Report for

City of Hamilton

CSO Facilities O&M Plan – MECP Order Item 6

January 31, 2019

City of Hamilton
CSO Facilities O&M Plan -
MECP Order Item 6

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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.

The Facilities Assessment Report dated November 31, 2018 prepared by Hatch provided in response to MECP Order Items 4, 7, 8 and 9 (Hatch CSO Facilities Assessment Report, 2018) discussed the findings of the Combined Sewer Overflow (CSO) facility inspections and evaluation of the need for modifications to improve the monitoring, performance and reliability of each facility to minimize the potential for unapproved bypasses/overflows/spills from the facilities (Order Items 4, 7 and 8); and provided recommendations as required by Order Item 9.

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

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

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

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

This current report addresses the requirements of Order Item 6, which requires the City to: using the information obtained from Item 4, and if applicable, Item 5 (updated CSO map), review and update drawings, Process Control Narratives (PCNs) and develop a written Operation and Maintenance Plan (O&M Plan) for each of the City's CSO facilities that identifies critical equipment and environmental discharge points, and shall include, but not be limited to: annual manual valve position checks of critical valves; monthly visual inspections of overflow structures at the CSO facilities equipped with station by-pass structures that discharge directly to the natural environment; and annual flow meter calibration.

The Hatch CSO Facilities Assessment Report (2018) already addressed the first requirement of Item 6, identifying critical equipment and potential environmental discharge points, and providing a number of recommendations to minimize the potential for such discharges in the future, including improved monitoring, control and inspection of the City's CSO facilities.

This report builds upon the information presented in the Hatch CSO Facilities Assessment Report (2018), providing a written O&M Plan for each of the City's CSO facilities and addressing whether updates are required to drawings and PCNs.

2. Discussion

The basis of the City's O&M Plan for each of the CSO facilities is their Standard Operating Procedure (SOP). The SOPs detail procedures for the safe and efficient operation of each facility, including the responsibilities of all levels of City staff involved in the operations and maintenance of the City's wastewater system, and in particular the CSO facilities; relevant safety notes and

procedures; procedures for the confined space entry into the underground CSO tanks and valve/gate chambers for the purposes of routine maintenance and inspection; an overview of the O&M process and equipment at each site; and specific procedures to be followed by City staff to safely operate and maintain each facility under all flow conditions, including annual and monthly inspection requirements.

The remaining components of the O&M Plan for each CSO facility include:

- The Process Control Narrative (PCN) for the facility, which describes how the facility is monitored and controlled by the City's Supervisory Control and Data Acquisition (SCADA) system
- Equipment Operation and Maintenance Manuals, which are typically provided by the Consultants and/or Contractors responsible for the construction and/or subsequent upgrades of each facility
- As-Built Drawings of each facility
- Additional formal procedures developed and employed by the City to operate and maintain the CSO facilities, including procedures for Confined Space Entry, Equipment Lock Out/Tagging, CSO Overflow Notification, and CSO Facility Inspection

This report summarizes the O&M Plan for each of the City's CSO facilities, including a brief description of the facility and any Critical Control Points (CCPs); an inventory of the key components of the plan, including the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings; and appendices including the current updated SOPs and PCNs.

Copies of the updated SOPs can be found in Appendix A, and a copy of the updated PCN for the Main/King CSO Tank (HCS04) can be found in in Appendix B. Copies of the remaining unchanged PCNs, equipment O&M manuals and as-built drawings are not provided here due their volume, but can be made available to the MECP.

The remainder of this report is broken down facility by facility, including a separate section for each of the City's existing CSO facilities, including the following locations:

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

Additional details on each of the CSO facilities can be found in the Hatch CSO Facilities Assessment Report (2018), including a brief narrative description of each facility and its purpose; drawings/figures showing the location of the CCPs at each facility, and also indicating the potential for possible unapproved sewage discharges to the environment, colour coded to indicate criticality; and tables providing an inventory of all the CCPs at each facility, including their name; SCADA tag name (where applicable); size/capacity; whether they are manually operated or motorized; their purpose in terms of flow control; their default position (as per the facility's PCN and/or SOP); their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/ spills into adjacent receiving waters.
The following sections of this current report provide a brief narrative description of each of the above CSO facilities and their purpose, and provide a summary of the key components of the O&M Plan for each facility, including a table providing an inventory of the key components of the plan, including the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings; and appendices including the current updated SOPs and PCNs.

As noted above, additional details on each CSO facility can be found in the respective section of the Hatch CSO Facilities Assessment Report (2018). For the sake of brevity, the drawings/figures and tables presented in the Hatch CSO Facilities Assessment Report (2018) are not reproduced here in this report, but are referenced where applicable below.

2.1 Greenhill CSO Tank #1 (HCS01)

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

Originally, HCS01 received sewage inflows directly from the combined trunk sewer running east along Greenhill Avenue, but with the addition of Greenhill CSO Tank #2 (HCS06), the original CSO tank now receives the overflows from the new CSO Tank #2 (HSC06). The combined operation of the two CSO tanks is discussed in more detail below in Section 2.6.

HCS01 is filled by gravity from the overflow from HCS06, and drained by motorized flow control gates over the discharges from the two storage cells, into the Red Hill Creek Sanitary Interceptor Sewer (RHCSI), which conveys flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). The gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. A water spray nozzle system is provided to clean the floor of Cell 2.

Level transmitters are provided to monitor the level of sewage stored in each storage cell, and in the CSO tank outlet channel; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

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

Figures 1A and 1B of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 1 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 1 provided below summarizes the key components of the O&M Plan for HCS01, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #5, Jan 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.4, Apr 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the Cell 1 and 2 Drain Gates themselves, to back up the existing sensors on the gate stems; and the City has plans to investigate and possibly upgrade the performance of the existing tank cleaning system.

Table 1: Summary of O&M Plan for Greenhill CSO Tank #1 (HCS01)

O&M Plan Component	Name of Document	Prepared By	Version #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Greenhill CSO Tank #1 (HCS01)	Hamilton Water Hatch Ltd.	Issue #5	Jan 2019
Equipment O&M Manual	Operation and Maintenance Manual – Contract RHW-86-10 (S) – HCS01	UMA Engineering Ltd.	N/A	1986
Equipment O&M Manual	Operation and Maintenance Manual for Odour Control System – HCS01	McCullough Gibson Construction Ltd	N/A	Nov 1997
Process Control Narrative (PCN)	Process Control Narrative – Greenhill Sewage Overflow Facility (HCS01)	Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.4	Apr 2016
As-Built Drawings	Greenhill Avenue Storage Facility – Contract No. RHW-86-01	UMA Engineering Ltd.	Dwg No. 807-13	Dec 1985

2.2 Bayfront Park CSO Tank (HCS02)

The Bayfront Park CSO Tank (HCS02) covers an area of approximately 3,200 m^2, and is over 6 m deep, providing approximately 21,000 m^3 of CSO storage capacity in two equally sized storage cells. A 4.0 m x 1.5 m box sewer (which later changes to 2,250 mm diameter) intercepts CSOs from the former Queen and Hess Street CSO outfalls and conveys them to the CSO tank. Flow into the tank is regulated by static CSO regulators at Queen/Barton, Stuart/Hess, and Stuart/Caroline, and by the Strachan Street Sewage Pumping Station (HC003). A flow regulating chamber is also provided upstream of the tank (near the CSO tank outfall), which includes three gates that can be operated to convey all flows into the CSO tank (in their default positions) or to provide a maintenance bypass of the tank (in their alternate positions). The operation of the gates is explained in more detail in the Hatch CSO Facilities Assessment Report (2018), and in the updated SOP found in Appendix A. The two Maintenance Bypass Gates are locked in the Fully Closed position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Hamilton Harbour at this location.

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

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

Combined sewage retained in the tank during wet weather is subsequently returned to the Western Sanitary Interceptor (WSI) and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 200 L/s submersible pumps located in Cell 1. A flap gate between Cell 1 and Cell 2 allows the two cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the WSI near Strachan and MacNab Streets. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. Ten (10) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (5 STFs in each cell).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility; and two (2) automatic samplers are provided to collect grab and composite samples of both the influent and effluent (overflow) water quality.

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

Figures 2A to 2C of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 2 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 2 provided below summarizes the key components of the O&M Plan for HCS02, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #3, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs; to note that the two Maintenance Bypass Gates have been locked in the Fully Closed position in December 2018; and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.3, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 2: Summary of O&M Plan for Bayfront Park CSO Tank (HCS02)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Bayfront CSO Tank (HCS02)	Hamilton Water Hatch Ltd.	Issue #3	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – CSO Facility HCS02 / Wastewater PS HC003	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.3	Apr 2016
Equipment O&M Manual	Operation and Maintenance Manual – Strachan Storage Tank – HCS02	Matthews Contracting Inc. (General Contractor) Priestep Electric Limited (Electrical Contractor)	N/A	Mar 1993
As-Built Drawings	Strachan Street (Bayfront Park) Storage Tank	Regional Municipality of Hamilton-Wentworth	Dwg No. 92-S-14	Feb 1992

2.3 James Street CSO Facility (HCS03 and HCG08)

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

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

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

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

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

Level transmitters are provided to monitor the level of sewage stored in the off-line storage tank, and in the CSO tank overflow channel; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

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

Figures 3A to 3D of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 3 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 3 provided below summarizes the key components of the O&M Plan for HCS03, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.5, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the HCG08 sluice gates themselves, to back up the existing sensors on the gate stems.

Table 3: Summary of O&M Plan for James Street CSO Facility (HCS03/HCG08)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – James Street CSO Tank (HCS03), Ferrie/Mary Sluice Gates (HCG08)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – James Street CSO Facility HCS03, Ferrie/Mary Sluice Gates (HCG08)	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.5	Apr 2016
As-Built Drawings	James Street North Storage Tank – Contract RHW 92-78 (ST)	Regional Municipality of Hamilton-Wentworth	Dwg No. 92-S-45	Sep 1992

2.4 Main/King CSO Tank (HCS04)

The Main/King CSO Tank (HCS04) covers an area of approximately 9,500 m^2, and is over 8 m deep, providing approximately 77,100 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 23,300 m^3 of storage, and the second provides a further 53,800 m^3 of storage. The Main/King CSO Tank operates off-line, with combined sewage entering the tank during larger CSO events. Flow into the tank is regulated by three WWTP-controlled CSO regulators that were constructed in conjunction with the CSO tank. The Glen Road CSO Outfall, which is located at the east end of Glen Road on the west side of Hwy 403, was effectively eliminated by installing a new WWTP-controlled CSO regulator gate at Glen/Macklin (Chamber 1) and constructing a new 1,350 mm diameter sewer to convey CSOs underneath Hwy 403 and into the CSO tank. The former McKittrick CSO Outfall, which previously diverted CSOs from the 1,980 mm diameter combined sewer that conveys flows to the WSI, was eliminated by constructing a new WWTP-controlled CSO regulator (Chamber 4) to divert CSOs into the new tank. Flow from the 2,100 mm x 2,250 mm box sewer which runs along the south side of Main Street was diverted into the new tank by a bulkhead placed in the sewer and a new WWTP-controlled CSO regulator located at the south-east corner of the tank (Chamber 5). Downstream of the bulkhead, this sewer is used to convey the overflows which will still occur from the tank when its design capacity is exceeded.

During DWF conditions, flow is directed to the WWTP via the WSI. The gate in Chamber 4 (King Street Sewer) is set to be Fully Open; the gate in Chamber 5 (Interceptor Sewer) is set to 30% Open; and the gate in Chamber 1 (Glen Road Sewer) is always set at 35%. The Main Street Overflow Sewer, which maintains a base flow during dry weather due mainly to infiltration, is directed to the CSO tank's wet well and pumped into the interceptor sewer. The gate in Chamber 4 is currently without power or communications, and it is currently manually set to convey wet weather flow mainly to the CSO tank.

During WWF conditions, the pumps are taken out of auto mode and turned off; the opening of Gate 4 is reduced to 7%; and the opening of Gate 5 is reduced to 2%. Excess flow from the three regulators enters the pumping station wet well, which is located beneath the control building at the south-east corner of the facility. During dry weather and small storm events, the CSO tank's pumping station acts as a normal sewage pumping station. During larger storm events, two motorized sluice gates are opened to permit flow from the wet-well to enter the CSO tank. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged into Chedoke Creek near the Main Street overpass, via the original 2,100 mm x 2,250 mm box sewer outfall. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank's wet well includes an Influent Well Overflow Gate (CSO Maintenance Bypass Gate) that can be operated to convey all flows into the CSO tank and pumping station (when Closed) or to provide a maintenance bypass of the tank (when Open). Prior to November 2018, the PCN for HCS04 incorrectly indicated that during DWF conditions this gate should be 5% open, and during WWF conditions this gate should be 100% open. The default settings for the gate should actually be Fully Closed during both DWF and WWF conditions and the PCN was updated in November 2018 to reflect this.

Combined sewage retained in the tank during wet weather is subsequently returned to the Combined Sewer System (CSS) and conveyed by the WSI to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by three (3) 375 L/s submersible pumps located in the pumping station wet well. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the original 1,980 mm sewer, which in turn discharges into the WSI near Hunt Street. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. Thirty (30) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (10 in Cell 1 and 20 in Cell 2).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility; and two (2) automatic samplers are provided to collect grab and composite samples of both the influent and effluent (overflow) water quality.

The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 4A to 4C of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 4 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 4 provided below summarizes the key components of the O&M Plan for HCS04, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to reflect recent changes to the operation of HCS04. These included padlocking the Influent Well Overflow Gate (CSO Maintenance Bypass Gate) in the Fully Closed position, and removing access to this gate for control purposes from the SCADA system; and setting the position of the Chamber 1 sluice gate at Glen Road to 35% Open for all flow conditions. These changes are described further in the updated SOP. Other updates to SOP included clarifying the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and adding a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6.

The previous version of the PCN has been recently updated (Version 3.5, November 2018) to reflect the operational gate changes described above and incorporated in the updated SOP, and a copy of the updated SOP is included in Appendix B.

No significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on all the sluice gates associated with the facility, on the gates themselves, to back up the existing sensors on the gate stems; and to consider simplifying the operation of the sluice gates in Chamber 4 and 5. The City is evaluating options to investigate the feasibility of moving the existing flowmeter and automatic sampler on the CSO tank overflow, to a location downstream of the above-mentioned Influent Well Overflow Gate (CSO Maintenance Bypass Gate), to also capture any possible future flows through this gate; to relocate the CSO tank influent sampler to a better location not prone to high flows damaging the unit; and to investigate and upgrade portions of the existing tank cleaning system.

Table 4: Summary of O&M Plan for Main/King CSO Tank (HCS04)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Main/King CSO Tank (HCS04)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Wastewater PS / Main/King CSO Tank HCS04	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 3.5	Nov 2018
Equipment O&M Manual	Electrical O&M Manual – Contract RHW-94-75 (COIW) - HCS04	Selectra Inc. (Electrical Contractor) Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000301	1998
Equipment O&M Manual	Installation, Operating & Maintenance Manuals – Contract RHW-94-75 (COIW) – HCS04	Bennett Mechanical Installations (Mech Contractor) Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000302	1998
Equipment O&M Manual	Operations/Maintenance Manuals – Contract RHW-94-75 (COIW) – HCS04	Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000520	1998
Equipment O&M Manual	Electrical/I&C Instruction Manual J936	Bristol Babcock (I&C Contractor) Kenaidan Contracting Ltd (General Contractor) R.V. Anderson Associates (Consultant)	Shelf D-3, Doc No. 0000521	1998
As-Built Drawings	Main/King CSO Tank – Contract RHW-94-75 (COIW) – HCS04	R.V. Anderson Associates Limited	Dwg No. 95-S-32	1998

2.5 Eastwood Park CSO Tank (HCS05, HCG06 and HCG07)

The Eastwood Park CSO Tank (HCS05) covers an area of approximately 4,000 m^2, and is over 6 m deep, providing approximately 27,350 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 14,700 m^3 of storage, and the second provides a further 12,650 m^3 of storage. A sewer along Dock Service Road intercepts the CSOs from the two outfalls and conveys them to the CSO tank. The original Catharine Street (1,050 mm) and Ferguson Avenue (1,500 mm) CSO outfalls were left in place and are used to carry the overflow from the CSO tank on the infrequent occasions when the design capacity of the tank is exceeded. A flow splitter diverts the overflow from the tank between the two previously existing outfall sewers.

The Eastwood Park CSO Tank operates off-line, with combined sewage entering the tank only during larger CSO events. Flow into the tank is regulated by static CSO regulators at Catharine/Brock, Picton/Ferguson and MacAulay/Ferguson and by the two WWTP-controlled CSO regulators at Burlington/Ferguson and Ferrie/Ferguson.

During DWF conditions, the Burlington/Ferguson (HCG06) and Ferguson/Ferrie Streets (HCG07) sluice gates normally remain open, directing all flow to the WSI sewer and on to the WWTP.

During WWF conditions, excess flows from the Catharine/Brock CSO regulator and the two CSO regulators along Ferguson Avenue overflow into the tank. When rainfall occurs, the station is placed into Storm Mode and the pumps in the CSO tank are Off, and the HCG06 and HCG07 gates are fully closed, eliminating flow into the WSI at these locations. Cell 1 will fill first, and if it fills completely, will overflow into Cell 2. If Cell 2 also fills, CSOs are discharged to Hamilton Harbour through the Catharine Street and Ferguson Avenue CSO outfalls. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank.

The CSO tank inlet chamber at the north-east corner of the tank includes three gates that can be operated to convey all flows into the CSO tank (in their default positions, with the CSO tank inlet gate open and the two CSO tank maintenance gates closed) or to provide a maintenance bypass of the tank (in their alternate positions). The operation of the gates is explained in more detail in the Hatch CSO Facilities Assessment Report (2018), and in the updated SOP found in Appendix A. The two Maintenance Bypass Gates are locked in the Fully Closed position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Hamilton Harbour at this location.

Combined sewage retained in the tank during wet weather is subsequently returned to the WSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by two (2) 289 L/sec submersible pumps located in Cell 1. One pump is used as a duty pump and the other as a stand-by pump. A flap gate between Cell 1 and Cell 2 allows the cells to be emptied at the same time. The pumps discharge into a forcemain that connects to the 900 mm portion of the WSI downstream of HCG06. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP. Fifteen (15) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (8 in Cell 1 and 7 in Cell 2).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility; and two (2) automatic samplers are provided to collect grab and composite samples of both the influent and effluent (overflow) water quality.

The facilities are monitored and controlled via SCADA by Operators at the WWTP. The motorized gates and pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of unauthorized entries to the control building.

Figures 5A to 5D of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 5 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 5 provided below summarizes the key components of the O&M Plan for HCS05, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #5, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs; to note that the two Maintenance Bypass Gates have been locked in the Fully Closed position in December 2018; and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.2, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings of the tank. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the CSO Tank Inlet Gate and the HCG06 (Burlington/Ferguson) and HCG07 (Ferrie/Ferguson) sluice gates, on the gates themselves, to back up the existing sensors on the gate stems.

Table 5: Summary of O&M Plan for Eastwood Park CSO Tank (HCS05), Burlington/Ferguson Sluice Gate (HCG06) and Ferrie/Ferguson Sluice Gate (HCG07)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Eastwood Park CSO Tank (HCS05), Burlington/Ferguson Sluice Gate (HCG06) and Ferrie/Ferguson Sluice Gate (HCG07)	Hamilton Water Hatch Ltd.	Issue #5	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Eastwood Park CSO Facility HCS05	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.2	Apr 2016
Equipment O&M Manual	Electrical Maintenance Manuals – Contract RHW-96-03 (S) – HCS05	Metric (Electrical Contractor) Granville (General Contractor) Thorburn Penny (Consultant)	Shelf D-3, Doc No. 0000303	1998
Equipment O&M Manual	Operation and Maintenance Manuals – Contract RHW-96-03 (S) – HCS05	Granville (General Contractor) Thorburn Penny Consulting Limited (Consultant)	Shelf D-3, Doc No. 0000307	1998
Equipment O&M Manual	Operations Manual – Contract C13-09-12 – HCG06 and HCG07	Stantec (Consultant) Newman Bros. Ltd (General Contractor)	Shelf D-5, Doc No. 0000639	Sep 2012
As-Built Drawings	Eastwood Park CSO Facility – Contract RHW-96-03 (S) – HCS05	Thorburn Penny Consulting Limited	Dwg No. 96-S-29	Oct 1995

2.6 Greenhill CSO Tank #2 (HCS06)

The second Greenhill CSO Tank (HCS06) is an underground reinforced concrete structure that was installed to augment the storage provided by the original Greenhill CSO Tank (HCS01). The rectangular tank covers an area of approximately 8,400 m^2, and is 7.5 to 8.3 m deep, providing approximately 66,750 m^3 of CSO storage capacity in two equally sized storage cells. The new facility increased the combined CSO storage volume at the Greenhill site to approximately 150,250 m^3.

HCS06 operates as an off-line facility, with combined sewage entering the tank only during larger CSO events. Flow into the storage tank is regulated by a WWTP-controlled CSO regulator located upstream of the tank. Cell 1 will fill first, and if it fills completely, excess flows overflow into Cell 2. If Cell 2 also fills, overflows will be conveyed into HCS01. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the new tank and prevent them from entering HCS01.

HCS06 is drained by gravity into the RHCSI via a 1,200 mm diameter sewer. The rate of drainage is regulated by a WWTP-controlled gate, based upon the current inflows at the WWTP.

The facility includes a bypass chamber between HCS06 and HCS01 that can be used to isolate HCS01 for maintenance purposes. To operate this bypass, the manual stop gate in the chamber has to be physically removed from its default position and inserted in the alternate position across the overflow channel from HCSO6 to HCS01 (thereby diverting flow to Red Hill Creek). Only one stop log is provided, making it impossible to block the flow of both sewers at the same time. Twenty (20) sediment flushing tanks (SFTs) are provided to clean the floor of the two tank cells (10 in each cell).

Level transmitters are provided to monitor the level of sewage stored in each storage cell; and a flowmeter is provided (at HCS01) to measure the rate and volume of any CSOs exiting the facility.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

HCS06 is also equipped with a biofilter odour control system to reduce the presence of unpleasant odours associated with the tank (possible when the tank is filling with sewage and air is being displaced from the tank).

Figures 6A to 6E of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 6 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 6 provided below summarizes the key components of the O&M Plan for HCS06, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #3, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.4, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the Dry Flow Control Gate and CSO Drain Gate, on the gates themselves, to back up the existing sensors on the gate stems.

Table 6: Summary of O&M Plan for Greenhill CSO Tank #2 (HCS06)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Greenhill CSO Tank #2 (HCS06)	Hamilton Water Hatch Ltd.	Issue #3	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Greenhill #2 CSO Tank HCS06	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.4	Apr 2016
Equipment O&M Manual	Operating and Maintenance Manuals – Contract TOE-02-05 (CSO) – HCS06	Bennett Contracting Millgrove Ltd General Contractor)	Shelf D-3, Doc No. 0000299	N/A
As-Built Drawings	Greenhill CSO Tank #2 – Contract TOE-02-05 (CSO) – HCS06	City of Hamilton	Dwg No. 01-S-23	Jan 2002

2.7 Red Hill Valley CSO Pipe Facility (HCS07)

The Red Hill Valley CSO Pipe Facility (HCS07) captures and stores CSOs from the former Lawrence, Queenston and Melvin CSO outfalls to Red Hill Creek. The facility stores the CSO in an oversized pipe running parallel to the existing RHCSI and along the Red Hill Parkway. The oversized storage pipe ranges in size from 2,000 to 2,250 mm in diameter, and a series of four (4) motorized sluice gates are used to convey flows into and create temporary storage within the pipe during WWF conditions, and also to control the subsequent drainage of the facility to the WWTP for treatment during DWF conditions.

HCS07 comprises three (3) flow control structures: HCS7A at Lawrence Road; HCS7B at Queenston Road; and HCS7C at Barton Street; creating two (2) storage pipe cells providing a total storage volume of approximately 14,200 m^3. Cell 1 consists of a 2,250 mm diameter pipe running between HCS7A and HCS7B; and Cell 2 consists of a 2,000 mm diameter pipe running between HCS7B and HCS7C. HCS7C includes an 1,800 mm diameter sanitary sewer to drain the storage facility, and a 2,250 mm diameter overflow sewer to Red Hill Creek that only becomes active if the design capacity of the facility is exceeded. The stored flow behind the gates can also be used to flush any sediments that may have settled at the bottom of the storage pipe cells during storage periods.

Level transmitters are provided to monitor the level of sewage at HCS7A/B/C (also giving the level of sewage stored in Cell 1 and 2); a flowmeter is provided at HCS7C at Barton Street to measure the rate and volume of any CSOs exiting the facility; and an automatic sampler is provided to collect grab and composite samples of effluent (overflow) water quality from the HCS7C overflow.

The facilities are all monitored and controlled via SCADA by Operators at the WWTP. The motorized gates can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control buildings.

Figures 7A to 7E of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 7 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 7 provided below summarizes the key components of the O&M Plan for HCS07, including current versions of the SOP, PCN, Equipment O&M Manuals, and drawings.

The SOP has been updated as part of this report (Issue #2, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been to the current version of the HCS7A/B/C PCNs (Version 2.3, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on all sluice gates associated with this facility, on the gates themselves, to back up the existing sensors on the gate stems.

Table 7: Summary of O&M Plan for Red Hill CSO Pipe Facility (HCS07, HCS7A/B/C)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Red Hill CSO Pipe Facility (HCS07)	Hamilton Water Hatch Ltd.	Issue #2	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Red Hill Valley CSO Pipe Facility HCS7A	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.3	Apr 2016
Process Control Narrative (PCN)	Process Control Narrative – Red Hill Valley CSO Pipe Facility HCS7B		Version 2.3	Apr 2016
Process Control Narrative (PCN)	Process Control Narrative – Red Hill Valley CSO Pipe Facility HCS7C		Version 2.3	Apr 2016
Equipment O&M Manual	SCADA Operations Manual – Contract PW-04-239/241 (RHV) – HCS07	Hatch Mott MacDonald (SCADA Consultant) Dufferin Construction Company (General Contractor)	Shelf D-2, Doc No. 0000570	Feb 2009
Equipment O&M Manual	Civil & Mechanical O&M Manual – Contract PW-04-239/241 (RHV) – HCS07	Dufferin Construction Company (General Contractor)	Shelf D-2, Doc No. 0000571	Feb 2009
Equipment O&M Manual	PLC & WAN Panel O&M Manual – Contract PW-04-239/241 (RHV) – HCS07	Hatch Mott MacDonald (SCADA Consultant) Dufferin Construction Company (General Contractor)	Shelf D-2, Doc No. 0000572	Oct 2009
Drawings	Red Hill Valley CSO Pipe Facility – Contract PW-04-239 (RHV) – HCS07	AWS Engineers & Planners	Dwg No. 04-H-67	Jul 2003

2.8 Royal Avenue CSO Tank (HCS08)

The Royal Avenue CSO Tank (HCS08) is an underground reinforced concrete structure that provides approximately 15,000 m^3 of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 41 m long x 37 m wide x 10 m deep.

The site originally included a CSO Regulator chamber that employed a motorized sluice gate to dynamically control the rate of flow conveyed to the Woodward Avenue WWTP. This sluice gate was removed, and control of the flow conveyed to the WWTP and the CSO tank is accomplished passively by a 525 mm diameter drop pipe located in the diversion chamber at the east end of Royal Avenue. During dry weather and small storm events, the 525 mm drop pipe conveys all flow into the downstream 900 mm sanitary sewer and on to the WWTP. During larger storm events, the 525 mm drop pipe will fill to capacity and excess flows will be diverted to the CSO tank after passing through a coarse bar screen included in the CSO Tank Inlet Chamber. Filling of the CSO Tank occurs passively without any actions having to be initiated by the Operators at the WWTP.

CSOs are conveyed to the storage tank by a 2,400 mm x 2,400 mm step sewer. The inlet sewer is designed to operate under surcharge, dependent upon the level of the sewage in the CSO storage tank, which provides some additional storage volume.

The inlet chamber also includes provision to isolate the CSO storage tank in emergencies and during special maintenance activities, and a 2,400 mm wide x 2,000 mm deep box culvert is provided to divert flow to Chedoke Creek for those activities. The chamber includes two sets of guides for alternate placement of a single stop log to control the direction of flow. Under normal operation, the stop log will be inserted in the guides over the upstream end of the emergency bypass sewer, sending all excess WWF into the CSO tank. To operate the bypass, the stop log has to be physically removed from its default position and inserted in the alternate position over the upstream end of the CSO tank inlet sewer. Only one stop log is provided, making it impossible to block the flow of both sewers at the same time. A removable stainless-steel bar screen is provided at the upstream end of the CSO tank inlet sewer to capture debris to protect the sewage pumps in the storage tank.

Inside the storage tank, a stainless-steel baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the tank, so they can be subsequently pumped from the tank and conveyed to the Woodward WWTP for treatment. A 5,400 mm wide x 1,800 mm deep box culvert is provided at the northeast corner of the site to convey any overflows from the facility into Chedoke Creek.

Three (3) submersible pumps are provided to pump the contents of the storage tank back into the Combined Sewer System (CSS) in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during dry weather, when the capacity is available to treat these flows. Three (3) 250 L/s pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps will be conveyed south via three (3) 400 mm diameter ductile iron forcemains into the relocated 900 mm sanitary sewer running east along the south wall of the tank. The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. Six (6) sediment flushing tanks (SFTs) are provided to clean the floor of the tank following each storm event.

Two (2) level transmitters are provided to monitor the level of sewage stored in the tank; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

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

Figures 8A to 8C of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 8 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 8 provided below summarizes the key components of the O&M Plan for HCS08, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #3, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.3, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 8: Summary of O&M Plan for Royal Avenue CSO Tank (HCS08)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Royal Avenue CSO Tank (HCS08)	Hamilton Water Hatch Ltd.	Issue #3	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Royal Avenue CSO Tank HCS08	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.3	Apr 2016
Equipment O&M Manual	SCADA O&M Manual – Contract PW-05-06 (CSO) – HCS08	Hatch Mott MacDonald (Consultant) Genivar (General Contractor)	Shelf D-3, Doc No. 0000308	Nov 2007
As-Built Drawings	Royal Avenue CSO Storage Tank – Contract PW-05-06 (CSO) – HCS08	Hatch Mott MacDonald / J&M Structural	Dwg No. 05-S-13	Jan 2008

2.9 McMaster CSO Tank (HCS09)

The McMaster CSO Tank (HCS09) is an underground reinforced concrete structure that provides approximately 5,935 m^3 of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 50 m long x 18 m wide x 6.6 m deep. When the tank is full, some additional CSO storage volume is provided within the upstream CSO tank inlet sewer.

A maintenance bypass is provided at the southwest corner of the storage tank, where the CSO inflow sewer enters the tank, to provide a means to bypass flows around the storage tank, to permit future isolation of the CSO storage tank in emergencies and during special maintenance activities.

Under normal operation, the CSO Tank Inlet Gate is Fully Open (it has been padlocked in this position) and the stop log over the end of the CSO tank overflow sewer is removed (sitting in guides above the end of the CSO tank overflow sewer), to allow all incoming flow to enter the tank, and the Operator does not have to do anything to allow the storage tank to fill. To operate the CSO tank bypass, in order to fully isolate the CSO tank from the CSO outfall pipe, the CSO Tank Inlet Gate must be fully closed and the stop log removed from its default position and inserted in the alternate guides provided over the end of the CSO tank overflow sewer. The CSO Tank Inlet Gate has recently been padlocked in the Fully Open position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Ancaster Creek.

