outlined in the Municipal Class EA. Notwithstanding for context, the Class EA for Resource Stewardship and Facility Development Projects framework provided by MNRF, includes a project screening mechanism by which proponents can evaluate their proposed undertakings, such as water-related excavation and dredging which will rehabilitate fish habitat. This inherently demonstrates that dredging, treatment and disposal of removed material and replacement of material into fish habitat are well understood practices that are included within the Category A projects under the MNRF Class EA for Resource Stewardship and Facility Development Projects framework of the EA Act, hence would similarly be expected to constitute approved activities under the Municipal Class EA procedures. In MNRF's experience, the Category A projects have low potential for significant negative environmental effects (social, economic, or natural environment) or agency or public concern. Planning and implementation of these projects is allowed to proceed in accordance with conditions imposed by MNRF to mitigate negative effects (e.g., in-water timing restrictions, HCA permitting) without further public review or approval. Consequently, the MNRF is usually involved with pre-assigned Category A projects in a very limited manner and does not typically have further requirements under this Class EA process. It is proposed that the MNRF Class EA process be used for context in the dialogue with MECP on the best approach to address the needs of the *Environmental Assessment Act*.

Furthermore, activities in water that support fish are subject to provincial and federal in-water works timing constraints (MNRF 2013; DFO 2013). The timing windows for in-water works are based on the fish species spawning periods and regional location of the fish habitat. Chedoke Creek is located within the Southern Region (federal and provincial regions are the same). The spring spawning period timing window to avoid in-water works (using known or likely fish species presence) can begin as early as April 1 (e.g., Northern Pike habitat) and extends as late as July 15 (e.g., Basses, Other/Unknown spring spawning species). RBG annual fish community data from Chedoke Creek and Cootes Paradise have confirmed the presence of spring spawning species with cool to warm water thermal regime preferences. As such, the anticipated timing window when in-water work is likely to be restricted based on species presence and MNRF Region is between April 1 and July 15. Meaning, in-water project activities may occur between July 16 and March 31, pending confirmation from the local MNRF district office.

In addition to the in-water timing windows, a fish salvage and relocation program will be required to move fish from the proposed work areas (ref. Management Units #1 through #3 as outlined in Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report) between the coffer dams and relocate them alive to downstream reaches of the creek or to Cootes Paradise, thereby minimizing potential for fish mortality. Reasonable effort must be made to capture and relocate fish from the work areas and based on experience a target for fish salvage efforts is to obtain an 80% reduction in fish densities within the salvaged areas which satisfies Regulator requirements. The fish salvage program will require a Licence to Collect Fish for Scientific Purposes from the local MNRF District office and may require a Licence to Stock Fish, as determined by MNRF on a case-by-case basis. This licensing process commonly requires development of a site-specific fish salvage protocol, identifying salvages areas, species likely to be encountered and identification of candidate release locations, as well as fish care and handling procedures.

The types of work requiring a *Lakes and Rivers Improvement Act* (LRIA) Section 14 or 16 approval include channelization of rivers, which encompasses dredging. However, LRIA approval is not required to undertake channelization within the area of a conservation authority, provided the area of the conservation authority is subject to a regulation made under the authority of Section 28 of the CAA (Ontario Regulation 454/96). Consequently, the proposed project is anticipated to require authorization from the HCA under the CAA in lieu of an MNRF LRIA approval.

4.3 Ministry of the Environment, Conservation, and Parks

The Permit to Take Water (PTTW) program is administered by the MECP and governed by the *Ontario Water Resources Act* (OWRA) and the *Water Taking and Transfer Regulation (O. Reg. 387/04*), made under the OWRA and *O. Reg. 63/16*, made under the *Environmental Protection Act*. The proposed hydraulic dredging would likely be considered a short-term water taking activity and would not require a PTTW if it can be demonstrated that;

- water taking is less than 50,000 litres of water per day;
- MECP agrees the proposed works are considered part of dewatering for construction purposes; and
- The water is returned to the same watercourse and meets discharge criteria. (note that based on the current concept presented in Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report, the water would not be directly returned to the adjacent waterway (Chedoke Creek) and rather directed to the WWTP and discharged to Hamilton Harbour)

Once the preferred management approach is established, including the specific operative elements it can be determined as to whether a PTTW will be required.

In addition to the PTTW, it will also be necessary to assess whether a revised Certificate of Approval (now Environmental Compliance Authorization) would be required for the temporary discharge to the sewer or leachate collection systems. Normally, MECP does not require these forms of amendments for temporary works, however this should be confirmed through the EA and subsequent dialogue with MECP.

The MECP has a responsibility under the *Environmental Assessment Act* to assess and review proposed undertakings. As outlined in Section 2.0, an Environmental Assessment (Class or Individual) is anticipated to be required, and the details on scope and type will need to be developed consultatively with MECP, to address the requirements of the Environmental Assessment Act.

4.4 Ministry of Transportation Ontario

Consultation with MTO will be required to define the related requirements associated with Highway Corridor Management. Specifically grading adjacent to Provincial Highways is controlled by the MTO under the Public Transportation and Highway Improvement Act. In accordance with Sections 34 and 38 of the Act, and with specific consideration for the preliminary proposed works associated with Chedoke Creek dredging, the MTO may require that a Highway Corridor Management Permit be issued by the Ministry.

Recognizing the proximity of the site to Highway 403, a co-ordinated application will need to be made to the MTO upon completion of the Class EA Report for the overall works, with particular focus on those works which fall within the zones requiring Ministry approval based upon proximity the Ministry's right-of-way and interchange ramps.

4.5 Fisheries and Oceans Canada

Activities near water are also governed by DFO and typically include a self-assessment as an initial step to determine whether project activities are likely to cause *serious harm* to fish as defined by subsection 35(1) of the *Fisheries Act*. Serious harm is defined as the death of fish or any permanent alteration to, or destruction of, fish habitat. It is anticipated the proposed dredging project will be recognized as habitat restoration by DFO, which is listed under the project activities and criteria where DFO review is not required. However, a Request for Project Review (RFR) to the Fisheries Protection Program (the Program) of DFO would confirm whether the proposed project is likely to cause serious harm to fish and fish habitat. The RFR also reviews the project to determine whether it is likely to affect listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*, unless authorized. A maximum review period for an RFR has not been defined by DFO; however, based on experience, a response is commonly received within 35 to 45 days following submission. The DFO decision options and associated timelines for an RFR are outlined below:

- Work determined not to cause serious harm – proponent receives confirmation from the Program and can implement the project in the manner and during the timeframe described within the RFR to ensure no serious harm to fish or prohibited effects on listed aquatic species at risk occurs. The response typically includes a caveat that should proposed project plans change or if information was omitted within the RFR, further review by the Program may be required.
- Work determined to potentially cause serious harm – the DFO will assign a biologist to the file and the proponent will be required to develop a Fish Habitat Offset Plan, complete and submit a Fisheries Act Authorization application form and submit a Letter of Credit for DFO review. The DFO has a 60-day review period following submission of the above documents to assess for completeness;
  - If accepted as complete, DFO has a 90-day review/consultation period during which the limit of 90 days could be extended indefinitely should further consultation with stakeholders or Indigenous groups be required. Pending outcomes from this review/consultation period, DFO can issue the *Fisheries Act* Authorization to complete the work.

To be clear, it is anticipated that the proposed remediation project, with appropriate mitigation strategies and following best management practices will not be determined to cause serious harm, and will not require a *Fisheries Act* Authorization.

5.0 Construction Sequencing and Cost Estimates

Physical removal of the organic sediment inferred to be sourced, largely from the spill event (but acknowledged to be in part from legacy conditions), within Chedoke Creek will directly address the three primary sources of potential impairment including nutrient contamination, bacteriological contamination, and habitat loss. As noted in Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report, it is anticipated that introduction of future contaminants due to CSO discharge events will not accumulate to the same degree as the current condition since the CSOs occur predominantly during wet weather periods thus inherently under conditions of higher flow and lower concentrations. This differs from the conditions during the spill event which were continuous and also during dry weather periods associated with lower flow rates and higher concentrations. While, dredging can be accomplished either through mechanical means or by use of hydraulic dredge equipment, hydraulic dredging (as outlined in Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report) is recommended in this reach of the Chedoke Creek over mechanical means for several reasons. Mechanical dredging would not be practicable due to width of the creek, the density of riparian vegetation, and most importantly the lack of continuous access.

Hydraulic dredging provides nearly complete containment of the dredge slurry along the pumping route, which reduces exposure of the sediments to the atmosphere that could cause odour or other problems if the material were to be handled by an excavator. Additionally, after initial separation of coarse material such as gravel, sand, and debris, dredge slurry from a hydraulic dredge can be relatively easily routed to the Woodward Wastewater Treatment Plant for dewatering and ultimate disposal/treatment, thus avoiding potential issues related to dredged material storage, dewatering, and handling operations, which are generally space intensive and costly. Complete removal of this material by hydraulic dredging is recommended as the primary means of remediation (ref. Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report for further details).

5.1 Proposed Project Sequence

The following is an outline of a possible project sequence of operations for the efficient removal of the target sediments down to a specific elevation without the need to disturb areas outside of the necessary dredge footprint, although the selected contractor will ultimately be responsible for specific means and methods.

Given the importance of maintaining workable water depths for sediment removal by dredging, the approximately 1,275 m (+/-) channel will likely be divided into at least three sections or "management units." Management unit sizes and number will vary based on the size of the proposed hydraulic dredging equipment and pumps, the selected contractor will mobilize to the site.

Hydraulic dredging will be expected to begin starting from the southern end of the subject reach of the Chedoke Creek near the outfall/plunge pool, working northward towards the junction with Cootes Paradise. The first management unit is proposed to extend north from the outfall/plunge pool roughly 425 m (+/-) to point south of Macklin Street North, as it enters Kay Drage Park. The second management unit would extend 320 m (+/-) from the end of the first unit, ending approximately 30 m north of the private road that connects Macklin Street North to Kay Drage Park. The third unit would likely extend north, roughly 520 m (+/-) to the junction with Cootes Paradise.

At the northern end of each management section, starting with unit one, the selected contractor would install a cofferdam system. Before dredging, the water level in each management unit would be raised and maintained at an elevation 2 to 3 m above the top of the sediment to allow a hydraulic dredge to be deployed and operated. The water needed to elevate the subject management unit will be sourced from either natural creek flows or alternatively can be pumped south from Cootes Paradise. The selected contractor must take care not to raise the water levels to the point that could cause flooding, disrupt the operation of the outfall/plunge pool, or interfere with the recently installed leachate system outfall that lines a portion of the eastern bank of Chedoke Creek. This aspect of the design will need to be carefully coordinated with the HCA and City through detailed hydraulic assessments and development of associated contingency plans and procedures.

During the dredging operation within each management unit, the hydraulic dredge is proposed to sweep the creek bottom and send a slurry of dredged material and mostly water to a temporary work yard area referred to as the dredge material management area (DMMA). Preliminary calculations based only on the amount and types of sediment to be dredged, indicate that a DMMA would cover approximately 3,000 to 6,000 m^2 (+/-) and consist of several small temporary storage areas and a larger open work area. If available, additional storage area may prove to be beneficial to reduce overall transportation costs but this is not anticipated to be necessary.

Based on Wood's preliminary review of the upland areas available, the central or northern portions of Kay Drage Park would be a good location for the construction the DMMA (assumed for the Conceptual Restoration Plan per the Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report) within the Kay Drage Park area (naturally further evaluation of alternatives and impact management, related to the execution of an Environmental Assessment, would confirm this preference). Importantly, this location would allow for direct road access, movement of construction equipment, and direct hydraulic pipeline access for the transportation of the dredge slurry and the return of targeted sediment back to the Woodward Wastewater Treatment Plant for final processing and disposal.

Areas of approximately 1,000 m^2 or larger with potential hydraulic pipeline access to Chedoke Creek and direct access to a sanitary sewer line or sewer force main, which lay adjacent to Chedoke Creek, are necessary for the material handling locations. Currently, the Kay Drage Park project area meets these criteria. Determining the final Kay Drage Park project area, operational creek heights, site layouts, etc. will require agreements with the City of Hamilton and users of the Kay Drage Park, additional data collection, and analysis of the proposed site Kay Drage Park area footprint. Following this site-specific data collection, it will be necessary to conduct the engineering design, acquire permits, and develop final tender and construction documents (plans and specifications).

At the Kay Drage Park DMMA, the inflowing dredged slurry will be fed to a series of mechanical dewatering equipment (filter presses, sand shakers, hydrocyclones, etc.), of the selected contractor's choosing, to separate debris, gravel, sand, from the incoming slurry. It is assumed that the separated debris will be directly transported and disposed of in the proper waste handling (landfill) location. If the gravel and sand passes the required sediment sampling tests, they can then be stored and then used as needed. Alternatively, the collected gravel and sand can be either returned to the creek bottom or used in future remediation projects. The remaining effluent, comprised of the targeted sediments and dredged water would then be routed (pumped) back to the Woodward Wastewater Treatment Plant for final processing and disposal. The City of Hamilton's Sewer Use By-Law (14-090) will need to be considered as related to influent quality. Given that the City is the owner operator of the Woodward WWTP, it is anticipated that subject to testing and integrated dialogue between the plant operators and the City team responsible for Chedoke Creek clean-up, that a reasonable approach can be established to accommodate the discharge. Further consultation will be required accordingly.

As noted earlier, the DMMA will require direct hydraulic pipeline access from Chedoke Creek to the Woodward Wastewater Treatment Plant. The DMMA will require direct road access for the movement of construction equipment. The DMMA will ideally have a total volumetric temporary storage capacity of at least 5,000 m^3 (+/-) which would allow for continuous dredging seven days a week during daylight hours.

The DMMA site could be partially lighted to allow the selected contractor to continuously process the dredged material seven days a week, 24 hours a day.

The slurry stream would be directed through the selected contractor's series of mechanical dewatering techniques (e.g., hydrocyclones, filter presses) at the DMMA site. The coarse dredged material (gravel, sandy sediments, and debris) needs to be captured by the mechanical dewatering techniques and would be sorted, stacked, and temporarily stored. Afterwards, this coarse dredged material would be transported to the final disposal location (to be determined based on quality and composition). The remaining processed slurry stream would then be directed to the Woodward Wastewater Treatment Plant for final treatment and disposal.

The selected contractor will install erosion and sediment control best management practices to minimize soil erosion and discharge of soil bearing water runoff or airborne dust to adjacent properties to the dredged material handling/dewatering site. The selected contractor will be responsible to return all construction related area to the previous site condition as defined by the contract documents.

5.2 Order of Magnitude Engineering and Construction Cost Estimate

Wood has prepared a preliminary Order of Magnitude Engineering and Construction Cost Estimate herein referred to as an "estimate," which covers hydraulically dredging fine-grained nutrient-rich organic sediments within the subject reach of the Chedoke Creek (ref. Appendix A).

For specialized construction items such as dredging and dredged material management, Wood's cost estimating team has utilized available information and knowledge of means and methods along with production rates observed on similar projects, to assist in deriving unit costs and production rates. To further assist with this estimation, Wood's cost estimating team has contacted three (3) reputable dredging and sediment removal firms and two temporary cofferdam instillation firms who operate throughout the United States and Canada, to aid in verifying general rates and further support cost estimating to mobilize/demobilize personnel and equipment to the project site.

The provided preliminary estimate includes all of the currently foreseeable project costs: including Environmental Assessment, Engineering Design and related data collection, and construction activities comprised of mobilization/demobilization; pre- and post-construction surveys (pre- and post-dredging and pre- and post-structural material placement area); maintenance of traffic; Kay Drage Park staging area preparation; upland erosion controls and soil tracking prevention devices; cofferdam system installation and removal; dredging; mechanical separation (debris, gravel, and sand); transportation/disposal of collected material (debris, gravel, and sand); rehabilitation of staging areas; and general labour.

The estimate includes a 20 percent construction contingency (typically a 20 to 30 percent contingency is applied to these forms of infrastructure projects at the conceptual stage with the contingency being reduced as the initial design is advanced and unknowns/uncertainties are reduced) and 10 percent contingency for final engineering, permitting, construction supervision, and project closeout costs.

For this preliminary estimate, Wood has made the following assumptions based on data collected, meetings with regulatory agencies and City of Hamilton staff, and other readily available external literature and discussions. The estimate for the preliminary dredging and DMMA plans presented in Appendix A has been prepared based on the following assumptions and stipulations.

- The preliminary estimate is consistent with the recommendations made to the City of Hamilton by Wood as outlined in the Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report.

- Before permitting and bid document creation and submission, it will be necessary to conduct additional data collection, engineering analysis, and update the draft remediation plan based on the data collection findings. This may alter the proposed design, ultimate site volume, and cost.
- The City of Hamilton will be able to acquire permits that allow the project to proceed as outlined above, which includes:
  - Acquiring the necessary agreements to use the Kay Drage Park (or any other location as per the outcomes of the Class EA).
  - Permitting the treatment of the dredged sediments within the wastewater system.
  - Final disposal agreements for all separated debris, gravel, and sand at the City Landfill
- The City of Hamilton will secure support that the proposed design (dam and hydraulic dredge) is acceptable to City and HCA stormwater and floodplain management coordinators.
- Wood's Construction Administration / Project Closeout effort assumes a contiguous 2 to 3-month construction period, which may prove to be unattainable due to unforeseen or unanticipated site conditions.
- An independent surveyor will establish (pre- and post-construction) horizontal and vertical limits and establish/verify existing elevations for payment applications. A similar survey (pre-and post-construction) will establish that the placement areas have been constructed and restored as required.
- The selected contractor will use a series of mechanical dewatering equipment to separate debris, gravel, and sand, from the incoming slurry. The remaining effluent, composed of the targeted sediments and dredged water would then be routed (pumped) back to the Woodward Wastewater Treatment Plant for final processing and disposal.
- The selected contractor's means and methods must indicate how the selected contractor will maintain proper water levels within each management unit.
- All currently available data indicate that the selected contractor will excavate roughly 5,600 m^3 of fine-grained organic sediments and a similar thin layer of creek bed containing mineral sand and other inorganic material (approximately 6,300 m^3). For the purposes of this estimate, a dredge volume of 12,000 m^3 is assumed.
- For the purposes of this estimate, it is assumed that the selected contractor will dispose of 50 % of the total volume of material (i.e. structural grade material (debris, gravel, and sand)) in an approved placement area with the balance (50%) to be placed in a suitable landfill. In no case should material be placed outside of permitted placement areas.
- This estimate assumes that the contractor will not be required to monitor environmental resources during construction activities.
- The preliminary estimate presented herein includes a 20 percent construction contingency and 10 percent contingency for construction supervision and permit closeout costs.

Based on the verification of all the listed assumptions and the project proceeding as outlined above, the analyses suggest a preliminary engineering and construction estimate of $2,110,000 for the proposed dredging project as outlined in this document.

As with most dredge projects of this scale, dredged material transportation, dewatering, and final placement of the dredged material are generally the most challenging and costly elements. The proposed construction activities will remove approximately 12,000 m^3 of sediment from Chedoke Creek, which is a construction cost of around \$137.50 per m^3 of sediment removed.

5.3 Limitations and Risks

The conceptual dredging project is based on limited historic data and field investigations to characterize the ecological, physical, and chemical conditions within Chedoke Creek. In addition, loading estimates for total suspended solids, total Kjeldahl nitrogen, and total phosphorus were calculated for the duration of the discharge event. Together, these data suggest that the organic material within Chedoke Creek is similar to the Main/King CSO event discharge after settling and consolidation. However, it is unclear what portion of the material within the creek may have been contributed from other sources.

Limited ecological and chemical data exist for Chedoke Creek prior to the discharge event beginning in 2014. Impacts to Chedoke Creek prior to 2014 are probable because the system has been significantly altered from its natural condition to facilitate drainage from developed areas. These alterations include multiple stormwater outfalls and CSOs which have likely contributed pollutants to Chedoke Creek.

Continued evaluation of water quality and additional evaluation of the current sediment conditions are recommended to further refine the project design. Continued water quality monitoring is also recommended although several years of additional water quality data may be required to provide a statistically valid analysis.

Given the potential risks associated with public contact and need for special handling and disposal, a standard methodology for upland dewatering and stockpiling of dredged solids is not recommended. As noted previously, wastewater conveyance infrastructure is located near the project area and is considered to provide a safe, convenient, and economic means of handling the dredge slurry from Chedoke Creek. The use of this conveyance infrastructure will be subject to assessment to adequately meet the conditions of the City's Sewer Use By-Law and also provide details and verification of the hydraulic operations during construction.

Final permits and the final design will require agreements with any land owners whose property may be affected by the remediation such as Kay Drage Park should it be selected as the preferred location. Following this site-specific data collection, it will be necessary to perform the requisite engineering design, acquiring permits, and develop final bid and construction documents (plans and specifications).

Also, additional detailed pre-dredge sediment thickness surveys and volume calculations will be required prior to project commencement and following project completion, which may significantly alter the proposed design, ultimate site volume, and cost.

6.0 Construction Considerations

The construction phase of the cofferdam and the sizing and installation of equipment for the DMMA are considered the two most complex processes in the construction sequence and they are further outlined in this section. The first phase of construction will constitute the selected contractor mobilizing to the DMMA site and the subject reach of the Chedoke Creek.

The next step in the process will consist of the construction of the DMMA. For the purpose of this conceptual remediation plan assessment, the Kay Drage Park has been identified as a potential good site for the DMMA; clearly however this site will need to be reviewed along with others as part of a broader based assessment (Class EA). For the purpose of the following discussion of construction considerations, it has been assumed that the Kay Drage Park would be the preferred site. The Kay Drage Park DMMA will require construction of a direct hydraulic pipeline access to, and from, the Chedoke Creek. The DMMA will also require unimpeded direct road access for the movement of construction equipment. The DMMA site should be partially lighted to allow the selected contractor to continuously process the dredged material seven days a week, 24 hours a day.

The dredge project should be constructed to avoid unnecessary impacts to the existing ecosystem within Chedoke Creek and downstream. Turbidity control is of primary concern with any dredge project. Hydraulic dredging is generally much less prone to turbidity issues than mechanical dredging because most of the disturbed material is entrained by the suction head. Turbidity will be controlled by the contractor using the cofferdam systems which will be arranged to maximize settling time within the work area prior to releasing discharges downstream.

The dredge and associated equipment will be staged, deployed, and operated in a way that limits disturbance of the riparian habitat. In most cases, it is likely that the dredge and associated equipment will be transferred to Chedoke Creek using a crane. Pipelines will be transported, installed, and fixed in place using a corridor that results in the least ecological disturbance.

Additional impact avoidance measures will be reviewed during the pre-design and detailed design stage. This review will also include an assessment of the pumping and sand removal process that will likely be a part of the overall dredge process stream. Ultimate placement of sandy material will be evaluated based on its physical and chemical properties.

Appendix A

Preliminary Order of Magnitude Engineering and Construction Cost Estimate for Hydraulic Dredging

Appendix A: Preliminary Order of Magnitude Engineering and Construction Cost Estimate

Client: City of Hamilton | **Prepared by: RJW/RBS**
Project: Chedoke Creek Sewage Study and Remedial Action Plan | **Date: January 7, 2019**
Project No.: TPB188127 | **Revision 2.00**
Preliminary Order of Magnitude Engineering & Construction Cost Estimate[1] | **Reviewed by: LML**

Item	Description	Plan Qty.	Unit	Unit Price	Total
1.00	**ENGINEERING ITEMS:**				
0.01	Class EA Study	1	LS	$200,000	$200,000
1.01	Data Collection & Conceptual Design[2]	1	LS	$81,300	$81,300
1.02	Permitting	1	LS	$14,500	$14,500
1.03	Final Engineering Design[3]	1	LS	$30,000	$30,000
1.04	Final Order of Magnitude Construction Cost[4]	1	LS	$2,900	$2,900
1.05	Construction Plans & Specifications	1	LS	$30,000	$30,000
1.06	Bidding Assistance	1	LS	$2,800	$2,800
1.07	Construction Administration / Project Closeout[5]	1	LS	$95,000	$95,000
	Subtotal (Engineering Items):				**$456,500**
2.00	**GENERAL ITEMS:**				
2.01	Mobilization/Demobilization	1	LS	$98,300	$98,300
2.02	Construction Surveys (pre- & post-dredging and pre- and post structural material placement area)[6]	4	LS	$9,900	$39,600
2.03	Maintenance of Traffic	1	LS	$13,100	$13,100
	Subtotal (General Items):				**$151,000**
3.00	**DREDGING, TEMPORARY HANDLING, & DISPOSAL:**				
3.01	Kay Drage Park Staging Area Preparation[7]	1	LS	$9,500	$9,500
3.02	Upland Erosion Controls & Soil Tracking Prevention Device	1	LS	$21,700	$21,700
3.03	Cofferdam System Instillation and Removal[8]	1	LS	$170,000	$170,000
3.04	Material Removal (Dredging)[9]	12,000	m^3	$29.50	$354,000
3.05	Mechanical separation of debris, gravel, & sand[10]	12,000	m^3	$5.90	$70,800
3.06	Transportation of Collected Material (debris, gravel, & sand) to approved landfill[11]	6,300	m^3	$8.00	$50,400
3.07	Allowance for 50% of material to be Landfilled (Tipping fees and transportation)	3,150	m^3	$140.00	$441,000
3.08	Rehabilitation of Staging Areas[12]	1	LS	$25,000	$25,000
3.09	Labour	1	LS	$45,900	$45,900
	Subtotal (Dredging Items):				**$1,190,000**
	Project Total (with contingency[13])				**$2,110,000**
	Approximate Dredge Volume (m^3):	**12,000**			
	Average Construction Cost per m^3:	**$137.50**			

Notes:

Appendix A: Preliminary Order of Magnitude Engineering and Construction Cost Estimate

1 The preliminary Order of Magnitude Engineering and Construction Cost Estimate ("estimate")

2 Collect any final data and create conceptual plans and narratives suitable for permitting. Data collection and the conceptual plans will cover all elements of the proposed project.

3 Before bid document submission need to update the draft construction drawings and specifications based on all permitting conditions. This may significantly alter the final engineering design.

4 Short letter memorandum and worksheets summarizing order of magnitude construction cost estimate, which will be used for final budgeting purposes.

5 Construction Administration / Project Closeout effort assumes a contiguous 3-month construction period, which may prove to be unattainable due to unforeseen or unanticipated site conditions.

6 A hydrographic construction survey will establish (pre- and post-construction) horizontal and vertical limits and establish/verify existing elevations for payment applications. A similar survey (pre-and post-construction) will establish that the placement areas have been constructed as required.

7 The selected contractor will use a series of mechanical dewatering equipment to separate debris, gravel, sand, from the incoming slurry. The remaining effluent, composed of the targeted sediments and dredged water would then be routed (pumped) back to the Woodward Wastewater Treatment Plant for final processing and disposal.

8 The selected contractor's means and methods must indicate how the selected contractor will maintain proper water levels within each management unit.

9 All currently available data indicates that the selected contractor will excavate roughly 5,600 m^3 of fine-grained organic sediments and a similar thin layer of the natural creek bed (approximately 6,300 m^3). For the purposes of this estimate, a dredge volume of 12,000 m^3 is assumed.

10 The selected contractor's means and methods must indicate, in detail, how the selected contractor will manage the dredge slurry while within the Kay Drage Park site and route the slurry onto he Woodward Wastewater Treatment Plant for final processing and disposal.

11 For the purposes of this estimate, it is assumed that the selected contractor will dispose of any structural grade material in an approved placement area (50% to go to approved City Landfill). In no case should material be placed in outside of the

12 This estimate assumes that the contractor will not be required to monitor environmental resources during construction activities.

13 A 20 percent construction contingency & 10 percent contingency for construction supervision & permit closeout costs has been added.

SLR Consulting (Canada) Ltd.
200-300 Town Centre Boulevard
Markham, ON, L3R 5Z6
Tel: 905-415-7248

Peer Review Report

To:	**Mani Seradj, M.A.Sc., P.Eng.** Project Manager – Watershed Management	**From:**	SLR Consulting (Canada) Ltd.
Company:	City of Hamilton		
cc:		**Date:**	May 15, 2019
Subject:	**PEER REVIEW REPORT – CHEDOKE CREEK NATURAL ENVIRONMENT AND SEDIMENT QUALITY ASSESSMENT AND REMEDIATION REPORT**		

1.0 INTRODUCTION

On behalf of the City of Hamilton, SLR Consulting (Canada) Ltd. (SLR) has conducted a peer review of Wood Environmental & Infrastructure Solutions (Wood) report titled, *MECP Order # 1-J25YB Item 1b Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report, City of Hamilton*, dated January 24, 2019.

1.1 Background

On August 2, 2018, the Ministry of Environment, Conservation and Parks (MECP) issued Provincial Officer's Order #1-J25YB (the Order) to the City in relation to the accidental discharge of untreated wastewater from the Main Street and King Street combined sewer overflow (CSO) facility to Chedoke Creek. The Order included requirements for the:

- Quantification of the volume and contaminant loadings associated with the sewage discharged from the Main-King CSO facility to Chedoke Creek between January 28, 2014 and July 18, 2018; and,
- Evaluation of the impacts to Chedoke Creek from the accidental sewage discharge.

To fulfil these Order requirements, the City retained Wood Environment and Infrastructure Solutions (Wood) (and their sub consultant Hatch) to quantify the spill volume and contaminant loadings associated with the wastewater discharge, and to complete a site assessment, impact assessment, and development of a remedial plan if needed (Wood, 2019). The following documents have been prepared:

- *Final Report for Wood Group/City of Hamilton - Quantification of Volume and Contaminant Loadings*, dated September 28, 2018 by Hatch.
- *Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report*, dated January 24, 2019 by Wood.

The City has asked SLR to provide peer review services related to the investigation and mitigation recommendations presented in the *MECP Order # 1-J25YB Item 1b Chedoke Creek Natural Environment and Sediment Quality Assessment and Remediation Report* (the Report). SLR has not reviewed the MECP Order.

1.2 Review Objectives

The purpose of the peer review was not to replicate the work that was completed by Wood, nor to prepare and provide revised recommendations. In conducting this peer review SLR was asked to:

- Provide an opinion on the appropriateness and completeness of the investigation scope and the methods that were applied during the investigation;
- Conduct an independent review of the work completed by Wood to investigate the significance and scale of impacts to the creek system, including streambed sediment, water quality and natural environment related to the wastewater discharge event; and,
- Provide an opinion on the appropriateness and completeness of the conclusions and recommendations made in the Wood report, including the ecological risks posed by the deposits identified in the Creek, proposed remedial alternatives, and the recommendation to physically remove (i.e. dredge) the organic sediment from Chedoke Creek.

SLR notes that the evaluation of each environmental media is generally thorough. The comments provided in this memorandum are based on our review which was completed over a limited timeframe and focused on the above objectives. The review was based on the information provided in the Wood report only. It is possible that additional information not reviewed by SLR would address some of the comments.

1.3 Format of SLR Review

The information presented in this memorandum is outlined as follow:

- Section 2.0 outlines comments on the appropriateness and completeness of the scope of investigation and the investigation methods that were applied.
- Sections 3.1 to 3.5 provide comments pertaining to sediment quality, benthic invertebrate community, fish community, aquatic habitat and surface water quality.
- Sections 4.1 and 4.2 provide comments regarding the conclusion and recommendations.

In addition, Table 1 after the text of this memorandum provides further detailed comments for consideration.

2.0 SCOPE OF INVESTIGATION AND INVESTIGATION METHOD

2.1 Scope of Investigation

The overall scope of investigation by Wood was relatively comprehensive in that it included five lines of evidence (LOEs): sediment physical characteristics and analytical chemistry, surface water analytical chemistry, benthic invertebrate community, fish community and aquatic habitat observations. Each LOE was evaluated separately in the report prepared by Wood, however, very little integration of findings among LOEs was provided.

Based on the information reviewed, it seems that the analytical chemistry was the only LOE used to evaluate the potential impacts associated with the CSO event. The Wood report indicates that the benthic invertebrate community and fish community LOEs were used to describe current condition in Chedoke Creek and as such to serve as "*a baseline for future assessment of potential improvements, following the implementation of remediation options*".

It appears that the benthic invertebrate community and fish community LOEs were not used to support an evaluation of the potential adverse effects associated with the exposure to Chedoke Creek sediment contamination. The evaluation of water quality was based on available analytical data for samples collected by third-parties between 1999 and 2018. The surface water quality analysis seems to have been used to demonstrate that a change in water quality (increase or decrease in concentrations) occurred at select locations before, during and/or after the CSO event. It appears that the water quality analysis was not used to support an evaluation of the potential adverse effects to aquatic life under current conditions or to evaluate the potential contribution of the sediment contamination to the water column. Finally, although aquatic habitat observations were provided in the Wood report, this information does not seem to have been used to support the interpretation of the benthic invertebrate community or fish community LOEs.

2.2 Method of Investigation

SLR understands that the purpose of the assessment was to evaluate the current conditions in Chedoke Creek, assess the extent of impact associated with discharge from the CSO event into Chedoke Creek (that occurred for the period January 2014 to July 2018) and ultimately to support remediation design alternatives, if appropriate. As such, it would be appropriate to include a section on what overall approach was used to evaluate the potential adverse effects resulting from exposure to the sediment contamination for the receptors of concern.

The Ontario Ministry of Environment, Conservation and Parks (MECP) has published guidelines relevant to contaminated sediment including: Guidelines for Identifying, Assessing and Managing Contaminated Sediment in Ontario: An Integrated Approach (OMOE (Ontario Ministry of Environment (now MECP)) 2008). It is unclear what approach was followed in the Wood report to assess the environmental impacts associated with the sediment contamination and if these guidelines were considered.

Although, the methodology for sample collection and data analysis has been provided for each of the abiotic and biotic components, there does not appear to be a description of the overall approach to evaluate the current impacts of the CSO event. In addition, no apparent criteria were provided as part of the methodology to distinguish recent effects from those expected downstream from CSO operating within regulatory compliance, nor to identify the parts of the study area that require management, nor to select the remedial options if required.

As Wood correctly identified the existence of other sources of contamination (e.g., other CSOs, urban runoff, erosion), the study design should include comparisons to appropriate reference location(s) to support the evaluation of impacts. While it may not be feasible to isolate all sources of contaminants, this is not the fundamental issue requiring resolution. To determine whether and to what extent remedial actions are required it is more important to identify how conditions differ upstream and downstream from the CSO under investigation (which may not be possible in some cases) and how conditions differ between a properly functioning, and permitted CSO, and the CSO under investigation, than to distinguish sources of all contaminants. Given the importance of this issue, the Wood report should state why differences in conditions upstream and downstream from the Main-King CSO, or for another stream with similar urban characteristics (i.e., reference CSO) were not, or cannot, be characterized. If adequate reference location(s) cannot be used to evaluate the impacts, the report should outline what alternative methodology was used.

The following list briefly outlines the items which would provide a clear process for analyses and criteria for decision making if included as part of the overall approach and study design:

- Description of provincial and/or federal guidance documents relevant to the study.
- Selection of the receptors of potential concern (human and/or ecological) and a description of the protection goal for these receptors, as well as assessment endpoints.
- Selection of the lines of evidence and measurement endpoints. This would support the selection or exclusion of lines of evidence typically used to assess sediment contamination (e.g., toxicity test, benthic community structure assessment).
- Description of the approach used to assess the potential adverse effects for each of the LOE, including the extent and magnitude of effects. This is warranted because the overall study design does not seem to use reference site(s) in Chedoke Creek or in another urban creek with similar characteristics. Guidance on the assessment and management of contaminated sediment generally require comparisons to reference sites to support the evaluation of adverse effects. This is of importance for an urban system such as Chedoke Creek which is known to receive various point-source and non-point-source inputs.
- Description of the overall weight of evidence (WOE) approach to evaluate the potential adverse effects. The report does not provide an integration of the different LOE to support an evaluation of potential risks to ecological receptors exposed to sediment contamination.
- Description of the approach to evaluate and select the remedial options (e.g., selection criteria, closure of data gaps).

3.0 BIOTIC AND ABIOTIC STUDIES

SLR was asked to review the work completed by Wood to investigate the significance and scale of impacts to the creek system, including streambed sediment, water quality and natural environment related to the wastewater discharge event. Our main comments associated with the sediment quality, benthic invertebrate community, fish community, aquatic habitat and water quality investigations are provided in the following subsections. Additional comments are provided in Table 1 (after the text of this memorandum).

3.1 Sediment

The interpretation of sediment quality focuses on comparing the concentrations in the grab and/or core samples to the Provincial Sediment Quality Guidelines (PSQGs); however, the discussion does not clearly identify parameters that are potential drivers of risk or discuss the areal extent or magnitude of potential adverse effects. The vertical distribution of contaminants of potential concern (COPC) should also have been considered to support the effect assessment because most sediment-dwelling organisms live in the surficial sediment (<10 cm). This is consistent with OMOE guidelines (OMOE, 2008) indicating: "*Benthic community structure assessments will also not be possible for sediments deeper than about 10 cm because the vast majority of the sediment-dwelling organisms live in shallower depths than 10 cm although some organisms (e.g., some bivalves) can burrow much deeper*." In addition, the report shows that generally, the nutrients, metals and PAHs contamination has not been delineated vertically. The implications of the COPC distribution and of the lack of vertical delineation should be discussed further, especially because dredging has been selected as the preferred remedial options (e.g., would higher COPC concentrations be exposed after dredging?).

The evaluation of the nutrients (TKN and TP) shows that concentrations exceed the lowest effects level (LEL) but are below the severe effects level (SEL). The Wood report notes that the "*sediments contain a level of contamination that can be tolerated by the majority of sediment-dwelling organisms, but not necessarily stress-intolerant taxa*." Additional considerations should be given to whether stress-intolerant taxa would be expected, notwithstanding the event, to inhabit the study area based on the historical ongoing sources of nutrients or potential limitations imposed by the urban habitat characteristics.

The report provides a generic description of impact for metals: "*unlike nutrients, metals pose a direct toxicity to living organism and removal of soft sediment material containing these metals would likely be beneficial to the ecological conditions within Chedoke Creek and downstream*". This generic statement should be supported by the biological assessment results and/or toxicity tests, as per OMOE (now MECP) guidance mentioned above.

3.2 Benthic Invertebrate Community

The Wood report indicated that the benthic invertebrate LOE was collected to establish the baseline condition against which any improvements resulting from dredging could be measured. The benthic invertebrate results recognize presence of taxa tolerant to environmental stress but not whether presence and abundance is outside the range of expectations for urban stream within the study area. This is considered an important point, as the Wood report recognizes that sediment contamination has occurred prior to the Main/King CSO event and that other potential sources are ongoing (e.g., "*other operating CSOs (e.g. Royal Tank) located upstream, storm water drainage from the adjacent highway infrastructure and runoff from upstream urban environs (i.e., extensive roadway network) discharging to the creek, as well as other upstream sources (e.g., industrial and landfill sources)".*

The benthic invertebrates LOE is identified as one of the LOE carrying the highest weight in assessing and managing contaminated sediment (OMOE, 2008). It is unclear why the study design did not consider this LOE to evaluate the potential effects associated with the sediment contamination in Chedoke Creek and to determine whether and to what extent mitigation associated with the CSO event is required.

3.3 Fish Community

Assessment of fish communities was undertaken using data collected by the Royal Botanical Gardens (RBG) from 2001 continuing through 2018. These collections allowed for comparison of fish community characteristics prior to and during the CSO event into Chedoke Creek from January 2014 until July 2018. Before-after and upstream-downstream comparisons represent a powerful study design to assess effects of spill events such as the one reviewed here, however owing to an extended culvert upstream from the CSO, comparable upstream fish collection may not be possible and only before and during overflow fish data comparisons could occur.

The Wood report developed several metrics to inform data interpretation and indicate general aquatic ecosystem health. The report proposed these metrics as a '*general indicator of health, and to provide a baseline for comparison to the same metrics following remedial actions*' (page 5). While these indicator metrics may collectively allow an interpretation of ecosystem health, some of the metrics are undefined, thus limiting usefulness to identify effects associated with the

CSO event. For example, the report identified tolerant species (carp, suckers, sunfish, bass) without characterizing tolerance (e.g., to warm or cold water temperatures, general habitat degradation, general urbanization, high levels of metals, nutrients, PAHs, DO, BOD). Characterization of fish species tolerance in the Wood report does not incorporate nuanced classification, thus cannot support fine scale interpretation of results.

Indicators such as abundance, species richness and total catch may be useful as general indicators of health, however the MECP Provincial Officer's Order specifically required '*evaluation of impacts to Chedoke Creek from sewage discharged from the Main-King CSO facility to Chedoke Creek'*. Specificity of this direction provided Wood the opportunity to explore, develop and evaluate diagnostic indicators to assess effects related to sewage releases. Wood could revise their report to identify what steps, if any, were taken to develop specific indicators to link changes in fish community characteristics to specific impacts associated with sewage discharge.

The Wood report neither characterizes variation associated with fish collections from various locations over time, or in comparison to reference locations, nor specifies what amount of change in fish community characteristics would be considered significant. Figure 4-3 and Figure 4-4 show variation in fish community indicators for four locations from 2001 to 2018 but without characterization of variation and threshold criteria for change, meaningful interpretation of the data is difficult and may appear arbitrary.

The Wood report states that *"the relative proportion of piscivore species at transects C1 and C2 within the creek has increased recently (2017 to 2018), possibly suggesting recent improvement of environmental quality, since the proportion of top-piscivores are indicative of healthy fish communities*". This description of current conditions would suggest the need for further monitoring rather than support remediation such as immediate sediment removal.

3.4 Aquatic Habitat

Recorded observations show an upstream to downstream transition in channel morphology and flow. Upstream near the CSO the stream channel showed sloping banks, flat bottom, meandering thalweg and boulders throughout the channel. Further downstream the bank included an armour stone wall, riparian vegetation and instream large woody debris. Overhanging trees provided cover and instream structure in the form of eroded tree roots occurred approximately 200m downstream from the CSO. Waterflow toward Cootes Paradise was no longer evident approximately 400 to 500m downstream from the CSO implying water elevation in Chedoke Creek equilibrated with water elevation in Cootes Paradise.

Change in water movement from upstream flowing conditions to downstream still water conditions may imply change from dynamic upstream sediment transport to downstream zone of sediment deposition. These changes in habitat may influence composition of fish and benthic communities independent of the CSO event, however the potential implications were not discussed.

3.5 Surface Water Quality

The Wood report does not include an objective related to water quality analysis. The analysis of water quality provided in the Wood report focuses on statistical comparisons of the water quality at select locations before and after the Gate 1 opening.

The report refers to "*degraded conditions in the water column*" (p. 19). This statement is not supported by comparisons of surface water analytical results to federal or provincial water quality guidelines (CCME or PWQO). The most recent surface water quality dataset (post event) has not been used to identify surface water COPC, to evaluate the extent and magnitude of exceedances above applicable guidelines nor to relates the findings to the receptors that can be exposed to the surface water COPC, such as benthic invertebrates and fish.

4.0 REPORT CONCLUSIONS AND RECOMMENDATIONS

4.1 Report Conclusions

As indicated in the introduction of this memorandum, SLR was asked to provide an opinion on the appropriateness and completeness of the conclusions made in the Wood report, including the ecological risks posed by the deposits identified in Chedoke Creek, proposed remedial alternatives, and the recommendation to physically remove the organic sediment within Chedoke Creek.

The Wood report lacks a conclusion section between the interpretation of results and the recommendations and thus the report's conclusions are not apparent. In addition, as discussed in Section 2.0 of this memorandum, the approach did not seem to follow the typical guidelines for the assessment and management of sediment contamination which represents a valid basis for a decision as to whether and to what extent mitigation is required; thus, a determination on whether the sediment pose an unacceptable risk to ecological receptors is not made in the report.

While several LOE are discussed in the Wood report, the evaluation of impacts seems to be based on chemistry only. The observations made for each environmental media are not assessed and incorporated into an integrated conclusion to determine if adverse effects are occurring: to identify the ecological receptors potentially at risk, to evaluate the nature, severity, and areal extent of such adverse effects; and to identify the risk drivers causing or substantially contributing to adverse effects. As per one of the OMOE (now MECP) guiding principles "*any remediation decisions will be based primarily on biology, not chemistry, since chemical PSQGs (or other criteria in the absence of a PSQG value) are not clean-up numbers by themselves and need to be used in a risk assessment framework*" (OMOE, 2008).

4.2 Report Recommendations

The Wood report identified, described and assessed remedial options including no-action (e.g., do nothing option), physical capping, chemical inactivation and direct removal (e.g., dredging). As a result of a comparative assessment of remedial alternatives, the Wood report recommended complete removal of sediment in Chedoke Creek by hydraulic dredging as the primary means of remediation.

Based on the information reviewed, SLR agrees with the assessment concluding that physical capping and chemical inactivation are not the preferred remedial options, if remediation is required. However, SLR is of the opinion that the uncertainties associated with the current assessment do not fully support the direct removal of sediment option.

There is a high level of uncertainty associated with the sources of COPC (bacteria, nutrients, metals and PAHs); the Wood report recognized that enrichment has occurred prior to the Main/King CSO event and that other potential sources are ongoing.

An apparent incongruity appears between Sections 1 to 4 and Section 5 (Remedial Action Plan) of the Wood report. Sections 1 to 4 describe methods and results associated with assessment of sediment quality, water quality and natural environment (benthic invertebrate and fish communities). Findings related to sediment quality, water quality and natural environment show high levels of uncertainty, and some potential evidence of stress. Some findings also show some potential evidence of recovery; however, these statements are provided with caution because robust approaches to provide more certainty in these conclusions were not applied. In any case, compelling evidence supporting direct sediment removal was not provided in the report.

Incongruity appears in Section 5 because support for the Remedial Action Plan appears not to rest on the basis of findings from sediment, water and natural environment analyses focused on Chedoke Creek but rather from speculation on the fate and potential impact of potential loadings to Cootes Paradise that appear inconclusive: '*It is unclear whether the Cootes Paradise stations CP-1, CP-2, and CP-20, have been directly impacted by the Chedoke Creek discharge event* (Wood 2019).

In addition, because of ongoing sources of contamination, it is unclear if sediment dredging will ameliorate the current conditions or if the potential for recontamination has been evaluated. The report suggests that sediment removal will likely not restore Chedoke Creek. Section 5.2.1. of the report reads: "*As noted earlier, the source of the material is not certain and conditions prior to the spill event suggest that the ecological conditions of Chedoke Creek had already been significantly impacted, so removal is not likely to restore Chedoke Creek*". The Wood report indicates that sediment removal would be beneficial to the downstream receiving environment, Cootes Paradise. A high level of uncertainty is associated with this statement because nutrient enrichment has occurred in Cootes Paradise prior to the event and because it appears that most of the TP mass load (about 90%) has already been solubilized or transported downstream. In addition, the report does not discuss whether sediments in Chedoke Creek are in a state of relative equilibrium in terms of sediment transport, which could also influence interpretations and conclusions.

A discussion of the presence of higher concentrations of COPCs at depth and lack of vertical delineation seems to be missing from the analysis of the direct removal option. Based on the information provided in the Wood report it is unclear if all three management units will be remediated equally or if the remediation of selected areas, based on the severity of effects, has been considered. Other options such as partial or no sediment removal in association with a risk assessment do not seem to have been considered and should be evaluated further.

5.0 CLOSURE

SLR is pleased to carry out this review on behalf of the City of Hamilton. Should you have any questions, please do not hesitate to contact the SLR team members listed below:

Team Member	Role	Contact Information
Celine Totman, M.Sc., R.P.Bio Senior Scientist	Sediment and Surface Water Lead	(604) 738-2500 ctotman@slrconsulting.com
Gord Wichert, Ph.D., R.P.Bio. Senior Ecologist	Fisheries and Aquatic Habitat Lead	(905) 415-7248 gwichert@slrconsulting.com
Kimberley Tasker, M.Sc., R.P.Bio. Senior Ecologist	Benthic Invertebrate Lead	(905) 415-7248 ktasker@slrconsulting.com

Table 1: Additional SLR Review Comments

Wood Report Reference Location	Wood Statement	SLR Comment(s)
General Comments		
NA	NA	Rather than provide a description of the study area for context and understanding, the report commenced with a stated purpose of the investigation and methods for characterization of sediment quality and natural environment. The report would benefit from a brief description of the study area and its surroundings including land use, terrestrial and aquatic features and a figure showing the Chedoke Creek watershed, perhaps with a detailed inset showing the study area and location of the Main-King CSO relative to Chedoke Creek.
Sediment – Physical Characteristics		
2.1.1 Sediment Thickness, Characterization and Bathymetry	NA	The depth of the soft sediment has been measured based on sediment core refusal and used to provide an estimate of the soft sediment volume. The report recognizes uncertainty in the method used to estimate the volume of soft sediment as the coring locations were selected to provide sediment chemistry rather than sediment bathymetry information. While imagery for Chedoke Creek in 2013 and 2017 was provided it is unclear if this was used to inform the discussion on the Creek morphology and habitat. For example, Figure 5-3 shows the presence of depositional areas on the west side of the Creek in 2013 within the study area. In addition, although particle size information has been collected it is unclear if this information was used to inform the evaluation of sediment transport. Finally, the ongoing contribution of fines from other sources upstream of the study area (e.g., storm events, erosion, additional CSOs) does not seem to have been considered.
Sediment – Analytical Chemistry		
2.1.2 Sediment Quality	NA	The sediment samples were submitted for analysis of parameters generally associated with CSO evaluation. SLR recognizes that it is not practical to include all contaminants of potential concern (COPC) that are known to be associated with municipal wastewater discharges (e.g., pharmaceuticals and personal care products; endocrine disrupting compounds). Additional sediment variables that could have been added to the list include total organic carbon (TOC), AVS and hydrogen sulphides. These would provide additional information for interpreting the sediment chemistry data (e.g., bioavailability of COPC) and the concentrations of organics in the sediment.

Section 2.1 and Table B1-2a to Table B1-2f	NA	The evaluation of sediment quality was conducted according to recommended methods: comparison of analytical results to the Provincial Sediment Quality Guidelines (PSQGs), lowest effect level (LEL) and severe effect level (SEL), as presented in Table B1-2a to Table B1-2f. The evaluation of the analytical results for metals should also have included comparisons to background sediment concentrations for metals published by Ontario Ministry of Environment (OMOE, 2008). Comparisons to background would show that at some of the sampling locations, select metals exceeded the LEL but were below the natural background concentrations (e.g., cadmium, copper, nickel); thus, would not be considered metals of concern for the given sampling location(s).
Section 3.2, Figures 3-2 to 3-5 and Tables B1-2a to B1-2f.	NA	The interpretation of sediment quality focuses on comparing the concentrations in the grab and/or core samples to the PSQGs and the evaluation of potential effects is limited. The discussion does not clearly identify parameters that are potential drivers of risk or discuss the magnitude of potential adverse effects. Potential adverse effects are discussed in general terms and do not relate to site-specific exposure of ecological receptors. As per one of OMOE (now MECP) guiding principles "*any remediation decisions will be based primarily on biology, not chemistry, since chemical PSQGs (or other criteria in the absence of a PSQG value) are not clean-up numbers by themselves and need to be used in a risk assessment framework*" (OMOE, 2008)
Section 3.2 (page 9) and Figure 3-2	*"low dissolved oxygen concentration associated with the organic sediments in Chedoke Creek likely reduces the diversity of benthic invertebrates and favours a few tolerant species. This, in turn, limits the available food sources for fish.*" *"The highest porewater BOD results were found at sample transect C-5/G-6 immediately upstream of the Princess Point bridge, as shown on Figure 3-2, with the next highest BOD value observed at the G-3 sample transect located upstream of the Kay Drage Park bridge. These results indicate organic compounds are present in higher amounts at these sample locations and therefore require more oxygen for microbial metabolism, which typically suggests impaired environmental quality."*	The process of organic waste degradation, its measurement through biochemical oxygen demand (BOD) and its effects on dissolved oxygen (DO) levels are clearly explained in Section 3.2. The Canadian Council of Ministers of the Environment (CCME) has derived guidelines for DO. These guidelines should be used to support the statement on DO as well as describing the extent of the potential adverse effect. Chedoke Creek is described as a warm water system. The CCME DO guidelines for warm water system specify lowest acceptable DO concentrations of 6 mg/L for early life stages biota and 5.5. mg/L for other life stages. Based on an interpretation of Figure 3-2, location G6 appears to be below the guideline for early life stages but not for other life stages. Location G3 appears to have DO concentration above the minimum guidelines, this appears to contradict the statement made on the effect of DO.

