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Updated Report for

City of Hamilton

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

November 30, 2018

CONFIDENTIAL



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

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HATCH				

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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 m³ 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 m³ of storage, and if the first cell fills, the second cell provides approximately 69,600 m³ 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.

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

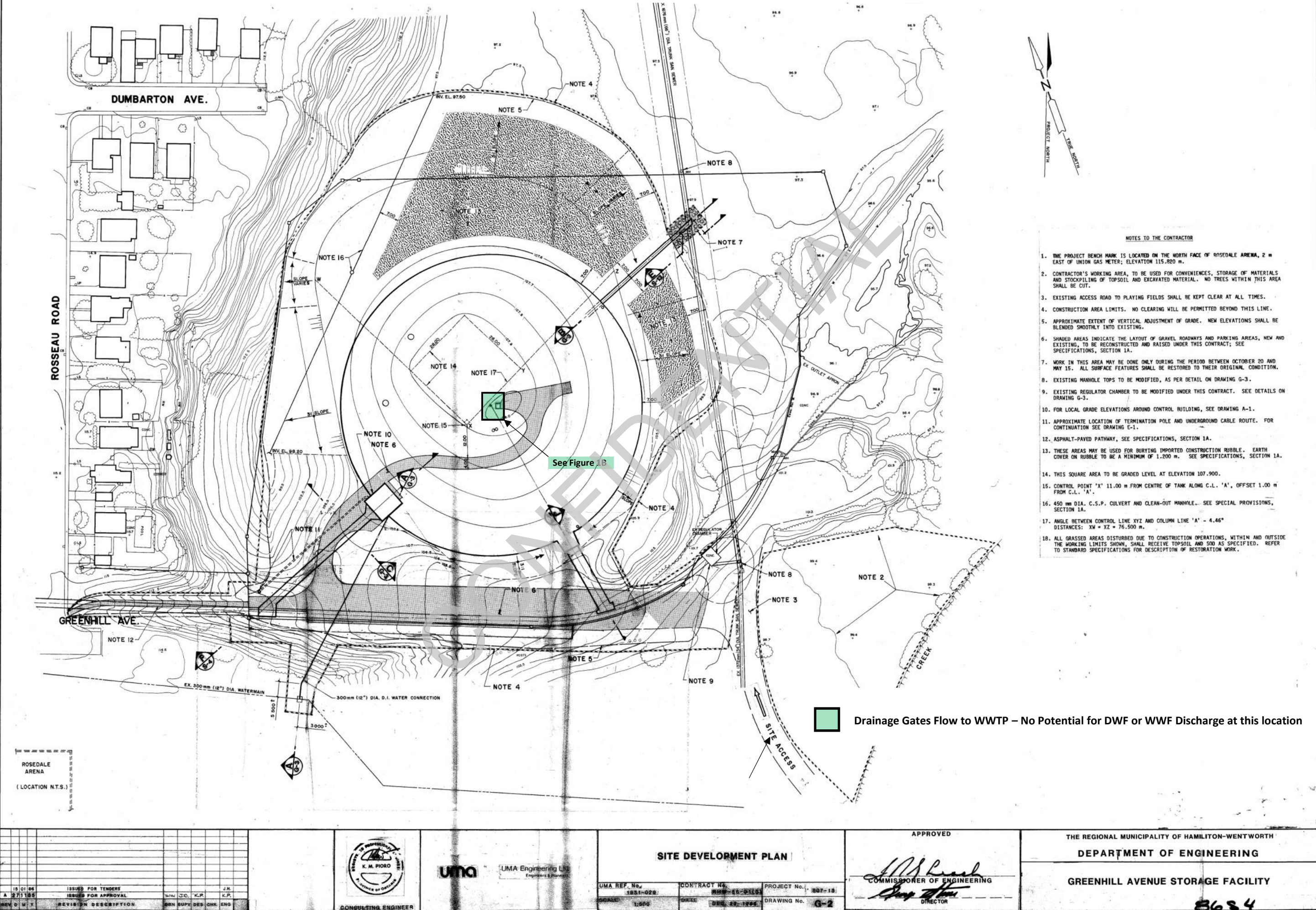


Figure 1B: Greenhill CSO Tank #1 (HCS01) – CSO Tank Drainage Gates

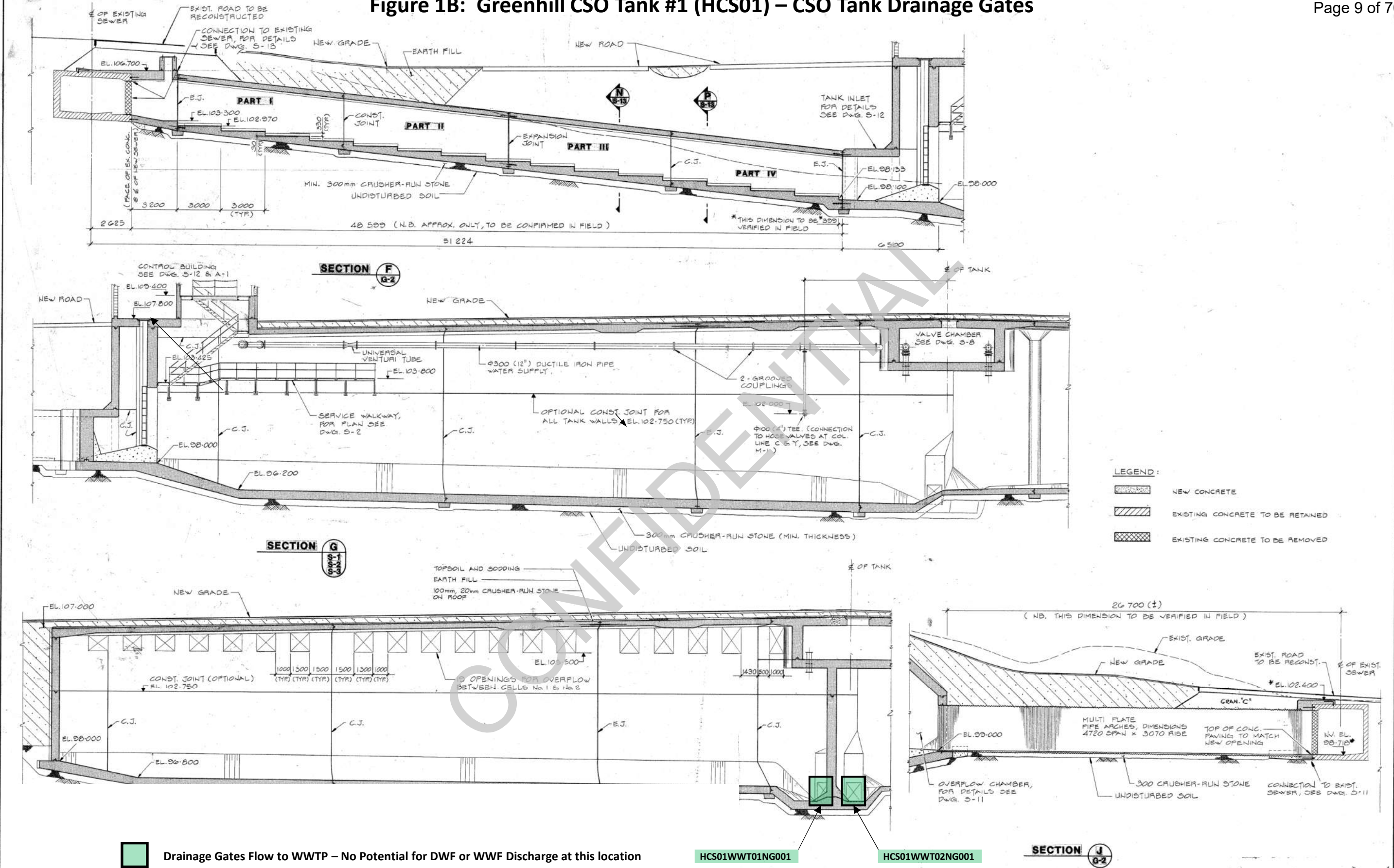


Table 1: Inventory of Critical Control Points at Greenhill CSO Tank #1 (HCS01)

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	<div><div></div>No significant changes required to PCN or SOP</div> <div><div></div>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</div>
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	<div><div></div>No significant changes required to PCN or SOP</div> <div><div></div>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</div>
							<div><div></div>Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.</div>

3.2 Bayfront Park CSO Tank (HCS02)

The Bayfront Park CSO Tank (HCS02) covers an area of approximately 3,200 m², and is over 6 m deep, providing approximately 21,000 m³ 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).

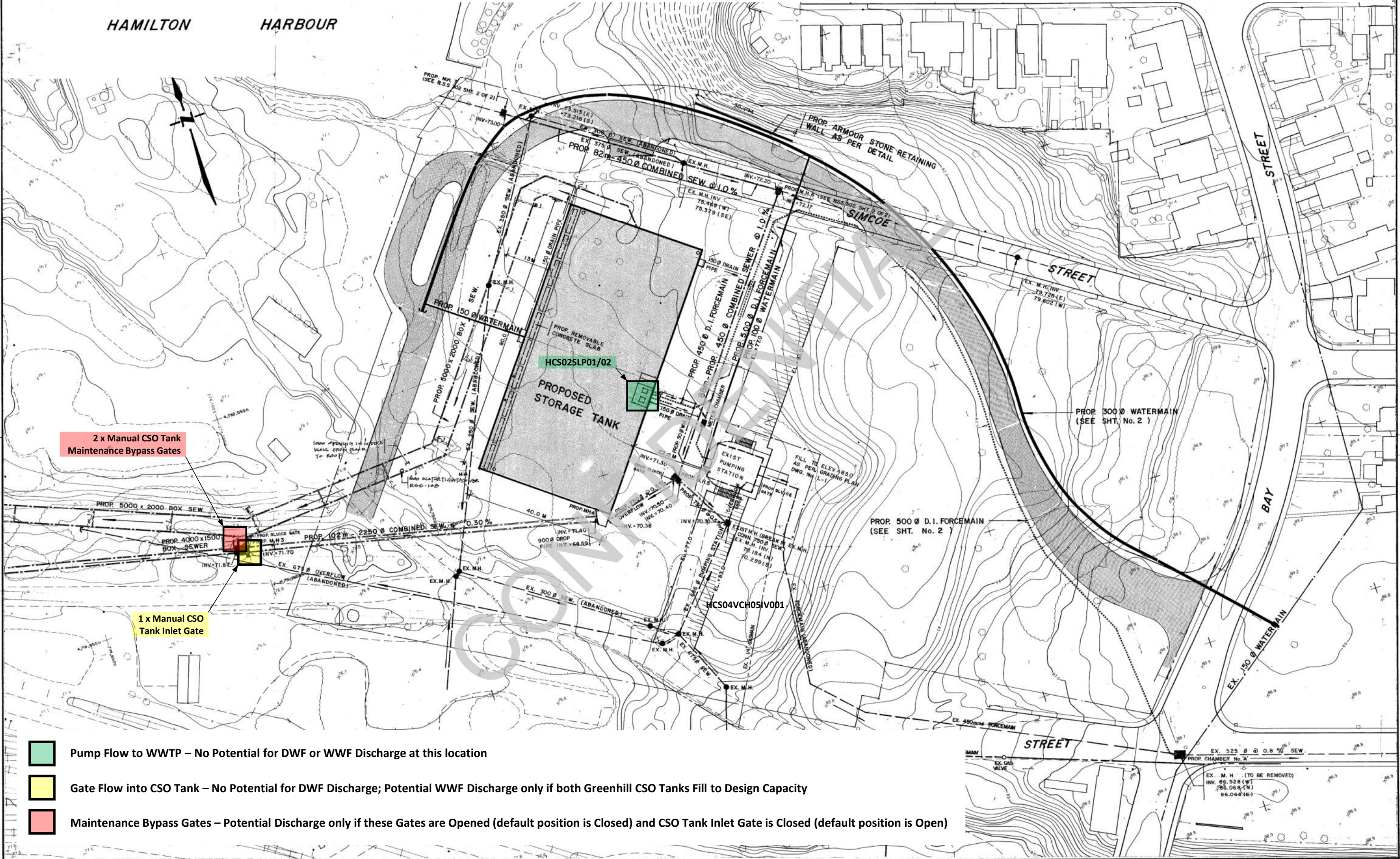
During WWF conditions, excess flows from the three static CSO regulators overflow into the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour via the outfall sewer that exits the north-west corner of the 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





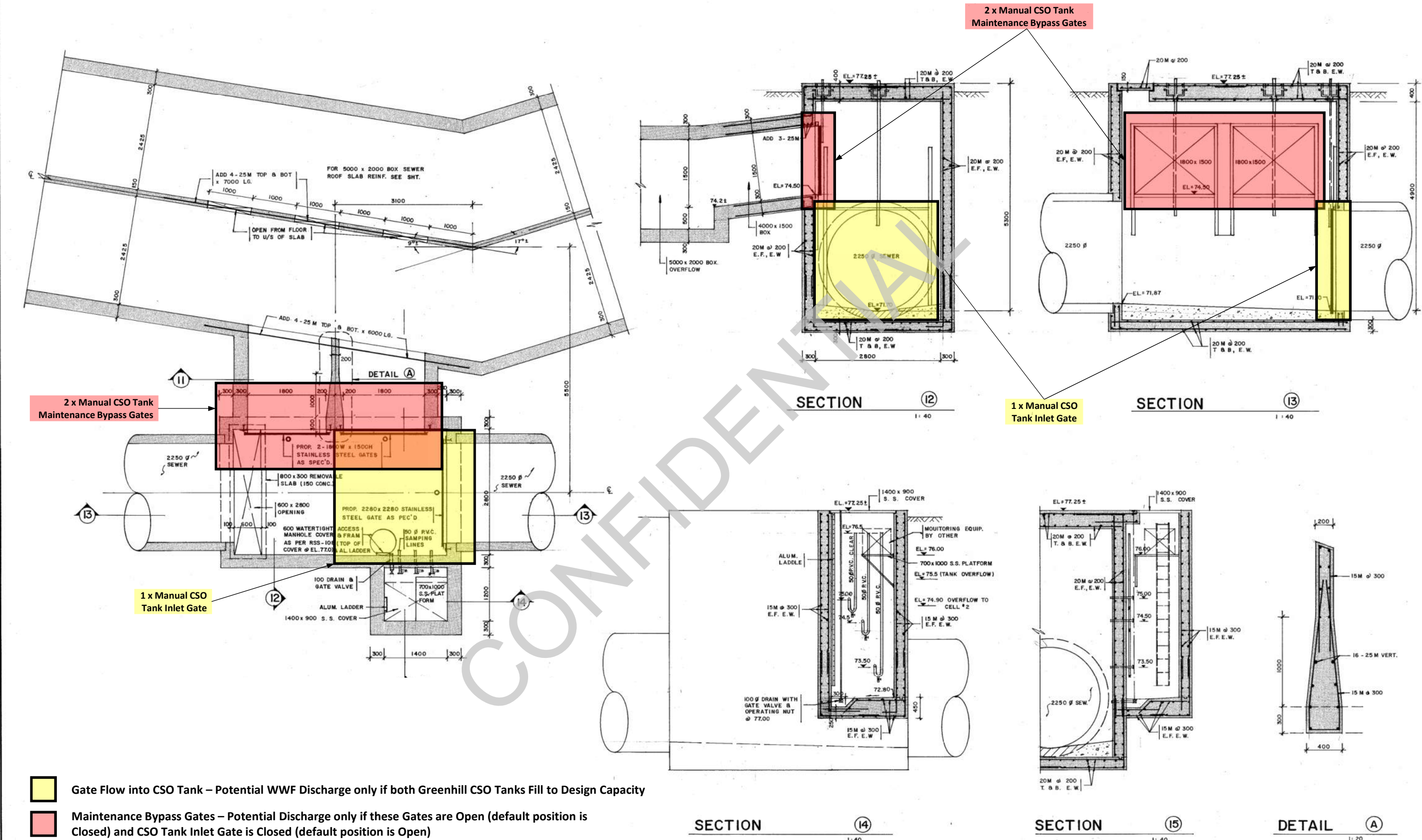
				NOTES:		T. HO		SCALES		APPROVED		THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH		PROPOSED STORAGE TANK	
								1: 500						DEPARTMENT OF ENGINEERING.	
										DIRECTOR		COMMISSIONER OF ENGINEERING		SITE PLAN	
												DATE: 92 - 02 - 17		PROJECT No. 819 - 118	
														DRAWING No. 92 - S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