Inside the storage tank, a stainless-steel underflow baffle is provided along the length of the overflow weir, suspended from the roof of the tank, to retain floatables and oils inside the CSO storage tank, so they can be subsequently pumped from the tank and conveyed to the WWTP for treatment. A 2,400 mm wide x 1,000 mm (sloped) overflow trough is provided at the northwest corner of the tank to safely convey any overflows from the facility into the 1,800 mm overflow sewer discharging to Lower Ancaster Creek

Three (3) 137 L/s submersible pumps are provided to pump the contents of the storage tank back into the CSS in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during DWF conditions, when capacity is available to treat these flows. Three pumps are provided, but only one pump will run at any given time. The other 2 pumps are provided for redundancy, ensuring an extra pump is available even if one pump is out for maintenance or repairs. The flow from the pumps is lifted via three (3) 200 mm diameter, ductile iron forcemains, which feed a single 350 mm diameter forcemain running around the east and south walls of the storage tank, then south through the City's easement within the Hydro One corridor, and finally east through the City's right-of-way at the west end of Sanders Boulevard, to connect to the gravity operated CSS along Sanders Boulevard. Three (3) sediment flushing tanks (SFTs) are provided to clean the floor of the tank following each storm event.

Two (2) level transmitters are provided to monitor the level of sewage stored in the tank; and a flowmeter is provided to measure the rate and volume of any CSOs exiting the facility.

The facility is monitored and controlled via SCADA by Operators at the WWTP. The motorized CSO tank inlet gate and the pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode is SCADA Manual, with operation directed by Operators at the WWTP. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figures 9A and 9B of the Hatch CSO Facilities Assessment Report (2018) showed the location of the CCPs at this facility, as well as potential for possible sewage discharges to the environment from each CCP, colour coded to indicate criticality; and Table 9 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 9 provided below summarizes the key components of the O&M Plan for HCS09, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

A new SOP has been created for this facility as part of this report (Issue #1, January 2019) to: provide a description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and include a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and no therefore no changes have been made to the current version of the PCN (Version 1.4, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 9: Summary of O&M Plan for McMaster CSO Tank (HCS09)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – McMaster CSO Tank (HCS09)	Hamilton Water Hatch Ltd.	Issue #1	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – McMaster CSO Tank HCS09	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.4	Apr 2016
Equipment O&M Manual	Electrical O&M Manual – Contract PW-08-13 (CSO) – HCS09	Varcon (General Contractor) Selectra (Electrical Contractor) Hatch Mott MacDonald (Consultant)	Shelf D-3, Doc No. 0000528	2010
Equipment O&M Manual	Mechanical O&M Manuals – Contract PW-08-13 (CSO) – HCS09	Varcon (General Contractor) Hatch Mott MacDonald (Consultant)	Shelf D-3, Doc No. 0000603	2010
As-Built Drawings	McMaster CSO Storage Tank – Contract PW-08-13 (CSO) – HCS09	Hatch Mott MacDonald / J&M Structural	Dwg No. 08-S-38	Sep 2010

2.10 Wentworth/Rosemary CSO Gate (HCG03)

HCG03 regulates the flow of combined sewage from a 266 ha drainage area served by a 1,220 mm x 1,525 mm combined sewer running north along Wentworth Street North. The gate is located in an underground chamber on the northeast corner of Wentworth Street North and Rosemary Avenue, near the entrance to the City's offices at 330 Wentworth Street North.

HCG03 is used to direct DWF and some WWF to the Burlington/Hillyard area where the flows enter the WSI North branch (WSIN) and are conveyed to the Woodward Avenue WWTP for treatment. The regulator also has the ability to isolate flows from the WSIN, where the gate is normally open but can be closed to direct flow to the Wentworth CSO outfall when the WSIN is surcharged.

During DWF conditions and small storms, a static overflow weir captures all flows and conveys them through the open gate in HCG03, into a 1,200 mm x 1,500 mm combined sewer which connects to the WSIN at the intersection of Hillyard Avenue and Burlington Street, and the WSIN conveys the flows east to the Woodward Avenue WWTP for treatment.

During larger storms, when the weir is overtopped, excess WWF is diverted to the Wentworth CSO Outfall via a 2,500 mm x 2,400 mm combined sewer on Wentworth Avenue.

During very large storms, every attempt is made to maximize the conveyance of combined sewage to the WWTP for treatment, however there will be circumstances where the Operator may need to close HCG03 to bypass combined sewage through the Wentworth CSO Outfall to protect the Influent Pump Station and biological treatment processes at the WWTP.

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

The Process Automation Controller (PAC), network equipment and gate actuator are powered by an Uninterruptable Power Supply (UPS). On a power failure, the gate is set to 30% Open.

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

Figure 10A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the gate, as well as the potential for possible sewage discharges to the environment, colour coded to indicate criticality; and Table 10 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 10 provided below summarizes the key components of the O&M Plan for HCG03, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 3.3, June 2012). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the gate itself, to back up the existing sensor on the gate stem.

Table 10: Summary of O&M Plan for Wentworth/Rosemary CSO Gate (HCG03)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Wentworth/Rosemary CSO Gate (HCG03)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – 330 Wentworth St North Wastewater Regulator HCG03	Hamilton Water BPR Eramosa Engineering Stantec	Version 3.3	Jun 2012
Equipment O&M Manual	Operations Manual – Contract C13-09-12 – HCG03	Stantec (Consultant) Newman Bros. Ltd (General Contractor)	Shelf D-5, Doc No. 0000635	2010
As-Built Drawings	Rosemary/Wentworth Regulator Upgrades – Contract C13-09-12 – HCG03	Stantec	Not Provided	Jan 2013

2.11 Brampton/Strathearne CSO Gate (HCG04)

HCG04 regulates the flow of combined sewage from a 210 ha drainage area served by a 2,134 mm x 2,286 mm combined sewer running north along Strathearne Avenue. The gate is located in an underground chamber behind the Arcelor Mittal security guard house located just south of Brampton Street.

During DWF conditions and small storms, a static overflow weir captures all flows and conveys them through the open gate in HCG04, into a 1,050 mm combined sewer on Strathearne Avenue, which connects to the WSI at the intersection of Strathearne Avenue and Burlington Street, and the WSI conveys the flows east to the Woodward Avenue WWTP for treatment.

During larger storms, when the weir is overtopped, excess WWF is diverted to the Strathearne CSO Outfall via a second, 2,100 mm x 2,250 mm combined sewer on Strathearne Avenue.

During very large storms, every attempt is made to maximize the conveyance of combined sewage to the WWTP for treatment, however there will be circumstances where the Operator may need to close HCG04 to bypass combined sewage through the Strathearne CSO Outfall to protect the Influent Pump Station and biological treatment processes at the WWTP.

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

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

Figure 11A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the gate, as well as the potential for possible sewage discharges to the environment, colour coded as described in the report to indicate criticality; and Table 11 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 11 provided below summarizes the key components of the O&M Plan for HCG04, including current versions of the SOP, PCN, Equipment O&M Manuals, and drawings.

The SOP has been updated as part of this report (Issue #4, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.2, April 2016). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the gate itself, to back up the existing sensor on the gate stem.

Table 11: Summary of O&M Plan for Brampton/Strathearne CSO Gate (HCG04)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Brampton/Strathearne CSO Gate (HCG04)	Hamilton Water Hatch Ltd.	Issue #4	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Brampton/Strathearne Regulator HCG04	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 1.2	Apr 2016
Equipment O&M Manual	Operating and Maintenance Manuals – Contract C11-85-07 – HCG04	Procon (General Contractor) Hydromantis, Inc. (Consultant)	Shelf D-5, Doc No. 0000635	2010
Drawings	Strathearne/Brampton CSO Gate Replacement – Contract C11-85-07 – HCG04	Hydromantis, Inc.	Not Provided	Mar 2007

2.12 Wellington/Burlington CSO Gate (HCG14)

HCG14 is located at the intersection of Wellington Street North and Burlington Street East, where the Wellington CSO Outfall sewer crosses the WSIN. The purpose of HCG14 is to capture and divert combined sewage from the Wellington CSO Outfall sewer into the WSIN for conveyance to the Woodward Avenue WWTP for treatment.

HCG14 is equipped with a modulation slide gate and back-up isolation slide gate, which are operated automatically by the City's Real Time Control (RTC) system based on level measurements on the receiving WSIN, the Wellington CSO Outfall sewer, and the regulator chamber itself. The modulation gate controls the flow into the WSIN and the isolation gate facilitates maintenance of the modulation gate (when required) and provides redundancy for the modulation gate to control flow into the WSIN. Two passive flap gates are also located just downstream of the flow diversion channel to the regulator to prevent water from Hamilton Harbour from flowing back into the sewer system.

During DWF conditions, the modulation gate remains fully closed and the isolation gate remains fully open. During WWF conditions, upon detection of a threshold flow depth in either the Wellington CSO Outfall sewer or in the WSI North Branch, the site is automatically switched to wet conditions strategy operation, which causes the isolation gate to remain open and the modulation gate to be placed in a partially open position according to the output from a proportional-integral-derivative (PID) controller. The PID controller will then cause the gate to modulate with the objective of attaining and then maintaining the flow level in the WSIN at a specified setpoint. Once the flow levels in the WSIN and the Wellington CSO Outfall sewer fall below the wet conditions strategy trigger levels, the site operation will revert back to the dry conditions strategy. A number of fail-safe and degraded operation conditions features are built into the process control logic in order to ensure the robust and safe operation of the site in the event of a variety of equipment failures (e.g. gate motors, level sensors, etc), all of which are detailed further within the PCN for the site.

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

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

Figure 12A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the gates, as well as the potential for possible sewage discharges to the environment, colour coded to indicate criticality; and Table 12 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 12 provided below summarizes the key components of the O&M Plan for HCG14, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #2, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No recent changes have been made, or are required, to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 1.7, January 2012). Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed. For example, the Hatch CSO Facilities Assessment Report (2018) recommended conducting an engineering study to determine the feasibility of adding redundant gate position sensors on the gates themselves, to back up the existing sensors on the gate stems.

Table 12: Summary of O&M Plan for Wellington/Burlington CSO Gate (HCG14)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Wellington/Burlington CSO Gate (HCG14)	Hamilton Water Hatch Ltd.	Issue #2	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Wastewater Regulator (221 Burlington St.) HCG14	Hamilton Water BPR Eramosa Engineering Stantec	Version 1.7	Jan 2012
Equipment O&M Manual	Operations Manual, Volume 1 of 2 – Contract C13-09-12 – HCG14	Stantec (Consultant) Newman Bros. Ltd (General Contractor)	Shelf D-5, Doc No. 0000637	Sep 2012
Equipment O&M Manual	Operations and Maintenance Manual, Volume 2 of 2 – Contract C13-09-12 – HCG14	Newman Bros. Ltd (General Contractor) Stantec (Consultant)	Shelf D-5, Doc No. 0000638	Sep 2012
As-Built Drawings	Wellington/Burlington Regulator Upgrades – Contract C13-09-12 – HCG14	Stantec	Not Provided	Mar 2013

2.13 Parkdale Burlington Wastewater Collection Station (HC001)

Wastewater Pumping Station HC001 is located on the northwest corner of the intersection of Parkdale Avenue and Burlington Street East. The purpose of the station is to lift CSOs from the combined sewer coming from Leaside Road and Woodward Avenue (and separate stormwater from the storm sewer on the north side of Burlington Street between Strathearne Avenue and Parkdale Avenue), which are too deep to be conveyed by gravity to the Parkdale CSO Outfall at the north end of Parkdale Avenue.

The station is equipped with five (5) active pumps, with two (2) 150 L/s pumps employed to handle normal flow conditions, and three (3) more 600 L/s pumps employed to handle high flow conditions. There is also a diesel engine driven pump, but it is currently out of service and not available for operation.

The pumps can be operated in either full Manual, SCADA Manual, or SCADA Auto modes. The default mode of operation involves monitoring of the wet well level via SCADA by Operators at the WWTP, with operation of the pumps in SCADA Auto mode, and only required when the Leaside/Woodward combined sewer and/or Burlington storm sewer are active. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

Figure 13A of the Hatch CSO Facilities Assessment Report (2018) showed the location of the pumps, as well as the potential for possible sewage discharges to the environment, colour coded to indicate criticality; and Table 13 of the same report provided an inventory of all the CCPs at this facility, including the details described above; their potential for discharge to the environment under different flow conditions; and recommendations for improving the monitoring, performance, reliability of operation and minimizing the potential for unapproved bypasses/overflows/spills into adjacent receiving waters.

Table 13 provided below summarizes the key components of the O&M Plan for HC001, including current versions of the SOP, PCN, Equipment O&M Manuals, and As-Built Drawings.

The SOP has been updated as part of this report (Issue #5, January 2019) to make the following changes: to clarify the description of the facilities; to provide consistency of format with all the other CSO facility SOPs, and to add a section on procedures for regular Inspection and Maintenance of the facility addressing the requirements of Order Item 6. No formal changes have been made to the operation of the facility via SCADA, and therefore no changes have been made to the current version of the PCN (Version 2.4, June 2015), although as noted in the SOP, some possible changes are being reviewed. Similarly, no significant upgrades have been completed recently at this station, so there has also been no need to update the existing Equipment O&M Manuals and As-Built Drawings. These would be updated in the future, if and when any upgrades are completed.

Table 13: Summary of O&M Plan for Parkdale Burlington Wastewater Collection Station (HC001)

O&M Plan Component	Name of Document	Prepared By	Reference #	Issue Date
Standard Operating Procedure (SOP)	Detailed Sewer System Operation – Parkdale Wastewater Collection Station (HC001)	Hamilton Water Hatch Ltd.	Issue #5	Jan 2019
Process Control Narrative (PCN)	Process Control Narrative – Parkdale/Burlington Wastewater PS HC001	Hamilton Water Eramosa Engineering Inc. Westin Engineering Inc. XCG Consultants Ltd. R.E. Poisson Engineering Inc.	Version 2.4	Jun 2015
As-Built Drawings	Parkdale Sewage Pumping Station – HC001	City of Hamilton	Plan No. P-138	1955

3. References

Hatch Corporation (2018). Report – CSO Facilities Assessment – MECP Order Items 4, 7, 8 and 9. Report prepared for the City of Hamilton, November 2018.

Appendix A

Updated Standard Operating Procedures for CSO Facilities

1 PURPOSE

To provide procedures for the safe and efficient operation of the first Greenhill CSO Storage Tank (HCS01).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of the wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
DWQMS	Drinking Water Quality Management System
MLD	Mega Litres per Day
PO	Plant Operations
PW	Public Works
RHCSI	Red Hill Creek Sanitary Interceptor
SCADA	Supervisory Control and Data Acquisition
SFT	Sediment Flushing Tank
SG	Sluice Gate
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to Superintendent, Wastewater Process and Superintendent of Operations
- Work with Superintendent, Wastewater Treatment Process to develop a corrective action plan and to implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop a corrective action plan and implement it to resolve any issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Greenhill CSO Tank #1 (HCS01) is located at the east end of Greenhill Avenue behind Rosseau Road, north of Rosedale Arena.

The HCS01 tank functions as a second CSO storage facility to capture overflows from the HCS06 tank. This document identifies procedures for the normal operation of HCS01, as well as operation of HCS01 if HCS06 is taken offline.

There is no backup power available at this station. In the event of a power failure, a portable 100 kW (600 V, 3PH) generator must be mobilized to the site.

Hydro Services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the Greenhill CSO Tank is considered a confined space (CS).

5.1.3 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.4 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.5 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.6 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out/Tagging PW-WW-PO-P-019-003).

5.1.7 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

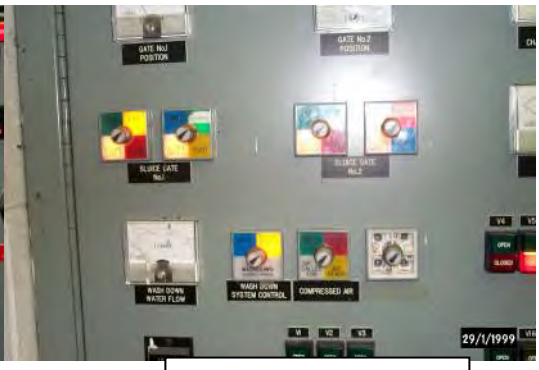
5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and a Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person.

5.2.1 Fill out and execute a Confined Space Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or Cell 905-570-6124) of your intent to enter the tank. Ensure that there is no impending rain in the weather forecast, the upstream HCS06 tank cells are empty, that the HCS01 tank cells have been cleaned and are empty, and that the washing system is turned off/isolated.

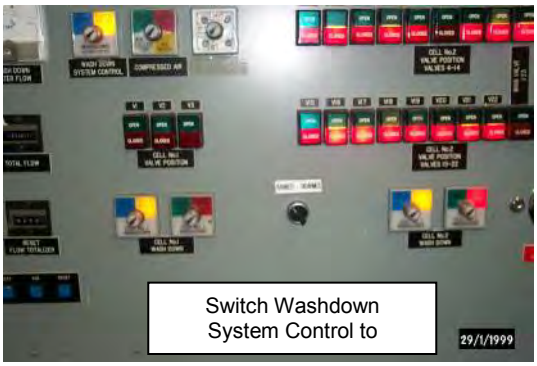
5.2.2 Sluice Gates: Ensure that no flow will be detained in the tank by placing gates SG1 and SG2 in the fully “Open” position. This will convey all flow directly into the Red Hill Creek Sanitary Interceptor (RHCSI) sewer. Contact the Process Supervisor and ensure that the gates are in the fully “Open” position. Place both gates in the Hand/Local mode to ensure the gates positions cannot be changed remotely via SCADA. The control panel is located in the building above the tank. Use the door on the north side of the building. Shut off the intrusion alarm.

Disarm the Intrusion



Open Sluice Gates 1&2 then place in "Hand" mode

5.2.3 When entering the tank, ensure that the tank has been flushed, and that the flushing system has been switched to "Station" mode.



Switch Washdown System Control to

5.2.4 The CSO tank cells have no mechanical/electrical ventilation system. Access to both cells of HCS01 is through access doors located in the main building on the south perimeter of the tank. Stairs on the north side lead into Cell 1, and on the south side, into Cell 2. There are no access hatches to open on either cell for ventilation. There is a buried access port atop Cell 2. Exercise care when entering the tank, as the steps can be slippery.

5.2.5 Personnel entering the tank shall carry a two-way radio; wear a chemical suit, breathing apparatus, fall arrest, personnel extraction equipment, and chemical protective gloves. Intrinsically safe portable lighting and a fully charged flashlight is necessary for lighting.

5.2.6 At least one person in full gear, equipped with a two-way radio and flashlight should remain outside the tank at all times, holding the lifeline, maintaining the Confined Space Entry Permit and communicating with the person/persons inside the tank via a two-way radio.

5.2.7 The outside person should initiate contact with the person in the tank every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.8 After all personnel have vacated the tank, secure all hatches.

5.2.9 Notify the Process Supervisor that the tank entry has been completed.

5.3 Process and Equipment Overview

5.3.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. In some areas, the CSOs are captured by underground detention storage tanks that store the sewage during wet weather. The CSO tanks are filled by gravity, and when flows subside after a rainstorm, their liquid contents are drained and/or pumped back into the combined sewer system and conveyed the WWTP where they receive treatment. Floating debris is retained in the tanks by a system of underflow baffles, and large volumes of solids settle to the bottom of the tanks while the sewage is detained in them. After the liquid contents of the tanks are conveyed to the WWTP, these solids remain on the bottom of the tanks. To reduce odours from the CSO tanks, the solids are washed from the tank floors by sediment flushing tanks (SFTs), commonly referred to as tipping buckets, or by high-pressure water spray nozzles (as is the case for HCS01).

NOTE: HCS01 cannot be washed out by the spray nozzle system and must be washed manually with fire hoses.

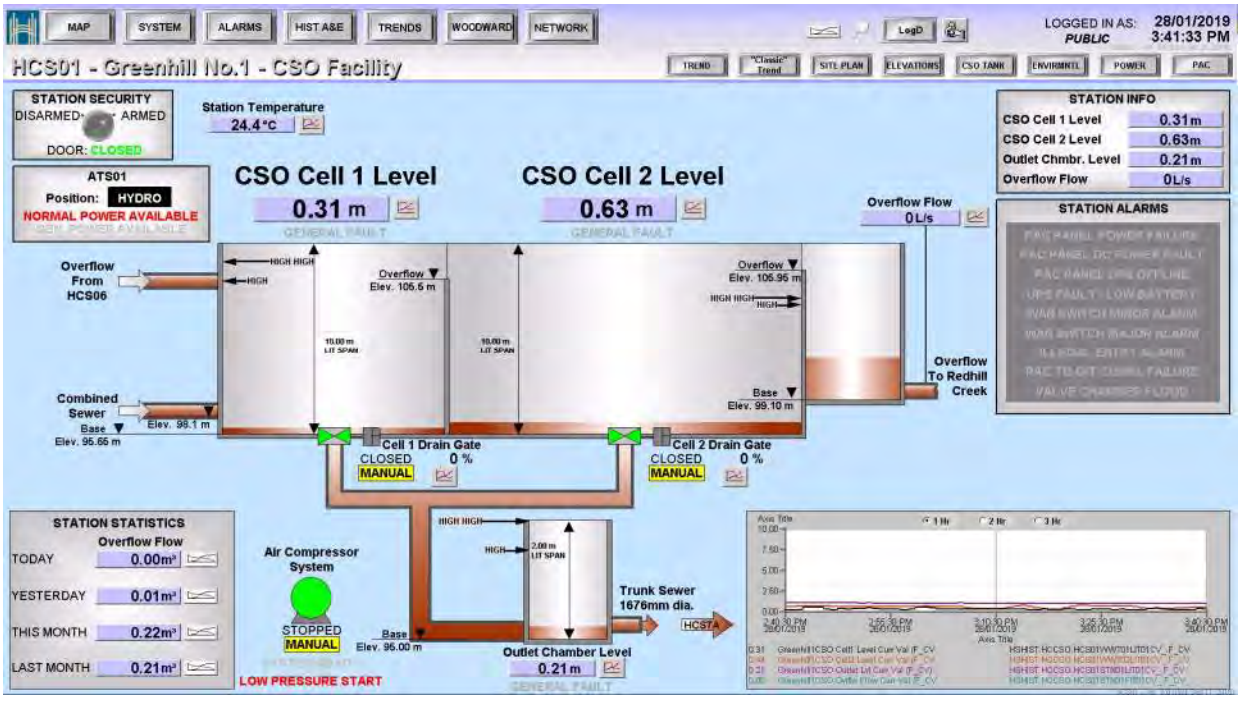
5.3.2 The Greenhill CSO Tank #1 (HCS01) is an underground reinforced concrete structure, which provides approximately 83,500 m^3 of CSO storage capacity, which was designed to capture the runoff from generated by a 15 mm design storm. The storage volume is provided within a circular tank, which is approximately 54 m in diameter and 9 m deep, and includes two separate storage cells. The first cell provides approximately 13,900 m^3 of storage. If the first cell fills, the second cell provides approximately 69,600 m^3 of additional storage. Normally, HCS01 will receive the overflow from HCS06 and act as a secondary CSO storage facility. When HCS06 is out of service, flow from the tank into the Red Hill Creek Sanitary Interceptor (RHCSI) is regulated by two motorized sluice gates, which can be controlled from the Woodward Avenue WWTP to regulate the rate of flow from the two storage cells. The first gate is typically set to allow sanitary sewage to flow straight through Cell 1 and into the RHCSI, which in turn conveys the sewage directly to the WWTP. Only when

the inflows to the tank exceed the threshold of this gate, does the storage tank begin to fill; first Cell 1, and then Cell 2. If Cell 2 also fills, CSOs from the tank are discharged to the Red Hill Creek via an outfall sewer located on the east side of the tank. Stainless steel underflow baffles are employed above the tank overflow in Cell 2 to retain floatable materials within the tank, and these are subsequently conveyed to the WWTP via the RHCSI.

5.3.3 Combined sewage retained in the tank during wet weather is subsequently drained by gravity into the RHCSI and conveyed to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The rate of drainage from the tank is regulated by the two WWTP-controlled gates, based upon the current inflows at the WWTP.

5.3.4 The entire facility is monitored and controlled via SCADA by plant operations staff. The SCADA system includes a security system to advise of any unauthorized entries into the control building.

5.4 Greenhill CSO Tank #1 (HCS01) SCADA Screen



5.5 Dry Weather Operation

5.5.1 During normal dry weather operation, HCS01 receives the overflow from HCS06 and both of the sluice gates are normally closed. During dry weather operation with HCS06 out of service, the sluice gates are normally completely open.

5.5.2 To set the opening of Sluice Gate 1 (SG1) to 100% via the SCADA system:

1. Go to the HCS01 screen
2. Select "SG1" and enter a gate position set point of 100%

5.5.3 To set the opening of Sluice Gate 2 (SG2) to 100% via the SCADA system:

1. Go to the HCS01 screen
2. Select "SG2" and enter a gate position set point of 100%

Typically, the Outlet Chamber Level during dry weather is in the 0.10-0.30 m range.

5.6 Wet Weather Operation

5.6.1 CSO enters the storage tanks by gravity, but the rate of filling of the tanks can be increased by closing the motorized gates at HCS01 and HCS06. This wet weather operation mode begins at the Greenhill CSO Tanks, and is initiated when:

- The flow rate into the Woodward Avenue WWTP exceeds 370 MLD; and
- The wet well level at the Woodward Avenue WWTP exceeds 66 m

5.6.2 To fill the tank, the sluice gates must be at least partially closed. This standard operating procedure is to completely close the gates, to provide maximum protection of the Woodward Avenue WWTP, and the maximum rate of filling of HCS01.

NOTE: If HCS01 overflows to the Red Hill Creek, a pop up will appear on the SCADA screen directing the Operator to a CSO Overflow Notification List (PW-WW-PO-L-011-004) which outlines specific instructions to be followed for this CSO overflow.

5.6.3 To close Sluice Gate 1 (SG1) to 0% via the SCADA system:

1. Go to the HCS01 SCADA screen
2. Select "SG1" and set gate position to 0% Open

5.6.4 To close Sluice Gate 2 (SG2) to 0% via the SCADA system:

1. Go to the HCS01 SCADA screen
2. Select "SG2" and set gate position to 0% Open

5.7 Emptying the Tank following a Rainfall Event

5.7.1 The CSO tank drains entirely by gravity. The decision to begin draining the tank is based upon the wet well level at the Woodward Avenue WWTP and/or the flow rate into the plant. Drainage begins when plant inflows drops below 350 MLD.

5.7.2 Following a storm, the Greenhill tanks are emptied first. Drain HCS06 before draining HCS01

5.7.3 Begin by opening SG1 to 5% and once Cell 1 has emptied, empty Cell 2.

5.7.4 Set the opening of Sluice Gate 1 (SG1) to 5% via the SCADA system:

1. Go to the HCS01 SCADA screen
2. Select "SG1" and set gate position to 5% Open

5.7.5 When Cell 1 is empty, set the opening of Sluice Gate 2 (SG2) to 5% via the SCADA system:

1. Go to the HCS01 SCADA screen
2. Select "SG2" and set gate position to 5% Open

5.7.6 As flow to the WWTP subsides, the gates can be opened up in increments of 5% but be sure to monitor the CSO outlet chamber level and not let it exceed 0.60 m in order to control flow to the WWTP.

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Operations Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Bar Screens, visual inspection to confirm not blocked by debris
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS01, annual position checks and exercising of all sluice gates associated with the facility to confirm they are in proper working order.

6.1.3 Specific to HCS01, annual calibration of CSO Tank Overflow flow metering system.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- CSO Overflow Notification List – PO Level IV - PW-WW-PO-L-011-004
- Greenhill No. 1 CSO Tank (HCS01) Process Control Narrative, Version 2.4
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Bayfront Park (Strachan Street) CSO Storage Tank (HCS02).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance Staff and Superintendents involved in operations of the wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
ECA	Environmental Compliance Approval
MECP	Ministry of Environment, Conservation and Parks
MLD	Mega Litres per Day
ORO	Overall Responsible Operator
PO	Plant Operations
PW	Public Works
SCADA	Supervisory Control and Data Acquisition
SFT	Sediment Flushing Tank
WSI	Western Sanitary Interceptor
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance and Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to Superintendent, Wastewater Process and Superintendent of Operations
- Work with Superintendent, Wastewater Treatment Process to develop a corrective action plan and to implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop a corrective action plan and implement it to resolve any issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Bayfront Park CSO Tank (HCS02) is located at Bayfront Park, off Harbour Front Drive, at the west end of Strachan Street.

This document identifies procedures for the normal operation of HCS02, as well as procedures for confined space entry into the underground storage tank.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the Bayfront Park CSO Tank is considered a confined space (CS).

5.1.3 Smoking is not permitted inside the tank, the adjoining HC003 control building, or the influent and effluent sampling huts.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.6 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out/Tagging PW-WW-PO-P-019-003).

5.1.8 Two persons trained and certified in confined space entry must be present at all times (one inside and one outside), and confined space entry protocol must be followed.

5.1.9 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and a Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by More Than One Person.

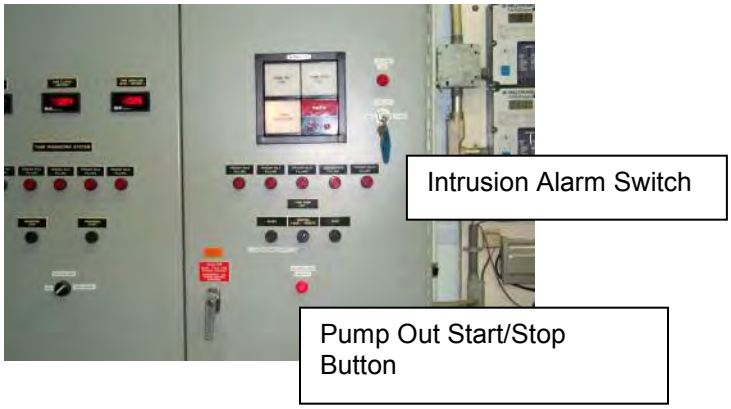
5.2.1 Fill out and execute a Confined Space Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or Cell 905-570-6124) of your intent to enter the tank. Ensure that there is no impending rain in the weather forecast, the tank has been cleaned and is empty, the pumps are turned on, and the washing system is turned off.

5.2.2 When entering the control room, shut off the intrusion alarm. Press the "Washdown Stop" button to ensure the washdown cycle has not been initiated.

5.2.3 Maintenance Bypass: A Maintenance Bypass of the CSO Tank is provided at Manhole HG06E052, where the influent sewer and CSO tank outfall sewer connect. Closing the Tank Inlet Gate on the east wall of the manhole (located just to the north of the influent sampling chamber) and opening the two Maintenance Bypass Gates on the north wall of the same manhole, diverts any flow in the upstream sewer to the CSO tank outfall sewer. The gates in this manhole should only be operated in this manner when tank entry is absolutely necessary during wet weather conditions. Proper authorities must be notified of any plans to employ such by-pass, and spill notification procedures should be followed.

NOTE: The two Maintenance Bypass Gates are locked in the Full Closed position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Hamilton Harbour at the is location. They should only be opened for maintenance purposes with the approval of the Overall Responsible Operator (ORO) and notification to the Ministry of Environment, Conservation and Parks (MECP) as per the Environmental Compliance Approval (ECA) for the facility.

5.2.4 Ensure minimum flow will enter the tank by turning all pumps to "Auto" (3 pumps in the Strachan Street Pumping Station (HC003) and 2 pumps in the CSO tank) at the control panel. Initiate tank pump out by pressing the tank pump out "Start" button.