Page 9	"…pathogenic contamination of the sediments within Chedoke Creek may present an ongoing risk to human health."	The presence of bacteria in sediment within the creek is identified, in the report, as a potential ongoing risk to human health via direct contact. While the term "risk" is used, a risk assessment including an evaluation of the potential human receptors and potential exposure pathways is not provided in the report.
Page 11	*"Unlike nutrients, metals pose a direct toxicity to living organism and removal of soft sediment material containing these metals would likely be beneficial to the ecological conditions within Chedoke Creek and downstream*".	This generic statement should be supported by the biological assessment results (benthic invertebrates) and/or toxicity tests as per OMOE (2008) guidance on managing contaminated sediment.
Appendix B1	NA	Quality assurance/quality control criteria were not presented in the report (e.g., blind field duplicates).
Appendix B1	Table notes for Tables B1-2a to 2f indicate that exceedances of the SEL were formatted as bold, underlined and shaded.	It seems that this rule has not been applied consistently, for example copper exceedances above the SEL were not consistently underlined.
Appendix B1	NA	SEL have been provided for PAHs, those were not shown in Table B1-2a to 2f. All the PAHs in sediment are below the SEL (assumed at 1% TOC).
Benthic Invertebrate Community		
2.2.1 Method	NA	The date at which the sediment grab samples were collected does not seem to have been provided. The time of sampling has potential implications on the species observed (e.g., period of emergence of some taxa as adults). This timing will also be important for any comparative analyses with future monitoring events.
4.1 Results	NA	The report uses several metrics to inform data interpretation and indicate general aquatic ecosystem health (%EPT, Simpson's Diversity Index, Hilsenhoff Biotic Index) which are common and appropriate for this study. However, once normalized for differences in physical habitat, there are no statistical analyses of these metrics among sampling locations.
Table B1-3	NA	Sediment grab samples were collected concurrently and submitted for analytical chemistry, particulate size and benthic invertebrate community structure analysis. Seven grab samples were collected for benthic invertebrate analysis. Particle size distribution results for Grab 7 seems to be missing. Analytical chemistry for Grabs 6 and 7 seems to be missing.

Section 4.1	NA	SLR agrees that chironomids and oligochaetes are generally considered tolerant to pollution. Although each group contains species with varying tolerance levels, certain taxa may be indicators of pollution. The analysis does not seem to discuss *genera* known to associate with elevated nutrient levels. Such analyses may be more diagnostic than general tolerance indicators and may demonstrate relationships between the CSO event and the benthic invertebrate biota.
Section 4.1 and Figure 4-1	*"Differences in habitat complexity are known to influence community metrics, such as taxa richness"*	The report presents information on sediment grain size associated with benthic invertebrate sample collections and notes that upstream sample locations contain coarser substrates than downstream sampling locations. Figure 4-1 shows a general upstream to downstream decline in Simpson's Diversity and Total Invertebrate Density. The report states, '*Differences in habitat complexity are known to influence community metrics, such as taxa richness*', but neither describes *how* habitat complexity influences community metrics, nor *whether* observed differences are within the expected range of variation. The benthic invertebrate results recognize presence of taxa tolerant to environmental stress but not whether presence and abundance is outside the range of expectations for locations within the study area.
Fish Community		
Section 4.2 (page 19)	generalist and specialist species	The report also refers to generalist and specialist species but does not define whether these species represent specialization, or generalization, in terms of habitat use, spawning or young rearing requirements, feeding habits, or other factors.
Section 4.2 (page 19)	"Tolerant species commonly include carps, suckers, sunfishes and basses (…)"	The report refers to sunfishes and basses as '*tolerant species*' (page 19). Fausch et al. (1990), a reference cited in the report, identified bass (sunfish are in the same family as bass) as indicators of high quality stream reaches because they were the first fish species to disappear downstream from sewage outfalls, this in contradiction to how bass and sunfish are used in the report.
Section 4.2	NA	The report should explain why integrative analyses of fish and water quality data were not considered. For example, the report shows results for total suspended solids (TSS). Given that fish exhibit a stress response to TSS ranging from behavioural avoidance to altered feeding habitats and physiological changes that can result in death when exposed to high TSS for sufficient duration (Newcombe and Jensen 1996), findings from fish community analyses could have been compared with water quality results to confirm whether findings corroborate anticipated trends. Fish species also show a range of sensitivity to dissolved oxygen, turbidity and other parameters associated with sewage discharge, and have demonstrated differences in relative abundance in response to effects of sewage discharge and sewage treatment in Toronto area waters (Wichert 1994; Wichert 1995).
Water Quality		

Section 4.4	Water quality plots	The analysis of water quality focuses on statistical comparisons of the water quality at select locations before and after the Gate 1 opening. The comparisons are provided as time series plots for select parameters and locations. An overall depiction of the concentrations of each parameter along the full length of the Creek (upstream, at CP-11 and downstream) seems to be missing from the report. In addition, the available plots do not include comparisons against federal or provincial water quality guidelines (CCME or PWQO) for the protection of aquatic life (e.g., a line representing the PWQO could be added to the plot).
Section 4.4	Water quality plots	The water quality plots seem to indicate that analytical data are available for late 2018, after the gate's correction (September and/or October 2018), these data were not used to evaluate the current water quality against federal or provincial water quality guidelines for the protection of aquatic life. For this reason, an identification of the potential COPCs under current conditions in surface water is not available from the report.
Section 4.4 (page22) and Figure 4-23; Figure 4-17	*"TSS concentrations appear fairly similar between 2009 and 2018 at stations CP-1, CP-2 and CP-20*" (downstream locations).	Figure 4-23 seems to show that TSS concentrations at CP-20 were lower during the event.
Section 4.4 (page22) and Figure 4-17	*"In general, the medians at stations CP-11 for TP, E. coli and TSS were lowest prior to 2014, increased between 2014 and 2017, increased again in early 2018 and decreased in late 2018*".	While this seems to be the case for TP and *E. coli*, Figure 4-17, shows the opposite for TSS. The median for TSS was higher prior to 2014 and decreased between 2014 and 2018. There seem to be uncertainties regarding the sources and variability of TSS in Chedoke Creek. This is an important point because the soft sediment in the study area has been attributed to TSS load discharged to Chedoke Creek between 2014 and 2018.

References

Newcombe, C.P. and J.O. Jensen. 1996. Channel Suspended Sediment and Fisheries: a Synthesis for Quantitative Assessment of Risk and Impact. North American Journal of Fisheries Management 16: 693-727.

OMOE (Ontario Ministry of Environment now Ministry of Environment, Conservation and Parks). 2008. Guidelines for Identifying, Assessing and Managing Contaminated Sediment in Ontario: An Integrated Approach.

Wichert, G.A. 1995. Effects of Improved Sewage Effluent Management and Urbanization on Fish Associations of Toronto Streams. North American Journal of Fisheries Management 15: 440-456.

Wichert, G. A. 1994. Fish as Indicators of Ecological Sustainability: Historical Sequences in Toronto Area Streams. Water Pollution Research Journal of Canada 29: 599-617

Memo

PUBLICLY RELEASED BY COUNCIL ON NOVEMBER 27, 2019

To: Mani Seradj, City of Hamilton

From: Ron Scheckenberger

Date: May 23, 2019

File: TPP188127

cc: Dale Klodnicki, Lance Lumbard

Re: **Chedoke Creek Project, Wood Commentary on SLR Peer Review Comments, City of Hamilton**

Thank you for providing the Peer Review Report for the Chedoke Creek project (ref. SLR, May 15, 2019). The Wood Team has reviewed the information as provided and offers the following for your consideration. As you indicated, several of the comments, while valid with a more fulsome timeline and budget, could not be addressed accordingly. We look forward to discussing these comments with City staff at your convenience.

1. General: Many of the comments regarding risk assessment and determining impacts attributable to the Main-King (M-K) CSO overflow event relative to other confounding factors and/or comparison to similar reference streams was not within the scope of work.

2. Section 2.2: Discussion of differing conditions upstream versus downstream of the M-K CSO suggests a lack of understanding by the review of the environmental setting; it would have been good to have a similar stream with permitted CSO discharge that had not experienced a similar event, to provide a suitable reference area, but this would likely have been very difficult to match Chedoke Creek conditions (and nearly impossible within the approved project timelines).

3. Section 2.2, Paragraph 2: The document *Guidelines for Identifying, Assessing and Managing Contaminated Sediment in Ontario: An Integrated Approach* could be utilized to provide the decision framework for handling the Chedoke Creek sediments. However, the scope was specific to addressing the sediments that were deposited specifically by the spill event, not a broad assessment of in-situ sediments or an investigation of potential contamination that may have been derived from any number of sources.

4. Section 2.2, Paragraph 3: The Wood Team considered that it was not possible to distinguish or characterize pre/active/or post biotic/abiotic conditions within the creek other than water quality since there is limited baseline ecological or chemical characterization. Instead, Wood focused on the available long-term water quality data and used that as a proxy for the other conditions.

5. Section 2.2, Paragraph 4: No suitable reference site was available and certainly not one that had been impacted previously similar to Chedoke Creek. Wood therefore estimated what was discharged during the spill and this was used as a direct quantification of new impacts from the spill event.

6. Section 2.2, Paragraph 5, Bullet 5: This is a difficult argument to make with any specificity to the spill-derived sediments. The site was already likely contaminated prior to the spill so any attempt to assess using weight-of-evidence may indicate that the sediments could be high risk (or not) but differentiating pre vs post spill event sediment would not be addressed by this approach.

7. Section 3.1, Paragraph 3: This could be performed but was not part of scope. Wood could add a citation here.

8. Section 3.1: SLR states potential COPC were not vertically delineated; however, Figures 3-3 through 3-5 show lower, mid and surface sample results for these parameters and differences among these strata are discussed in Section 3 of the report. Further, SLR suggests additional sediment analysis (e.g., toxicity tests) could have been conducted – this is true, but was not within the approved scope or budget.

9. Section 3.2, Paragraph 2: Again, it is not possible to distinguish pre-spill benthic invertebrate conditions from post-spill benthic invertebrate conditions so Wood did not quantify the impacts to benthic invertebrates from the spill event.

10. Section 3.2: Adding a discussion regarding expected BIC taxa typical of an urban stream would provide more context for comparison to existing conditions; however, without pre-overflow (or suitable reference area) BIC data for comparison to the current BIC, it is difficult to evaluate potential effects associated with the sediment contamination within the creek (as noted throughout the report).

11. Section 3.3, Paragraph 4: No conclusions made because of limited data and inability to distinguish impacts that may have caused changes in fish population prior to spill event.

12. Section 3.3: The fish community indicator metrics were developed to provide a general indicator of health, as indicated in the report and discussed with City of Hamilton. There are data limitations with regard to inconsistent effort (electrofishing seconds) and the report indicates subsequent monitoring would show further changes in community and improve data interpretation (also noted by SLR). Additional fish indicators may provide further interpretation using the existing data set, as noted by SLR.

13. Section 3.4: Clearer discussion regarding observed changes in habitat type and habitat-specific influences to the BIC and fish community may provide additional insight, as noted by SLR.

14. Section 3.5, Paragraph 1: This was the best available data that existed for pre, during, and post spill. Wood could add some additional supporting information stating the objective of water quality analysis to clarify.

15. Section 4.1, Paragraph 2: Chedoke Creek sediments are a mixture of impacts from pre-spill, spill, and post-spill conditions. Wood estimated the loading associated specifically with the spill event and rather than in-situ sediment characteristics which could be from many sources. Wood could perform additional evaluation if requested by the City, or this could become part of a future EA Study.

16. Section 4.1, Paragraph 3: Prior impacts unrelated to the MK CSO spill event could be causing biological impairments. Therefore, Wood focused on mass loading estimated from the spill event.

17. Section 4.1, Paragraph 5: The remedial action plan is based on defining and addressing the material that entered Chedoke Creek due to a discrete event caused by the subject MK CSO spill. There are confounding factors due to other potential sources of long-term non-point-source contamination which were likely ongoing prior to, during, and potentially even after the spill event which make assessing the impacts associated with the event difficult, if not impossible. Some of this material has likely been transported downstream but much of it is also likely still within the creek. Agreed that we could expand the evaluation to incorporate additional assessments of whether the material poses a risk based on the Ontario sediment guidelines. However, the sediments within Chedoke Creek were evaluated using the same PSQG LELs that are used as the basis of evaluation in the sediment guidance document.

Table 1 Comments

- Section 2.1.1: Figures 5-1 through 5-3 showing the 2013 and 2017 aerial imagery are showing different water levels (flow conditions), these show the changes in morphology discussed in the report (e.g., more coarse grained, higher velocity upstream).
- Section 3.2: sample location G-3 is located in an area with higher surface water velocity, typically meaning higher dissolved oxygen concentrations as shallow reaches of creek water are aerated when flowing through coarse substrate (riffles), whereas location G-6 is positioned near the Kay Drage Park bridge in an area of no measurable flow velocities, as such this location is expected to have lower surface water DO. Fig. 3-2 shows a general trend of decreasing DO concentration from upstream to downstream and suggests impaired environmental quality between these locations.

RBS/kf

HATCH

PUBLICLY RELEASED BY COUNCIL ON NOVEMBER 27, 2019

Updated Report for

City of Hamilton

CSO Facilities Assessment – MECP Order Items 4,7,8 and 9

November 30, 2018

City of Hamilton
CSO Facilities Assessment -
MECP Order Items 4,7,8 and 9

Contact:
Mark Stirrup - Principal Project Manager, Associate

Address:
5035 South Service Rd, Sixth Floor
Burlington, Ontario, Canada L7L 6M9
Tel: +1 (905) 315 3500
www.hatch.com

November 30, 2018

Date	Rev.	Status	Prepared By	Checked and Approved By
11/30/18	1	Final	Mark Stirrup, M.Eng., P.Eng.	Graeme Henderson, P.Eng., PMP

HATCH

Table of Contents

1. Introduction and Background

On August 2, 2018, the Ministry of Environment, Conservation and Parks (MECP) issued Provincial Officer's Order #1-J25YB (hereinafter referred to as the Order) to the City in relation to the discharge of untreated wastewater to the environment.

This report addresses MECP Order Items 4, 7, 8 and 9, which include the following specific requirements:

Item 4 requires the City to inspect all CSO facilities and inventory all critical valves (bypass gates) and control points (overflows) which can be a source of discharge to the natural environment and which would not be captured by existing flow monitoring equipment, including confirmation of manual and SCADA valve position correlation and local or remote control.

Item 7 requires the City to evaluate the need for modification(s) to the Main/King CSO Facility, to improve monitoring, performance, reliability and to minimize bypasses/overflows/spills into the 2400 mm storm outfall from the (CSO tank) overflow trough and inlet chamber bypass.

Item 8 requires the City to evaluate the need for modification(s) similar to those required by Item 7 above for all other CSO facilities within the Hamilton Wastewater Collection System to minimize bypasses/overflows/spills.

Item 9 requires the City to prepare a written report which sets out the evaluation required by the Items 7 and 8 above, along with recommendations and timelines to implement these recommendations.

This report discusses the findings of the CSO facility inspections and evaluation of the need for modifications to improve the monitoring, performance and reliability of each facility to minimize the potential for unapproved bypasses/overflows/spills from the facilities (Items 4, 7 and 8); and provides recommendations required by Item 9 of the Order.

2. Methodology

Work on Order Item 4 began with a desktop assessment and review of existing as-built drawings; specific gate/valve equipment cut-sheets and maintenance manuals; and overall O&M manuals, process control narratives (PCNs), and standard operating procedures (SOPs) for all critical control points (CCPs) at each of the City's CSO facilities.

The purpose of the desktop review was to assist with the inventory of the specific gate/valve equipment installed at each of CSO facilities; and document the intended mode(s) of operation of the equipment under various flow conditions (dry weather flow (DWF) and wet weather flow (WWF)); and the potential for possible discharge to the natural environment under various gate positions and/or operating modes. It also helped to plan for the site visits to inspect the facilities, to focus on the information required to meet the requirements of MECP Order Items 4, 6, 7, 8 and 9.

Next, site visits were completed of all the City's CSO facilities to: i) inspect all critical valves (bypass gates) and control points that could, under certain conditions, be a source of a discharge to the natural environment, and which would not be measured by existing flow monitoring equipment at each site; ii) confirm the ultimate outlet location of such discharges; and iii) confirm manual (actual) and SCADA valve position correlation, and local/remote control capabilities.

The site visits were used to confirm and/or augment the findings of the desktop review and finalize the assessment and inventory of the critical gate/valve equipment at each CSO facility, as presented in this report.

The following CSO facilities were visited and inspected in person by City and Hatch staff on October 2 and November 7, 2018:

1) Greenhill CSO Tank #1 (HCS01)
2) Bayfront Park CSO Tank (HCS02)
3) James Street CSO Tank (HCS03), including Ferrie-Mary CSO Regulator Gate (HCG03)
4) Main/King CSO Tank (HCS04)
5) Eastwood Park CSO Tank (HCS05), including Burlington-Ferguson and Ferrie-Ferguson CSO Regulator Gates (HCG06 and HCG07)
6) Greenhill CSO Tank #2 (HCS06)
7) Red Hill Storage Facility (HCS07), including Lawrence Road, Queenston Road and Barton Street Gates (HCS7A, HCS7B and HCS7C) and Lawrence/King CSO Gate (HCG05)
8) Royal Avenue CSO Tank (HCS08)
9) McMaster/Ewen CSO Tank (HCS09)
10) Wentworth/Rosemary CSO Gate (HCG03)
11) Brampton/Strathearne CSO Gate (HCG04)
12) Wellington/Burlington CSO Gate (HCG14)
13) Parkdale Pumping Station (HC001)

The findings of the CSO facilities desktop review and site inspections were then combined and studied further to evaluate the need for and provide recommendations for any modifications needed to improve the monitoring and performance of each of the CSO facilities, and to minimize unapproved bypass events and/or increase the Operators' ability to identify and deal with such events.

+ For Order Item 7, this included the evaluation of possible modification(s) to the Main/King CSO facility, to improve monitoring, performance and reliability, and to minimize unapproved bypasses/overflows/ spills into the 2,400 mm storm outfall from the CSO tank overflow trough and inlet chamber bypass.
+ For Order Item 8, this included the evaluation of similar modifications at the other twelve CSO facilities within the Hamilton Wastewater Collection System to minimize unapproved bypasses/overflows/ spills into adjacent receiving waters.

This report presents the findings of the above investigation, covering all the deliverables related to Order Items 4, 7 and 8, for each inventoried Critical Control Point (CCP), and providing recommendations required under Order Item 9.

The remainder of this report is broken down facility by facility, including a separate section for each of the City's existing CSO facilities (at the locations noted above).

3. Discussion

The following sections of the report provide a brief narrative description of each of the above CSO facilities and their purpose, and include a series of drawings/figures showing the location of the CCPs at each facility, and also indicating the potential for possible unapproved sewage discharges to the environment from each CCP, colour coded as follows:

- Green indicates CCPs that convey sewage flows to the Woodward Avenue WWTP, with absolutely no potential for DWF or WWF discharges to the environment. This includes all manual and motorized flow control gates and pumps that convey sewage flows towards the WWTP during DWF and WWF.
- Yellow indicates CCPs that convey sewage flows into the CSO storage facilities, which if operated correctly, have no potential for DWF discharges to the environment, and have the potential to contribute to WWF discharges to the environment only if the design capacity of the CSO storage facilities are exceeded and an overflow occurs following the normal course of events. This includes all manual and motorized flow control gates and manual stop logs/gates that divert sewage flows into the CSO storage facilities during WWF.
- Red indicates CCPs that under default settings convey sewage flows to the WWTP or into the CSO storage facilities, so have no potential for discharge to the environment under normal operating conditions; but could cause a sewage discharge to the environment if they are moved from their default positions. This includes any manual or motorized gates or manual stop logs/gates that could be used to bypass the CSO storage facilities to allow isolation of the facilities to conduct maintenance inside them. It should be noted that this is unlikely to be done, and if it was, significant planning, approvals and mitigation measures would be required to be undertaken before implementing such a bypass.

Each section also includes a table providing an inventory of all the CCPs at each facility, including their name; SCADA tag name (where applicable); size/capacity; whether they are manually operated or motorized; their purpose in terms of flow control; their default position (as per the facility's PCN and/or SOP); their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

3.1 Greenhill CSO Tank #1 (HCS01)

The original Greenhill CSO Tank (HCS01) is an underground reinforced concrete structure that provides approximately 83,500 m^3 of CSO storage capacity, and was designed to capture the runoff from a 15 mm design storm. The storage volume is provided within a circular tank, which is approximately 54 m in diameter and 9 m deep, and includes two separate storage cells. The first cell provides approximately 13,900 m^3 of storage, and if the first cell fills, the second cell provides approximately 69,600 m^3 of additional storage.

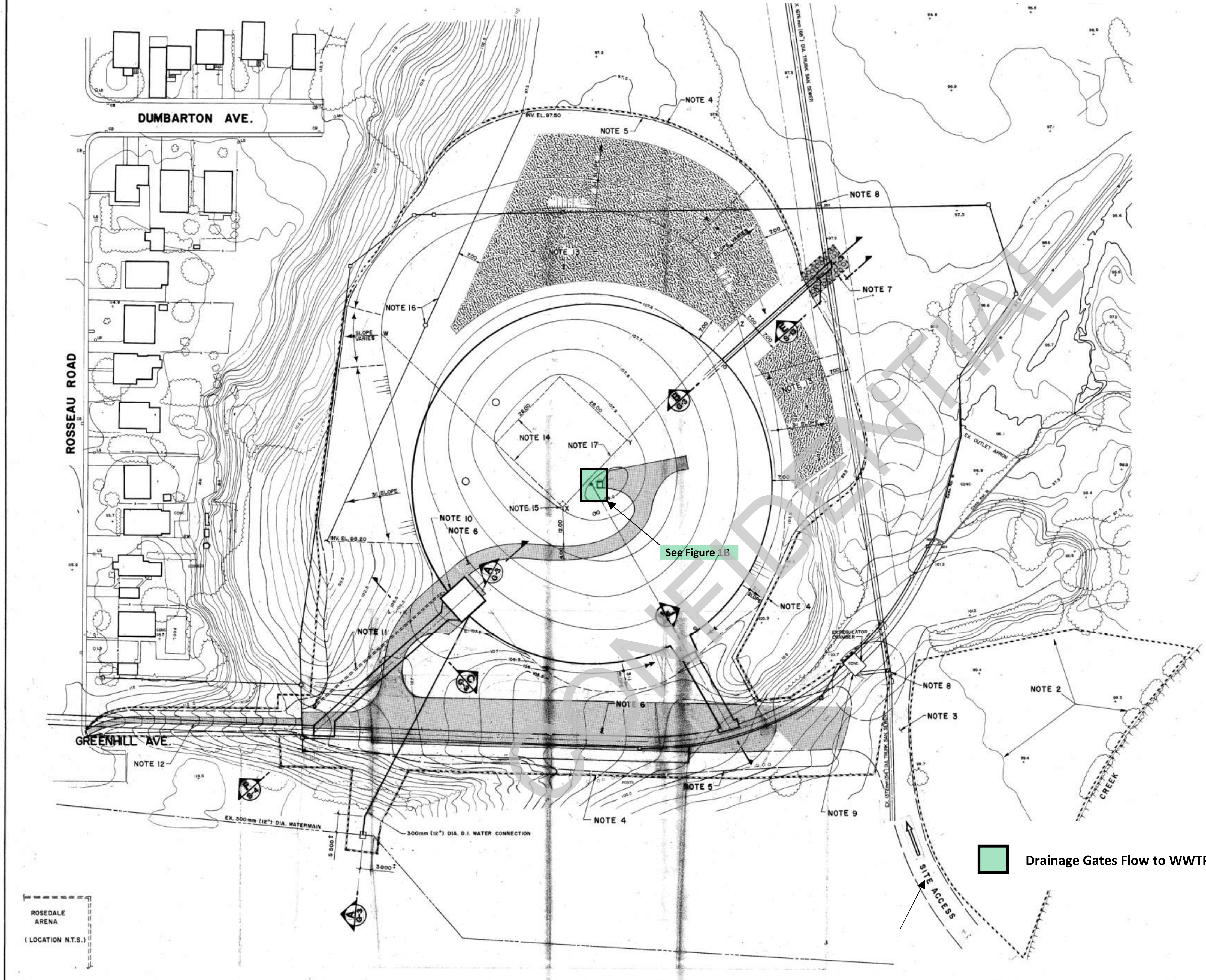
Originally, HCS01 received sewage inflows directly from the combined trunk sewer running east along Greenhill Avenue, but with the addition of Greenhill CSO Tank #2 (HCS06), the original CSO tank now receives the overflows from the new CSO tank. The combined operation of the two CSO tanks is discussed in more detail below in Section 3.6.

HCS01 is filled by gravity from the overflow from HCS06, and drained by motorized flow control gates over the discharges from the two storage cells, into the Red Hill Creek Sanitary Interceptor Sewer (RHCSI), which conveys flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). The gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station.

Figures 1A and 1B show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described above. Table 1 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 1A: Greenhill CSO Tank #1 (HCS01) – Site Plan



NOTES TO THE CONTRACTOR

1. THE PROJECT BENCH MARK IS LOCATED ON THE NORTH FACE OF ROSEDALE ARENA, 2 m EAST OF UNION GAS METER; ELEVATION 115.820 m.
2. CONTRACTOR'S WORKING AREA, TO BE USED FOR CONVENIENCES, STORAGE OF MATERIALS AND STOCKPILING OF TOPSOIL AND EXCAVATED MATERIAL. NO TREES WITHIN THIS AREA SHALL BE CUT.
3. EXISTING ACCESS ROAD TO PLAYING FIELDS SHALL BE KEPT CLEAR AT ALL TIMES.
4. CONSTRUCTION AREA LIMITS. NO CLEARING WILL BE PERMITTED BEYOND THIS LINE.
5. APPROXIMATE EXTENT OF VERTICAL ADJUSTMENT OF GRADE. NEW ELEVATIONS SHALL BE BLENDED SMOOTHLY INTO EXISTING.
6. SHADED AREAS INDICATE THE LAYOUT OF GRAVEL ROADWAYS AND PARKING AREAS, NEW AND EXISTING, TO BE RECONSTRUCTED AND RAISED UNDER THIS CONTRACT; SEE SPECIFICATIONS, SECTION 1A.
7. WORK IN THIS AREA MAY BE DONE ONLY DURING THE PERIOD BETWEEN OCTOBER 20 AND MAY 15. ALL SURFACE FEATURES SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
8. EXISTING MANHOLE TOPS TO BE MODIFIED, AS PER DETAIL ON DRAWING G-3.
9. EXISTING REGULATOR CHAMBER TO BE MODIFIED UNDER THIS CONTRACT. SEE DETAILS ON DRAWING G-3.
10. FOR LOCAL GRADE ELEVATIONS AROUND CONTROL BUILDING, SEE DRAWING A-1.
11. APPROXIMATE LOCATION OF TERMINATION POLE AND UNDERGROUND CABLE ROUTE. FOR CONTINUATION SEE DRAWING E-1.
12. ASPHALT-PAVED PATHWAY, SEE SPECIFICATIONS, SECTION 1A.
13. THESE AREAS MAY BE USED FOR BURYING IMPORTED CONSTRUCTION RUBBLE. EARTH COVER ON RUBBLE TO BE A MINIMUM OF 1.200 m. SEE SPECIFICATIONS, SECTION 1A.
14. THIS SQUARE AREA TO BE GRADED LEVEL AT ELEVATION 107.900.
15. CONTROL POINT 'X' 11.00 m FROM CENTRE OF TANK ALONG C.L. 'A', OFFSET 1.00 m FROM C.L. 'A'.
16. 450 mm DIA. C.S.P. CULVERT AND CLEAN-OUT MANHOLE. SEE SPECIAL PROVISIONS, SECTION 1A.
17. ANGLE BETWEEN CONTROL LINE XYZ AND COLUMN LINE 'A' - 4.46° DISTANCES: XW = XZ = 76.500 m.
18. ALL GRASSED AREAS DISTURBED DUE TO CONSTRUCTION OPERATIONS, WITHIN AND OUTSIDE THE WORKING LIMITS SHOWN, SHALL RECEIVE TOPSOIL AND SOD AS SPECIFIED. REFER TO STANDARD SPECIFICATIONS FOR DESCRIPTION OF RESTORATION WORK.

Drainage Gates Flow to WWTP – No Potential for DWF or WWF Discharge at this location

REV	D M Y	REVISION DESCRIPTION	DRN	SUPV	DES	CHK	ENG
	15 01 86	ISSUED FOR TENDERS					J.H.
A	27 11 85	ISSUED FOR APPROVAL		J.D.	K.P.		K.P.

CONSULTING ENGINEER: K. M. PIORO
UMA Engineering Ltd.

SITE DEVELOPMENT PLAN
UMA REF. No. 1831-029 | CONTRACT No. RMH-85-01(S) | PROJECT No. 807-15
SCALE 1:500 | DATE DEC. 20, 1985 | DRAWING No. G-2

APPROVED
COMMISSIONER OF ENGINEERING
DIRECTOR

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
DEPARTMENT OF ENGINEERING
GREENHILL AVENUE STORAGE FACILITY
8684

Figure 1B: Greenhill CSO Tank #1 (HCS01) – CSO Tank Drainage Gates

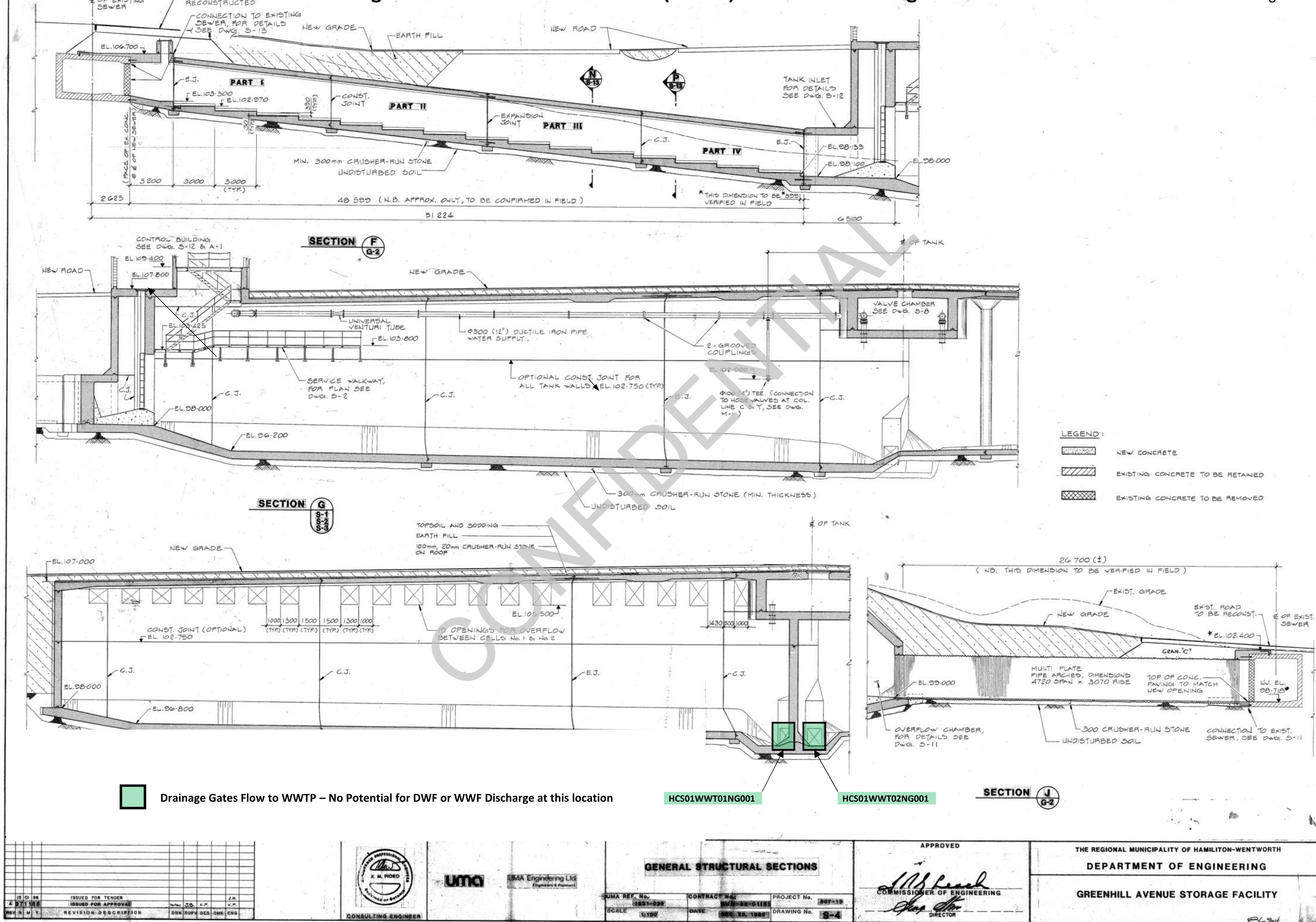


Table 1: Inventory of Critical Control Points at Greenhill CSO Tank #1 (HCS01)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Cell No. 1 Drain Gate	HCS01WWT01NG001	1200 x 1200 mm	Motorized	To drain stored CSO from Storage Cell No. 1	Fully Closed; Opened only to drain the CSO Tank	None	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
Cell No. 2 Drain Gate	HCS01WWT02NG001	1200 x 1200 mm	Motorized	To drain stored CSO from Storage Cell No. 2	Fully Closed; Opened only to drain the CSO Tank	None	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

3.2 Bayfront Park CSO Tank (HCS02)

The Bayfront Park CSO Tank (HCS02) covers an area of approximately 3,200 m^2, and is over 6 m deep, providing approximately 21,000 m^3 of CSO storage capacity in two equally sized storage cells. A 4.0 m x 1.5 m box sewer (which later changes to 2,250 mm diameter) intercepts CSOs from the former Queen and Hess Street CSO outfalls and conveys them to the CSO tank. Flow into the tank is regulated by static CSO regulators at Queen/Barton, Stuart/Hess, and Stuart/Caroline, and by the Strachan Street Sewage Pumping Station (HC003). A flow regulating chamber is also provided upstream of the tank (near the CSO tank outfall), which includes three gates that can be operated to convey all flows into the CSO tank (in their default positions) or to provide a maintenance bypass of the tank (in their alternate positions). This is explained further below.

During DWF conditions, all flow is directed to the WWTP via the CSO regulators and the three (3) dry pit pumps in the pumping station (3 x 180 L/s).

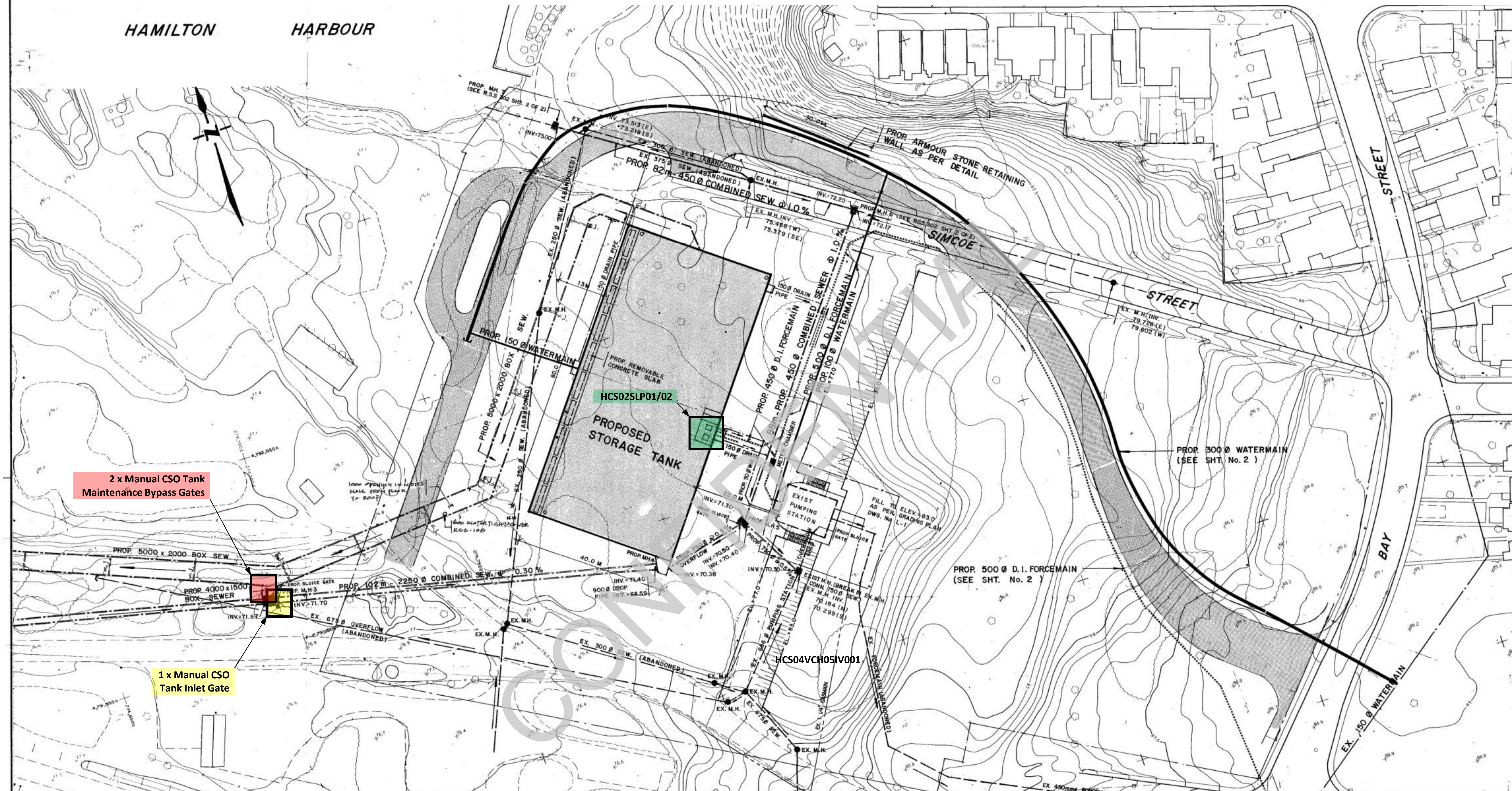
During WWF conditions, excess flows from the three static CSO regulators overflow into the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour via the outfall sewer that exits the north-west corner of the tank. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank. If the tank fills completely, CSOs are conveyed via a 5,000 mm x 2,000 mm box sewer to the outfall that enters the Harbour at the east end of the inlet between the park and the railway lands.

Combined sewage retained in the tank during wet weather is subsequently returned to the Western Sanitary Interceptor (WSI) and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 200 L/s submersible pumps located in Cell 1. A flap gate between Cell 1 and Cell 2 allows the two cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the WSI near Strachan and MacNab Streets. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

The entire facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station. Stand-by power is provided for the sewage pumping station by a diesel power generator.

Figures 2A to 2C show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously. Table 2 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 2A: Bayfront Park CSO Tank (HCS02) – Site Plan



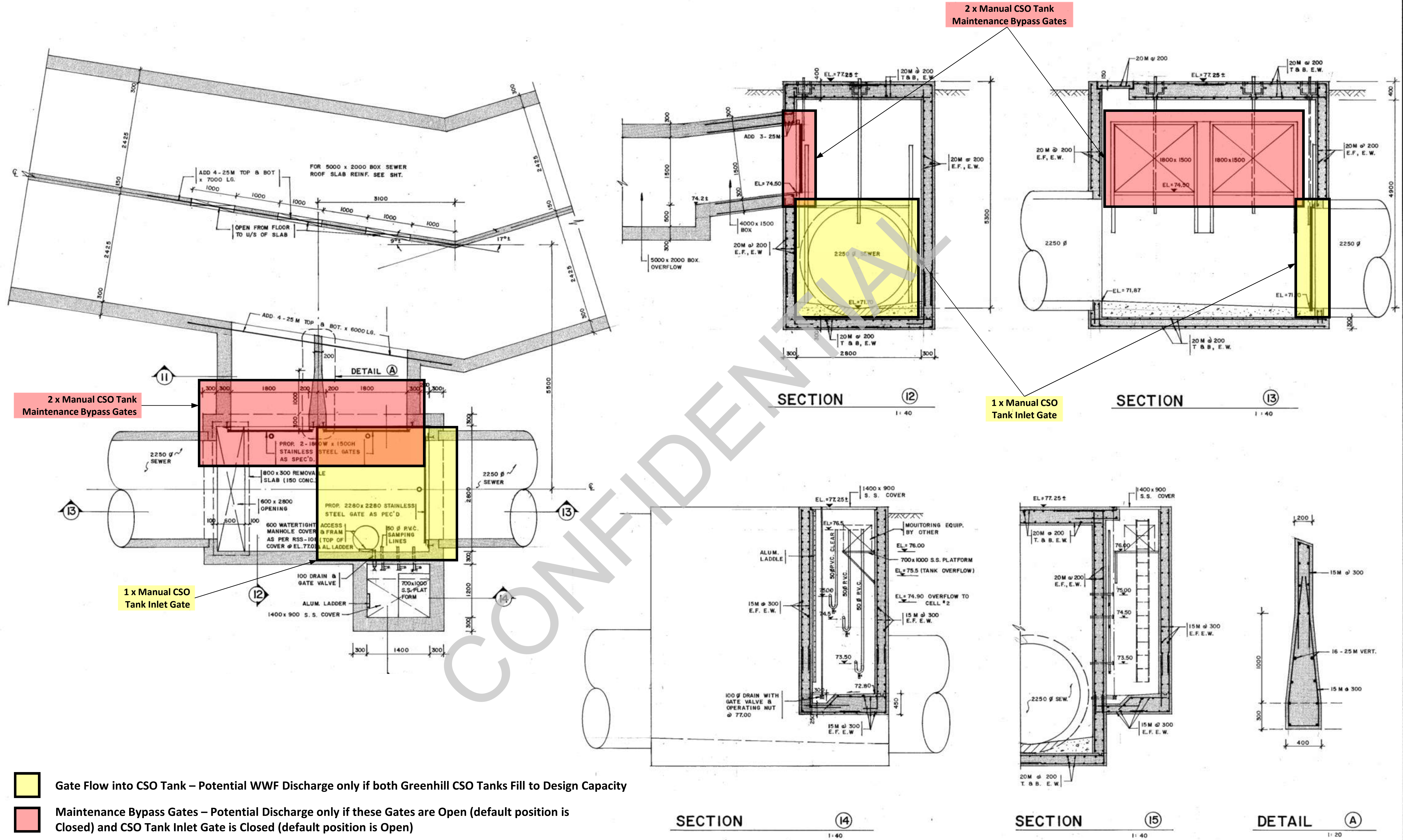
Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location

Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if both Greenhill CSO Tanks Fill to Design Capacity

Maintenance Bypass Gates – Potential Discharge only if these Gates are Opened (default position is Closed) and CSO Tank Inlet Gate is Closed (default position is Open)

No.	REVISIONS	DATE	INITIAL	NOTES:	SCALES 1:500	DIRECTOR	APPROVED COMMISSIONER OF ENGINEERING	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH DEPARTMENT OF ENGINEERING	PROPOSED STORAGE TANK STRACHAN STREET SITE PLAN
							DATE: 92-02-17	PROJECT No. 819-118	DRAWING No. 92-S-14 SHEET 1 OF 37

Figure 2B: Bayfront Park CSO Tank (HCS02) – CSO Tank Inlet and Maintenance Bypass Gates

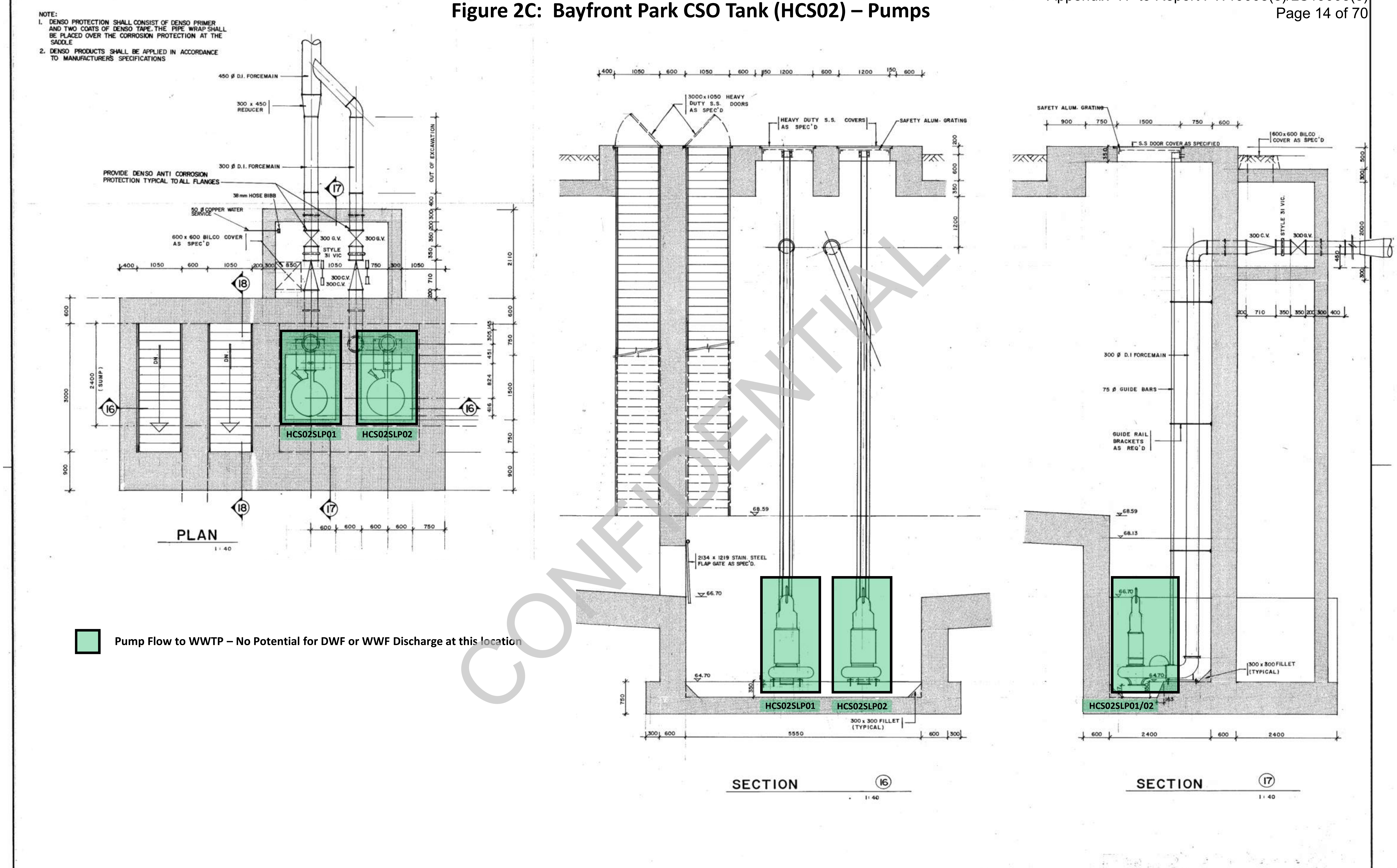


Gate Flow into CSO Tank – Potential WWF Discharge only if both Greenhill CSO Tanks Fill to Design Capacity

Maintenance Bypass Gates – Potential Discharge only if these Gates are Open (default position is Closed) and CSO Tank Inlet Gate is Closed (default position is Open)

No.	REVISIONS	DATE	INITIAL	CHECKED BY	DRAWN BY	SCALES	DIRECTOR	APPROVED		
					T. HO	AS NOTED		COMMISSIONER OF ENGINEERING	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH DEPARTMENT OF ENGINEERING	PROPOSED STORAGE TANK STRACHAN STREET MANHOLE No. 3 DETAIL SECTIONS
									DATE: 92 - 02 - 17 PROJECT No. 819 - 118	DRAWING No. 92 - S - 14 REV. 0 SHEET 17 OF 37

Figure 2C: Bayfront Park CSO Tank (HCS02) – Pumps



Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location

No.	REVISIONS	DATE	INITIAL	CHECKED BY	DRAWN BY T. HO	SCALES 1:40	DIRECTOR	APPROVED COMMISSIONER OF ENGINEERING	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH DEPARTMENT OF ENGINEERING	PROPOSED STORAGE TANK STRACHAN STREET PLAN, SECTIONS
									DATE: 92 - 02 - 17 PROJECT No. 819 - 118	DRAWING No. 92 - S - 14 REV. 0 SHEET 16 OF 37

Table 2: Inventory of Critical Control Points at Bayfront Park CSO Tank (HCS02)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Tank Inlet Gate	N/A (Not on SCADA)	2280 x 2280 mm	Manual	Controls WWF into CSO Tank	Fully Open	In default Fully Open position: No potential for DWF discharge; and Potential for WWF discharge only if CSO tank fills to design capacity.	+ No significant changes required to PCN, but the operation of this manual Tank Inlet Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
Maintenance Bypass Gate No. 1	N/A (Not on SCADA)	1800 x 1500 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed	In Default Fully Closed Position: No potential for DWF or WWF discharge. Potential for WWF discharge only if Tank Inlet Gate is Closed and one or both of these Maintenance Bypass Gates are Opened.	+ No significant changes required to PCN, but the operation of these manual Maintenance Bypass Gates should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6 + Evaluate options to physically lock both gates in Fully Closed position
Maintenance Bypass Gate No. 2	N/A (Not on SCADA)	1800 x 1500 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed		
Sewage Lift Pump No. 1	HCS02SLP01	200 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling; On to drain the CSO Tank	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 2	HCS02SLP02	200 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling; On to drain the CSO Tank	None	+ No significant changes required to PCN or SOP
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

3.3 James Street CSO Facility (HCS03 and HCG08)

The James Street CSO Storage Facility (HCS03) incorporates both off-line and in-line storage components, which provide a total CSO storage capacity of approximately 3,200 m^3.