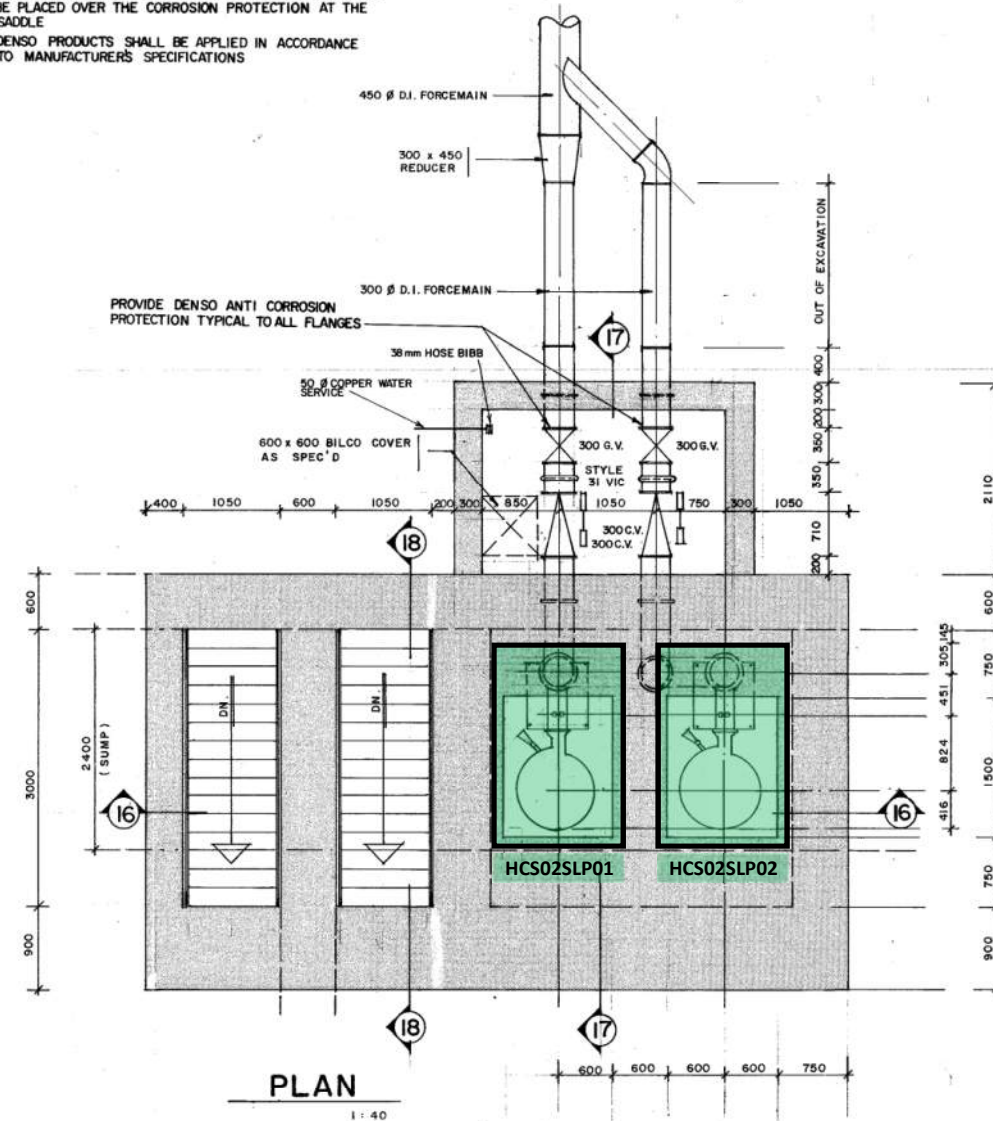
Figure 2B: Bayfront Park CSO Tank (HCS02) – CSO Tank Inlet and Maintenance Bypass Gates



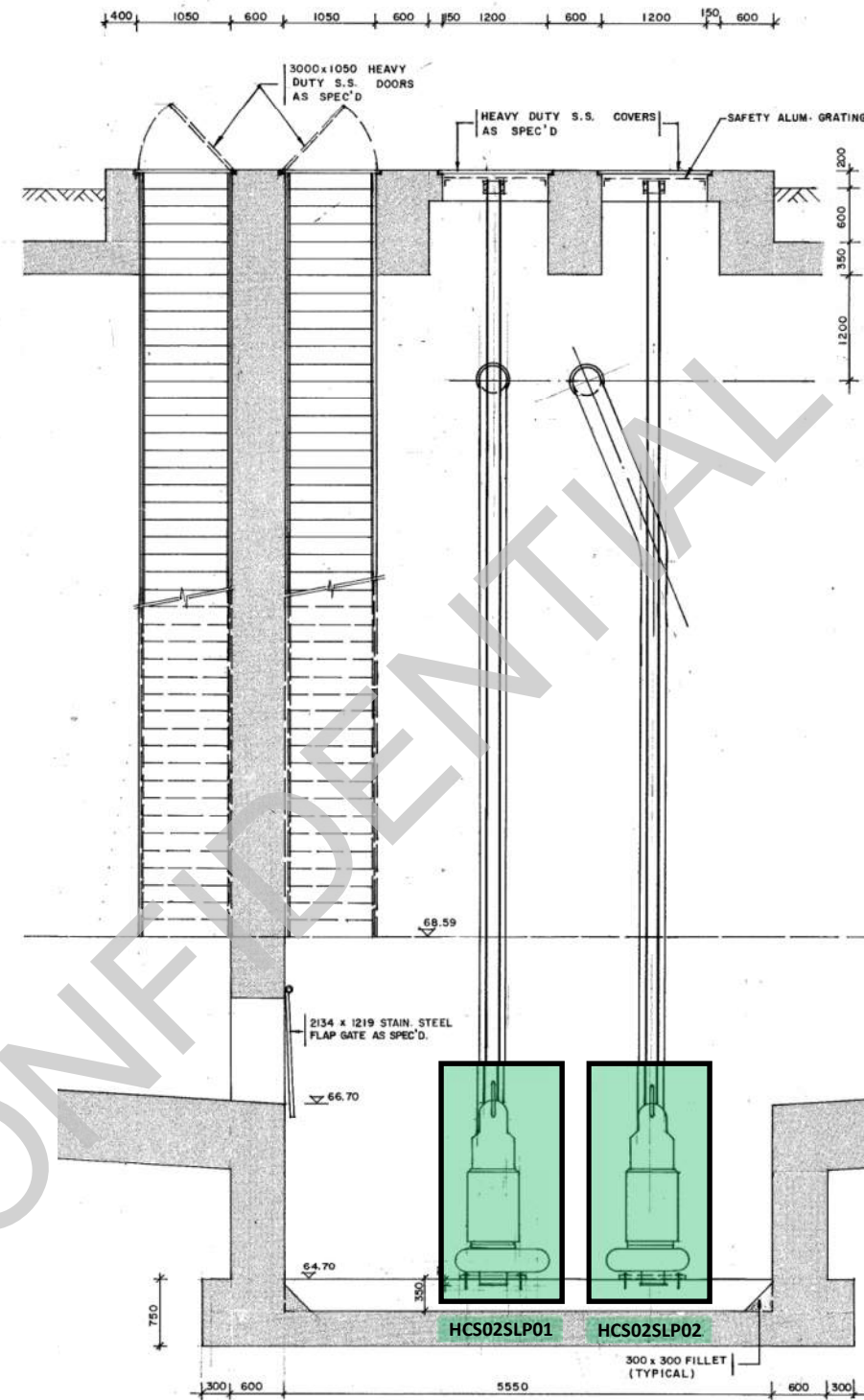
CHECKED BY		DRAWN BY		SCALES		APPROVED		THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH		PROPOSED STORAGE TANK	
		T. HO		AS NOTED		[Signature]		DEPARTMENT OF ENGINEERING		STRACHAN STREET	
						COMMISSIONER OF ENGINEERING		DATE: 92 - 02 - 17		PROJECT No. 819 - 118	
No.		REVISIONS		DATE		INITIAL		DRAWING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

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

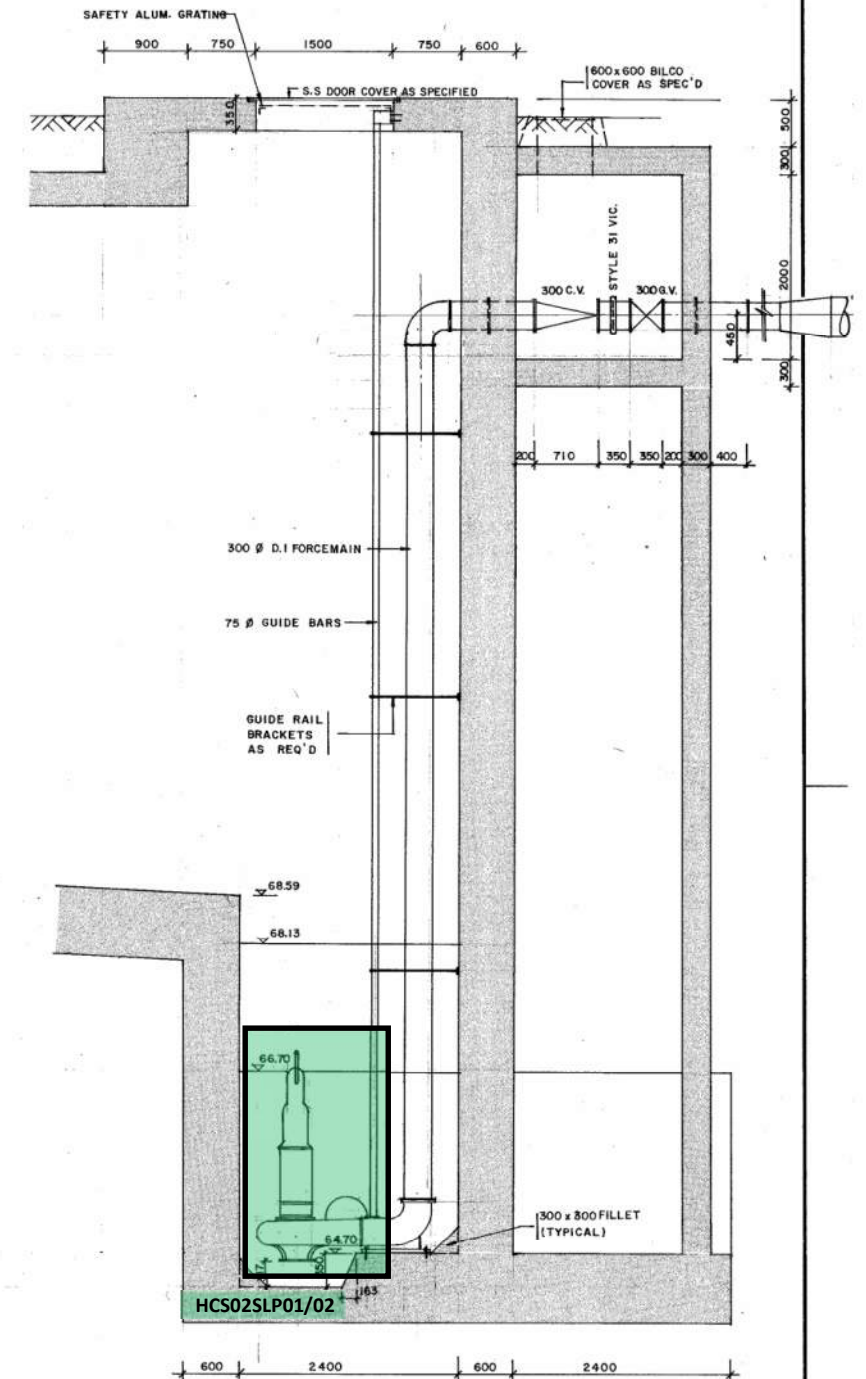
- NOTE:
1. DENSO PROTECTION SHALL CONSIST OF DENSO PRIMER AND TWO COATS OF DENSO TAPE. THE PIPE WRAP SHALL BE PLACED OVER THE CORROSION PROTECTION AT THE SADDLE
 2. DENSO PRODUCTS SHALL BE APPLIED IN ACCORDANCE TO MANUFACTURER'S SPECIFICATIONS



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



SECTION



SECTION

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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 <u>only if</u> 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 m³.

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 m², and is 0.8 to 2.1 m deep, providing approximately 1,400 m³ of CSO storage capacity.

The off-line storage capacity is augmented by 1,800 m³ 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.

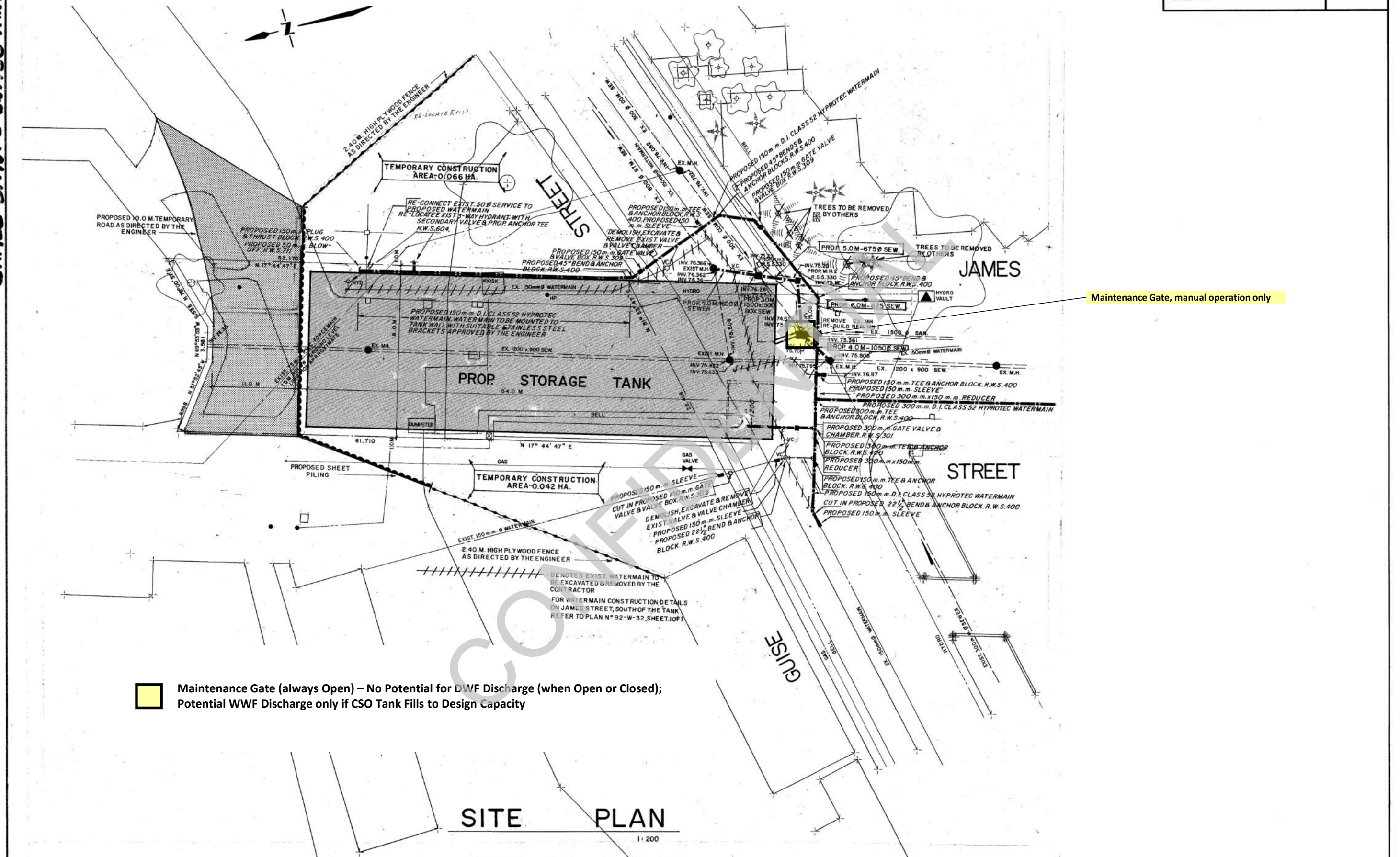
Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by gravity as the in-line storage pipe empties. The rate of drainage from the in-line 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



No.	REVISIONS	INITIAL	DATE	DRAWN BY: T. HOOG <i>T. Hoog</i> DATE: SEPTEMBER 4, 1992 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
									SITE PLAN

Appendix "H" to Report PW 19008 (e) / LS 19008 (e)