5.2.5 The CSO tank has no mechanical/electrical ventilation or lighting. Ventilation is provided by opening the access hatches above the sediment flushing tanks (SFTs). Open all SFT access hatches to the storage cell or cells you are going to enter (10 hatches on the west side for Cell 1, and 10 hatches on the east side for Cell 2). Also open the hatches to all secondary accesses (i.e. manholes in the northwest corner of Cell 1 and northeast corner of Cell 2). The tank's primary access points are the staircases on either side of the centre wall of the tank, beginning at the east wall. The south set of stairs accesses Cell 1, and the north set accesses Cell 2. Exercise care when entering the tank, as the steps can be slippery. The person **inside the tank** should carry a fully charged flashlight.

5.2.6 At least one person equipped with a two-way radio and flashlight should remain outside the tank at all times, holding the lifeline, maintaining the Confined Space Entry Permit and communicating with the person inside the tank via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.7 The outside person should initiate contact with the person in the tank every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.8 A portable gas detector should be used to determine if the air inside the tank is safe for entry. The gas detector should remain with the person/persons inside the tank and should be turned on at all times. If the gas detector alarm sounds at any time, all personnel inside the tank should exit immediately. Re-entry should only be attempted using fully charged breathing apparatus.

5.2.9 After all personnel have vacated the tank, secure all access hatches.

5.2.10 At the control panel, reset the controls for the washing system and pumps to the "Remote" mode. Reinstate the intrusion alarm and secure the door.

5.2.11 Notify the Process Supervisor that the tank entry has been completed.

5.3 PROCESS AND EQUIPMENT OVERVIEW

5.3.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and storm water runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. In some areas, the CSOs are captured by underground detention storage tanks that store the sewage during wet weather. The CSO tanks are filled by gravity, and when flows subside after a rainstorm, their liquid contents are drained and/or pumped back into the combined sewer system and conveyed the WWTP where they receive treatment. Floating debris is retained in the tanks by a system of underflow baffles, and large volumes of solids settle to the bottom of the tanks while the sewage is detained in them. After the liquid contents of the tanks are conveyed to the WWTP, these solids remain on the bottom of the tanks. To reduce odours from the CSO tanks, the solids are washed from the tank floors by sediment flushing tanks (SFTs), commonly referred to as tipping buckets, or by high-pressure water spray nozzles. HCS02 employs SFTs for tank cleaning.

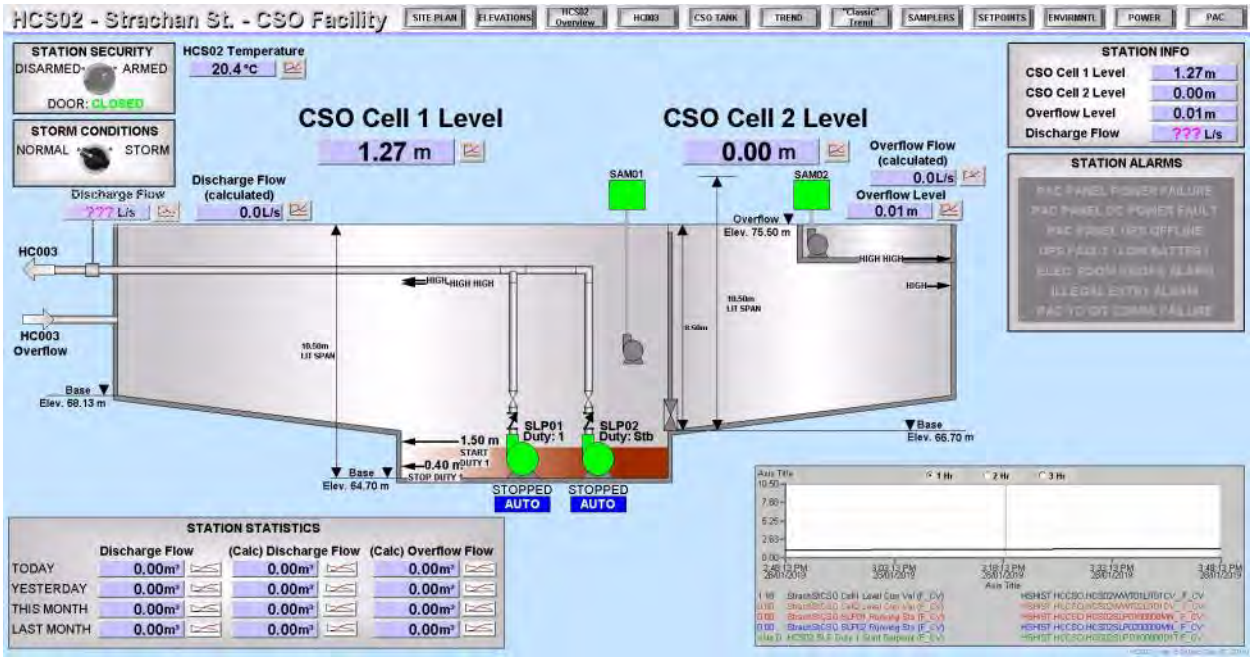
5.3.2 The Bayfront Park CSO Tank (HCS02) covers an area of approximately 3,200 m^2, and is over 6 m deep, providing approximately 21,000 m^3 of CSO storage capacity in two equally sized storage cells. A new 4.0 m x 1.5 m box sewer (which later changes to 2250 mm) was constructed to intercept the CSOs from the former Queen and Hess Street CSO outfalls and convey them to the CSO tank. The two outfalls were replaced by a single outfall to carry the overflow from the CSO tank on the infrequent occasions when the tank is filled. The new outfall discharges to the Harbour at the east end of the inlet which separates the park and the railway lands. The Bayfront Park CSO Tank operates off-line, meaning that combined sewage is only diverted into the facility during larger CSO events. This reduces the potential for odours and reduces tank cleaning costs. 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). During dry weather, all flow is directed to the WWTP via the CSO regulators and the three (3) dry pit pumps in the pumping station (1 x 394 L/s and 2 x 1,232 L/s).

5.3.3 During wet weather, excess flows from the three 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 new 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. 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/sec 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. Solids that settle from the combined sewage detained in the CSO tank, and floatable materials retained in the tank by the underflow baffles, are washed from the floor by ten (10) SFTs. The SFTs are large stainless steel buckets, which are suspended above and along the west wall of the CSO tank, about 6 m above the floor. The SFTs are filled with potable water, and when full, they tip and empty their contents down the back walls of the tank. The flush water continues down the sloped floor of the tank at a high velocity and washes the solids from the floor. Washwater from the SFTs is collected in a trough at the bottom of the tank and is also pumped back into the combined sewer system and conveyed to the WWTP for treatment.

5.3.4 Two automatic water quality samplers are provided to sample the influent and effluent from the CSO tank, as per its Certificate of Approval/Environmental Compliance Approval. The influent sampler collects its samples from Manhole 3, where the incoming box sewer changes from 4.0 m x 1.5 m to 2250 mm. The effluent sampler collects it samples from the tank overflow channel at the north end of Cell 2. The samplers are housed in above ground huts located adjacent to each sampling location.

5.3.5 The entire facility is monitored and controlled via SCADA by plant operations staff. 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.

5.4 Bayfront Park (Strachan St.) CSO Tank (HCS02) SCADA Screen



5.5 Dry Weather Operation

5.5.1 Set pumps at the Bayfront Park Pumping Station to “Enable/Dry” mode through the SCADA system:

1. Go to the HCS02 SCADA screen
2. Select Pumping Station System Control “Enable/Dry”

5.5.2 Set pumps in the tank to “Start/Dry” through the SCADA system:

1. Go to the HCS02 SCADA screen
2. Select CSO Pumps System Control “Start/Dry”

5.6 Wet Weather Operation

5.6.1 CSO enters the storage tank cells by gravity, but the rate of filling of the tank cells can be increased by closing motorized gates and/or disabling pumps at each of the facilities. This wet weather operation mode begins at the Greenhill CSO Tank, and is initiated when:

- The Woodward Avenue WWTP exceeds 66 m, and
- The flow rate into the Woodward Avenue WWTP exceeds 370 MLD

As the flow rate at the plant increases, filling rates at other facilities are also increased.

5.6.2 And set the pumps in the CSO tank to "Stop/Storm" via the SCADA system:

1. Go to the HCS02 SCADA screen
2. Select CSO Pumps System Control "Stop/Storm"

5.7 Emptying the Tank Following a Rainfall Event

5.7.1 Following a storm, when the Woodward Avenue WWTP can accept more flow, the James Street and Greenhill CSO tanks are emptied first. When Gate 1 at the Greenhill facility is 10% open, the remaining tanks are emptied in this order: Main/King, Bayfront Park, and then Eastwood Park.

5.7.2 For the Bayfront Park CSO Tank, set the pumps at the Strachan Street Sewage Pumping Station (HC003) to "Enable/Dry" mode via the SCADA system:

1. Go to the HCS02 SCADA screen
2. Select Pumping Station System Control "Enable/Dry"

5.7.3 And set the pumps in the CSO tank to "Start/Dry" through the SCADA system:

1. Go to the HCS02 SCADA screen
2. Select CSO Pumps System Control "Start/Dry"

5.8 Washing the Tank Following a Rainfall Event

5.8.1 Ensure all pumps are on. When the level in the tank drops below 1.5m, tank washing may commence via the SCADA system:

1. Go to the HCS02 SCADA screen
2. Select "Start Wash" from the CSO Wash Tank box

If excessive sediment buildup has occurred due to the tank not being flushed between storms or the contents of the tank being detained for an extended period of time, a second flushing is recommended.

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers

- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Bar Screens, visual inspection to confirm not blocked by debris
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS02, annual position checks and exercising of all sluice gates associated with the facility to confirm they are in proper working order (except the Influent Well Overflow Gate, which has been padlocked in the Fully Closed position).

6.1.3 Specific to HCS02, annual calibration of CSO Tank Overflow flow metering system.

6.2 Monthly Inspections

6.2.1 Specific to HCS02, monthly inspections of the Tank Inlet Gate and two Maintenance Bypass Gates in the chamber near the end of the CSO Tank Outfall channel to confirm the Tank Inlet Gate is the Fully Open position and that the two Maintenance Bypass Gates are both in the Fully Closed Position and that no sewage is leaking through these gates. The latter can be accomplished by visual inspection of the CSO Tank Outfall Channel on the north side of the gates, which can be viewed from above by opening the access hatch cover on top of the inlet/bypass chamber. Additional lighting may be required to see well enough to confirm no flow is passing through the bypass gates.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- CSO Overflow Notification List – PO Level IV - PW-WW-PO-L-011-004
- Strachan St. (Bayfront Park) CSO Facility (HCS02) and WWPS (HC003) Process Control Narrative, Version 1.3
- O-M1 Wastewater Station Inspection (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the James Street CSO Storage Tank (HCS03) and Ferrie/Mary Sluice Gates (HCG08).

2 SCOPE

This procedure applies to all operations staff including: plant operators, process supervisors, maintenance staff and superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
EME	Environmental Monitoring and Enforcement
MLD	Mega Litres per Day
PO	Plant Operations
PW	Public Works
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
WSI	Western Sanitary Interceptor
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The James Street CSO Tank (HCS03) is located at the north end of James Street North, at Guise Street. The off-line storage tank is augmented by additional in-line storage created within the combined sewer downstream of the tank, by the Mary/Ferrie Sluice Gates (HCG08) located at the intersection of Mary/Ferrie Streets.

This document identifies procedures for the normal operation of HCS03 and HCG08, as well as procedures for confined space entry into the underground storage tank and sluice gate chamber.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the off-line storage tank and the underground chamber that contains the Ferrie/Mary sluice gates are both considered a confined space (CS).

5.1.3 Smoking is not permitted inside the CSO tank or the Mary/Ferrie sluice gate chamber.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.6 Ensure that the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out / Tagging PW-WW-PO-P-019-003).

5.1.8 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Process and Equipment Overview

5.2.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. In some areas, the CSOs are captured by underground detention storage tanks that store the sewage during wet weather. The CSO tanks are filled by gravity, and when flows subside after a rainstorm, their liquid contents are drained and/or pumped back into the combined sewer system and conveyed the WWTP where they receive treatment. Floating debris is retained in the tanks by a system of underflow baffles, and large volumes of solids settle to the bottom of the tanks while the sewage is detained in them. After the liquid contents of the tanks are conveyed to the WWTP, these solids remain on the bottom of the tanks. To reduce odours from the CSO tanks, the solids are washed from the tank floors by sediment flushing tanks (SFTs), commonly referred to as tipping

buckets, or by high-pressure water spray nozzles. HCS03 employs water spray nozzles for tank cleaning.

5.2.2 The James Street CSO Storage Facility (HCS03) incorporates both off-line and in-line storage components, which provide a total CSO storage capacity of approximately 3,200 m^3. The off-line storage tank is an underground, reinforced concrete structure, which resides beneath the parking lot of the Royal Hamilton Yacht Club, located at the north end of James Street. The rectangular tank covers an area of approximately 900 m^2, and is 0.8 to 2.1 m deep, providing approximately 1,500 m^3 of CSO storage capacity. The off-line storage capacity is augmented by 1,800 m^3 of in-line storage, which is provided within the 1500 mm diameter combined sewer downstream of the CSO tank. The additional in-line storage is created by the Mary/Ferrie CSO Sluice Gates (HCG08). The Mary/Ferrie sluice gates control the rate of flow from the James combined sewer system into the Western Sanitary Interceptor (WSI) at Mary and Ferrie Streets. In dry weather, the gate is set to allow all flow to enter the WSI.

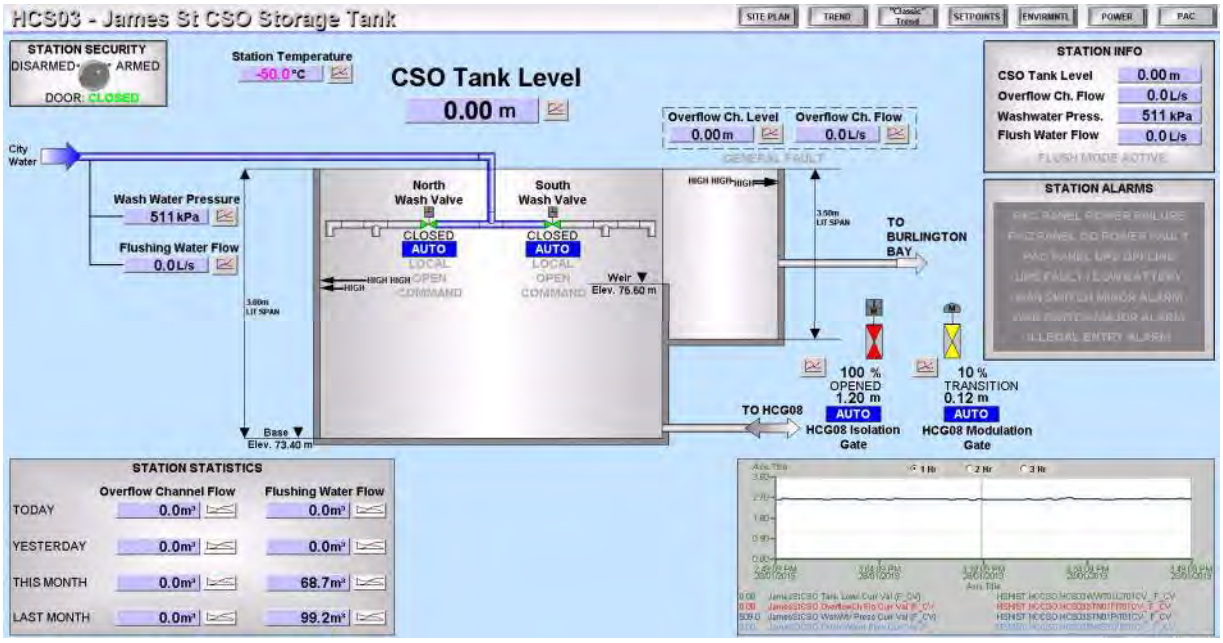
NOTE: When in auto mode the Mary/Ferrie Sluice Gates (HCG08) function as part of the Real Time Control (RTC) system, and will automatically close the isolation gate when the southern branch of the Western Sanitary Interceptor (WSI) reaches a high level.

5.2.3 During wet weather, 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 gate. 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 1200 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 Mary/Ferrie gates, which can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

5.2.4 Solids that settle from the combined sewage detained in the CSO tank, and floatable materials retained in the tank by the underflow baffles, are washed from the floor by high-pressure water spray nozzles located around the perimeter of the tank, and are also conveyed to the WWTP for treatment.

5.2.5 The entire facility is monitored and controlled via SCADA by plant operations staff.

5.3 James Street CSO Tank (HCS03) and Ferrie/Mary Sluice Gates (HCG08) SCADA Screen



5.4 Dry Weather Operation (Manual)

Manually open the Mary/Ferrie Sluice Gate (HCG08) via the SCADA system:

1. Go to the HCG08 screen on SCADA
2. Switch station control to manual
3. Select “HCG08 Isolation Gate” and set to “Open”

5.5 Wet Weather Operation

NOTE: When in Auto mode the HCG08 Mary/Ferrie sluice gates function as part of the Real Time Control (RTC) system and will automatically close the isolation gate when the southern branch of the WSI reaches a high level.

5.5.1 When three (3) pumps are operating at the Woodward Avenue WWTP during an extreme storm and bypassing is imminent (Flow > 614MLD), set the Mary/Ferrie Sluice Gate (HCG08) to “Closed” via the SCADA system:

1. Go to the HCG08 screen on SCADA
2. Switch station control to manual
3. Select “HCG08 Isolation Gate” and set to “Closed”

NOTE: When putting the CSO tank in service, notification must be given to the Supervisor of Environmental Monitoring and Enforcement (EME) at Extension 5678. When the CSO tank overflows, refer to the CSO Overflow Notification list (CSO Overflow Notification List PW-WW-PO-L-011-004).

5.6 Emptying the Tank Following a Rainfall Event

5.6.1 The CSO tank drains entirely by gravity. The decision to begin draining the tank is based upon the wet well level at the Woodward Avenue WWTP and/or the flow rate into the plant. Drainage begins when plant inflows drop below 350 MLD.

5.6.2 Emptying the tank can be done by either placing HCG08 station control to Auto or manually opening the Mary/Ferrie Sluice Gate (HCG08) via the SCADA system:

1. Go to the HCG08 screen on SCADA
2. Switch station control to manual
3. Select “HCG08 Isolation Gate” and set to “Open”

5.7 Washing the Tank Following a Rainfall Event

5.7.1 The CSO tank should be cleaned after each use. When the sewage level in the tank has dropped below 0.1 m, tank washing may commence via the SCADA system:

1. Go to the HCG08 screen on SCADA
2. Select Start on the Wash Tank icon

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City’s O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers

- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Bar Screens, visual inspection to confirm not blocked by debris
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS03, annual position checks and exercising of all sluice gates associated with the facility to confirm they are in proper working order.

6.1.3 Specific to HCS03, annual calibration of CSO Tank Overflow flow metering system.

7 ASSOCIATED DOCUMENTS

- CSO Overflow Notification List PW-WW-PO-L-011-004
- Lock Out / Tagging PW-WW-PO-P-019-003
- Confined Space Procedure – Plant Operations Section PW-WW-PO-P-019-001
- Confined Space Program PW-WW-P-019-001
- Confined Space Hazard Assessment Form Template- Plant Operations - Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – Plant Operations Level IV PW-WW-PO-F-019-003
- Confined Space Plan PW-WW-PO-F-019-001
- James Street CSO Facility (HCS03) Process Control Narrative, Version 2.5
- O-M1 Wastewater Station Inspections (James CSO) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Main/King CSO Storage Tank (HCS04).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
MLD	Mega Litres per Day
PO	Plant Operations
PW	Public Works
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
SG	Sluice Gate
SFT	Sediment Flushing Tank
WSI	Western Sanitary Interceptor
WW	Wastewater
WWPS	Wastewater Pumping Station
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Main/King CSO Tank (HCS04) is located in Cathedral Park, in the area bounded by King Street/Dundurn Street/Main Street/Highway 403. Inflows to the CSO tank are regulated by three external sluice gates, installed in Chamber 1 (on Glen Road), Chamber 4 (near the northwest corner of the tank) and Chamber 5 (just outside the control building).

This document identifies procedures for the normal operation of HCS04 (and the gates in Chambers 1, 4 and 5), as well as procedures for confined space entry into the underground storage tank and sluice gate chambers.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the storage tank and the underground gate chambers are all considered a confined space (CS).

5.1.3 Smoking is not permitted inside the CSO tank or the sluice gate chambers.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.6 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out / Tagging PW-WW-PO-P-019-003).

5.1.8 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person.

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter the tank. Ensure that there is no impending rain in the weather forecast, the tank floor has been cleaned and is empty, and the washing system is turned off. The tank may have some liquid in it. Entry can be made so long as gas levels are within acceptable levels.

5.2.2 When entering the control room, shut off the intrusion alarm. Exhaust fans and lights should be turned on from the panel prior to entering the tank.

5.2.3 When entering either storage cell, ensure that the tank has been flushed and the flushing system has been locked out. Ensure that no flow will enter the tank in dry weather by placing Gates 4 and 5 in the fully open position and maintaining the opening for Gate 1 at 35%, which will direct dry weather flow into the Western Sanitary Interceptor sewer. Lock out of gates 4 and 5 is not needed unless you are entering the chambers for each. Gates should be confirmed to be in open position with Process Supervisor before entry is done. The tank cannot be washed every time there is an entry. Gas testing will determine if the tank needs to be washed. If there is no gas, then there is no need to wash the tank.

5.2.4 Leave all pumps in “Auto” position to ensure that any flow into the tank is pumped out.

5.2.5 Exercise care when entering the tank, as the steps can be slippery.

5.2.6 Do not enter if the portable Methane Detection System does not register “OK”. Personnel inside the tank should carry and use a portable gas detector.

5.2.7 At least one person equipped with a two-way radio and flashlight should remain outside the tank at all times, maintaining the "Confine Space Entry Permit" and communicating with the person inside the tank via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.8 The person outside the tank should initiate contact with the person in the tank every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.9 Notify the process supervisor when leaving the site. Remove all lockouts and return all gates to "Remote" mode. Shut off all lights and exhaust fans. Reinstate the intrusion alarm and secure all doors.

5.3 Process and Equipment Overview

5.3.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. In some areas, the CSOs are captured by underground detention storage tanks that store the sewage during wet weather. The CSO tanks are filled by gravity, and when flows subside after a rainstorm, their liquid contents are drained and/or pumped back into the combined sewer system and conveyed the WWTP where they receive treatment. Floating debris is retained in the tanks by a system of underflow baffles, and large volumes of solids settle to the bottom of the tanks while the sewage is detained in them. After the liquid contents of the tanks are conveyed to the WWTP, these solids remain on the bottom of the tanks. To reduce odours from the CSO tanks, the solids are washed from the tank floors by sediment flushing tanks (SFTs), commonly referred to as tipping buckets, or by high-pressure water spray nozzles. HCS04 employs SFTs for tank cleaning.

5.3.2 The Main/King CSO Tank (HCS04) covers an area of approximately 9,500 m^2, and is over 8 m deep, providing approximately 77,100 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 23,300 m^3 of storage, and the second provides a further 53,800 m^3 of storage. The Main-King CSO Tank operates off-line, with combined sewage entering the tank during larger CSO events. Flow into the tank is regulated by three WWTP-controlled CSO regulators which 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 eliminated by installing a new WWTP-controlled CSO regulator gate at Glen/Macklin

(Chamber 1) and constructing a new 1350 mm diameter sewer to convey CSOs underneath Hwy 403 and into the new CSO tank. The former McKittrick CSO Outfall, which previously diverted CSOs from the 1980 mm diameter combined sewer which runs along the north side of the Main Street, was eliminated by constructing a new WWTP-controlled CSO regulator (Chamber 4) to divert CSOs into the new tank. Flow from the 2100 mm x 2250 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.

5.3.3 During dry weather, flow is directed to the WWTP via the interceptor sewer. The gate in Chamber 4 (King Street Sewer) should be 100% opened and Chamber 5 (Interceptor Sewer) at 30% and 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 tank's wet well and pumped into the Western Sanitary Interceptor (WSI) sewer.

NOTE: The gate in Chamber 4 is presently without power and communication with SCADA. The gate has been manually set to divert wet weather flows mainly to the CSO tank.

5.3.4 The CSO tank 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). Under normal operating conditions, this gate should remain Fully Closed at all times, under all flow conditions.

NOTE: The Influent Well Overflow Gate has been closed and padlocked in the Fully Closed position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Chedoke Creek. Access to the gate for control purposes has also been removed from the SCADA system.

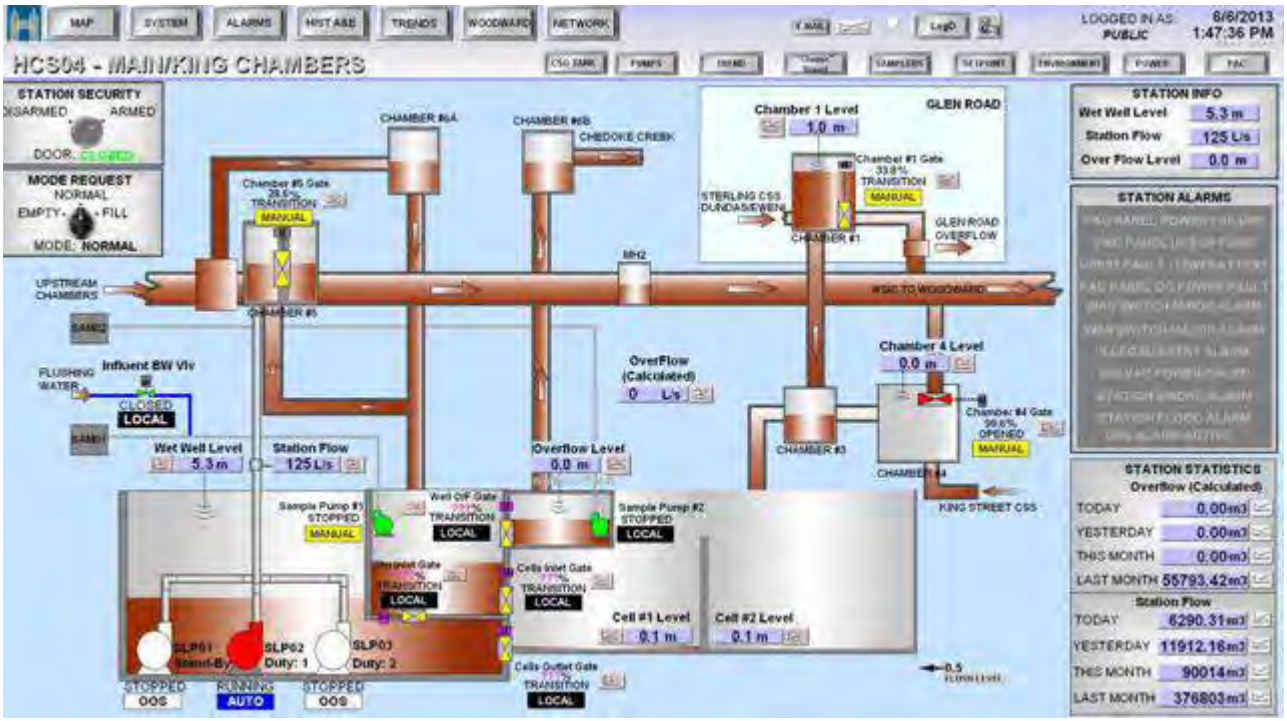
5.3.5 During wet weather, the pumps are taken out of auto mode and turned off; the opening of Gate 4 is reduced to 7%; and the opening of Gate 5 is reduced to 2%. Excess flows from the three regulators enters the pumping station wet-well, which is located beneath the control building at the south-east 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 remaining 2100 mm x 2250 mm box culvert. Stainless steel underflow baffles are employed above the tank

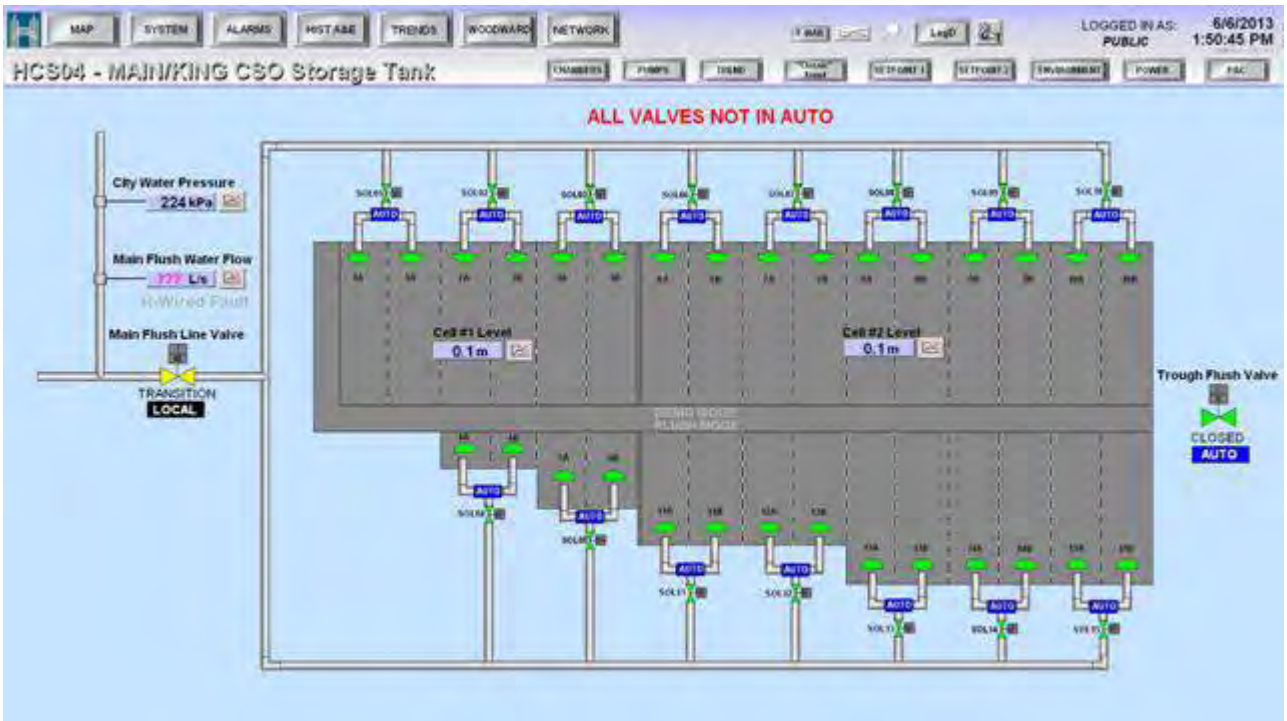
overflow in Cell 2 to retain floatable materials within the tank. Combined sewage retained in the tank during wet weather is subsequently returned to the CSS and conveyed by the WSI to the WWTP for treatment during dry weather, when the plant can deal with the additional flow. The tank is drained by three (3) 375 L/sec 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 1980 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.

5.3.6 Solids that settle from the combined sewage detained in the CSO tank, and floatable materials retained in the tank by the underflow baffles, are washed from the floor by a series of 30 SFTs, and also conveyed to the WWTP for treatment. The SFTs are large stainless steel buckets, which are suspended above and along the west wall of the CSO tank, about 8 m above the floor. The SFTs are filled with potable water, and when full, they tip and empty their contents down the back walls of the tank. The flush water continues down the sloped floor of the tank at a high velocity and washes the solids from the floor. Washwater from the SFTs is collected in a trough at the bottom of the tank and is also pumped back into the combined sewer system and conveyed to the WWTP for treatment.