The off-line storage tank is an underground, reinforced concrete structure, which resides beneath the parking lot of the Royal Hamilton Yacht Club, located at the north end of James Street. The rectangular tank covers an area of approximately 900 m^2, and is 0.8 to 2.1 m deep, providing approximately 1,400 m^3 of CSO storage capacity.

The off-line storage capacity is augmented by 1,800 m^3 of in-line storage, which is provided within the 1,400 mm diameter combined sewer downstream of the CSO tank. The additional in-line storage is created by the Ferrie-Mary CSO Regulator Gates (HCG08). The HCG08 sluice gates control the rate of flow from the James Street combined sewer system into the WSI at Ferrie and Mary Streets. These gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

During DWF conditions, the gates are set to allow all flow to enter the WSI. During WWF conditions, the gates can be partially or completely closed to throttle the flow of combined sewage into the WSI, and begin filling the storage facilities. The rate of filling is determined by the position of the gates. The in-line storage pipe will fill first, and as levels in this pipe increase, the off-line storage tank will also begin to fill. If the tank fills completely, CSOs are discharged to Hamilton Harbour via the pre-existing 1,200 mm x 900 mm CSO outfall at the north end of the tank. Stainless steel underflow baffles are employed above the tank overflow to retain floatable materials within the tank.

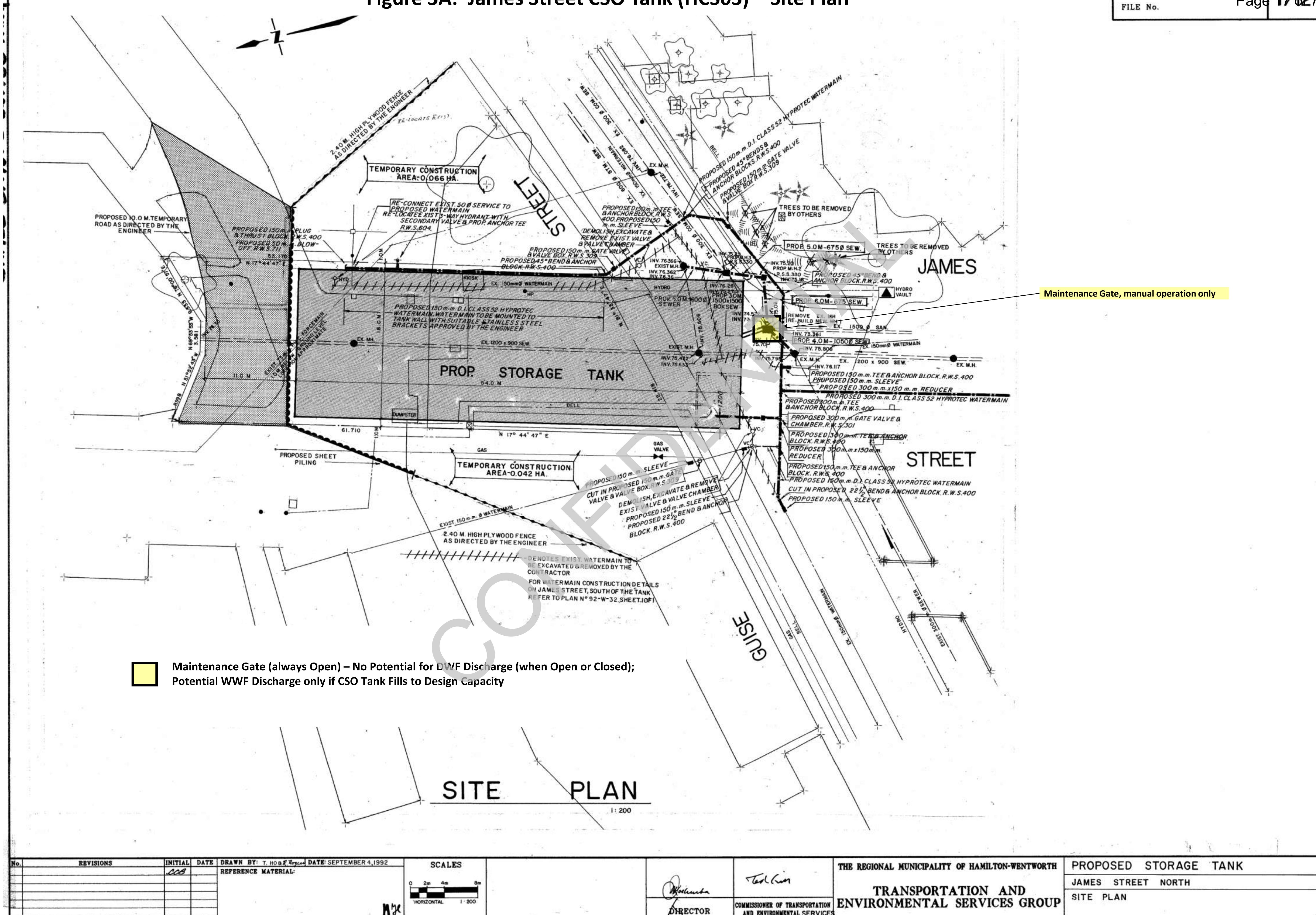
Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by gravity as the in-line storage pipe empties. The rate of drainage from the in-line storage pipe and the off-line storage tank is determined by the position of the HCG08 gates, which can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

The facilities are monitored and controlled via SCADA by Operators at the WWTP.

Figures 3A to 3D show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

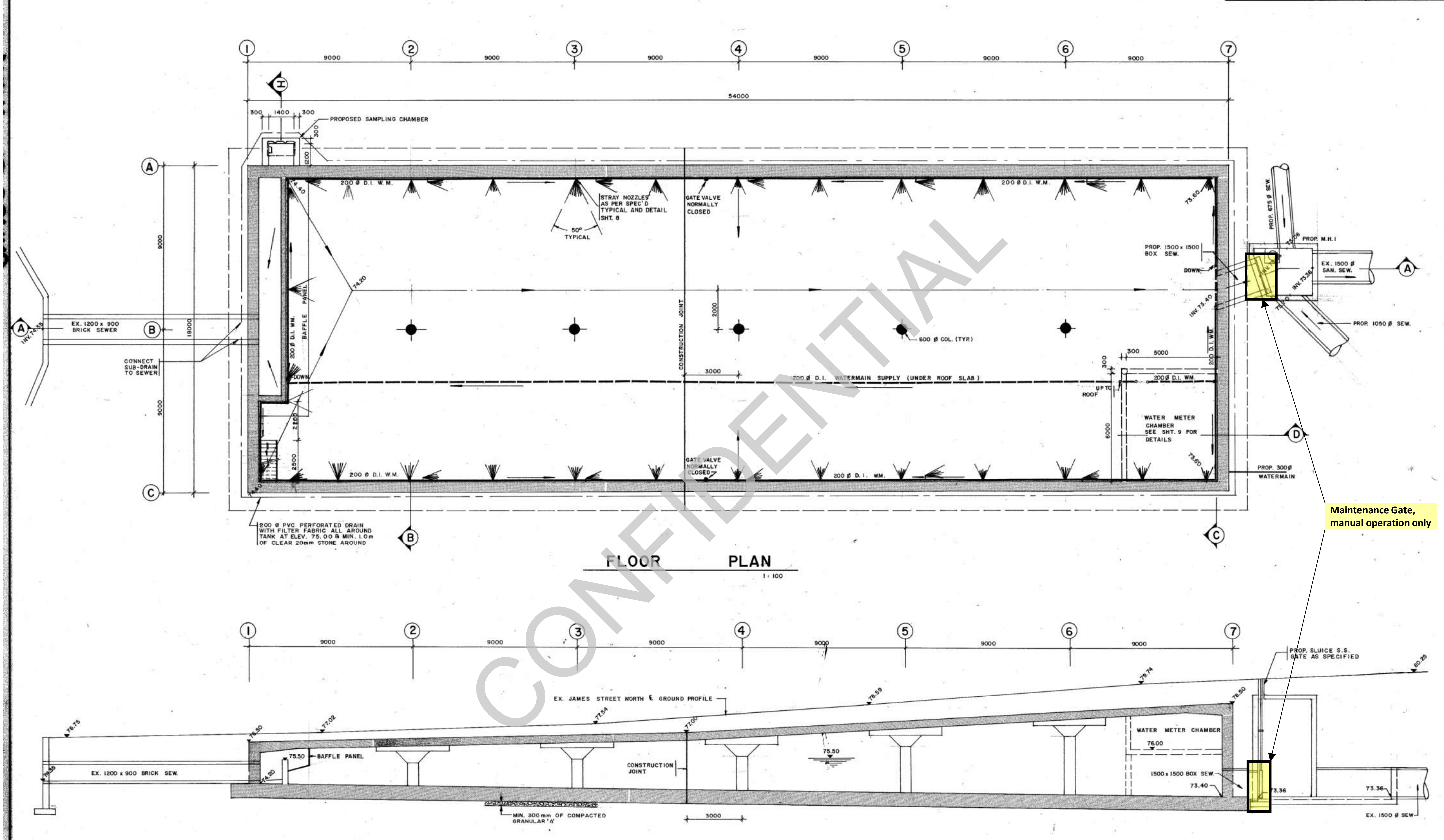
Table 3 provides an inventory of all the CCPs at the two facilities, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 3A: James Street CSO Tank (HCS03) – Site Plan



CONTRACT No. RHW 92-78 (ST.) | SHEET No. 2 / 12
DRAWING No. 92 - S - 45
FILE No. ___-__

Figure 3B: James Street CSO Tank (HCS03) – Maintenance Gate



Maintenance Gate (always Open) – No Potential for DWF Discharge (when Open or Closed); Potential WWF Discharge only if CSO Tank Fills to Design Capacity

No.	REVISIONS	INITIAL	DATE	DRAWN BY: T. HO	DATE: SEPTEMBER 4, 1992	SCALES 1:100
				REFERENCE MATERIAL:		

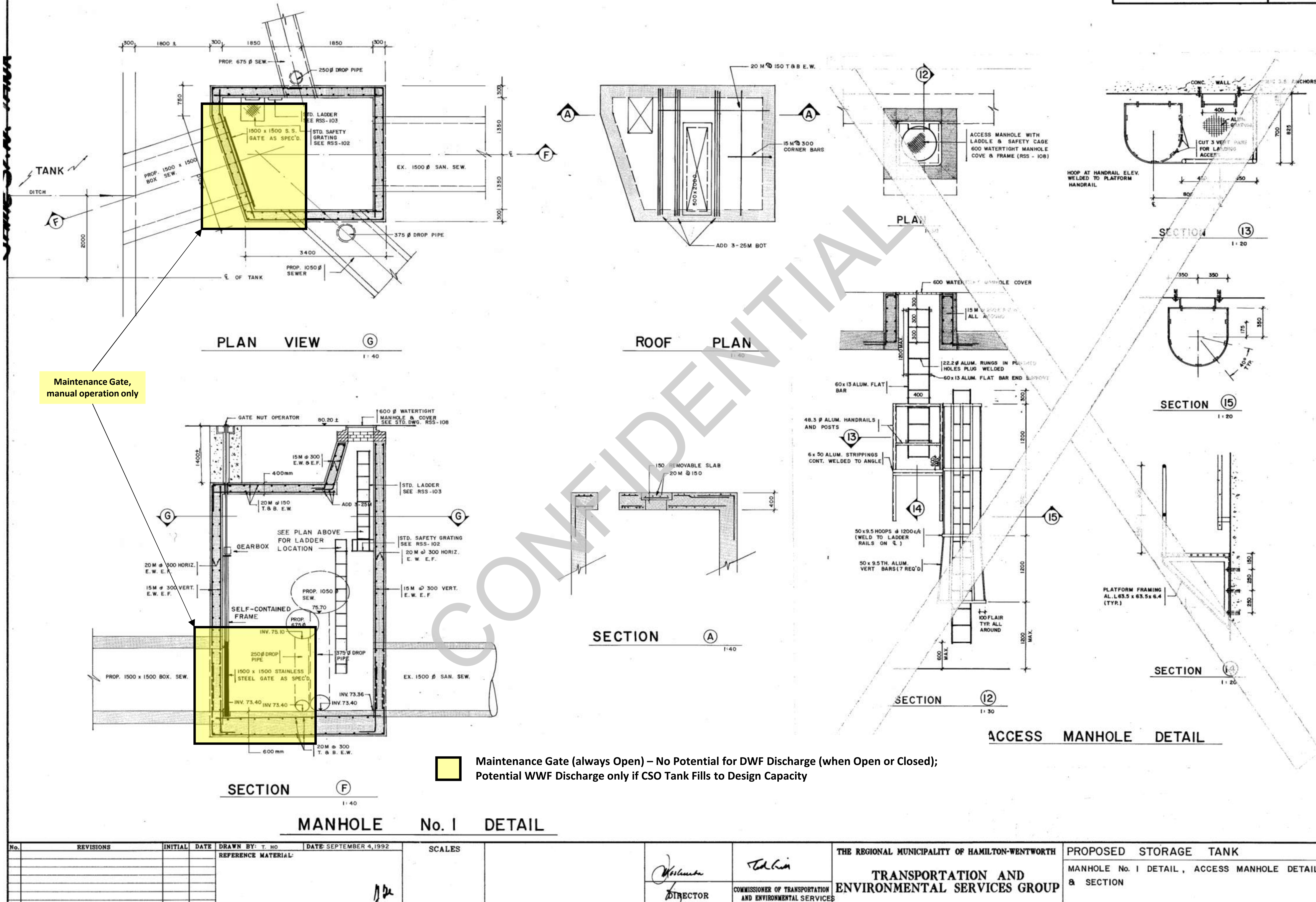
DIRECTOR

COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP

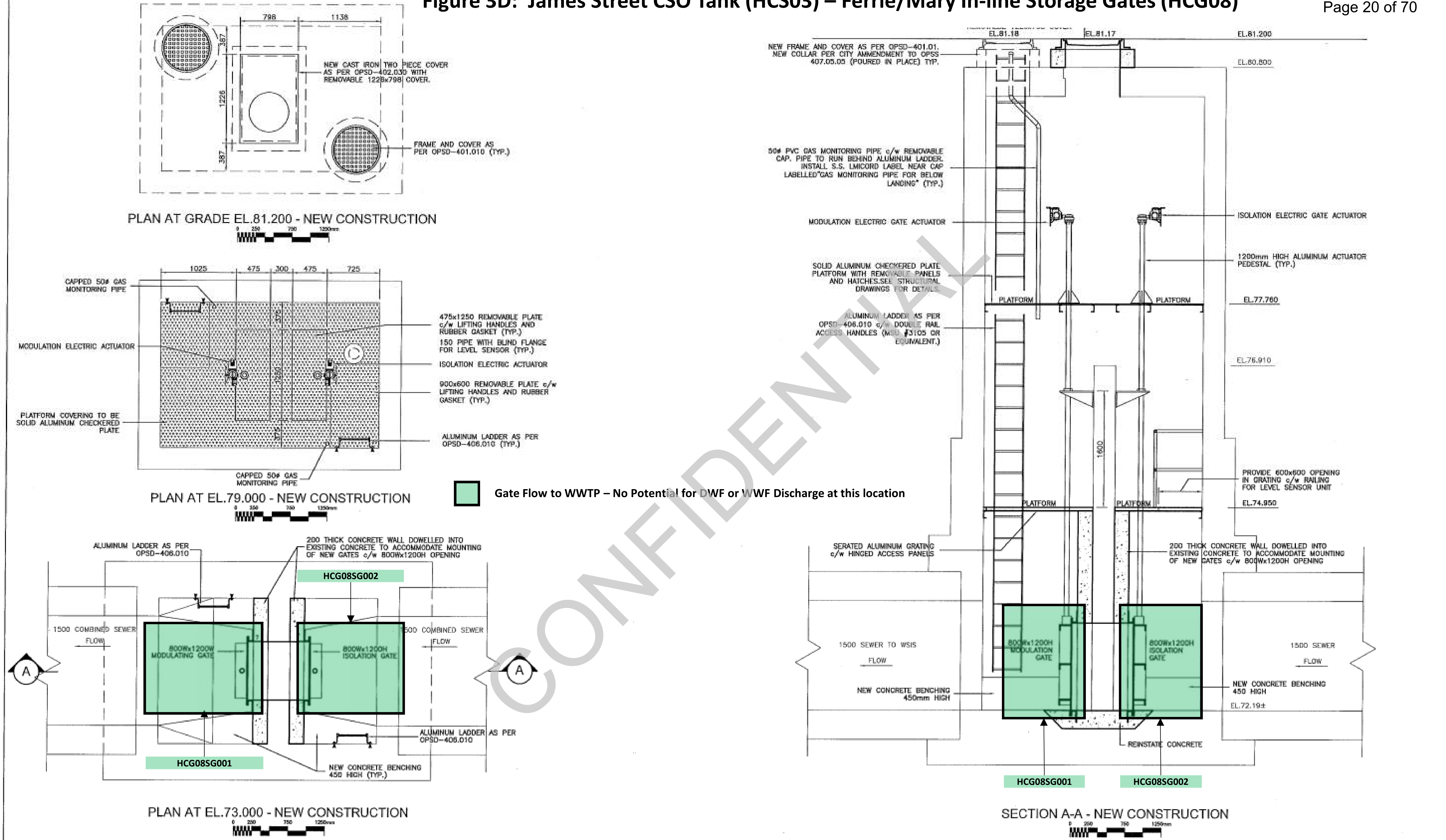
PROPOSED STORAGE TANK
JAMES STREET NORTH
FLOOR PLAN & CROSS SECTION

Figure 3C: James Street CSO Tank (HCS03) – Maintenance Gate



Maintenance Gate (always Open) – No Potential for DWF Discharge (when Open or Closed); Potential WWF Discharge only if CSO Tank Fills to Design Capacity

Figure 3D: James Street CSO Tank (HCS03) – Ferrie/Mary In-line Storage Gates (HCG08)



Notes
1. GATE AND ACTUATOR DIMENSIONS MOUNTING DETAILS SHOWN ARE FOR REFERENCE ONLY. CONTRACTOR TO SUBMIT SHOP DRAWINGS TO ENGINEER FOR REVIEW AND APPROVAL FOR GATES, ACTUATORS AND ALL ASSOCIATED MOUNTING EQUIPMENT. MOUNTING ANCHORS ARE TO BE 13ø x140mm LONG S.S. CHEMICAL ANCHOR BOLTS. SPACING AND LAYOUT AS PER MANUFACTURERS RECOMMENDATIONS.

No.	Description	By	Date
1	ISSUED FOR PRELIMINARY DESIGN	C.G.	11.07.11
2	ISSUED FOR 50% DESIGN	C.G.	11.09.13
3	ISSUED FOR 90% DESIGN	C.G.	11.10.13
4	ISSUED FOR TENDER	J.R.	11.11.21
5	ISSUED FOR CONSTRUCTION	J.R.	12.02.24
6	AS BUILT	J.R.	13.03.21

Consultants
Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON Canada
K1Z 7T1

BPR CSO
5100, Sherbrooke Street East, Suite 900
Montreal, (Quebec), Canada H1V 3R9
Phone: 514 257-0707
Fax: 514 257-2414

Stamps

CITY OF HAMILTON
Public Works Department

CITY OF HAMILTON
RTC IMPLEMENTATION PROJECT

MARY/FERRIE (HCG08)
REGULATOR SITE

PLAN AND SECTION SHOWING NEW CONSTRUCTION

Scale	Designed	Checked	Drawn	Project No.	Date	Dwg. No.	Issue
AS SHOWN	C.G.	J.R.	E.C.		11.05.02	A-C08	6

Table 3: Inventory of Critical Control Points at James Street CSO Tank (HCS03)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Maintenance Gate over CSO Tank Inlet/Outlet Pipe	N/A (Not on SCADA)	1500 x 1500 mm	Manual	Maintenance Gate that can be used to isolate the CSO tank if in-tank maintenance work is required	Fully Open	In default Open position: No potential for DWF discharge; and Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN, but the operation of this manual Maintenance Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
Ferrie-Mary Control Gate No. 1	HCG08SG001	800 x 1200 mm	Motorized	Operated in tandem, these two gates create in-line storage in sewer downstream of HCS03; which ultimately also causes the tank to fill	Fully Open in DWF; Closed in WWF	In these default positions, no potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
Ferrie-Mary Control Gate No. 2	HCG08SG002	800 x 1200 mm	Motorized		Fully Open in DWF; Closed in WWF		
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

3.4 Main/King CSO Tank (HCS04)

The Main/King CSO Tank (HCS04) covers an area of approximately 9,500 m^2, and is over 8 m deep, providing approximately 77,100 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 23,300 m^3 of storage, and the second provides a further 53,800 m^3 of storage. The Main/King CSO Tank operates off-line, with combined sewage entering the tank only during larger CSO events. Flow into the tank is regulated by three WWTP-controlled CSO regulators that were constructed in conjunction with the CSO tank. The former Glen Road CSO Outfall, which was located at the east end of Glen Road on the west side of Hwy 403, was effectively eliminated by installing a new WWTP-controlled CSO regulator gate at Glen/Macklin (Chamber 1) and constructing a new 1,350 mm diameter sewer to convey CSOs underneath Hwy 403 and into the CSO tank. The former McKittrick CSO Outfall, which previously diverted CSOs from the 1,980 mm diameter combined sewer that conveys flows to the WSI, was eliminated by constructing a new WWTP-controlled CSO regulator (Chamber 4) to divert CSOs into the new tank. Flow from the 2,100 mm x 2,250 mm box sewer which runs along the south side of Main Street was diverted into the new tank by a bulkhead placed in the sewer and a new WWTP-controlled CSO regulator located at the south-east corner of the tank (Chamber 5). Downstream of the bulkhead, this sewer is used to convey the overflows which will still occur from the tank when its design capacity is exceeded.

During DWF conditions, all flow is directed to the WWTP via the WSI. The gate in Chamber 4 (King Street Sewer) is set to be Fully Open; the gate in Chamber 5 (Interceptor Sewer) is set to 30% Open; and the gate in Chamber 1 (Glen Road Sewer) is always set at 35%. The Main Street Overflow Sewer, which maintains a base flow during dry weather due mainly to infiltration, is directed to the CSO tank's wet well and pumped into the interceptor sewer.

During WWF conditions, the pumps are taken out of auto mode and turned off; the opening of Gate 4 is reduced to 7%; and the opening of Gate 5 is reduced to 2%. Excess flow from the three regulators enters the pumping station wet well, which is located beneath the control building at the south-east corner of the facility. During dry weather and small storm events, the CSO tank's pumping station acts as a normal sewage pumping station. During larger storm events, two motorized sluice gates are opened to permit flow from the wet-well to enter the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged into Chedoke Creek near the Main Street overpass, via the original 2,100 mm x 2,250 mm box sewer outfall. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank's wet well includes an Influent Well Overflow Gate that can be operated to convey all flows into the CSO tank and pumping station (when Closed) or to provide a maintenance bypass of the tank (when Open). The current PCN for HCS04 incorrectly indicates that during DWF conditions this gate should be 5% open, and during WWF conditions this gate should be 100% open. The default settings for the gate should actually be Fully Closed during both DWF and WWF conditions.

Combined sewage retained in the tank during wet weather is subsequently returned to the Combined Sewer System (CSS) and conveyed by the WSI to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by three (3) 375 L/s submersible pumps located in the pumping station wet well. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the original 1,980 mm sewer, which in turn discharges into the WSI near Hunt Street. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

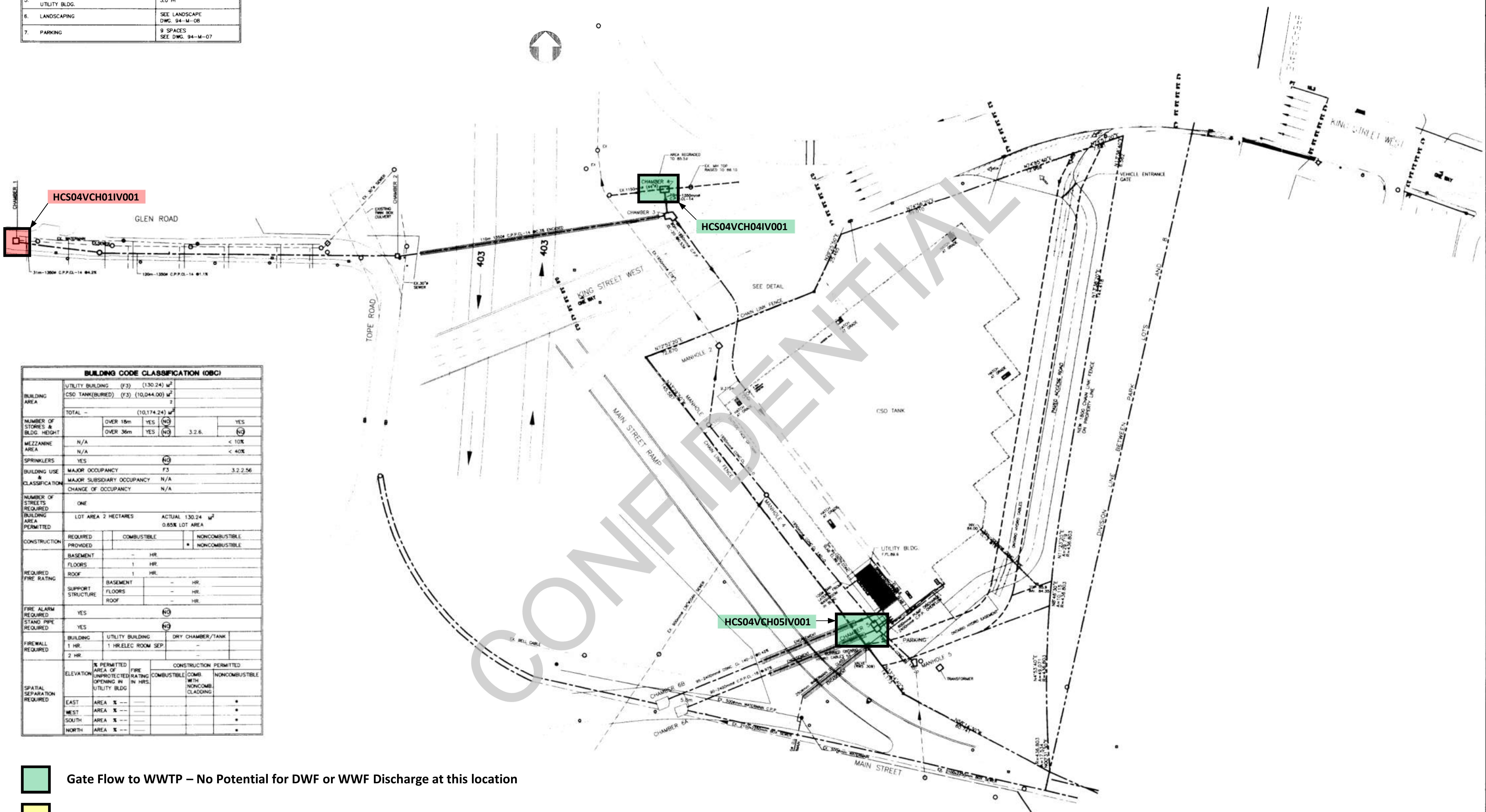
Figures 4A to 4C show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 4 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

CONTRACT No. | DRAWING No. 94-M-01 | FILE No. 3900SITE

Figure 4A: Main/King CSO Tank (HCS04) – Site Plan and External Flow Control Gates

SITE DATA	
ZONING : 'A' DISTRICT – 'OPEN SPACE'	
1. LOT AREA	20,000 m^2
2. LOT FRONTAGE	257.419 m
3. BUILDING AREA UTILITY BLDG. % OF LOT	0.65 % – UTILITY BUILDING (BURIED TANK – N/A)
4. BUILDING SETBACK Minimum: Actual:	12.00 m 13.75 m
5. BUILDING HEIGHT UTILITY BLDG.	3.0 m
6. LANDSCAPING	SEE LANDSCAPE DWG. 94–M–08
7. PARKING	9 SPACES SEE DWG. 94–M–07



BUILDING CODE CLASSIFICATION (OBC)							
BUILDING AREA	UTILITY BUILDING (F3) (130.24) m^2						
	CSO TANK(BURIED) (F3) (10,044.00) m^2						
	2						
	TOTAL – (10,174.24) m^2						
NUMBER OF STORIES & BLDG. HEIGHT		OVER 18m	YES	NO		YES	
		OVER 36m	YES	NO	3.2.6.	NO	
MEZZANINE AREA	N/A					< 10%	
	N/A					< 40%	
SPRINKLERS	YES			NO			
BUILDING USE & CLASSIFICATION	MAJOR OCCUPANCY			F3		3.2.2.56	
	MAJOR SUBSIDIARY OCCUPANCY			N/A			
	CHANGE OF OCCUPANCY			N/A			
NUMBER OF STREETS REQUIRED	ONE						
BUILDING AREA PERMITTED	LOT AREA 2 HECTARES			ACTUAL 130.24 m^2 0.65% LOT AREA			
CONSTRUCTION	REQUIRED		COMBUSTIBLE			NONCOMBUSTIBLE	
	PROVIDED			•		NONCOMBUSTIBLE	
REQUIRED FIRE RATING	BASEMENT	– HR.					
	FLOORS	1 HR.					
	ROOF	1 HR.					
	SUPPORT STRUCTURE	BASEMENT	– HR.				
		FLOORS	– HR.				
		ROOF	– HR.				
FIRE ALARM REQUIRED	YES			NO			
STAND PIPE REQUIRED	YES			NO			
FIREWALL REQUIRED	BUILDING	UTILITY BUILDING		DRY CHAMBER/TANK			
	1 HR.	1 HR.ELEC ROOM SEP.		–			
	2 HR.			–			
SPATIAL SEPARATION REQUIRED	ELEVATION	% PERMITTED AREA OF UNPROTECTED OPENING IN UTILITY BLDG	FIRE RATING IN HRS.	CONSTRUCTION PERMITTED: COMBUSTIBLE	COMB. WITH NONCOMB. CLADDING	NONCOMBUSTIBLE	
	EAST	AREA % --	——			•	
	WEST	AREA % --	——			•	
	SOUTH	AREA % --	——			•	
	NORTH	AREA % --	——			•	

Gate Flow to WWTP – No Potential for DWF or WWF Discharge at this location

Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if CSO Tank Fills to Design Capacity

Gate Flow to WWTP – Potential WWF Discharge only if Gate is Opened more than 35% (normal default position)

No.	REVISIONS	INITIAL	DATE
A	ISSUED FOR CLIENT REVIEW	T.R.	8/11/94
B	ISSUED FOR TENDER	T.R.	16/11/94
C	RECORD DRAWING	D.W.	1997

DRAWN BY: DATE: OCT.'94
REFERENCE MATERIAL:
X-REF. FILE: – 3900DTMFASBLT.DWG
PLOT 1=.75

SCALE 1:750

R.V. Anderson Associates Limited

DIRECTOR

COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

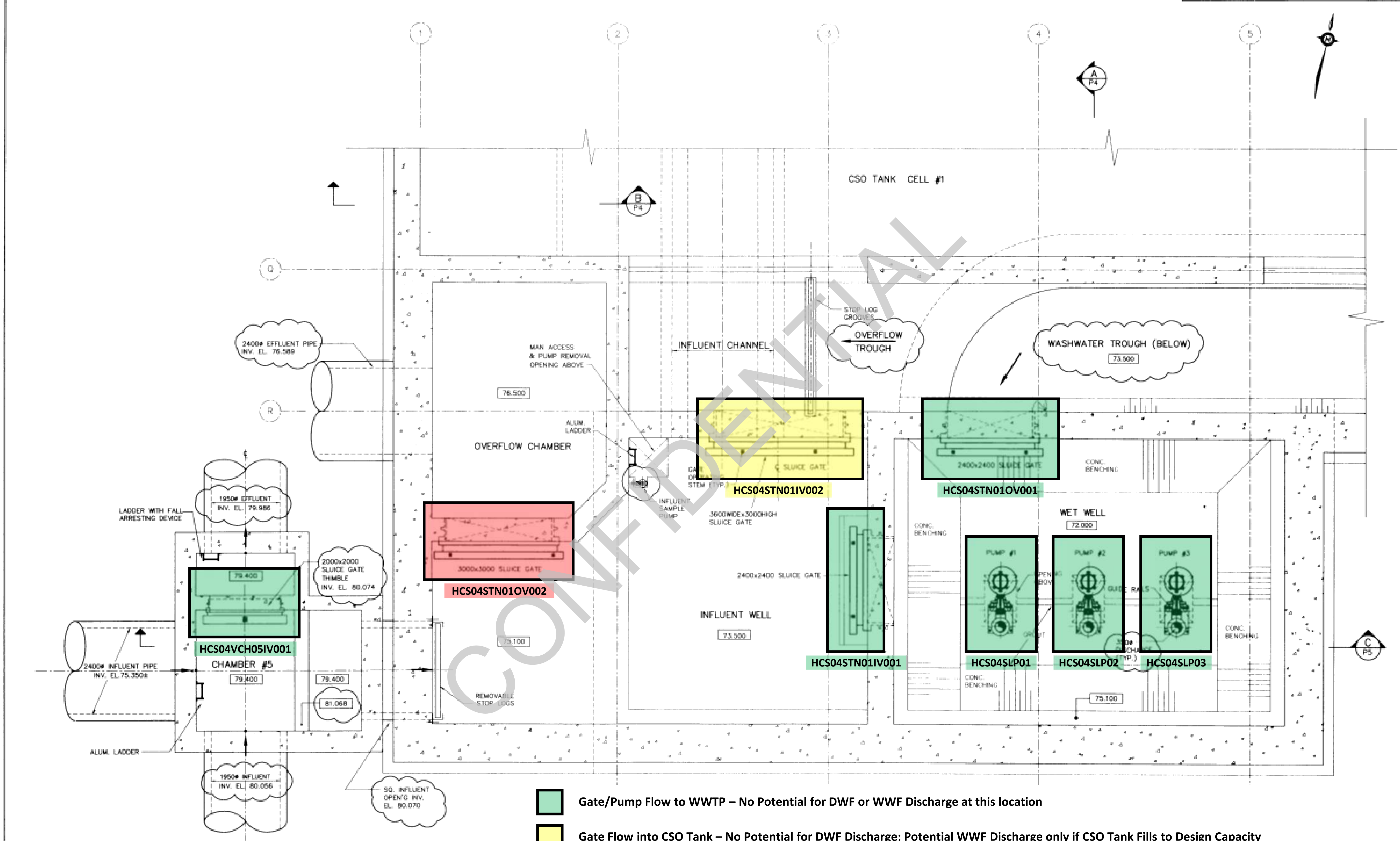
TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP

MAIN/KING CSO TANK

SITE PLAN

Figure 4B: Main/King CSO Tank (HCS04) - Influent Wet Well, Control Gates and Pumps

DRAWING No. 94-P-03
FILE No. 3900P3



- Gate/Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location
- Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if CSO Tank Fills to Design Capacity
- Maintenance Bypass Gate – Potential Discharge only if this Gate is Open (default position is Closed) and sewage level in Influent Well exceeds 76.600 m

No.	REVISIONS	INITIAL	DATE
A	ISSUED FOR CLIENT REVIEW	T.R.	8/11/94
B	ISSUED FOR TENDER	T.R.	18/11/94
C	RECORD DRAWING	DW	1997

DRAWN BY: DATE: OCT. '94
REFERENCE MATERIAL:

SCALE 1:50

R.V. Anderson Associates Limited

DIRECTOR

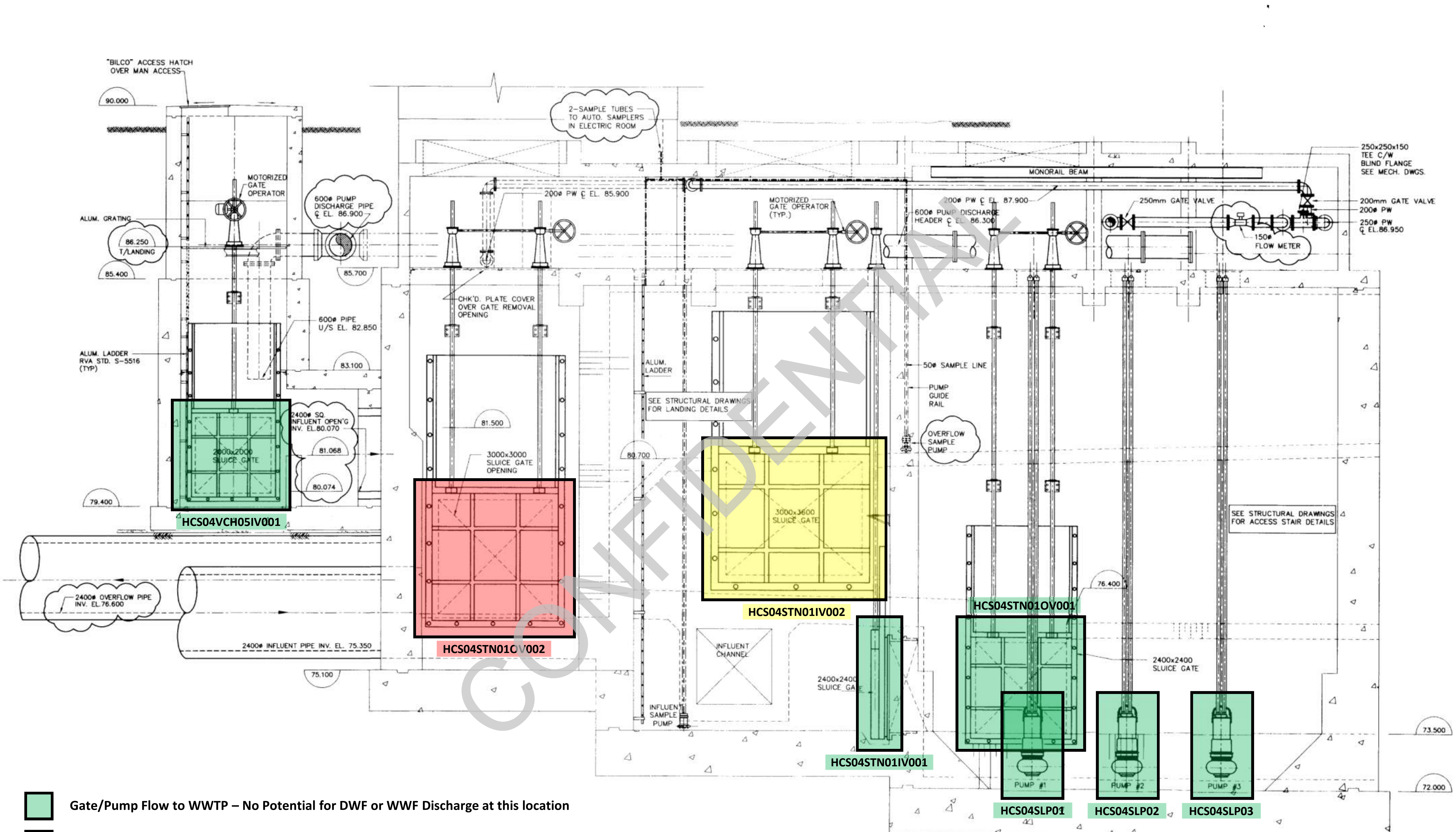
COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES

THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP

MAIN/KING CSO TANK
PROCESS
PUMP GALLERY
WET WELL PLAN

Figure 4C: Main/King CSO Tank (HCS04) - Influent Wet Well, Control Gates and Pumps

DRAWING No. 94-P-05
FILE No. 3900P5



Gate/Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location

Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if CSO Tank Fills to Design Capacity

Maintenance Bypass Gate – Potential Discharge only if this Gate is Open (default position is Closed) and sewage level in Influent Well exceeds 76.600 m

No.	REVISIONS	INITIAL	DATE
A	ISSUED FOR CLIENT REVIEW	T.R.	8/11/94
B	ISSUED FOR TENDER	T.R.	16/11/94
C	RECORD DRAWING	DW	1997

DRAWN BY: DATE: OCT. '94
REFERENCE MATERIAL:
SCALE 1:50
R.V. Anderson Associates Limited consulting engineers and architect
DIRECTOR
COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES
THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH
TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP
MAIN/KING CSO TANK
PROCESS
PUMP GALLERY
SECTIONS (II)

Table 4: Inventory of Critical Control Points at Main/King CSO Tank (HCS04)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Chamber 1 Gate, on Glen Road	HCS04VCH01IV001	1100 x 1700 mm	Motorized	Conveys underflow to WWTP; and overflows into the CSO tank	35% Open in DWF; 10% Open in WWF	In default positions: No potential for DWF or WWF discharge at these locations; Potential for WWF discharge only if CSO tank fills to design capacity	+ Consider simplifying the operation of these gates, to employ the same position during both DWF and WWF conditions + Exact gate positions to be determined by further investigation, with recommendations included in response to MECP Order Item 6 + Consider removing electrical operation of the gate + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
Chamber 4 Gate, behind Cathedral	HCS04VCH04IV001	1220 x 1220 mm	Motorized	Conveys underflow to WWTP; and overflows into the CSO tank	Fully Open in DWF; 7% Open in WWF		
Chamber 5 Gate, outside CSO tank control bldg	HCS04VCH05IV001	1500 x 1500 mm	Motorized	Conveys underflow to WWTP; and overflows into the CSO tank	30% Open in DWF; 2% Open in WWF		
Influent Well Overflow Gate (Maintenance Bypass Gate)	HCS04STN01OV002	3000 x 3000 mm	Manual	Allows tank bypass if Opened and Tank Inlet Gate Closed	5% Open in DWF 100% Open in WWF	Potential for DWF and WWF discharges at this location based on current PCN	+ PCN needs to be revised to correct default position of this gate, which should be Fully Closed at all times + Note that this gate is padlocked in Fully Closed position + Conduct engineering study to consider the feasibility of adding level sensor and/or flow meter in chamber on downstream side of gate (to confirm no flow through it)
Wet Well Inlet Gate	HCS04STN01IV001	2400 x 2400 mm	Motorized	Controls flow from CSO Tank Influent Well into Wet Well; can be closed to isolate Wet Well for maintenance	Fully Open	None	+ No changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
CSO Tank Cells Inlet Gate	HCS04STN01IV002	3000 x 3000 mm	Motorized	Controls flow into CSO tank storage cells from CSO Tank Influent Well	Closed in DWF; Open in WWF	Potential for WWF discharge only if CSO tank fills to design capacity	
CSO Tank Cells Outlet Gate	HCS04STN01OV001	2400 x 2400 mm	Motorized	To drain stored CSO from the CSO tank into Wet Well	Open in DWF; Closed in WWF	None	
Sewage Lift Pump No. 1	HCS04SLP01	375 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	+ No changes required to PCN or SOP
Sewage Lift Pump No. 2	HCS04SLP02	375 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	
Sewage Lift Pump No. 2	HCS04SLP03	375 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

3.5 Eastwood Park CSO Tank (HCS05)

The Eastwood Park CSO Tank (HCS05) covers an area of approximately 4,000 m^2, and is over 6 m deep, providing approximately 27,350 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 14,700 m^3 of storage, and the second provides a further 12,650 m^3 of storage. A sewer along Dock Service Road intercepts the CSOs from the two outfalls and conveys them to the CSO tank. The original Catharine Street (1,050 mm) and Ferguson Avenue (1,500 mm) CSO outfalls were left in place and are used to carry the overflow from the CSO tank on the infrequent occasions when the design capacity of the tank is exceeded. A flow splitter diverts the overflow from the tank between the two previously existing outfall sewers.

The Eastwood Park CSO Tank operates off-line, with combined sewage entering the tank only during larger CSO events. Flow into the tank is regulated by static CSO regulators at Catharine/Brock, Picton/Ferguson and MacAulay/Ferguson and by the two WWTP- controlled CSO regulators at Burlington/Ferguson and Ferrie/Ferguson.

During DWF conditions, the Burlington/Ferguson (HCG06) and Ferguson/Ferrie Streets (HCG07) sluice gates normally remain open, directing all flow to the WSI sewer and on to the WWTP.

During WWF conditions, excess flows from the Catharine/Brock CSO regulator and the five CSO regulators along Ferguson Avenue overflow into the tank. When rainfall occurs, the pumps in the CSO tank are turned off, and the HCG06 and HCG07 gates are fully closed, eliminating flow into the WSI at these locations. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour through either the Catharine Street or Ferguson Avenue CSO outfalls. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank inlet chamber at the north-east corner of the tank includes three gates that can be operated to convey all flows into the CSO tank (in their default positions, with the CSO tank inlet gate open and the two CSO tank maintenance gates closed) or to provide a maintenance bypass of the tank (in their alternate positions).

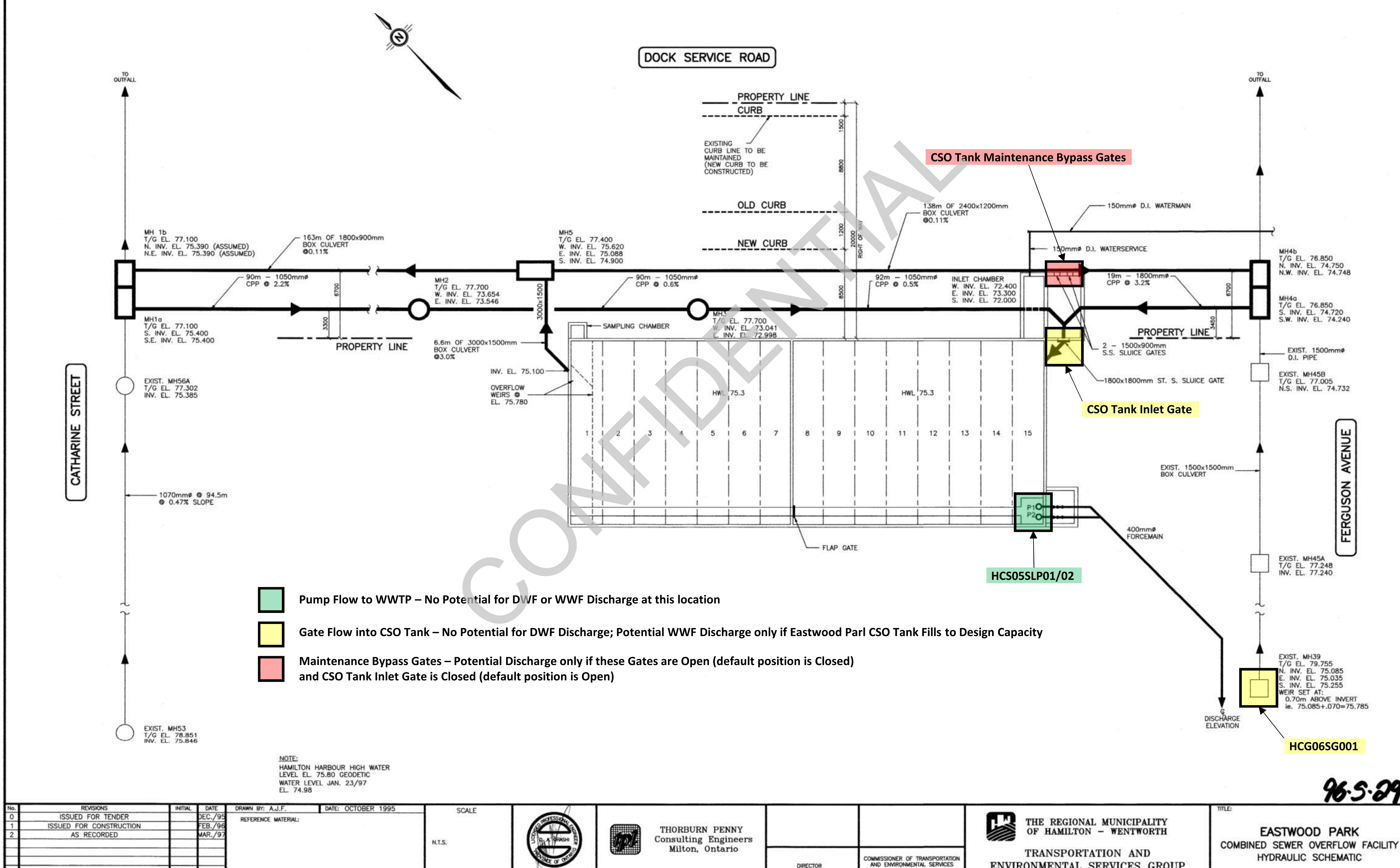
Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 289 L/sec submersible pumps located in Cell 1. One pump is used as a duty pump and the other as a stand-by pump. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the 900 mm portion of the WSI downstream of HCG06. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

The facilities are monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of unauthorized entries to the control building.