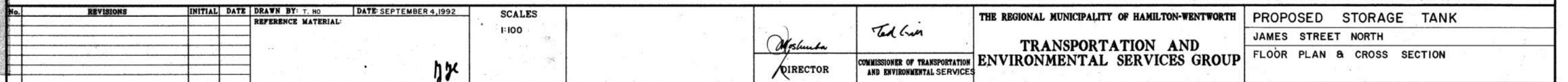


Figure 3C: James Street CSO Tank (HCS03) – Maintenance Gate

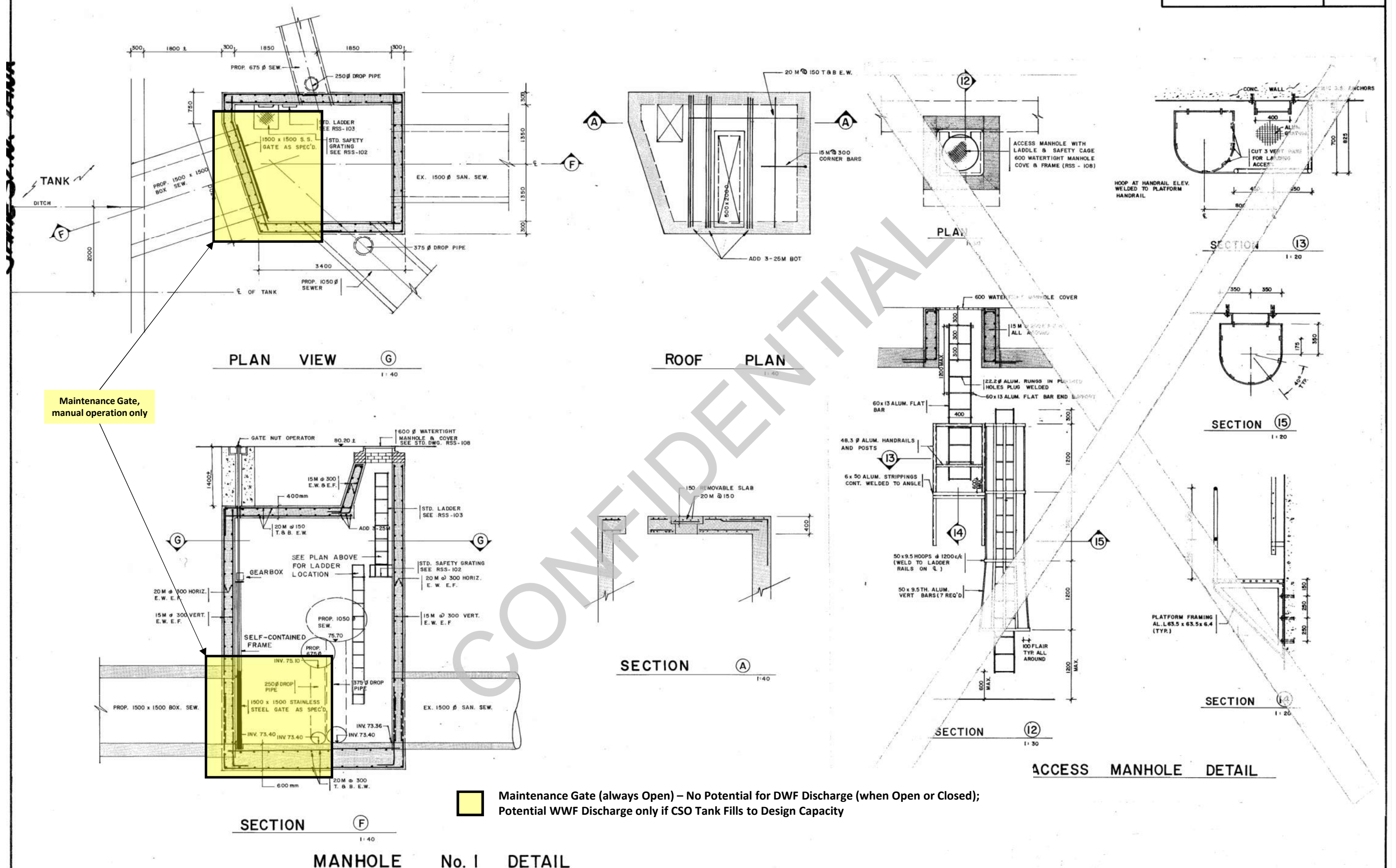
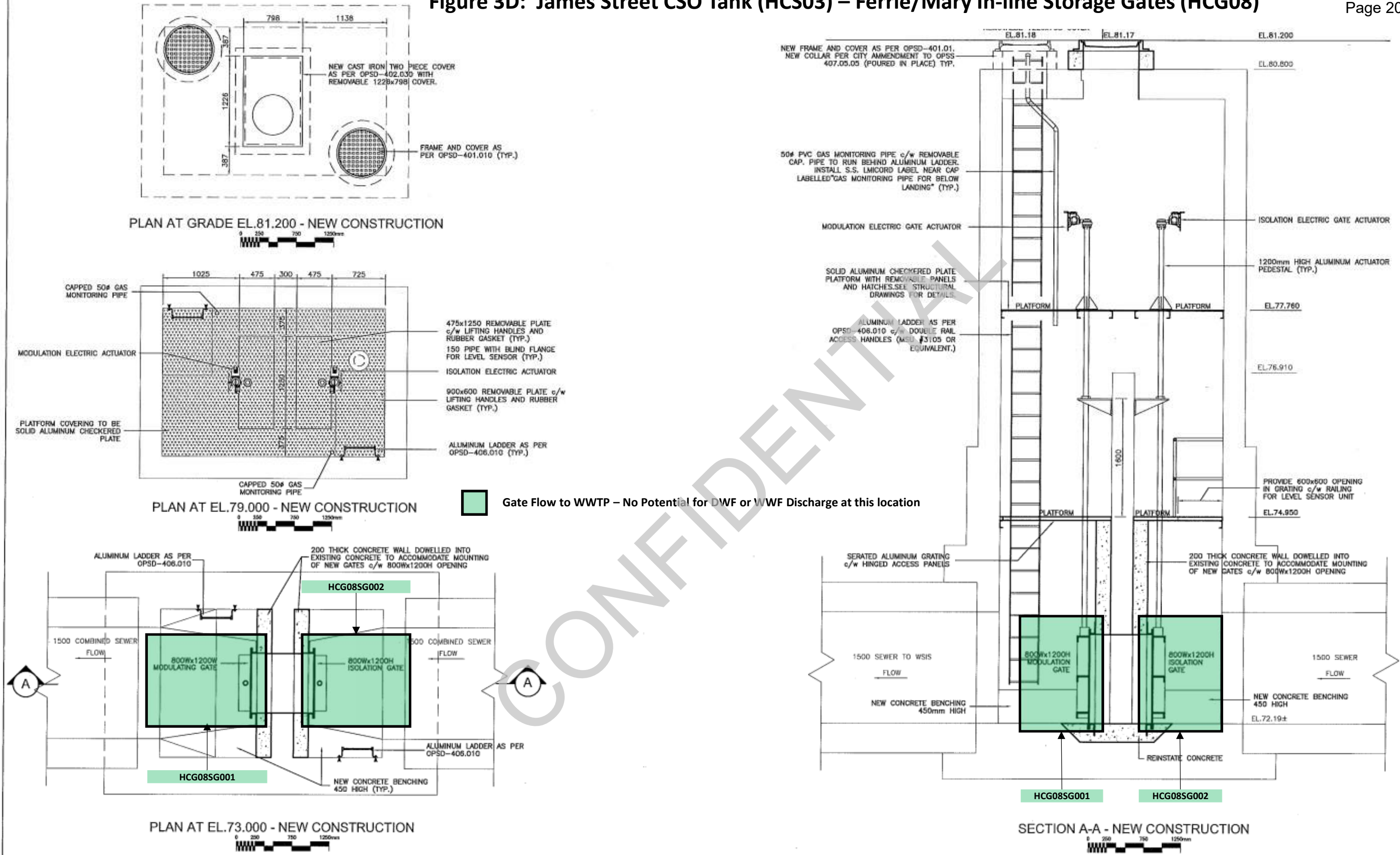
[illegible]

Figure 3D: James Street CSO Tank (HCS03) – Ferrie/Mary In-line Storage Gates (HCG08)



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

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 13# 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
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1505 Laperriere Avenue
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CSO
BPR CSO
5100, Sherbrooke Street East, Suite 900
Montreal, (Quebec), Canada H1V 3P9
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
Scale AS SHOWN
Designed C.G.
Checked J.R.
Drawn E.C.
Project No. 11.05.02
Date

City of Hamilton	Project Name	Dwg. No.
CITY OF HAMILTON Public Works Department	CITY OF HAMILTON RTC IMPLEMENTATION PROJECT MARY/FERRIE (HCG08) REGULATOR SITE	A-C08
Scale AS SHOWN	PLAN AND SECTION SHOWING NEW CONSTRUCTION	Issue 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 m², and is over 8 m deep, providing approximately 77,100 m³ of CSO storage capacity in two separate storage cells. The first cell provides approximately 23,300 m³ of storage, and the second provides a further 53,800 m³ 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.

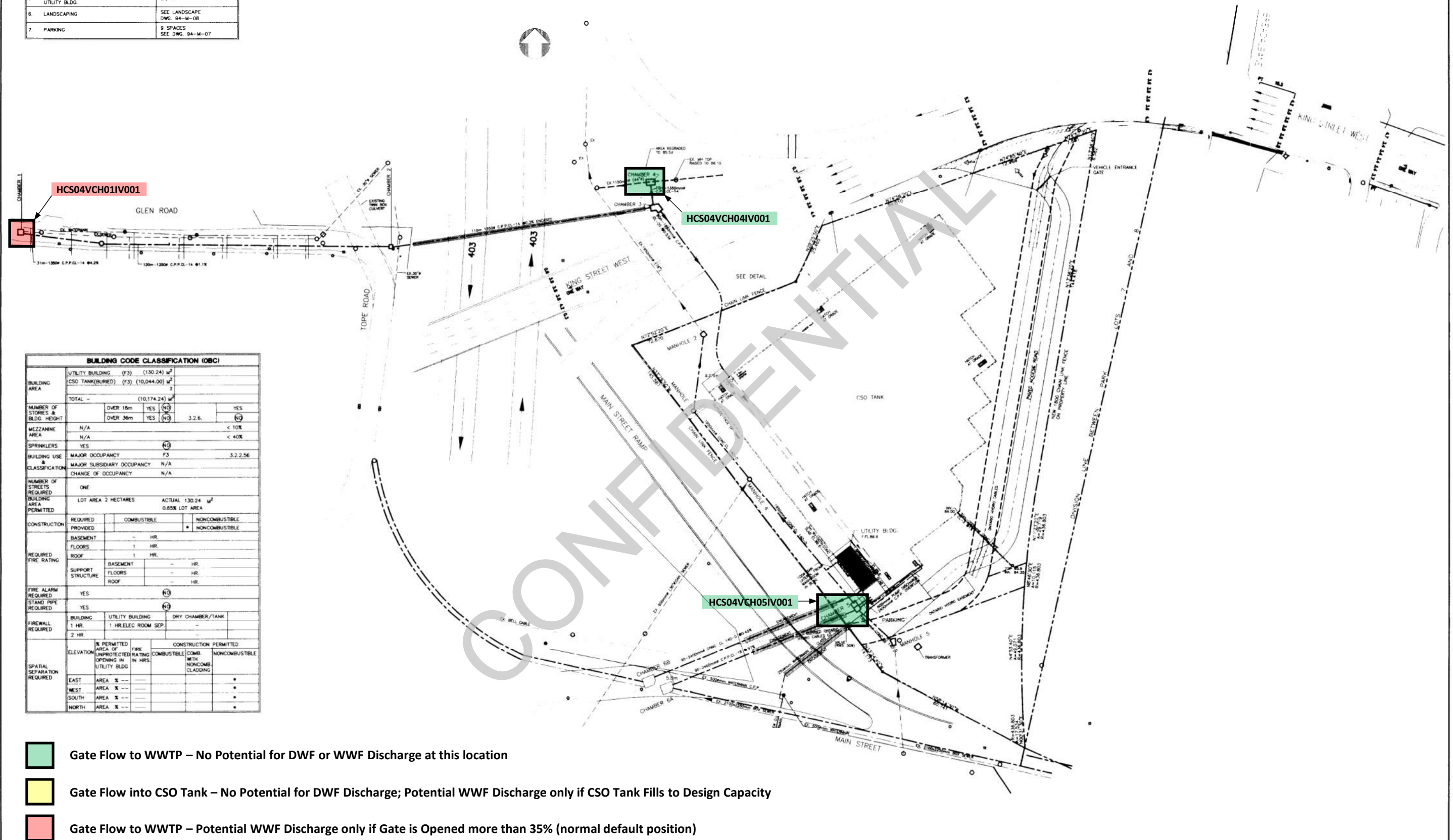
Combined sewage retained in the tank during wet weather is subsequently returned to the Combined Sewer System (CSS) and conveyed by the WSI to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by three (3) 375 L/s submersible pumps located 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.

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 STORES & 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						
				0.85% 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 HRELEC ROOM SEP		-						
	2 HR.									
SPATIAL SEPARATION REQUIRED	ELEVATION	% PERMITTED AREA OF UNPROTECTED OPENING IN BLDG	FIRE RATING IN HRS.	COMBUSTIBLE	COMB. WITH NONCOMB. CLADDING	CONSTRUCTION PERMITTED				
						NONCOMBUSTIBLE				
	EAST	AREA %	--	--			*			
	WEST	AREA %	--	--			*			
	SOUTH	AREA %	--	--			*			
		NORTH	AREA %	--	--			*		




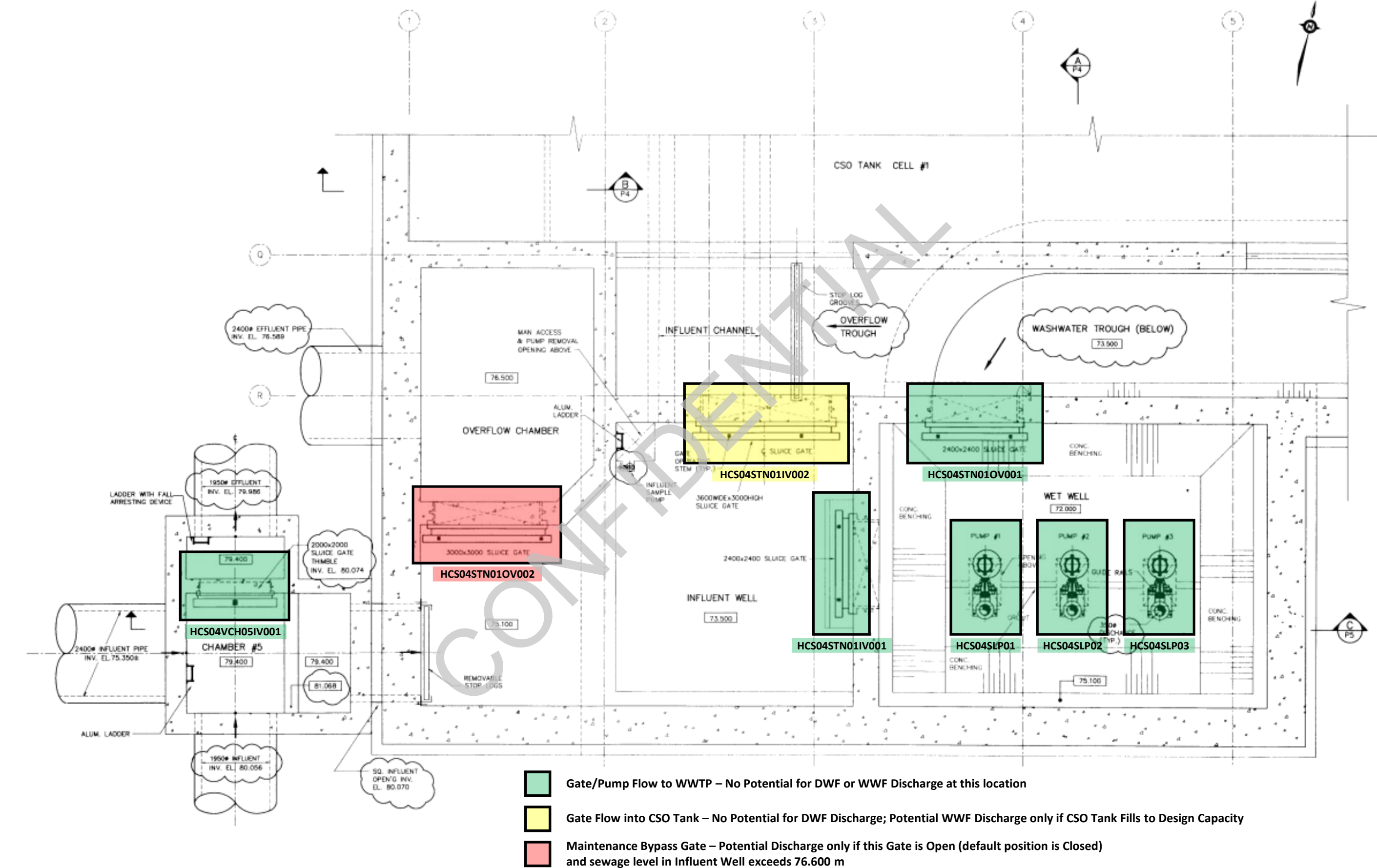
REVISIONS A ISSUED FOR CLIENT REVIEW B ISSUED FOR TENDER C RECORD DRAWING		DETAIL T.R. D.W.	DATE 5/11/94 16/11/94 1997	DRAWN BY: DATE: OCT/94 REFERENCE MATERIAL: X-REF. FILE: -- 3900DTMFASBLT.DWG PLOT 1= 75	SCALE 1:750	 R.V. Anderson Associates Limited civil engineering and architecture	DIRECTOR	COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP	MAIN/KING CSO TANK MAIN (10-A) SITE PLAN
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Figure 4B: Main/King CSO Tank (HCS04) - Influent Wet Well, Control Gates and Pumps




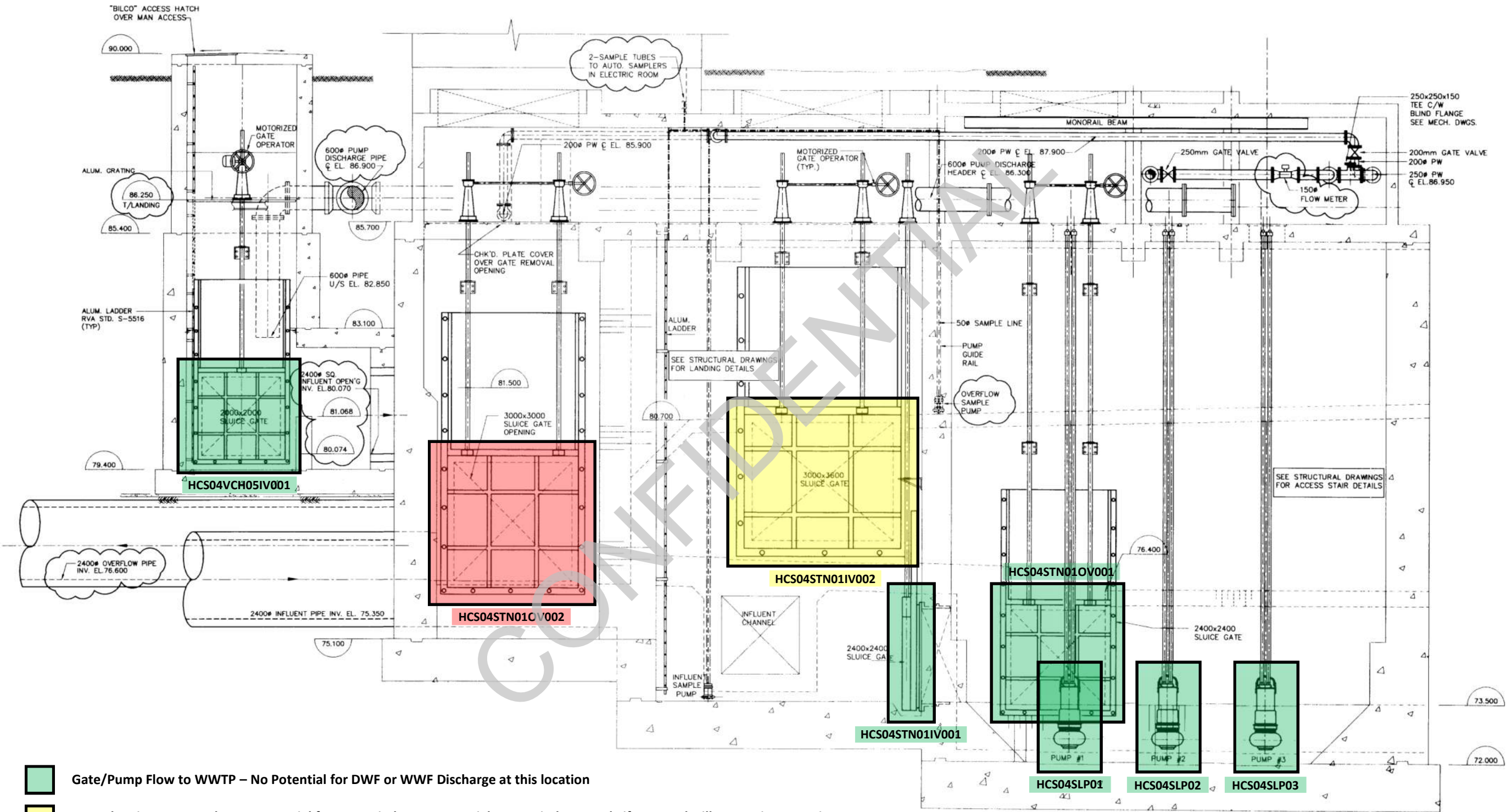
REVISIONS		INITIAL	DATE	DRAWN BY:	DATE:	SCALE	 R.V. Anderson Associates Limited consulting engineers and architects	DIRECTOR	COMMISSIONER OF TRANSPORTATION AND ENVIRONMENTAL SERVICES	THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH TRANSPORTATION AND ENVIRONMENTAL SERVICES GROUP	MAIN/KING CSO TANK										
A	ISSUED FOR CLIENT REVIEW	T.R.	8/11/94	REFERENCE MATERIAL:		1:50					PROCESS										
B	ISSUED FOR TENDER	T.R.	10/11/94								PUMP GALLERY										
C	RECORD DRAWING	OW	1997								WET WELL PLAN										