5.3.7 The entire facility is monitored and controlled via SCADA by plant operations staff. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station.

5.4 Main/King CSO Tank (HCS04) SCADA Screen





5.5 Dry Weather Operation

5.5.1 In Normal mode, during dry weather operation, HCS04 operates as a typical wet well pumping station, with the pump station isolated from the CSO storage tank.

5.5.2 The gates in Chambers 1, 4 and 5 should be in the following positions:

- Chamber 1 Gate = 35% Open
- Chamber 4 Gate = 100% Open
- Chamber 5 Gate = 30% Open

5.5.3 And the gates in the pump station should be in the following positions:

- PS Inlet Gate = 100% Open
- CSO Tank Inlet Gate = 50% Open
- CSO Tank Outlet Gate = 100% Open

NOTE: The gate in Chamber 1 (Glen Road) should always be set to 35% Open, in all flow conditions, and should never be opened more than 35%.

5.6 Wet Weather Operation

5.6.1 To fill the Main/King CSO Tank, the various sluice gates should be placed in the following positions:

- Chamber 1 Gate = 35% Open
- Chamber 4 Gate = 7% Open
- Chamber 5 Gate = 2% Open
- PS Inlet Gate = 100% Open
- CSO Tank Inlet Gate = 100% Open
- CSO Tank Outlet Gate = 100% Open

5.7 Emptying the Tank following a Rainfall Event

5.7.1 The Main/King CSO Tank drains entirely by gravity, through the CSO Tank Influent Well and Pump Station Wet Well, and then back through Chamber 5, from which point the drained flows are conveyed by gravity via the Western Sanitary Interceptor (WSI) to the Woodward Avenue WWTP. The decision to begin draining the tank is based upon the wet well level at the Woodward Avenue WWTP and/or the flow rate into the plant. Drainage begins when plant inflows drops below 320 MLD.

5.7.2 Following a storm, the James Street and Greenhill tanks are emptied first. When Gate 1 at the Greenhill facility is 10% open, the remaining tanks are emptied in this order: Main/King, Bayfront Park, and then Eastwood Park.

5.7.3 As flow to the plant subsides, the gates can be opened up in increments of 5%. When the openings of the Greenhill Sluice Gates are both 10%, drainage of the other CSO tanks may begin.

5.7.4 To begin emptying the Main/King CSO Tank, when the Wet Well level is between 9.9-10.3 m, the various sluice gates should be placed in the following positions:

- Chamber 1 Gate = 35% Open
- Chamber 4 Gate = 7% Open
- Chamber 5 Gate = 10% Open
- PS Inlet Gate = 100% Open
- CSO Tank Inlet Gate = 100% Open
- CSO Tank Outlet Gate = 100% Open

5.7.5 When the Wet Well level is between 9.7-9.9 m, the various sluice gates should be placed in the following positions:

- Chamber 1 Gate = 35% Open
- Chamber 4 Gate = 100% Open
- Chamber 5 Gate = 10% Open
- PS Inlet Gate = 100% Open
- CSO Tank Inlet Gate = 100% Open
- CSO Tank Outlet Gate = 100% Open

5.7.6 When the Wet Well level falls to 9.05 m, the system flips back to Normal pump station mode and the Duty 1 and Duty 2 sewage lift pumps are started to drain the rest of the Wet Well and CSO Tank.

5.8 Washing the Tank following a Rainfall Event

5.8.1 Washing of the floors of the Main/King CSO Tank is done remotely via SCADA:

1. Go to the HCS04 screen on SCADA
2. Check that the CSO Tank Backwash is set to “Run” and in “Remote” mode
3. Select Cell 1 “Start”
4. When Cell 1 is complete, Select Cell 2 “Start”
5. Note: Cell 2 will not wash if the CSO Tank Cells Outlet Gate in the wet well is less than 10% open

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS04, annual position checks and exercising of all sluice gates associated with the facility to confirm they are in proper working order (except the Influent Well Overflow Gate, which has been padlocked in the Fully Closed position).

6.1.3 Specific to HCS04, annual calibration of CSO Tank Overflow flow metering system.

6.2 Monthly Inspections

6.2.1 Specific to HCS04, monthly inspections of the Influent Well Overflow Gate to confirm that it is in the Fully Closed Position, and that no sewage is leaking through the gate. The latter can be accomplished by visual inspection of the Overflow Chamber on the downstream side of the gate, which can be viewed from above by opening the access hatch cover on top of the Overflow Chamber. Additional lighting may be required to see down to the floor of the chamber on the downstream side of the gate and confirm no flow is passing through the gate.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-PO-F-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- E2 Confined Space Plan – PW-WW-PO-F-019-014
- HCS04-01 Confined Space Plan – WW Level IV - PW-WW-PO-F-019-01-096
- WWPS HCS04 (Main/King CSO Tank), Process Control Narrative, Version 3.5
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Eastwood Park CSO Storage Tank (HCS05), Burlington/Ferguson Sluice Gate (HCG06), and Ferrie/Ferguson Sluice Gate (HCG07).

2 SCOPE

This procedure applies to all operations staff including: Plant Operations, Process Supervisors, Maintenance staff and Superintendents involved in operations of the wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
EME	Environmental Monitoring and Enforcement
MECP	Ministry of Environment, Conservation and Parks
MLD	Mega Litres per Day
ORO	Overall Responsible Operator
PO	Plant Operations
PW	Public Works
SCADA	Supervisory Control and Data Acquisition
WSI	Western Sanitary Interceptor
WW	Wastewater
WWTP	Wastewater Treatment Plant
SFT	Sediment Flushing Tank

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure

- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Eastwood Park CSO Tank (HCS05) is located at 113 Burlington Street East in Eastwood Park, on the northwest corner of Burlington Street East and Ferguson Avenue North. Inflows to the tank are regulated by two upstream CSO regulators: the Burlington/Ferguson Sluice Gate (HCG06) and Ferrie/Ferguson Sluice Gate (HCG07).

This document identifies procedures for the normal operation of HCS05 (and HCG06 and HCG07), as well as procedures for confined space entry into the underground storage tank and sluice gate chambers.

There is no backup power available at this station. In the event of a power failure a portable 350 kW (600 V, 3PH) generator must be mobilized to the site.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the storage tank and the underground gate chambers are all considered a confined space (CS).

5.1.3 Smoking is not permitted inside the CSO tank, sampling huts, or sluice gate chambers.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.6 Ensure that the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out / Tagging PW-WW-PO-P-019-003).

5.1.8 Two persons trained and certified in confined space entry must be present at all times (one inside and one outside), and confined space entry protocol must be followed.

5.1.9 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A hazard assessment and a project specific entry procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person. Only pump the pump well down to the level of the bend in the suction pipe, i.e. do not air lock the pumps.

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter the tank. Ensure that there is no impending rain in the weather forecast, the tank floor has been cleaned and is empty, and the washing system is turned off. The tank may have some liquid in it. Entry can be made so long as gas levels are within acceptable levels.

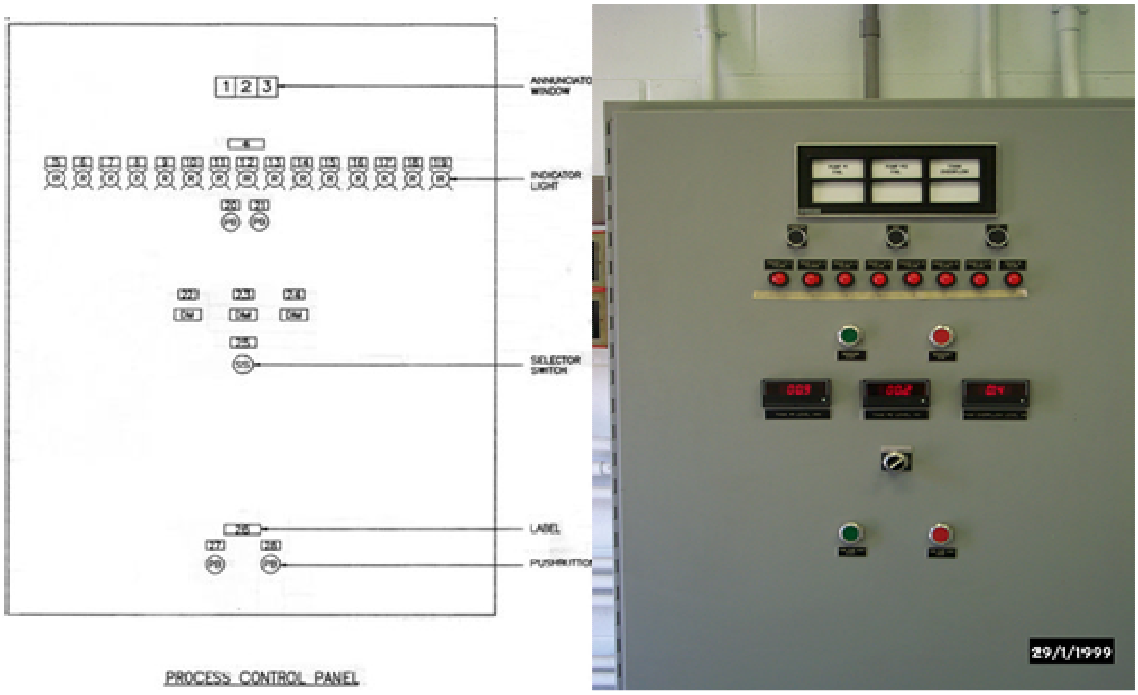
5.2.2 Burlington/Ferguson (HCG06) and Ferrie/Ferguson (HCG07) Sluice Gates: Ensure that no flow will enter the tank in dry weather, by placing the HCG06 and HCG07 sluice gates in the fully Open position, directing all flow to the Western Sanitary Interceptor (WSI) sewer. Contact the Process Supervisor and ensure that the gates are in the Open position. Lock out the power to both gates in the Open position. The control panels are located on the side of the road near each gate.

5.2.2.1 Ferrie/Ferguson Sluice Gate (HCG06): Open the gate and then lock out power to the actuator at the disconnect.

5.2.2.2 Burlington/Ferguson Sluice Gate (HCG07): Open the gate and lock out power to the actuator at the disconnect.

5.2.3 Eastwood Park Tank Control Panel: Contact the Process Supervisor to ensure that the tank floor has been flushed, and that the flushing system is not currently operating. Ensure that the pumps are in the Auto position. Notify the Process Supervisor of your intent to enter the Control Room. When entering the Control Room, which is located on the south side of the Pavilion (replica of a tugboat), shut off the intrusion alarm (lower right corner of the control panel). Press the green button labelled “Tank Pump Out” Start. This will pump out the wet well. Place the flushing system in “Local” mode on the control panel. Ensure that the pumps are left in the “Auto” position.

5.2.3.1 Eastwood Park CSO Tank Control Panel and Pump Controls



PROCESS CONTROL PANEL

5.2.4 The CSO tank has no mechanical/electrical ventilation or lighting. Ventilation is provided by opening the access hatches above the sediment flushing tanks (SFTs). Open all SFT access hatches to the cell or cells you are going to enter (14 hatches on the east side for Cell 1, and 16 hatches on the west side for Cell 2). Also open the hatch above the submersible pumps at the southeast corner of the tank. The tank’s primary access points are the entrance staircase to Cell1, which is located along the east wall of the tank and begins at the northeast corner of the tank, and the entrance ladder to Cell 2, which is located at the northwest corner of the tank. Exercise care

when entering the tank, as the steps can be slippery. The person inside the tank should carry intrinsically safe portable lighting and a fully charged flashlight.

5.2.5 At least one person equipped with a two-way radio and flashlight should remain outside the tank at all times, holding the lifeline, maintaining the Confined Space Entry Permit and communicating with the person inside the tank via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.6 The outside person should initiate contact with the person in the tank at least every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.7 A portable gas detector should be used to determine if the air inside the tank is safe for entry. The gas detector should remain with the person/persons inside the tank and should be turned on at all times. If the gas detector alarm sounds at any time, all personnel inside the tank should exit immediately. Re-entry should only be attempted using fully charged breathing apparatus.

5.2.8 After all personnel have vacated the tank, secure all access hatches.

5.2.9 At the control panel, reset the controls for the washing system and pumps to the “Remote” mode. Reinstate the intrusion alarm and secure the door.

5.2.10 Reinstate power to the HCG06 and HCG07 sluice gates.

5.2.11 Notify the Process Supervisor that the tank entry has been completed, and the lockouts have been removed.

5.3 Process and Equipment Overview

5.3.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the WWTP. During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows are necessary in order to minimize basement flooding and overloading of the WWTP. In some areas, the CSOs are captured by underground detention storage tanks that store the sewage during wet weather. The CSO tanks are filled by gravity, and when flows subside after a rainstorm, their liquid contents are drained and/or pumped back into the combined sewer system and conveyed the WWTP where they receive treatment. Floating debris is retained in the tanks by a system of underflow baffles, and large volumes of solids settle to the bottom of the tanks while the sewage is detained in them. After the liquid contents of the tanks are conveyed to the WWTP, these solids remain on the bottom of the tanks. To reduce odours from the CSO tanks,

the solids are washed from the tank floors by sediment flushing tanks, commonly referred to as tipping buckets, or by high-pressure water spray nozzles. HCS05 employs SFTs for tank cleaning.

5.3.2 The Eastwood Park CSO Tank (HCS05) covers an area of an area of approximately 4,000 m^2, and is over 6 m deep, providing approximately 27,350 m^3 of CSO storage capacity in two separate storage cells. The first cell provides approximately 14,700 m^3 of storage, and the second provides a further 12,650 m^3 of storage. A new sewer was constructed along Dock Service Road to intercept the CSOs from the two outfalls and convey them to the CSO tank. The original Catharine Street (1050 mm) and Ferguson Avenue (1500 mm) CSO outfalls were left in place and are still used to carry the overflow from the CSO tank on the infrequent occasions when the tank is filled. A flow splitter diverts the overflow from the tank between the two previously existing outfall sewers.

5.3.3 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 Caroline/Brock, Picton/Ferguson and McAulay/Ferguson and by the two WWTP-controlled CSO regulators at Burlington/Ferguson and Ferrie/Ferguson. During dry weather, the Burlington/Ferguson (HCG06) and Ferrie/Ferguson (HCG07) sluice gates normally remain open, directing all flow to the Western Sanitary Interceptor (WSI) sewer.

5.3.4 Maintenance Bypass: A Maintenance Bypass of the CSO Tank is provided in the CSO Tank Inlet Chamber at the northeast corner of the tank. Closing the CSO Tank Inlet Gate on the south wall of the chamber and opening the two Maintenance Bypass Gates on the north wall of the same chamber, diverts any flow in the upstream sewer to the CSO tank outfall sewer. The gates in this chamber should only be operated in this manner when tank entry is absolutely necessary during wet weather conditions. Proper authorities must be notified of any plans to employ such by-pass, and spill notification procedures should be followed.

NOTE: The two Maintenance Bypass Gates are locked in the Full Closed position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Hamilton Harbour at the is location. They should only be opened for maintenance purposes with the approval of the Overall Responsible Operator (ORO) and notification to the Ministry of Environment, Conservation and Parks (MECP) as per the Environmental Compliance Approval (ECA) for the facility.

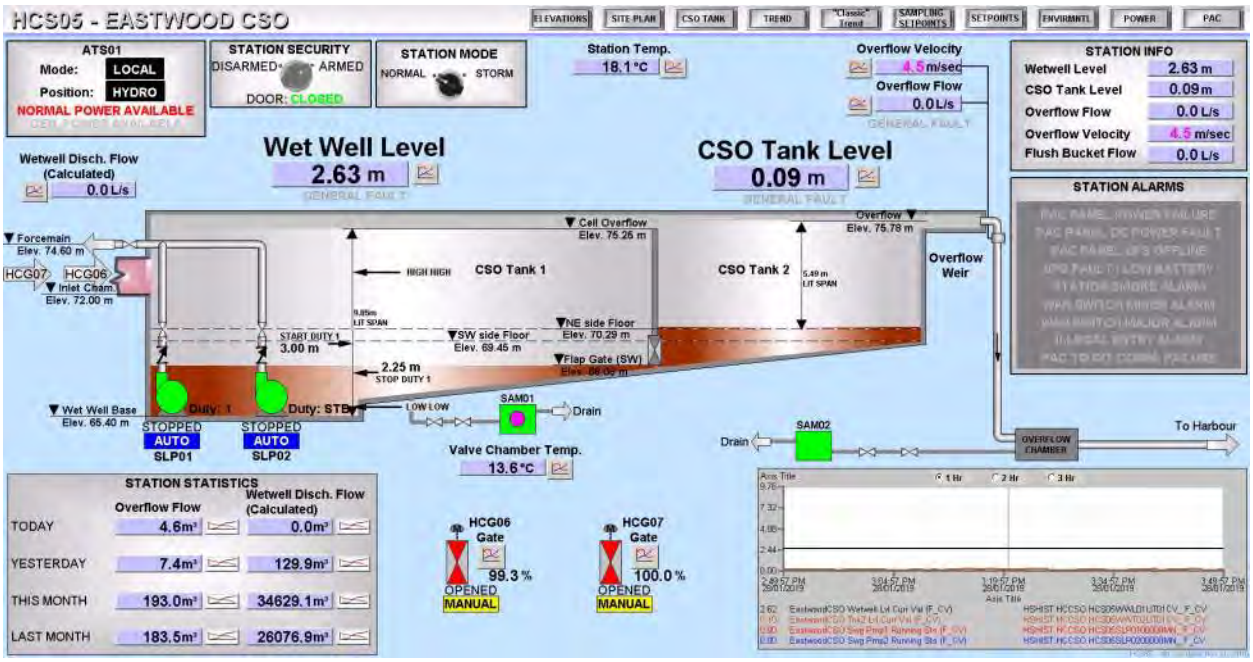
5.3.5 During wet weather, excess flows from the Catharine/Brock CSO regulator and the five CSO regulators along Ferguson Avenue overflow into the tank. When rainfall occurs, the pumps in the CSO tank are taken out of auto "DRY" mode and turned off, and gates HCG06 and HCG07 are fully closed, eliminating 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. 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 the HCG06 sluice gate. The rate of pumping from the tank can be controlled by Operators at the WWTP, based upon the current inflows at the WWTP.

5.3.6 Solids that settle from the combined sewage detained in the CSO tank, and floatable materials retained in the tank by the underflow baffles, are washed from the floor by fifteen (15) SFTs. The SFTs are large stainless steel buckets, which are suspended above and along the west wall of the CSO tank, about 6 m above the floor. The SFTs are filled with potable water, and when full, they tip and empty their contents down the back walls of the tank. The flush water continues down the sloped floor of the tank at a high velocity and washes the solids from the floor. Washwater from the SFTs is collected in a trough at the bottom of the tank and is also pumped back into the combined sewer system and conveyed to the WWTP for treatment.

5.3.7 Two automatic water quality samplers are provided to sample the influent and effluent from the CSO tank, as per its Certificate of Approval. The influent sampler collects its samples from the inlet chamber at the northeast corner of the tank, and the effluent sampler collects it samples from the overflow channel at the northwest corner of the tank. The samplers are housed in above ground huts and collected by the Environmental Monitoring and Enforcement (EME) sample technicians.

5.3.8 The entire facility is monitored and controlled via SCADA by plant operations staff. The SCADA system includes a security system to advise of any unauthorized entries into the pumping station.

5.4 Eastwood Park CSO Tank (HCS05), Burlington/Ferguson Sluice Gate (HCG06), Ferrie/Ferguson Sluice Gate (HCG07) SCADA Screen



5.5 Dry Weather Operation

5.5.1 During normal dry weather operation HCS05 receives very little sanitary flow with the HCG06 and HCG07 sluice gates in their normal Open position and the pumps cycling as a lift station would.

5.5.2 Set to “Dry” Mode, to run pumps automatically via the SCADA system:

1. Go to the HCS05 SCADA screen
2. Select “Dry” in the CSO Wash Tank box to set the pumps to “Dry” Mode

Ensure that the duty pump is rotated to provide equal operating time on both pumps.

5.5.3 Set the Burlington/Ferguson Sluice Gate (HCG06) to 100% Open via the SCADA system:

1. Go to the HCS05 SCADA screen
2. Select “HCG06 Sluice Gate” and set to 100% Open

5.5.4 Set the Ferrie/Ferguson Sluice Gate (HCG07) to 100% Open via the SCADA system:

1. Go to the HCS05 SCADA Screen
2. Select “HCG07 Sluice Gate” and set to 100% Open

5.6 Wet Weather Operation

5.6.1 CSO enters the storage tanks by gravity, but the rate of filling of the tanks can be increased by closing motorized gates and/or disabling pumps at each of the facilities. This wet weather operation mode begins with the Greenhill CSO Tank first, and is initiated when:

- The wet well level at the Woodward Avenue WWTP exceeds 66 m, and
- The flow rate into the Woodward Avenue WWTP exceeds 370 MLD

As the flow rate at the plant increases, filling rates at other facilities are also increased.

5.6.2 For the Eastwood Park CSO Tank (HCS05), set pumps to "Storm" mode via the SCADA system:

1. Go to the HCS05 SCADA screen
2. Select "Storm" mode from the CSO Wash Tank box

The pumps will not operate without intervention. Ensure that the pumps are set back to "Dry" mode following a rainfall event.

5.6.3 Set the opening of the Burlington/Ferguson Sluice Gate (HCG06) to 0% Open (i.e. gate fully closed) via the SCADA system:

1. Go to the HCS05 SCADA screen
2. Select "HCG06 Sluice Gate" and set to 0% Open (i.e. gate fully closed)

Set the opening of the Ferrie/Ferguson Sluice Gate (HCG07) to 0% Open (i.e. gate fully closed) via the SCADA system:

1. Go to the HCS05 SCADA screen
2. Select "HCG07 Sluice Gate" and set to 0% Open (i.e. gate fully closed)

5.7 Emptying the Tank Following a Rainfall Event

5.7.1 Following a storm, when the Woodward Avenue WWTP can accept more flow, the James Street and Greenhill CSO tanks are emptied first. The decision to begin draining the tanks is based upon the wet well level at the Woodward Avenue WWTP and/or the flow rate into the plant. The CSO tanks that are overflowing should be drained first. Priority should then be given to tanks that are approaching overflow.

5.7.2 The Eastwood Park CSO Tank (HCS05) is drained by pumping. Re-open gates HCG06 and HCG07 (refer to Dry Weather Operation).

Start up pumps**.** Set pumps to "Dry" mode via the SCADA system:

1. Go to the HCS05 screen
2. Select "Dry" mode from the CSO Tank Wash box

5.8 Washing the Tank following a Rainfall Event

5.8.1 Ensure that the pumps are enabled to dry weather mode. When the level in the tank drops below 2.0 m, tank washing may commence via the SCADA system:

1. Go to the HCS05 SCADA screen
2. Select "Storm" Condition from the CSO Tank Wash box
3. Select "TK1 Wash. This will initiate flushing of both storage tank cells

5.8.2 If excessive sediment buildup has occurred due to the tank not being flushed between storms or the contents of the tank being detained for an extended period of time, a second flushing is recommended.

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Bar Screens, visual inspection to confirm not blocked by debris
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities

- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS05, annual position checks and exercising of all sluice gates associated with the facility to confirm they are in proper working order.

6.1.3 Specific to HCS05, annual calibration of CSO Tank Overflow flow metering system.

6.2 Monthly Inspections

6.2.1 Specific to HCS05, monthly inspections of the CSO Tank Inlet Gate and two Maintenance Bypass Gates in the chamber at the northeast corner of the tank to confirm the CSO Tank Inlet Gate is in the Fully Open position, and that the two Maintenance Bypass Gates are both in the Fully Closed position and that no sewage is leaking through these gates.

7 ASSOCIATED DOCUMENTS

- Safe Entry and Exit from Stations – PW-WW-PO-P-011-002
- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-PO-F-019-001
- Confined Space Entry Permit – PW-WW-PO-F-019-003
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- BCOS + DWQMS - Log Book and Record Keeping Procedure
- Eastwood Park CSO Tank (HCS05) Process Control Narrative, Version 2.2
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Greenhill CSO Storage Tank (HCS06).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of the wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
MCC	Motor Control Centre
MLD	Mega Litres per Day
PO	Plant Operations
PW	Public Works
RHCSI	Red Hill Creek Sanitary Interceptor
PLC	Programmable Logic Controller
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
SG	Sluice Gate
SFT	Sediment Flushing Tank
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBLITIES

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Greenhill CSO Tank #2 (HCS06) is located at 100 Greenhill Avenue in Hamilton, behind Rosedale Arena. HCS06 operates in conjunction with Greenhill CSO Tank #1 (HCS01), which functions as a second CSO storage facility to capture overflows from the HCS06 tank. The two facilities include a number of sluice gate and stop-log chambers to control the flow to the storage tanks, including bypassing of either of the tanks for major maintenance activities, should they be required.

This document identifies procedures for the normal operation of HCS06, as well as procedures for confined space entry into the underground storage tank and associated flow control gate and stop-log chambers.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the storage tank and the underground sluice gate and stop-log chambers are all considered a confined space (CS).

5.1.3 Smoking is not permitted in the control building or inside the tank.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.6 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out/Tagging PW-WW-PO-P-019-003).

5.1.8 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter the tank. Ensure that there is

no impending rain in the weather forecast, the tank has been cleaned and is empty, and the washing system is turned off.

5.2.2 Sluice Gates: Ensure that no flow will be detained in the tank by placing gates SG3 in the fully "Open" position and SG4 in the fully "Closed" position. This will convey all flow directly into the Red Hill Creek Sanitary Interceptor (RHCSI) sewer. Contact the Process Supervisor and ensure that the gates are in the fully "Open" position. Place both gates in the "Hand" mode to ensure the gates positions cannot be changed remotely via SCADA and lock-out conforming to lock out procedure PW-WW-PO-P-019-003. The control panel is located in the building above the tank. Use the door on the north side of the building. Shut off the intrusion alarm.

5.2.3 When entering the tank, ensure that the tank has been flushed, and that the flushing system has been switched to "Station" mode

5.2.4 There are five supply fans, SF-1 to SF-5, to ventilate the gallery and service areas. They can be operated locally at the CSO Tank's electrical room or automatically controlled by programmable logic controller (PLC). The Local/Remote control is operator selectable at the MCC panel. If methane gas reaches a level of 20% L.E.L, the PLC shall initiate the Hi gas alarm and turn on the supply fans (the selector switches are left on "Remote). If the methane gas is still rising up to 40% L.E.L., the RPU shall initiate the Hi-Hi gas alarm. The supply fans shall stay on until the methane gas is back to normal.

NOTE: The electrical control panel alarm annunciator horn will continue sounding 5 seconds after the alarm has been acknowledged

5.2.5 Personnel entering the tank shall carry a two-way radio; wear a chemical suit, breathing apparatus, fall arrest, personnel extraction equipment, and chemical protective gloves. Intrinsically safe portable lighting and a fully charged flashlight is necessary for lighting.

5.2.6 At least one person in full gear, equipped with a two-way radio and flashlight should remain outside the tank at all times, holding the lifeline, maintaining the Confined Space Entry Permit and communicating with the person/persons inside the tank via a two-way radio.

5.2.7 The outside person should initiate contact with the person in the tank every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.8 After all personnel have vacated the tank, secure all hatches.

5.2.9 Notify the Process Supervisor that the tank entry has been completed.

5.3 Process and Equipment Overview

5.3.1 The total storage capacity is 66,000 m^3 (divided evenly into two 33,000 m^3 cells). Each cell has 20 washdown lanes and sediment flushing tanks (SFTs) to thoroughly wash down the tank after each use. Both cells can be drained by the motorized sluice gate SG-4 that is controlled remotely by the Operators at the Woodward Avenue WWTP or locally by panel door mounted pushbuttons.

5.3.2 The 3.0 m X 3.0 m inlet box sewer will divert the existing Greenhill Avenue trunk sewer flow to the rectangular storage tank HCSO6. All dry weather flow will by-pass the storage tank discharging to the existing Red Hill Creek sanitary trunk sewer and then to the Woodward WWTP. The dry weather flow is diverted into the 900 mm diameter sewer by the drop structure and the opened motorized sluice gate SG-3.

5.3.3 During a storm event, sluice gate SG-3 should be closed, causing all flows to be diverted into HCS06 Cell 1, and if HCS06 Cell 1 fills, then into HCS06 Cell 2.

5.3.4 If HCS06 Cell 2 is filled, excess wet weather flows will overflow into HCS01 Cell 1, and if HCS01 Cell 1 fills, then into HCS01 Cell 2. Overflows to Red Hill Creek will only occur if HCS01 Cell 2 is filled.

5.3.5 There are three flow control gates and two stop-gates, whose functions are as follows:

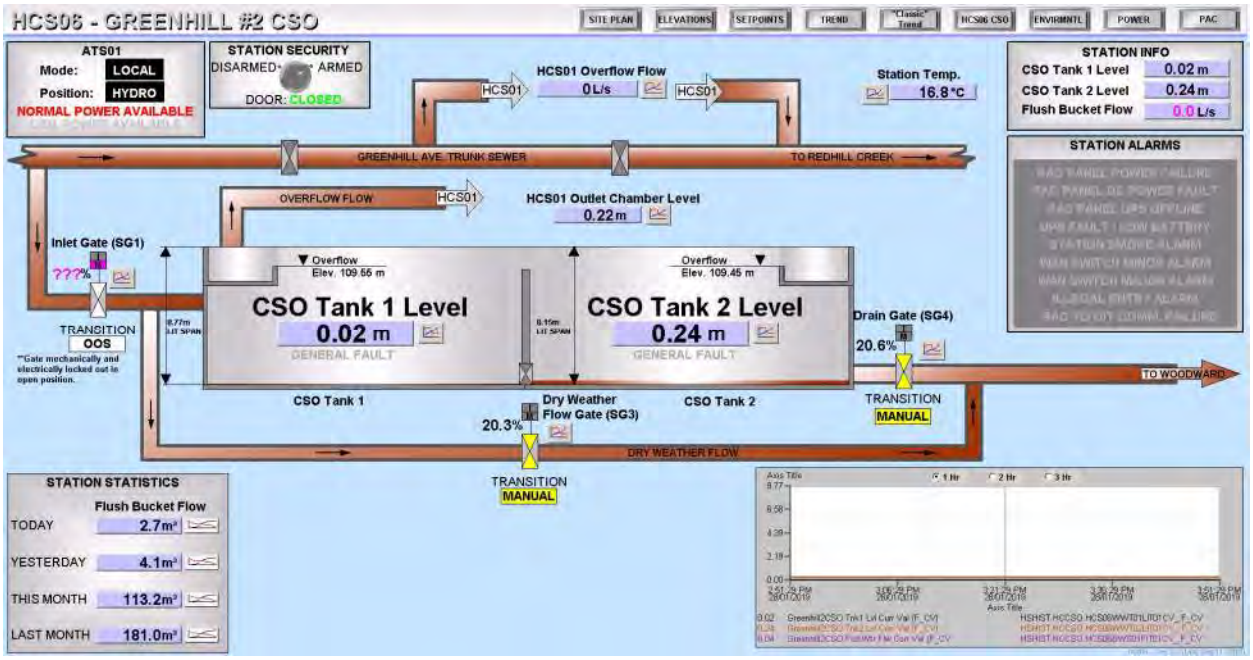
5.3.5.1 SG-1 (Sluice Gate #1): This motorized sluice gate should normally remain Fully Open directing all inflow into HCS06, with the manual Stop Gate #1 (located in the same chamber) in its default Closed position sending all flow towards HCS06. SG-1 should never closed with the stop gate in its default position, since this could cause sewage to backup in the incoming trunk sewer on Greenhill Avenue and cause basement flooding upstream. To prevent this from happening, SG-1 is locally padlocked in the fully "Open" position, with no remote control possible from the Woodward Avenue WWTP; i.e. **there is no PC Manual Control allowed for sluice gate SG-1.**

5.3.5.2 Stop Gate #1: This manual stop gate should normally remain Fully Closed. It is used only to bypass flows around HCS06 for maintenance purposes (and only with a pre-approved bypass plan in place). When bypassing HCS06 for maintenance, Stop Gate #1 would be opened and SG-1 would be closed. Removal of Stop Gate #1 from its default Fully Closed position would require a boom truck or crane.