Figures 5A to 5D show the location of the CCPs associated with this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 5 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 5A: Eastwood Park CSO Tank (HCS05) – Site Plan



Pump Flow to WWTP – No Potential for DWF or WWF Discharge at this location

Gate Flow into CSO Tank – No Potential for DWF Discharge; Potential WWF Discharge only if Eastwood Parl CSO Tank Fills to Design Capacity

Maintenance Bypass Gates – Potential Discharge only if these Gates are Open (default position is Closed) and CSO Tank Inlet Gate is Closed (default position is Open)

Figure 5B: Eastwood Park CSO Tank (HCS05) – CSO Tank Inlet Chamber

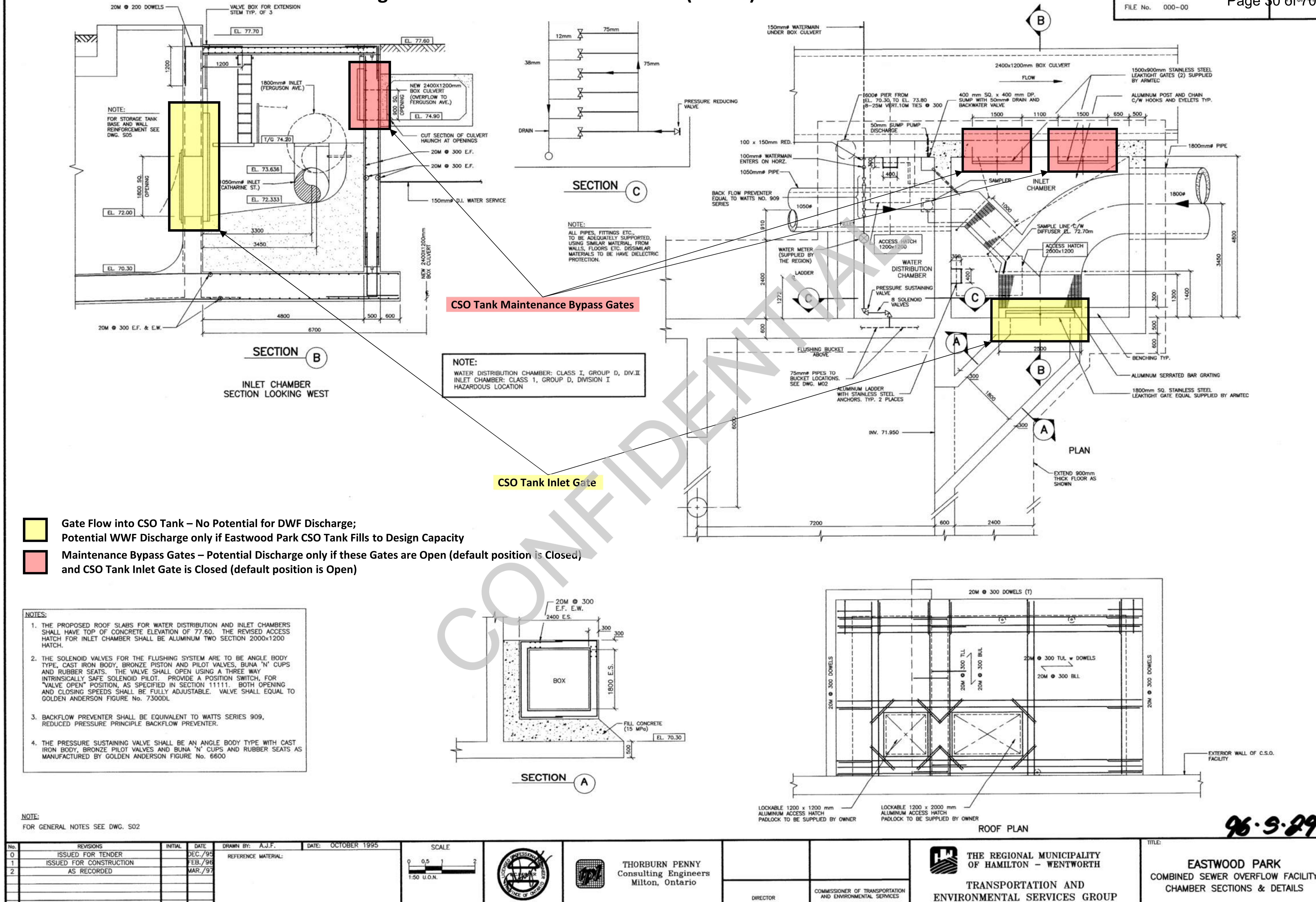


Figure 5C: Eastwood Park CSO Tank (HCS05) – Burlington/Ferguson Gate (HCG06)

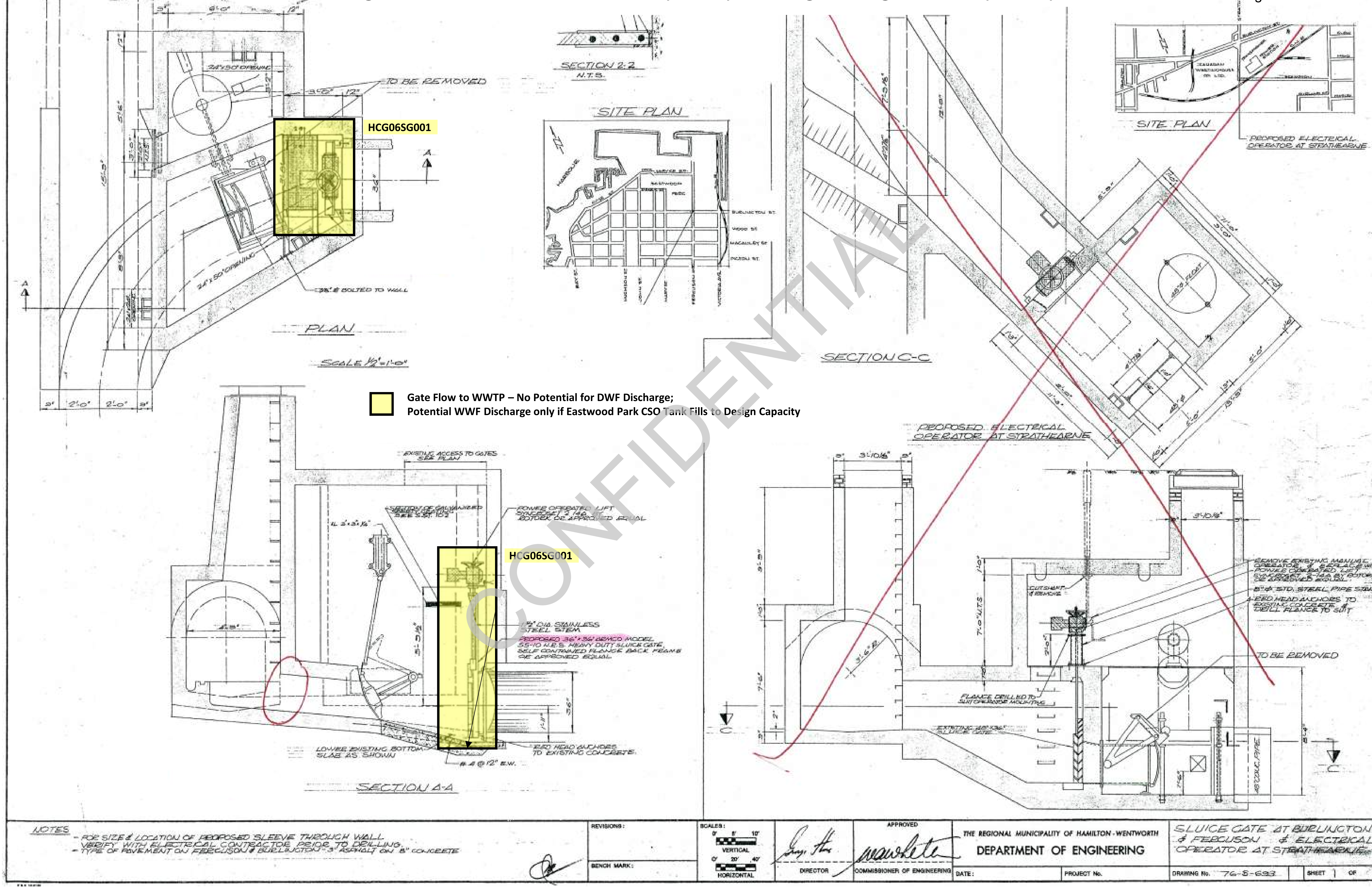


Figure 5D: Eastwood Park CSO Tank (HCS05) – Ferrie/Ferguson Gate (HCG07)

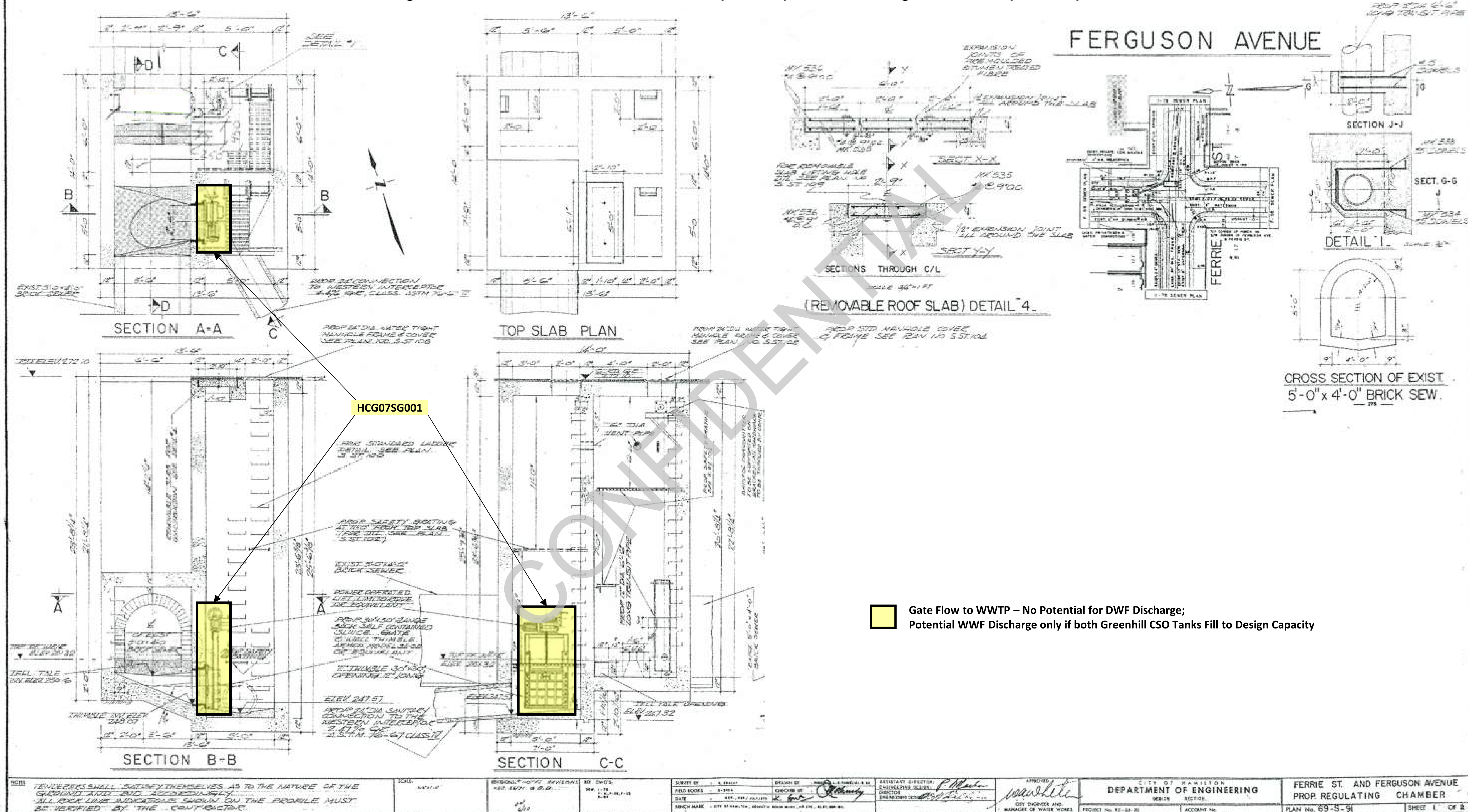


Table 5: Inventory of Critical Control Points at Eastwood Park CSO Tank (HCS05)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
CSO Tank Inlet Gate	N/A (Not on SCADA)	1800 x 1800 mm	Manual	Controls WWF into CSO Tank	Fully Open	In default Open position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN, but the operation of this manual CSO Tank Inlet Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6 + Evaluate options to physically lock the gate in Fully Open position
CSO Tank Maintenance Bypass Gate No. 1	N/A (Not on SCADA)	1500 x 900 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed	In default Closed position: No potential for DWF or WWF discharge. Potential for WWF discharge only if Tank Inlet Gate is Closed and one or both of these Maintenance Bypass Gates are Opened.	+ No significant changes required to PCN, but the operation of these two manual Maintenance Bypass Gates should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6 + Evaluate options to physically lock both gates in Fully Closed position
CSO Tank Maintenance Bypass Gate No. 2	N/A (Not on SCADA)	1500 x 900 mm	Manual	Allows CSO Tank bypass if Opened and Tank Inlet Gate Closed	Fully Closed		
Sewage Lift Pump No. 1	HCS05SLP01	289 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	+ No changes required to PCN or SOP
Sewage Lift Pump No. 2	HCS05SLP02	289 L/s	N/A	To drain stored CSO from the CSO tank	Off when CSO tank is filling	None	+ No changes required to PCN or SOP
Burlington-Ferguson Regulator Gate	HCG06SG001	900 x 900 mm	Motorized	To convey underflow to WWTP; and excess WWF to CSO tank	Fully Open in DWF; Fully Closed in WWF to fill the CSO tank	In default Open position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
Ferrie-Ferguson Regulator Gate	HCG07SG001	750 x 750 mm	Motorized				
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

3.6 Greenhill CSO Tank #2 (HCS06)

The second Greenhill CSO Tank (HCS06) is an underground reinforced concrete structure that was installed to augment the storage provided by the original Greenhill CSO Tank (HCS01). The rectangular tank covers an area of approximately 8,400 m^2, and is 7.5 to 8.3 m deep, providing approximately 66,750 m^3 of CSO storage capacity in two equally sized storage cells. The new facility increased the combined CSO storage volume at the Greenhill site to approximately 150,250 m^3.

HCS06 operates as an off-line facility, with combined sewage entering the tank only during larger CSO events. Flow into the storage tank is regulated by a WWTP-controlled CSO regulator located upstream of the tank. Cell 1 will fill first, and if it fills completely, excess flows overflow into Cell 2. If Cell 2 also fills, overflows will be conveyed into HCS01. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the new tank and prevent them from entering HCS01.

HCS06 is drained by gravity into the RHCSI via a 1,200 mm diameter sewer. The rate of drainage is regulated by a WWTP-controlled gate, based upon the current inflows at the WWTP.

The facility includes a bypass chamber between HCS06 and HCS01 that can be used to isolate HCS01 for maintenance purposes. To operate this bypass, the manual stop gate in the chamber has to be physically removed from its default position and inserted in the alternate position across the overflow channel from HCSO6 to HCS01 (thereby diverting flow to Red Hill Creek). Only one stop log is provided, making it impossible to block the flow of both sewers at the same time.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

HCS06 is also equipped with a biofilter odour control system to reduce the presence of unpleasant odours associated with the tank (possible when the tank is filling with sewage and air is being displaced from the tank).

Figures 6A to 6E show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 6 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 6A: Greenhill #2 CSO Tank (HCS06) – Site Plan

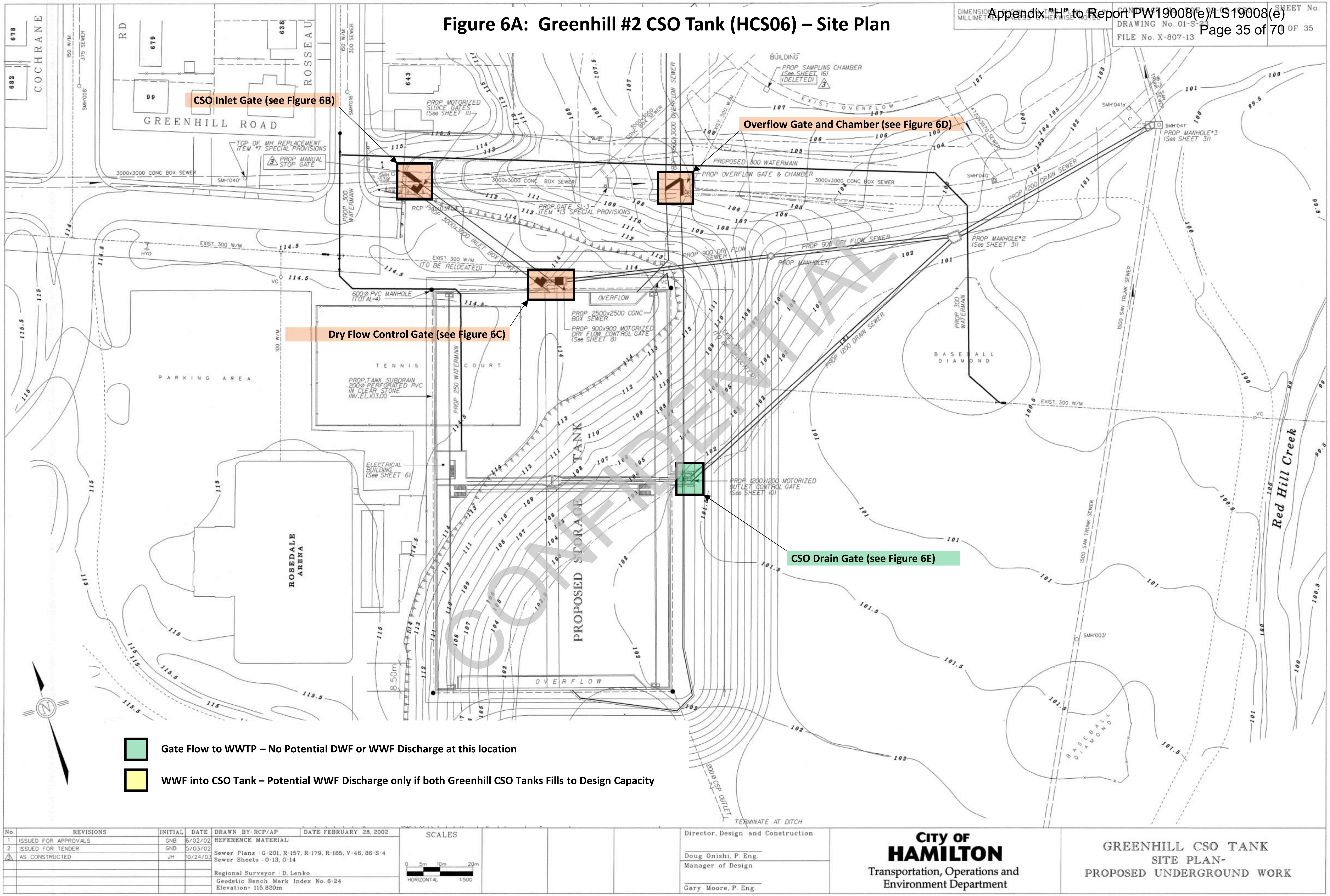
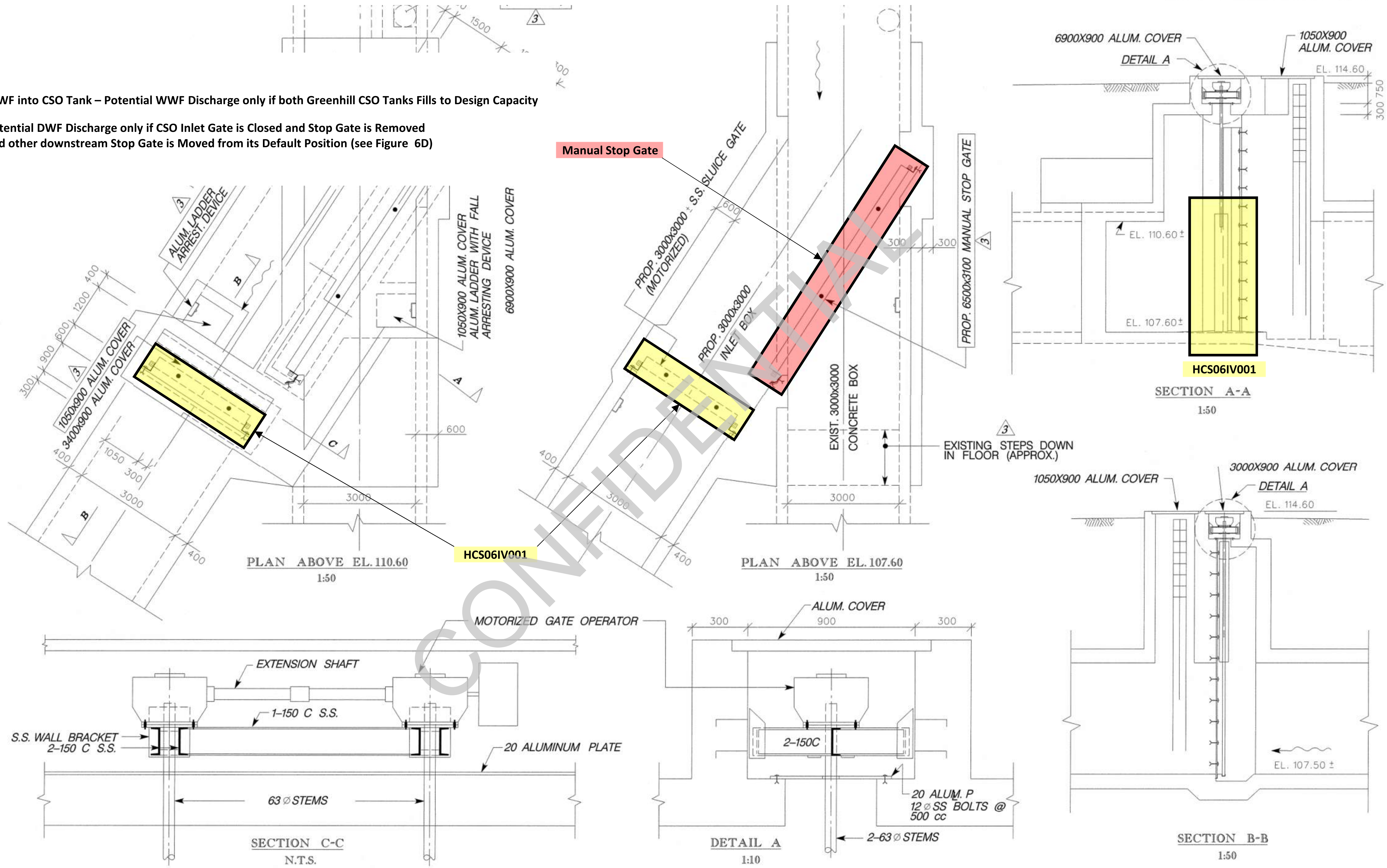


Figure 6B: Greenhill #2 CSO Tank (HCS06) – CSO Inlet Gate

WWF into CSO Tank – Potential WWF Discharge only if both Greenhill CSO Tanks Fills to Design Capacity

Potential DWF Discharge only if CSO Inlet Gate is Closed and Stop Gate is Removed and other downstream Stop Gate is Moved from its Default Position (see Figure 6D)



No.	REVISIONS	INITIAL	DATE
1	ISSUED FOR APPROVALS	GNB	6/02/02
2	ISSUED FOR TENDER	GNB	5/03/02
3	AS CONSTRUCTED	JH	10/24/03

DRAWN BY RCP — DATE JANUARY 22, 2002
REFERENCE MATERIAL: Road Plans: Sewer Plans: Water Plans:
Regional Surveyor:
Geodetic Bench Mark Index No. Elevation-

SCALES: AS SHOWN

Director, Design and Construction: Doug Onishi, P. Eng.
Manager of Design: Gary Moore, P. Eng.

City of HAMILTON
Transportation, Operations and Environment Department

INLET CHAMBER WITH MOTORIZED SLUICE GATES

DRAWING No. 01-S-33 — FILE No. X-807-13 — SHEET No. 1 OF 35

Figure 6C: Greenhill #2 CSO Tank (HCS06) – Dry Flow Control Gate

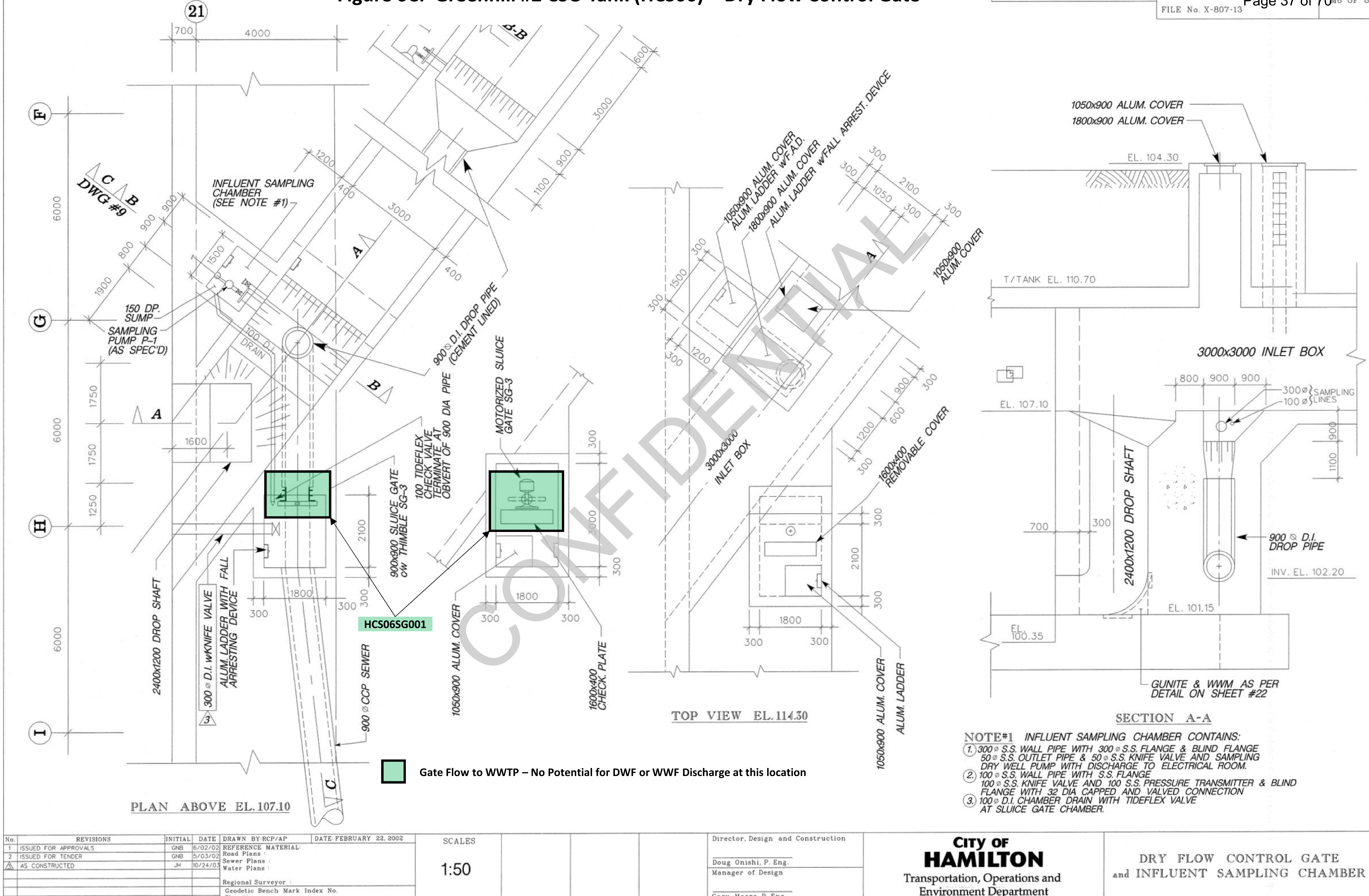


Figure 6D: Greenhill #2 CSO Tank (HCS06) – Overflow Gate and Chamber

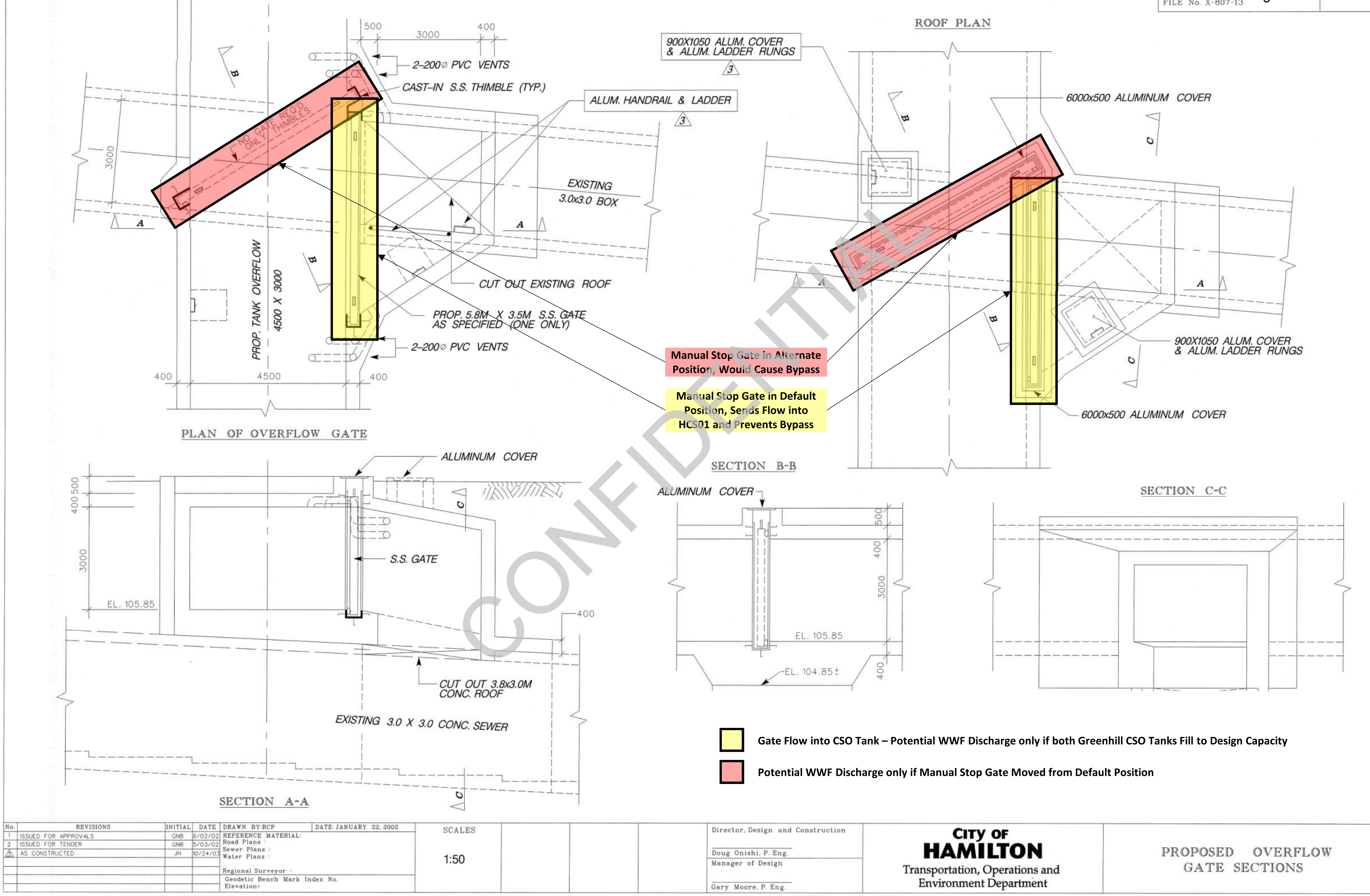
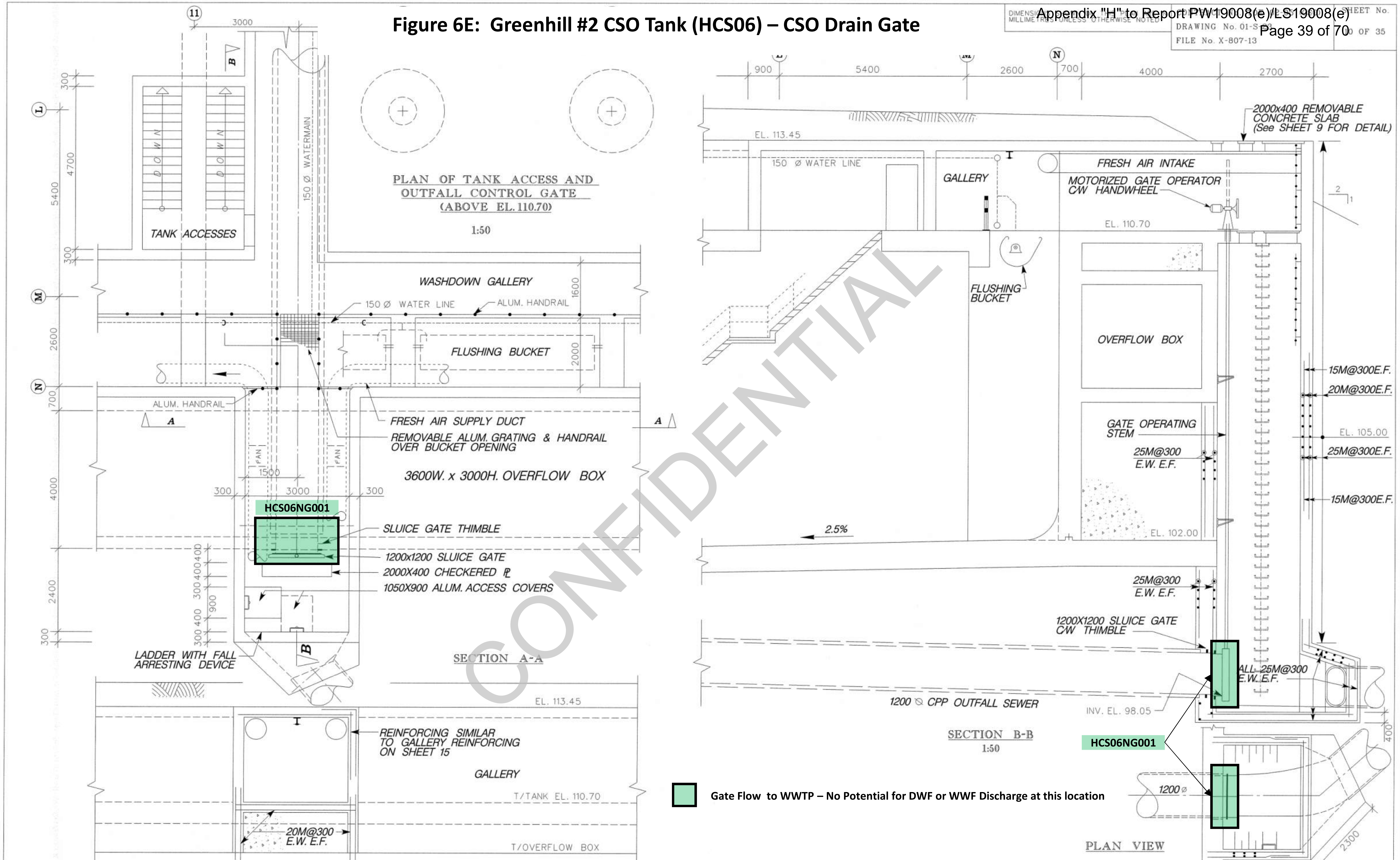


Figure 6E: Greenhill #2 CSO Tank (HCS06) – CSO Drain Gate



CONFIDENTIAL

No.	REVISIONS	INITIAL	DATE
1	ISSUED FOR APPROVALS	GNB	6/02/02
2	ISSUED FOR TENDER	GNB	5/03/02
△	AS CONSTRUCTED	JH	10/24/03

DRAWN BY: RCP — DATE: JANUARY 22, 2002
REFERENCE MATERIAL: Road Plans, Sewer Plans, Water Plans
Regional Surveyor
Geodetic Bench Mark Index No.
Elevation:

SCALES: AS SHOWN

Director, Design and Construction
Doug Onishi, P. Eng.
Manager of Design
Gary Moore, P. Eng.

CITY OF HAMILTON
Transportation, Operations and Environment Department

OUTLET GATE CHAMBER

DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED
DRAWING No. 01-S-38
FILE No. X-807-13
SHEET No. 10 OF 35

Table 6: Inventory of Critical Control Points at Greenhill CSO Tank #2 (HCS06)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
CSO Inlet Gate	HCS06IV001	3000 x 3000 mm	Motorized	Conveys DWF and WWF toward the Dry Flow Control Gate and the CSO Tank	Fully Open	In default Open position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity.	+ No significant changes required to PCN or SOP + This gate is padlocked in Fully Open position
Manual Stop Gate in CSO Inlet Gate Chamber	N/A (Not on SCADA)	6500 x 3100 mm	Manual Stop Gate	Allows bypass of HCS06 tank if Stop Gate is removed and CSO Inlet Gate is Closed	Fully Closed	In default Closed position: No potential for DWF or WWF discharge. Potential for WWF discharge <u>only if</u> Tank Inlet Gate is Closed and stop gate is removed.	+ No significant changes required to PCN, but the placement of this manual Stop Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
Dry Flow Control Gate	HCS06SG001	900 x 900 mm	Motorized	Allows CSO tank bypass if Stop Gate is removed and CSO Inlet Gate is Closed Conveys underflow to RHCSI and WWTP; and overflows into the CSO Tank	20% Open	No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity.	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
Overflow Gate and Chamber between HCS01 and HCS06	N/A (Not on SCADA)	5800 x 3500 mm	Manual Stop Gate	Allows bypass of HCS01 tank if Stop Gate is moved from default position over CSO Outfall Pipe to alternate position over HCS01 Tank Inlet	In place over end of CSO Outfall Pipe	In default position: No potential for DWF or WWF discharge. Potential for WWF discharge <u>only if</u> Stop Gate moved to alternate position over HCS01 Tank Inlet.	+ No significant changes required to PCN, but the placement of this manual Stop Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
CSO Drain Gate	HCS06NG001	1200 x 1200 mm	Motorized	To drain stored CSO from the CSO Tank	Fully Closed during WWF; Opened during DWF	None	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

3.7 Red Hill Valley CSO Pipe Facility (HCS07)

The Red Hill Valley CSO Pipe Facility (HCS07) captures and stores CSOs from the former Lawrence, Queenston and Melvin CSO outfalls to Red Hill Creek. The facility stores the CSO in an oversized pipe running parallel to the existing RHCSI and along the Red Hill Parkway. The oversized storage pipe ranges in size from 2,000 to 2,250 mm in diameter, and a series of four (4) motorized sluice gates are used to convey flows into and create temporary storage within the pipe during WWF conditions, and also to control the subsequent drainage of the facility to the WWTP for treatment during DWF conditions.

HCS07 comprises three (3) flow control structures: HCS7A at Lawrence Road; HCS7B at Queenston Road; and HCS7C at Barton Street; creating two (2) storage pipe cells providing a total storage volume of approximately 14,200 m^3. Cell 1 consists of a 2,250 mm diameter pipe running between HCS7A and HCS7B; and Cell 2 consists of a 2,000 mm diameter pipe running between HCS7B and HCS7C. HCS7C includes an 1,800 mm diameter sanitary sewer to drain the storage facility, and a 2,250 mm diameter overflow sewer to Red Hill Creek that only becomes active if the design capacity of the facility is exceeded.

The stored flow behind the gates can also be used to flush any sediments that may have settled at the bottom of the storage pipe cells during storage periods.

The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control buildings.

Figures 7A to 7E show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 7 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 7A: Red Hill CSO Facility (HCS07) – Site Plan

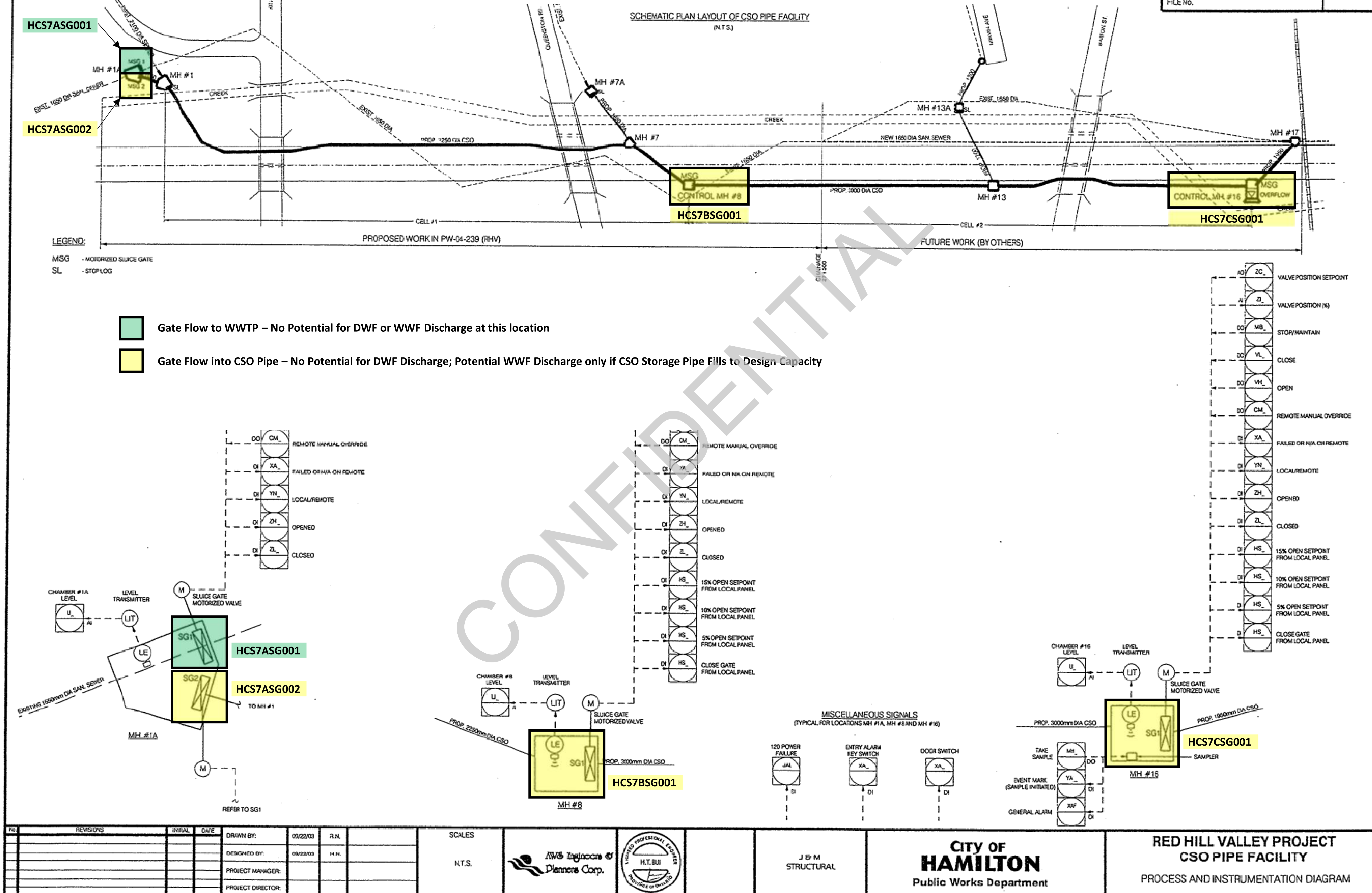
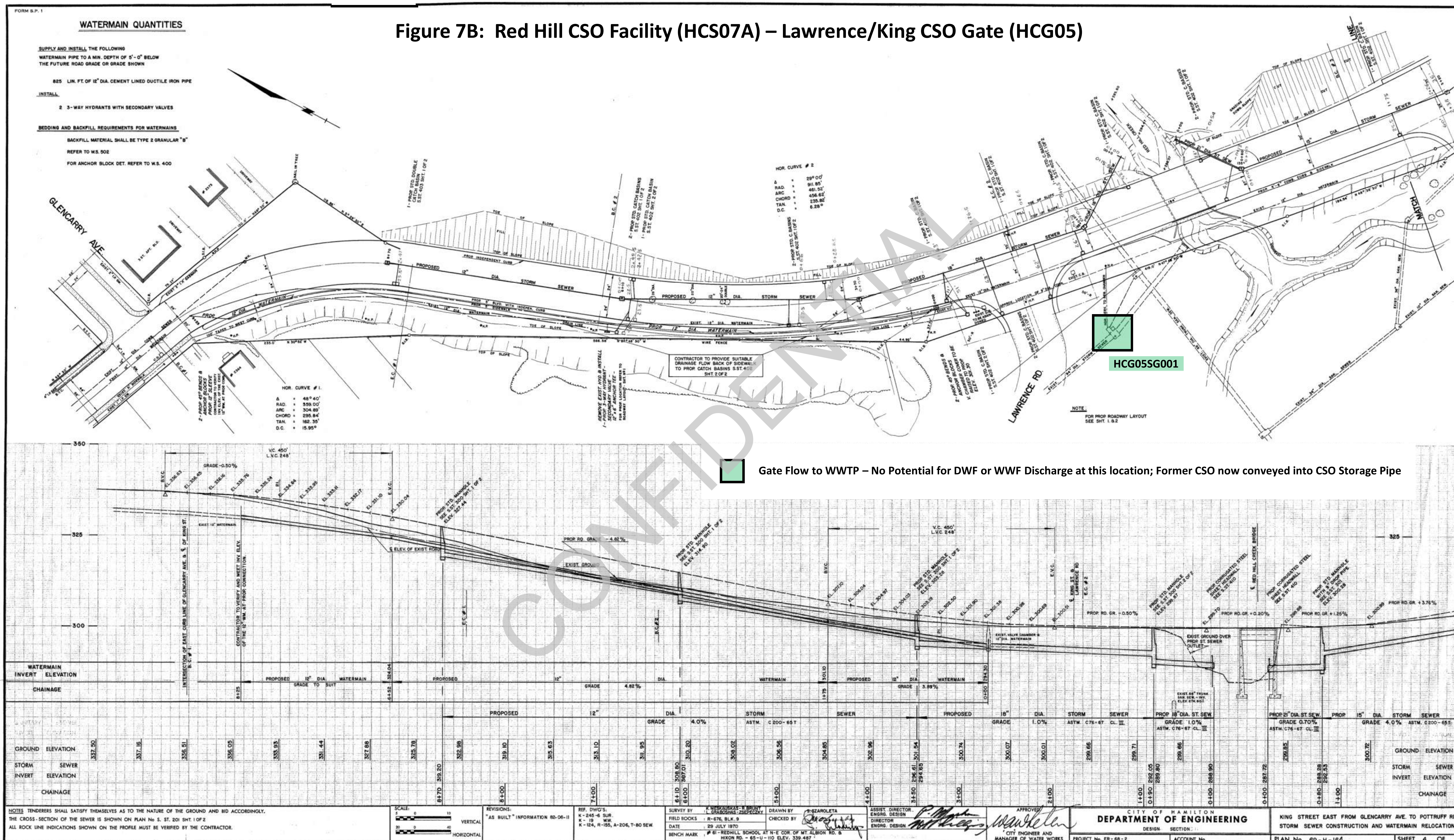
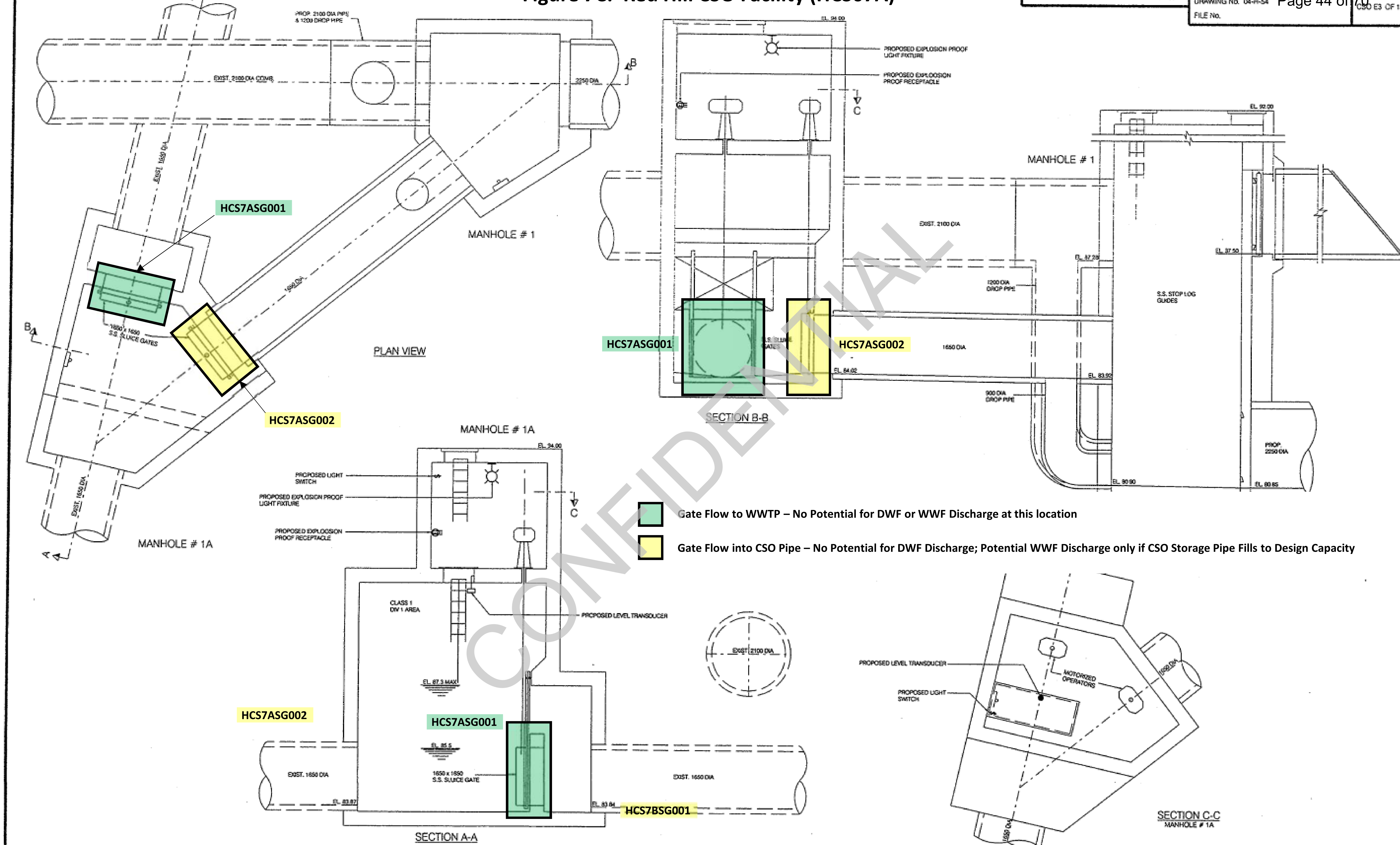


Figure 7B: Red Hill CSO Facility (HCS07A) – Lawrence/King CSO Gate (HCG05)



Gate Flow to WWTP – No Potential for DWF or WWF Discharge at this location; Former CSO now conveyed into CSO Storage Pipe

Figure 7C: Red Hill CSO Facility (HCS07A)



Gate Flow to WWTP – No Potential for DWF or WWF Discharge at this location

Gate Flow into CSO Pipe – No Potential for DWF Discharge; Potential WWF Discharge only if CSO Storage Pipe Fills to Design Capacity

DRAWN BY:	09/22/03	H.N.
DESIGNED BY:	09/22/03	H.N.
PROJECT MANAGER:		
PROJECT DIRECTOR:		

SCALES 1:50

AWS Engineers & Planners Corp.