Figure 4C: Main/King CSO Tank (HCS04) - Influent Wet Well, Control Gates and Pumps



- 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

REVISIONS		INITIAL	DATE	DRAWN BY:	DATE:
A ISSUED FOR CLIENT REVIEW		T.R.	8/11/94	REFERENCE MATERIAL:	OCT. '94
B ISSUED FOR TENDER		T.R.	16/11/94		
C RECORD DRAWING		DW	1997		

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

PUMP GALLERY
SECTIONS (II)

PROCESS

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	<ul style="list-style-type: none">+ 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	<ul style="list-style-type: none">+ 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	<ul style="list-style-type: 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	<ul style="list-style-type: 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	
							<ul style="list-style-type: 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 m², and is over 6 m deep, providing approximately 27,350 m³ of CSO storage capacity in two separate storage cells. The first cell provides approximately 14,700 m³ of storage, and the second provides a further 12,650 m³ 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

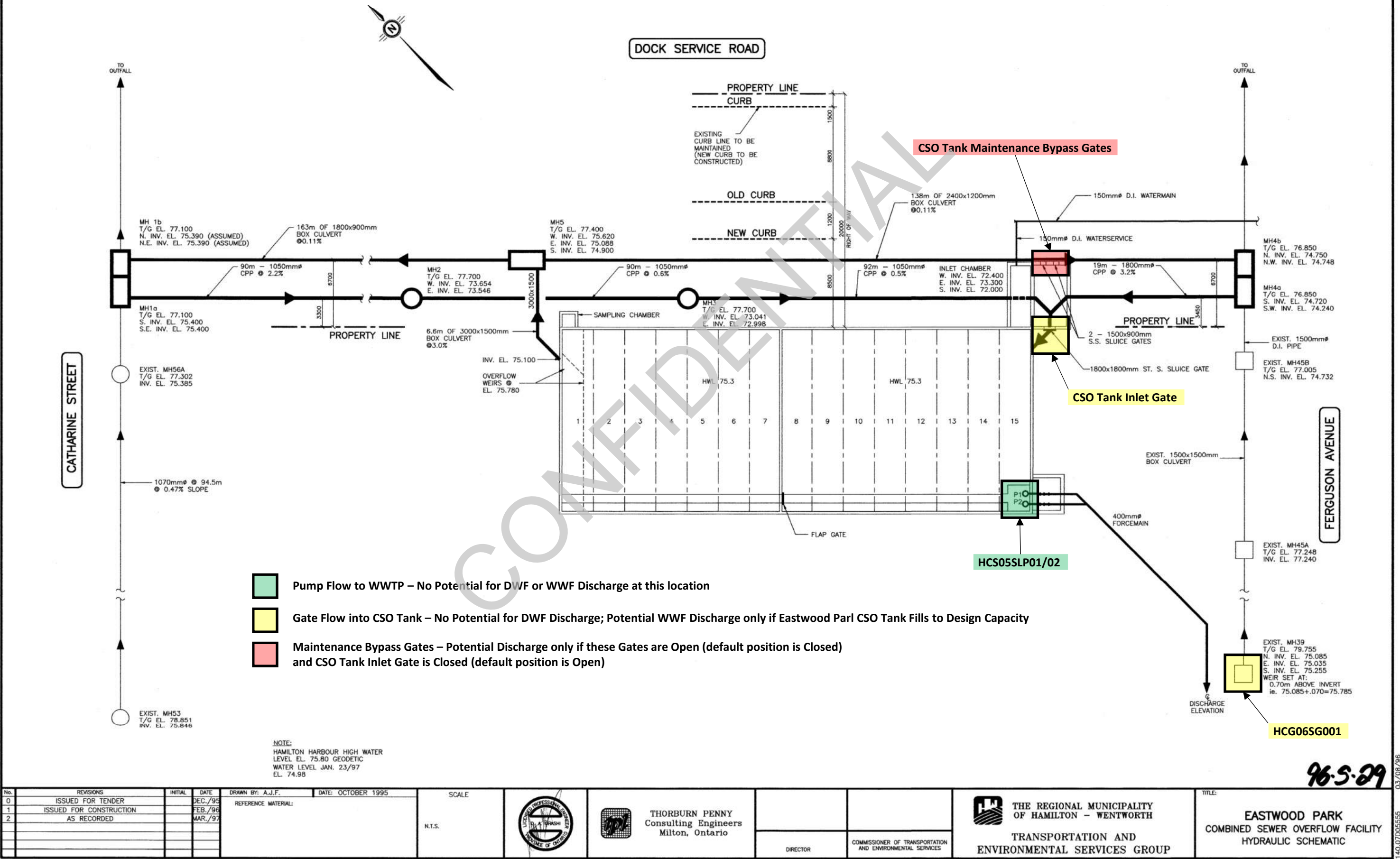
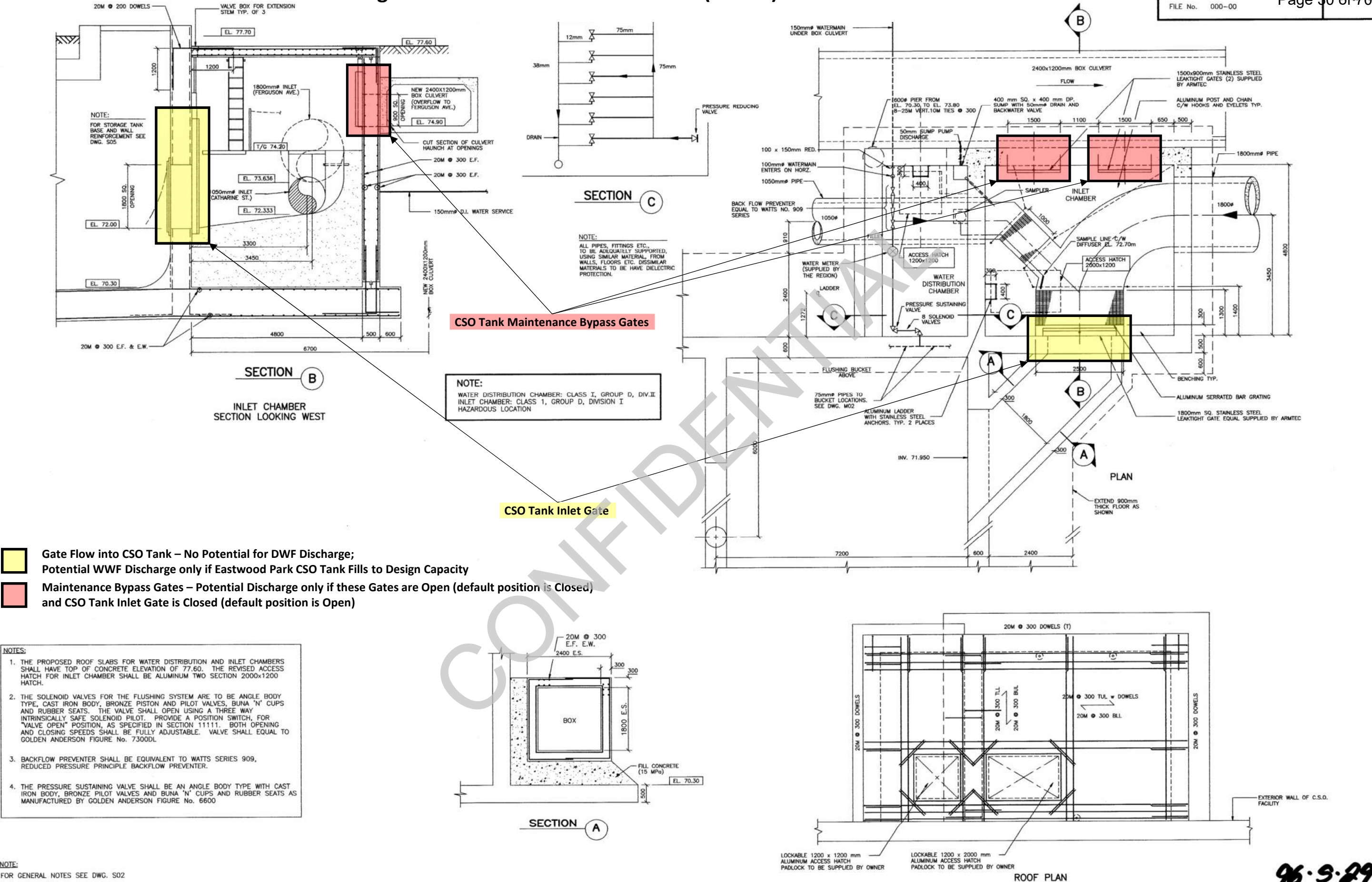
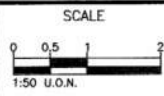


Figure 5B: Eastwood Park CSO Tank (HCS05) – CSO Tank Inlet Chamber



No.	REVISIONS	INITIAL	DATE	DRAWN BY: A.J.F.	DATE: OCTOBER 1995
0	ISSUED FOR TENDER		DEC./95		
1	ISSUED FOR CONSTRUCTION		FEB./96		
2	AS RECORDED		MAR./97		

REFERENCE MATERIAL:



THORBURN PENNY
Consulting Engineers
Milton, Ontario

DIRECTOR

COMMISSIONER OF TRANSPORTATION
AND ENVIRONMENTAL SERVICES

THE REGIONAL MUNICIPALITY
OF HAMILTON - WENTWORTH
TRANSPORTATION AND
ENVIRONMENTAL SERVICES GROUP

TITLE:
**EASTWOOD PARK
COMBINED SEWER OVERFLOW FACILITY
CHAMBER SECTIONS & DETAILS**

96.9.29

140.07005567 03/08/96

Figure 5C: Eastwood Park CSO Tank (HCS05) – Burlington/Ferguson Gate (HCG06)

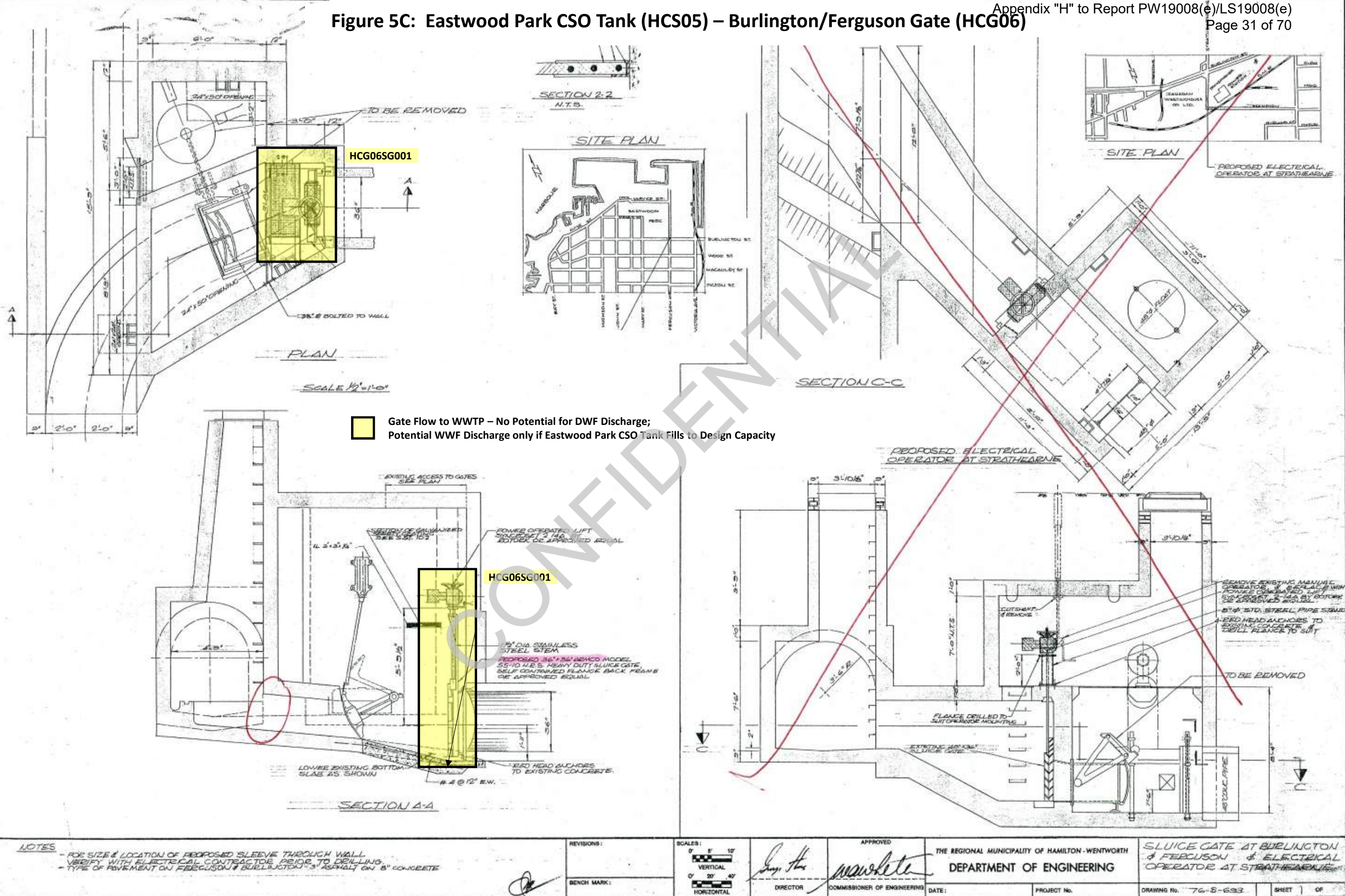
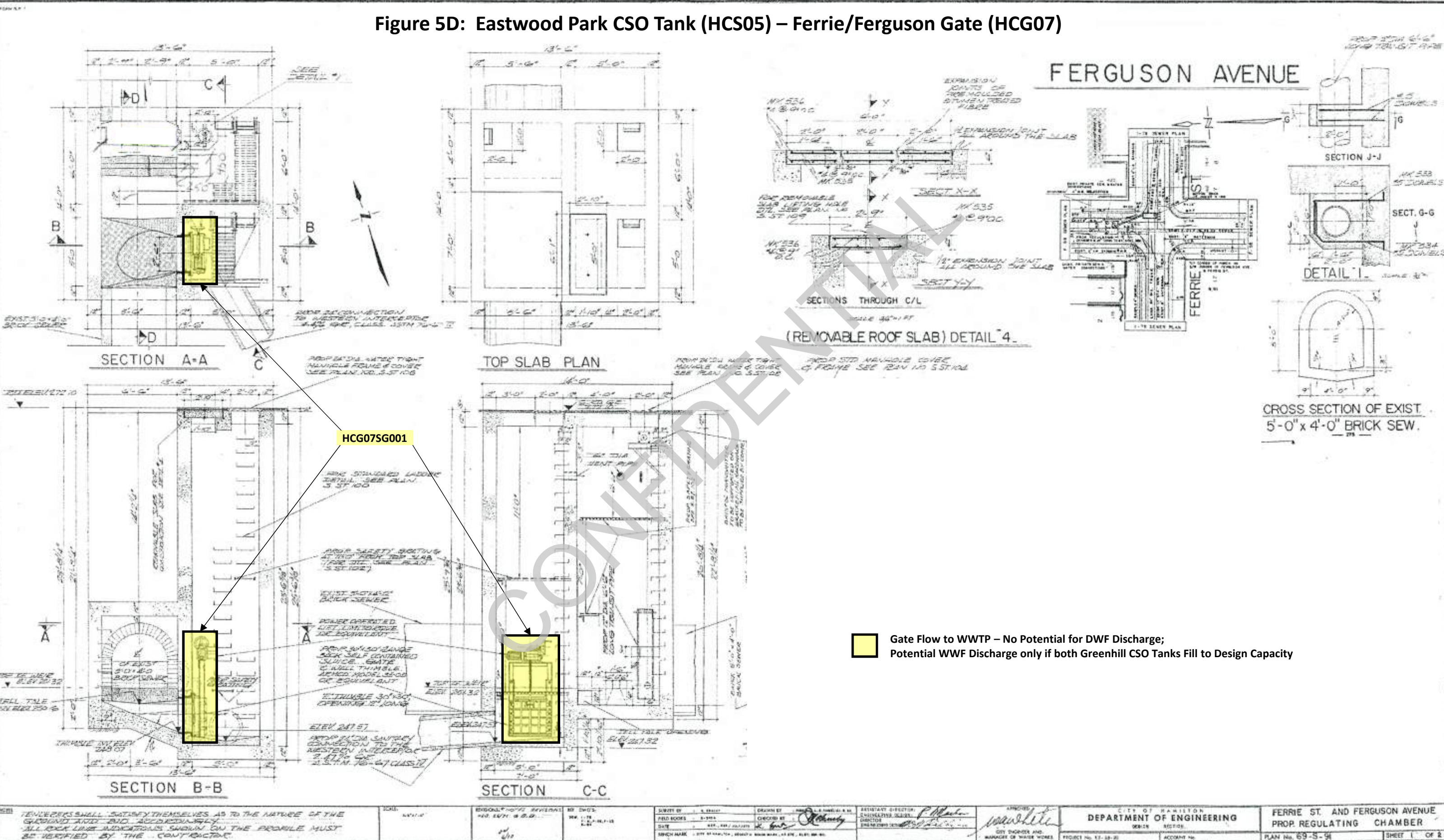


Figure 5D: Eastwood Park CSO Tank (HCS05) – Ferrie/Ferguson Gate (HCG07)



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

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	<div><div></div>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</div> <div><div></div>Evaluate options to physically lock the gate in Fully Open position</div>

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 m², and is 7.5 to 8.3 m deep, providing approximately 66,750 m³ 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 m³.