5.3.5.3 SG-3 (Sluice Gate #3): This motorized sluice gate provides dry weather flow control, controlling how much flow is conveyed directly into the RHCSI and on to the Woodward Avenue WWTP. Open the gate. The normal setting of this gate is approximately 20% Open.

5.3.5.4 SG-4 (Sluice Gate #4): This motorized sluice gate is also referred to as the Outflow Sluice Gate, which is opened to drain both cells of the HCS06 storage tank. The percentage of opening will be based on the measured outlet chamber level at HCS01.

5.4 Greenhill CSO Tank #2 (HCS06) SCADA Screen



5.5 Control Modes

In general, there are two control modes available for operation of the equipment at HCS06: LOCAL Manual and PC Manual (PC standing for Personal Computer).

5.5.1 Local Manual

5.5.1.1 Equipment can be controlled locally by the operator using the “ON-OFF” or “START-STOP” or “OPEN-CLOSE” switch on the local panel.

5.5.1.2 First, the panel hand switch must be in LOCAL, and then the operator can operate the equipment locally.

5.5.1.3 When the panel switch is in LOCAL position, the equipment is not available for control by either the RPU or the SCADA system.

5.5.1.4 Each gate is provided with manual controls incorporated within the actuator. These allow the operator to open and close the gates directly from the gate.

5.5.2 PC Manual.

5.5.2.1 Equipment can be controlled remotely from one of the SCADA PCs at the Woodward Avenue WWTP.

5.5.2.2 First, the “LOCAL-REMOTE” switch must be in REMOTE.

5.5.2.3 The SCADA system is then on-line for process control. With the SCADA system set to MANUAL, an operator may operate equipment manually from one of the SCADA PCs.

5.5.2.4 Each gate is provided with a means of selecting LOCAL or REMOTE mode directly from the actuator. The gate must be selected to REMOTE mode to allow the SCADA system to control the gate. Similarly, REMOTE mode must be selected to allow the electrical room gate push-buttons to control the gate.

5.6 Washing the HCS06 Tank following a Rainfall Event

5.6.1 The tank can be cleaned (backwashed) locally at the station via push-buttons located on the electrical room control panel or remotely from the SCADA system. Note that the solenoid valves and the proximity switches (c/w intrinsic safety barriers) supplied and installed for the backwash system are intrinsically safe; therefore, the tank can be backwashed even under high methane gas alarms.

5.6.2 There are 20 solenoid valves to control the flow of water for filling the sediment flushing tanks (SFTs) used to clean the tank. Valves 1 to 10 (WLL01SV01-WLL01SV10) are for washing Cell 1, and valves 11 to 20 (WLL02SV11-WLL02SV20) are for washing Cell 2.

5.6.3 Forty (40) SFTs are employed to clean the tank. SFTs # 1-20 are used to backwash Cell 1 and SFTs # 21-40 are used to wash Cell 2. The solenoid valves will provide potable water to fill the SFTs as programmed in SCADA. Solenoid Valve #1 fills SFTs # 1&2, Valve #2 fills SFTs # 3&4, and so on. After each pair of SFTs are filled, they will tip backwards by gravity and release their water volume down the back wall and then along the floor of the tank to wash the tank. SFTs (which are also referred as flushing buckets (FB)) are numbered 00000FB01 to 00000FB40 in SCADA.

5.6.4 Flushing Sequence

<u>To Flush Cell 1[1]:</u>

1. Open Solenoid Valve #1 to fill SFTs # 1 & 2.
2. SFTs # 1 & 2 are filled and tipped; upon receiving signals that the SFTs have tipped, close Valve #1 and start 30-second delay timer.
3. After 30 seconds timeout, open Valve #6 to fill SFTs # 11 & 12.
4. SFTs # 11 & 12 are filled and tipped; upon receiving signals that SFTs # 11 & 12 have tipped, close Valve #6 and start 30-second delay timer.
5. After 30 seconds timeout, open Valve #2 to fill SFTs # 3 & 4.
6. SFTs # 3 & 4 are filled and tipped; upon receiving signals that SFTs # 3 & 4 have tipped, close Valve #2 and start 30-second delay timer.
7. After 30 seconds timeout, open Valve #7 to fill SFTs # 13 & 14.

[1] Due to possible low water pressure, a 30-Seconds Delay Timer is added in the program between water valves operation.

8. SFTs # 13 & 14 are filled and tipped; upon receiving signals that SFTs # 13 & 14 have tipped, close Valve #7 and start 30-second delay timer.
9. After 30 seconds timeout, open Valve #3 to fill SFTs # 5 & 6.
10. SFTs # 5 & 6 are filled and tipped; upon receiving signals that SFTs # 5 & 6 have tipped, close Valve #3 and start 30-second delay timer.
11. After 30 seconds timeout, open Valve #8 to fill SFTs # 15 & 16.
12. SFTs # 15 & 16 are filled and tipped; upon receiving signals that SFTs # 15 & 16 have tipped, close Valve #8 and start 30-second delay timer.
13. After 30 seconds timeout, open Valve #4 to fill water in SFTs # 7 & 8.
14. SFTs # 7 & 8 are filled and tipped; upon receiving signals that SFTs # 7 & 8 have tipped, close Valve #4 and start 30-second delay timer.
15. After 30 seconds timeout, open Valve #9 to fill SFTs # 17 & 18.
16. SFTs # 17 & 18 are filled and tipped; upon receiving signals that SFTs # 17 & 18 have tipped, then close Valve #9 and start 30-second delay timer.
17. After 30 seconds timeout, open Valve #5 to fill SFTs # 9 & 10.
18. SFTs # 9 & 10 are filled and tipped; upon receiving both signals that SFTs # 9 & 10 have tipped, close Valve #5 and start 30-second delay timer.
19. After 30 seconds timeout, open Valve #10 for SFTs # 19 & 20.
20. SFTs # 19 & 20 are filled and tipped; upon receiving both signals that SFTs # 19 & 20 have tipped, then close Valve #10.

This completes the flushing of Cell 1.

To Flush Cell 2:

1. Open Solenoid Valve #20 to fill SFTs # 40 & 39.
2. SFTs # 40 & 39 are filled and tipped; upon receiving signals that SFTs # 40 & 39 have tipped, close Valve #20 and start 30-second delay timer.
3. After 30 seconds timeout, open Valve #15 to fill SFTs # 30 & 29.
4. SFTs # 30 & 29 are filled and tipped; upon receiving signals that SFTs # 30 & 29 have tipped, then close Valve #15 and start 30-second delay timer.
5. After 30 seconds timeout, open Valve #19 to fill SFTs # 38 & 37.
6. SFTs # 38 & 37 are filled and tipped; upon receiving signals that SFTs # 38 & 37 have tipped, close Valve #19 and start 30-second delay timer.
7. After 30 seconds timeout, open Valve #14 to fill SFTs # 28 & 27.
8. SFTs # 28 & 27 are filled and tipped; upon receiving signals that SFTs # 28 & 27 have tipped, close Valve #14 and start 30-second delay timer.
9. After 30 seconds timeout, open Valve #18 to fill SFTs # 36 & 35.
10. SFTs # 36 & 35 are filled and tipped; upon receiving signals that SFTs # 36 & 35 have tipped, close Valve #18 and start 30-second delay timer.
11. After 30 seconds timeout, open Valve# 13 to fill SFTs # 26 & 25.
12. SFTs # 26 & 25 are filled and tipped; upon receiving signals that SFTs # 26 & 25 have tipped, close Valve #13 ands start 30-second delay timer.
13. After 30 seconds timeout, open Valve# 17 to fill SFTs # 34 & 33.
14. SFTs # 34 & 33 are filled and tipped; upon receiving signals that SFTs # 34 & 33 have tipped, close Valve #17 and start 30-second delay timer.
15. After 30 seconds timeout, open Valve# 12 to fill SFTs # 24 & 23.
16. SFTs # 24 & 23 are filled and tipped; upon receiving signals that SFTs # 24 & 23 have tipped, close Valve #12 and start 30-second delay timer.
17. After 30 seconds timeout, open Valve# 16 to fill SFTs # 32 & 31.

18. SFTs # 32 & 31 are filled and tipped; upon receiving signals that SFTs # 32 & 31 have tipped, close Valve #16 and start 30-second delay timer.
19. After 30 seconds timeout, open Valve #11 to fill SFTs # 23 & 22.
20. SFTs # 22 & 21 are filled and tipped; upon receiving signals that SFTs # 22 & 21 have tipped, close Valve #11.

This completes the flushing of Cell 2.

5.6.5 A timer (6 minutes) is set up in the PLC programs so that if a solenoid water valve fails to actuate or the proximity switch to indicate the buckets have tipped is broken, the program will automatically advance to the next pair of valves/SFTs. This value is not adjustable from the SCADA screen.

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS06, annual position checks and exercising of all motorized sluice gates associated with the facility to confirm they are in proper working order.

6.2 Monthly Inspections

6.2.1 Specific to HCS06, monthly inspections of the CSO Tank Inlet Gate to confirm it is in the Fully Open position.

6.2.2 Specific to HCS06, monthly inspections of the Manual Stop Gate in the CSO Tank Inlet Chamber to confirm it is in its correct default position, diverting all flow towards HCS06, and that no sewage is leaking around the edges of the stop gate. The latter can be accomplished by visual inspection of the chamber/pipe on the downstream side of the stop gate, which can be viewed from above by opening the access hatch cover on top of the stop gate. The air pressure of the inflatable bladder around the outside of the stop gate (which provides the seal around the gate) should be checked to ensure the seal is tight to prevent any possibility of sewage discharge downstream of the gate (which would in any case continue into HCS01, so would not discharge directly to the environment).

6.2.3 Specific to HCS06, monthly inspections of the Manual Stop Gate in the Overflow Gate and Chamber on the overflow channel running from HCS06 to HCS01 to confirm it is in its correct default position, diverting all flow towards HCS01, and that no sewage is leaking around the edges of the stop gate into Red Hill Creek. The latter can be accomplished by visual inspection of the chamber/pipe on the downstream side of the stop gate, which can be viewed from above by opening the access hatch cover on top of the chamber. The air pressure of the inflatable bladder around the outside of the stop gate (which provides the seal around the gate) should be checked to ensure the seal is tight to prevent any possibility of sewage discharge directly into Red Hill Creek.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- CSO Overflow Notification List – PO Level IV - PW-WW-PO-L-011-004
- Greenhill No. 2 CSO Tank (HCS06) Process Control Narrative, Version 2.4
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Red Hill CSO Pipe Facility (HCS07), including Chambers HCS7A/B/C.

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
EME	Environmental Monitoring and Enforcement
MLD	Mega Litres per Day
PO	Plant Operations
PW	Public Works
SCADA	Supervisory Control and Data Acquisition
SG	Sluice Gate
WSI	Western Sanitary Interceptor
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Red Hill 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 Red Hill Creek Sanitary Interceptor (RHCSI) sewer and along the Red Hill Parkway. The oversized 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 wet weather flow conditions, and also to control the subsequent drainage of the facility to the Woodward Avenue Wastewater Treatment Plant (WWTP) for treatment during dry weather flow conditions.

HCS07 comprises three (3) flow control structures: HCS7A at Lawrence Road; HCS7B at Queenston Road; and HCS7C at Barton Street; creating two (2) storage pipe cells providing a total storage volume of approximately 14,200 m^3. Cell 1 consists of a 2,250 mm diameter pipe running between HCS7A and HCS7B; and Cell 2 consists of a 2,000 mm diameter pipe running between HCS7B and HCS7C. HCS7C includes an 1,800 mm diameter sanitary sewer to drain the storage facility, and a 2,250 mm diameter overflow sewer to Red Hill Creek that only becomes active if the design capacity of the facility is exceeded.

The stored flow behind the gates can also be used to flush any sediments that may have settled at the bottom of the storage pipe cells during storage periods.

This document identifies procedures for the normal operation of HCS07 (including Chambers HCS7A, HCS7B and HCS7C), as well as procedures for confined space entry into the sluice gate chambers.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are applicable and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the CSO storage pipe and the HCS7A, HCS7B and HCS7C sluice gate chambers are each considered a confined space (CS).

5.1.3 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.4 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002), is completed before entry.

5.1.5 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.6 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out/Tagging PW-WW-PO-P-019-003).

5.1.7 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Procedure for Facility Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person.

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter HCS7A, HCS7B or HCS7C. Ensure that there is no impending rain in the weather forecast, and that all CSO pipe inflow gates are closed and locked out in the closed position, so all sewage flow is in the RCHSI, and none in HCS07.

5.2.2 Do not enter if the portable Methane Detection System does not register "OK". Personnel inside the chambers should carry and use a portable gas detector.

5.2.3 At least one person equipped with a two-way radio and flashlight should remain outside the chambers at all times, maintaining the "Confine Space Entry Permit" and communicating with the person inside the chamber via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.4 The person outside the chamber should initiate contact with the person in the chamber every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.5 Notify the process supervisor when leaving the site. Remove all lockouts and return all gates to "Remote" mode. Shut off all lights and exhaust fans. Reinstate the intrusion alarm and secure all doors.

5.3 Process and Equipment Overview

5.3.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. Nearly 200 diversion structures regulate the amount of flow reaching the WWTP. The vast majority of these structures are static flow regulators where the volume of overflow is simply dependent upon the level of sewage entering the structure. Static flow regulators cannot be quickly or easily manipulated, if at all, to control the volume of flow entering the interceptors. However, the Combined Sewer System also employs a number of motorized sluice gates which can be opened or closed by operators at the Woodward Avenue WWTP to dynamically regulate the amount of flow entering the sanitary interceptors. These gates are required to reduce inflows to the WWTP Main Pumphouse during extreme storm events, in order to ensure that the WWTP is not overloaded. Centralized control of the gates is made possible via the Supervisory Control and Data Acquisition (SCADA) system.

5.3.2 The Red Hill 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 Red Hill Creek Sanitary Interceptor (RHCSI) sewer and along the Red Hill Parkway. The oversized 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 wet weather flow conditions, and also to control the subsequent drainage of the facility to the Woodward Avenue Wastewater Treatment Plant (WWTP) for treatment during dry weather flow conditions.

5.3.3 HCS07 comprises three (3) flow control structures: HCS7A at Lawrence Road (Manhole #1); HCS7B at Queenston Road (Manhole #8); and HCS7C at Barton Street (Manhole #16); creating two (2) storage pipe cells providing a total storage volume of approximately 14,200 m^3. Cell 1 consists of a 2,250 mm diameter pipe running between HCS7A and HCS7B; and Cell 2 consists of a 2,000 mm diameter pipe running between HCS7B and HCS7C.

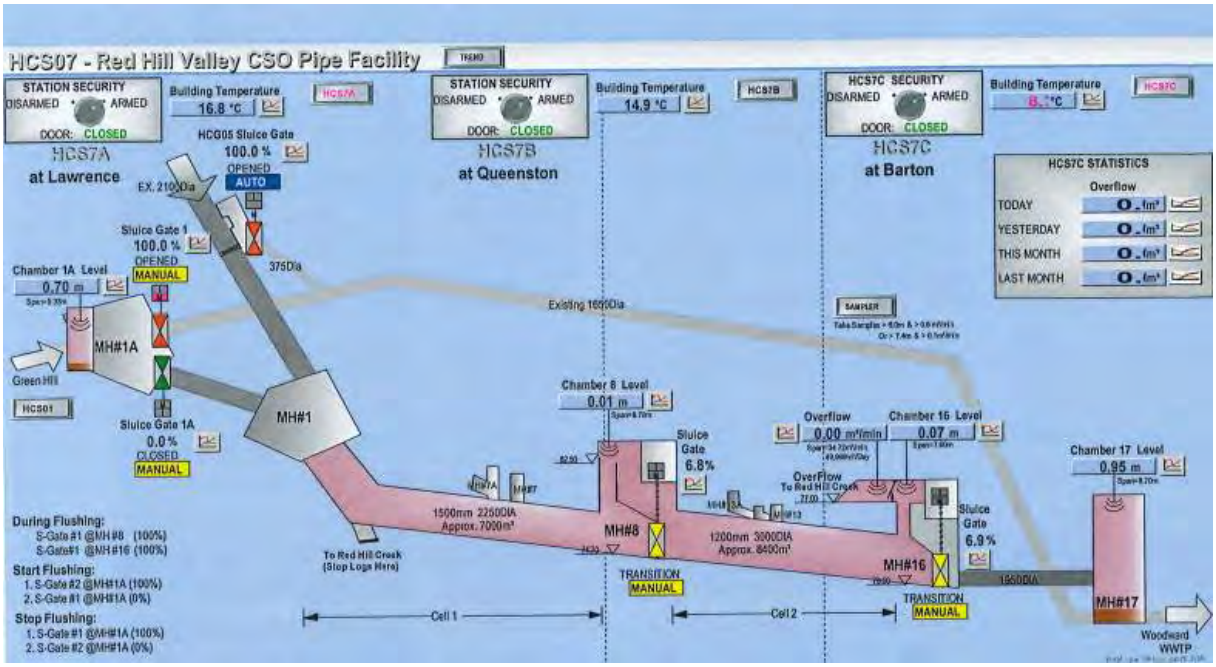
5.3.4 HCS7C includes an 1,800 mm diameter sanitary sewer to drain the storage facility, and a 2,250 mm diameter overflow sewer to Red Hill Creek that only becomes active if the design capacity of the facility is exceeded.

5.3.5 The stored flows are drained from the facility during dry weather, when capacity is available at the Woodward Avenue WWTP to treat the flows, by opening the sluice gates in Chambers HCS7B and HCS7C.

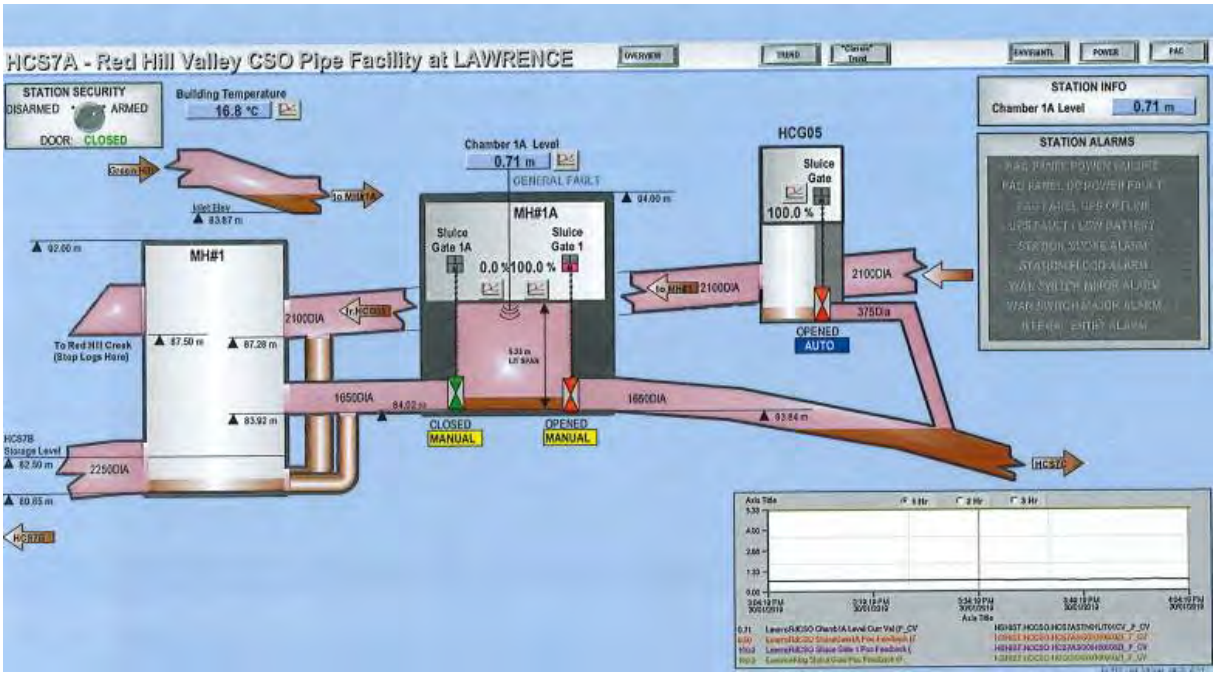
5.3.6 The stored flow behind the gates can also be used to flush any sediments that may have settled at the bottom of the storage pipe cells during storage periods.

5.4 Red Hill CSO Pipe (HCS07) SCADA Screens

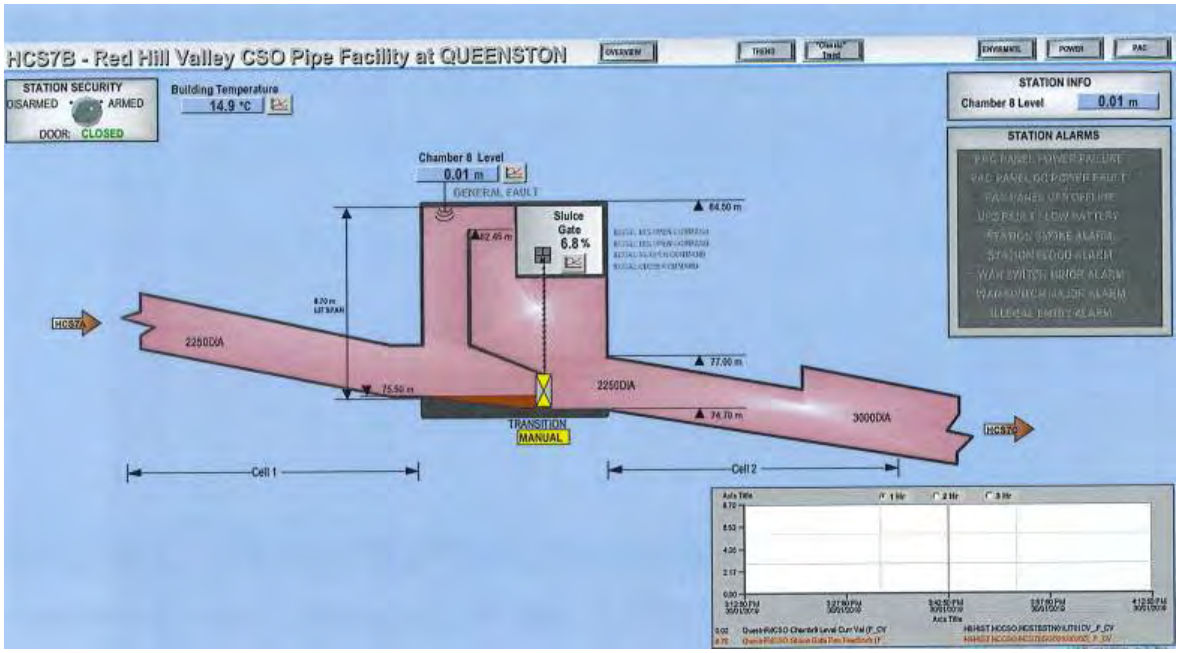
5.4.1 HCS07 Main SCADA Screen



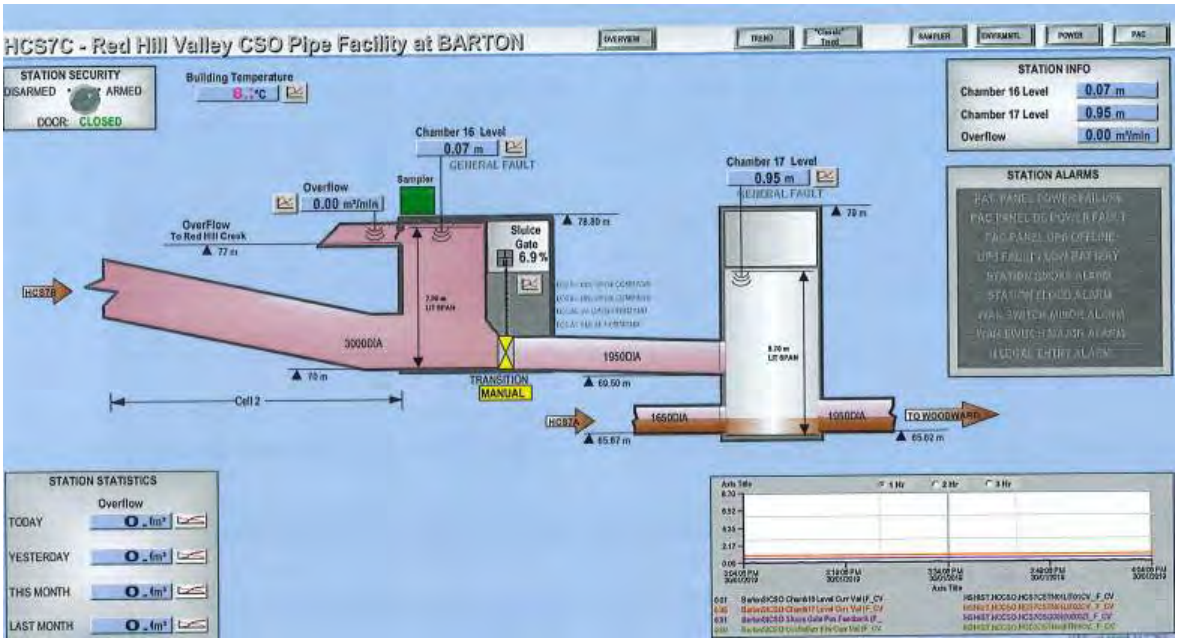
5.4.2 HCS7A SCADA Screen



5.4.3 HCS7B SCADA Screen



5.4.4 HCS7C SCADA Screen



5.5 Dry Weather Operation

5.5.1 HCS7A at Lawrence Road (Manhole #1A SG-1): This gate is normally Open directing inflow to the storage pipe. It is only closed when maintenance is required on the existing 1650 mm diameter RHCSI upstream of this manhole, or while flushing the storage pipe.

5.5.2 HCS7A at Lawrence Road (Manhole #1A SG-2: This gate is normally Closed. It is only opened for backwashing/flushing of the CSO storage pipe.

5.5.3 HCG05, adjacent to HCS7A at Lawrence Road: This gate is normally Open allowing flow into the 1650 mm diameter RHCSI downstream of this gate. This gate can also be closed to reduce the flow into the RCHSI and divert that flow into the CSO storage pipe.

5.5.4 HCS7B at Queenston Road (Manhole #8 SG-1): This gate is normally 5% Open during dry weather allowing flow to enter the RHCSI for conveyance to the WWTP. During a wet weather event, and if the WWTP cannot handle any additional flow, the gate shall be closed with flows diverted into Cell # 1 of the CSO storage pipe.

5.5.5 HCS7C at Barton Street (Manhole #16 SG-1): This gate is normally 5% Open during dry weather allowing flow to enter the RHCSI for conveyance to the WWTP. During a wet weather event, and if the Woodward WWTP cannot handle any additional flow, the gate shall be closed with flows diverted into Cell 2 of the CSO storage pipe.

HCS7B Chamber #8 SG-1 and HCS7C Chamber #16 SG-1 are setpoint limited, only up to 20% Open from the Local Operator Interface, to safely control the rate of drainage of the CSO storage pipe into the RHCSI and on to the WWTP.

5.6 Wet Weather Operation - Filling of the CSO Storage Pipe

5.6.1 The control gates at HCS7B and HCS7C (Manholes #8 and #16) are normally 5% Open during dry weather and when there is no CSO overflowing into the storage facility. During a wet weather event, and if the Woodward WWTP cannot handle any additional flow, these two control gates shall be closed to begin filling the CSO storage pipe. Cell #1 (between HCS7A and HCS7B) fills first, followed by Cell #2 (between HCS7B and HCS7C) after Cell #1 is filled.

The liquid level in the CSO storage pipe is monitored by level sensors installed in storage Cell #1 and Cell #2.

NOTE: When putting the CSO storage pipe into service, notification must be given to the Supervisor of Environmental Monitoring and Enforcement (EME) at Ext 5678. If the CSO storage pipe overflows (at Barton Street) refer to the CSO Overflow Notification list (CSO Overflow Notification List PW-WW-PO-L-011-004) for instructions on reporting.

5.7 Emptying the CSO Storage Pipe following a Rainfall Event

5.7.1 After the storm event, and when Woodward WWTP has capacity available to treat the stored flows, Cell #2 shall be drained first by opening the sluice gate at HCS7C (Manhole #16) gradually in 5% increments (5%, 10%, 15%, etc), at a flow rate that can be safely accommodated for treatment at the Woodward Avenue WWTP. After Cell 2 has been drained, Cell 1 shall be drained in the same manner until it is empty.

5.8 Flushing the CSO Storage Pipe following a Rainfall Event

5.8.1 The gates at HCS7A (Manhole #1A) can be used for maintenance and flushing purposes. Two sluice gates are installed at this structure, SG-1 and SG-2.

Gate SG-1 at HCS7A (Manhole #1A) is normally Open. It should only be Closed when maintenance is required on the existing 1650 mm diameter RHCSI upstream of this manhole, or during backwashing/flushing of the CSO storage pipe.

Gate SG-2 at HCS7A (Manhole #1A) is normally Closed. It should only be Opened for backwashing/flushing of the CSO storage pipe.

Gates SG-1 at HCS7B and HCS7C (Manholes #8 and #16) shall be set to Fully Open for flushing the storage pipe.

The storage pipe can also be scheduled to be washed down in conjunction with drainage of the Greenhill CSO tanks (HCS01 and HCS06), where the flows drained from the upstream CSO tanks will provide more flow that can also be temporarily diverted into the CSO storage pipe to provide increased flushing power.

To Flush the CSO Storage Pipe:

- Set Gate SG-1 at HCS7A (Manhole #1A) to Fully Closed (0% Open)
- Set Gate SG-2 at HCS7A (Manhole #1A) to Fully Open (100% Open)
- Set Gate SG-1 at HCS7B (Manhole #8) to Fully Open (100% Open)
- Set Gate SG-1 at HCS7C (Manhole #16) to Fully Open (100% Open)

5.8.2 Auto Sampler

The automatic water quality sampler on the CSO storage pipe overflow is located at HCS7C (Manhole #16) at Barton Street, and is set up to take a sample automatically every time the level in the chamber at HCS7C (Manhole #16) tops the elevation of the overflow weir crest @ 7.7 meters above the chamber invert.

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Bar Screens, visual inspection to confirm not blocked by debris
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS07, annual position checks and exercising of all sluice gates associated with the facility to confirm they are in proper working order.

6.1.3 Specific to HCS07, annual calibration of CSO Pipe Overflow flow metering system at Chamber HCS7C at Barton Street.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- Confined Space Plan – PW-WW-PO-F-019-001
- CSO Overflow Notification List – PW-WW-PO-L-011-004
- Red Hill Valley CSO Pipe Facility (HCS07) Process Control Narrative, Version 4.2a
- Red Hill Valley CSO Facility (HCS7A) Process Control Narrative, Version 2.3
- Red Hill Valley CSO Facility (HCS7B) Process Control Narrative, Version 2.3
- Red Hill Valley CSO Facility (HCS7C) Process Control Narrative, Version 2.3
- O-M1 Wastewater Station Inspections (Red Hill CSO) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Royal Avenue CSO Storage Tank (HCS08).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
MLD	Mega Litres per Day
PO	Plant Operations
PLC	Programable Logic Controller
PW	Public Works
SCADA	Supervisory Control and Data Acquisition
SFT	Sediment Flushing Tank
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Royal Avenue CSO Tank (HCS08) is located in Stroud Road Park at the east end of Royal Avenue. Inflows to the tank are regulated by a passive overflow structure (Inlet Chamber) located at the southwest corner of the park, which also provides a manual stop log that can be moved to bypass the CSO storage tank if required for maintenance purposes.