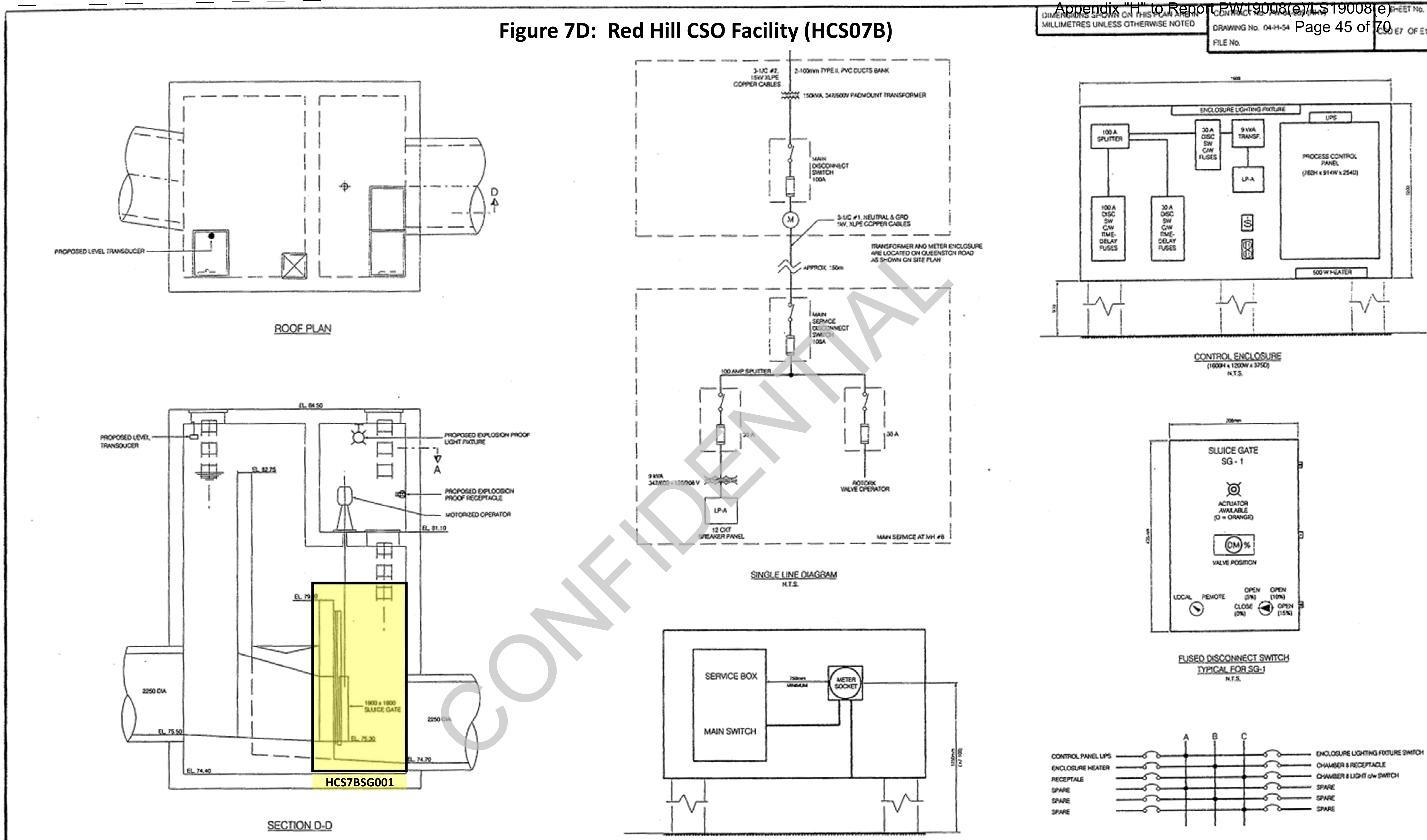
J & M STRUCTURAL

City of HAMILTON
Public Works Department

RED HILL VALLEY PROJECT
CSO PIPE FACILITY
MH #1 & MH #1A - PROPOSED LOCATION FOR ELECTRICAL AND INSTRUMENTATION EQUIPMENT

DRAWING No. 04-H-54
CSO E3 OF 13

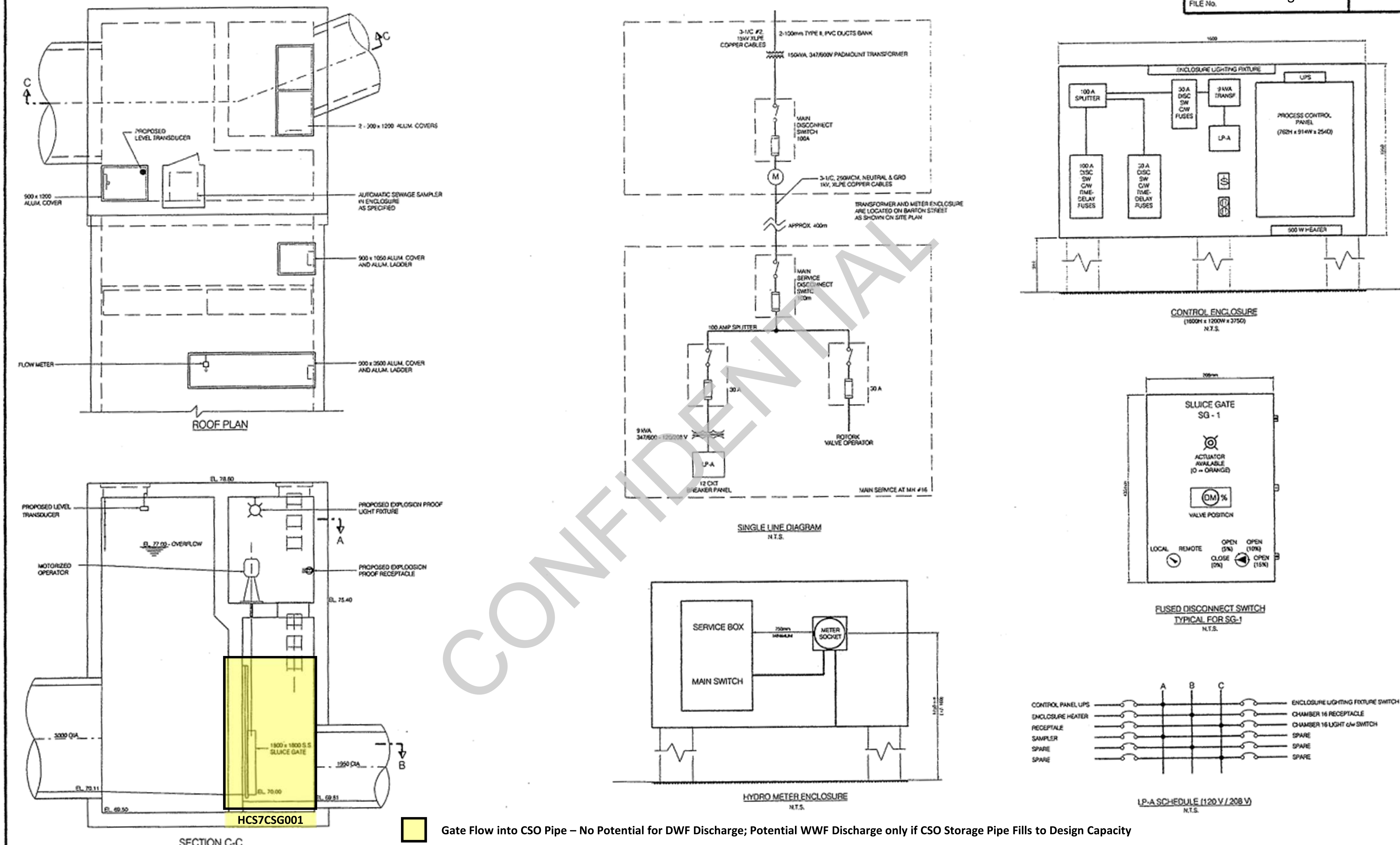
Figure 7D: Red Hill CSO Facility (HCS07B)



Gate Flow into CSO Pipe – No Potential for DWF Discharge;
Potential WWF Discharge only if CSO Storage Pipe Fills to Design Capacity

No.	REVISIONS	INITIAL	DATE				SCALES					
				DRAWN BY:	09/22/03	R.N.	1:50	AWS Engineers & Planners Corp.	H.T. BUI	J & M STRUCTURAL	CITY OF HAMILTON Public Works Department	RED HILL VALLEY PROJECT CSO PIPE FACILITY SLUICE GATE CHAMBER #8 SINGLE LINE DIAGRAM, LP-A, HYDRO & CONTROL ENCLOSURE DIAGRAM AND EQUIPMENT LAYOUT
				DESIGNED BY:	09/22/03	H.N.						
				PROJECT MANAGER:								
				PROJECT DIRECTOR:								

Figure 7E: Red Hill CSO Facility (HCS07C)



Gate Flow into CSO Pipe – No Potential for DWF Discharge; Potential WWF Discharge only if CSO Storage Pipe Fills to Design Capacity

DRAWN BY:	03/22/03	R.N.
DESIGNED BY:	03/22/03	H.N.
PROJECT MANAGER:		
PROJECT DIRECTOR:		

SCALES 1:50

AMS Engineers & Planners Corp.

J & M STRUCTURAL

CITY OF HAMILTON
Public Works Department

RED HILL VALLEY PROJECT
CSO PIPE FACILITY
SLUICE GATE CHAMBER #16
SINGLE LINE DIAGRAM, LP-A, HYDRO & CONTROL ENCLOSURE DIAGRAM AND EQUIPMENT LAYOUT

Table 7: Inventory of Critical Control Points at Red Hill Valley CSO Pipe (HCS07)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
HCS7A Sluice Gate No. 1	HCS07ASG001	1650 x 1650 mm	Motorized	To convey flow to WWTP in DWF; or to CSO Storage Pipe in WWF	Fully Open in DWF; Fully Closed in WWF	No potential for DWF discharge at this location; Potential for WWF discharge at Barton Street only if CSO pipe fills to design capacity	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
HCS7A Sluice Gate No. 2	HCS07ASG002	1650 x 1650 mm	Motorized		Fully Closed in DWF; Fully Open in WWF		
HCG05 Sluice Gate	HCG05SG001	1650 x 1650 mm	Motorized	To convey flow into RHCSI and on to WWTP in DWF; or to CSO Storage Pipe in WWF	Fully Open in DWF; Fully Closed in WWF	No potential for DWF discharge at this location; Potential for WWF discharge at Barton Street only if CSO pipe fills to design capacity	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
HCS7B Sluice Gate No. 1	HCS07BSG001	1800 x 1800 mm	Motorized	To create in-line storage in CSO Storage Pipe between HCS7A and HCS7B in WWF; and drain the pipe in DWF	5% Open in DWF; Fully Closed in WWF	No potential for DWF discharge; Potential for WWF discharge at Barton Street only if CSO Storage Pipe fills to design capacity	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
HCS7C Sluice Gate No. 1	HCS07CSG001	1800 x 1800 mm	Motorized	To create in-line storage in CSO Storage Pipe between HCS7B and HCS7C in WWF; and drain the pipe in DWF	5% Open in DWF; Fully Closed in WWF	No potential for DWF discharge; Potential for WWF discharge at Barton Street only if CSO Storage Pipe fills to design capacity	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.

3.8 Royal Avenue CSO Tank (HCS08)

The Royal Avenue CSO Tank (HCS08) is an underground reinforced concrete structure that provides approximately 15,000 m^3 of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 41 m long x 37 m wide x 10 m deep.

The site originally included a CSO Regulator chamber that employed a motorized sluice gate to dynamically control the rate of flow conveyed to the Woodward Avenue WWTP. This sluice gate was removed, and control of the flow conveyed to the WWTP and the CSO tank is accomplished passively by a 525 mm diameter drop pipe located in the diversion chamber at the east end of Royal Avenue. During dry weather and small storm events, the 525 mm drop pipe conveys all flow into the downstream 900 mm sanitary sewer and on to the WWTP. During larger storm events, the 525 mm drop pipe will fill to capacity and excess flows will be diverted to the CSO tank after passing through a coarse bar screen included in the CSO Tank Inlet Chamber. Filling of the CSO Tank occurs passively without any actions having to be initiated by the Operators at the WWTP.

CSOs are conveyed to the storage tank by a 2,400 mm x 2,400 mm step sewer. The inlet sewer is designed to operate under surcharge, dependent upon the level of the sewage in the CSO storage tank, which provides some additional volume.

The inlet chamber also includes provision to isolate the CSO storage tank in emergencies and during special maintenance activities, and a 2,400 mm wide x 2,000 mm deep box culvert is provided to divert flow to Chedoke Creek for those activities. The chamber includes two sets of guides for alternate placement of a single stop log to control the direction of flow. Under normal operation, the stop log will be inserted in the guides over the upstream end of the emergency bypass sewer, sending all excess WWF into the CSO tank. To operate the bypass, the stop log has to be physically removed from its default position and inserted in the alternate position over the upstream end of the CSO tank inlet sewer. Only one stop log is provided, making it impossible to block the flow of both sewers at the same time. A removable stainless-steel bar screen is provided at the upstream end of the CSO tank inlet sewer to capture debris to protect the sewage pumps in the storage tank.

Inside the storage tank, a stainless-steel baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the tank, so they can be subsequently pumped from the tank and conveyed to the Woodward WWTP for treatment. A 5,400 mm wide x 1,800 mm deep box culvert is provided at the northeast corner of the site to convey any overflows from the facility into Chedoke Creek.

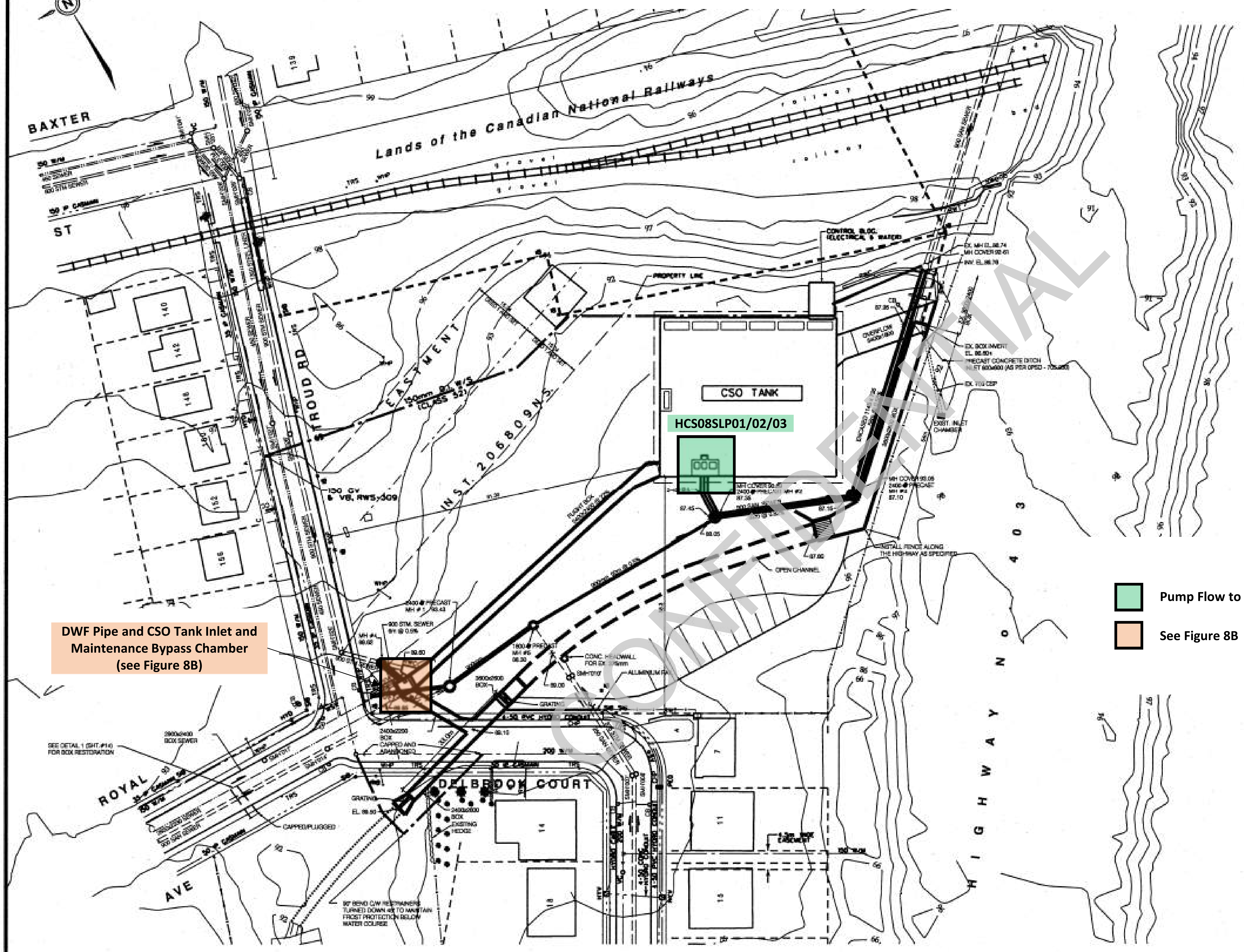
Three (3) submersible pumps are provided to pump the contents of the storage tank back into the CSS in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during dry weather, when the capacity is available to treat these flows. Three (3) pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps will be conveyed south via three (3) 400 mm diameter ductile iron forcemains into the relocated 900 mm sanitary sewer running east along the south wall of the tank. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 8A to 8C show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 8 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 8A: Royal Avenue CSO Tank (HCS08) – Site Plan



Pump Flow to WWTP – No Potential DWF or WWF Discharge at this location

See Figure 8B

No.	REVISIONS	INITIAL	DATE
1.	ISSUED FOR APPROVALS		01/05
2.	ISSUED FOR MOE APPROVAL		02/05
3.	ISSUED FOR TENDER		08/05
4.	AS BUILT		10/07

DRAWN BY: R.N. DATE: 09/04
REFERENCE MATERIAL:
Road Plans :
Sewer Plans :
Water Plans :
Regional Surveyor :
Geodetic Bench Mark Index No. 1-24
Elevation= 92.398m

SCALES 1:500

ORIGINAL DWG. SEALED BY J. HUDOBA 05/03/05

Hatch Mott MacDonald
J & M STRUCTURAL

Manager of Construction
Jerry Parisotto, P. Eng.
Manager of Design
Gary Moore, P. Eng.

CITY OF HAMILTON
Public Works Department

CITY OF HAMILTON
ROYAL AVENUE COMBINED SEWER OVERFLOW STORAGE TANK
SITE PLAN

DIMENSIONS SHOWN IN MILLIMETRES UNLESS OTHERWISE NOTED
DRAWING No. 05-S-13
FILE No. 918-43
SHEET No. 1 OF 20

Figure 8B: Royal Avenue CSO Tank (HCSO8) – CSO Tank Inlet Chamber

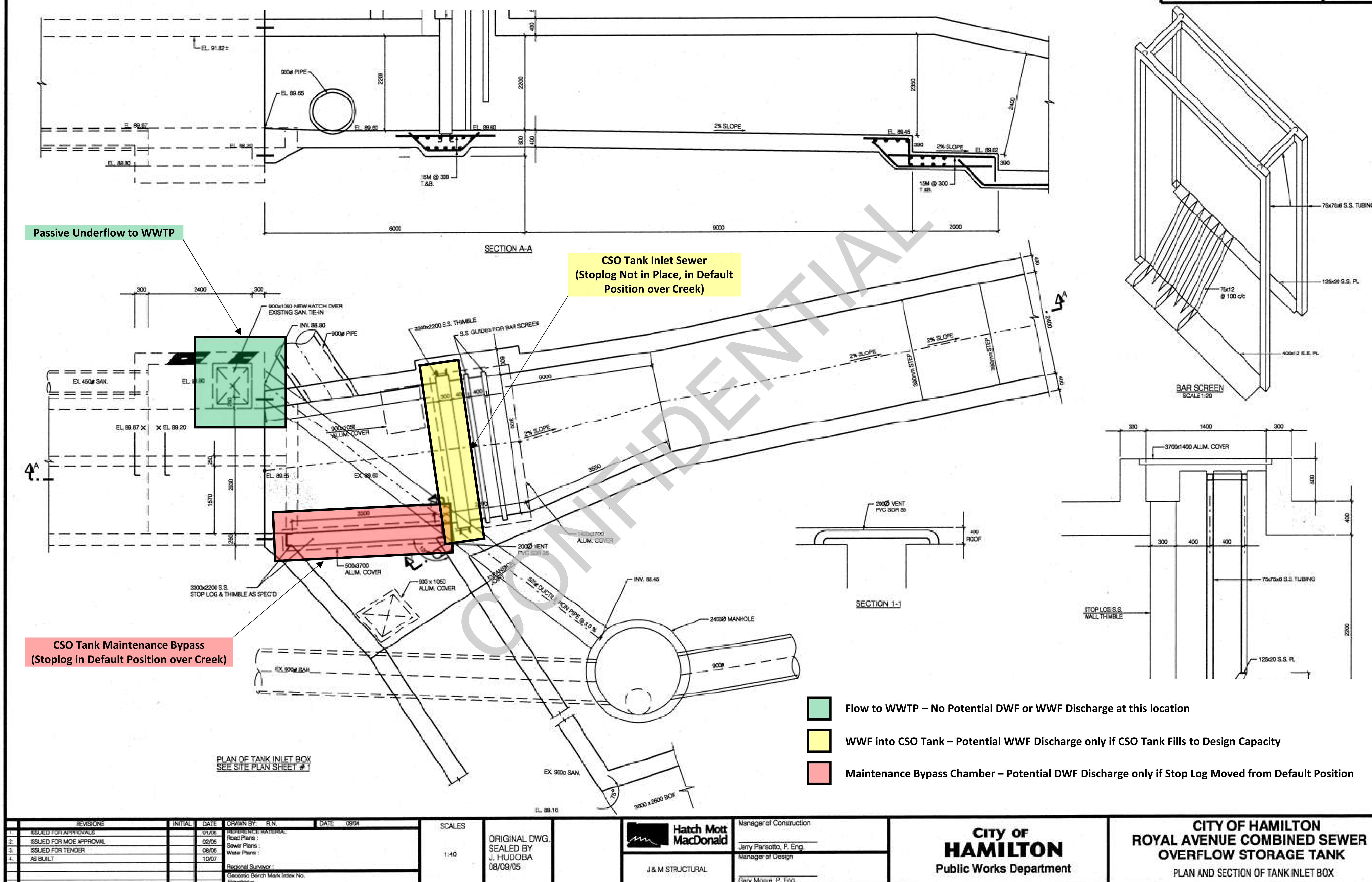
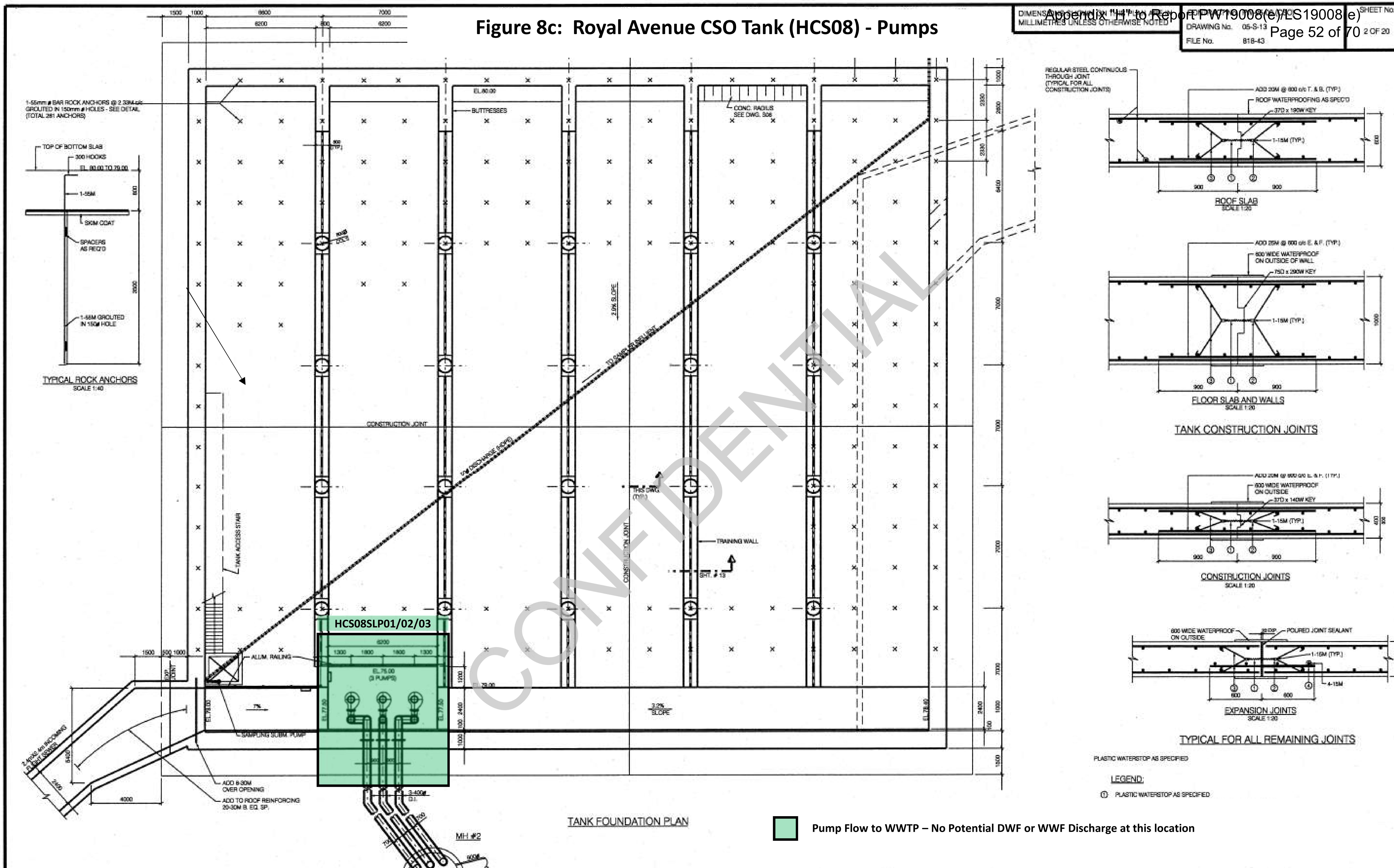


Figure 8c: Royal Avenue CSO Tank (HCS08) - Pumps



Pump Flow to WWTP – No Potential DWF or WWF Discharge at this location

REVISIONS		DATE
1.	ISSUED FOR APPROVALS	01/05
2.	ISSUED FOR MOE APPROVAL	02/05
3.	ISSUED FOR TENDER	08/05
4.	AS BUILT	10/07

SCALES 1:100

ORIGINAL DWG. SEALED BY J. HUDOBA 08/09/05

Hatch Mott MacDonald
J & M STRUCTURAL

Manager of Construction: Jerry Parisotto, P. Eng.
Manager of Design: Gary Moore, P. Eng.

CITY OF HAMILTON
Public Works Department

CITY OF HAMILTON
ROYAL AVENUE COMBINED SEWER OVERFLOW STORAGE TANK
TANK FOUNDATION PLAN

DRAWING No. 05-S-13
FILE No. 818-43
SHEET No. 2 OF 20

Table 8: Inventory of Critical Control Points at Royal Avenue CSO Tank (HCS08)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
CSO Tank Inlet Chamber Stop Log	N/A (Not on SCADA)	3300 x 2200 mm	Manual Stop Log	In default position over end of Bypass Culvert, conveys WWF into CSO Tank; In alternate position over CSO Tank Inlet Sewer, provides CSO Tank Maintenance Bypass	In place over end of Bypass Culvert	In default position: No potential for DWF discharge; Potential for WWF discharge only if CSO tank fills to design capacity	+ No significant changes required to PCN, but the operation of this manual Stop Log should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
Sewage Lift Pump No. 1	HCS08SLP01	250 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 2	HCS08SLP02	250 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 3	HCS08SLP03	250 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
							+ Establish appropriate inspection program for the facility, including visual inspection of manual Stop Log to confirm correct position

3.9 McMaster CSO Tank (HCS09)

The McMaster CSO Tank (HCS09) is an underground reinforced concrete structure that provides approximately 5,935 m^3 of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 50 m long x 18 m wide x 6.6 m deep. When the tank is full, some additional CSO storage volume is provided within the upstream CSO tank inlet sewer.

A maintenance bypass is provided at the southwest corner of the storage tank, where the CSO inflow sewer enters the tank, to provide a means to bypass flows around the storage tank, to permit future isolation of the CSO storage tank in emergencies and during special maintenance activities.

Under normal operation, the CSO tank inlet gate is fully open and the stop log over the end of the CSO tank overflow sewer is removed (sitting in guides above the end of the CSO tank overflow sewer), to allow all incoming flow to enter the tank. To operate the CSO tank bypass, in order to fully isolate the CSO tank from the CSO outfall pipe, the CSO tank inlet gate must be fully closed and the stop log removed from its default position and inserted in the alternate guides provided over the end of the CSO tank overflow sewer. This bypass was employed during the construction of the CSO storage tank and inlet sewer.

Inside the storage tank, a stainless-steel underflow baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the CSO storage tank, so they can be subsequently pumped from the tank and conveyed to the WWTP for treatment. A 2,400 mm wide x 1,000 mm (sloped) overflow trough is provided at the northwest corner of the tank to safely convey any overflows from the facility into the 1,800 mm overflow sewer discharging to Lower Ancaster Creek

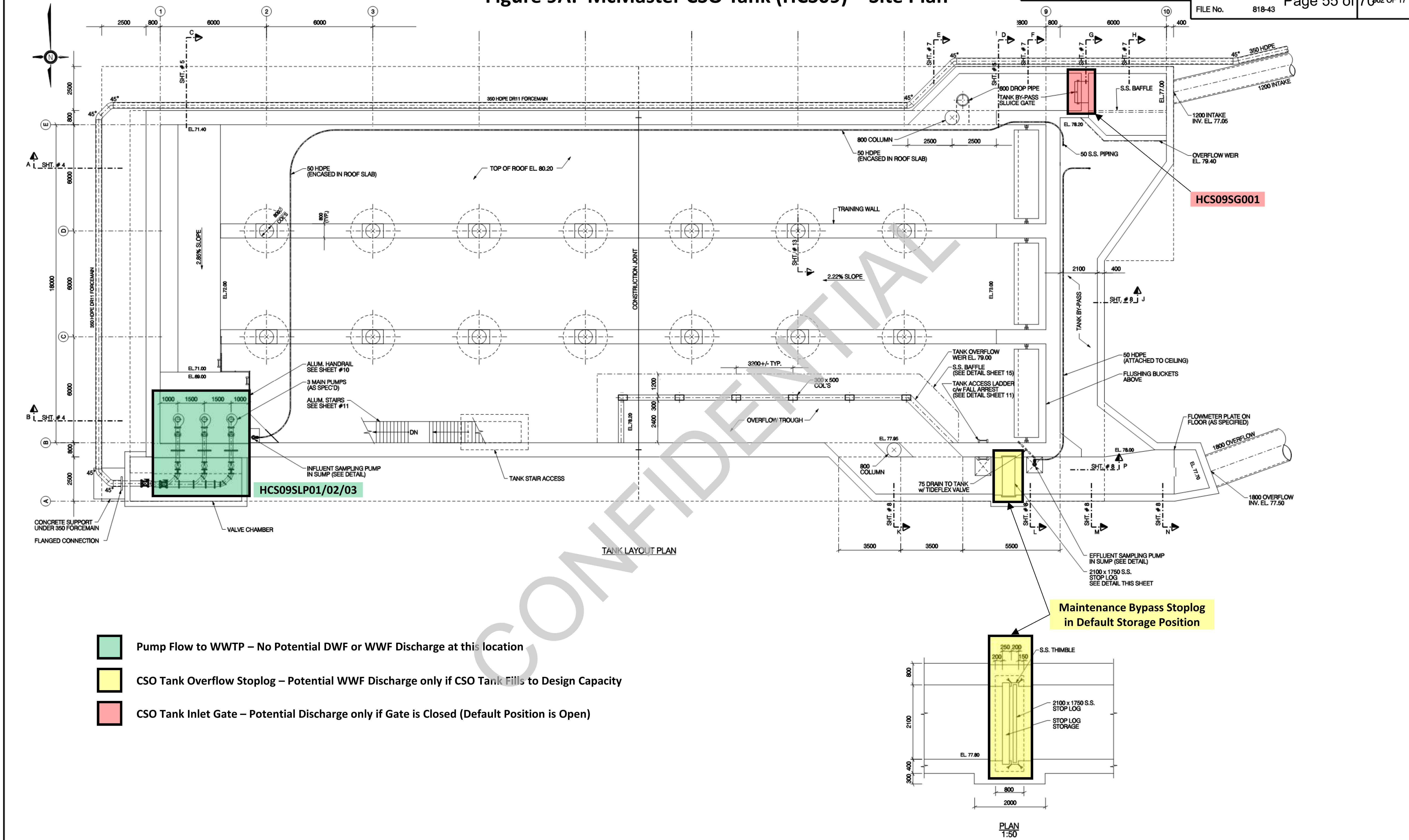
Three (3) submersible pumps are provided to pump the contents of the storage tank back into the CSS in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during DWF conditions, when capacity is available to treat these flows. Three pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps is lifted via three (3) 200 mm diameter, ductile iron forcemains, which feed a single 350 mm diameter forcemain running around the east and south walls of the storage tank, then south through the City’s easement within the Hydro One corridor, and finally east through the City’s right-of-way at the west end of Sanders Boulevard, to connect to the gravity operated CSS along Sanders Boulevard.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized CSO tank inlet gate and the pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 9A and 9B show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

Table 9 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.

Figure 9A: McMaster CSO Tank (HCS09) – Site Plan



- Pump Flow to WWTP – No Potential DWF or WWF Discharge at this location
- CSO Tank Overflow Stoplog – Potential WWF Discharge only if CSO Tank Fills to Design Capacity
- CSO Tank Inlet Gate – Potential Discharge only if Gate is Closed (Default Position is Open)

REVISIONS		INITIAL	DATE
0.	ISSUED FOR TENDER	A.J.F.	12/08
1.	ISSUED FOR CONSTRUCTION	A.J.F.	02/09
2.	AS CONSTRUCTED	A.J.F.	09/10

DRAWN BY: A.J.F. DATE: 10/07

SCALES 1:100

ORIGINAL DRAWING SEALED BY J. HUDOBA FEBRUARY 2009

Hatch Mott MacDonald — J & M STRUCTURAL

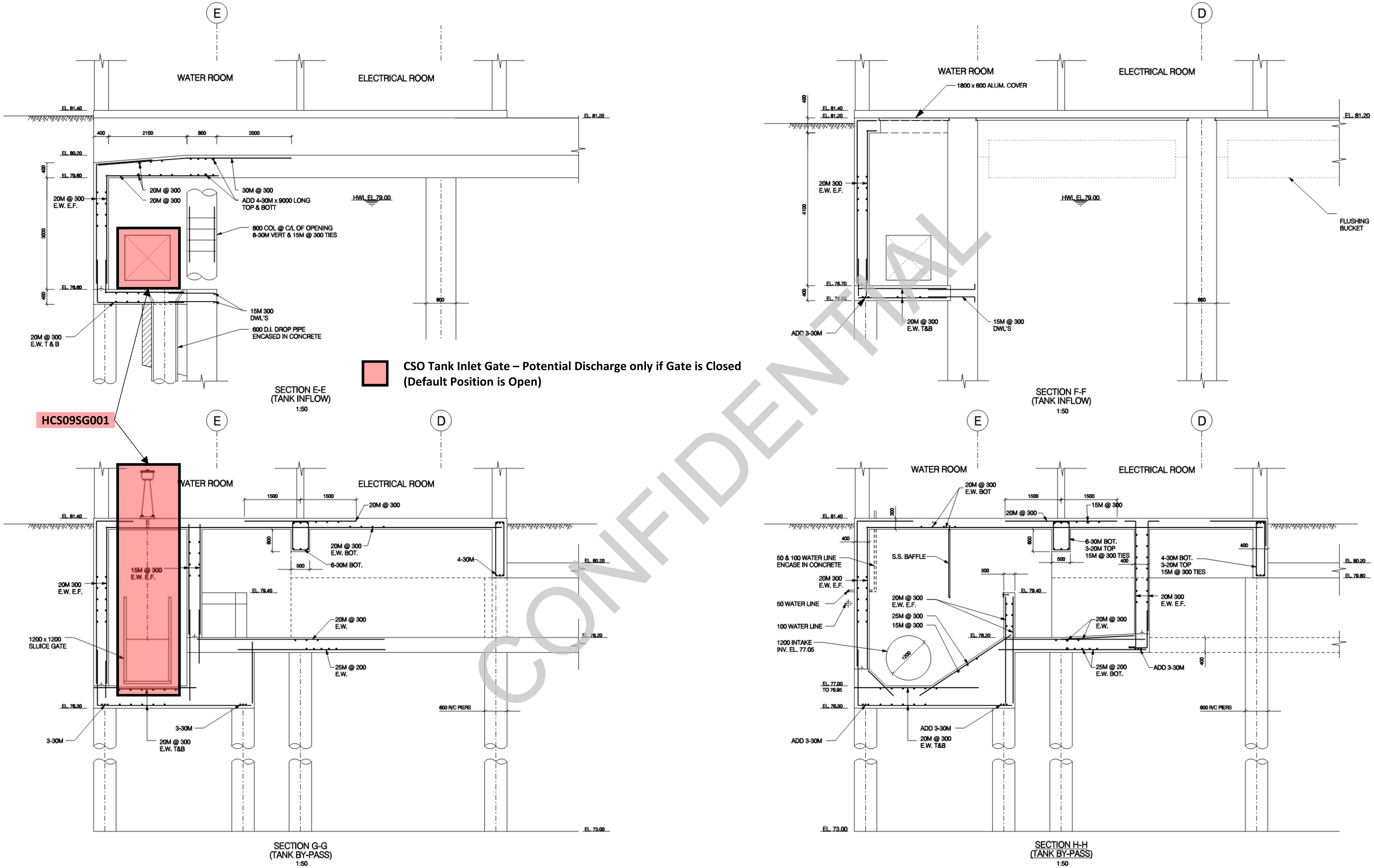
Manager of Construction: Jerry Parisotto, P. Eng.
Manager of Design: Susan Jacob, P. Eng.

City of HAMILTON Public Works Department

CITY OF HAMILTON
McMASTER COMBINED SEWER OVERFLOW STORAGE TANK
TANK LAYOUT PLAN

DRAWING No. 08-S-38 FILE No. 818-43 SHEET No. S02 OF 17

Figure 9B: McMaster CSO Tank (HCS09) – CSO Tank Inlet Gate



DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETRES UNLESS OTHERWISE NOTED

DRAWING No. 08-S-38 | FILE No. 818-43 | SHEET No. 7 OF 17

	REVISIONS	INITIAL	DATE
0.	ISSUED FOR TENDER	A.J.F.	12/08
1.	ISSUED FOR CONSTRUCTION	A.J.F.	02/09
2.	AS CONSTRUCTED	A.J.F.	09/10

DRAWN BY: A.J.F. DATE: 10/07

REFERENCE MATERIAL: Road Plans : Sewer Plans : Water Plans : Regional Surveyor : Geodetic Bench Mark Index No. Elevation=

SCALES 1:50

ORIGINAL DRAWING SEALED BY J. HUDOBA FEBRUARY 2009

Hatch Mott MacDonald
J & M STRUCTURAL

Manager of Construction: Jerry Parisotto, P. Eng.
Manager of Design: Susan Jacob, P. Eng.

CITY OF HAMILTON Public Works Department

CITY OF HAMILTON
McMASTER COMBINED SEWER OVERFLOW STORAGE TANK
TANK INFLOW AND TANK BY-PASS SECTIONS

Table 9: Inventory of Critical Control Points at McMaster CSO Tank (HCS09)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Inlet Sluice Gate	HCS09SG001	1200 x 1200 mm	Motorized	In default Open position, conveys WWF into CSO Tank; If Closed, provides CSO Tank Maintenance Bypass	Fully Open	No potential for DWF discharge. In default Open position, Potential for WWF discharge only if CSO tank fills to design capacity. Potential for WWF discharge only if the gate is Closed during WWF, which it never should be.	+ No significant changes required to PCN, but the operation of this Inlet Sluice Gate should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6 + This gate should be Fully Open at all times, and is currently padlocked in this position
Overflow Stop Log	N/A (Not on SCADA)	2100 x 1700 mm	Manual Stop Log	Purely for maintenance. In default position above CSO Tank Overflow Channel, has no impact on operation of the CSO Tank. If moved to alternate position over end of CSO Tank Overflow Channel, can be used to isolate the Storage Tank for maintenance.	Sitting in guides provided above the end of the CSO Tank Overflow Channel	In default Closed position: No potential for DWF or WWF discharge. Potential for WWF discharge only if Tank Inlet Gate is Closed and stop gate is removed.	+ No significant changes required to PCN, but the operation of this manual Stop Log should be covered in the SOP and/or other documents to be submitted in response to MECP Order Item 6
Sewage Lift Pump No. 1	HCS09SLP01	137 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 2	HCS09SLP02	137 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
Sewage Lift Pump No. 3	HCS09SLP03	137 L/s	N/A	To drain stored CSO from the Storage Tank	Off when CSO Tank is filling	None	+ No significant changes required to PCN or SOP
							+ Establish appropriate inspection program for the facility, including visual inspection of manual Stop Log to confirm correct position

3.10 Wentworth/Rosemary CSO Gate (HCG03)

HCG03 regulates the flow of combined sewage from a 266 ha drainage area served by a 1,220 mm x 1,525 mm combined sewer running north along Wentworth Street North. The gate is located in an underground chamber on the northeast corner of Wentworth Street North and Rosemary Avenue, near the entrance to the City's offices at 330 Wentworth Street North.

HCG03 is used to direct DWF and some WWF to the Burlington/Hillyard area where the flows enter the WSI North branch (WSIN) and are conveyed to the Woodward Avenue WWTP for treatment. The regulator also has the ability to isolate flows from the WSIN, where the gate is normally open but can be closed to direct flow to the Wentworth CSO outfall when the WSIN is surcharged.

During DWF conditions and small storms, a static overflow weir captures all flows and conveys them through the open gate in HCG03, into a 1,200 mm x 1,500 mm combined sewer which connects to the WSIN at the intersection of Hillyard Avenue and Burlington Street, and the WSIN conveys the flows east to the Woodward Avenue WWTP for treatment.

During larger storms, when the weir is overtopped, excess WWF is diverted to the Wentworth CSO Outfall via a 2,500 mm x 2,400 mm combined sewer on Wentworth Avenue.

During very large storms, every attempt is made to maximize the conveyance of combined sewage to the WWTP for treatment, however there will be circumstances where the Operator may need to close HCG03 to bypass combined sewage through the Wentworth CSO Outfall to protect the Influent Pump Station and biological treatment processes at the WWTP.

The gate can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Auto, with operation directed by the RTC system, to maximize flow to the WWTP.

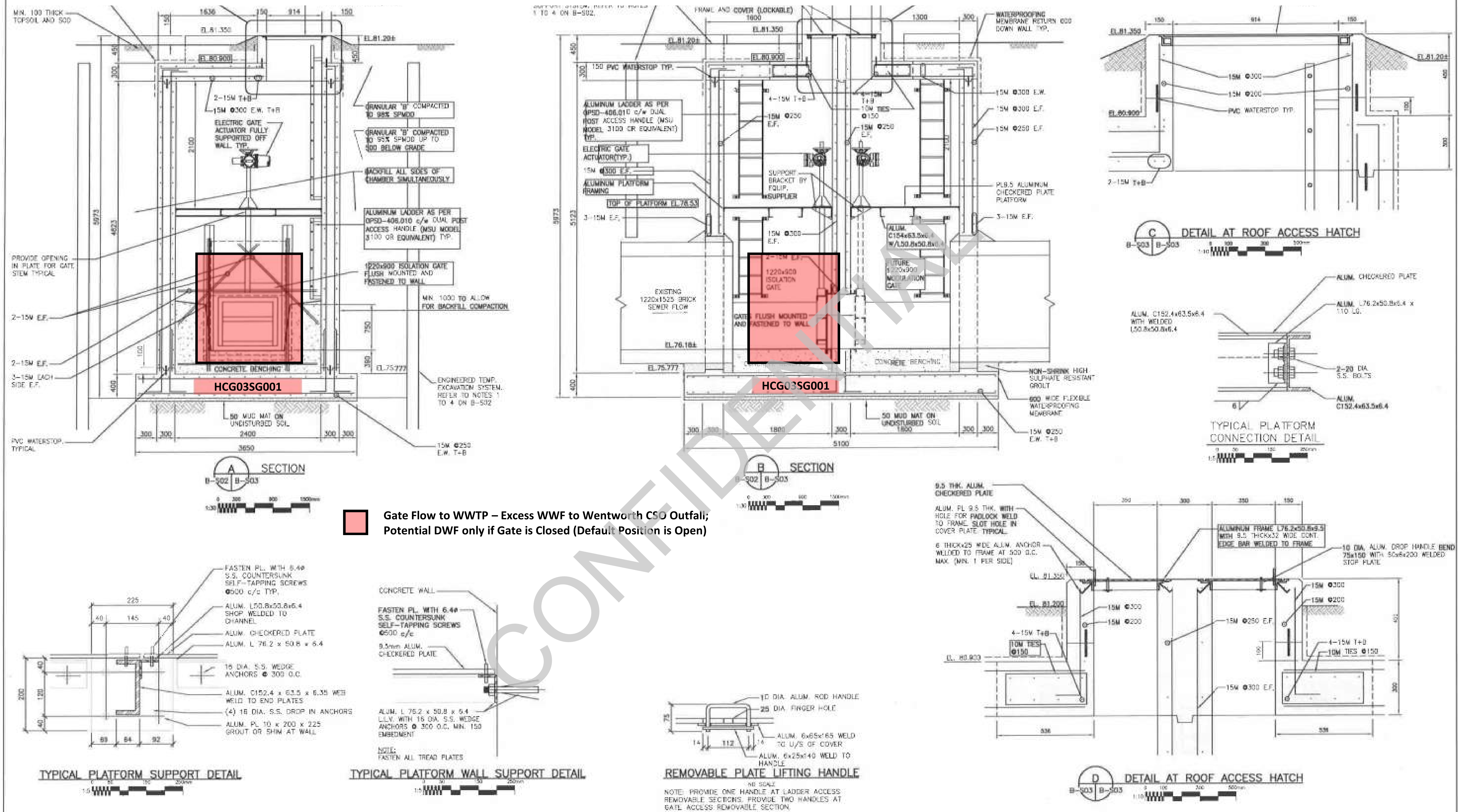
The Process Automation Controller (PAC), network equipment and gate actuator are powered by an Uninterruptable Power Supply (UPS). On a power failure, the gate is set to 30% Open.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 10A shows the location of the gate, as well as the potential for possible sewage discharges to the environment, colour coded as described above. The 'Future Modulation Gate' shown in the figure is just that, and is not currently installed.

Table 10 provides an inventory of the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 10A: Wentworth/Rosemary CSO Gate (HCG03)



Gate Flow to WWTP – Excess WWF to Wentworth CSO Outfall; Potential DWF only if Gate is Closed (Default Position is Open)

Notes
1. PAINT ALL ALUMINUM SURFACES IN CONTACT WITH CONCRETE WITH 2 COATS OF BITUMINOUS PAINT.
2. ALL FASTENERS TO BE 316 STAINLESS STEEL.
3. PROVIDE 3mm THK. NEOPRENE GASKET ON CHECKERED PLATE AT CONNECTION TO FRAMING MEMBERS.
4. PLATFORM DESIGN LOAD = 4.8 kPa.
5. SEAL ALL OPENINGS IN PLATFORM GAS-TIGHT.

No.	Description	By	Date
1	ISSUED FOR 50% DESIGN	S.E.A.	11.09.13
2	ISSUED FOR 90% DESIGN	S.E.A.	11.10.13
3	ISSUED FOR TENDER	S.E.A.	11.11.21
4	ISSUED FOR CONSTRUCTION	S.E.A.	12.02.24
5	AS BUILT	S.E.A.	13.01.30

Consultants
Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON Canada
K1Z 7T1

BPR CSO

CITY OF HAMILTON
Public Works Department

CITY OF HAMILTON
RTC IMPLEMENTATION PROJECT
ROSEMARY/WENTWORTH (HCG03) REGULATOR UPGRADES
NEW REGULATOR CHAMBER SECTIONS & DETAILS

Scale: AS SHOWN
Designed: S.E.A.
Checked: S.H.T.
Drawn: G.A.Q.
Date: 11.11.17
Dwg. No. B-S03
Issue 5

Table 10: Inventory of Critical Control Points at Wentworth/Rosemary CSO Gate (HCG03)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Isolation Gate	HCG03SG001	1220 x 900 mm	Motorized	In default Open position, conveys all DWF and some WWF into WSIN and on to WWTP, with excess WWF diverted to Wentworth CSO Outfall; If Closed, all flow diverted directly to Wentworth CSO Outfall	Fully Open	In default Open position, no potential for DWF discharge, and potential for WWF discharge only during larger storms. Potential for DWF discharge only if the gate is Closed during DWF, which it never should be.	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gate based on its function and criticality of operation + Note that this gate should not be fully closed during exercising, as this could cause DWF discharge

3.11 Brampton/Strathearne CSO Gate (HCG04)

HCG04 regulates the flow of combined sewage from a 210 ha drainage area served by a 2,134 mm x 2,286 mm combined sewer running north along Strathearne Avenue. The gate is located in an underground chamber behind the Arcelor Mittal security guard house located just south of Brampton Street.

During DWF conditions and small storms, a static overflow weir captures all flows and conveys them through the open gate in HCG04, into a 1,050 mm combined sewer on Strathearne Avenue, which connects to the WSI at the intersection of Strathearne Avenue and Burlington Street, and the WSI conveys the flows east to the Woodward Avenue WWTP for treatment.

During larger storms, when the weir is overtopped, excess WWF is diverted to the Strathearne CSO Outfall via a second, 2,100 mm x 2,250 mm combined sewer on Strathearne Avenue.

During very large storms, every attempt is made to maximize the conveyance of combined sewage to the WWTP for treatment, however there will be circumstances where the Operator may need to close HCG04 to bypass combined sewage through the Strathearne CSO Outfall to protect the Influent Pump Station and biological treatment processes at the WWTP.

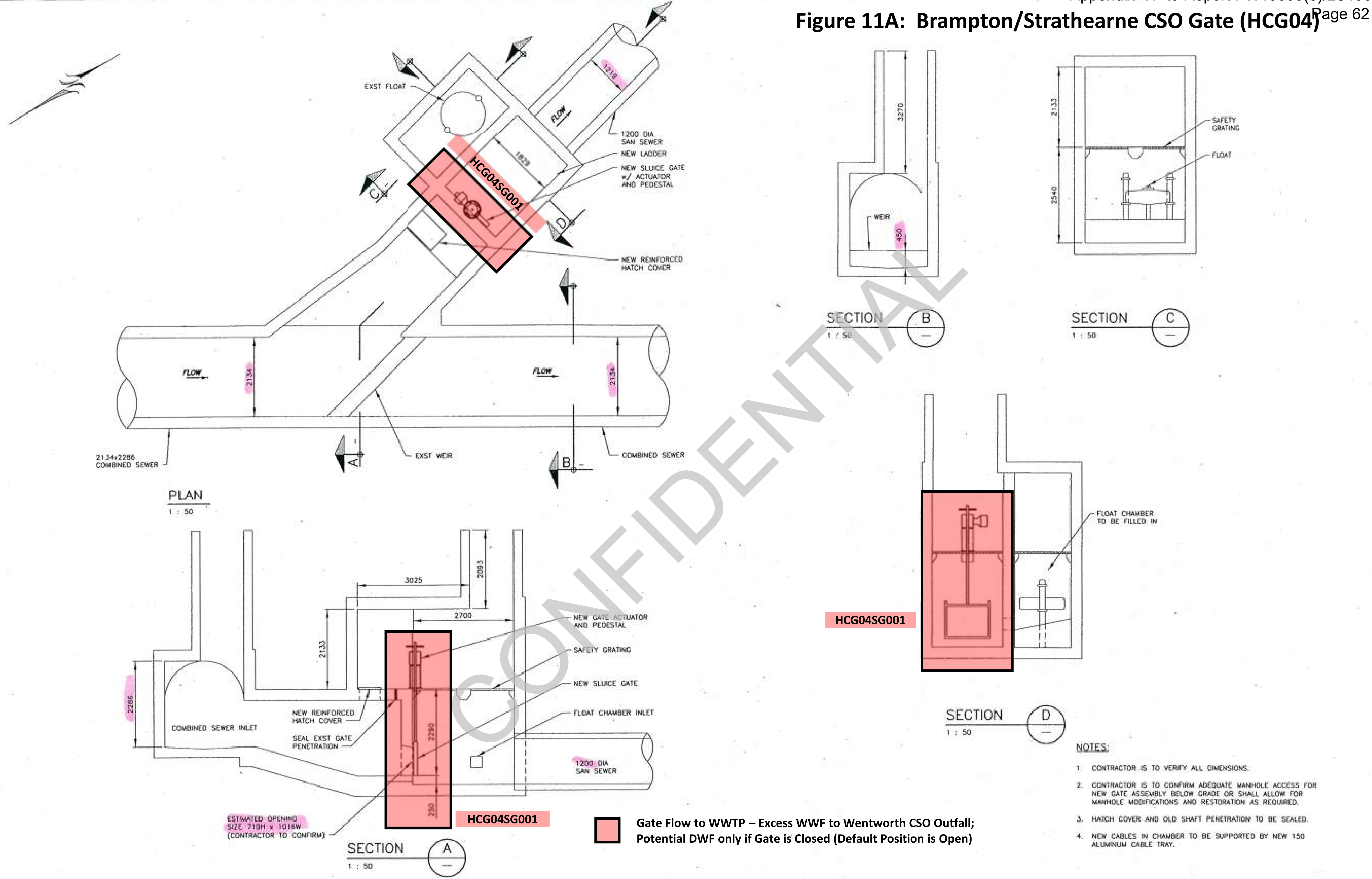
The gate can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP, to maximize flow to the WWTP.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 11A shows the location of the gate, as well as the potential for possible sewage discharges to the environment, colour coded as described above.