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.

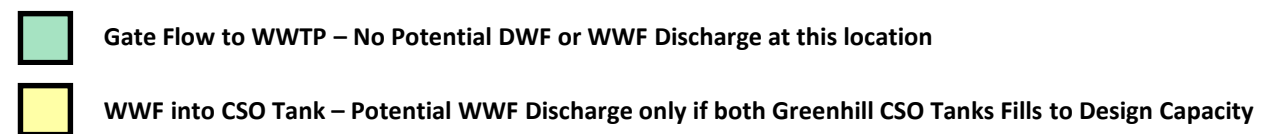
The facility includes a bypass chamber between HCS06 and HCS01 that can be used to isolate HCS01 for maintenance purposes. To operate this bypass, the manual stop gate in the chamber has to be physically removed from its default position and inserted in the alternate position across the overflow channel from HCS06 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.

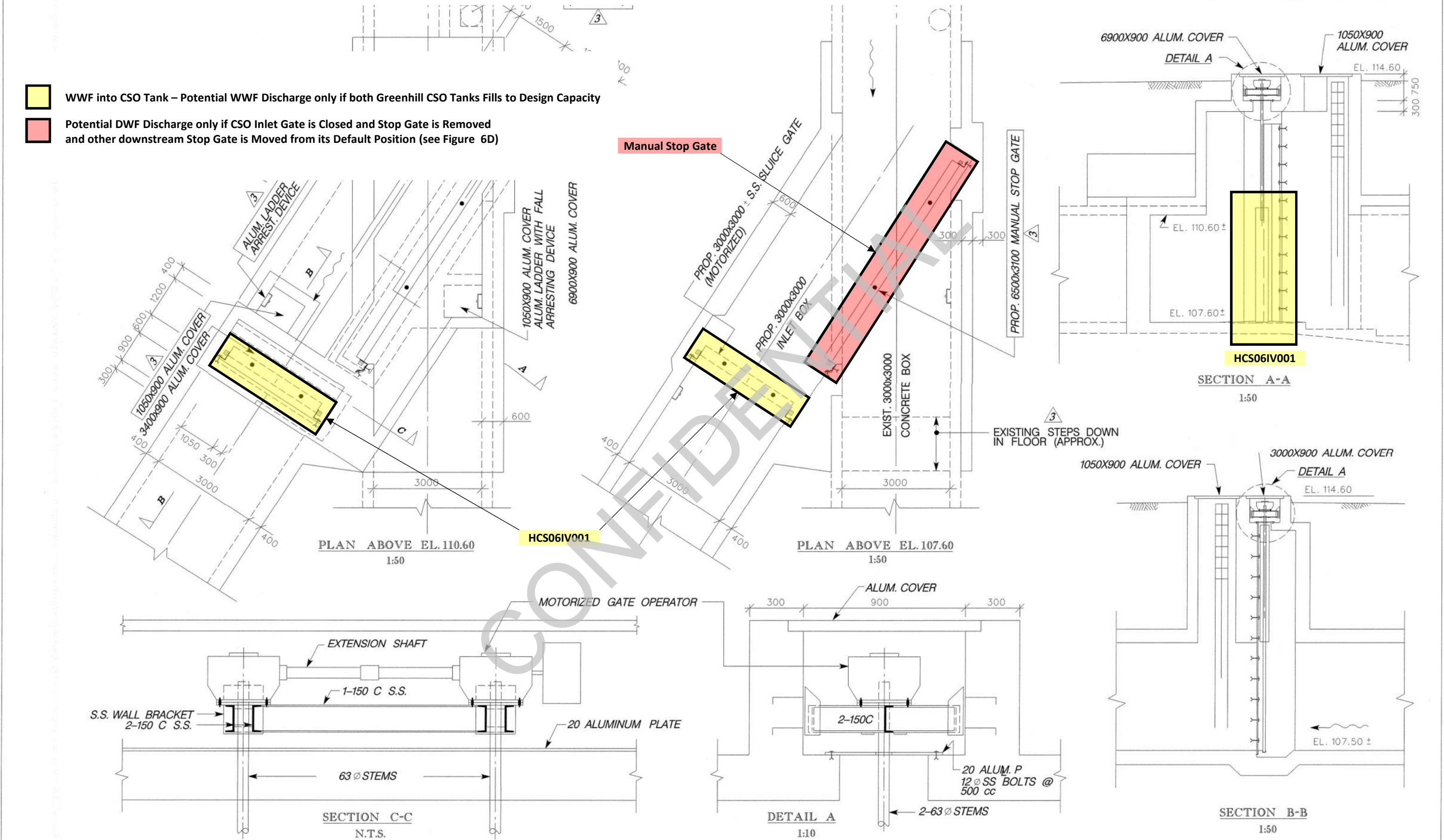
Table 6 provides an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.



GREENHILL CSO TANK SITE PLAN- PROPOSED UNDERGROUND WORK

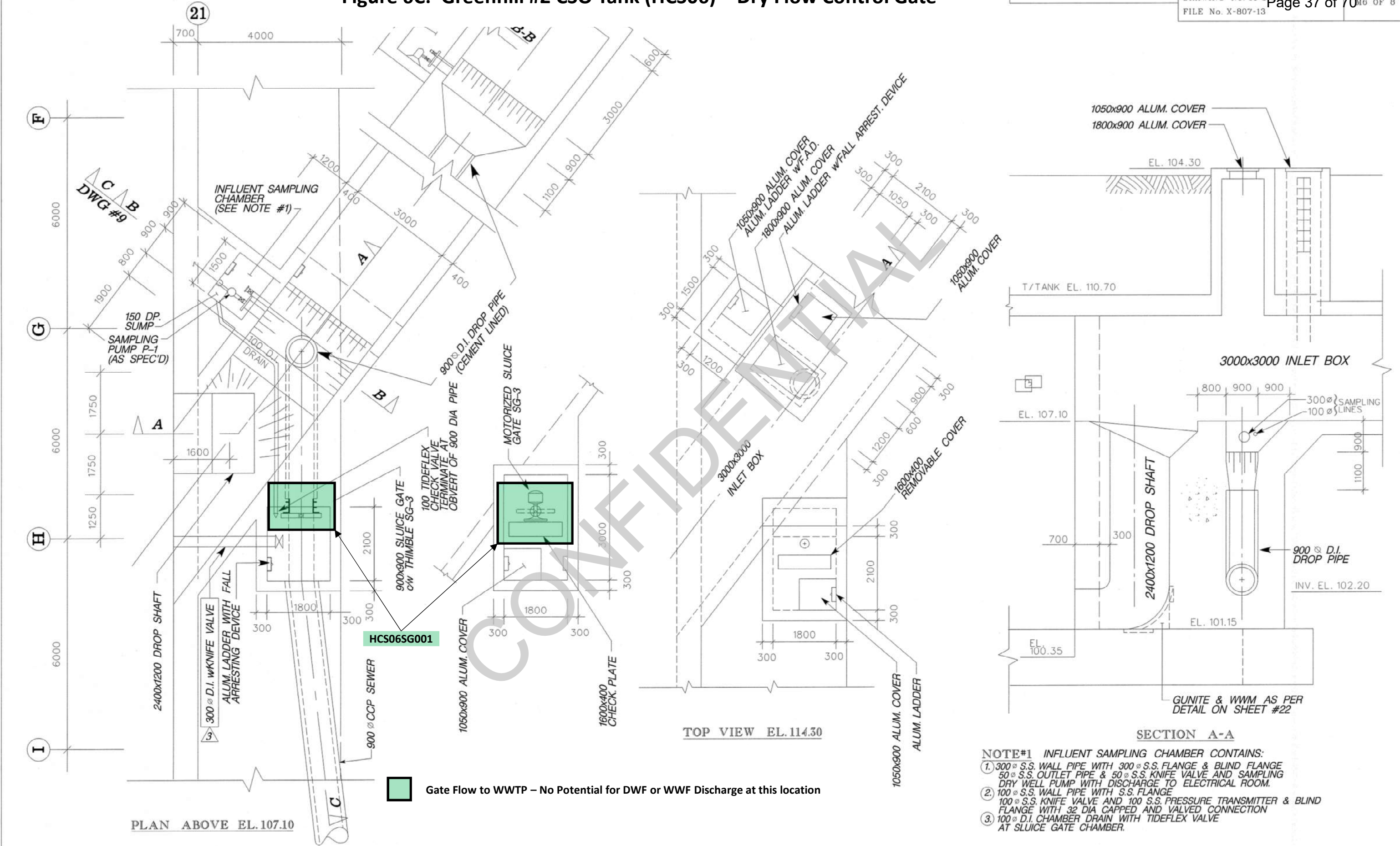
Figure 6B: Greenhill #2 CSO Tank (HCS06) – CSO Inlet Gate

- 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	DRAWN BY: RCP	DATE: JANUARY 22, 2002	SCALES	AS SHOWN	Director, Design and Construction	City of HAMILTON Transportation, Operations and Environment Department	INLET CHAMBER WITH MOTORIZED SLUICE GATES
1	ISSUED FOR APPROVALS	GNB	6/02/02	REFERENCE MATERIAL:				Doug Onishi, P. Eng.		
2	ISSUED FOR TENDER	GNB	5/03/02	Road Plans:				Manager of Design		
3	AS CONSTRUCTED	JH	10/24/03	Sewer Plans:				Gary Moore, P. Eng.		
				Water Plans:						

Figure 6C: Greenhill #2 CSO Tank (HCS06) – Dry Flow Control Gate



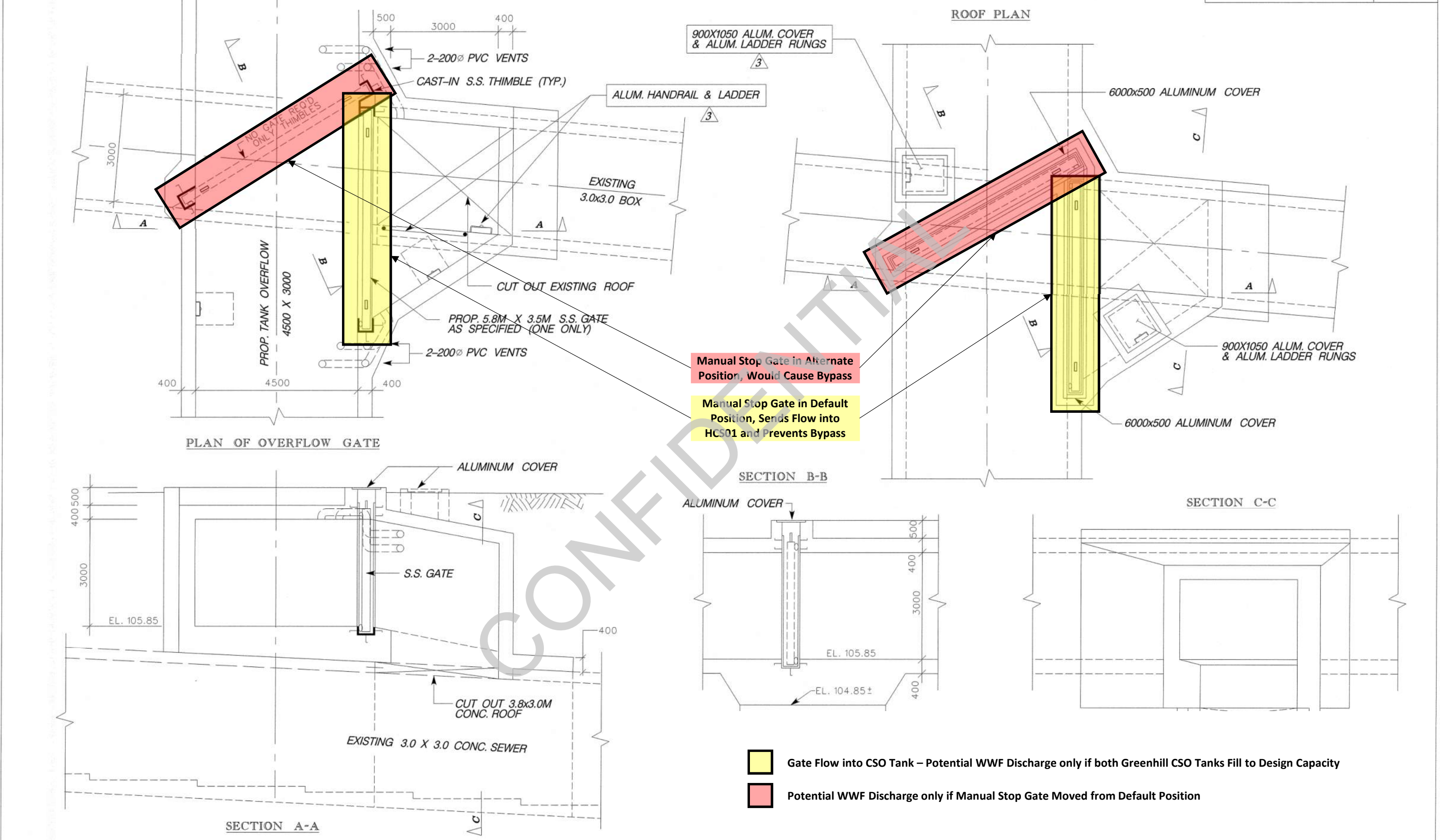
No.	REVISIONS	INITIAL	DATE	DRAWN BY: RCP/AP	DATE: FEBRUARY 22, 2002
1	ISSUED FOR APPROVALS	GMB	6/02/02	REFERENCE MATERIAL:	
2	ISSUED FOR TENDER	GMB	5/03/02	Road Plans:	
3	AS CONSTRUCTED	JH	10/24/03	Sewer Plans:	
				Water Plans:	
				Regional Surveyor:	
				Geodetic Bench Mark Index No.	
				Elevation:	

SCALES	Director, Design and Construction
1:50	Doug Onishi, P. Eng.
	Manager of Design
	Gary Moore, P. Eng.

City of HAMILTON
Transportation, Operations and Environment Department

DRY FLOW CONTROL GATE and INFLUENT SAMPLING CHAMBER

Figure 6D: Greenhill #2 CSO Tank (HCS06) – Overflow Gate and Chamber



No.	REVISIONS	INITIAL	DATE	DRAWN BY:RCP	DATE:JANUARY 22, 2002
1	ISSUED FOR APPROVALS	GNB	6/02/02	REFERENCE MATERIAL:	
2	ISSUED FOR TENDER	GNB	5/03/02	Road Plans :	
3	AS CONSTRUCTED	JH	10/24/03	Sewer Plans :	
				Water Plans :	
				Regional Surveyor :	
				Geodetic Bench Mark Index No.	
				Elevation:	

SCALES

1:50

Director, Design and Construction

Doug Onishi, P. Eng.

Manager of Design

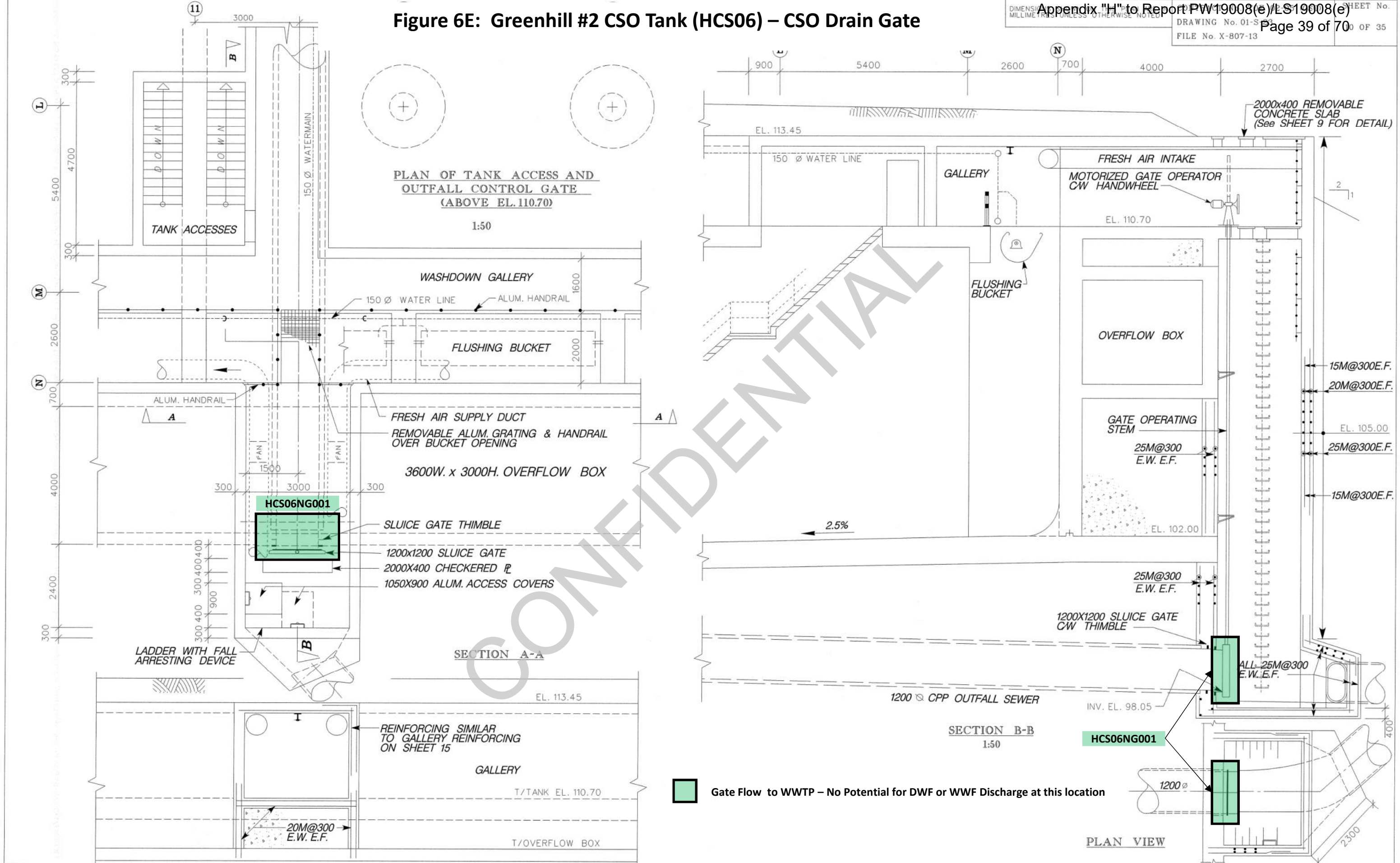
Gary Moore, P. Eng.