This document identifies procedures for the normal operation of HCS08, as well as procedures for confined space entry into the underground storage tank and inlet chamber.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the storage tank and inlet chamber are both considered to be a confined space (CS).

5.1.3 Smoking is not permitted inside the CSO tank, inlet chamber, or effluent flow monitoring chamber.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.6 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out/Tagging PW-WW-PO-P-019-003).

5.1.8 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person.

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter the tank. Ensure that there is no impending rain in the weather forecast, the tank floor has been cleaned and is empty, and the washing system is turned off. The tank may have some liquid in it. Entry can be made so long as gas levels are within acceptable levels.

5.2.2 When entering the control room, shut off the intrusion alarm.

5.2.3 When entering the tank, ensure that it has been flushed and the flushing system has been locked out. The tank may not need to be washed every time there is an entry. Gas testing will determine if the tank needs to be washed. If there is no gas, then there is no need to wash the tank.

5.2.4 Leave all pumps in “Auto” position to ensure that any flow into the tank is pumped out.

5.2.5 Exercise care when entering the tank, as the steps can be slippery.

5.2.6 Do not enter if the portable Methane Detection System does not register "OK". Personnel inside the tank should carry and use a portable gas detector.

5.2.7 At least one person equipped with a two-way radio and flashlight should remain outside the tank/chamber at all times, maintaining the Confined Space Entry Permit and communicating with the person inside the tank via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.8 The person outside the tank/chamber should initiate contact with the person in the tank every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.9 Notify the process supervisor when leaving the site. Remove all lockouts and return all gates to "Remote" mode. Shut off all lights and exhaust fans. Reinstate the intrusion alarm and secure all doors.

5.3 Process and Equipment Overview

5.3.1 The City has constructed a 15,000 m^3 CSO detention storage tank to control existing CSOs discharging to Chedoke Creek at the Royal CSO outfall. The CSO tank is located in the northeast corner of the City-owned parkland on the northeast corner of Royal Avenue and Stroud Road. The underground storage tank will capture CSO prior to discharge and store it during wet weather. During dry weather, the captured CSO will be pumped back into the collection system and conveyed to the Woodward Avenue Wastewater Treatment Plant (WWTP) for full treatment. Settled solids that remain in the tanks after the liquid contents are emptied will be washed from the floor of the tanks and also conveyed to the WWTP. Floating debris will be contained in the tank by underflow baffles located over the CSO tank overflow weir. All equipment at the facilities, including flow control gates, floor cleaning system, pumps, monitoring devices and status indicator alarms is connected to the City's Supervisory Control and Data Acquisition (SCADA) system, so that operators at the Woodward WWTP can monitor and operate all equipment at the tanks remotely. The control building, located at the northeast corner of the storage tank, includes two separate rooms; one to house the electrical controls, and another to house the water valves that control the distribution of water to the sediment flushing buckets and the influent and effluent water quality samplers.

5.3.2 The site originally included a CSO Regular chamber that employed a motorized sluice gate to dynamically control the rate of flow conveyed to the Woodward WWTP. This sluice gate has been removed, and control of the flow conveyed to the WWTP and the new CSO tank is now accomplished passively by a 525 mm drop pipe located in the new diversion chamber at the east end of Royal Avenue. During dry weather and small storm events, the drop pipe will convey all flow into the downstream 900mm

sanitary sewer and on to the WWTP. During larger storm events, the drop pipe will fill to capacity and excess flows will be diverted to the CSO tank after passing through a coarse bar screen. Filling of the CSO Tank will occur passively without any actions having to be initiated by the Operators or the SCADA screen.

5.3.3 The rectangular storage tank is approximately 41 m long x 37 m wide x 10 m deep. Inside the tank, three (3) submersible pumps are provided to empty the tank, and six (6) sediment flushing tanks (SFTs) are provided to clean the floor of the tank after each use. The primary access/regress in/out of the storage tank is provided via a permanent stairway located along the west wall of the storage tank, and the access to the stairs is covered by a large hatch at the ground surface. A secondary access/regress is provided via a manhole located at the northeast corner of the tank, which includes multiple landing areas and guides for fall-arrest equipment. Additional access hatches are provided above the submersible pumps in the southwest corner of the tank to facilitate the removal and installation of each pump for maintenance or repairs as required. Multiple access hatches for the sediment flushing tanks are provided along a concrete pad running the length of the north wall of the tank. A 200 mm diameter vent, located at the northeast corner of the tank, and disguised as a flagpole, provides a means for air to exit the tank as it is displaced by incoming sewage, However, the majority of the air will exit the tank via the CSO tank overflow sewer, where it will then flow into the existing box culvert at the northeast corner of the site.

5.3.4 CSO is conveyed to the storage tank by a 2400 mm x 2400 mm step sewer. The inlet sewer is designed to operate under surcharge, dependent upon the level of the sewage in the CSO storage tank, and air relief is provided along the roof of the sewer to prevent flow from choking due to air pockets that may form after the level of sewage in the storage tank rises above the obvert of the downstream end of the sewer, where it enters the tank. 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. The bars have a spacing of 100 mm, and area inclined at an angle of 45° with the floor of the sewer. The bars span the width of the inlet sewer, but extend only 600 mm up from the floor of the sewer to ensure they cannot become plugged and cause upstream flooding. An emergency bypass is provided at the upstream end of the CSO tank inlet sewer to permit future isolation of the CSO storage tank in emergencies and during special maintenance activities, and a 2400 mm wide x 2000 mm deep box culvert is provided to divert flow to the Chedoke Creek in such special circumstances. The chamber located at the intersection of the incoming box sewer and outgoing CSO tank inlet and emergency bypass sewers 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 upstream end of the emergency bypass sewer, sending all excess wet weather flow to the CSO storage tank. To operate the emergency bypass, the stop log will have to be physically

removed and inserted in the guides 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.

5.3.5 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 CSO storage tank, so they can be subsequently pumped from the tank and coveyed to the Woodward WWTP for treatment. A 5400 mm wide x 1800 mm deep box culvert is provided at the northeast corner of the site. A flow meter and water quality sampler are installed in the CSO tank overflow sewer to monitor the future performance of the facility. A 300 mm high, stainless steel weir, with a 150 mm high square-notch, is installed in the overflow sewer to improve the measurement of smaller overflow rates.

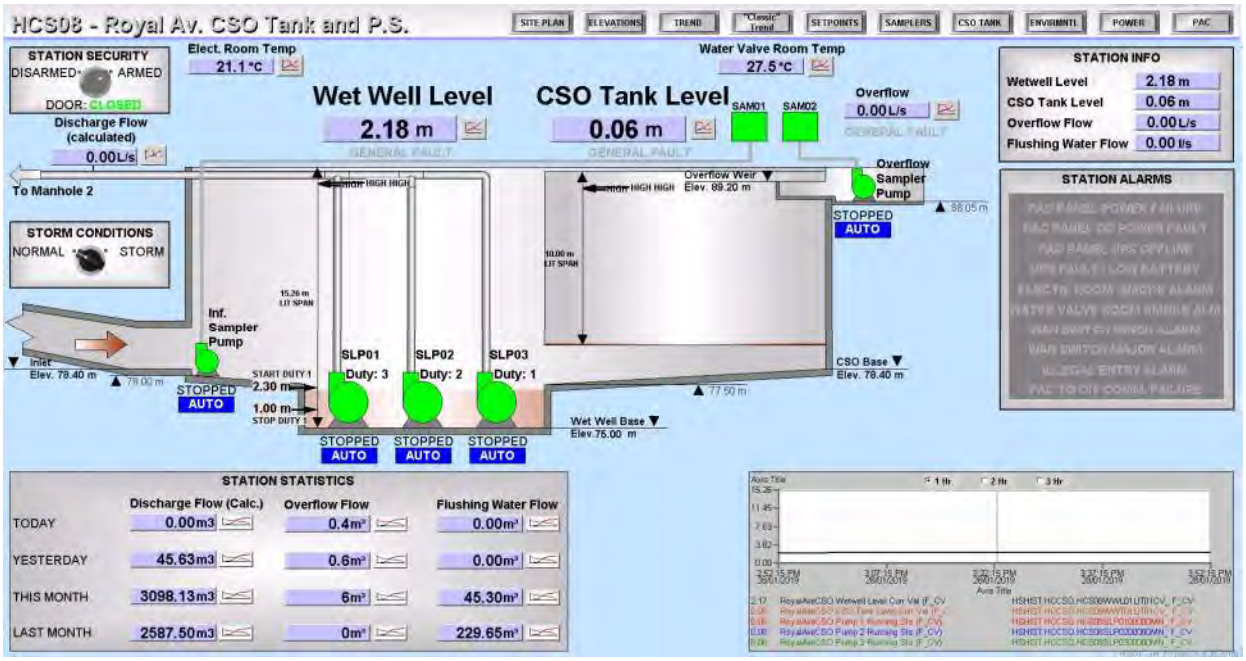
5.3.6 Three (3) 250 L/sec submersible pumps are provided to pump the contents of the storage tank back into the combined sewer system in dry weather, for subsequent conveyance to the Woodward WWTP. The contents of the CSO tank will be drained and conveyed to the WWTP only during dry weather, when the 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.

5.3.7 Six (6) stainless steel sediment flushing tanks (SFTs) are employed to clean the floor of the storage tank following each use. The SFTs are suspended above the floor along the back (north) wall of the storage tank. The SFTs will be filled with potable water, and when full, they will tip and empty their contents down the back wall of the storage tank. The flush water will continue down the sloped floor of the storage tank at a high velocity and wash the solids from the floor. The floor of the tank is sloped, and small containment walls are provided along the floor of the tank between each flushing bay to maintain the momentum and velocity of the flow from the flushing buckets. A 2400 mm wide x 1500 mm deep trough along the south wall of the tank will collect the wash water and channel it to the submersible pumps used to drain the storage tank. The wash water collection trough is sloped toward the sump containing the sewage pumps to reduce the possibility of sediment remaining on the trough slopes. A 150 mm diameter water line is provided from the 150 mm watermain on Stroud Road to supply the water to fill the sediment flushing buckets. The water line terminates inside the control building at the northeast corner of the tank, which houses the valves employed to distribute the water to the flushing buckets.

5.3.8 All equipment at the Royal Avenue CSO Tank, including the submersible sewage pumps; the sediment flushing tanks and the valves that deliver water to them; sewage

level sensors; flow-meters; water quality samplers; and numerous other devices and status indicators and alarms; are connected to a programable logic controller (PLC) in the control building, which records and stores information from these devices, and provides a means of locally operating the sewage pumps and cleaning system. The PLC is connected to the City's SCADA system, which provides the capability to control the storage tank remotely from the Woodward WWTP.

5.4 Royal Avenue CSO Tank (HCS08) SCADA Screen



5.5 Dry Weather Operation (Manual)

5.5.1 Set pumps in the CSO tank to "Start/Dry" via the SCADA system:

1. Go to the HCS08 screen on SCADA
2. Select CSO Pumps System Control "Start/Dry

5.6 Wet Weather Operation

5.6.1 CSO enters the City's storage tanks by gravity, but the rate of filling of the tanks can be increased by closing motorized gates and/or disabling pumps at each of the facilities. This wet weather operation mode begins at the Greenhill CSO Tank, and is initiated when:

- The wet well level at the Woodward Avenue WWTP exceeds 66 m, and
- The flow rate into the Woodward Avenue WWTP exceeds 350 MLD

5.6.2 As the flow rate at the plant increases, filling rates at other facilities are also increased.

The Royal Avenue CSO Tank (HCS08) fills passively by gravity, when the capacity of the 525 mm dry weather flow drop pipe in the tank inlet chamber at the southwest corner of the park is exceeded.

5.6.3 For the Royal Avenue CSO Tank (HCS08), set the pumps in the tank to "Stop/Storm" via the SCADA system.

1. Go to the HCS08 screen on SCADA
2. Select CSO Pumps System Control "Stop/Storm"

NOTE: When putting the CSO tank into wet weather mode, notification must be given to the Supervisor of Environmental Monitoring and Enforcement (EME) at Ext 5678. When the CSO tank overflows, refer to the CSO Overflow Notification List (CSO Overflow Notification List PW-WW-PO-L-011-004).

5.7 Emptying the Tank following a Rainfall Event

5.7.1 Following a storm, when the Woodward Avenue WWTP can accept more flow, the James Street and Greenhill tanks are emptied first. CSO Tanks should be emptied based on priority given to tanks that are closest to overflowing.

5.7.2 For the Royal Avenue CSO Tank, set the pumps in the CSO tank to "Start/Dry" through the SCADA system:

1. Bring up the MAP screen
2. Select CSO Pumps System Control "Start/Dry"

5.8 Washing the Tank following a Rainfall Event

5.8.1 The CSO tank should be cleaned after each use. When the sewage level in the tank has dropped below 1.1 m, tank washing may commence via the SCADA system:

1. Go to the HCS08 screen on SCADA
2. Select Start on the "Wash Tank" icon

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)

- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Bar Screens, visual inspection to confirm not blocked by debris
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS08, annual calibration of CSO Tank Overflow flow metering system.

6.2 Monthly Inspections

6.2.1 Specific to HCS08, monthly inspections of the Manual Stop Log in the CSO Tank Inlet Chamber to confirm that it is in its default Fully Closed Position, and that no sewage is leaking around the Stop Log. The latter can be accomplished by visual inspection of the Inlet Chamber on the downstream side of the stop gate, which can be viewed from above by opening the access hatch cover on the south side of the chamber. The air pressure of the inflatable bladder around the outside of the stop gate (which provides the seal around the gate) should be checked to ensure the seal is tight to prevent any possibility of sewage discharge to Chedoke Creek.

7 ASSOCIATED DOCUMENTS

- CSO Overflow Notification List – PW-WW-PO-L-011-004
- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Plan – PW-WW-PO-F-019-001
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- Royal Ave. CSO Tank (HCS08) Process Control Narrative, Version 1.3
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the McMaster CSO Storage Tank (HCS09).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
EME	Environmental Monitoring and Enforcement
MLD	Mega Litres per Day
PO	Plant Operations
PLC	Programable Logic Controller
PW	Public Works
SCADA	Supervisory Control and Data Acquisition
SFT	Sediment Flushing Tank
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The McMaster CSO Tank (HCS09) is located at McMaster University in the far southwest corner of their Zone M (lower) parking lot on the west side of Cootes Drive.

Wet weather inflows to the tank are regulated by a passive CSO weir at Ewen Road and Main Street West. The CSO tank includes a motorized sluice gate (CSO Tank Inlet Gate) at the southwest corner of the tank that controls flow into the tank, which is normally left in the Fully Open position to allow all flow to enter the storage tank.

The CSO Tank Inlet Gate (if Fully Closed) can also be used to provide a bypass of the storage tank in emergencies or during special maintenance activities, and a manual stop log provided inside the CSO Tank Overflow Chamber can be used to further

isolate the CSO storage tank for special maintenance activities to be conducted within the tank itself. The stop log is normally in a resting position above the CSO Tank Overflow so it does affect the normal hydraulic operation of the tank.

NOTE: The CSO Tank Inlet Gate has been padlocked in the Fully Open position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Ancaster Creek.

This document identifies procedures for the normal operation of HCS09, as well as procedures for confined space entry into the underground storage tank, inlet and overflow chambers, and maintenance bypass channel.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedures

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the storage tank and inlet chamber are both considered to be a confined space (CS).

5.1.3 Smoking is not permitted inside the CSO tank, inlet and overflow chambers, or the maintenance bypass channel.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002) is completed before entry.

5.1.6 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out/Tagging PW-WW-PO-P-019-003).

5.1.8 Use of a portable gas detector, lifeline/extraction, and two-way radios are mandatory. Fully charged breathing apparatus should be on site at all times in case of an emergency.

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person.

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter the tank. Ensure that there is no impending rain in the weather forecast, the tank floor has been cleaned and is empty, and the washing system is turned off. The tank may have some liquid in it. Entry can be made so long as gas levels are within acceptable levels.

5.2.2 When entering the control room, shut off the intrusion alarm.

5.2.3 When entering the tank, ensure that it has been flushed and the flushing system has been locked out. The tank may not need to be washed every time there is an entry. Gas testing will determine if the tank needs to be washed. If there is no gas, then there is no need to wash the tank.

5.2.4 Leave all pumps in “Auto” position to ensure that any flow into the tank is pumped out.

5.2.5 Exercise care when entering the tank, as the steps can be slippery.

5.2.6 Do not enter if the portable Methane Detection System does not register “OK”. Personnel inside the tank should carry and use a portable gas detector.

5.2.7 At least one person equipped with a two-way radio and flashlight should remain outside the tank/chamber at all times, maintaining the Confined Space Entry Permit and communicating with the person inside the tank via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.8 The person outside the tank/chamber should initiate contact with the person in the tank every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.9 Notify the process supervisor when leaving the site. Remove all lockouts and return all gates to “Remote” mode. Shut off all lights and exhaust fans. Reinstate the intrusion alarm and secure all doors.

5.3 Process and Equipment Overview

5.3.1 The McMaster CSO Tank (HCS09) is an underground reinforced concrete structure that provides approximately 5,935 m^3 of CSO storage capacity. The storage volume is provided within a rectangular tank, which is approximately 50 m long x 18 m wide x 6.6 m deep. When the tank is full, some additional CSO storage volume is provided within the upstream CSO tank inlet sewer.

5.3.2 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.

5.3.3 Under normal operation, the CSO Tank Inlet Gate is Fully Open and the manual 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.

NOTE: The CSO Tank Inlet Gate has been padlocked in the Fully Open position to ensure all incoming sewage flows are conveyed into the CSO storage tank and eliminate the possibility of any dry weather sewage discharges to Ancaster Creek.

5.3.4 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 manual stop log has to be physically removed from its default position and inserted into the alternate guides provided over the end of the CSO tank overflow sewer.

5.3.5 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 2400 mm wide x 1000 mm (sloped) overflow trough is provided at the northwest corner of the tank to safely convey any overflows from the facility into the 1800 mm overflow sewer discharging to Lower Ancaster Creek

5.3.6 Three (3) 137 L/sec submersible pumps are provided to pump the contents of the storage tank back into the combined sewer system 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 flow 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.

5.3.7 Three (3) stainless steel sediment flushing tanks (SFTs) are employed to clean the floor of the storage tank following each use. The SFTs are suspended above the floor along the back (north) wall of the storage tank. The SFTs are filled with potable water, and when full, they will tip and empty their contents down the back wall of the storage

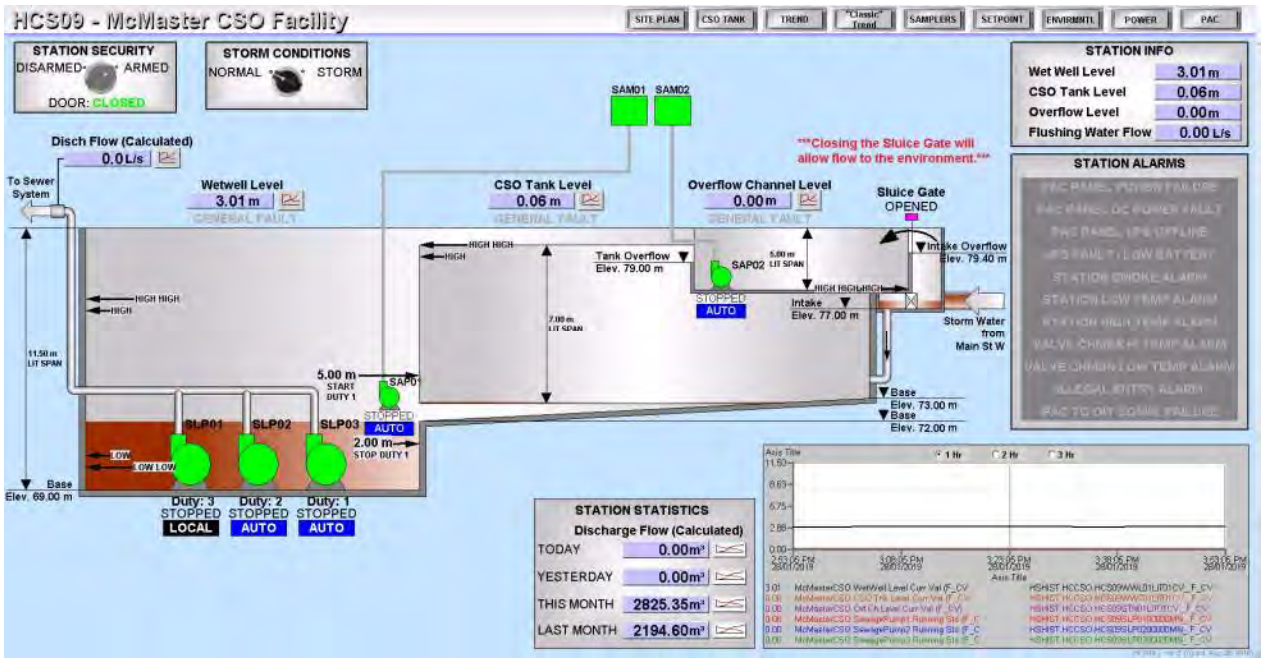
tank. The flush water continues down the sloped floor of the storage tank at a high velocity and wash the solids from the floor. The floor of the tank is sloped, and small containment walls are provided along the floor of the tank between each flushing bay to maintain the momentum and velocity of the flow from the flushing buckets.

5.3.8 A 2400 mm wide x 600-1000 mm deep trough along the east wall of the tank collects the wash water and channels it to the submersible pumps used to drain the storage tank. The wash water collection trough is sloped toward the sump containing the sewage pumps to reduce the possibility of sediment remaining on the trough slopes. A 100 mm diameter water line is provided from the watermain on Sanders Boulevard to supply the water to fill the SFTs. The water line terminates inside the control building at the soutwest corner of the tank, which houses the valves employed to distribute the water to the SFTs.

5.3.9 The facility is monitored and controlled via the City's Supervisory Control and Data Acquisition (SCADA) system 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.

5.3.10 All equipment at the McMaster CSO Tank, including the CSO Tank Inlet Gate, the submersible sewage pumps; the sediment flushing tanks and the valves that deliver water to them; sewage level sensors; flow-meters; water quality samplers; and numerous other devices and status indicators and alarms; are connected to a programable logic controller (PLC) in the control building, which records and stores information from these devices, and provides a means of locally operating the sewage pumps and cleaning system. The PLC is connected to the City's SCADA system, which provides the capability to control the storage tank remotely from the Woodward WWTP.

5.4 McMaster CSO Tank (HCS09) SCADA Screen



5.5 Dry Weather Operation (Manual)

5.5.1 Set pumps in the CSO tank to “Start/Dry” via the SCADA system:

1. Go to the HCS09 screen on SCADA
2. Select CSO Pumps System Control “Start/Dry

5.6 Wet Weather Operation

5.6.1 CSO enters the City’s storage tanks by gravity, but the rate of filling of the tanks can be increased by closing motorized gates and/or disabling pumps at each of the facilities. This wet weather operation mode begins at the Greenhill CSO Tank, and is initiated when:

- The wet well level at the Woodward Avenue WWTP exceeds 66 m, and
- The flow rate into the Woodward Avenue WWTP exceeds 350 MLD

5.6.2 As the flow rate at the plant increases, filling rates at other facilities are also increased.

The McMaster CSO Tank (HCS09) fills passively by gravity, when the capacity of the CSO regulator (overflow weir) at Ewen Road and Main Street West is exceeded.

5.6.3 For the McMaster CSO Tank (HCS09), set the pumps in the tank to “Stop/Storm” via the SCADA system.

1. Go to the HCS09 screen on SCADA
2. Select CSO Pumps System Control "Stop/Storm"

NOTE: When putting the CSO tank into wet weather mode, notification must be given to the Supervisor of Environmental Monitoring and Enforcement (EME) at Ext 5678. When the CSO tank overflows, refer to the CSO Overflow Notification List (CSO Overflow Notification List PW-WW-PO-L-011-004).

5.7 Emptying the Tank following a Rainfall Event

5.7.1 Following a storm, when the Woodward Avenue WWTP can accept more flow, the James Street and Greenhill tanks are emptied first. CSO Tanks should be emptied based on priority given to tanks that are closest to overflowing.

5.7.2 For the McMaster CSO Tank, set the pumps in the CSO tank to "Start/Dry" through the SCADA system:

1. Go to the HCS09 screen on SCADA
2. Select CSO Pumps System Control "Start/Dry"

5.8 Washing the Tank following a Rainfall Event

5.8.1 The CSO tank should be cleaned after each use. When the sewage level in the tank has dropped below 1.0 m, tank washing may commence via the SCADA system:

1. Go to the HCS09 screen on SCADA
2. Select Start on the "Wash Tank" icon

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting

- Bar Screens, visual inspection to confirm not blocked by debris
- Flushing System, including testing of system in SCADA Auto mode, verifying SFTs are tipping and emptying properly, checking valve chambers for leaks, and reporting any abnormalities
- Water Quality Samplers, including testing to confirm proper operation
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

6.1.2 Specific to HCS09, annual calibration of CSO Tank Overflow flow metering system.

6.2 Monthly Inspections

6.2.1 Specific to HCS09, monthly inspections of the CSO Tank Inlet Gate to confirm that it is in the Fully Open position (it should be, since it has been padlocked in this position).

7 ASSOCIATED DOCUMENTS

- CSO Overflow Notification List – PW-WW-PO-L-011-004
- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Plan – PW-WW-PO-F-019-001
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- McMaster CSO Tank (HCS09) Process Control Narrative, Version 1.4
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Wentworth/Rosemary Sluice Gate (HCG03).

2 SCOPE

This procedure applies to all operations staff including: Plant operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
MLD	Mega Litres per Day
PO	Plant Operations
PW	Public Works
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
WSI	Western Sanitary Interceptor
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Wentworth/Rosemary Sluice Gate (HCG03) is located in Manhole HJ06E002 at the intersection of Wentworth Street North and Rosemary Avenue.

The CSO gate regulates flows from the combined sewer on Wentworth Street North, controlling the amount of flow conveyed to the Woodward Avenue Wastewater Treatment Plant (WWTP) and/or Wentworth Street CSO Outfall Sewer in wet weather.

This document identifies procedures for the normal operation of the gate in both dry and wet weather flow, as well as procedures for confined space entry into the underground gate chamber.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedure

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the chamber that contains the sluice gate and overflow weir is considered a confined space (CS).

5.1.3 Smoking is not permitted inside the control building or sluice gate chamber.

5.1.4 Ensure the City of Hamilton policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002), is completed before entry.

5.1.6 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out/Tagging PW-WW-PO-P-019-003).

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person.

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter the sluice gate chamber. Ensure that there is no impending rain in the weather forecast. The chamber may have some flow passing through it. Entry can be made so long as gas levels are within acceptable levels.

5.2.2 When entering the control room/building, shut off the intrusion alarm.

5.2.3 Make sure the sluice gate is Open so sewage continues to enter the downstream interceptor sewer and cannot back up inside the chamber.

5.2.4 Do not enter the gate chamber if the portable Methane Detection System does not register “OK”. Personnel inside the tank should carry and use a portable gas detector.

5.2.5 At least one person equipped with a two-way radio and flashlight should remain outside the chamber at all times, maintaining the “Confine Space Entry Permit” and communicating with the person inside the chamber via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.6 The person outside the chamber should initiate contact with the person in the chamber every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.7 Notify the process supervisor when leaving the site. Remove all lockouts and return all gates to "Remote" mode. Shut off all lights and exhaust fans. Reinstate the intrusion alarm and secure all doors.

5.3 Process and Equipment Overview

5.3.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. Nearly 200 diversion structures regulate the amount of flow reaching the WWTP. The vast majority of these structures are static flow regulators where the volume of overflow is simply dependent upon the level of sewage entering the structure. Static flow regulators cannot be quickly or easily manipulated, if at all, to control the volume of flow entering the interceptors. However, the Combined Sewer System also employs a number of motorized sluice gates which can be opened or closed by operators at the Woodward Avenue WWTP to dynamically regulate the amount of flow entering the sanitary interceptors. These gates are required to reduce inflows to the WWTP Main Pumphouse during extreme storm events, in order to ensure that the WWTP is not overloaded. Centralized control of the gates is made possible via the Supervisory Control and Data Acquisition (SCADA) system.

5.3.2 The Wentworth/Rosemary Sluice Gate regulates the flow of combined sewage from a 266 ha area. The gate is located in Manhole HJ06E002 at the intersection of Wentworth Street North and Rosemary Avenue. During dry weather and small storms, a static overflow weir captures all flows and conveys them through the open gate and into the Western Sanitary Interceptor (WSI) via a 900 mm sewer on Hillyard Street. This sewer connects to the WSI at the intersection of Hillyard and Burlington Streets, and the WSI conveys the flows east to the WWTP. During larger storms, when the weir is overtopped, excess flows are diverted to the Wentworth Street CSO outfall via a 2500 mm x 2400 mm sewer on Wentworth Street North. During an emergency or where an extreme storm event requires operation of more than three (3) pumps in the WWTP Main Pump house and plant by-passing at the is imminent (Flow > 614MLD), the Process Supervisor may elect to close this sluice gate to by-pass all combined sewage through the Wentworth Street CSO Outfall. Bypassing these excess flows at

their source provides additional protection of the WWTP and reduces the pumping of flows at the plant that would not be provided treatment in any case.

NOTE: When in Auto mode this station functions as part of the Real Time Control (RTC) system and will automatically close the isolation gate when the Western Sanitary Interceptor (WSI) reaches a high level measured at HCG14.