Table 11 provides an inventory of the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 11A: Brampton/Strathearne CSO Gate (HCG04)



Gate Flow to WWTP – Excess WWF to Wentworth CSO Outfall;
Potential DWF only if Gate is Closed (Default Position is Open)

NOTES:

1. CONTRACTOR IS TO VERIFY ALL DIMENSIONS.
2. CONTRACTOR IS TO CONFIRM ADEQUATE MANHOLE ACCESS FOR NEW GATE ASSEMBLY BELOW GRADE OR SHALL ALLOW FOR MANHOLE MODIFICATIONS AND RESTORATION AS REQUIRED.
3. HATCH COVER AND OLD SHAFT PENETRATION TO BE SEALED.
4. NEW CABLES IN CHAMBER TO BE SUPPORTED BY NEW 150 ALUMINUM CABLE TRAY.

NOTES

1. INFORMATION CONTAINED ON THIS DRAWING IS OF CONFIDENTIAL NATURE AND SHALL NOT BE USED OR REPRODUCED WITHOUT WRITTEN CONSENT FROM HYDROMANTIS, INC. CONSULTING ENGINEERS.
2. THIS DRAWING IS NOT APPROVED FOR CONSTRUCTION UNTIL SIGNED AND DATED BY THE APPROVING ENGINEER. DESTROY ALL PREVIOUSLY DATED OR REVISION LEVEL DRAWINGS.

VERIFY SCALES
BAR MEASURES 100mm ON ORIGINAL DRAWING
IF NOT 100mm ON THIS SHEET, ADJUST SCALES ACCORDINGLY

NO.	DATE	REVISION	BY	CHK'D	APP'D
0	MAR 28/2007	ISSUED FOR TENDER	BWH		

DESIGN B. KUKOR
DRAWN M. SOSNOVSKY
CHECKED B. MARSH

B. A. KUKOR
2007-03-21

Hydromantis, Inc.
Consulting Engineers
HAMILTON (905) 522 0012 CAMBRIDGE (519) 624 7223 ONTARIO

CITY OF HAMILTON
STRATHEARNE – BRAMPTON
CSO CHAMBER HCG04 SLUICE GATE REPLACEMENT
PROCESS MECHANICAL
PLANS AND SECTIONS

SCALE AS SHOWN
DATE APR/11/2008
PROJECT No 239-047
DRAWING No 401
REV. No 0

239-047-401 -13:53-APR 26/2007

Table 11: Inventory of Critical Control Points at Brampton/Strathearne CSO Gate (HCG04)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Sluice Gate	HCG04SG001	1016 x 710 mm	Motorized	In default Open position, conveys all DWF and some WWF into WSI and on to WWTP, with excess WWF diverted to Strathearne CSO Outfall; If Closed, all flow diverted directly to Strathearne CSO Outfall	Fully Open	In default Open position, no potential for DWF discharge, and potential for WWF discharge only during larger storms. Potential for DWF discharge only if the gate is Closed during DWF, which it never should be.	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gate itself, to back up the existing sensor on the gate stem
							+ Establish appropriate inspection program for the facility, including visual inspection and exercising of gate based on its function and criticality of operation + Note that this gate should not be fully closed during exercising, as this could cause DWF discharge

3.12 Wellington/Burlington CSO Gate (HCG14)

HCG14 is located at the intersection of Wellington Street North and Burlington Street East, where the Wellington CSO Outfall sewer crosses the WSIN. The purpose of HCG14 is to capture and divert combined sewage from the Wellington CSO Outfall sewer into the WSIN for conveyance to the Woodward Avenue WWTP for treatment.

HCG14 is equipped with a modulation slide gate and back-up isolation slide gate, which are operated automatically by the City's Real Time Control (RTC) system based on level measurements on the receiving WSIN, the Wellington CSO Outfall sewer, and the regulator chamber itself. The modulation gate controls the flow into the WSIN and the isolation gate facilitates maintenance of the modulation gate (when required) and provides redundancy for the modulation gate to control flow into the WSIN. Two passive flap gates are also located just downstream of the flow diversion channel to the regulator to prevent water from Hamilton Harbour from flowing back into the sewer system.

During DWF conditions, the modulation gate remains fully closed and the isolation gate remains fully open. During WWF conditions, upon detection of a threshold flow depth in either the Wellington CSO Outfall sewer or in the WSIN, the site is automatically switched to wet conditions strategy operation, which causes the isolation gate to open and the modulation gate to be placed in a partially open position according to the output from a proportional-integral-derivative (PID) controller. The PID controller will then cause the gate to modulate with the objective of attaining and then maintaining the flow level in the WSIN at a specified setpoint. Once the flow levels in the WSIN and the Wellington CSO Outfall sewer fall below the wet conditions strategy trigger levels, the site operation will revert back to the dry conditions strategy. A number of fail-safe and degraded operation conditions features are built into the process control logic in order to ensure the robust and safe operation of the site in the event of a variety of equipment failures (e.g. gate motors, level sensors, etc), all of which are detailed further within the PCN for the site.

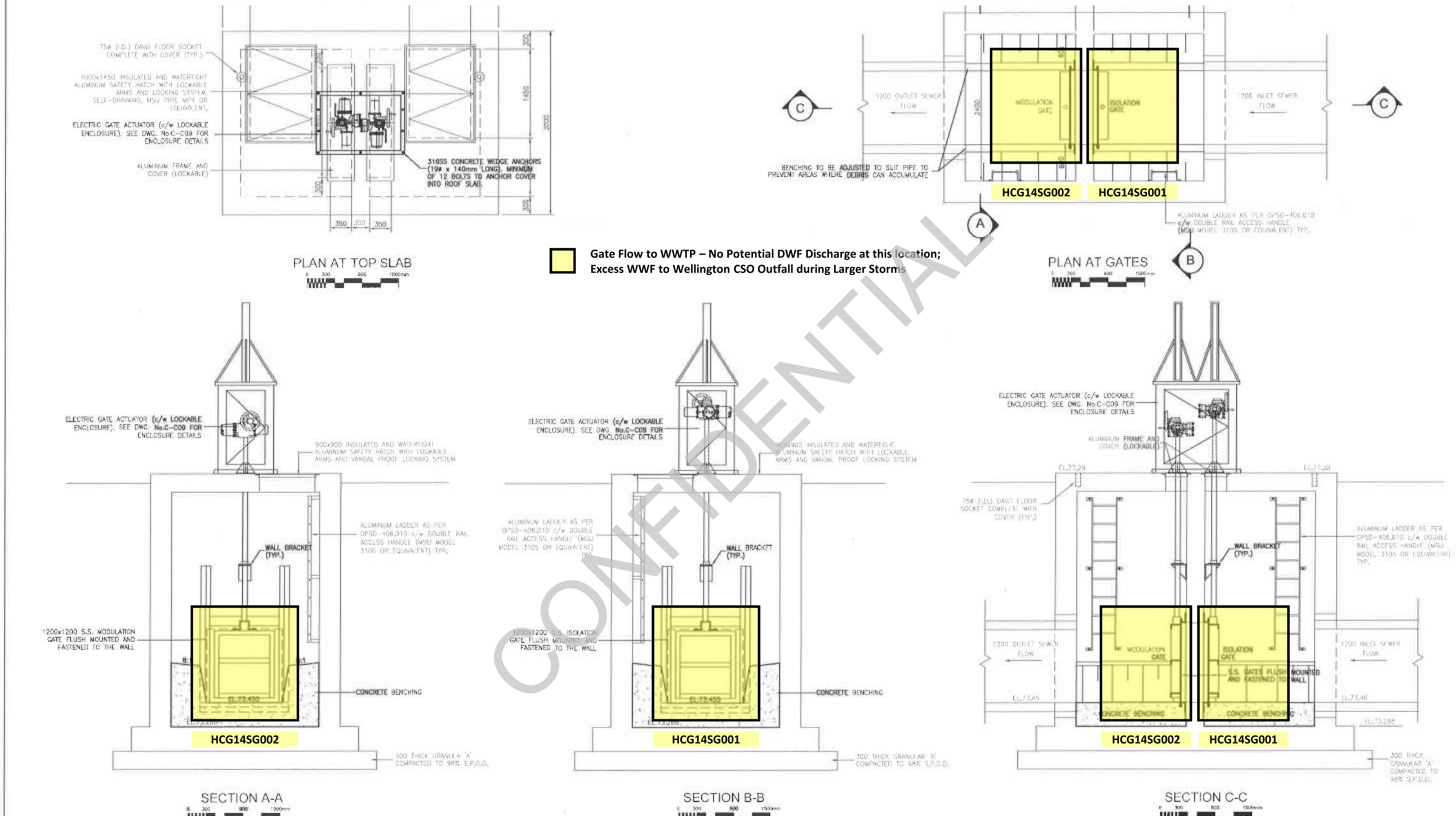
The gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Auto, with operation directed by the RTC system, to maximize flow to the WWTP.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 12A shows the location of the gates, as well as the potential for possible sewage discharges to the environment, colour coded as described above.

Table 12 provides an inventory of the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 12A: Wellington/Burlington CSO Gate (HCG14)



Notes

1. GATE AND ACTUATOR DIMENSIONS MOUNTING DETAILS SHOWN ARE FOR REFERENCE ONLY. CONTRACTOR TO SUBMIT SHOP DRAWINGS TO ENGINEER FOR REVIEW AND APPROVAL FOR GATES, ACTUATORS AND ALL ASSOCIATED MOUNTING EQUIPMENT. MOUNTING ANCHORS ARE TO BE 12ø x140mm LONG S.S. CHEMICAL ANCHOR BOLTS. SPACING AND LAYOUT AS PER MANUFACTURERS RECOMMENDATIONS.

No.	Description	By	Date
1	ISSUED FOR PRELIMINARY DESIGN	C.G.	11.07.11
2	ISSUED FOR 50% DESIGN	C.G.	11.09.13
3	ISSUED FOR 90% DESIGN	C.G.	11.10.13
4	ISSUED FOR TENDER	J.R.	11.11.21
5	ISSUED FOR ADDENDUM No.2	J.R.	12.01.18
6	ISSUED FOR CONSTRUCTION	J.R.	12.02.24
7	ISSUED FOR SI-10	J.R.	12.06.04
8	AS BUILT	J.R.	13.03.21

Consultants

Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON Canada
K1Z 7T1

BPR CSO

Stamps

CITY OF HAMILTON
Public Works Department

CITY OF HAMILTON
RTC IMPLEMENTATION PROJECT

WELLINGTON/BURLINGTON (HCG14)
REGULATOR CHAMBER

REGULATOR CHAMBER
DETAILS

Scale	Designed	Checked	Drawn	Project No.	Date	Dwg. No.	Issue
AS SHOWN	C.G.	J.R.	E.C.		10.05.27	C-C08	8

Table 12: Inventory of Critical Control Points at Wellington/Burlington CSO Gate (HCG14)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Modulation Gate	HCG14SG002	1200 x 1200 mm	Motorized	To capture and divert flows from the Wellington West CSO Outfall sewer into the WSIN and on to WWTP, with excess WWF diverted to Wellington CSO Outfall	Fully Closed in DWF conditions; Opened with position modulated by RTC system in WWF conditions to convey additional flow to WWTP	No potential for DWF discharge, and potential for WWF discharge only during larger storms	+ No significant changes required to PCN or SOP + Conduct engineering study to determine the feasibility of adding a redundant gate position sensor on the gates themselves, to back up the existing sensors on the gate stems
Isolation Gate	HCG14SG001	1200 x 1200 mm	Motorized	To facilitate maintenance of Modulation Gate and provide redundancy for Modulation Gate	Fully Open in all conditions, unless being used for maintenance or redundancy of Modulation Gate		
Flap Gate #1	N/A (Not on SCADA)	2290 x 925 mm	N/A	To prevent backflow of water from Hamilton Harbour into the WSIN	Operates passively, normally Closed, but opens if excess WWF needs to be conveyed north to Wellington West CSO Outfall	No potential for DWF discharge, and potential for WWF discharge only during larger storms	+ Not a CCP, operates passively, no modifications required
Flap Gate #2	N/A (Not on SCADA)	2290 x 925 mm					
							+ Establish appropriate inspection program for the facility, including visual inspection of motorized gates to confirm correct position, and flap gates to confirm they are in good working order and not held open by debris that has got into the sewer

3.13 Parkdale Wastewater Pumping Station (HC001)

Wastewater Pumping Station HC001 is located on the northwest corner of the intersection of Parkdale Avenue and Burlington Street East. The purpose of the station is to lift CSOs from the combined sewer coming from Leaside Road and Woodward Avenue (and separate stormwater from the storm sewer on the north side of Burlington Street between Strathearne Avenue and Parkdale Avenue), which are too deep to be conveyed by gravity to the Parkdale CSO Outfall at the north end of Parkdale Avenue.

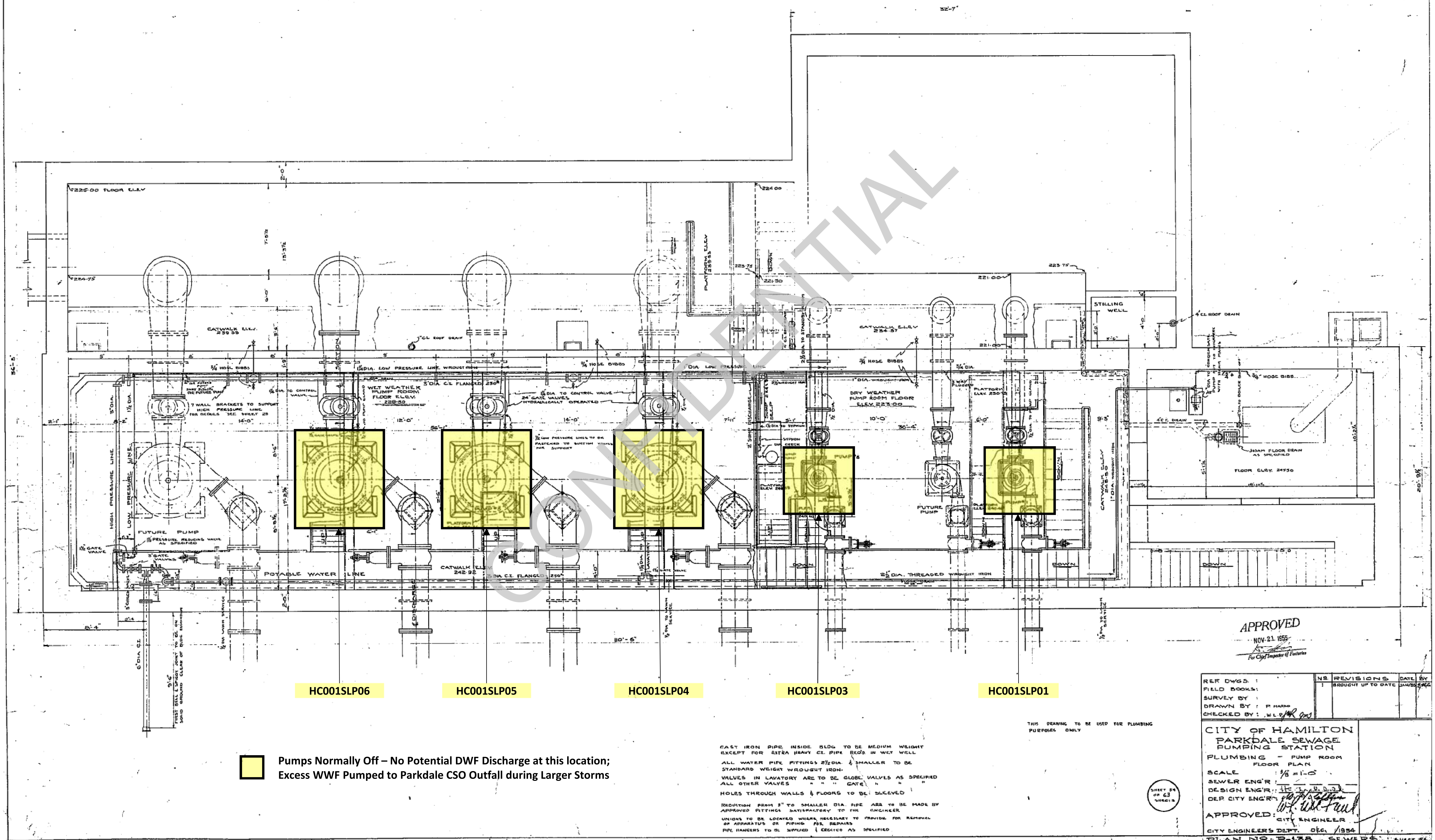
The station is equipped with five (5) active pumps, with two (2) pumps employed to handle normal flow conditions, and three (3) more pumps employed to handle high flow conditions. There is also a diesel engine driven pump, but it is currently out of service and not available for operation.

The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode of operation involves monitoring of the wet well level via SCADA by Operators at the WWTP, with operation of the pumps in SCADA Auto mode, and only required when the Leaside/Woodward combined sewer and/or Burlington storm sewer are active. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 13A shows the location of the pumps, as well as the potential for possible sewage discharges to the environment, colour coded as described above.

Table 13 provides an inventory of the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Figure 13A: Parkdale Pumping Station (HC001)



Pumps Normally Off – No Potential DWF Discharge at this location; Excess WWF Pumped to Parkdale CSO Outfall during Larger Storms

Table 13: Inventory of Critical Control Points at Parkdale Wastewater Pumping Station (HC001)

CCP Component Description	SCADA Tag Name	Size	Manual or Motorized	Purpose	Valve Position Correlation, Default Position	Potential for Discharge to Environment	Recommendations
Sewage Lift Pump #1	HC001SLP01	150 L/s	N/A	To lift overflows from Leaside/Woodward combined sewer and/or Burlington storm sewer into the Parkdale CSO Outfall sewer during WWF events, for conveyance to Hamilton Harbour	Off in DWF conditions; On during WWF conditions when Leaside/Woodward combined sewer and/or Burlington storm sewer are active	No potential for DWF discharge; Potential for WWF discharge only if Leaside/ Woodward combined sewer and/or Burlington storm sewer are active, and respective pumps are turned On	+ No significant changes required to PCN or SOP
Sewage Lift Pump #3	HC001SLP03	150 L/s	N/A				
Sewage Lift Pump #4	HC001SLP04	600 L/s	N/A				
Sewage Lift Pump #5	HC001SLP05	600 L/s	N/A				
Sewage Lift Pump #6	HC001SLP06	600 L/s	N/A				
Diesel Driven Pump	HC001SLP02	N/A	N/A	Currently Out of Service	N/A	N/A	
							+ Establish appropriate inspection program for the facility, including visual inspection of wet well and pumps

4. Recommendations

Specific detailed recommendations to improve the reliability of operation and monitoring of each of the CSO facilities were provided in Tables 1-13 included in Section 3.

Key recommendations aimed at improving the monitoring, performance, operational reliability of the CSO facilities and minimizing the potential for unapproved discharge to the environment include the following:

+ Conduct an engineering study to determine the feasibility of adding redundant gate position sensors on the motorized gates (on the gates themselves), to backup existing sensors on the gate stems. This is to provide redundancy in case a gate becomes disconnected from the gate stem (where the sensor on the gate stem would give a false reading).
+ Conduct an engineering study to determine the feasibility of adding new or redundant level sensors and/or flowmeters on the downstream side of any maintenance bypass gates or stop logs (to provide additional confirmation the gates are closed and not leaking).
+ Consider simplifying the operation of the CSO regulator gates at some of the CSO facilities (e.g. the external CSO regulators at the Main/King CSO tank), to employ the same gate position during both DWF and WWF conditions. Exact positions would need to be determined based on further investigation and discussions amongst City operations staff, and this suggestion would also need to be considered within the context of the objectives of the City's RTC system.
+ Most PCNs and SOPs do not require significant changes, but where they do not already do so, these documents should include a discussion of how to operate any manual or motorized gates that can be used to bypass flows around the facilities (mainly to ensure they are placed and left in their intended normal default positions).
+ Wherever possible, any maintenance bypass gates should be physically locked in their intended normal default positions, minimizing the potential for unapproved discharge to the environment. Note that this has already been done to the CSO Tank Inlet Gate at the Greenhill CSO tanks, the Influent Well Overflow Gate (Maintenance Bypass Gate) at the Main/King CSO Tank, and the Inlet Control Gate at the McMaster CSO Tank. Options to do the same could be evaluated for the Bayfront Park and Eastwood Park CSO tanks.
+ Establish appropriate inspection programs for each of the CSO facilities, including visual inspection and exercising of CCPs based on the function and criticality of operation of each individual CCP.

PUBLICLY RELEASED BY COUNCIL ON NOVEMBER 27, 2019

Report for

City of Hamilton

CSO Facilities O&M Plan – MECP Order Item 6

January 31, 2019

City of Hamilton
CSO Facilities O&M Plan -
MECP Order Item 6

Contact:
Mark Stirrup - Principal Project Manager, Associate

Address:
2265 Upper Middle Rd, Fifth Floor
Oakville, Ontario, Canada L6H 0G5
Tel: +1 (905) 486 0742
www.hatch.com

January 31, 2019

Date	Rev.	Status	Prepared By	Checked and Approved By
01/31/19	1	Final	Mark Stirrup, M.Eng., P.Eng.	Graeme Henderson, P.Eng., PMP

Table of Contents

1. Introduction and Background

On August 2, 2018, the Ministry of Environment, Conservation and Parks (MECP) issued Provincial Officer's Order #1-J25YB (hereinafter referred to as the Order) to the City in relation to the discharge of untreated wastewater to the environment.

The Facilities Assessment Report dated November 31, 2018 prepared by Hatch provided in response to MECP Order Items 4, 7, 8 and 9 (Hatch CSO Facilities Assessment Report, 2018) discussed the findings of the Combined Sewer Overflow (CSO) facility inspections and evaluation of the need for modifications to improve the monitoring, performance and reliability of each facility to minimize the potential for unapproved bypasses/overflows/spills from the facilities (Order Items 4, 7 and 8); and provided recommendations as required by Order Item 9.

Item 4 required the City to inspect all CSO facilities and inventory all critical valves (bypass gates) and control points (overflows) which can be a source of discharge to the natural environment and which would not be captured by existing flow monitoring equipment, including confirmation of manual and SCADA valve position correlation and local or remote control.

Item 7 required the City to evaluate the need for modification(s) to the Main/King CSO Facility, to improve monitoring, performance, reliability and to minimize bypasses/overflows/spills into the 2400 mm storm outfall from the (CSO tank) overflow trough and inlet chamber bypass.

Item 8 required the City to evaluate the need for modification(s) similar to those required by Item 7 above for all other CSO facilities within the Hamilton Wastewater Collection System to minimize bypasses/overflows/spills.

Item 9 required the City to prepare a written report which sets out the evaluation required by the Items 7 and 8 above, along with recommendations and timelines to implement these recommendations.

This current report addresses the requirements of Order Item 6, which requires the City to: using the information obtained from Item 4, and if applicable, Item 5 (updated CSO map), review and update drawings, Process Control Narratives (PCNs) and develop a written Operation and Maintenance Plan (O&M Plan) for each of the City's CSO facilities that identifies critical equipment and environmental discharge points, and shall include, but not be limited to: annual manual valve position checks of critical valves; monthly visual inspections of overflow structures at the CSO facilities equipped with station by-pass structures that discharge directly to the natural environment; and annual flow meter calibration.

The Hatch CSO Facilities Assessment Report (2018) already addressed the first requirement of Item 6, identifying critical equipment and potential environmental discharge points, and providing a number of recommendations to minimize the potential for such discharges in the future, including improved monitoring, control and inspection of the City's CSO facilities.

This report builds upon the information presented in the Hatch CSO Facilities Assessment Report (2018), providing a written O&M Plan for each of the City's CSO facilities and addressing whether updates are required to drawings and PCNs.

2. Discussion

The basis of the City's O&M Plan for each of the CSO facilities is their Standard Operating Procedure (SOP). The SOPs detail procedures for the safe and efficient operation of each facility, including the responsibilities of all levels of City staff involved in the operations and maintenance of the City's wastewater system, and in particular the CSO facilities; relevant safety notes and procedures; procedures for the confined space entry into the underground CSO tanks and valve/gate chambers for the purposes of routine maintenance and inspection; an overview of the O&M process and equipment at each site; and specific procedures to be followed by City staff to safely operate and maintain each facility under all flow conditions, including annual and monthly inspection requirements.

The remaining components of the O&M Plan for each CSO facility include:

- The Process Control Narrative (PCN) for the facility, which describes how the facility is monitored and controlled by the City's Supervisory Control and Data Acquisition (SCADA) system
- Equipment Operation and Maintenance Manuals, which are typically provided by the Consultants and/or Contractors responsible for the construction and/or subsequent upgrades of each facility
- As-Built Drawings of each facility
- Additional formal procedures developed and employed by the City to operate and maintain the CSO facilities, including procedures for Confined Space Entry, Equipment Lock Out/Tagging, CSO Overflow Notification, and CSO Facility Inspection

This report summarizes the O&M Plan for each of the City's CSO facilities, including a brief description of the facility and any Critical Control Points (CCPs); an inventory of the key components of the plan, including the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings; and appendices including the current updated SOPs and PCNs.

Copies of the updated SOPs can be found in Appendix A, and a copy of the updated PCN for the Main/King CSO Tank (HCS04) can be found in in Appendix B. Copies of the remaining unchanged PCNs, equipment O&M manuals and as-built drawings are not provided here due their volume, but can be made available to the MECP.

The remainder of this report is broken down facility by facility, including a separate section for each of the City's existing CSO facilities, including the following locations:

1) Greenhill CSO Tank #1 (HCS01)
2) Bayfront Park CSO Tank (HCS02)
3) James Street CSO Tank (HCS03), including Ferrie-Mary CSO Regulator Gate (HCG03)
4) Main/King CSO Tank (HCS04)
5) Eastwood Park CSO Tank (HCS05), including Burlington-Ferguson and Ferrie-Ferguson CSO Regulator Gates (HCG06 and HCG07)
6) Greenhill CSO Tank #2 (HCS06)
7) Red Hill Storage Facility (HCS07), including Lawrence Road, Queenston Road and Barton Street Gates (HCS7A, HCS7B and HCS7C) and Lawrence/King CSO Gate (HCG05)
8) Royal Avenue CSO Tank (HCS08)
9) McMaster/Ewen CSO Tank (HCS09)
10) Wentworth/Rosemary CSO Gate (HCG03)
11) Brampton/Strathearne CSO Gate (HCG04)
12) Wellington/Burlington CSO Gate (HCG14)
13) Parkdale Burlington Wastewater Collection Station (HC001)

Additional details on each of the CSO facilities can be found in the Hatch CSO Facilities Assessment Report (2018), including a brief narrative description of each facility and its purpose; drawings/figures showing the location of the CCPs at each facility, and also indicating the potential for possible unapproved sewage discharges to the environment, colour coded to indicate criticality; and tables providing an inventory of all the CCPs at each facility, including their name; SCADA tag name (where applicable); size/capacity; whether they are manually operated or motorized; their purpose in terms of flow control; their default position (as per the facility's PCN and/or SOP); their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.
The following sections of this current report provide a brief narrative description of each of the above CSO facilities and their purpose, and provide a summary of the key components of the O&M Plan for each facility, including a table providing an inventory of the key components of the plan, including the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings; and appendices including the current updated SOPs and PCNs.

As noted above, additional details on each CSO facility can be found in the respective section of the Hatch CSO Facilities Assessment Report (2018). For the sake of brevity, the drawings/figures and tables presented in the Hatch CSO Facilities Assessment Report (2018) are not reproduced here in this report, but are referenced where applicable below.

2.1 Greenhill CSO Tank #1 (HCS01)

The original Greenhill CSO Tank (HCS01) is an underground reinforced concrete structure that provides approximately 83,500 m^3 of CSO storage capacity, and was designed to capture the runoff from a 15 mm design storm. The storage volume is provided within a circular tank, which is approximately 54 m in diameter and 9 m deep, and includes two separate storage cells. The first cell provides approximately 13,900 m^3 of storage, and if the first cell fills, the second cell provides approximately 69,600 m^3 of additional storage.

Originally, HCS01 received sewage inflows directly from the combined trunk sewer running east along Greenhill Avenue, but with the addition of Greenhill CSO Tank #2 (HCS06), the original CSO tank now receives the overflows from the new CSO Tank #2 (HSC06). The combined operation of the two CSO tanks is discussed in more detail below in Section 2.6.

HCS01 is filled by gravity from the overflow from HCS06, and drained by motorized flow control gates over the discharges from the two storage cells, into the Red Hill Creek Sanitary Interceptor Sewer (RHCSI), which conveys flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). The gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. A water spray nozzle system is provided to clean the floor of Cell 2.

Level transmitters are provided to monitor the level of sewage stored in each storage cell, and in the CSO tank outlet channel; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station.

Figures 1A and 1B of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 1 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 1 provided below summarizes the key components of the O&M Plan for HCS01, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #5, Jan 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.4, Apr 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the Cell 1 and 2 Drain Gates themselves, to back up the existing sensors on the gate stems; and the City has plans to investigate and possibly upgrade the performance of the existing tank cleaning system.

Table 1: Summary of O&M Plan for Greenhill CSO Tank #1 (HCS01)

O&M Plan Component	Name of Document	Prepared By	Version #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Greenhill CSO Tank #1 (HCS01)	Hamilton Water Hatch Ltd.	Issue #5	Jan 2019
Equipment O&M Manual	Operation and Maintenance Manual – Contract RHW-86-10 (S) – HCS01	UMA Engineering Ltd.	N/A	1986
Equipment O&M Manual	Operation and Maintenance Manual for Odour Control System – HCS01	McCullough Gibson Construction Ltd	N/A	Nov 1997
Process Control Narrative (PCN)	Process Control Narrative – Greenhill Sewage Overflow Facility (HCS01)	Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.4	Apr 2016
As-Built Drawings	Greenhill Avenue Storage Facility – Contract No. RHW-86-01	UMA Engineering Ltd.	Dwg No. 807-13	Dec 1985

2.2 Bayfront Park CSO Tank (HCS02)

The Bayfront Park CSO Tank (HCS02) covers an area of approximately 3,200 m^2, and is over 6 m deep, providing approximately 21,000 m^3 of CSO storage capacity in two equally sized storage cells. A 4.0 m x 1.5 m box sewer (which later changes to 2,250 mm diameter) intercepts CSOs from the former Queen and Hess Street CSO outfalls and conveys them to the CSO tank. Flow into the tank is regulated by static CSO regulators at Queen/Barton, Stuart/Hess, and Stuart/Caroline, and by the Strachan Street Sewage Pumping Station (HC003). A flow regulating chamber is also provided upstream of the tank (near the CSO tank outfall), which includes three gates that can be operated to convey all flows into the CSO tank (in their default positions) or to provide a maintenance bypass of the tank (in their alternate positions). The operation of the gates is explained in more detail in the Hatch CSO Facilities Assessment Report (2018), and in the updated SOP found in Appendix A. The two Maintenance Bypass Gates are locked in the Fully Closed position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Hamilton Harbour at this location.

During Dry Weather Flow (DWF) conditions, all flow is directed to the WWTP via the CSO regulators and the three (3) dry pit pumps in the pumping station (3 x 180 L/s).

During Wet Weather Flow (WWF) conditions, excess flows from the three static CSO regulators overflow into the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour via the outfall sewer that exits the north-west corner of the tank. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank. If the tank fills completely, CSOs are conveyed via a 5,000 mm x 2,000 mm box sewer to the outfall that enters the Harbour at the east end of the inlet between the park and the railway lands.

Combined sewage retained in the tank during wet weather is subsequently returned to the Western Sanitary Interceptor (WSI) and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 200 L/s submersible pumps located in Cell 1. A flap gate between Cell 1 and Cell 2 allows the two cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the WSI near Strachan and MacNab Streets. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. Ten (10) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (5 STFs in each cell).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility; and two (2) automatic samplers are provided to collect grab and composite samples of both the influent and effluent (overflow) water quality.

The entire facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station. Stand-by power is provided for the sewage pumping station by a diesel power generator.

Figures 2A to 2C of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 2 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 2 provided below summarizes the key components of the O&M Plan for HCS02, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #3, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs; to note that the two Maintenance Bypass Gates have been locked in the Fully Closed position in December 2018; and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.3, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 2: Summary of O&M Plan for Bayfront Park CSO Tank (HCS02)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Bayfront CSO Tank (HCS02)	Hamilton Water Hatch Ltd.	Issue #3	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – CSO Facility HCS02 / Wastewater PS HC003	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.3	Apr 2016
Equipment O&M Manual	Operation and Maintenance Manual – Strachan Storage Tank – HCS02	Matthews Contracting Inc. (General Contractor) Priestep Electric Limited (Electrical Contractor)	N/A	Mar 1993
As-Built Drawings	Strachan Street (Bayfront Park) Storage Tank	Regional Municipality of Hamilton-Wentworth	Dwg No. 92-S-14	Feb 1992

2.3 James Street CSO Facility (HCS03 and HCG08)

The James Street CSO Storage Facility (HCS03) incorporates both off-line and in-line storage components, which provide a total CSO storage capacity of approximately 3,200 m^3.

The off-line storage tank is an underground, reinforced concrete structure, which resides beneath the parking lot of the Royal Hamilton Yacht Club, located at the north end of James Street. The rectangular tank covers an area of approximately 900 m^2, and is 0.8 to 2.1 m deep, providing approximately 1,400 m^3 of CSO storage capacity.

The off-line storage capacity is augmented by 1,800 m^3 of in-line storage, which is provided within the 1,400 mm diameter combined sewer downstream of the CSO tank. The additional in-line storage is created by the Ferrie-Mary CSO Regulator Gates (HCG08). The HCG08 sluice gates control the rate of flow from the James Street combined sewer system into the WSI at Ferrie and Mary Streets. These gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP.

During DWF conditions, the gates are set to allow all flow to enter the WSI. During WWF conditions, the gates can be partially or completely closed to throttle the flow of combined sewage into the WSI, and begin filling the storage facilities. The rate of filling is determined by the position of the gates. The in-line storage pipe will fill first, and as levels in this pipe increase, the off-line storage tank will also begin to fill. If the tank fills completely, CSOs are discharged to Hamilton Harbour via the pre-existing 1,200 mm x 900 mm CSO outfall at the north end of the tank. Stainless steel underflow baffles are employed above the tank overflow to retain floatable materials within the tank.

Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by gravity as the in-line storage pipe empties. The rate of drainage from the in-line storage pipe and the off-line storage tank is determined by the position of the HCG08 gates, which can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. A water spray nozzle system is provided to clean the floor of the tank.

Level transmitters are provided to monitor the level of sewage stored in the off-line storage tank, and in the CSO tank overflow channel; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

The facilities are monitored and controlled via SCADA by Operators at the WWTP.

Figures 3A to 3D of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 3 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 3 provided below summarizes the key components of the O&M Plan for HCS03, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.5, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the HCG08 sluice gates themselves, to back up the existing sensors on the gate stems.

Table 3: Summary of O&M Plan for James Street CSO Facility (HCS03/HCG08)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – James Street CSO Tank (HCS03), Ferrie/Mary Sluice Gates (HCG08)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – James Street CSO Facility HCS03, Ferrie/Mary Sluice Gates (HCG08)	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.5	Apr 2016
As-Built Drawings	James Street North Storage Tank – Contract RHW 92-78 (ST)	Regional Municipality of Hamilton-Wentworth	Dwg No. 92-S-45	Sep 1992

2.4 Main/King CSO Tank (HCS04)

The Main/King CSO Tank (HCS04) covers an area of approximately 9,500 m^2, and is over 8 m deep, providing approximately 77,100 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 23,300 m^3 of storage, and the second provides a further 53,800 m^3 of storage. The Main/King CSO Tank operates off-line, with combined sewage entering the tank during larger CSO events. Flow into the tank is regulated by three WWTP-controlled CSO regulators that were constructed in conjunction with the CSO tank. The Glen Road CSO Outfall, which is located at the east end of Glen Road on the west side of Hwy 403, was effectively eliminated by installing a new WWTP-controlled CSO regulator gate at Glen/Macklin (Chamber 1) and constructing a new 1,350 mm diameter sewer to convey CSOs underneath Hwy 403 and into the CSO tank. The former McKittrick CSO Outfall, which previously diverted CSOs from the 1,980 mm diameter combined sewer that conveys flows to the WSI, was eliminated by constructing a new WWTP-controlled CSO regulator (Chamber 4) to divert CSOs into the new tank. Flow from the 2,100 mm x 2,250 mm box sewer which runs along the south side of Main Street was diverted into the new tank by a bulkhead placed in the sewer and a new WWTP-controlled CSO regulator located at the south-east corner of the tank (Chamber 5). Downstream of the bulkhead, this sewer is used to convey the overflows which will still occur from the tank when its design capacity is exceeded.

During DWF conditions, flow is directed to the WWTP via the WSI. The gate in Chamber 4 (King Street Sewer) is set to be Fully Open; the gate in Chamber 5 (Interceptor Sewer) is set to 30% Open; and the gate in Chamber 1 (Glen Road Sewer) is always set at 35%. The Main Street Overflow Sewer, which maintains a base flow during dry weather due mainly to infiltration, is directed to the CSO tank's wet well and pumped into the interceptor sewer. The gate in Chamber 4 is currently without power or communications, and it is currently manually set to convey wet weather flow mainly to the CSO tank.

During WWF conditions, the pumps are taken out of auto mode and turned off; the opening of Gate 4 is reduced to 7%; and the opening of Gate 5 is reduced to 2%. Excess flow from the three regulators enters the pumping station wet well, which is located beneath the control building at the south-east corner of the facility. During dry weather and small storm events, the CSO tank's pumping station acts as a normal sewage pumping station. During larger storm events, two motorized sluice gates are opened to permit flow from the wet-well to enter the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged into Chedoke Creek near the Main Street overpass, via the original 2,100 mm x 2,250 mm box sewer outfall. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank's wet well includes an Influent Well Overflow Gate (CSO Maintenance Bypass Gate) that can be operated to convey all flows into the CSO tank and pumping station (when Closed) or to provide a maintenance bypass of the tank (when Open). Prior to November 2018, the PCN for HCS04 incorrectly indicated that during DWF conditions this gate should be 5% open, and during WWF conditions this gate should be 100% open. The default settings for the gate should actually be Fully Closed during both DWF and WWF conditions and the PCN was updated in November 2018 to reflect this.

Combined sewage retained in the tank during wet weather is subsequently returned to the Combined Sewer System (CSS) and conveyed by the WSI to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by three (3) 375 L/s submersible pumps located in the pumping station wet well. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the original 1,980 mm sewer, which in turn discharges into the WSI near Hunt Street. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. Thirty (30) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (10 in Cell 1 and 20 in Cell 2).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility; and two (2) automatic samplers are provided to collect grab and composite samples of both the influent and effluent (overflow) water quality.

The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 4A to 4C of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 4 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 4 provided below summarizes the key components of the O&M Plan for HCS04, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to reflect recent changes to the operation of HCS04. These included padlocking the Influent Well Overflow Gate (CSO Maintenance Bypass Gate) in the Fully Closed position, and removing access to this gate for control purposes from the SCADA system; and setting the position of the Chamber 1 sluice gate at Glen Road to 35% Open for all flow conditions. These changes are described further in the updated SOP. Other updates to SOP included clarifying the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and adding a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6.

The previous version of the PCN has been recently updated (Version 3.5, November 2018) to reflect the operational gate changes described above and incorporated in the updated SOP, and a copy of the updated SOP is included in Appendix B.

No significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on all the sluice gates associated with the facility, on the gates themselves, to back up the existing sensors on the gate stems; and to consider simplifying the operation of the sluice gates in Chamber 4 and 5. The City is evaluating options to investigate the feasibility of moving the existing flowmeter and automatic sampler on the CSO tank overflow, to a location downstream of the above-mentioned Influent Well Overflow Gate (CSO Maintenance Bypass Gate), to also capture any possible future flows through this gate; to relocate the CSO tank influent sampler to a better location not prone to high flows damaging the unit; and to investigate and upgrade portions of the existing tank cleaning system.

Table 4: Summary of O&M Plan for Main/King CSO Tank (HCS04)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Main/King CSO Tank (HCS04)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Wastewater PS / Main/King CSO Tank HCS04	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 3.5	Nov 2018
Equipment O&M Manual	Electrical O&M Manual – Contract RHW-94-75 (COIW) - HCS04	Selectra Inc. (Electrical Contractor) Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000301	1998
Equipment O&M Manual	Installation, Operating & Maintenance Manuals – Contract RHW-94-75 (COIW) – HCS04	Bennett Mechanical Installations (Mech Contractor) Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000302	1998
Equipment O&M Manual	Operations/Maintenance Manuals – Contract RHW-94-75 (COIW) – HCS04	Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000520	1998
Equipment O&M Manual	Electrical/I&C Instruction Manual J936	Bristol Babcock (I&C Contractor) Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000521	1998
As-Built Drawings	Main/King CSO Tank – Contract RHW-94-75 (COIW) – HCS04	R.V. Anderson Associates Limited	Dwg No. 95-S-32	1998

2.5 Eastwood Park CSO Tank (HCS05, HCG06 and HCG07)

The Eastwood Park CSO Tank (HCS05) covers an area of approximately 4,000 m^2, and is over 6 m deep, providing approximately 27,350 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 14,700 m^3 of storage, and the second provides a further 12,650 m^3 of storage. A sewer along Dock Service Road intercepts the CSOs from the two outfalls and conveys them to the CSO tank. The original Catharine Street (1,050 mm) and Ferguson Avenue (1,500 mm) CSO outfalls were left in place and are used to carry the overflow from the CSO tank on the infrequent occasions when the design capacity of the tank is exceeded. A flow splitter diverts the overflow from the tank between the two previously existing outfall sewers.

The Eastwood Park CSO Tank operates off-line, with combined sewage entering the tank only during larger CSO events. Flow into the tank is regulated by static CSO regulators at Catharine/Brock, Picton/Ferguson and MacAulay/Ferguson and by the two WWTP-controlled CSO regulators at Burlington/Ferguson and Ferrie/Ferguson.

During DWF conditions, the Burlington/Ferguson (HCG06) and Ferguson/Ferrie Streets (HCG07) sluice gates normally remain open, directing all flow to the WSI sewer and on to the WWTP.

During WWF conditions, excess flows from the Catharine/Brock CSO regulator and the two CSO regulators along Ferguson Avenue overflow into the tank. When rainfall occurs, the station is placed into Storm Mode and the pumps in the CSO tank are Off, and the HCG06 and HCG07 gates are fully closed, eliminating flow into the WSI at these locations. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour through the Catharine Street and Ferguson Avenue CSO outfalls. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank inlet chamber at the north-east corner of the tank includes three gates that can be operated to convey all flows into the CSO tank (in their default positions, with the CSO tank inlet gate open and the two CSO tank maintenance gates closed) or to provide a maintenance bypass of the tank (in their alternate positions). The operation of the gates is explained in more detail in the Hatch CSO Facilities Assessment Report (2018), and in the updated SOP found in Appendix A. The two Maintenance Bypass Gates are locked in the Fully Closed position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Hamilton Harbour at this location.

Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 289 L/sec submersible pumps located in Cell 1. One pump is used as a duty pump and the other as a stand-by pump. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the 900 mm portion of the WSI downstream of HCG06. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. Fifteen (15) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (8 in Cell 1 and 7 in Cell 2).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility; and two (2) automatic samplers are provided to collect grab and composite samples of both the influent and effluent (overflow) water quality.

The facilities are monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of unauthorized entries to the control building.

Figures 5A to 5D of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 5 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 5 provided below summarizes the key components of the O&M Plan for HCS05, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #5, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs; to note that the two Maintenance Bypass Gates have been locked in the Fully Closed position in December 2018; and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.2, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings of the tank. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the CSO Tank Inlet Gate and the HCG06 (Burlington/Ferguson) and HCG07 (Ferrie/Ferguson) sluice gates, on the gates themselves, to back up the existing sensors on the gate stems.

Table 5: Summary of O&M Plan for Eastwood Park CSO Tank (HCS05), Burlington/Ferguson Sluice Gate (HCG06) and Ferrie/Ferguson Sluice Gate (HCG07)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Eastwood Park CSO Tank (HCS05), Burlington/Ferguson Sluice Gate (HCG06) and Ferrie/Ferguson Sluice Gate (HCG07)	Hamilton Water Hatch Ltd.	Issue #5	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Eastwood Park CSO Facility HCS05	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.2	Apr 2016
Equipment O&M Manual	Electrical Maintenance Manuals – Contract RHW-96-03 (S) – HCS05	Metric (Electrical Contractor) Granville (General Contractor) Thorburn Penny (Consultant)	Shelf D-3, Doc No. 0000303	1998
Equipment O&M Manual	Operation and Maintenance Manuals – Contract RHW-96-03 (S) – HCS05	Granville (General Contractor) Thorburn Penny Consulting Limited (Consultant)	Shelf D-3, Doc No. 0000307	1998
Equipment O&M Manual	Operations Manual – Contract C13-09-12 – HCG06 and HCG07	Stantec (Consultant) Newman Bros. Ltd (General Contractor)	Shelf D-5, Doc No. 0000639	Sep 2012
As-Built Drawings	Eastwood Park CSO Facility – Contract RHW-96-03 (S) – HCS05	Thorburn Penny Consulting Limited	Dwg No. 96-S-29	Oct 1995

2.6 Greenhill CSO Tank #2 (HCS06)

The second Greenhill CSO Tank (HCS06) is an underground reinforced concrete structure that was installed to augment the storage provided by the original Greenhill CSO Tank (HCS01). The rectangular tank covers an area of approximately 8,400 m^2, and is 7.5 to 8.3 m deep, providing approximately 66,750 m^3 of CSO storage capacity in two equally sized storage cells. The new facility increased the combined CSO storage volume at the Greenhill site to approximately 150,250 m^3.

HCS06 operates as an off-line facility, with combined sewage entering the tank only during larger CSO events. Flow into the storage tank is regulated by a WWTP-controlled CSO regulator located upstream of the tank. Cell 1 will fill first, and if it fills completely, excess flows overflow into Cell 2. If Cell 2 also fills, overflows will be conveyed into HCS01. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the new tank and prevent them from entering HCS01.

HCS06 is drained by gravity into the RHCSI via a 1,200 mm diameter sewer. The rate of drainage is regulated by a WWTP-controlled gate, based upon the current inflows at the WWTP.

The facility includes a bypass chamber between HCS06 and HCS01 that can be used to isolate HCS01 for maintenance purposes. To operate this bypass, the manual stop gate in the chamber has to be physically removed from its default position and inserted in the alternate position across the overflow channel from HCSO6 to HCS01 (thereby diverting flow to Red Hill Creek). Only one stop log is provided, making it impossible to block the flow of both sewers at the same time. Twenty (20) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (10 in each cell).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; and a flowmeter is provided (at HCS01) to measure the rate and volume of any CSOs exiting the facility.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

HCS06 is also equipped with a biofilter odour control system to reduce the presence of unpleasant odours associated with the tank (possible when the tank is filling with sewage and air is being displaced from the tank).

Figures 6A to 6E of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 6 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 6 provided below summarizes the key components of the O&M Plan for HCS06, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #3, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.4, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the Dry Flow Control Gate and CSO Drain Gate, on the gates themselves, to back up the existing sensors on the gate stems.

Table 6: Summary of O&M Plan for Greenhill CSO Tank #2 (HCS06)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Greenhill CSO Tank #2 (HCS06)	Hamilton Water Hatch Ltd.	Issue #3	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Greenhill #2 CSO Tank HCS06	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.4	Apr 2016
Equipment O&M Manual	Operating and Maintenance Manuals – Contract TOE-02-05 (CSO) – HCS06	Bennett Contracting Millgrove Ltd General Contractor)	Shelf D-3, Doc No. 0000299	N/A
As-Built Drawings	Greenhill CSO Tank #2 – Contract TOE-02-05 (CSO) – HCS06	City of Hamilton	Dwg No. 01-S-23	Jan 2002

2.7 Red Hill Valley CSO Pipe Facility (HCS07)

The Red Hill Valley CSO Pipe Facility (HCS07) captures and stores CSOs from the former Lawrence, Queenston and Melvin CSO outfalls to Red Hill Creek. The facility stores the CSO in an oversized pipe running parallel to the existing RHCSI and along the Red Hill Parkway. The oversized storage pipe ranges in size from 2,000 to 2,250 mm in diameter, and a series of four (4) motorized sluice gates are used to convey flows into and create temporary storage within the pipe during WWF conditions, and also to control the subsequent drainage of the facility to the WWTP for treatment during DWF conditions.

HCS07 comprises three (3) flow control structures: HCS7A at Lawrence Road; HCS7B at Queenston Road; and HCS7C at Barton Street; creating two (2) storage pipe cells providing a total storage volume of approximately 14,200 m^3. Cell 1 consists of a 2,250 mm diameter pipe running between HCS7A and HCS7B; and Cell 2 consists of a 2,000 mm diameter pipe running between HCS7B and HCS7C. HCS7C includes an 1,800 mm diameter sanitary sewer to drain the storage facility, and a 2,250 mm diameter overflow sewer to Red Hill Creek that only becomes active if the design capacity of the facility is exceeded. The stored flow behind the gates can also be used to flush any sediments that may have settled at the bottom of the storage pipe cells during storage periods.

Level transmitters are provided to monitor the level of sewage at HCS7A/B/C (also giving the level of sewage stored in Cell 1 and 2); a flowmeter is provided at HCS7C at Barton Street to measure the rate and volume of any CSOs exiting the facility; and an automatic sampler is provided to collect grab and composite samples of effluent (overflow) water quality from the HCS7C overflow.

The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control buildings.

Figures 7A to 7E of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 7 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 7 provided below summarizes the key components of the O&M Plan for HCS07, including current versions of the SOP, PCN, Equipment O&M Manuals, and drawings.