CITY OF HAMILTON

Transportation, Operations and Environment Department

PROPOSED OVERFLOW GATE SECTIONS

Figure 6E: Greenhill #2 CSO Tank (HCS06) – CSO Drain Gate



No.	REVISIONS	INITIAL	DATE	DRAWN BY: RCP	DATE: JANUARY 22, 2002	SCALES	Director, Design and Construction	City of HAMILTON Transportation, Operations and Environment Department	OUTLET GATE CHAMBER
1	ISSUED FOR APPROVALS	GMB	6/02/02	REFERENCE MATERIAL:		AS SHOWN	Doug Onishi, P. Eng.		
2	ISSUED FOR TENDER	GMB	5/03/02	Road Plans:			Manager of Design		
3	AS CONSTRUCTED	JH	10/24/03	Sewer Plans:			Gary Moore, P. Eng.		
				Water Plans:					
				Regional Surveyor:					
				Geodetic Bench Mark Index No.					
				Elevation:					

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.	<div><div></div> No significant changes required to PCN or SOP</div> <div><div></div> This gate is padlocked in Fully Open position</div>
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 only if Tank Inlet Gate is Closed and stop gate is removed.	<div><div></div> 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</div>
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.	<div><div></div> No significant changes required to PCN or SOP</div> <div><div></div> 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</div>
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 only if Stop Gate moved to alternate position over HCS01 Tank Inlet.	<div><div></div> 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</div>
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	<div><div></div> No significant changes required to PCN or SOP</div> <div><div></div> 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</div>
							<div><div></div> Establish appropriate inspection program for the facility, including visual inspection and exercising of gates based on their function and criticality of operation.</div>

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.


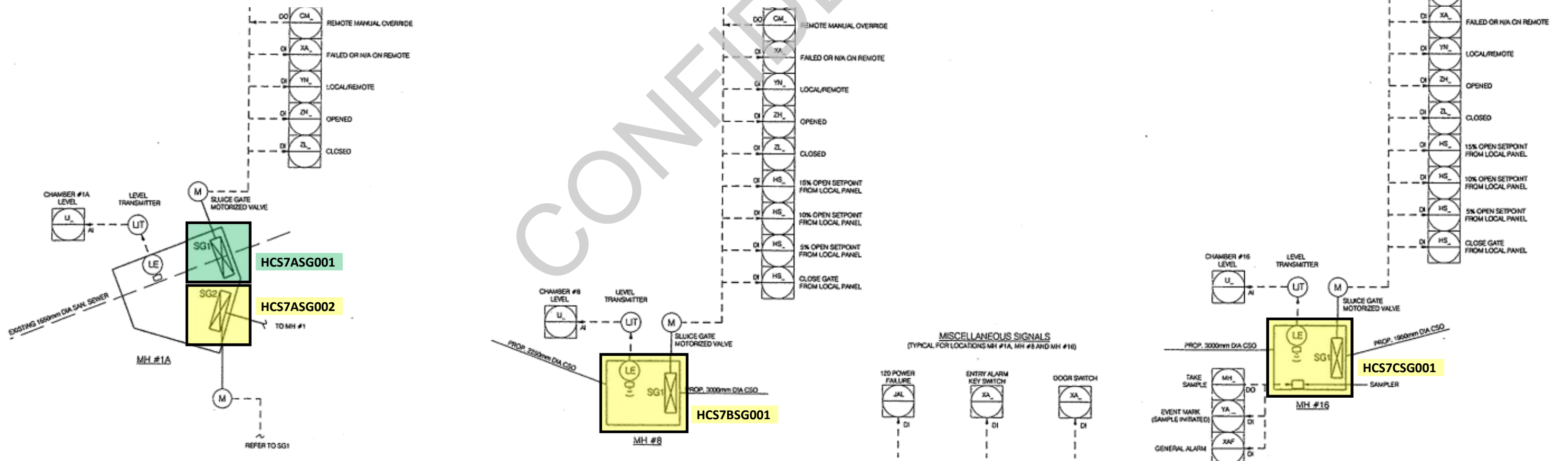
HCS07 comprises three (3) flow control structures: HCS7A at Lawrence Road; HCS7B at Queenston Road; and HCS7C at Barton Street; creating two (2) storage pipe cells providing a total storage volume of approximately 14,200 m³. Cell 1 consists of a 2,250 mm diameter pipe running between HCS7A and HCS7B; 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.



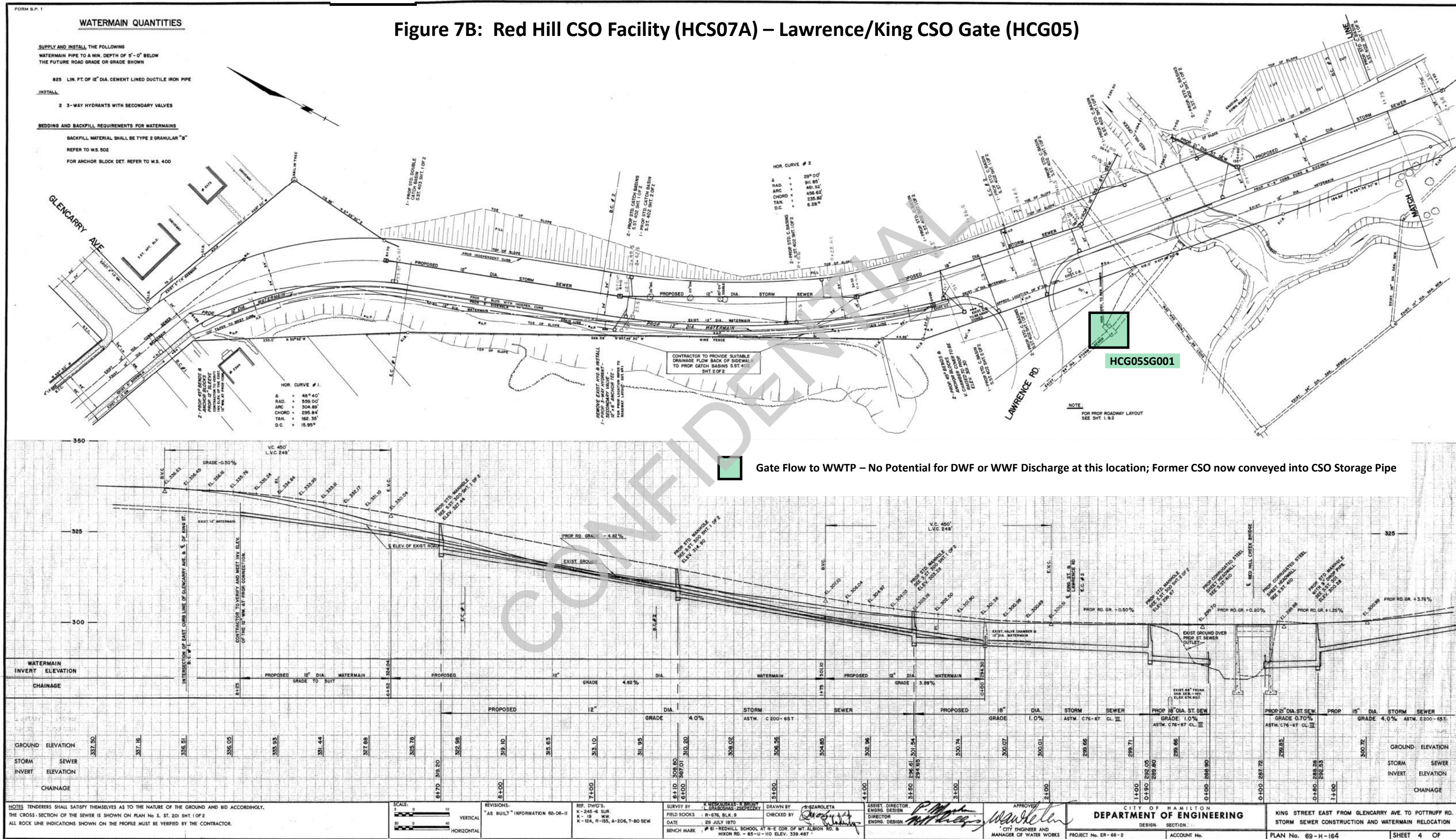
**AWE Engineers &
Planners Corp.**

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STRUCTURAL

**CITY OF
HAMILTON**
Public Works Department

RED HILL VALLEY PROJECT
CSO PIPE FACILITY
PROCESS AND INSTRUMENTATION DIAGRAM

Figure 7B: Red Hill CSO Facility (HCS07A) – Lawrence/King CSO Gate (HCG05)



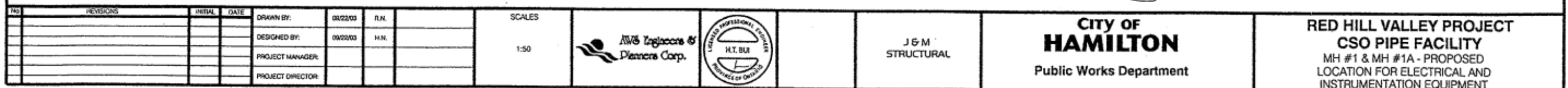
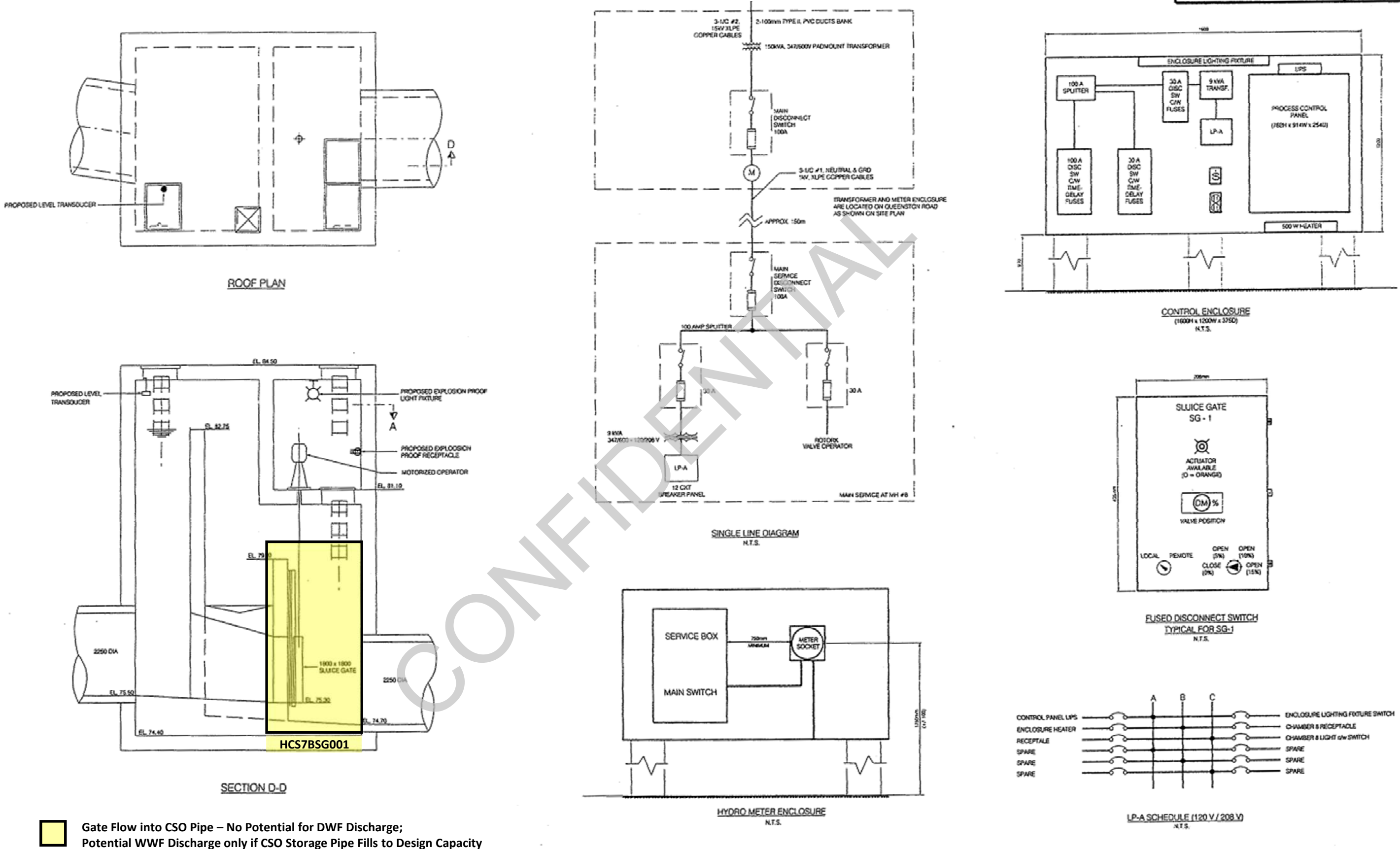


Figure 7D: Red Hill CSO Facility (HCS07B)



Gate Flow into CSO Pipe – No Potential for DWF Discharge;
Potential WWF Discharge only if CSO Storage Pipe Fills to Design Capacity

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	<ul style="list-style-type: 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
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	<ul style="list-style-type: 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
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	<ul style="list-style-type: 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
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	<ul style="list-style-type: 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
							<ul style="list-style-type: none">+ 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 m³ 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.

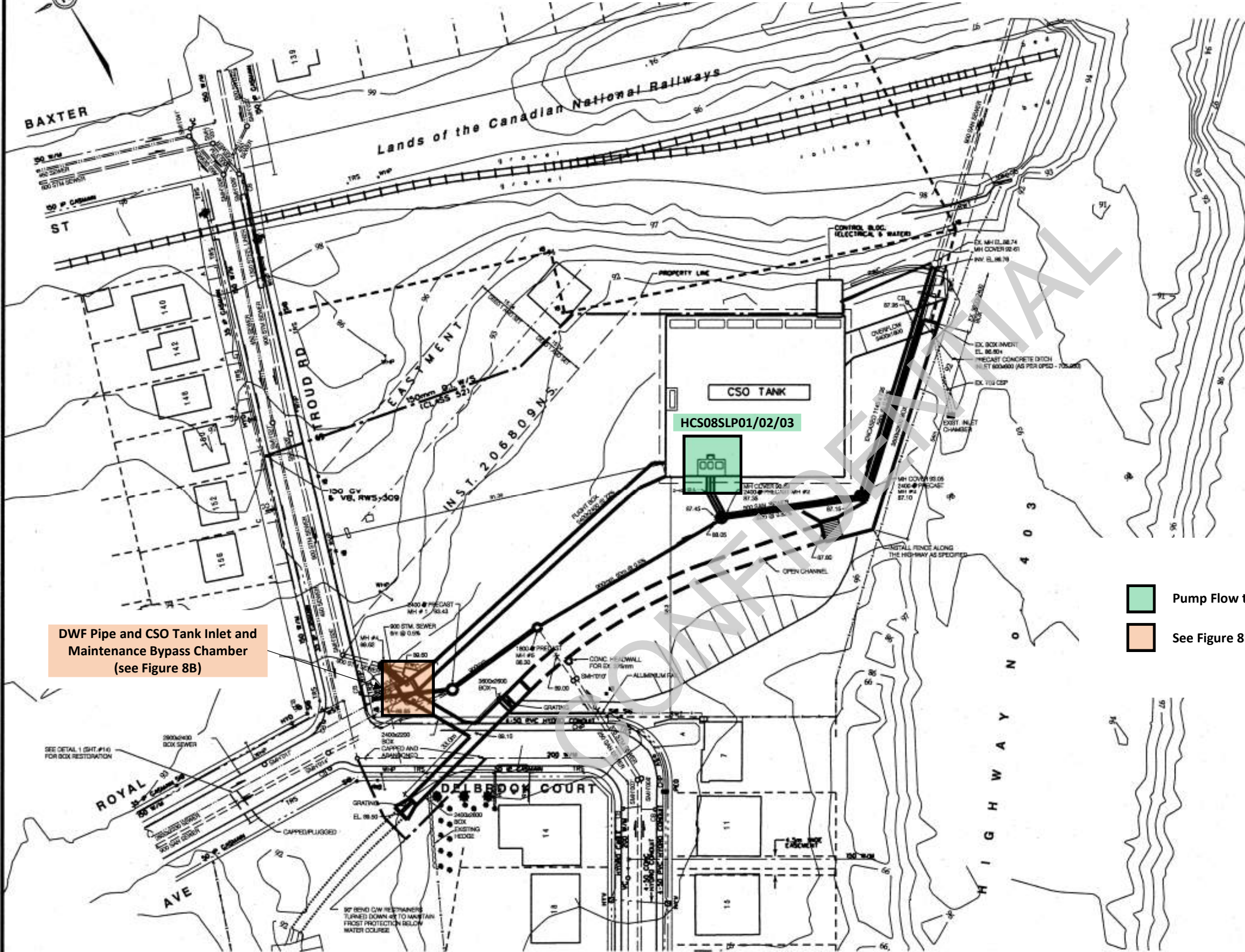
The facility is monitored and controlled via SCADA by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

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.