5.4 Dry Weather Operation (Manual)

Manually set the Wentworth/Rosemary Sluice Gate (HCG03) to "Open" via the SCADA system:

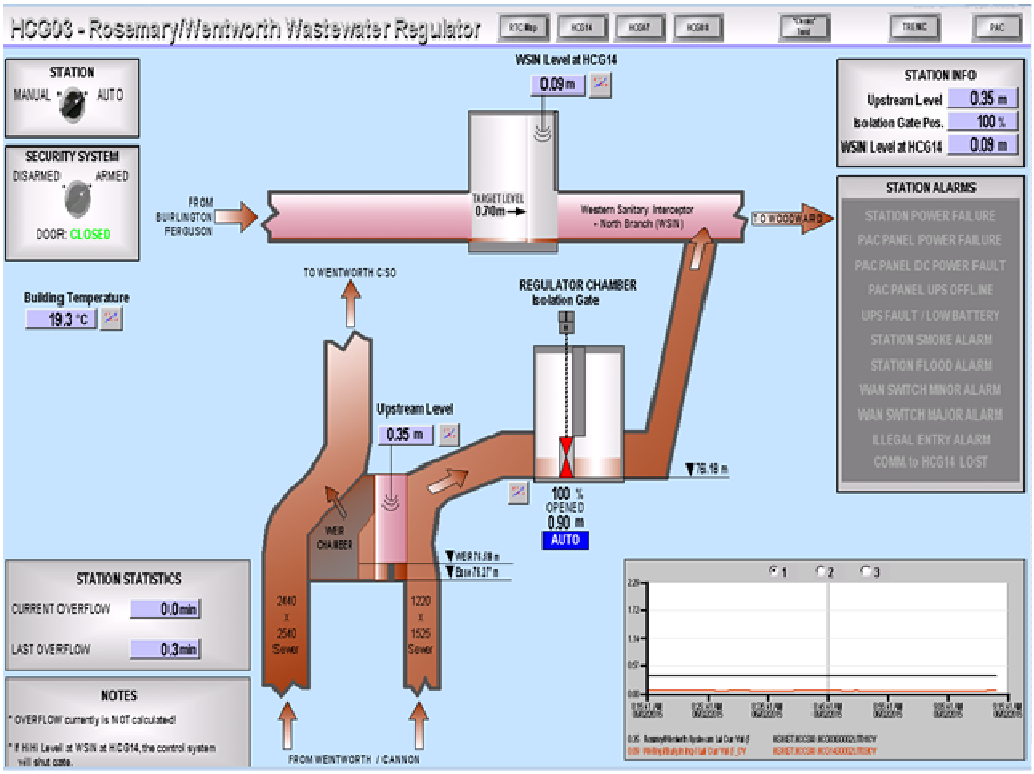
1. Go to the HCG03 screen on SCADA
2. Select "HCG03 Isolation Gate" and set to "Open"

5.5 Wet Weather Operation

When three (3) pumps are operating at the Woodward Avenue WWTP during an extreme storm and bypassing is imminent (Flow > 614 MLD), set the Wentworth/ Rosemary Sluice Gate (HCG03) to "Closed" via the SCADA system:

1. Go to the HCG03 screen on SCADA
2. Select "HCG03 Isolation Gate" and set to "Closed

5.6 Wentworth/Rosemary Sluice Gate (HCG03) SCADA Screen



6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, electric hoists, hatch covers

6.1.2 Specific to HCG03, annual position checks and exercising of the sluice gate to confirm it is in proper working order.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- Wentworth/Rosemary Regulator (HCG03) Process Control Narrative, Version 3.3
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Brampton/Strathearne Sluice Gate (HCG04).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
PO	Plant Operations
PW	Public Works
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
WSI	Western Sanitary Interceptor
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Plant Manager / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to Superintendent, Wastewater Treatment Process
- Work with Superintendent, Wastewater Treatment Process to develop corrective action plan and to implement it to resolve the issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems.

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Brampton/Strathearne Sluice Gate (HCG04) is located in Manhole HO06E003 on Strathearne Avenue, just south of Brampton Street behind the Dofasco security guard house.

This CSO gate regulates flows from the combined sewer on Strathearne Avenue, controlling the amount of flow conveyed to the Woodward Avenue WWTP and/or Strathearne Avenue CSO Outfall Sewer in wet weather.

This document identifies procedures for the normal operation of the gate in both dry and wet weather flow, as well as procedures for confined space entry into the underground gate chamber.

5.1 Safety Notes and Procedure

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the chamber that contains the sluice gate and overflow weir is considered a confined space (CS).

5.1.3 Smoking is not permitted inside the control building or sluice gate chamber.

5.1.4 Ensure the company policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.5 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template PW-WW-PO-F-019-002), is completed before entry.

5.1.6 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.7 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out / Tagging PW-WW-PO-P-019-003).

5.2 Procedure for Tank Entry: Routine Minor Maintenance and Inspection

NOTE: A Hazard Assessment and Project Specific Entry Procedure must be written for Construction, Major Maintenance, or for Entry by more than One Person.

5.2.1 Fill out and execute a Confined Space Entry Permit and notify the Process Supervisor at the Woodward Avenue Wastewater Treatment Plant (WWTP) (905-546-2424 Ext 1086 or cell phone 905-570-6124) of your intent to enter the sluice gate chamber. Ensure that there is no impending rain in the weather forecast. The chamber may have some flow passing through it. Entry can be made so long as gas levels are within acceptable levels.

5.2.2 When entering the control room/building, shut off the intrusion alarm.

5.2.3 Make sure the sluice gate is Open so sewage continues to enter the downstream interceptor sewer and cannot back up inside the chamber.

5.2.4 Do not enter the gate chamber if the portable Methane Detection System does not register “OK”. Personnel inside the tank should carry and use a portable gas detector.

5.2.5 At least one person equipped with a two-way radio and flashlight should remain outside the chamber at all times, maintaining the “Confine Space Entry Permit” and communicating with the person inside the chamber via a two-way radio. All personnel should wear long sleeves, long pants, safety boots, gloves, safety vest and hardhat at all times.

5.2.6 The person outside the chamber should initiate contact with the person in the chamber every 10 minutes via two-way radio. If there is no response, attempt to contact a second time, and if there is no response again, initiate emergency measures.

5.2.7 Notify the process supervisor when leaving the site. Remove all lockouts and return all gates to “Remote” mode. Shut off all lights and exhaust fans. Reinstate the intrusion alarm and secure all doors.

5.3 Process and Equipment Overview

5.3.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. Nearly 200 diversion structures regulate the amount of flow reaching the WWTP. The vast majority of these structures are static flow regulators where the volume of overflow is simply dependent upon the level of sewage entering the structure. Static flow regulators cannot be quickly or easily manipulated, if at all, to control the volume of flow entering the interceptors. However, the Combined Sewer System also employs a number of motorized sluice gates which can be opened or closed by operators at the Woodward Avenue WWTP to dynamically regulate the amount of flow entering the sanitary interceptors. These gates are required to reduce inflows to the WWTP Main Pumphouse during extreme storm events, in order to ensure that the WWTP is not overloaded. Centralized control of the gates is made possible via the Supervisory Control and Data Acquisition (SCADA) system.

5.3.2 The Brampton/Strathearne Sluice Gate regulates the flow of combined sewage from a 210 ha area. The gate is located in manhole HO06E003 on Strathearne Avenue, just south of Brampton Street behind the Dofasco security guard house. During dry weather and small storms, a static overflow weir captures all flows and conveys them through the open gate and into the Western Sanitary Interceptor (WSI) via a 1050 mm sewer on Strathearne Avenue. This sewer connects to the WSI at the intersection of Strathearne Avenue and Burlington Street, and the WSI conveys the flows east to the WWTP. During larger storms, when the weir is overtopped, excess flows are diverted to the Strathearne CSO outfall via a 2100 mm x 2250 mm sewer on Strathearne Avenue. During an emergency, where an extreme storm event requires operation of five (5) or more pumps in the WWTP Main Pump House, the Process Supervisor may elect to close this sluice gate to by-pass all combined sewage through the Strathearne Avenue CSO Outfall. Bypassing these excess flows at their source provides additional protection of the WWTP, and reduces the pumping of flows at the plant that would not be provided treatment in any case.

5.4 Dry Weather Operation (Manual)

Manually set the Brampton/Strathearne Sluice Gate (HCG04) to “Open” via the SCADA system:

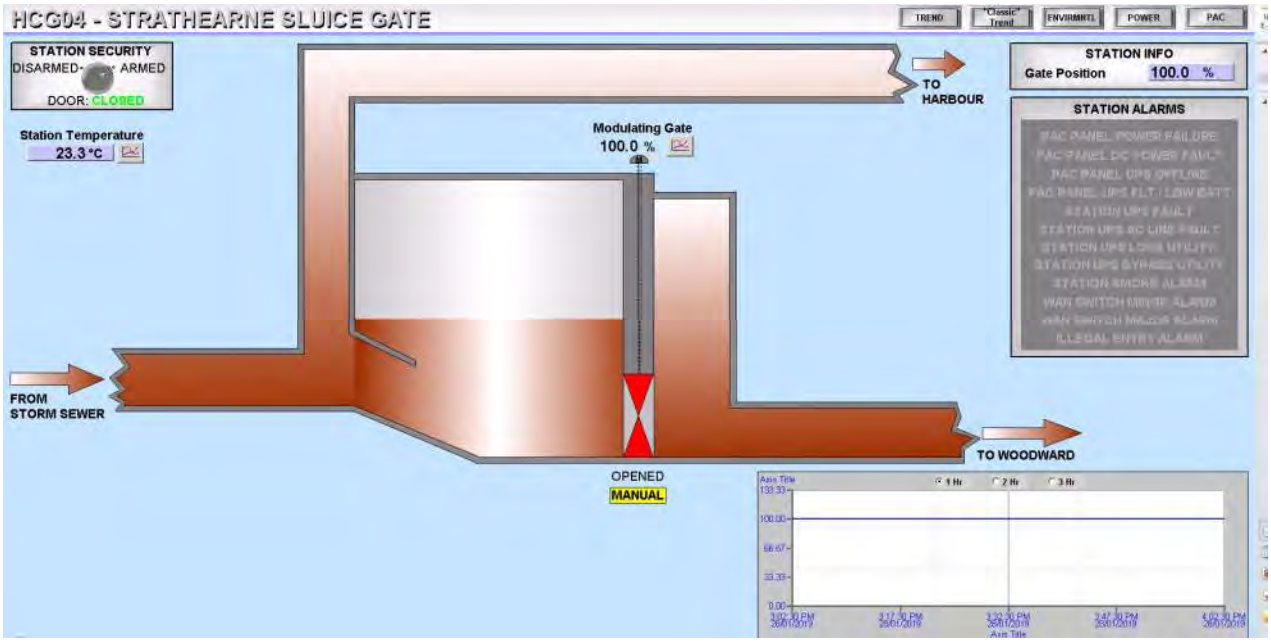
1. Go to the HCG04 SCADA screen
2. Select “HCG04 Isolation Gate” and set to “Open” or alternatively enter 100% Open setpoint

5.5 Wet Weather Operation

When five (5) pumps are operating at the Woodward Avenue WWTP during an extreme storm event, set the Brampton/Strathearne Sluice Gate (HCG04) to "Closed" via the SCADA system:

1. Go to the HCG04 SCADA screen
2. Select "HCG04 Isolation Gate" and set to "Closed" or alternatively enter 0% Open setpoint

5.6 Brampton/Strathearne Sluice Gate (HCG04) SCADA Screen:



6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment

- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, electric hoists, hatch covers

6.1.2 Specific to HCG04, annual position checks and exercising of the sluice gate to confirm it is in proper working order.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging – PW-WW-PO-P-019-003
- Confined Space Procedure – PW-WW-PO-P-019-001
- Confined Space Program – WW Level III - PW-WW-P-019-001
- Confined Space Hazard Assessment Form – PO Level IV - PW-WW-PO-F-019-002
- Confined Space Entry Permit – PO Level IV - PW-WW-PO-F-019-003
- Brampton/Strathearne Regulator (HCG04) Process Control Narrative, Version 1.2
- O-M1 Wastewater Station Inspections (CSO Stations) Procedure

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Wellington/Burlington Sluice Gates (HCG14).

2 SCOPE

This procedure applies to all operations staff including: plant operators, process supervisors, maintenance staff and superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
CS	Confined Space
CSO	Combined Sewer Overflow
DWF	Dry Weather Flow
PCN	Process Control Narrative
PID	Proportional-Integral-Derivative Controller
PO	Plant Operations
PW	Public Works
PLC	Programmable Logic Controller
RTC	Real Time Control
SCADA	Supervisory Control and Data Acquisition
WW	Wastewater
WWF	Wet Weather Flow
WWTP	Wastewater Treatment Plant
WSIN	West Sewer Interceptor, North Branch

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure

- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy
- Ensure that staff are trained on and follow this procedure
- Ensure that all the operations staff follow this procedure and respond to alarms

4.3 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.4 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop corrective action plan and to implement it to resolve the issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.5 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

The Wellington/Burlington Sluice Gates (HCG14) is located on the north side of Burlington Street, just west of Wellington Street.

This CSO gates regulate flows from the combined sewer on Wellington Street, controlling the amount of flow conveyed to the Woodward Avenue WWTP and/or Wellington CSO Outfall Sewer in wet weather.

This document identifies procedures for the normal operation of HCG14 in both dry and wet weather flow, as well as procedures for confined space entry into the underground gate chamber.

Hydro services to this station are provided by Alectra Utilities (905-522-6611).

5.1 Safety Notes and Procedure

5.1.1 Ensure all applicable City of Hamilton policies and procedures are understood and followed. Refer to BCOS or PO Workspace.

5.1.2 The area inside the chamber that contains the sluice gate and overflow weir is considered a confined space.

5.1.3 Ensure the company policy on Confined Space Entry (Confined Space Program PW-WW-P-019-001) is understood and followed before entry is attempted.

5.1.4 Ensure that the Confined Space Hazard Assessment (Confined Space Hazard Assessment Form Template- Plant Operations - Level IV - PW-WW-PO-F-019-002), is completed before entry.

5.1.5 Ensure the CS Entry Plan (Confined Space Plan PW-WW-PO-F-019-001) and CS Entry Permit (Confined Space Entry Permit – Plant Operations Level IV PW-WW-PO-F-019-003) are filled out prior to entry.

5.1.6 Ensure any lockout points are identified and locked according to Lock Out/Tag procedure (Lock Out / Tagging PW-WW-PO-P-019-003).

5.2 Process and Equipment Overview

5.2.1 The older parts of the City of Hamilton are served by combined sewers, where a single sewer system conveys both sanitary sewage and stormwater runoff. During dry weather and light rainfall, the combined sewers convey all flows to the Woodward Avenue Wastewater Treatment Plant (WWTP). During heavy rainstorms, flows that exceed the capacity of the sewer system and/or the WWTP are diverted to local receiving waters. These combined sewer overflows (CSOs) are necessary in order to minimize basement flooding and overloading of the WWTP. Nearly 200 diversion structures regulate the amount of flow reaching the WWTP. The vast majority of these structures are static flow regulators where the volume of overflow is simply dependent upon the level of sewage entering the structure. Static flow regulators cannot be quickly or easily manipulated, if at all, to control the volume of flow entering the interceptors. However, the Combined Sewer System also employs a number of motorized sluice gates which can be opened or closed by operators at the Woodward Avenue WWTP to dynamically regulate the amount of flow entering the sanitary interceptors. These gates are required to reduce inflows to the WWTP Main Pumphouse during extreme storm events, in order to ensure that the WWTP is not

overloaded. Centralized control of the gates is made possible via the Supervisory Control and Data Acquisition (SCADA) system.

NOTE: 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.

5.2.2 The Wellington-Burlington Regulator (SCADA tag HCG14), went into service in the year 2012, at the intersection of Wellington Street North and Burlington Street East where the Wellington CSO crosses the West Sewer Interceptor (WSIN). The purpose of this site is to capture combined sewage from the Wellington CSO and to convey it to the WSIN for conveyance to the Woodward Avenue WWTP for treatment.

5.2.3 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.

5.2.4 During dry weather flow (DWF) conditions, both gates remain fully closed. During wet weather flow (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 set-point. 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 process control narrative (PCN) for the site.

5.2.5 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.

5.2.6 The Control Building at 221 Burlington Street East contains the electrical, control, communications equipment and UPS back-up power for isolation slide gate emergency operation in the event of power failure

5.3 Dry Weather Operation (Manual)

Manually set the Wellington/Burlington Sluice Gate (HCG14) to "Open" via the SCADA system:

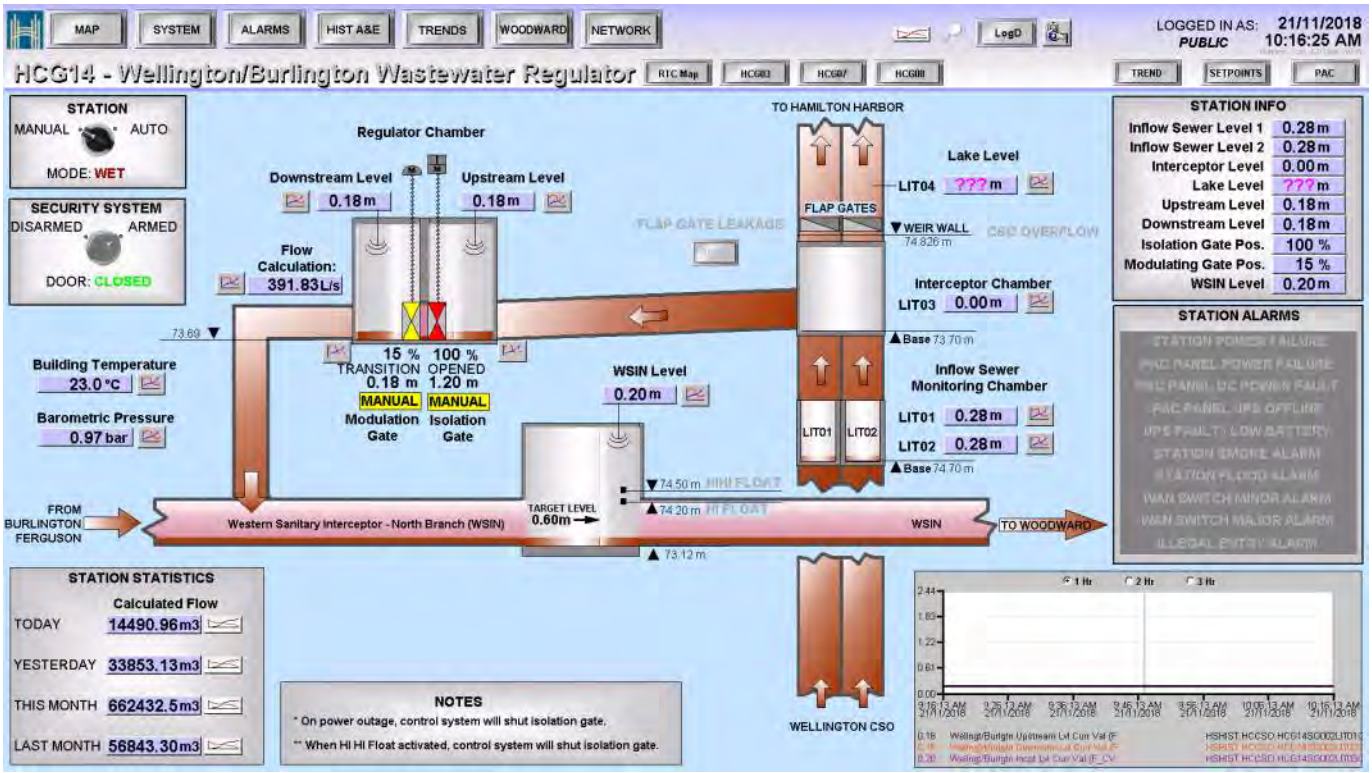
1. Go to the HCG14 SCADA screen
2. Select "HCG14 Isolation Gate" and set to "Open"

5.4 Wet Weather Operation (Manual)

When three (3) pumps are operating at the Woodward Avenue WWTP during an extreme storm and bypassing is imminent (Flow > 614 MLD), set the Wellington/Burlington Sluice Gate (HCG14) to "Closed" via the SCADA system:

1. Go to the HCG14 SCADA screen
2. Select "HCG14 Isolation Gate" and set to "Closed

5.5 SCADA Screen for HCG14 WWTP-Controlled Sluice Gates



6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections (CSO Stations) Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, electric hoists, hatch covers

6.1.2 Specific to HCG14, annual position checks and exercising of the sluice gates to confirm they are in proper working order.

7 ASSOCIATED DOCUMENTS

- Lock Out / Tagging PW-WW-PO-P-019-003
- Confined Space Procedure – Plant Operations Section PW-WW-PO-P-019-001
- Confined Space Program PW-WW-P-019-001
- Confined Space Hazard Assessment Form Template- Plant Operations - Level IV-PW-WW-PO-F-019-002
- Confined Space Entry Permit – Plant Operations Level IV PW-WW-PO-F-019-003
- Wastewater Regulator (HCG14) Process Control Narrative, Version 1.7
- O-M1 Wastewater Station Inspections (CSO Stations)

BCOS software tracks the revision history of document.

1 PURPOSE

To provide procedures for the safe and efficient operation of the Parkdale Burlington Wastewater Collection Station (HC001).

2 SCOPE

This procedure applies to all operations staff including: Plant Operators, Process Supervisors, Maintenance staff and Superintendents involved in operations of wastewater systems.

3 DEFINITIONS

BCOS	Beyond Compliance Operating System
DWQMS	Drinking Water Quality Management System
PO	Plant Operations
PW	Public Works
SCADA	Supervisory Control and Data Acquisition
PLC	Programmable Logic Controller
WW	Wastewater
WWTP	Wastewater Treatment Plant

4 RESPONSIBILITY

4.1 Manager, Plant Operations / Manager, Plant Maintenance & Technical Services

- Overall responsibility to ensure compliance with this procedure
- Ensure that, at all times, the facilities and related equipment and appurtenances used to achieve the compliance with this procedure are properly operated and maintained

4.2 Superintendent, Wastewater Treatment Process

- Update this procedure as required to ensure its accuracy

4.3 Superintendent, Plant Operations

- Ensure that all the operations staff follow this procedure and respond to alarms

4.4 Process Supervisor

- Immediately report suspected problems and issues to the Superintendent, Wastewater Treatment Process and Superintendent, Plant Operations
- Work with the Superintendent, Wastewater Treatment Process to develop a corrective action plan and implement it to resolve any issues

4.5 Operators

- Follow this procedure and respond to alarms
- Immediately report suspected problems and issues to the Process Supervisor
- Work with Superintendent, Wastewater Treatment Process and Process Supervisor to develop a corrective action plan and to implement it to resolve any issues
- Thoroughly document with time all aspects of any incident including the identification of a potential problem, consultations, assessments, actions taken, corrective action plan, implementation of corrective actions, and actions required to prevent reoccurrence of problems

4.6 Maintenance Staff

- Follow this procedure
- Immediately report suspected problems and issues to your Supervisor

5 PROCEDURE

5.1 General Overview

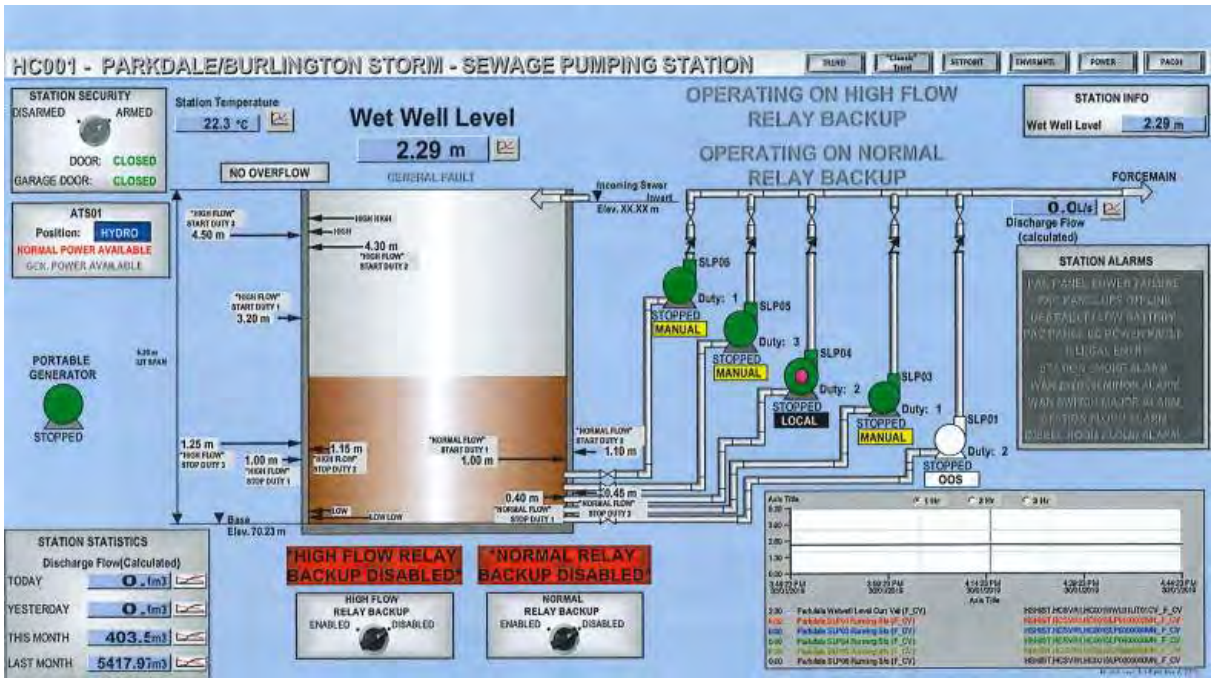
5.1.1 This collection station is located on the northwest corner of Parkdale Avenue North and Nicola Tesla Boulevard in Hamilton.

5.1.2 This station is equipped with 5 pumps - 2 each rated at 150 L/s, and 3 each rated at 600 L/s.

5.1.3 This station is used for high flow bypass during rainstorms by allowing the wet well to fill and then pumping it out to Hamilton Harbour.

NOTE: This procedure is currently under review. Currently, pumps are kept on standby until the HI HI level is reached in the wet well.

5.2 Parkdale Burlington Wastewater Collection Station (HC001) SCADA Screen



5.3 Normal Operation

5.3.1 Under normal operating conditions, HC001 is monitored and controlled automatically through the City's SCADA system located in the control room of the Woodward Avenue Wastewater Treatment Plant (WWTP) and can also be monitored from several other remote locations. The level relays from the wet well ultrasonic transmitter are used to start and stop each of the pumps.

5.3.2 When the operation of the pumps is in Auto Control mode, the units start and stop according to the following set points programmed within the station's programmable logic controller (PLC). These set points open and close relays within each of the five pumps, which in turn start and stop the pumps:

Milltronics Control	Starting	Stopping
Pump #1	0.9 m	0.2 m
Pump #3	1.1 m	0.27 m
Pump #4	3.2 m	0.9 m
Pump #5	4.3 m	1.0 m
Pump #6	4.6 m	1.25 m

NOTE: The wet well has been sealed off due to safety concerns about the entry walls.

5.4 Manual Operation at the Control Panel in Station

To operate the station, manually perform the following:

- Ensure all discharge and suction valves are open.
- Turn the MAN-OFF-AUTO Selector Switch for each pump to the OFF position.
- Turn the MAN-OFF-AUTO Selector Switch for each pump to the MAN position.
- Push the start button for the selected pump.
- The pumps will start and run continuously.

NOTE: There is no level control system when the system is operated manually.

- Only pump the wet well down to the level of the bend in the suction pipe, i.e. Do not air lock the pumps.
- Switch the station back to automatic mode when required.

5.5 Local Operation at the Control Panel in Station

To operate the station manually, perform the following:

- Turn the HAND-OFF-AUTO Selector Switch for each pump to the OFF position.
- Turn the HAND-OFF-AUTO Selector Switch for each pump to the HAND position.
- The pumps will start and run continuously.

NOTE: There is no level control system when the system is operated manually.

- Only pump the wet well down to low level, i.e. Do not air lock the pumps.
- Switch the station back to automatic mode when required.

5.6 Resetting the Pump(s)

- Turn the MAN-OFF-AUTO Selector Switch for each pump to the OFF position.
- Reset pump breaker, located in the electrical panel on south wall of station.
- Turn the MAN-OFF-AUTO Selector Switch for each pump to the AUTO position.
- The pump will start. If it does not, call maintenance.

6 INSPECTION & MAINTENANCE

6.1 Annual Inspections

6.1.1 An Annual Inspection of the facilities should be conducted, as outlined in the City's O-M1 Wastewater Station Inspections Procedure, where applicable including but not limited to:

- Health and Safety, including fire extinguishers
- General Facility, including lighting, heating and ventilation, and general condition of the premises (building, grounds, doors, etc)
- Sewage Pumps, including pump run tests and checking of pumps for bearing/motor heat/noise and air locks, and checking of breakers
- Sluice Gates, including exercising of gates to confirm proper operation, only where the gates can be exercised without risk of sewage discharges to the environment
- Wet Well, including well level controls, signs of scum/debris accumulation, piping and valves, ventilation and lighting
- Documenting any significant Odours noticed outside the station
- Other Operational Checks, including control panels, SCADA alarms, backflow preventers, electric hoists, hatch covers, well level controls

7 ASSOCIATED DOCUMENTS

- Safe Entry and Exit from Stations PW-WW-PO-P-011-002
- BCOS + DWQMS - Log Book and Record Keeping Procedure
- Parkdale Burlington WWCS (HC001) Process Control Narrative, Version 2.4
- O-M1 Wastewater Station Inspections Procedure

BCOS software tracks the revision history of document.

Appendix B

Updated Process Control Narrative for Main/King CSO Tank (HCS04)

Hamilton

WASTEWATER PUMPING STATION HCS04

(Main St. / King St.)

PROCESS CONTROL NARRATIVE

Version 3.5

(Narrative format: SCADA Standards Version 5.0)

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November 2018

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Revision History

Version	Date	Description Of Revisions
1.0	16 November 2010	Original Version
2.0	11 January 2011	Reconciled with final I/O list
3.0	January 2012	Released with SCADA Standards Version 4.2 and updated to address City comments
3.1	January 2013	Released with SCADA Standards Version 4.3
3.2	October 2013	Released with SCADA Standards Version 4.4
3.3	February 2014	Control Variable Setpoints Update
3.4	August 2017	Updated to SCADA Standards V5.0
3.5	November 2018	PCN Update

Definitions Glossary

Term	Definition
ADSL	Asymmetric Digital Subscriber Line (ADSL) is a method of communication that allows data transmission over telephone lines.
AI	Analog Input (AI). Incoming signals (inputs) that are modulating in nature (i.e. 4-20mA or 0-5VDC).
AO	Analog Output (AO). Outgoing setpoint signals (outputs) that are modulating in nature (i.e. 4-20mA or 0-5VDC).
ATS	Automatic Transfer Switch (ATS). A device which automatically transfers normal power to emergency power in the event of disruption in normal or quality of normal power feed.
BOD	Biochemical Oxygen Demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period.
CEPT	Chemically Enhanced Primary Treatment (CEPT). Additional wastewater treatment of bypass flows, polymer addition and possible increase of ferric sulphate dosing, during wet weather (storm) events.
DI	Digital Input (DI). Incoming signals (inputs) that are on/off in nature.
DO	Digital Output (DO). Outgoing command signals (outputs) that are on/off in nature.
HLP	High Lift Pump (HLP).
HMI	Human Machine Interface (HMI) is the user interface in a process control system. It provides a graphics-based visualization of an industrial control and monitoring system. An HMI typically resides in an office-based Windows computer that communicates with programmable logic controllers throughout the plant.
HVAC	Heating, Ventilation, and Air Conditioning (HVAC).
I/O	Input/Output (I/O).
ISR	Intrinsically Safe Relay (ISR). This is a relay that provides an 'intrinsically safe' barrier between circuits. Typically used when interfacing signals sourced from hazardous environments.
MCC	Motor Control Centre (MCC).
MOE	The Ministry of Environment (MOE) is the government agency responsible for the enforcement of water quality standards in Canada.
NAC	Network Access Closet (NAC). A cabinet that houses the WAN equipment.
OIT	Operator Interface Terminal (OIT). This is a local display which allows operations staff to view process and alarming as well as enter setpoints and control equipment without using a SCADA workstation. Typically it is mounted on the control panel enclosure doors at remote stations or on vendor panels.
P&ID	Process and Instrumentation Diagram (P&ID) – A diagram illustrating all of the process equipment, interconnecting piping and instrumentation, including the connections to the process control system.