The SOP has been updated as part of this report (Issue #2, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been to the current version of the HCS7A/B/C PCNs (Version 2.3, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on all sluice gates associated with this facility, on the gates themselves, to back up the existing sensors on the gate stems.

Table 7: Summary of O&M Plan for Red Hill CSO Pipe Facility (HCS07, HCS7A/B/C)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Red Hill CSO Pipe Facility (HCS07)	Hamilton Water Hatch Ltd.	Issue #2	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Red Hill Valley CSO Pipe Facility HCS7A	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.3	Apr 2016
Process Control Narrative (PCN)	Process Control Narrative – Red Hill Valley CSO Pipe Facility HCS7B		Version 2.3	Apr 2016
Process Control Narrative (PCN)	Process Control Narrative – Red Hill Valley CSO Pipe Facility HCS7C		Version 2.3	Apr 2016
Equipment O&M Manual	SCADA Operations Manual – Contract PW-04-239/241 (RHV) – HCS07	Hatch Mott MacDonald (SCADA Consultant) Dufferin Construction Company (General Contractor)	Shelf D-2, Doc No. 0000570	Feb 2009
Equipment O&M Manual	Civil & Mechanical O&M Manual – Contract PW-04-239/241 (RHV) – HCS07	Dufferin Construction Company (General Contractor)	Shelf D-2, Doc No. 0000571	Feb 2009
Equipment O&M Manual	PLC & WAN Panel O&M Manual – Contract PW-04-239/241 (RHV) – HCS07	Hatch Mott MacDonald (SCADA Consultant) Dufferin Construction Company (General Contractor)	Shelf D-2, Doc No. 0000572	Oct 2009
Drawings	Red Hill Valley CSO Pipe Facility – Contract PW-04-239 (RHV) – HCS07	AWS Engineers & Planners	Dwg No. 04-H-67	Jul 2003

2.8 Royal Avenue CSO Tank (HCS08)

The Royal Avenue CSO Tank (HCS08) is an underground reinforced concrete structure that provides approximately 15,000 m^3 of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 41 m long x 37 m wide x 10 m deep.

The site originally included a CSO Regulator chamber that employed a motorized sluice gate to dynamically control the rate of flow conveyed to the Woodward Avenue WWTP. This sluice gate was removed, and control of the flow conveyed to the WWTP and the CSO tank is accomplished passively by a 525 mm diameter drop pipe located in the diversion chamber at the east end of Royal Avenue. During dry weather and small storm events, the 525 mm drop pipe conveys all flow into the downstream 900 mm sanitary sewer and on to the WWTP. During larger storm events, the 525 mm drop pipe will fill to capacity and excess flows will be diverted to the CSO tank after passing through a coarse bar screen included in the CSO Tank Inlet Chamber. Filling of the CSO Tank occurs passively without any actions having to be initiated by the Operators at the WWTP.

CSOs are conveyed to the storage tank by a 2,400 mm x 2,400 mm step sewer. The inlet sewer is designed to operate under surcharge, dependent upon the level of the sewage in the CSO storage tank, which provides some additional storage volume.

The inlet chamber also includes provision to isolate the CSO storage tank in emergencies and during special maintenance activities, and a 2,400 mm wide x 2,000 mm deep box culvert is provided to divert flow to Chedoke Creek for those activities. The chamber includes two sets of guides for alternate placement of a single stop log to control the direction of flow. Under normal operation, the stop log will be inserted in the guides over the upstream end of the emergency bypass sewer, sending all excess WWF into the CSO tank. To operate the bypass, the stop log has to be physically removed from its default position and inserted in the alternate position over the upstream end of the CSO tank inlet sewer. Only one stop log is provided, making it impossible to block the flow of both sewers at the same time. A removable stainless-steel bar screen is provided at the upstream end of the CSO tank inlet sewer to capture debris to protect the sewage pumps in the storage tank.

Inside the storage tank, a stainless-steel baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the tank, so they can be subsequently pumped from the tank and conveyed to the Woodward WWTP for treatment. A 5,400 mm wide x 1,800 mm deep box culvert is provided at the northeast corner of the site to convey any overflows from the facility into Chedoke Creek.

Three (3) submersible pumps are provided to pump the contents of the storage tank back into the Combined Sewer System (CSS) in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during dry weather, when the capacity is available to treat these flows. Three (3) 250 L/s pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps will be conveyed south via three (3) 400 mm diameter ductile iron forcemains into the relocated 900 mm sanitary sewer running east along the south wall of the tank. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. Six (6) sediment flushing tanks (SFTs) are provided to clean the floor of the tank following each storm event.

Two (2) level transmitters are provided to monitor the level of sewage stored in the tank; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 8A to 8C of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 8 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 8 provided below summarizes the key components of the O&M Plan for HCS08, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #3, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.3, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 8: Summary of O&M Plan for Royal Avenue CSO Tank (HCS08)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Royal Avenue CSO Tank (HCS08)	Hamilton Water Hatch Ltd.	Issue #3	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Royal Avenue CSO Tank HCS08	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.3	Apr 2016
Equipment O&M Manual	SCADA O&M Manual – Contract PW-05-06 (CSO) – HCS08	Hatch Mott MacDonald (Consultant) Genivar (General Contractor)	Shelf D-3, Doc No. 0000308	Nov 2007
As-Built Drawings	Royal Avenue CSO Storage Tank – Contract PW-05-06 (CSO) – HCS08	Hatch Mott MacDonald / J&M Structural	Dwg No. 05-S-13	Jan 2008

2.9 McMaster CSO Tank (HCS09)

The McMaster CSO Tank (HCS09) is an underground reinforced concrete structure that provides approximately 5,935 m^3 of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 50 m long x 18 m wide x 6.6 m deep. When the tank is full, some additional CSO storage volume is provided within the upstream CSO tank inlet sewer.

A maintenance bypass is provided at the southwest corner of the storage tank, where the CSO inflow sewer enters the tank, to provide a means to bypass flows around the storage tank, to permit future isolation of the CSO storage tank in emergencies and during special maintenance activities.

Under normal operation, the CSO Tank Inlet Gate is Fully Open (it has been padlocked in this position) and the stop log over the end of the CSO tank overflow sewer is removed (sitting in guides above the end of the CSO tank overflow sewer), to allow all incoming flow to enter the tank, and the Operator does not have to do anything to allow the storage tank to fill. To operate the CSO tank bypass, in order to fully isolate the CSO tank from the CSO outfall pipe, the CSO Tank Inlet Gate must be fully closed and the stop log removed from its default position and inserted in the alternate guides provided over the end of the CSO tank overflow sewer. The CSO Tank Inlet Gate has recently been padlocked in the Fully Open position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Ancaster Creek.

Inside the storage tank, a stainless-steel underflow baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the CSO storage tank, so they can be subsequently pumped from the tank and conveyed to the WWTP for treatment. A 2,400 mm wide x 1,000 mm (sloped) overflow trough is provided at the northwest corner of the tank to safely convey any overflows from the facility into the 1,800 mm overflow sewer discharging to Lower Ancaster Creek

Three (3) 137 L/s submersible pumps are provided to pump the contents of the storage tank back into the CSS in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during DWF conditions, when capacity is available to treat these flows. Three pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps is lifted via three (3) 200 mm diameter, ductile iron forcemains, which feed a single 350 mm diameter forcemain running around the east and south walls of the storage tank, then south through the City's easement within the Hydro One corridor, and finally east through the City's right-of-way at the west end of Sanders Boulevard, to connect to the gravity operated CSS along Sanders Boulevard. Three (3) sediment flushing tanks (SFTs) are provided to clean the floor of the tank following each storm event.

Two (2) level transmitters are provided to monitor the level of sewage stored in the tank; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized CSO tank inlet gate and the pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 9A and 9B of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 9 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 9 provided below summarizes the key components of the O&M Plan for HCS09, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

A new SOP has been created for this facility as part of this report (Issue #1, January 2019) to: provide a description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and include a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and no therefore no changes have been made to the current version of the PCN (Version 1.4, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 9: Summary of O&M Plan for McMaster CSO Tank (HCS09)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – McMaster CSO Tank (HCS09)	Hamilton Water Hatch Ltd.	Issue #1	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – McMaster CSO Tank HCS09	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.4	Apr 2016
Equipment O&M Manual	Electrical O&M Manual – Contract PW-08-13 (CSO) – HCS09	Varcon (General Contractor) Selectra (Electrical Contractor) Hatch Mott MacDonald (Consultant)	Shelf D-3, Doc No. 0000528	2010
Equipment O&M Manual	Mechanical O&M Manuals – Contract PW-08-13 (CSO) – HCS09	Varcon (General Contractor) Hatch Mott MacDonald (Consultant)	Shelf D-3, Doc No. 0000603	2010
As-Built Drawings	McMaster CSO Storage Tank – Contract PW-08-13 (CSO) – HCS09	Hatch Mott MacDonald / J&M Structural	Dwg No. 08-S-38	Sep 2010

2.10 Wentworth/Rosemary CSO Gate (HCG03)

HCG03 regulates the flow of combined sewage from a 266 ha drainage area served by a 1,220 mm x 1,525 mm combined sewer running north along Wentworth Street North. The gate is located in an underground chamber on the northeast corner of Wentworth Street North and Rosemary Avenue, near the entrance to the City's offices at 330 Wentworth Street North.

HCG03 is used to direct DWF and some WWF to the Burlington/Hillyard area where the flows enter the WSI North branch (WSIN) and are conveyed to the Woodward Avenue WWTP for treatment. The regulator also has the ability to isolate flows from the WSIN, where the gate is normally open but can be closed to direct flow to the Wentworth CSO outfall when the WSIN is surcharged.

During DWF conditions and small storms, a static overflow weir captures all flows and conveys them through the open gate in HCG03, into a 1,200 mm x 1,500 mm combined sewer which connects to the WSIN at the intersection of Hillyard Avenue and Burlington Street, and the WSIN conveys the flows east to the Woodward Avenue WWTP for treatment.

During larger storms, when the weir is overtopped, excess WWF is diverted to the Wentworth CSO Outfall via a 2,500 mm x 2,400 mm combined sewer on Wentworth Avenue.

During very large storms, every attempt is made to maximize the conveyance of combined sewage to the WWTP for treatment, however there will be circumstances where the Operator may need to close HCG03 to bypass combined sewage through the Wentworth CSO Outfall to protect the Influent Pump Station and biological treatment processes at the WWTP.

The gate can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Auto, with operation directed by the Real Time Control (RTC) system, to maximize flow to the WWTP.

The Process Automation Controller (PAC), network equipment and gate actuator are powered by an Uninterruptable Power Supply (UPS). On a power failure, the gate is set to 30% Open.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 10A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the gate, as well as the potential for possible sewage discharges to the environment, colour coded to indicate criticality; and Table 10 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 10 provided below summarizes the key components of the O&M Plan for HCG03, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 3.3, June 2012). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the gate itself, to back up the existing sensor on the gate stem.

Table 10: Summary of O&M Plan for Wentworth/Rosemary CSO Gate (HCG03)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Wentworth/Rosemary CSO Gate (HCG03)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – 330 Wentworth St North Wastewater Regulator HCG03	Hamilton Water BPR Eramosa Engineering Stantec	Version 3.3	Jun 2012
Equipment O&M Manual	Operations Manual – Contract C13-09-12 – HCG03	Stantec (Consultant) Newman Bros. Ltd (General Contractor)	Shelf D-5, Doc No. 0000635	2010
As-Built Drawings	Rosemary/Wentworth Regulator Upgrades – Contract C13-09-12 – HCG03	Stantec	Not Provided	Jan 2013

2.11 Brampton/Strathearne CSO Gate (HCG04)

HCG04 regulates the flow of combined sewage from a 210 ha drainage area served by a 2,134 mm x 2,286 mm combined sewer running north along Strathearne Avenue. The gate is located in an underground chamber behind the Arcelor Mittal security guard house located just south of Brampton Street.

During DWF conditions and small storms, a static overflow weir captures all flows and conveys them through the open gate in HCG04, into a 1,050 mm combined sewer on Strathearne Avenue, which connects to the WSI at the intersection of Strathearne Avenue and Burlington Street, and the WSI conveys the flows east to the Woodward Avenue WWTP for treatment.

During larger storms, when the weir is overtopped, excess WWF is diverted to the Strathearne CSO Outfall via a second, 2,100 mm x 2,250 mm combined sewer on Strathearne Avenue.

During very large storms, every attempt is made to maximize the conveyance of combined sewage to the WWTP for treatment, however there will be circumstances where the Operator may need to close HCG04 to bypass combined sewage through the Strathearne CSO Outfall to protect the Influent Pump Station and biological treatment processes at the WWTP.

The gate can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP, to maximize flow to the WWTP.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 11A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the gate, as well as the potential for possible sewage discharges to the environment, colour coded as described in the report to indicate criticality; and Table 11 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 11 provided below summarizes the key components of the O&M Plan for HCG04, including current versions of the SOP, PCN, Equipment O&M Manuals, and drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.2, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the gate itself, to back up the existing sensor on the gate stem.

Table 11: Summary of O&M Plan for Brampton/Strathearne CSO Gate (HCG04)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Brampton/Strathearne CSO Gate (HCG04)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Brampton/Strathearne Regulator HCG04	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.2	Apr 2016
Equipment O&M Manual	Operating and Maintenance Manuals – Contract C11-85-07 – HCG04	Procon (General Contractor) Hydromantis, Inc. (Consultant)	Shelf D-5, Doc No. 0000635	2010
Drawings	Strathearne/Brampton CSO Gate Replacement – Contract C11-85-07 – HCG04	Hydromantis, Inc.	Not Provided	Mar 2007

2.12 Wellington/Burlington CSO Gate (HCG14)

HCG14 is located at the intersection of Wellington Street North and Burlington Street East, where the Wellington CSO Outfall sewer crosses the WSIN. The purpose of HCG14 is to capture and divert combined sewage from the Wellington CSO Outfall sewer into the WSIN for conveyance to the Woodward Avenue WWTP for treatment.

HCG14 is equipped with a modulation slide gate and back-up isolation slide gate, which are operated automatically by the City's Real Time Control (RTC) system based on level measurements on the receiving WSIN, the Wellington CSO Outfall sewer, and the regulator chamber itself. The modulation gate controls the flow into the WSIN and the isolation gate facilitates maintenance of the modulation gate (when required) and provides redundancy for the modulation gate to control flow into the WSIN. Two passive flap gates are also located just downstream of the flow diversion channel to the regulator to prevent water from Hamilton Harbour from flowing back into the sewer system.

During DWF conditions, the modulation gate remains fully closed and the isolation gate remains fully open. During WWF conditions, upon detection of a threshold flow depth in either the Wellington CSO Outfall sewer or in the WSI North Branch, the site is automatically switched to wet conditions strategy operation, which causes the isolation gate to remain open and the modulation gate to be placed in a partially open position according to the output from a proportional-integral-derivative (PID) controller. The PID controller will then cause the gate to modulate with the objective of attaining and then maintaining the flow level in the WSIN at a specified setpoint. Once the flow levels in the WSIN and the Wellington CSO Outfall sewer fall below the wet conditions strategy trigger levels, the site operation will revert back to the dry conditions strategy. A number of fail-safe and degraded operation conditions features are built into the process control logic in order to ensure the robust and safe operation of the site in the event of a variety of equipment failures (e.g. gate motors, level sensors, etc), all of which are detailed further within the PCN for the site.

The gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Auto, with operation directed by the RTC system, to maximize flow to the WWTP.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 12A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the gates, as well as the potential for possible sewage discharges to the environment, colour coded to indicate criticality; and Table 12 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 12 provided below summarizes the key components of the O&M Plan for HCG14, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #2, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.7, January 2012). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the gates themselves, to back up the existing sensors on the gate stems.

Table 12: Summary of O&M Plan for Wellington/Burlington CSO Gate (HCG14)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Wellington/Burlington CSO Gate (HCG14)	Hamilton Water Hatch Ltd.	Issue #2	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Wastewater Regulator (221 Burlington St.) HCG14	Hamilton Water BPR Eramosa Engineering Stantec	Version 1.7	Jan 2012
Equipment O&M Manual	Operations Manual, Volume 1 of 2 – Contract C13-09-12 – HCG14	Stantec (Consultant) Newman Bros. Ltd (General Contractor)	Shelf D-5, Doc No. 0000637	Sep 2012
Equipment O&M Manual	Operations and Maintenance Manual, Volume 2 of 2 – Contract C13-09-12 – HCG14	Newman Bros. Ltd (General Contractor) Stantec (Consultant)	Shelf D-5, Doc No. 0000638	Sep 2012
As-Built Drawings	Wellington/Burlington Regulator Upgrades – Contract C13-09-12 – HCG14	Stantec	Not Provided	Mar 2013

2.13 Parkdale Burlington Wastewater Collection Station (HC001)

Wastewater Pumping Station HC001 is located on the northwest corner of the intersection of Parkdale Avenue and Burlington Street East. The purpose of the station is to lift CSOs from the combined sewer coming from Leaside Road and Woodward Avenue (and separate stormwater from the storm sewer on the north side of Burlington Street between Strathearne Avenue and Parkdale Avenue), which are too deep to be conveyed by gravity to the Parkdale CSO Outfall at the north end of Parkdale Avenue.

The station is equipped with five (5) active pumps, with two (2) 150 L/s pumps employed to handle normal flow conditions, and three (3) more 600 L/s pumps employed to handle high flow conditions. There is also a diesel engine driven pump, but it is currently out of service and not available for operation.

The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode of operation involves monitoring of the wet well level via SCADA by Operators at the WWTP, with operation of the pumps in SCADA Auto mode, and only required when the Leaside/Woodward combined sewer and/or Burlington storm sewer are active. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 13A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the pumps, as well as the potential for possible sewage discharges to the environment, colour coded to indicate criticality; and Table 13 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 13 provided below summarizes the key components of the O&M Plan for HC001, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #5, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No formal changes have been made to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.4, June 2015), although as noted in the SOP, some possible changes are being reviewed. Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 13: Summary of O&M Plan for Parkdale Burlington Wastewater Collection Station (HC001)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Parkdale Wastewater Collection Station (HC001)	Hamilton Water Hatch Ltd.	Issue #5	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Parkdale/Burlington Wastewater PS HC001	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.4	Jun 2015
As-Built Drawings	Parkdale Sewage Pumping Station – HC001	City of Hamilton	Plan No. P-138	1955

3. References

Hatch Corporation (2018). Report – CSO Facilities Assessment – MECP Order Items 4, 7, 8 and 9. Report prepared for the City of Hamilton, November 2018.

PUBLICLY RELEASED BY COUNCIL ON NOVEMBER 27, 2019

Ministry of the Environment, Conservation and Parks

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Ontario

Provincial Officer's Order

Environmental Protection Act, R.S.O. 1990, c.E 19 (EPA)
Nutrient Management Act, R.S.O. 2002, c.4 (NMA)
Ontario Water Resources Act, R.S.O. 1990, c.O. 40 (OWRA)
Pesticides Act, R.S.O. 1990, c. P11 (PA)
Safe Drinking Water Act, S.O. 2002, c.32 (SDWA)

Order Number
1-J25YB

To: HAMILTON, CITY OF
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

Site: WW HAMILTON-WOODWARD AVE WWTP
700 WOODWARD AVE,
HAMILTON, L8H 6P4,
Canada

Work Ordered

Pursuant to my authority in sections 16 and 16.1, and subsection 104(2) if the Ontario Water Resources Act, and in section 157 and 157.1 and subsection 196(1) of the Environmental Protection Act, I hereby require you to take all necessary steps and to do the following:

1. (a) Retain a licensed external Professional Engineer with appropriate expertise to quantify the volume and contaminant loadings associated with the sewage discharged from the Main/King CSO facility to Chedoke Creek between January 28, 2014 and July 18, 2018. Submit a written report on the results of 1. (a) to the undersigned Provincial Officer by September 30, 2018.

1. (b) Retain a licensed external Qualified Person (QP) with appropriate expertise in remediation of wastewater discharges to the natural environment, to evaluate impacts to Chedoke Creek from the sewage discharged from the Main/King CSO facility to Chedoke Creek between January 28, 2014 and July 18, 2018. This evaluation shall identify whether remediation and/or mitigation of Chedoke Creek is required, and (if remediation and/or mitigation is recommended), make recommendations regarding the most effective way to complete the remediation and/or mitigation. Submit a written report on the results of 1. (b) to the undersigned Provincial Officer by October 31, 2018.

1. (c) Submit a written report on the associated implementation timeline for any necessary remedial and/or mitigation work with respect to Chedoke Creek, to the undersigned Provincial Officer by November 30, 2018.

2. Submit a Spill Report of this sewage discharge incident to the undersigned Provincial Officer by August 15, 2018 outlining details and time line of receiving HCA/RBG and SAC spill report, City staff response to spill, sample results, confirmation of clean up efforts and summary of clean up actions taken to date. Identify any non-conformances with Standard Operating Procedures and demonstrate how they will be addressed under Item No. 3 below.

3. Submit to the undersigned Provincial Officer by September 30, 2018 revisions to the following spills procedures that informs and directs action by City staff in the event of sewage spills from the collection system including but not limited to pipes, manholes, catch basins, pumping stations and tanks (including CSO tanks) in both dry and wet weather conditions consistent with the reporting requirements under the Ontario Water Resources Act and the Environmental Protection Act:

- Spills Response Notification, Coordination and Corrective Actions, PW-WW-P-012-003, Issue 5
- BCOS – Spills Emergency – Plant Operations, Issue 16
- BCOS Emergency Main Sewer Spill, PW-WW-DC-WC-P-012-005, Issue 5

The listed procedures shall be reviewed and updated at a minimum frequency of once every 3 years.

All necessary City staff shall receive annual training on the Spills Response Notification, Coordination and Corrective Actions, PW-WW-P-012-003 procedure, and records of this training shall be maintained in conformance with the City's records retention procedures.

4. Inspect all CSO facilities and inventory all:

a. Critical valves (bypass gates), control points (overflows) which can be a source of a discharge to the natural environment and which would not be captured by existing flow monitoring equipment; and

b. Confirmation of manual and SCADA valve position correlation and local or remote control.

A written report of the results of the inspection required by Item No. 4 shall be submitted to the undersigned Provincial Officer by October 31, 2018.

5. Identify all combined sewer overflow points (controlled and uncontrolled) with in the City of Hamilton and submit a detailed map of the exact locations and spreadsheet of the combined sewer overflow points in a written report to the undersigned Provincial Officer by October 31, 2018.

6. Using the information obtained from Item No. 4 and if applicable, Item No. 5 above, review and update drawings, PCN's and develop a written Operation and Maintenance Plan (the "O & M Plan") for each of the City's CSO facilities that identifies critical equipment and environmental discharge control points. The O&M Plan shall include, but not be limited to: annual manual valve position checks of critical valves; monthly visual inspections of overflow structures at CSO facilities equipped with station by-pass structures that discharge directly to the natural environment; and annual flow meter calibration. The O & M Plan for all CSO facilities equipped with a station by-pass structure shall be submitted to the undersigned Provincial Officer by January 31, 2019.

7. Evaluate in writing the need for modification(s) to the Main/King CSO facility, to improve monitoring, performance, reliability and to minimize bypasses/overflows/spills into the 2400 mm storm outfall from the overflow trough and inlet chamber bypass.

8. Evaluate in writing the need for modification(s) similar to those required by Item No. 7 above for all other CSO facilities within the Hamilton Wastewater Collection System to minimize bypasses/overflows/spills.

9. Submit a written report to the undersigned Provincial Officer by October 31, 2018 which sets out the evaluation required by Item No. 7 and 8 above, along with recommendations and timelines to implement these recommendations.

A. While this Order is in effect, a copy or copies of this order shall be posted in a conspicuous place.

B. While the Order is in effect, report in writing, to the District or Area Office, any significant changes of operation, emission, ownership, tenancy or other legal status of the facility or operation.

This Order is being issued for the reasons set out in the annexed Provincial Officer's Report which forms part of the Order.

Issued at City of Hamilton this 02/08/2018 (dd/mm/yyyy)

Shelley Yeudall
Badge Number: 881
Hamilton District

APPEAL/REVIEW INFORMATION

REQUEST FOR REVIEW

You may request that this order be reviewed by the Director. Your request must be made in writing (or orally with written confirmation) within seven days of service of this order and sent by mail or fax to the Director at the address below. In the written request or written confirmation you must,

- specify the portions of this order that you wish to be reviewed;
- include any submissions to be considered by the Director with respect to issuance of the order to you or any other person and within respect to the contents of the order;
- apply for a stay of this order, if necessary; and provide an address for service by one of the following means:
  1. Mail
  2. Fax

The Director may confirm, alter or revoke this order. If this order is revoked by the Director, you will be notified in writing. If this order is confirmed or amended by order of the Director, the Director's order will be served upon you. The Director's order will include instructions for requiring a hearing before the Environmental Review Tribunal.

DEEMED CONFIRMATION OF THIS ORDER

If you do not receive oral or written notice of the Director's decision within seven days of receipt of your request, this order is deemed to be confirmed by order of the Director and deemed to be served upon you.

You may require a hearing before the Environmental Review Tribunal if, within 15 days of service of the confirming order deemed to have been made by the Director, you serve written notice of your appeal on the Environmental Review Tribunal and the Director. Your notice must state the portions of the order for which a hearing is required and the grounds on which you intend to rely at the hearing. Except by leave of the Environmental Review Tribunal, you are not entitled to appeal a portion of the order or to rely on grounds of appeal that are not stated in the notice requiring the hearing. Unless stayed by the Environmental Review Tribunal, the order is effective from the date of service.

Written notice requiring a hearing must be served personally or by mail upon:

The Secretary Environmental Review Tribunal 655 Bay Street, 15th Floor Toronto, ON M5G 1E5	and	Director (Provincial Officer Orders) Ministry of the Environment, Conservation and Parks 119 King St. W., 9th floor Hamilton, ON, L8P 4Y7 Fax: (905) 521-7806

Where service is made by mail, it is deemed to be made on the fifth day after the date of mailing and the time for requiring a hearing is not extended by choosing service by mail.

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal by

Tel: (416) 212-6349 Fax: (416) 326-5370 www.ert.gov.on.ca

FOR YOUR INFORMATION

- Unless stayed by the Director of the Environmental Review Tribunal, this order is effective from the date of service. Non-compliance with the requirements of this order constitutes an offence.
- The requirements of this order are minimum requirements only and do not relieve you from complying with the following:
  - Any applicable federal legislation;
  - Any applicable provincial requirements that are not addressed in the order; and
  - Any applicable municipal law.
- The requirements of this order are severable. If any requirement of this order or the application of any requirement to any circumstances is held invalid, the application of such requirement to other circumstances and the remainder of the order are not affected.
- Further orders may be issued in accordance with the legislation as circumstances require.
- The procedures to request a review by the Director and other information provided above are intended as a guide. The legislation should be consulted for additional details and accurate reference.

Ministry of the Environment, Conservation and Parks

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Ontario

Provincial Officer's Report

Order Number
1-J25YB

To:
HAMILTON, CITY OF
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

Site:
700 WOODWARD AVE,
HAMILTON, L8H 6P4,
Canada

Observations

Definitions Section:
CSO = combined sewer overflow
City = City of Hamilton
Ministry = Ministry of Environment, Conservation and Parks
HU = Local Health Unit
P&ID = Process and Instrumentation Diagram
PLC = Process Logic Control
PCN = Process Control Narrative

On July 6, 2018, the Spills Action Center received a public complaint regarding the presence of sewage odours and plastic debris, similar to what is expected in raw sewage waste that may enter a sewage treatment plant, within Chedoke Creek along Desjardin Recreational Trail at Princess Point in the City and forwarded complaint to the Hamilton District office.

Provincial Officer, Tamara Posadowski, conducted an inspection of the area with staff of the City, Environmental Enforcement Operations group on the same day at Desjardin Recreational Trail at Princess Point. No sewage odours were observed but intermittent odours typical of decaying organic matter was observed along with some grey clumpy material visible at the side of the creek bank.

On July 9, 2018, Provincial Officer, Paul Widmeyer received an email from the Hamilton Health Unit, as per Section 11 (1) of the Health Protection and Promotion Act regarding the health hazard of extremely high E.coli results meeting the criteria of "suspected sewage contamination" in Chedoke Creek with results reported of 3.4 million CFU/100 mL and a trend of historical high results from approximately the end of May 2018. On July 10, 2018 the Health Unit required warning signs be posted for the public at potential water access points along Chedoke Creek and Princess Point, and along the Waterfront Trail to the Desjardin Canal including the removal of the canoe/kayak dock at Princess Point.

On July 11, 2018 the Hamilton Conservation Authority took samples in the Chedoke Creek watershed at several locations for E. coli and human/bovine bacteria markers in order to try to isolate the section of Chedoke Creek where the discharge was occurring and determine the source of contamination. Sample results showed high concentrations of E.coli and bacteria readings consistent with human bacteria. Resampling was conducted on July 18, 2018 by the Hamilton Conservation Authority with same results.

On July 11, 2018 the City also sampled in the Chedoke Creek and the MTO work site, located along Highway 403 between the Main Street and Aberdeen Street exit's, with the highest E.coli and caffeine (an indicator of human sewage effluent) results found at the Glen Road outfall.

Investigations conducted by the City of Hamilton continued at: a private force main near Aberdeen Street; the Main Street/King Street CSO tank and pumping station; other CSO tanks within the catchment area; conducted video inspection of the Kay Drage landfill leachate collection system; camera inspection program on sections of sanitary sewers that run in the area of the Chedoke Creek storm channel; and confirmation of the sealing of a historical, combined sewer overflow north of the Main Street/King Street combined sewer overflow (CSO) tank. On July 18, 2018 the City began removing floating material in Chedoke Creek with boom installation and vactor truck removal.

The undersigned Provincial Officer also conducted inspections on:
July 16, 2018 with Provincial Officer Zafar Bhatti at Kay Drage Park bridge with sewage odours and some sewage debris observed in Chedoke Creek. No odours or debris observed at Princess Point bridge or associated boat launch.
July 17, 2018 with City staff at Glen Road/Chedoke Creek outfall with strong sewage odours observed downwind of the outfall, and significant sewage solids in the creek. At the Kay Drage bridge a slight increase in sewage debris was observed in the creek. No odours or solids were observed at Princess Point bridge.
July 18, 2018 upstream of the Chedoke Creek outfall at the MTO work site with water running clear and no odour.

On July 18, 2018, Calder Engineering Ltd conducted a confined space inspection of the twinbox sewer (that runs under Main Street West to the head of Chedoke Creek and that receives flow from two directions; one from the direction of the MTO work site and the other from the King Street/Main Street CSO tank) including water sampling. It was this inspection that found sanitary sewage flowing into the box sewer from King Street/Main Street CSO tank at an estimated rate of 150 L/sec and clear water coming from the MTO work site and Chedoke Creek. Further investigation at the Main Street/King Street pump station found sewage in the CSO tank overflow chamber discharging to a 2400 mm storm discharge culvert. Sewage was entering the overflow chamber through a reported 4.7% open 3000 mm x 3000 mm gate valve between the overflow chamber and the influent 1950 mm combined sewer entering the station. The valve was closed to 0.7 % at approx. 1:35 pm and totally closed at 1:45 pm with manual valve operation followed by the valve being chained, tagged and locked the same day. Provincial Officer Zafar Bhatti and the undersigned attended on July 18, 2018 at the King Street/Main Street CSO to confirm that the discharge had stopped and to conduct a visual inspection of the Chedoke Creek outfall which showed no flow from the east side of the box culvert which had been observed the previous day by the undersigned Provincial Officer. Sewage debris were observed with sewage odours and turbid water from site work. Removal of floating material from Chedoke Creek started on July 18, 2018 and clean up work was proposed by City staff to continue as needed with daily inspection and sampling. Preliminary reports from the City showed the gate valve had been open since January 29, 2014. The estimated volume of sewage discharged to the creek from January 29, 2014 until the gate valve was fully closed is 15.9 Giga Liter (15.9 million m3).

The undersigned Provincial Officer also conducted an inspection on July 20, 2018 and found strong sewage odours on Glen Road, downwind of Creek and observed a boom installed by City contractors between Kay Drage bridge and the Chedoke Creek Outfall to collect floating materials.

During the course of the inspection the following adverse effects were identified:
a) impairment of the quality of the natural environment for any use that can be made of it;
b) an adverse effect on the health of any person;
c) impairment of the safety of any person; and
d) rendering any property or plant or animal life unfit for human use.

Offence(s)
Suspected Violation(s)/Offence(s)
Act – Regulation – Section
Description

Environmental Protection Act, Section 14 (1) Subject to subsection (2) but despite any other provision of this Act or the regulations, a person shall not discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect. 2005, c. 12, s. 1 (5).

Ontario Water Resources Act, Section 30 (1) Every person that discharges or causes or permits the discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters is guilty of an offence. R.S.O. 1990, c. O.40, s. 30 (1).

S. Yeudall

Shelley Yeudall
Provincial Officer
Badge Number: 881

Ontario

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Ministry of the Environment, Conservation and Parks

Certificate of Service

Environmental Protection Act s.175(1)(b)
Nutrient Management Act, R.S.O. 2002, c.4 (NMA)
Ontario Water Resources Act s.115(1)(b)
Pesticides Act s. 51(1)(b)
Safe Drinking Water Act, 2002 s.159(3)

I, Shelley Yeudall a designated Provincial Officer under the Environmental Protection Act, Nutrient Management Act, Ontario Water Resources Act, Pesticides Act and Safe Drinking Water Act, certify that I served a true copy of this Provincial Officer's Order order number: 1-J25YB on the following person(s) or company ordered in the manner indicated.

SERVICE DECLARATION

Person/Company
HAMILTON, CITY OF

Address
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

Left With
Andrew Grice

Position
Director, Hamilton Water

Date of Service
02/08/2018

Method of Service
Email

S. Yeudall

Shelley Yeudall
Provincial Officer
Badge Number: 881
02/08/2018 (dd/mm/yyyy)
Hamilton District

Ministry of the Environment,
Conservation and Parks

Ministère de l'Environnement, de la Protection
de la nature et des Parcs

Ontario

Provincial Officer's Report

Order Number
1-J3XAY

To:
HAMILTON, CITY OF
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

Site:
700 WOODWARD AVE,
HAMILTON, L8H 6P4,
Canada

Observations

Definitions Section:

SLR = SLR Consulting (Canada) Ltd.
Wood = Wood Environmental & Infrastructure Solutions a division of Wood Canada Limited.

Provincial Officer Order (POO) Number 1-J25YB was issued on August 2, 2018 requiring, among others, the submission of the following:

"1. (b) Retain a licensed external Qualified Person (QP) with appropriate expertise in remediation of wastewater discharges to the natural environment, to evaluate impacts to Chedoke Creek from the sewage discharged from the Main/King CSO facility to Chedoke Creek between January 28, 2014 and July 18, 2018. This evaluation shall identify whether remediation and/or mitigation of Chedoke Creek is required, and (if remediation and/or mitigation is recommended), make recommendations regarding the most effective way to complete the remediation and/or mitigation. Submit a written report on the results of 1. (b) to the undersigned Provincial Officer by October 31, 2018."

and

"1.(c) Submit a written report on the associated implementation timeline for any necessary remedial and/or mitigation work with respect to Chedoke Creek, to the undersigned Provincial Officer by November 30, 2018."

Item 1. (b) and (c) were both submitted on January 31, 2019 after the approval of two (2) request for extensions.

On March 20, 2019, the City reported that a peer review was being conducted of the original reports.

On May 30, 2019 the Ministry received both: a Peer Review Report by SLR, dated May 15th, 2019; and a Memo from Wood, dated May 23, 2019.

On September 19, 2019 clarification/confirmation was requested from the City due to the Ministry's review, which found that requested information in the POO was not provided. The Ministry had expected that the City would do the following:

- evaluate impacts at the time of the spill through to date to Chedoke Creek and Cootes Paradise from the sewage discharged and possible material remaining in the creek from the Main/King CSO facility spilled to Chedoke Creek between January 28, 2014 and July 18, 2018;

- identify any anticipated on-going impacts, including the impacts noted above, and review options to remediation and/or mitigation, and/or monitoring of Chedoke Creek/Cootes Paradise and recommend and justify what is and is not required for cleanup and further mitigation; and

- and (if remediation and/or mitigation and/or monitoring is recommended), make recommendations regarding the most effective way to complete the remediation and/or mitigation and/or monitoring.

On October 1, 2019 the City reported additional sampling work was completed at the site during the last week of September 30, 2019.

On October 10, 2019 the Ministry requested a final report and recommendations by November 15th. Due to field work just completed and lab analysis turn around time, the City indicated that a final SLR report could not be provided until the end of January 2020.

The City was requested to provide more information to support the delay in the submission by October 18, 2019.

The City plan to receiving a draft Ecological Risk Assessment (ERA) by SLR at the end of January 2020.

Offence(s)
Suspected Violation(s)/Offence(s)
Act – Regulation – Section
Description

Environmental Protection Act, Section 14 (1) Subject to subsection (2) but despite any other provision of this Act or the regulations, a person shall not discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect. 2005, c. 12, s. 1 (5).

Ontario Water Resources Act, Section 30 (1) Every person that discharges or causes or permits the discharge of any material of any kind into or in any waters or on any shore or bank thereof or into or in any place that may impair the quality of the water of any waters is guilty of an offence. R.S.O. 1990, c. O.40, s. 30 (1).

Shelley Yeudall
Provincial Officer
Badge Number: 881

Ministry of the Environment, Conservation and Parks

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Ontario

Provincial Officer's Order

Order Number
1-J3XAY

Environmental Protection Act, R.S.O. 1990, c.E 19 (EPA)
Nutrient Management Act, R.S.O. 2002, c.4 (NMA)
Ontario Water Resources Act, R.S.O. 1990, c.O. 40 (OWRA)
Pesticides Act, R.S.O. 1990, c. P11 (PA)
Safe Drinking Water Act, S.O. 2002, c.32 (SDWA)

To: HAMILTON, CITY OF
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

Site: WW HAMILTON-WOODWARD AVE WWTP
700 WOODWARD AVE,
HAMILTON, L8H 6P4,
Canada

Work Ordered

Pursuant to my authority in sections 16 and 16.1, and subsection 104(2) of the Ontario Water Resources Act, and in section 157 and 157.1 and subsection 196(1) of the Environmental Protection Act, I hereby require you to take all necessary steps and to do the following:

As per Provincial Officers Report and Order # 1-J25YB, Report # 1-J3XAY and discussions with Cari Vanderperk, Manager, Compliance & Regulations, Public Works, Hamilton Water, the Ministry requires that the City submit the following reports and information to the undersigned Provincial Officer by February 14, 2020:

i) Final Report of Chedoke Creek Ecological Risk Assessment (ERA), by SLR Consulting (Canada) Ltd This report shall include an evaluation of the impact to Chedoke Creek and Cootes Paradise from the sewage discharged between January 28, 2014 and July 18, 2018, an evaluation of the material remaining in the creek, identification of any anticipated on-going impacts, and review of options for remediation, mitigation and monitoring of Chedoke Creek/Cootes Paradise.

ii) City's final conclusion with respect to remediation, mitigation and monitoring of Chedoke Creek and Cootes Paradise if recommended and if so, include the selected option for remediation, mitigation and monitoring, including all supporting documentation for the selected option and implementation timeline for all work with respect to Chedoke Creek spill cleanup, including significant milestones and approvals from MNR and Hamilton Conservation Authority.

A. While this Order is in effect, a copy or copies of this order shall be posted in a conspicuous place.

B. While the Order is in effect, report in writing, to the District or Area Office, any significant changes of operation, emission, ownership, tenancy or other legal status of the facility or operation.

This Order is being issued for the reasons set out in the annexed Provincial Officer's Report which forms part of the Order.

Issued at City of Hamilton this 14/11/2019 (dd/mm/yyyy)

S. Yeudall

Shelley Yeudall
Badge Number: 881
Hamilton District

APPEAL/REVIEW INFORMATION

REQUEST FOR REVIEW

You may request that this order be reviewed by the Director. Your request must be made in writing (or orally with written confirmation) within seven days of service of this order and sent by mail or fax to the Director at the address below. In the written request or written confirmation you must,

- specify the portions of this order that you wish to be reviewed;
- include any submissions to be considered by the Director with respect to issuance of the order to you or any other person and within respect to the contents of the order;
- apply for a stay of this order, if necessary; and provide an address for service by one of the following means:
  1. Mail
  2. Fax

The Director may confirm, alter or revoke this order. If this order is revoked by the Director, you will be notified in writing. If this order is confirmed or amended by order of the Director, the Director's order will be served upon you. The Director's order will include instructions for requiring a hearing before the Environmental Review Tribunal.

DEEMED CONFIRMATION OF THIS ORDER

If you do not receive oral or written notice of the Director's decision within seven days of receipt of your request, this order is deemed to be confirmed by order of the Director and deemed to be served upon you.

You may require a hearing before the Environmental Review Tribunal if, within 15 days of service of the confirming order deemed to have been made by the Director, you serve written notice of your appeal on the Environmental Review Tribunal and the Director. Your notice must state the portions of the order for which a hearing is required and the grounds on which you intend to rely at the hearing. Except by leave of the Environmental Review Tribunal, you are not entitled to appeal a portion of the order or to rely on grounds of appeal that are not stated in the notice requiring the hearing. Unless stayed by the Environmental Review Tribunal, the order is effective from the date of service.

Written notice requiring a hearing must be served personally or by mail upon:

The Secretary Environmental Review Tribunal 655 Bay Street, 15th Floor Toronto, ON M5G 1E5	and	Director (Provincial Officer Orders) Ministry of the Environment, Conservation and Parks 119 King St. W., 9th floor Hamilton, ON, L8P 4Y7 Fax: (905) 521-7806

Where service is made by mail, it is deemed to be made on the fifth day after the date of mailing and the time for requiring a hearing is not extended by choosing service by mail.

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal by

Tel: (416) 212-6349 Fax: (416) 326-5370 www.ert.gov.on.ca

FOR YOUR INFORMATION

- Unless stayed by the Director of the Environmental Review Tribunal, this order is effective from the date of service. Non-compliance with the requirements of this order constitutes an offence.
- The requirements of this order are minimum requirements only and do not relieve you from complying with the following:
  - Any applicable federal legislation;
  - Any applicable provincial requirements that are not addressed in the order; and
  - Any applicable municipal law.
- The requirements of this order are severable. If any requirement of this order or the application of any requirement to any circumstances is held invalid, the application of such requirement to other circumstances and the remainder of the order are not affected.
- Further orders may be issued in accordance with the legislation as circumstances require.
- The procedures to request a review by the Director and other information provided above are intended as a guide. The legislation should be consulted for additional details and accurate reference.

Ontario

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Ministry of the Environment, Conservation and Parks

Certificate of Service

Environmental Protection Act s.175(1)(b)
Nutrient Management Act, R.S.O. 2002, c.4 (NMA)
Ontario Water Resources Act s.115(1)(b)
Pesticides Act s. 51(1)(b)
Safe Drinking Water Act, 2002 s.159(3)

I, Shelley Yeudall a designated Provincial Officer under the Environmental Protection Act, Nutrient Management Act, Ontario Water Resources Act, Pesticides Act and Safe Drinking Water Act, certify that I served a true copy of this Provincial Officer's Order order number: 1-J3XAY on the following person(s) or company ordered in the manner indicated.

SERVICE DECLARATION

Person/Company
HAMILTON, CITY OF

Address
700 WOODWARD Ave N
HAMILTON ON L8H 6P4
Canada

Left With
Andrew Grice

Position
Director, Hamilton Water

Date of Service
14/11/2019

Method of Service
Email

S. Yeudall

Shelley Yeudall
Provincial Officer
Badge Number: 881
14/11/2019 (dd/mm/yyyy)
Hamilton District

Authority: Item 2, General Issues Committee
Report 19-025 (FCS19070)
CM: November 27, 2019
Ward: City Wide

Bill No. 288

CITY OF HAMILTON

BY-LAW NO. 19-

To Amend the Sanitary Surcharge and Wastewater Abatement By-law No. 03-272 and Implement the 2020 Fees and Charges

WHEREAS on September 24, 2003, the Council of the City of Hamilton passed By-law No. 03-272, known and referred to as "The Sanitary Surcharge and Wastewater Abatement By-law";

AND WHEREAS pursuant to sections 8, 9 and 10 of the *Municipal Act, 2001,* a municipality may pass by-laws respecting public assets of the municipality acquired for the purpose of exercising its authority under the *Municipal Act 2001* or any other Act, and respecting services that the municipality considers necessary or desirable for the public, including the provision of public utilities such as water and sewage, as defined in the *Municipal Act, 2001*;

AND WHEREAS sections 9, 10 and 391 of the *Municipal Act, 2001*, authorize a municipality to pass by-laws imposing fees or charges for services or activities provided or done by or on behalf of the municipality and for the use of the municipality's property, including property under its control;

AND WHEREAS on the 27th day of November, 2019 the Council of the City of Hamilton approved Item 2 of General Issues Committee Report 19-025 and authorized the 2020 fees and charges set out herein;

AND WHEREAS notice of the 2020 fees and charges set out herein has been given in accordance with the provisions of the City of Hamilton's Public Notice Policy By-law No. 07-351;

NOW THEREFORE the Council of the City of Hamilton enacts as follows:

1. Schedule "A" to By-law No. 03-272 is deleted and replaced with the new Schedule "A" attached to this by-law.

2. Schedule “B” to By-law No. 03-272 is deleted and replaced with the new Schedule “B” attached to this by-law.

3. The fees and charges imposed by this by-law continue in force until amended, repealed or replaced (by by-law or by a resolution of the Council of the City of Hamilton confirmed by by-law) and for greater certainty this includes continuing in force after December 31, 2020 until amended, repealed or replaced.

4. This by-law comes into force on January 1, 2020.

PASSED this 27th day of November, 2019.

F. Eisenberger	A. Holland
Mayor	City Clerk

SCHEDULE “A”

Wastewater/Storm Fees and Charges

I. Metered Water Customers

The Wastewater/Storm Fees and Charges consist of a daily wastewater/storm fixed charge and a wastewater/storm treatment charge.

A) Daily Wastewater/Storm Fixed Charge

The daily wastewater/storm fixed charge is not related to the direct costs of consumption and are not dependent upon or related to the amount of consumption incurred. The fixed charges are intended to offset the fixed costs of maintaining the City’s wastewater/storm sewage systems.

Meter Size	**Wastewater/Storm Rate**
15mm	$ 0.39
16 mm	$ 0.39
20 mm	$ 0.39
21 mm	$ 0.39
25 mm	$ 0.98
38 mm	$ 1.95
50 mm	$ 3.12
75 mm	$ 6.24
100 mm	$ 9.75
150 mm	$19.50
200 mm	$31.20
250 mm	$44.85
300 mm	$66.30

Schedule "A" continued

B) Wastewater/Storm Treatment Charges

Wastewater/storm treatment charges are based on metered water consumption and the cost of wastewater collection and treatment, and stormwater management. Charges are on a per cubic meter basis at the rates indicated in the table below. The total monthly wastewater/storm treatment charge is the sum of usage in all blocks at the rate for each block:

		Residential	**Multi-Residential, Commercial, Institutional & Industrial**
Consumption Block	**Monthly Water Consumption (m^3)**	**Rate ($/m3)**	**Rate ($/m3)**
1	0-10	0.88	1.75
2	>10	1.75	1.75

II. Non-Metered Water Customers

The non-metered annual wastewater/storm rate is $638.75 per annum, plus applicable taxes,

Note: The non-metered annual water rate for water supplied by the City of Hamilton is $594.95 per annum, plus applicable taxes, for a combined total non-metered water and wastewater/storm annual rate of $1,233.70 per annum, plus applicable taxes.

SCHEDULE "B"

Wastewater Abatement Program

1.	(a)	Application Processing Fee (Section 10)	\$374.50 plus applicable taxes and full cost recovery for peer review, if required by Director
	(b)	Annual Administration Fee (where annual Abatement exceeds \$500.00 -sub-section 22(b))	\$745.30 plus applicable taxes

2. In determining whether a Consumer appears to qualify for an Abatement under section 10 of this By-law, the Abatement shall be calculated in accordance with the following formula, based on data from the calendar year prior to the year of application for the Abatement:

A = annual volume (m^3) of water supplied to the property from the potable water supply

B = annual volume of water that was sourced from the potable water supply and diverted from the City's sanitary sewage works (if B is less than 25% of A, the Consumer is not eligible for the Abatement; if B is greater than 75% of A, insert a value equal to 75% of A)

C = annual wastewater discharged to the City's sanitary sewer and combined sewer system (C = A – B) or C = actual measured value using sewer flow monitoring if required by the Director

D = infiltration and inflow add back (D = C x 133%: add back adjustment of 33% to the volumetric charge so that all ratepayers continue to pay an equal portion of the treatment costs associated with inflow and infiltration)

E% = wastewater Abatement in percentage

Step 1: A – B = C; or C = actual measured value using sewer flow monitoring if required by the Director

Step 2: D = C x 133%

Step 3: $E\% = \frac{(A - D)}{A} \times 100$

Schedule "B" continued

3. If an Abatement is authorized for a Consumer in accordance with this By-law, the Abatement will be applied quarterly each year in accordance with the following formula:

F = actual volume (m3) of potable water supplied to the property by the City during the previous quarter
G = volume (m3) of water eligible for the Abatement during the previous quarter
H= wastewater/storm treatment charge (see Schedule "A" to this By-law)
$I = dollar amount of Abatement for the billing period

Step 4: F x E% = G
Step 5: G x H = $I

Authority: Item 2, General Issues Committee
Report 19-025 (FCS19070)
CM: November 27, 2019
Ward: City Wide

Bill No. 289

CITY OF HAMILTON

BY-LAW NO. 19-

To Amend the Sewer and Drain By-law No. 06-026, and Implement the 2020 Fees and Charges

WHEREAS on February 15, 2006, the Council of the City of Hamilton passed By-law No. 06-026, known and referred to as "The Sewer and Drain By-law", which by-law came into force on March 1, 2006;

AND WHEREAS sections 9, 10 and 391 of the *Municipal Act, 2001*, authorize a municipality to pass by-laws imposing fees or charges for services or activities provided or done by or on behalf of the municipality and for the use of the municipality's property, including property under its control;

AND WHEREAS on the 27th day of November, 2019, the Council of the City of Hamilton approved Item 2 of General Issues Committee Report 19-025 and authorized the 2020 fees and charges set out herein;

AND WHEREAS notice of the 2020 fees and charges set out herein has been given in accordance with the provisions of the City of Hamilton's Public Notice Policy By-law No. 07-351;

NOW THEREFORE the Council of the City of Hamilton enacts as follows:

1. Schedule "A" to By-law No. 06-026 is deleted and replaced with the new Schedule "A" attached to this by-law.

2. The fees and charges imposed by this by-law continue in force until amended, repealed or replaced (by by-law or by a resolution of the Council of the City of Hamilton confirmed by by-law) and for greater certainty this includes continuing in force after December 31, 2020 until amended, repealed or replaced.

3. This by-law comes into force on January 1, 2020.

PASSED this 27th day of November, 2019.