CONFIDENTIAL

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

DIMENSIONS SHOWN ON THIS PLAN ARE IN MILLIMETERS UNLESS OTHERWISE NOTED	CONTRACT No. PW-05-08 (CSO) DRAWING No. 05-S-13 FILE No. 818-43	SHEET No. 10 OF 20
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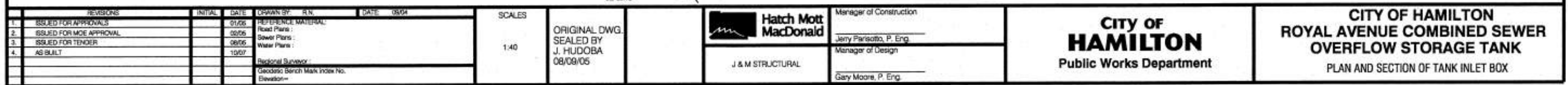
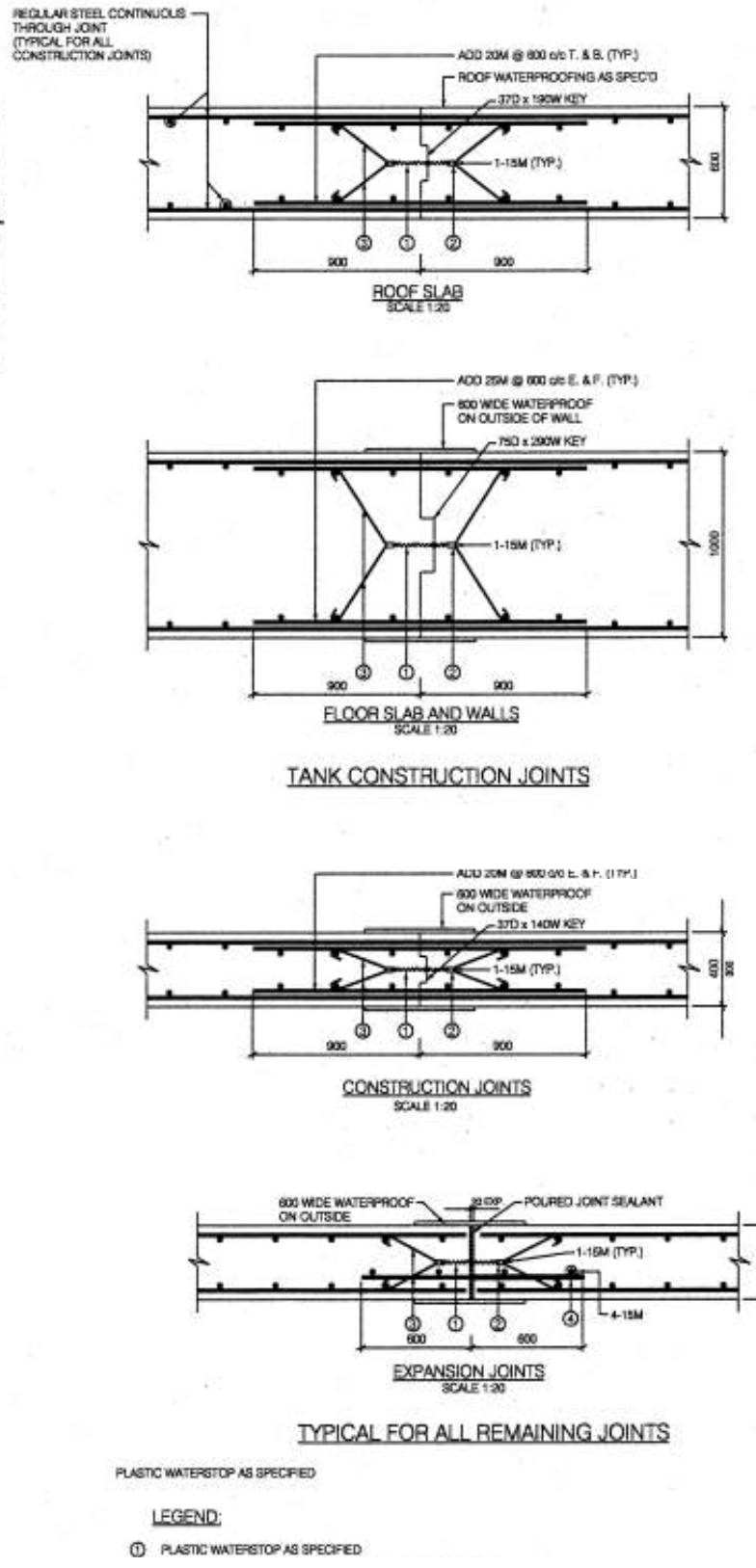
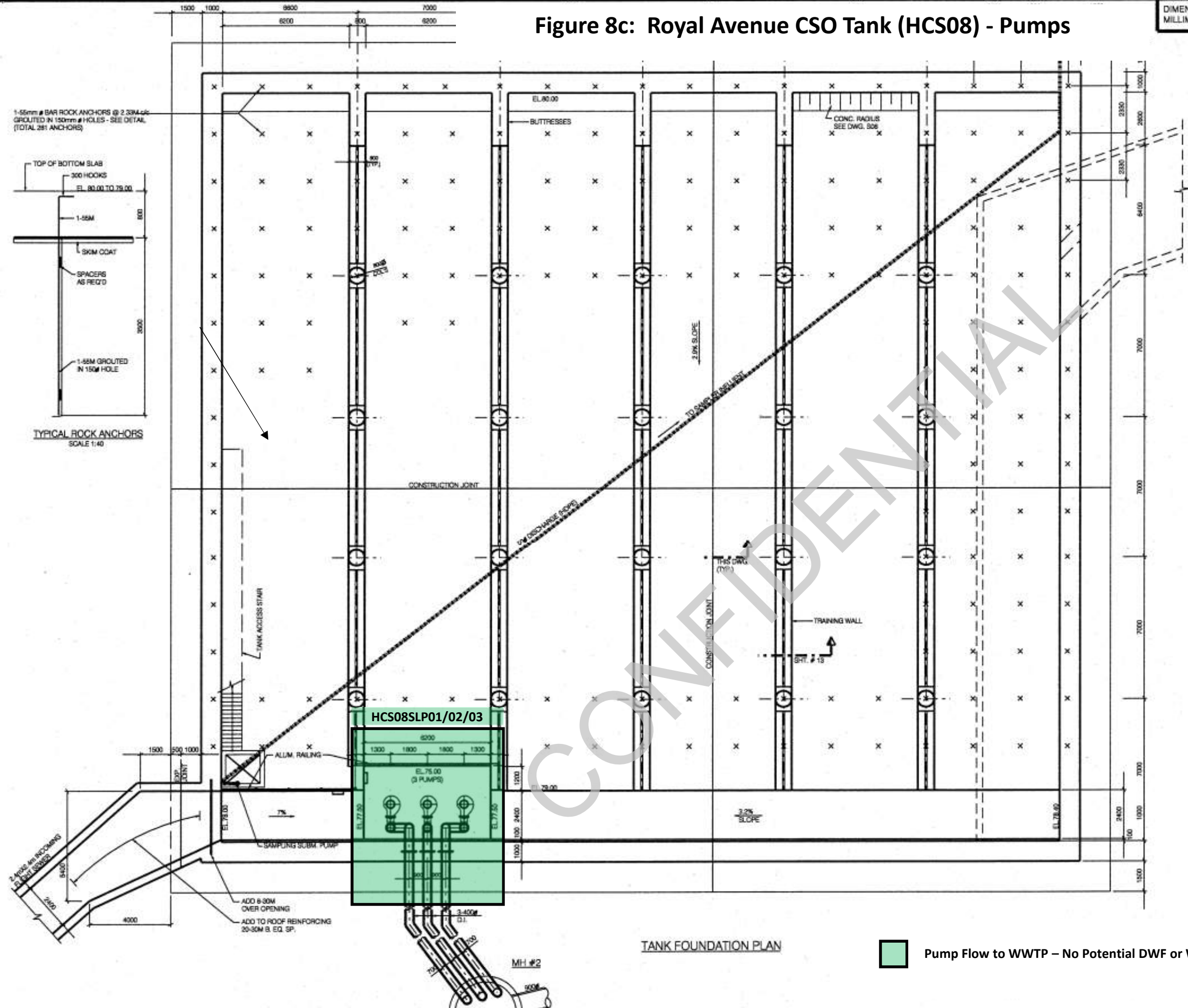


Figure 8c: Royal Avenue CSO Tank (HCS08) - Pumps



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

REVISIONS	INITIAL	DATE	DRAWN BY	R.N.	DATE	04/04
1. ISSUED FOR APPROVALS		01/06				
2. ISSUED FOR MCE APPROVAL		02/06				
3. ISSUED FOR TENDER		06/06				
4. AS BUILT		10/07				

1:100	ORIGINAL DWG. SEALED BY J. HUDOBA 08/09/05	Hatch Mott MacDonald J & M STRUCTURAL	Manager of Construction Jenny Parisotto, P. Eng. Manager of Design Gary Moore, P. Eng.
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CITY OF HAMILTON Public Works Department	CITY OF HAMILTON ROYAL AVENUE COMBINED SEWER OVERFLOW STORAGE TANK TANK FOUNDATION PLAN
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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 m³ 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.

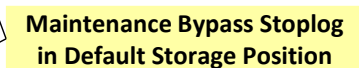
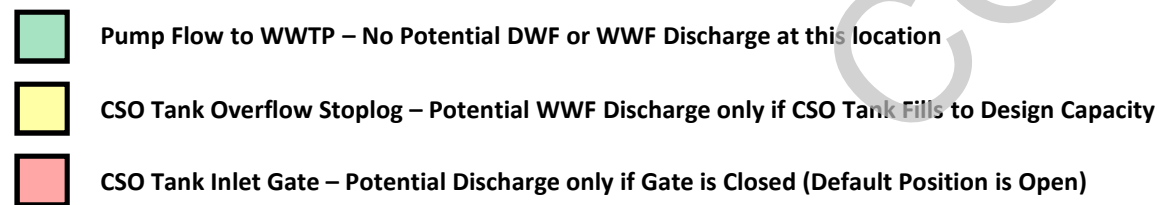
Inside the storage tank, a stainless-steel underflow baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the CSO storage tank, so they can be subsequently pumped from the tank and conveyed to the WWTP for treatment. A 2,400 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.

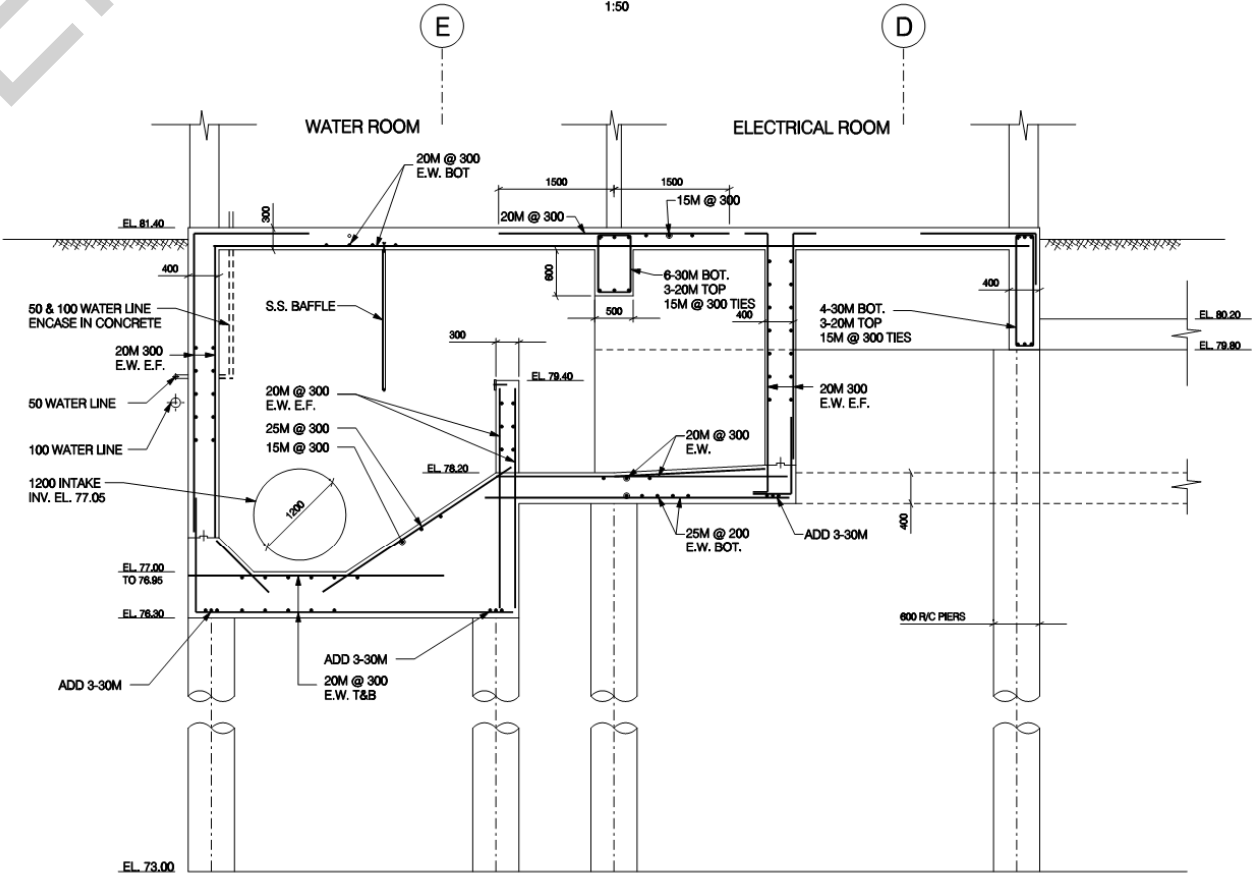
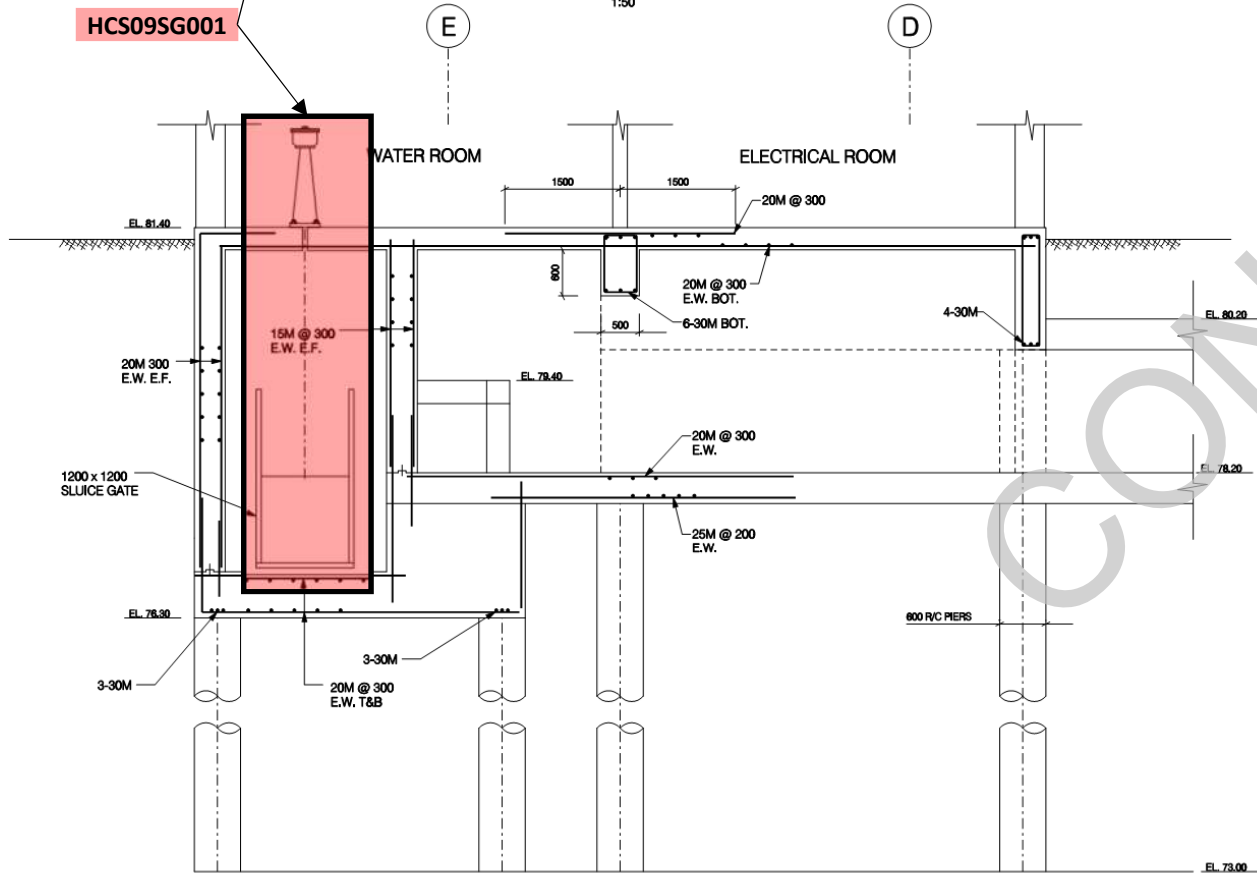
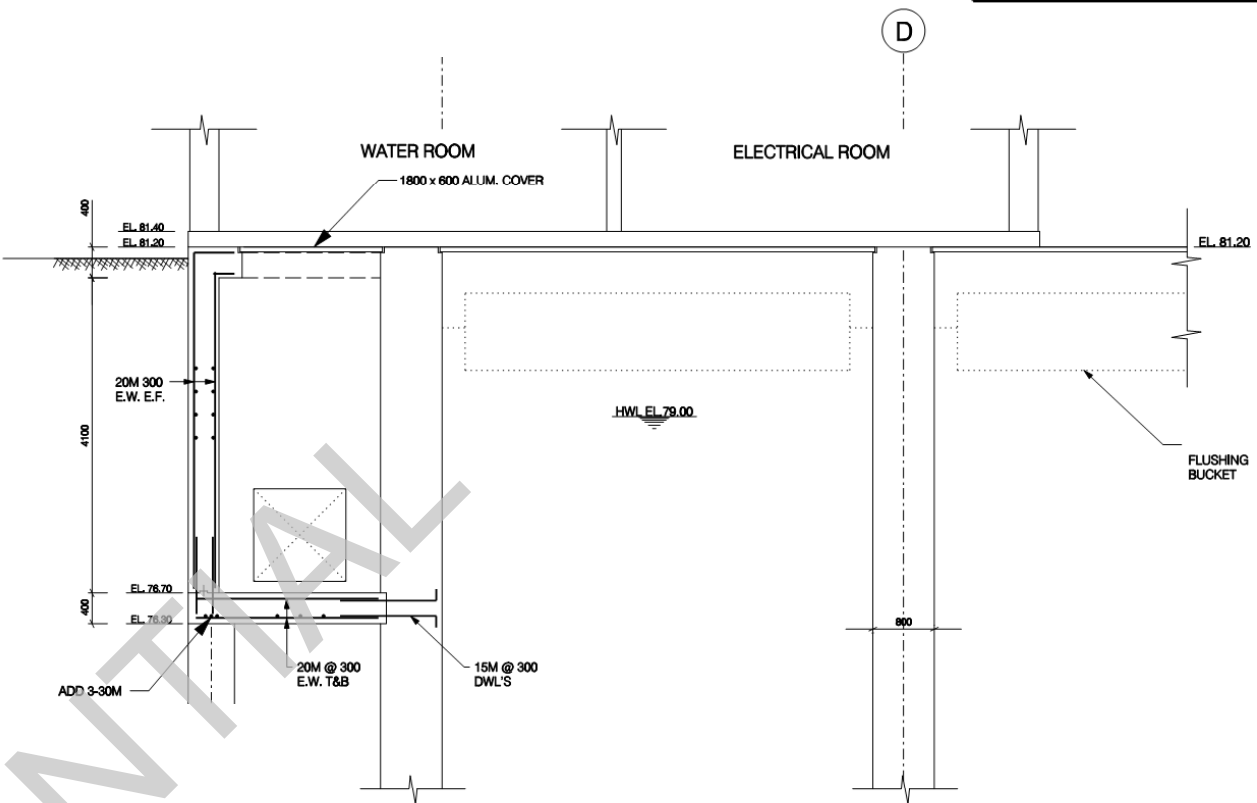
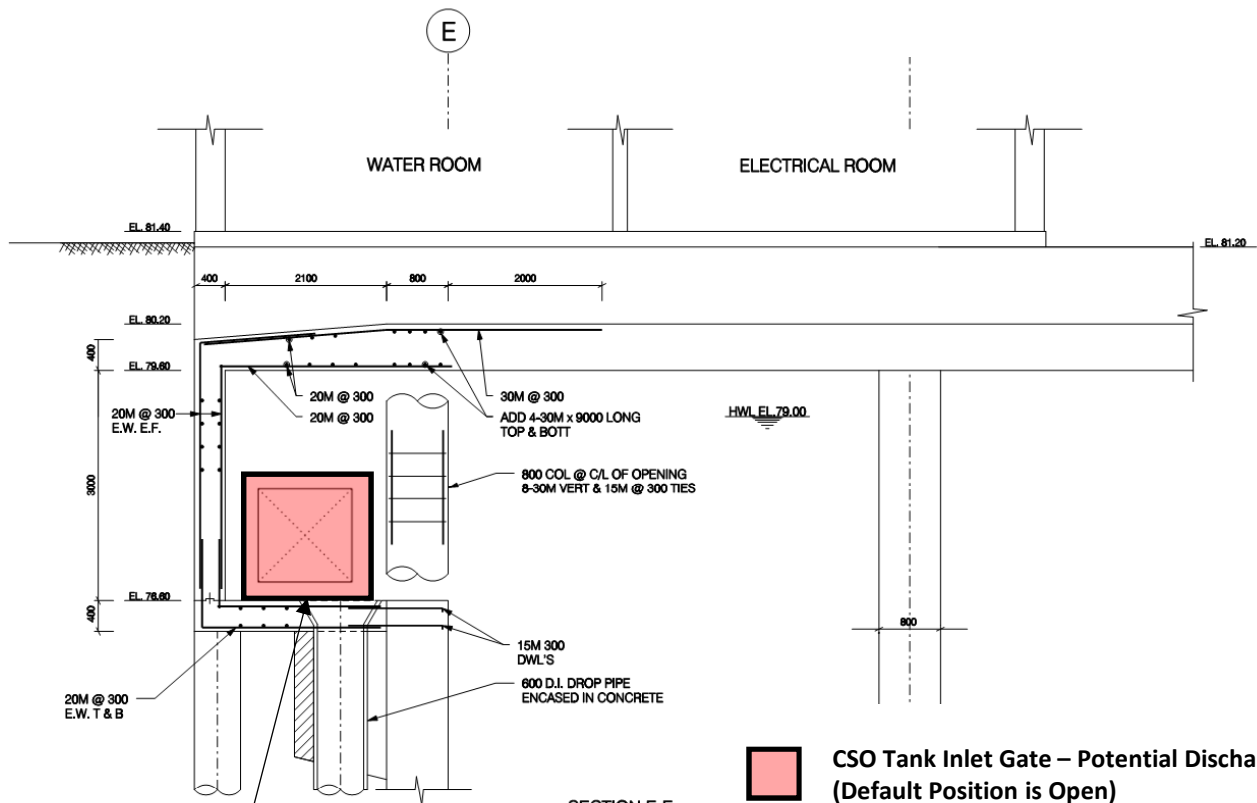
Figures 9A and 9B show the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded as described previously.

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.



REVISIONS		INITIAL	DATE	DRAWN BY: A.J.F.	DATE: 10/07	SCALES 1:100	ORIGINAL DRAWING SEALED BY L. HUDOBA FEBRUARY 2009	 Hatch Mott MacDonald	Manager of Construction	 City of HAMILTON Public Works Department	CITY OF HAMILTON McMASTER COMBINED SEWER OVERFLOW STORAGE TANK TANK LAYOUT PLAN
0.	ISSUED FOR TENDER	A.J.F.	12/08	REFERENCE MATERIAL:					Jerry Parisotto, P. Eng.		
1.	ISSUED FOR CONSTRUCTION	A.J.F.	02/09	Road Plans :					Manager of Design		
2.	AS CONSTRUCTED	A.J.F.	09/10	Sewer Plans :					J & M STRUCTURAL		
				Water Plans :					Susan Jacob, P. Eng.		
				Regional Surveyor :							
				Geodetic Bench Mark Index No.							
				Elevation=							

Figure 9B: McMaster CSO Tank (HCS09) – CSO Tank Inlet Gate



REVISIONS		INITIAL	DATE	DRAWN BY: A.J.F.	DATE: 10/07	SCALES	ORIGINAL DRAWING SEALED BY J. HUDOBA FEBRUARY 2009	 Hatch Mott MacDonald	Manager of Construction	 CITY OF HAMILTON Public Works Department	CITY OF HAMILTON McMASTER COMBINED SEWER OVERFLOW STORAGE TANK TANK INFLOW AND TANK BY-PASS SECTIONS		
0.	ISSUED FOR TENDER	A.J.F.	12/08	REFERENCE MATERIAL:					1:50			J & M STRUCTURAL	Jerry Parisotto, P. Eng.
1.	ISSUED FOR CONSTRUCTION	A.J.F.	02/09	Road Plans :									Manager of Design
2.	AS CONSTRUCTED	A.J.F.	09/10	Sewer Plans :									Susan Jacob, P. Eng.
				Water Plans :									
				Regional Surveyor :									
				Geodetic Bench Mark Index No.									
				Elevation ==									

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.	<div><div></div><div>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</div><div></div><div>This gate should be Fully Open at all times, and is currently padlocked in this position</div></div>
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.	<div><div></div><div>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</div></div>
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	<div><div></div><div>No significant changes required to PCN or SOP</div></div>
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	<div><div></div><div>No significant changes required to PCN or SOP</div></div>
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	<div><div></div><div>No significant changes required to PCN or SOP</div></div>
							<div><div></div><div>Establish appropriate inspection program for the facility, including visual inspection of manual Stop Log to confirm correct position</div></div>

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.

[illegible]

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.	<div><div></div><div><div></div><div>No significant changes required to PCN or SOP</div><div>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</div></div></div>
							<div><div></div><div><div></div><div>Establish appropriate inspection program for the facility, including visual inspection and exercising of gate based on its function and criticality of operation</div><div>Note that this gate should not be fully closed during exercising, as this could cause DWF discharge</div></div></div>

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.

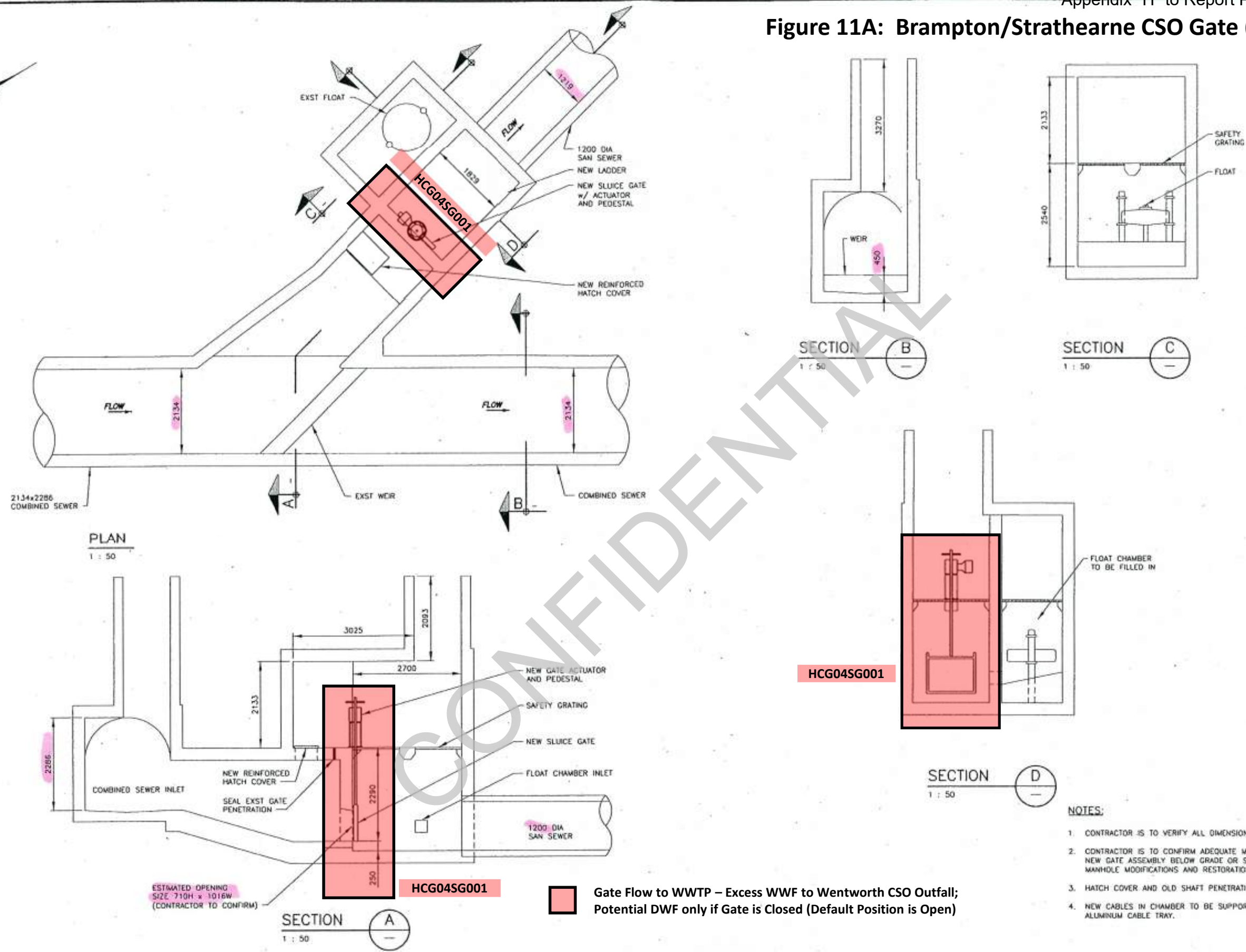
The gate can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP, to maximize flow to the WWTP.

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)



- 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



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

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.	<div><div></div><div>No significant changes required to PCN or SOP</div><div></div><div>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</div></div>
							<div><div></div><div>Establish appropriate inspection program for the facility, including visual inspection and exercising of gate based on its function and criticality of operation</div><div></div><div>Note that this gate should not be fully closed during exercising, as this could cause DWF discharge</div></div>

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.

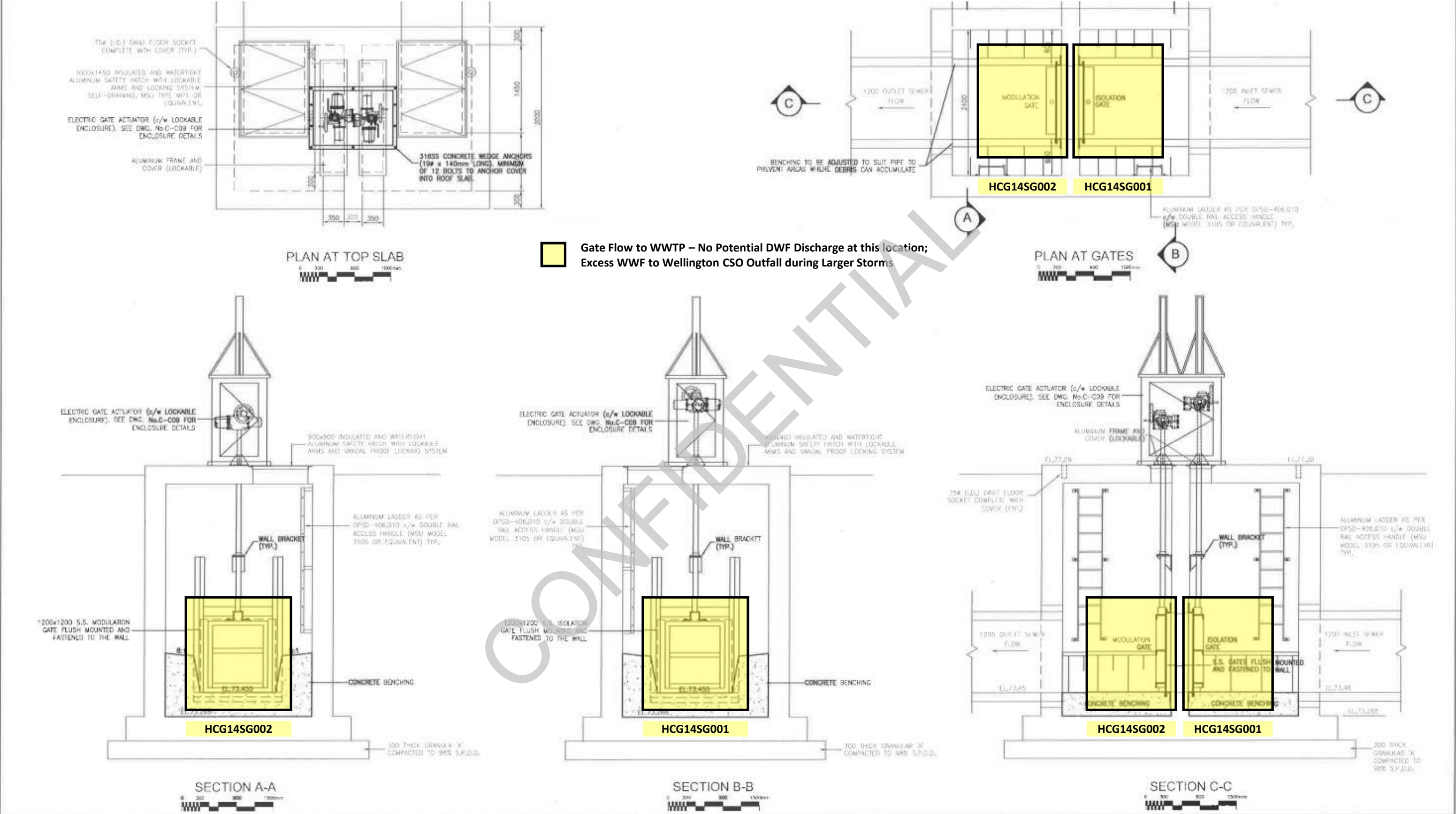
The gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Auto, with operation directed by the RTC system, to maximize flow to the WWTP.

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 13# 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 SOX DESIGN	C.G.	11.08.13
3	ISSUED FOR SOX 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 S+10	J.R.	12.06.04
8	AS BUILT	J.R.	13.03.21

Consultants

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BPR

CSO

BPR (BPR)
3100, Sherbrooke Street East, Suite 300
Montréal, (Québec) Canada H1X 3K9
Phone: 514 257-8777
Fax: 514 257-2414

Stamps

City of HAMILTON

Public Works Department

Scale

AS SHOWN

Designed

C.G.

Checked

J.R.

Drawn

E.C.

Project No.

Date

10.05.27

CITY OF HAMILTON
RTC IMPLEMENTATION PROJECT

WELLINGTON/BURLINGTON (HCG14)
REGULATOR CHAMBER

REGULATOR CHAMBER
DETAILS

Dwg. No.

C-C08

Issue

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	<div><div></div><div>No significant changes required to PCN or SOP</div><div></div><div>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</div></div>
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	<div><div></div><div>Not a CCP, operates passively, no modifications required</div></div>
Flap Gate #2	N/A (Not on SCADA)	2290 x 925 mm					
							<div><div></div><div>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</div></div>

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.



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.