F. Eisenberger	A. Holland
Mayor	City Clerk

SCHEDULE "A"

SCHEDULE OF FEES AND CHARGES
Effective January 1, 2020

1. The following fees are payable for the sewer permit, which fees include a visual inspection of a Sewer Lateral - Private Portion or a Storm Sewer Lateral - Private Portion, or both, to confirm the Sewer Lateral - Private Portion or a Storm Sewer Lateral - Private Portion, or both, have been installed or repaired to the City of Hamilton specifications and in accordance with a sewer permit:

   (a) Regular Hours inspection $96.68

   (b) After Hours/Emergency inspection $205.40

2. In addition to the fee described in section 1 of this Schedule "A", the following sewer permit fee is payable for a CCTV inspection of a Main Sewer where determined by the General Manager of Public Works to be necessary to confirm that a Sewer Lateral - Private Portion or a Storm Sewer Lateral - Private Portion, or both, have been installed or repaired to the City of Hamilton specifications and in accordance with a sewer permit:

   Main Sewer inspection Cost plus 33% overhead

3. Sewer-related service calls on private property
   Note: Cost for service call to investigate a sewer related complaint where the issue is determined to be on private property. No charge for sewer complaints related to issue originating from the City's sewer system. Missed appointments will be billed the corresponding service call rate.

   (a) Service Call - Regular Hours $86.11
   (b) Service Call - After Hours/Emergency $173.70

4. Missed or Cancelled Inspection Fee $69.50

5. Sewer Lateral Cleaning and Investigation Fees:

   (a) Complete Sewer Lateral Investigation – Regular Hours $405.91

   (b) Complete Sewer Lateral Investigation – After Hours $448.36

	(c)	Partial Sewer Lateral Cleaning – Regular Hours	$132.65
	(d)	Partial Sewer Lateral Cleaning – After Hours	$185.71
	(e)	Abandoned Sewer Lateral Investigation- Regular Hours	$212.24
	(f)	Abandoned Sewer Lateral Investigation – After Hours	$265.30
6.	Miscellaneous Wastewater Collection System repair – for damage caused by a third party		Cost + 33% overhead

7. Additional Labour Charges:
Fees in Section 1 and 3 of this Schedule A allow for maximum one hour of total labour. An additional labour charge for all services/calls that exceed that allotted labour time will be charged as follows:

½ hour additional labour – Wastewater Collection – Regular Hours $21.90
½ hour additional labour – Wastewater Collection – After Hours/Emergency $32.83

Notes to Schedule "A":

1. Fees do not include HST which will be added where applicable.
2. "Regular Hours" means any working day, 7:00 a.m. - 4:30 p.m. Monday to Friday, excluding weekends, statutory and other public holidays or any other day on which the City has elected to be closed for business.
3. "After Hours" means outside Regular Hours Monday to Friday, a Saturday, Sunday, statutory and other public holiday or any other day on which the City has elected to be closed for business.
4. "Emergency" means any occurrence where staff and/or equipment must be re-deployed from previously assigned task(s) to respond to a time-sensitive request for services/call made under this By-law.
5. "Partial Sewer Lateral Cleaning" means services to relieve blockage(s) in the Sewer Lateral in order to temporarily reinstate sewer service.
6. "Complete Sewer Lateral Investigation" means services to complete a thorough cleaning and closed circuit television inspection of the Sewer Lateral.
7. "Abandoned Sewer Lateral Investigation" means services related to an unsuccessful attempt to access the Sewer Lateral for cleaning.

Authority: Item 2, General Issues Committee
Report 19-025 (FCS19070)
CM: November 27, 2019
Ward: City Wide

Bill No. 290

CITY OF HAMILTON

BY-LAW NO. 19-

To Amend the Waterworks By-law No. R84-026 and Implement the 2020 Fees and Charges

WHEREAS pursuant to sections 8, 9 and 10 of the *Municipal Act, 2001,* a municipality may pass by-laws respecting public assets of the municipality acquired for the purpose of exercising its authority under the *Municipal Act, 2001* or any other Act, and respecting services that the municipality considers necessary or desirable for the public, including the provision of public utilities such as water and sewage, as defined in the *Municipal Act, 2001*;

AND WHEREAS sections 9, 10 and 391 of the *Municipal Act, 2001* authorize a municipality to pass by-laws imposing fees or charges for services or activities provided or done by or on behalf of the municipality and for the use of the municipality's property, including property under its control;

AND WHEREAS on the 27th day of November, 2019, the Council of the City of Hamilton approved Item 2 of General Issues Committee Report 19-025 and authorized the 2020 fees and charges set out herein;

AND WHEREAS notice of the 2020 fees and charges set out herein has been given in accordance with the provisions of the City of Hamilton's Public Notice Policy By-law No. 07-351.

NOW THEREFORE the Council of the City of Hamilton enacts as follows:

1. Schedule "A" to By-law No. R84-026 is deleted and replaced with the new Schedule "A" attached to this by-law.

2. Schedule "C" to By-law No. R84-026 is deleted and replaced with the new Schedule "C" attached to this by-law.

3. Schedule "E" to By-law No. R84-026 is deleted and replaced with the new Schedule "E" attached to this by-law.

4. Schedule “G” to By-law No. R84-026 is deleted and replaced with the new Schedule “G” attached to this by-law.

5. Schedule “H” to By-law No. R84-026 is deleted and replaced with the new Schedule “H” attached to this by-law.

6. The fees and charges imposed by this by-law continue in force until amended, repealed or replaced (by by-law or by a resolution of the Council of the City of Hamilton confirmed by by-law) and for greater certainty this includes continuing in force after December 31, 2020 until amended, repealed or replaced.

7. This by-law comes into force on January 1, 2020.

PASSED this 27th day of November, 2019.

F. Eisenberger	A. Holland
Mayor	City Clerk

SCHEDULE "A"

NON-METERED WATER RATES
EFFECTIVE JANUARY 1, 2020*

The non-metered annual water rate for water supplied by the City of Hamilton is:

$594.95 per annum.

Note: The non-metered annual wastewater/storm rate is $638.75 per annum, for a combined total non-metered water and wastewater/storm annual rate of $1,233.70 per annum.

*Fees above do not include HST which will be added where applicable.

SCHEDULE "C"

MISCELLANEOUS RATES FOR WATER
EFFECTIVE JANUARY 1, 2020*

(Referred to in sub-sections 12(6), (7) and (8))

1. Travelling Shows and Other Temporary Occasions

Applicants for travelling shows or applicants for other temporary occasions shall pay a deposit of Six Thousand, Three Hundred Dollars ($6,300.00), which consists of:

(a) Three Hundred Dollars ($300.00) as a usage deposit (to be applied to the cost of temporary connection/ disconnection, the per diem rental cost for the fire hydrant adapter and the amount due for water used); and

(b) Six Thousand Dollars ($6,000.00) as a damage deposit (refundable upon return to the City of the fire hydrant adapter, less any damages incurred).

The fee for connecting and disconnecting the water service and for the fire hydrant adapter rental are set forth in Section 7 of Schedule "E" to this By-law and are in addition to the applicable metered water rate set out in Schedule "G" to this By-law.

2. Public Water Filling Stations

(a) The rate payable by water users for water supplied to tank trucks at the Public Water Filling Stations is $2.45 per cubic metre or part thereof. The Public Water Filling Stations are located at:

(i) Cormorant Road, Ancaster
(ii) Dartnall Road, Hamilton.

(b) Annual Water Haulage License Fee $57.44

3. Private Water Filling Stations

The one time permit fee for new Private Water Filling Stations approved by the General Manager of Public Works is $1,217.22 and is payable upon permit application.

The annual permit fee for both existing Private Water Filling Stations and new Private Water Filling Stations approved by the General Manager of Public Works is $386.22 and is payable by the Owner of the Private Water Filling Station within one month of the notification by the City.

4. Areas Outside the City of Hamilton

The rate for water supplied to municipalities for the Owner or Occupant of any lands outside the City of Hamilton is the applicable metered water rates set forth in Schedule "G" to this By-law, plus such other surcharge and rate of return as may be specifically defined in the agreement between the City and the municipality, Owner or Occupant of the lands outside the City of Hamilton.

* Fees above do not include HST which will be added where applicable.

SCHEDULE "E"

TABLE OF FEES FOR VARIOUS SERVICES*
EFFECTIVE JANUARY 1, 2020

1. Permit fees associated with the supply and installation of water meter and remote reading device, inspection and the turning on of the water, as referred to in clause 4(1)(b) of By-law R84-026, as amended.

Size of Water Meter	Fee
16 mm displacement	$ 359.70
20 mm displacement	$ 404.60
21 mm displacement	$ 404.60
25 mm displacement	$ 559.40
38 mm displacement	$ 905.08
50 mm displacement	$ 1,218.80
50 mm turbine	$ 1,409.67
50 mm compound	$ 3,316.40
100 mm turbine	$ 3,870.13
100 mm compound	$ 5,304.84
100 mm fire service turbine	$ 6,759.21
100 mm fire service compound	$ 8,787.29
100 mm magnetic flow meter [1.]	$ 9,067.33
100 mm fire rated magnetic flow meter [1.]	$ 9,472.19
150 mm turbine	$ 7,608.67
150 mm compound	$10,419.16
150 mm fire service turbine	$11,235.65
150 mm magnetic flow meter [1.]	$11,396.47
150 mm fire rated magnetic flow meter [1.]	$12,566.10
150 mm fire service compound	$14,215.97
200 mm turbine	$ 9,187.68

200 mm compound	$12,344.57
200 mm magnetic flow meter [1.]	$12,268.08
200 mm fire rated magnetic flow meter [1.]	$13,407.34
200 mm fire service turbine	$14,437.52
200 mm fire service compound	$19,450.06
250 mm turbine	$15,785.99
250 mm magnetic flow meter [1.]	$14,686.07
250 mm fire rated magnetic flow meter [1.]	$17,382.96
250 mm fire service turbine	$19,673.87
250 mm fire service compound	$25,297.11
Radio Remote Read Equipment Installation	$ 214.63
[1.] Must be approved by Supervisor of Meter Operations	

2. Water Meter Removal Fee

Size of Water Meter	Fee
16 mm displacement	$112.87
20 mm displacement	$112.87
21 mm displacement	$112.87
25 mm displacement	$112.87
38mm – 250 mm (cost depends on size, labour, and meter location	Cost + 10% overhead

3. Water Meter Inspection Services
   (a) Inspection – Regular Hours $115.86
   (b) Inspection – After Hours $151.73

4. Upsize Water Service Connection from 20mm to 25mm $155.00
   Note: Charge for upsizing the water service connection (public portion) when water service connection replacement is already being completed by the City.

5. Turning Water Off or On
Note: Turning water off at the curb to enable a property owner to complete internal plumbing repairs, or a private water service repair or replacement, and then turning the water back on.

(a) For turning water off and on (Regular Hours) – 2 visits	$124.10
(b) For turning water off and on (After Hours/Emergency) – 2 visits	$208.25
(c) For turning water off and on during the same visit – ½ hour maximum (Regular Hours)	$83.47
(d) For turning water off and on during the same visit – ½ hour maximum (After Hours)	$114.13
(e) For turning water off (non-compliance) - ½ hour maximum (Regular Hours)	$83.47
(f) For turning water on (non-compliance) - ½ hour maximum (Regular Hours)	$83.47

6. Hydrant flow test / Water Quality Flushing — $106.29
Note: Cost to operate a City Fire Hydrant(s) for a maximum of 1 hour total labour

7. For temporary connections and disconnections (hydrant\road adapter fees):**
Note: Costs to install or remove water meter and backflow prevention device. When moving a hydrant\road adapter from one site to another for the same customer, both removal and installation fees apply. This service requires a usage deposit and a damage deposit.

Usage cost (metered water rate) plus connection/disconnection fee

(a) Connection/Disconnection Fee – Regular Hours	$146.94/visit
(b) Connection/Disconnection Fee – After Hours/Emergency	$276.71/visit
(c) Hydrant\road adapter rental (for initial 7 days)	$82.56
(d) Per diem charge for fire hydrant adapter rental (after initial 7 days)	$6.13/day

8. Replacement Cost for Lost or Broken Water Meter and Attachments

Size of Meter	Cost
15 mm displacement	$ 221.75
16 mm displacement	$ 221.75

20 mm displacement	$ 342.24
21 mm displacement	$ 342.24
25 mm displacement	$ 393.97
38 mm displacement	$ 1,082.62
50 mm turbine	$1,297.30
50 mm displacement	$1,596.50
50 mm compound	$2,069.60
50 mm strainer	$419.15
100 mm turbine	$3,264.10
100 mm compound	$5,273.63
100 mm fire service turbine	$7,212.18
100 mm fire service compound	$8,855.57
100 mm magnetic flow meter	$9,855.25
100 mm fire rated magnetic flow meter	$10,290.10
100 mm strainer	$775.66
150 mm turbine	$6,006.42
150 mm compound	$9,139.82
150 mm fire service turbine	$10,968.91
150 mm fire service compound	$13,949.23
150 mm magnetic flow meter	$10,918.06
150 mm fire rated magnetic flow meter	$12,170.80
150 mm strainer	$1,240.69
200 mm turbine	$ 6,570.69
200 mm compound	$10,222.12
200 mm fire service turbine	$14,454.48

200 mm fire service compound	$19,466.10
200 mm magnetic flow meter	$13,177.47
200 mm fire rated magnetic flow meter	$14,395.02
200 mm strainer	$2,107.80
250 mm turbine	$11,424.07
250 mm magnetic flow meter	$13,336.65
250 mm fire rated magnetic flow meter	$16,225.00
250 mm fire service turbine	$18,219.75
250 mm fire service compound	$25,704.87
250 mm strainer	$3,533.73

9. Testing water meters, referred to in Section 9 of this By-law

15 and 16 mm diameter	$ 314.56
16 – 25 mm diameter (where removed from service within prior 90 days)	$ 130.39
20 mm diameter	$ 362.87
25 mm diameter	$ 414.60
38 mm diameter	$ 914.18
50 mm diameter	$1,542.08
100 mm plus diameter (in situ testing)	$ 930.42

10. Water Quality/Quantity Service Calls
Note: Cost for a service call to investigate a water quality/quantity complaint and the issue resides on private property. No charge for water quality/quantity complaints related to issues originating from the City's distribution system. Missed appointments will be billed the corresponding service call rate.

(a) Service Call – Regular Hours – Maximum 1 hour total labour $ 83.47
(b) Service Call – After Hours/Emergency – Maximum 1 hour total labour $148.36

11. Hydrant Repair, Replace or Relocate
Note: cost to repair, replace or relocate a City fire hydrant.
Fee includes labour, materials and equipment. cost plus 33% overhead

12. Watermain Shutdown
Note: Cost associated with isolating a watermain to facilitate third party work.

(a) Watermain Shutdown/Recharge – Regular Hours $129.11
(b) Watermain Shutdown/Recharge – After Hours/Emergency $232.49

13. Construction Water fees:
Note: Charge for unmetered water used for construction prior to meter installation. Paid at the time of submitting building permit payment.

(a) Single residential (per lot or townhouse) $100.00
(b) Multi-residential (per apartment/condo unit) $46.75
(c) Industrial/commercial/institutional ($ per 1,000 square feet of building area or $ per hectare where no structure is constructed) $32.80

14. Water Inspection Services:
Note: Cost associated with various permit and inspection services related to water services for properties.

(a) Private Water Service Repair/Replacement Inspection – Regular Hours $93.45
(b) Private Water Service Repair/Replacement Inspection – After Hours/Emergency $158.36
(c) Water Service Abandonment Inspection – Regular Hours $ 83.47
(d) Water Service Abandonment Inspection – After Hours/Emergency $148.36
(e) Water Service Inspection for Demolition – Regular Hours $83.47
(f) Water Service Inspection for Demolition – After Hours/Emergency $148.36
(g) Missed or Cancelled Inspection $60.65

15. General Administration Fees:
Account Review $ 87.91
General Administrative Request (per hour) $ 69.16
NSF Cheque $ 60.15
Permit Cancellation Administration Fee $ 41.14
Permit Renewal Fee $ 41.14
Lead Water Service Replacement Loan Application Fee $ 51.60

Monthly Manual Meter Read Fee	$ 3.00
Water Shut Off	$ 20.00
Water Shut-off – Notice on Door	$ 28.25

16. Miscellaneous Water Distribution System Repair — cost plus 33% overhead
Note: Cost for the City to repair damage to the water distribution system caused by a third party. Costs include labour, parts, materials, equipment and permanent restoration.

17. Additional Labour Charges:
Fees in this Schedule "E" allow for maximum one hour of total labour unless otherwise specified. An additional labour charge for all services/calls that exceed that allotted labour time will be charged as follows:

½ Hour Additional Labour – Regular Hours	$22.83
½ Hour Additional Labour – After Hours/Emergency	$34.25

Costs are for a single Water Distribution Operator in minimum increments of 30 minutes.

Notes to Schedule "E":

* Fees do not include HST which will be added where applicable.
** This service requires a $6,300.00 deposit ($300.00 usage deposit and $6,000.00 damage deposit).

"Regular Hours" means any working day, 7:00 a.m. - 4:30 p.m. Monday to Friday, excluding weekends, statutory and other public holidays or any other day on which the City has elected to be closed for business.

"After Hours" means outside Regular Hours Monday to Friday, a Saturday, Sunday, statutory and other public holiday or any other day on which the City has elected to be closed for business.

"Emergency" means any occurrence where staff and/or equipment must be re-deployed from previously assigned task(s) to respond to a time-sensitive request for services/call made under this By-law.

SCHEDULE "G"

METERED WATER RATES

EFFECTIVE JANUARY 1, 2020

The metered water rates consist of a daily water fixed charge and a metered water consumption charge.

A) Daily Water Fixed Charge

The daily water fixed charge is not related to the direct costs of consumption and are not dependent upon or related to the amount of consumption incurred. The fixed charges are intended to offset the fixed costs of maintaining the Waterworks.

Meter Size	Water Rate
15mm	$ 0.37
16 mm	$ 0.37
20 mm	$ 0.37
21 mm	$ 0.37
25 mm	$ 0.93
38 mm	$ 1.85
50 mm	$ 2.96
75 mm	$ 5.92
100 mm	$ 9.25
150 mm	$18.50
200 mm	$29.60
250 mm	$42.55
300 mm	$62.90

B) Metered Water Consumption Charges

Water consumption shall be charged on a per cubic metre basis at the rates indicated in the table below. The total monthly metered water consumption charge is the sum of usage in all blocks at the rate for each block:

		Residential	**Multi-Residential, Commercial, Institutional & Industrial**
Consumption Block	**Monthly Water Consumption (m^3)**	**Rate ($/m3)**	**Rate ($/m3)**
1	0-10	0.83	1.64
2	>10	1.64	1.64

Note to Schedule "G":

Wastewater/storm fees and charges are as set out in By-law No. 03-272 and in the Water and Wastewater/Storm Fees and Charges By-law.
Fees do not include HST which will be added where applicable.

SCHEDULE "H"

PRIVATE UNMETERED FIRE LINE FEES

EFFECTIVE JANUARY 1, 2020

(referred to in Section 11(4)

Size of Connection		**Monthly Fees or Charges**
mm	**inches**	
25	1	$ 3.60
38	1.5	$ 8.28
50	2	$ 14.40
75	3	$ 32.40
100	4	$ 57.60
150	6	$129.60
200	8	$230.40
250	10	$230.40
300	12	$230.40

Note:
1. Fees do not include HST which will be added where applicable.
2. The service shall consist of permanent unmetered connections to the main for the purpose of supplying water to private fire protection systems such as automatic sprinkler systems, standpipes and private hydrants. This service shall also include reasonable quantitites of water used for testing check valves and other backflow protection devices.

Authority: Item 2, General Issues Committee
Report 19-025 (FCS19070)
CM: November 27, 2019
Ward: City Wide

Bill No. 291

CITY OF HAMILTON

BY-LAW NO. 19-

A By-law to Establish the 2020 Water and Wastewater/Storm Fees and Charges for Services, Activities and Use of Property Provided by the City of Hamilton

WHEREAS sections 9, 10 and 391 of the *Municipal Act, 2001*, authorize a municipality to pass by-laws imposing fees or charges for services or activities provided or done by or on behalf of the municipality and for the use of the municipality's property, including property under its control;

AND WHEREAS pursuant to sections 8, 9 and 10 of the *Municipal Act, 2001,* a municipality may pass by-laws respecting public assets of the municipality acquired for the purpose of exercising its authority under the *Municipal Act, 2001* or any other Act, and respecting services that the municipality considers necessary or desirable for the public, including the provision of public utilities such as water and sewage, as defined in the *Municipal Act, 2001*;

AND WHEREAS the City of Hamilton wishes to establish and maintain in one by-law a list of all of its water and wastewater/storm services and activities and the use of property subject to fees or charges, as well as the amount of each fee or charge;

AND WHEREAS on the 27th day of November, 2019, the Council of the City of Hamilton approved Item 2 of General Issues Committee Report 19-025 and authorized the 2020 water and wastewater/storm fees and charges set out herein;

AND WHEREAS notice of the 2020 water and wastewater/storm fees and charges set out herein has been given in accordance with the provisions of the City of Hamilton's Public Notice Policy By-law No. 07-351.

NOW THEREFORE the Council of the City of Hamilton enacts as follows:

1. The water and wastewater/storm fees and charges identified under the headings of Daily Water & Wastewater/Storm Fixed Charges, Metered Water Consumption Charges, Wastewater/Storm Treatment Charges, and Non-Metered Annual Water and Wastewater/Storm Rate on Schedule "A" attached hereto, shall be imposed by the City of Hamilton

for those services, activities and use of property provided by the City of Hamilton.

2. The water and wastewater/storm fees and charges identified as the “2020 Approved Fee or Charge” on Schedule “B” attached hereto, shall be imposed by the City of Hamilton for those services, activities and use of property provided by the City of Hamilton and identified as the “Service Offered” on the said Schedule “B”.

3. (1) The fees and charges approved and imposed under section 2 are subject to any adjustment authorized by a statute, regulation or by-law in respect of the calculation or administration of a fee or charge, such adjustment to be effective as provided for in such statute, regulation or by-law.

   (2) Despite sections 1 and 2, any fee or charge:

      (a) authorized by a by-law that comes into effect on the same or a later date than this By-law; or

      (b) included in a valid agreement entered into by the City of Hamilton and one or more other parties,

   shall be the approved and imposed fee or charge for the service, activity or use of property specified.

4. The water and wastewater fees and charges listed in Schedules “A” and “B” attached hereto are subject to the Harmonized Sales Tax (H.S.T.), where applicable.

5. The fees and charges imposed by this by-law are due and payable:

   (a) at the time of the transaction for which the fee or charge is imposed; or

   (b) if subsection 5(a) is not applicable, upon the due date specified in any invoice issued by the City of Hamilton or by any other body acting on behalf of the City of Hamilton to any person in connection with a fee or charge imposed by this By-law.

6. Late payment charges shall be added to all unpaid fees and charges as follows:

   (a) for the fees and charges set out in Schedule “A” and Schedule “B” attached hereto, when billed by a third party on behalf of the

City of Hamilton, a rate of 1.5% per month calculated daily on any overdue amount, or such other rate as is approved by Council;

(b) for the fees and charges set out in Schedule “A” and Schedule “B” attached hereto, when billed by the City of Hamilton, the current prime rate plus 2%, adjusted quarterly, on any overdue amount, or such other rate as is approved by Council.

7. All unpaid fees or charges imposed by this By-law on a person are a debt due to the City of Hamilton and the City of Hamilton may take such action as it considers necessary and as permitted by law to collect the debt.

8. Where all or part of a fee or charge imposed by this By-law relates to fees and charges for the supply of a public utility, as defined in the *Municipal Act, 2001*, and remains unpaid, such fee or charge may be added to the tax roll for the property to which the public utility was supplied, and collected in like manner as municipal taxes.

9. Where all or part of a fee or charge imposed by this By-law relates to fees and charges other than those set out in section 8 of this By-law, and remains unpaid, such fee or charge may be added to the tax roll for the property for which all of the owners are responsible for payment of the fee or charge, and collected in like manner as municipal taxes.

10. Each provision of this By-law, including Schedules “A” and “B”, continues in force until amended, repealed or replaced (by by-law or by a resolution of the Council of the City of Hamilton confirmed by by-law) and for greater certainty this includes continuing in force after December 31, 2020 until amended, repealed or replaced.

11. In the event of any conflict between the provisions of this By-law and the provisions of By-law No. R84-026, being the Waterworks By-law for the City of Hamilton, the provisions of By-law No. R84-026 shall prevail.

12. In the event of any conflict between the provisions of this By-law and the provisions of By-law No. 06-026, being The Sewer and Drain By-law for the City of Hamilton, the provisions of By-law No. 06-026 shall prevail.

13. In the event of any conflict between the provisions of this By-law and the provisions of By-law No. 03-272, being The Sanitary Surcharge

and Wastewater Abatement By-law for the City of Hamilton, the provisions of By-law No. 03-272 shall prevail.

14. Should any part of this By-law, including any part of Schedule "A" and/or Schedule "B" attached hereto, be determined by a court of competent jurisdiction to be invalid or of no force, it is the stated intention of Council that such invalid part of this By-law shall be severable from this By-law and that the remainder of this By-law, including the remainder of Schedule "A" and/or "B", as applicable, shall continue to operate and be in force.

15. Schedules "A" and "B" are attached to and form part of this By-law.

16. This By-law may be referred to as the "Water and Wastewater/Storm Fees and Charges By-law".

17. By-law No. 18-345, being a by-law to establish the 2019 Water and Wastewater/Storm Fees and Charges for Services, Activities and Use of Property Provided by the City of Hamilton, is repealed upon the coming into force of this By-law.

18. This By-law comes into force on January 1, 2020.

PASSED this 27th day of November, 2019.

F. Eisenberger	A. Holland
Mayor	City Clerk

SCHEDULE "A" TO BY-LAW 19-291

CITY OF HAMILTON

2020 WATER AND WASTEWATER/STORM FEES AND CHARGES

Effective January 1, 2020

A) Daily Water & Wastewater/Storm Fixed Charges*
The fixed daily charge is not related to the direct costs of consumption and are not dependent upon or related to the amount of consumption incurred. The fixed charges are intended to offset the fixed costs of maintaining the City's water, wastewater and storm systems.

Meter Size	Water Rate	Wastewater/ Storm Rate
15 mm	$0.37	$0.39
16 mm	$0.37	$0.39
20 mm	$0.37	$0.39
21 mm	$0.37	$0.39
25 mm	$0.93	$0.98
38 mm	$1.85	$1.95
50 mm	$2.96	$3.12
75 mm	$5.92	$6.24
100 mm	$9.25	$9.75
150 mm	$18.50	$19.50
200 mm	$29.60	$31.20
250 mm	$42.55	$44.85
300 mm	$62.90	$66.30

B) Metered Water Consumption Charges*
Water Consumption shall be charged on a per cubic metre basis at the rates indicated in the table below. The total monthly Water Consumption charge is the sum of usage in all blocks at the rate for each block.

		Residential	Multi-Residential, Commercial, Institutional & Industrial
Consumption Block	Monthly Water Consumption (m^3)	Rate (\$/m^3)	Rate (\$/m^3)
1	0-10	0.83	1.64
2	>10	1.64	1.64

C) Wastewater/Storm Treatment Charges*
Wastewater/Storm Treatment Charges are based on metered water consumption and the cost of wastewater collection and treatment, and stormwater management. Charges are on a per cubic metre basis at the rates indicated in the table below. The total monthly Wastewater/Storm Treatment Charge is the sum of usage in all blocks at the rate for each block.

		Residential	Multi-Residential, Commercial, Institutional & Industrial
Treatment Block	Monthly Water Consumption (m3)	Rate ($/m3)	Rate ($/m3)
1	0-10	0.88	1.75
2	>10	1.75	1.75

D) Non-Metered Annual Water And Wastewater/Storm Rate*
Flat Rate Water Customers Annual Rate: $594.95
Flat Rate Wastewater/Storm Customers Annual Rate: $638.75
Combined Flat Rate Water & Wastewater/Storm Customers Annual Rate: $1,233.70

*** Fees do not include HST which will be added where applicable.**

SCHEDULE "B" TO BY-LAW NO. 19-291

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: **PUBLIC WORKS**
Division: **WATERWORKS, WASTEWATER & STORM**

A: WATERWORKS BY-LAW R84-026 FEES AND CHARGES

Service Offered	2020 Approved Fee or Charge
WATER DISTRIBUTION	
Water Meter Permit Fees	
Note: Charged for first-time meter installations. Includes supply and installation of water meter and remote reading device by City and related inspection.	
16mm Displacement	**$359.70**
20mm Displacement	**$404.60**
21 mm Displacement	**$404.60**
25mm Displacement	**$559.40**
38mm Displacement	**$905.08**
50mm Displacement	**$1,218.80**
50mm Turbine	**$1,409.67**
50mm Compound	**$3,316.40**
100mm Turbine	**$3,870.13**
100mm Compound	**$5,304.84**
100mm Fire Service Turbine	**$6,759.21**
100mm Fire Service Compound	**$8,787.29**
100mm Magnetic Flow Meter [1.]	**$9,067.33**
100mm Fire Rated Magnetic Flow Meter [1.]	**$9,472.19**
150mm Turbine	**$7,608.67**
150mm Compound	**$10,419.16**
150mm Fire Service Turbine	**$11,235.65**
150mm Magnetic Flow Meter [1.]	**$11,396.47**
150mm Fire Rated Magnetic Flow Meter [1.]	**$12,566.10**
150mm Fire Service Compound	**$14,215.97**
200mm Turbine	**$9,187.68**
200mm Compound	**$12,344.57**
200mm Magnetic Flow Meter [1.]	**$12,268.08**
200mm Fire Rated Magnetic Flow Meter [1.]	**$13,407.34**
200mm Fire Service Turbine	**$14,437.52**
200mm Fire Service Compound	**$19,450.06**
250mm Turbine	**$15,785.99**
250mm Magnetic Flow Meter [1.]	**$14,686.07**
250mm Fire Rated Magnetic Flow Meter [1.]	**$17,382.96**
250mm Fire Service Turbine	**$19,673.87**
250mm Fire Service Compound	**$25,297.11**
Radio Remote Read Equipment Installation	**$214.63**
[1.] Must be approved by Supervisor of Meter Operations	
Water Meter Removal Fee (all meter sizes)	
Note: Cost to remove a meter prior to the building being demolished and/or the water service being decommissioned or abandoned. Failure to have the meter removed prior to the building being demolished will incur a meter replacement cost charge. Does not include a turn water off fee, which is required and charged separately.	
16mm Displacement	**$112.87**
20mm Displacement	**$112.87**
21mm Displacement	**$112.87**
25mm Displacement	**$112.87**
38mm - 250mm Meters (cost depends on size, labour and meter location)	**Cost + 10% overhead**
Water Meter Inspection Services	
Note: Cost for customer requested service relating to meter investigation.	
Inspection - Regular Hours	**$115.86**
Inspection - After Hours	**$151.73**

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM
A: WATERWORKS BY-LAW R84-026 FEES AND CHARGES, CONTINUED

Service Offered	2020 Approved Fee or Charge
Turning Water Off or On:	
Note: Turning water off at curb to enable customers to perform internal plumbing repairs or a private water service repair or replacement, then turning water back on.	
Turning water off and on - Regular Hours - 2 visits	**$124.10**
Turning water off and on - After Hours/Emergency - 2 visits	**$208.25**
Turning water off and on during the same visit - 1/2 hour maximum (Regular Hours)	**$83.47**
Turning water off and on during the same visit - 1/2 hour maximum (After Hours)	**$114.13**
Turning water off - Non-Compliance - 1/2 hour maximum (Regular Hours)	**$83.47**
Turning water on - Non-Compliance - 1/2 hour maximum (Regular Hours)	**$83.47**
Hydrant Flow Test / Water Quality Flushing	**$106.29**
Note: Cost to operate a City Fire Hydrant(s) for a maximum of 1 hour total labour.	
Hydrant/Road Adapter Fees	
Note: Costs to install or remove water meter and backflow prevention device. When moving a hydrant/road adapter from one site to another for the same customer, both removal and installation fees apply. This service requires a usage deposit and a damage deposit.	
Usage Cost (Metered Hauled Water Rate/m^3)	**$2.45**
Connection/Disconnection Fee - Regular Hours (fee for both services)	**$146.94**
Connection/Disconnection Fee - After Hours/Emergency (fee for both services)	**$276.71**
Usage Deposit	**$300.00**
Security/Damage Deposit	**$6,000.00**
Hydrant/road adapter rental fee for initial seven days	**$82.56**
Per diem hydrant/road adapter rental fee after initial seven days	**$6.13**
Replacement Cost for Lost Meter:	
Note: Cost to replace a meter that has been lost, stolen or damaged. Includes meter, installation and administrative costs.	
15mm Displacement	**$221.75**
16mm Displacement	**$221.75**
20mm Displacement	**$342.24**
21mm Displacement	**$342.24**
25mm Displacement	**$393.97**
38mm Displacement	**$1,082.62**
50mm Turbine	**$1,297.30**
50mm Displacement	**$1,596.50**
50mm Compound	**$2,069.60**
50mm Strainer	**$419.15**
100mm Turbine	**$3,264.16**

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

A: WATERWORKS BY-LAW R84-026 FEES AND CHARGES, CONTINUED

Service Offered	2020 Approved Fee or Charge
100mm Compound	**$5,273.63**
100mm Fire Service Turbine	**$7,212.18**
100mm Fire Service Compound	**$8,855.57**
100mm Magnetic Flow Meter	**$9,855.25**
100mm Fire Rated Magnetic Flow Meter	**$10,290.10**
100mm Strainer	**$775.66**
150mm Turbine	**$6,006.42**
150mm Compound	**$9,139.82**
150mm Fire Service Turbine	**$10,968.91**
150mm Fire Service Compound	**$13,949.23**
150mm Magnetic Flow Meter	**$10,918.05**
150mm Fire Rated Magnetic Flow Meter	**$12,170.80**
150mm Strainer	**$1,240.69**
200mm Turbine	**$6,570.69**
200mm Compound	**$10,222.12**
200mm Fire Service Turbine	**$14,454.48**
200mm Fire Service Compound	**$19,466.10**
200mm Magnetic Flow Meter	**$13,177.47**
200mm Fire Rated Magnetic Flow Meter	**$14,395.02**
200mm Strainer	**$2,107.80**
250mm Turbine	**$11,424.07**
250mm Magnetic Flow Meter	**$13,336.65**
250mm Fire Rated Magnetic Flow Meter	**$16,225.00**
250mm Fire Service Turbine	**$18,219.75**
250mm Fire Service Compound	**$25,704.87**
250mm Strainer	**$3,533.73**
Testing Water Meters	
Note: Cost to have a water meter tested for accuracy. If the meter tests within the accuracy standards as set out by AWWA then the property owner is responsible for the cost of the test and the replacement cost of the water meter; otherwise cost borne by the City. Fee includes removal of existing meter and installation of replacement meter.	
15mm & 16mm Diameter	**$314.56**
16-25mm Diameter - Test where meter has been removed from service within prior 90 days	**$130.39**
20mm Diameter	**$362.87**
25mm Diameter	**$414.60**
38mm Diameter	**$914.18**
50mm Diameter	**$1,542.08**
100mm plus diameter (in Situ testing)	**$930.42**
Water Quality/Quantity Service Calls	
Note: Cost for a service call to investigate a water quality/quantity complaint and the issue resides on private property. No charge for water quality/quantity complaints related to issues originating from the City's distribution system. Missed appointments will be billed the corresponding service call rate.	
Service Call - Regular Hours - Maximum 1 hour total labour	**$83.47**
Service Call - After Hours/Emergency - Maximum 1 hour total labour	**$148.36**
Hydrant Repair, Replace or Relocate	
Note: Cost to repair, replace or relocate a City fire hydrant. Fee includes labour, materials and equipment.	**Cost + 33% overhead**
Watermain Shutdown	
Note: Cost associated with isolating a watermain to facilitate third party work	
Watermain Shutdown/Recharge - Regular Hours	**$129.11**
Watermain Shutdown/Recharge - After Hours/Emergency	**$232.49**

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

A: WATERWORKS BY-LAW R84-026 FEES AND CHARGES, CONTINUED

Service Offered	2020 Approved Fee or Charge
Private Water Filling Station Permit Fees	
Annual Renewal	**$386.22**
New Application	**$1,217.22**
Water Haulage License Fees	
Water Haulage License Fee	**$57.44**
Note: Annual license fee to utilize the City's Public Water Filling Stations.	
Account review	**$87.91**
Note: Costs charged for administrative services to provide customer account information for personal or taxation purposes	
Construction Water:	
Note: Charge for unmetered water used for construction prior to meter installation. Paid at the time of submitting building permit payment.	
Single Residential (per lot or townhouse)	**$100.00**
Multi-Residential (per apartment/condo unit)	**$46.75**
Industrial/Commercial/Institutional (per 1,000 sq ft of building area or $/ha where no structure is constructed)	**$32.80**
Water Inspection Services	
Note: Cost associated with various permit and inspection services related to water services for properties	
Private Water Service Repair/Replacement Inspection - Regular Hours	**$93.45**
Private Water Service Repair/Replacement Inspection - After Hours/Emergency	**$158.36**
Water Service Abandonment Inspection - Regular Hours	**$83.47**
Water Service Abandonment Inspection - After Hours/Emergency	**$148.36**
Water Service Inspection for Demolition - Regular Hours	**$83.47**
Water Service Inspection for Demolition - After Hours/Emergency	**$148.36**
Missed or Cancelled Inspection	**$60.65**
Upsize Public Portion Water Service from 20mm to 25mm	**$155.00**
Note: Charge for upsizing a public portion water service from 20mm to 25mm when a public portion water service replacement is already being completed by the City	
General Administration Fees:	
General administrative requests (per hour)	**$69.16**
NSF cheque	**$60.15**
Permit cancellation administration fee	**$41.14**
Permit renewal fee	**$41.14**
Lead water service replacement loan application fee	**$51.60**
Monthly Manual Meter Read Fee	**$3.00**
Water Shut-off Administration fee	**$20.00**
Water Shut-off Notice on Door	**$28.25**
Miscellaneous Water Distribution System Repair	
Note: Cost for the City to repair damage to the water distribution system caused by a third party. Costs include labour, parts, materials, equipment and permanent restoration	**Cost plus 33% overhead**
Additional Labour Charges:	
Note: Fees in this Schedule allow for a maximum one hour of total labour. An additional labour charge for all services/calls that exceed that allotted labour time will be charged as follows:	
1/2 Hour Additional Labour - Regular Hours	**$22.83**
1/2 Hour Additional Labour - After Hours/Emergency	**$34.25**
Costs are for a single Water Distribution Operator in minimum increments of 30 minutes	

Note:

1. "Regular Hours" means any working day, 7:00 a.m. - 4:30 p.m. Monday to Friday, excluding weekends, statutory and other public holidays or any other day on which the City has elected to be closed for business.

2. "After Hours" means outside Regular Hours Monday to Friday, a Saturday, Sunday, statutory and other public holiday or any other day on which the City has elected to be closed for business.

3. "Emergency" means any occurrence where staff and/or equipment must be re-deployed from previously assigned task(s) to respond to a time-sensitive request for services/call made under this By-law.

4. Fees do not include HST which will be added where applicable.

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

B: SEWER AND DRAIN BY-LAW 06-026 FEES AND CHARGES

Service Offered	2020 Approved Fee or Charge*
COLLECTION SYSTEM INSPECTION & MAINTENANCE	
Private Sewer Lateral Permit and Visual Inspection Fees	
a) Regular Hours inspection	**$96.68**
b) After Hours/Emergency inspection	**$205.40**
Main Sewer inspection	**Cost plus 33% overhead**
Missed or Cancelled Sewer Lateral Inspection Fee	**$69.50**
Sewer Related Service Calls **Note**: Cost for a service call to investigate a sewer related complaint and the issue resides on private property. No charge for sewer complaints related to issue originating from the City's sewer system. Missed appointments will be billed the corresponding service call rate.	
Service Call - Regular Hours	**$86.11**
Service Call - After Hours/Emergency	**$173.70**
Sewer Lateral Cleaning and Investigation Fees **Note:** The City's reimbursement of contractor expenses will be no greater than the amounts set out below, less the City's administration fee. Equipment supply purchases and equipment rental costs are not eligible for reimbursement by the City.	
Complete Sewer Lateral Investigation - Regular Hours	**$405.91**
Complete Sewer Lateral Investigation - After Hours	**$448.36**
Partial Sewer Lateral Cleaning - Regular Hours	**$132.65**
Partial Sewer Lateral Cleaning - After Hours	**$185.71**
Abandoned Sewer Lateral Investigation - Regular Hours	**$212.24**
Abandoned Sewer Lateral Investigation - After Hours	**$265.30**
Miscellaneous Wastewater Collection System Repair **Note**: Cost for the City to repair damage to the wastewater collection system caused by a third party. Costs include labour, parts, materials, equipment and permanent restoration.	**Cost + 33% overhead**
Additional Labour Charges **Note: Fees for Private Sewer Lateral Permit and Visual Inspection and Sewer Related Service allow for maximum one hour of total labour. An addition labour charge for services/calls that exceed that allotted labour time will be charged as follows:**	
1/2 Hour Additional Labour - Regular Hours	**$21.90**
1/2 Hour Additional Labour - After Hours/Emergency	**$32.83**

Note:
1. "Regular Hours" means any working day, 7:00 a.m. - 4:30 p.m. Monday to Friday, excluding weekends, statutory and other public holidays or any other day on which the City has elected to be closed for business.

2. "After Hours" means outside Regular Hours Monday to Friday, a Saturday, Sunday, statutory and other public holiday or any other day on which the City has elected to be closed for business.

3. "Emergency" means any occurrence where staff and/or equipment must be re-deployed from previously assigned task(s) to respond to a time-sensitive request for services/call made under this By-law.

4. "Partial Sewer Lateral Cleaning" means services to relieve blockage(s) in the Sewer Lateral in order to temporarily reinstate sewer service

5. "Complete Sewer Lateral Investigation" means services to complete a thorough cleaning and closed circuit television inspection of the Sewer Lateral.

6. "Abandoned Sewer Lateral Investigaton" means services related to an unsuccessful attempt to access the Sewer Lateral for cleaning.

7. Fees do not include HST which will be added where applicable.

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

C: LABORATORY SERVICES FEES AND CHARGES

Service Offered	2020 Approved Fee or Charge
LABORATORY SERVICES	
Inorganic Tests:	
Solids	
Total Suspended Solids (TSS)	**$21.70**
TSS plus Volatile Suspended Solids (VSS)	**$21.70**
Total Solids (TS)	**$19.10**
TS plus Volatile Solids (VS)	**$20.10**
Total Dissolved Solids	**$32.00**
Skalar	
Total Cyanide	**$34.40**
Phenolics	**$31.80**
Total Kjeldhal Nitrogen (TKN)	**$31.40**
Ammonia	**$34.60**
Dissolved Organic Carbon	**$34.30**
Total Organic Carbon	**$34.30**
Reactive Silica	**$28.80**
Ion Chromatography Scan (IC Scan)	**$50.40**
PC Titrate	
pH	**$16.50**
Alkalinity	**$16.40**
Conductivity	**$16.40**
Fluoride	**$24.80**
Turbidity	**$24.70**
UV Transmittance	**$25.30**
Color Apparent	**$22.90**
Color True	**$22.90**
O Phosphate	**$26.70**
Chemical Oxygen Demand (COD)	**$37.90**
Biochemical Oxygen Demand (BOD)	**$37.70**
Volatile Acid	**$37.30**
Microbiology Tests:	
Total Coliform/E coli/Total Background Coliform (DC)	**$25.70**
EC (mFC-BIG)	**$28.60**
Heterotrophic Plate Count	**$26.70**
Micro Examination	**$137.30**
Microcystin	**$515.00**

NOTE: (1) Rush service may be subject to a surcharge, that will vary depending on the analysis and turnaround requirements.
(2) Fees do not include HST which will be added where applicable.

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

C: LABORATORY SERVICES FEES AND CHARGES, CONTINUED

Service Offered	2020 Approved Fee or Charge
Metals Tests:	
Inductively Coupled Plasma (ICP)	
ICP Optical Emission Spectrometry Scan (ICP OES) (Wastewater)	**$58.20**
Total Phosphorous	**$27.70**
Total Dissolved Phosphorous	**$27.70**
Inductively Coupled Plasma Mass Spectrometry (ICP MS)	
ICP MS Scan	**$58.20**
Atomic Absorption Spectrometry (AA)	
Mercury	**$45.70**
Organics	
Caffeine	**$124.60**
Additional Fees	
Weekend surcharge	**$100.00**

Note: (1) Rush service may be subject to a surcharge, that will vary depending on the analysis and turnaround requirements
(2) Fees do not include HST which will be added where applicable.

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: **PUBLIC WORKS**
Division: **WATERWORKS, WASTEWATER & STORM**

D: SEWER USE BY-LAW 14-090 FEES AND CHARGES

Service Offered	2020 Approved Fee or Charge
To Regulate the Discharge of any Matter into the Sanitary, Combined, and Storm Sewer Systems.	
Annual permit to discharge hauled sewage	**$329.00**
Discharge fees for hauled sewage generated:	
Inside the City - Compliant	
Note: Cost per truck full of sewage containing materials within Sewer Use By-law limits	
up to 1000 imperial gallons (4.54 m3) or any part thereof	**$50.15**
greater than 1000 (4.54 m3) but less than or equal to 3500 imperial gallons (15.9m3)	**$50.15**
greater than 3500 (15.9 m3) but less than or equal to 5000 imperial gallons (22.7 m3)	**$100.30**
greater than 5000 (22.7 m3) but less than or equal to 8000 Imperial gallons (36.3 m3)	**$150.45**
greater than 8000 (36.3 m3) but less than or equal to 10000 imperial gallons (45.43 m3)	**$200.60**
Inside the City - Non-Compliant	
Note: Cost per truck full of sewage containing materials that exceed one or more Sewer Use By-law limits	
up to 1000 imperial gallons (4.54 m3) or any part thereof	**$50.15**
greater than 1000 (4.54 m3) but less than or equal to 3500 imperial gallons (15.9m3)	**$100.30**
greater than 3500 (15.9 m3) but less than or equal to 5000 imperial gallons (22.7 m3)	**$150.45**
greater than 5000 (22.7 m3) but less than or equal to 8000 imperial gallons (36.3 m3)	**$250.75**
greater than 8000 (36.3 m3) but less than or equal to 10000 imperial gallons (45.43 m3)	**$300.90**

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

D: SEWER USE BY-LAW 14-090 FEES AND CHARGES, CONTINUED

Service Offered	2020 Approved Fee or Charge
Holding Tank for a Recreational Vehicle	
Discharge fee for holding tank of a recreational vehicle	**$8.50**
Overstrength Discharge Fees (charge per kg)	
Biochemical oxygen demand	**$0.78**
Total suspended solids	**$0.63**
Total phosphorus	**$1.78**
Total kjeldahl nitrogen	**$1.00**
Oil and grease (animal/vegetable)	**$0.44**
Surcharge Discharge Fee (charge per m^3)	**$1.75**
Application Fees for Sewer Discharge Permits	
Application Fee (all permit types)	**$629.34**
Wastewater Characterization deposit (optional)	**$500.00**
Amendment Fee (all permit types)	**$295.47**
Administrative Fees for Sewer Discharge Permits (charges per quarter*)	
Overstrength Discharge Permit	**$435.00**
Surcharge Discharge Permit	**$435.00**
Compliance Discharge Permit	**$1,071.00**
Chlorides Discharge Permit	**$435.00**
Conditional Discharge Permit	**$1,071.00**
Information Requests	**$150.86**
Wastewater Sampling Fees	
Wastewater Sampling Vehicle Fee (per km)	**$1.21**
Wastewater Sampling Equipment Fee (per day)	**$39.68**
Wastewater Sampling Technician Fee (per hour) Mon - Fri	**$50.04**
Wastewater Sampling Technician Fee (per hour) Sat	**$75.06**
Wastewater Sampling Technician Fee (per hour) Sun	**$100.07**

*multiple permit holders pay the higher administrative fee (for example, if the permit holder has both an Overstrength Discharge Permit and a Compliance Program Permit, they will pay $810.00 per quarter).

Fees do not include HST which will be added where applicable.

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: **Public Works**
Division: **WATERWORKS, WASTEWATER & STORM**

E: SANITARY SURCHARGE AND WASTEWATER ABATEMENT BY-LAW 03-272 FEES AND CHARGES

Service Offered	2020 Approved Fee or Charge
Application Processing Fee (section 10)	**$374.50 plus full cost recovery for peer review, if required by Director**
Annual Administration Fee (where annual Abatement exceeds $500 - sub-section 22 (b))	**$745.30**

Note: Fees do not include HST which will be added where applicable.

WATER AND WASTEWATER FEES AND CHARGES

Effective January 1, 2020

Department: **PUBLIC WORKS**
Division: **WATERWORKS, WASTEWATER & STORM**

F: BACKFLOW PREVENTION BY-LAW 10-103 FEES AND CHARGES

Service Offered	2020 Approved Fee or Charge
BACKFLOW PREVENTION PROGRAM	
Annual Fee (in accordance with Section 4.2 of the Backflow Prevention By-law)	**$134.96 per year to be paid by person listed on Authorized Functions List**
Test Report receipt and processing (per submission)	**$64.26 with submission of each Test Report to the City of Hamilton**
Cross Connection Survey Form - receipt and processing	**$160.28 with submission of each Cross Connection Survey Form to the City of Hamilton**
Backflow Prevention Device Inspection - Regular Hours	**$142.12**
Backflow Prevention Device Inspection - After Hours	**$206.90**

Note:
1. "Regular Hours" means any working day, 7:00 a.m. - 4:30 p.m. Monday to Friday, excluding weekends, statutory and other public holidays or any other day on which the City has elected to be closed for business.

2. "After Hours" means outside Regular Hours Monday to Friday, a Saturday, Sunday, statutory and other public holiday or any other day on which the City has elected to be closed for business.

3. Fees do not include HST which will be added where applicable.

WATER AND WASTEWATER FEES AND CHARGES
Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

G: PRIVATE FIRE LINE RATES

Service Offered		2020 Approved Fee or Charge
Size of Connection		
mm	inches	
25	1	$3.60
38	1.5	$8.28
50	2	$14.40
75	3	$32.40
100	4	$57.60
150	6	$129.60
200	8	$230.40
250	10	$230.40
300	12	$230.40

Note:
1. Fees do not include HST which will be added where applicable.

2. The service shall consist of permanent unmetered connections to the main for the purpose of supplying water to private fire protection systems such as automatic sprinkler systems, standpipes and private hydrants. This service shall also include reasonable quantitites of water used for testing check valves and other backflow protection devices.

WATER AND WASTEWATER FEES AND CHARGES
Effective January 1, 2020

Department: PUBLIC WORKS
Division: WATERWORKS, WASTEWATER & STORM

H: OTHER

Service Offered	2020 Approved Fee or Charge
Environmental Records Search PRISM Reports related to soil contamination	$159.80
Environmental Assessments and Master Plans Reports Additional fee per page of Report	$15.71

Fees do not include HST which will be added where applicable.