Term	Definition
PAC	Process Automation Controller (PAC) – A microprocessor-controlled device to which all of the process and instrumentation I/O is connected and which contains the process control logic. Functionally identical, and for the purposes of the process narrative, the same as, a PLC (programmable logic controller) or RPU (remote processing unit).
PCN	Process Control Narrative (PCN).
PLC	Programmable Logic Controller (PLC). This is a programmable field controller.
PRV	Pressure Reducing Valve (PRV). A valve that will automatically open when a pre-set pressure is reached then close automatically when the pressure is relieved.
SCADA	Supervisory Control and Data Acquisition (SCADA) refers to an industrial control system; a computer system monitoring and controlling a process.
SCADA Tag	The term 'SCADA Tag' or 'code' refers to the 18-character code that is defined within this standard. The code is used to define the physical location of the equipment within the City's water and wastewater system. It also defines functionality within the SCADA system when using Fragment 8 to expand upon specifics of the location tag defined in the first 15 characters of the coding system.
SNMP	Simple Network Management Protocol (SNMP). Internet-standard protocol for managing devices on IP networks.
TSS	Total Suspended Solids (TSS) is a filter residue measurement to determine water quality.
UPS	Uninterruptible Power Supply (UPS). A power supply device which provides emergency power to the supplied device, for a limited period of time, from battery power during a power failure/quality event.
VAC	Voltage in Alternating Current (VAC). A unit of voltage.
VDC	Voltage Direct Current (VDC). A unit of voltage.
VFD	Variable Frequency Drive (VFD). This is a motor starter unit which utilizes a solid state (electronic) starter control which allows dynamic/adjustable motor speed control.
WAN	Wide Area Network (WAN) is a geographically dispersed telecommunications network. The term distinguishes a broader telecommunication structure from a local area network (LAN).
WAO	Work Area Outlet (WAO). A set of Ethernet jacks to connect to the SCADA system.
WET WEATHER	Wet weather (storm) conditions/events are classified as flows greater than 614MLD into the Woodward WWTP.
WTP	Water Treatment Plant (WTP).
WWTP	Wastewater Treatment Plant (WWTP).

1 FACILITY DESCRIPTION

1.1 FACILITY OVERVIEW

The Main St. and King St. Combined Sewage Overflow (CSO) facility is located in the park between Main and King Streets, adjacent to Hwy 403. The station consists of a single-story control building, a Wetwell, and two below-ground cells within a CSO Tank.

The following table lists important information about the site:

Table 1-1: HCS04 Station Details

Station	Detail
Civic Address	707 King St. W, Hamilton, Ontario
Site Phone Number	905-777-1125
Hydro Account Number	24468-709 (Alectra)
Hydro Meter Number	TBD

1.1.1 Main Process

During dry weather the station collects wastewater in a Wetwell and automatically pumps it to the Woodward WWTP.

There are three (3) sewage lift pumps (duty 1, duty 2 and standby) available, each with a rated capacity of 375 L/s. Refer to "For a backwash sequence to start, the level in both CSO tanks must be below 1m. Once the sequence is started the following sequence is followed.

Backwash CSO Tank Cell No.1:

1. Flush bucket fill valve no.1 is opened for a time period sufficient to tipping flush buckets no.1 & 2;
2. Flush buckets no.1 & 2 are full and tilted then flush bucket fill valve no.1 is closed;
3. Flush bucket fill valve 2 is opened for a time period sufficient to tipping flush buckets no.3 & 4;
4. Flush buckets no.3 & 4 are full and tilted then flush bucket fill valve no.2 is closed;
5. Flush bucket fill valve 3 is opened for a time period sufficient to tipping flush buckets no.5 & 6;
6. Flush buckets no.5 & 6 are full and tilted then flush bucket fill valve no.3 is closed;
7. Flush bucket fill valve 4 is opened for a time period sufficient to tipping flush buckets no.7 & 8;
8. Flush buckets no.7 & 8 are full and tilted then flush bucket fill valve no.4 is closed;
9. Flush bucket fill valve 5 is opened for a time period sufficient to tipping flush buckets no.9 & 10;
10. Flush buckets no.9 & 10 are full and tilted then flush bucket fill valve no.5 is closed.
11. CSO Tank Cell no.1 backwash is completed.

Backwash CSO Tank Cell No.2:

1. Flush bucket fill valve no.6 is opened for a time period sufficient to tipping flush buckets no.11 & 12;
2. Flush buckets no.11 & 12 are full and tilted then flush bucket fill valve no.6 is closed;
3. Flush bucket fill valve no.7 is opened for a time period sufficient to tipping flush buckets no.13 & 14;
4. Flush buckets no.13 & 14 are full and tilted then flush bucket fill valve no.7 is closed;
5. Flush bucket fill valve no.8 is opened for a time period sufficient to tipping flush buckets no.15 & 16;
6. Flush buckets no.15 & 16 are full and tilted then flush bucket fill valve no.8 is closed;
7. Flush bucket fill valve no.9 is opened for a time period sufficient to tipping flush buckets no.17 & 18;
8. Flush buckets no.17 & 18 are full and tilted then flush bucket fill valve no.9 is closed;
9. Flush bucket fill valve no.10 is opened for a time period sufficient to tipping flush buckets no.19 & 20;
10. Flush buckets no.19 & 20 are full and tilted then flush bucket fill valve no.10 is closed;
11. Flush bucket fill valve no.11 is opened for a time period sufficient to tipping flush buckets no.21 & 22;

12. Flush buckets no.21 & 22 are full and tilted then flush bucket fill valve no.11 is closed;
13. Flush bucket fill valve no.12 is opened for a time period sufficient to tipping flush buckets no.23 & 24;
14. Flush buckets no.23 & 24 are full and tilted then flush bucket fill valve no.12 is closed;
15. Flush bucket fill valve no.13 is opened for a time period sufficient to tipping flush buckets no.25 & 26;
16. Flush buckets no.25 & 26 are full and tilted then flush bucket fill valve no.13 is closed;
17. Flush bucket fill valve no.14 is opened for a time period sufficient to tipping flush buckets no.27 & 28;
18. Flush buckets no. 27 & 28 are full and tilted then flush bucket fill valve no.14 is closed;
19. Flush bucket fill valve no.15 is opened for a time period sufficient to tipping flush buckets no.29 & 30;
20. Flush buckets no.29 & 30 are full and tilted then flush bucket fill valve no.15 is closed.
21. CSO Tank Cell no.2 backwash is completed.

After the backwash cycle is complete, flush bucket fill valve no.16 is activated for two minutes to flush the trough. Should any flush bucket fill valve fail to open when commanded as determined by the city water pressure transmitter (no pressure drop), an alarm is annunciated on the SCADA HMI and the next tipping flush buckets fill in the sequence until the entire sequence is complete. Should three (3) or more flush bucket fill valves fail to close when commanded as determined by the city water pressure transmitter (no pressure increase) an alarm is annunciated on the SCADA HMI, the main flushing water line shut-off line is commanded to close and the flush sequence is terminated.

1.1.2 Demo Backwashing Sequence

The DEMO mode is a short cycle, used to demonstrate the backwashing process.

When the DEMO mode is selected from the SCADA HMI, flush bucket fill valve no.1 opens for a time period sufficient to fill tipping flush buckets no. 1 and 2. When full, the flush buckets tip, flush bucket fill valve no.1 closes, and flush bucket fill valve no.2 opens to fill tipping flush buckets no.3 and 4. When full, the flush buckets tip, flush bucket fill valve no.2 closes, and the cycle repeats until the timers set for both flush bucket fill valves time out.

1.1.3 Influent and Overflow Sampler Modes

Table 5-10: HCS04 Sampler Modes

Sampler Mode	Description
1. Inactive	No samples are taken and sampler pumps remain off
2. Time Paced Sample	Time Paced Sampling begins when the level increases above the sampler pump start setpoint. Samples are taken at defined intervals until bottle change (24 samples). The influent sampler uses an intervals of 60 seconds while the overflow sampler uses and interval of 180 seconds.
3. Volume Paced Sample (Influent Sampler only)	After 24 samples have been taken in time paced mode the Influent Sampler is put in volume paced sample mode. A sample is taken for every 4390 m3 of volume in the CSO tanks. See Calculated Variables for volume paced calculations.
4. Hourly Samples	After 24 samples have been taken by the Overflow Sampler, the Overflow Sampler is put into Hourly Samples mode. The Influent sample is issued a command to finish its current bottle and then sync with the Overflow Sampler. Once synchronized, samples are taken every hour for 24 hours. After 24 samples are taken both samplers are moved to the Inactive state. They will then move to Time Paced Mode if the start conditions are met.

Sampler Mode	Description
5. Finish Bottle	When in Finish Bottle mode, samples will be taken at the minimum allowed interval until the current bottle is finished (24 samples). The Influent Sampler has a minimum sample interval of 60 seconds while the Overflow Sampler has a minimum sample interval of 180 seconds. After the finish bottle sequence is complete the sample event ends.
6. Overflow Sync	When Overflow Hourly Sample Mode begins it moves the Influent Sampler into Finish Bottle mode in order to synchronize the Influent Sampler with the Overflow Sampler. Once synchronized with the Overflow Sampler, the Influent sampler will remain in Overflow Sync Mode until the Overflow Sampler has completed its sequence.

SCADA Auto Starting/Stopping Conditions" in Section 5.4 for detailed sewage lift pump duty arrangements.

During periods of heavy precipitation, a.k.a. wet weather, when flows exceed the treatment capacity of the Woodward WWTP, this facility stores the excess influent in the onsite CSO Tank.

Storm water enters the Wetwell and flows into Cell No.1 during a storm event from four separate interceptor chambers:

- Main Street overflow via Chamber No. 6A
- Interceptor sewer via Chamber No.5
- King Street sewer via Chamber No.4
- Glen Road sewer via Chamber No. 1

Storm flows exceeding the storage volume of Cell No.1 overflow a weir into Cell No.2. Storm water exceeding the capacity of Cell No.2 overflows a second weir in Cell No.1 and discharges into Cootes Paradise at the mouth of Chedoke Creek.

After flows return to normal, the sewage lift pumps are used to dewater the CSO Tank. A tank flush system is present at this station for removal of accumulated solids from the CSO Tank floor after it has drained.

1.1.4 Sampling

There is both influent and overflow sampling at this station. Influent sampling occurs when the level in the Wetwell reaches a preset height. Overflow sampling occurs when the level in the overflow channel reaches a preset height.

1.1.5 CSO Tank Overflow

Storm flows exceeding the storage volume of Cell No.1 overflow a weir into Cell No.2. Storm water exceeding the capacity of Cell No.2 overflows a second weir in Cell No.1 and Cell No. 2 and discharges into Cootes Paradise at the mouth of Chedoke Creek. The following table describes the overflow details:

Table 1-2: HCS04 Overflow Summary

Overflow Type	Elevation	Destination	Civil Drawing
Overflow Weir - Cell 1 & 2	TBD	Cell 1	TBD
CSO Tank Overflow Weir	TBD	Chedoke Creek	TBD

1.1.6 Backup Power

There is no generator on site; however there is a hookup for a portable generator.

Refer to "Section 8.1 - Electrical Equipment and Standby Power" for detailed power information at this station.

This station has a CSO Maintenance Bypass Gate that connects the inlet chamber directly to the outfall channel which flows to Chedoke Creek. Opening this gate results in flow bypassing the pumping station and CSO tanks to discharge to the environment. This gate is to remain fully closed at all times and is locked out with the hand wheel chained to prevent it being opened. The only reason to alter the position of this gate is for emergency situations which would require the authorization of the ORO.

1.2 SCADA System Overview

The station is monitored and can be controlled via the SCADA HMI from the Woodward WTP/WWTP, Dundas WWTP or other locations based on security access.

There is one (1) PAC control panel (HCS04CP001) which contains an Allen-Bradley ControlLogix PAC.

The controller is connected to Hamilton's SCADA WAN via fibre optic Ethernet link.

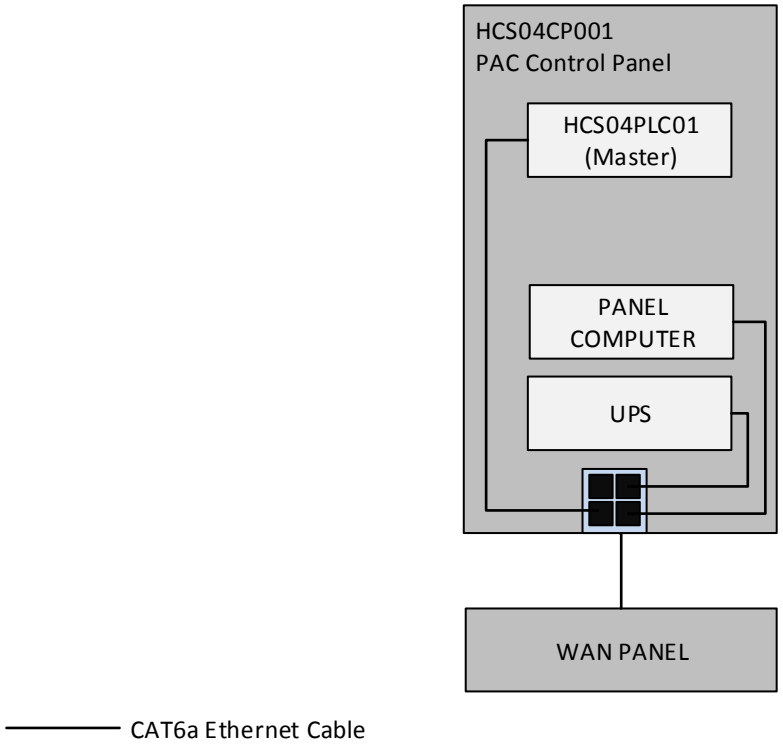


Figure 1-1: HCS04 Simplified Network Layout

The controller details are shown in the following table:

Table 1-3: HCS04 Communications

SCADA Tag	Equipment Description
HCS04PAC0100000	Wastewater CSO Tank PAC (Main/Master PAC)
HCS04OIT0100000	Wastewater CSO Tank Panel Computer

Refer to "Table 7-3: HCS04 Local Logging" for details on captured data points.

Local monitoring at the station is provided by a liquid crystal display (LCD) panel computer mounted on the control panel. From the panel computer, operators and maintenance personnel can monitor the operation of the station including equipment status, process information, etc. All equipment controlled by the PACs in this station can be operated from the panel computer.

Table 1-4: HCS04 Network Equipment Summary

SCADA Tag	Equipment Description
HCS04NAC01NAS01	WAN Panel Ethernet Switch
HCS04NWA0100000	Network Work Area Outlet(s)

Refer to DWG. 127207- C11-38-08-HCS04 I001, the SCADA system network diagram, for further information.

1.3 FACILITY DRAWINGS

The following drawings should be viewed in conjunction with this narrative:

- Instrumentation & Control: Procon CS2087 HCS04CP01 001-019, Procon CS2087 HCS04CP02 001-025
- Process: 127207-C11-38-08-HCS04 P001-P004

Refer to Appendix C for the P&ID drawings.

2 EQUIPMENT & INSTRUMENTATION

2.1 MECHANICAL EQUIPMENT

The facility includes the following major mechanical equipment connected to the SCADA system.

Table 2-1: HCS04 SCADA Mechanical Equipment Summary

SCADA Tag	Equipment Description
HCS04SLP0100000	Sewage Lift Pump No.1
HCS04SLP0200000	Sewage Lift Pump No.2
HCS04SLP0300000	Sewage Lift Pump No.3
HCS04SAM0100000	Influent Sampler
HCS04SAM0200000	Overflow Sampler
HCS04SAP0100000	Sample Pump No.1
HCS04SAP0200000	Sample Pump No.2
HCS04SAM01VLV01	Influent Backwash Valve
HCS04STN01IV001	Wetwell Inlet Gate
HCS04STN01IV002	CSO Tank Cells Inlet Gate
HCS04STN01OV001	CSO Tank Cells Outlet Gate
HCS04STN01OV002	CSO Maintenance Bypass Gate
HCS04VCH01IV001	Chamber No.1 Gate
HCS04VCH04IV001	Chamber No.4 Gate

SCADA Tag	Equipment Description
HCS04VCH05IV001	Chamber No.5 Gate
HCS04WWT01SOL01	Cell No.1 Flush Valve No.1
HCS04WWT01SOL02	Cell No.1 Flush Valve No.2
HCS04WWT01SOL03	Cell No.1 Flush Valve No.3
HCS04WWT01SOL04	Cell No.1 Flush Valve No.4
HCS04WWT01SOL05	Cell No.1 Flush Valve No.5
HCS04WWT01VLV01	Main Flushing Water Line Shutoff Valve
HCS04WWT02SOL06	Cell No.2 Flush Valve No.6
HCS04WWT02SOL07	Cell No.2 Flush Valve No.7
HCS04WWT02SOL08	Cell No.2 Flush Valve No.8
HCS04WWT02SOL09	Cell No.2 Flush Valve No.9
HCS04WWT02SOL10	Cell No.2 Flush Valve No.10
HCS04WWT02SOL11	Cell No.2 Flush Valve No.11
HCS04WWT02SOL12	Cell No.2 Flush Valve No.12
HCS04WWT02SOL13	Cell No.2 Flush Valve No.13
HCS04WWT02SOL14	Cell No.2 Flush Valve No.14
HCS04WWT02SOL15	Cell No.2 Flush Valve No.15
HCS04WWT02SOL16	Cell No.2 Trough Flush Valve No.16
HCS04ATS0100000	Automatic Transfer Switch

The facility includes the following major mechanical equipment that is not connected to the SCADA system.

Table 2-2: HCS04 Mechanical Equipment Summary

SCADA Tag	Equipment Description
HCS04SLP01DV001	Sewage Lift Pump No.1 Discharge Valve
HCS04SLP01CV001	Sewage Lift Pump No.1 Check Valve
HCS04SLP02DV001	Sewage Lift Pump No.2 Discharge Valve
HCS04SLP02CV001	Sewage Lift Pump No.2 Check Valve
HCS04SLP03DV001	Sewage Lift Pump No.3 Discharge Valve
HCS04SLP03CV001	Sewage Lift Pump No.3 Check Valve

The pump capacities are identified below:

Table 2-3: HCS04 Pump Capacity Summary

Pump	Nominal Rate Capacity	Comments
Sample Pump No.1	TBD	Constant Speed
Sample Pump No.2	TBD	Constant Speed

Pump	Nominal Rate Capacity	Comments
Sewage Lift Pump No.1	375 L/s (4,949 GPM)	Constant Speed
Sewage Lift Pump No.2	375 L/s (4,949 GPM)	Constant Speed
Sewage Lift Pump No.3	375 L/s (4,949 GPM)	Constant Speed

The Wetwell capacities are identified below:

Table 2-4: HCS04 Wetwell Capacity Summary

Wetwell	Nominal Capacity	Comments
HCS04WWL0100000	TBD m^3	Wetwell Capacity
HCS04WWT0100000	22,000 m^3	CSO Tank Cell No.1 Capacity
HCS04WWT0200000	53,000 m^3	CSO Tank Cell No.2 Capacity

2.2 INSTRUMENTATION

The following instruments are located in this station:

Table 2-5: HCS04 Instrumentation Summary

SCADA Tag	Instrument Description	Analog / Discrete	Span
HCS04STN01FIT01	Station Discharge Flow Transmitter	Analog	0 – 1400 L/s
HCS04STN01LIT01	Overflow Weir Level Transmitter	Analog	0 – 2.7 m
HCS04STN01PIT01	City Water Pressure Transmitter	Analog	300 kPa
HCS04VCH01LIT01	Chamber No. 1 Level Transmitter	Analog	0 – 1.2 m
HCS04VCH04LIT01	Chamber No. 4 Level Transmitter	Analog	0 – 1.3 m
HCS04WWL01LIT01	Wetwell Level Transmitter	Analog	0 - 12.7 m
HCS04WWT01FIT01	Main Flushing Water Line Flow Transmitter	Analog	0 – 10 L/s
HCS04WWT01LIT01	CSO Tank Cell No. 1 Level Transmitter	Analog	0 - 11.0 m
HCS04WWT02LIT01	CSO Tank Cell No. 2 Level Transmitter	Analog	0 - 11.0 m
HCS04STN01IV001	Wetwell Inlet Gate Position Transmitter	Analog	0 – 100%
HCS04STN01IV002	CSO Tank Cells Inlet Gate Position Transmitter	Analog	0 – 100%
HCS04STN01OV001	CSO Tank Cells Outlet Gate Position Transmitter	Analog	0 – 100%
HCS04STN01OV002	Influent Well Overflow Gate Position Transmitter	Analog	0 – 100%
HCS04VCH01IV001	Chamber No. 1 Gate Position Transmitter	Analog	0 – 100%
HCS04VCH04IV001	Chamber No. 4 Gate Position Transmitter	Analog	0 – 100%
HCS04VCH05IV001	Chamber No. 5 Gate Position Transmitter	Analog	0 – 100%
HCS04STN01TIT01	Building Temperature Transmitter	Analog	0 – 100 °C

2.3 I/O LISTING

Refer to the I/O listings in Appendices A and B. Appendix A provides an I/O listing grouped by device and can be cross-referenced to the facility loop diagrams. Appendix A also includes a comprehensive list of all the Networked I/O that communicates with the PAC from other communication protocols (e.g. Modbus or DeviceNet).

Appendix B provides an I/O listing grouped by PAC I/O card assignments, and can be cross-referenced to the facility I/O drawings.

3 COMPLIANCE WITH HAMILTON SCADA STANDARDS

All work was completed in accordance with the Hamilton SCADA standards v5.0 as of January 2017 with the exception of the following deviations:

Table 3-1: HCS04 Standards Deviation

Deviation	Description
N/A	

4 CONTROL MODES

The station is normally unattended and is continuously monitored via the SCADA HMI at the Woodward Avenue WTP/WWTP. Three (3) control modes are available for "normal" operation of the station equipment: local, SCADA manual, and SCADA auto.

The following table defines each of the three (3) control modes as generally applied to the City's SCADA system.

Table 4-1: HCS04 Standard Control Modes

Local Control Modes	Description
LOCAL	Local control mode is selected in the field at or near the device, MCC, control panel, etc. by means of physically selecting the local control mode, commonly by using a Local-Remote or Hand-Off-Auto selector switch. When a device is in local mode, the device can be controlled locally only. A device in local mode cannot be controlled via the SCADA System. Putting a device in local mode will bypass all software interlocks and in most cases, all hardwired interlocks. In addition, devices in local mode will typically not be operated by hardwired backup circuits, if existing.

Remote Control Modes	Description
SCADA MANUAL	Prior to selecting the SCADA Manual mode of control on the SCADA HMI system, a device must be in remote control mode. Remote control mode is selected in the field at or near the device, MCC, control panel, etc., by means of physically selecting the remote control mode, commonly by using a Local-Remote or Hand-Off-Auto selector switch. When a device is in remote control mode, the SCADA Manual mode is selected by an Operator on the SCADA HMI system. Control of the device is then accomplished by an Operator via commands that are input into the SCADA HMI system. Putting a device in SCADA Manual mode will typically bypass all software interlocks only. Hardwired interlocks will not be bypassed. Devices that are being operated in SCADA Manual mode will typically be operated by hardwired backup circuits, if existing.
SCADA AUTO	Prior to selecting the SCADA Auto mode of control on the SCADA HMI system, a device must be in remote control mode. Remote control mode is selected in the field at or near the device, MCC, control panel, etc., by means of physically selecting the remote control mode, commonly by using a Local-Remote or Hand-Off-Auto selector switch. When a device is in remote control mode, the SCADA Auto mode is selected by an Operator on the SCADA HMI system. Control of the device is then accomplished automatically by control logic that is programmed into a PAC/PLC. Putting a device in SCADA Auto mode will not bypass software interlocks or hardwired interlocks. Devices that are being operated in SCADA Auto mode will typically be operated by hardwired backup circuits, if existing.

4.1.1 Station Control Mode

This station is equipped with a selector switch which determines how the station operates. The sewage lift pumps in the Wetwell are operated under three conditions. The following table describes the control modes available.

Table 4-2: HCS04 Station Control Modes

Control Modes	Description
NORMAL MODE	In Normal mode, this station acts as a Wetwell station. The pump station is isolated from the CSO storage tank. The chamber gates are in the following positions: • Chamber No.1 gate = 35% • Chamber No.4 gate = 100% • Chamber No.5 gate = 30% The station gates are in the following position: • PS Inlet Gate = 100% • CSO Inlet Gate = 50% • CSO Outlet Gate =100% **NOTE: Gate 1 should never be open more than 35%.**

Control Modes	Description
FILL MODE	Fill mode is selected during significant storm events that would produce flows that exceed the capacity of the Woodward WWTP to treat. When Tank Fill mode is selected from SCADA, all running sewage lift pumps are automatically turned off to fill the CSO tank cells. The chamber gates divert substantial portions of wastewater flows into the HCS04 influent well and from there into CSO Cell No.1. Storm events producing flows that exceed the storage volume of CSO Cell No.1 overflow a weir into CSO Cell No.2. Flows exceeding the capacity of CSO Cell No.2 overflow a second weir in CSO Cell No.1 and discharge into Cootes Paradise at the mouth of Chedoke Creek via Chamber No.6B. The chamber gates are in the following positions: • Chamber No.1 gate = 35% • Chamber No.4 gate = 7% • Chamber No.5 gate = 2% The station gates are in the following position: • PS Inlet Gate = 100% • CSO Inlet Gate = 100% • CSO Outlet Gate = 100% **NOTE: Gate 1 should never be open more than 35%.**
EMPTY MODE	After the storm event has passed and the interceptor level has decreased, the stored storm water is released back to the WSIS and the Woodward WWTP. When Empty mode is selected from SCADA, the operating sequence of the chamber gates and sewage lift pumps are as follows: **1.** When the Wetwell level is higher than 10.3 m, the sewage lift pumps are shut off. The chamber gates are in the following positions: • Chamber No.1 gate = 35% • Chamber No.4 gate = 7% • Chamber No.5 gate = 2% **2.** When the CSO tank level is decreasing (CSO tank draining by gravity) and the Wetwell level is higher than 9.9 m but less than 10.3 m, the sewage lift pumps remain off. The chamber gates are in the following positions: • Chamber No.1 gate = 35% • Chamber No.4 gate = 7% • Chamber No.5 gate = 10% **3.** When the CSO tank level is decreasing (CSO tank draining by gravity) and the Wetwell level is higher than 9.7 m but less than 9.9 m, the sewage lift pumps remain off. The chamber gates are in the following positions: • Chamber No.1 gate = 35% • Chamber No.4 gate = 100% • Chamber No.5 gate = 10%

Control Modes	Description
	4. When the Wetwell level falls to 9.05 m the system flips back to Normal Mode and the DUTY 1 and DUTY 2 sewage lift pumps are started to drain the Wetwell and CSO tank. The station gates are in the following position: • PS Inlet Gate = 100% • CSO Inlet Gate = 50% • CSO Outlet Gate = 100% **NOTE: Gate 1 should never be open more than 35%.**

5 STATION CONTROL

5.1 GENERAL DESCRIPTION

5.1.1 Main Process

Dry Weather

The CSO facility is operated as a wastewater pumping station during dry weather conditions. The three (3) sewage lift pumps are operated automatically, based on Wetwell levels and associated start and stop levels setpoints programmed in the PAC logic to pump sewage into the interceptor sewer.

Sewage lift pump duty is rotated automatically at the end of each cycle by the PAC, or manually by an Operator via the SCADA HMI.

In order for a sewage lift pump to produce flow, the associated discharge valve must be open. There is no monitoring or control of the sewage lift pump discharge.

Wet (Storm) Weather

During storm events and high flow conditions, chamber gates in the collection system are operated automatically to divert storm water from the WSIS (Western Sanitary Interceptor South) and sewers into the CSO Tank Wetwell. The sewage lift pumps are stopped and storm water is allowed to overflow the Wetwell into the CSO Tank. The CSO Tank is filled by partially closing Chamber control gates 4 and 5 causing water to be diverted to the CSO Tank Cells (or into the overflow when storm water volumes exceeds the Tank capacity) and away from the WSIS sewer and the Woodward WWTP.

After the storm event has passed and the WSIS level has decreased, the stored storm water is released back to the WSIS and the Woodward WWTP. As the WSIS level drops some of the CSO Tank contents are gravity fed back into the WSIS through Chamber gates 4 and 5. CSO Tank contents below the Chamber 5 weir crest elevation of 9.05 m must be pumped out using the sewage lift pumps located in the CSO Tank Wetwell. After the CSO Tank is dewatered, a tank flushing system comprised of a series of tipping flush buckets are filled with water and dumped sequentially to flush remaining solids from the Tank.

5.1.2 CSO Sampling System Description

Two (2) 24-hour composite flow proportional samplers and sample pumps provide sample collection of the storm water influent and overflow from the CSO Tank during each storm event or when the CSO Tank is in operation. Flow monitoring devices and recorders at the CSO Tank measure the quantity of sewage being conveyed by the sewage pumping station and the quantity of the combined sewer overflow emitted to Cootes Paradise/Hamilton Harbor via the 6B Chamber to Chedoke Creek.

Influent Sampler

The Influent sample pump starts when the Wetwell level reaches 5.4 meters.

The duration of each event is captured in the PAC. The influent event duration timer to accumulate, as long as the level of the Wetwell remains above 4.9 m.

Upon indication of 5.4 m level in the Wetwell, an influent event is activated and a 24-hour timer is started. The sample pump is initiated. When the pump's run status is confirmed the sampler may start. Sampling is triggered with one digital signal sent from the PAC every 1 minute for 24 minutes. Once the first influent bottle is filled, the influent sampler is switched to volume paced mode. In volume paced mode the number of samples taken are based on the calculated volume in the CSO tanks. Samples are taken in even volume intervals as the volume in the CSO tanks increased. Indication of an influent event occurring appears on the sampler pop-up window.

See Calculated Variables for the volume equation.

The end of a sampling event is determined by time, i.e., T_0+24 hours. If a bottle is not completely full by T = 24, a forced bottle change occurs. This creates a full sample by cycling the contacts once per minute to simulate a full bottle.

The PAC monitors the sample number and keeps track of the bottle numbers filled. As each bottle is filled, the bottle number is trended so the Process Supervisor can inform the operator of the dates to label the bottles collected. When all 8 bottles become full, alarms (a pop-up display and an alarm generated on the alarm summary screen) are sent to SCADA and the program is shut down and will not send any more pulses until it is reset. The SCADA sampling program needs to be reset manually from the Sampler Setpoint popup. A hardwired general alarm from the sampler does not directly end the sampling sequence; only if the sampler fails to respond to repeated sample requests from the PAC will the sampling sequencing fault. Resetting of the sampling program within SCADA is performed manually from the Sampler Setpoint popup.

Parameters listed in Table 5-3: HCS04 Effluent Sampler Key Parameters as global variables are available at SCADA in order for adjustments to be made in the future. There may have to be a security level on global variables.

Table 5-1: HCS04 Influent Sampler Key Parameters

Parameter	Amount	Type of Variable
Sample trigger	Wetwell level detected and volume paced as described above	Global
Aliquot	50 ml	ISCO Variable
Number of pulses per sample bottle	24	
Minimal water level for pump	20 mm	Local

Table 5-2: HCS04 Influent Sampler Programming Parameters

Step	Action	Condition
1	• A Wetwell Event is started. • The influent sample pump is started. • The influent 24-hour timer is started. • Pulse 24 times at 1-minute intervals (until bottle change)	• Wetwell Level of 5.4 m
	• Confirm bottle change with bottle number update	• Bottle change
2	• Volume Paced Sampling is started.	• Samples are taken every 4390 m^3 of volume in CSO tanks

Step	Action	Condition
3	• Finish Bottle	• 24 hours has elapsed since start of influent sequence.
	• Return to Step 1 start influent event	• If Wetwell level is still above 5.4 m the sample pump will remain off until the level rate of change in the CSO tank is seen to increase above the rate of change setpoint.

Influent Sampling Line – Backwash Valve

When the sampling system is operating in SCADA auto mode, the PAC opens the valve for two (2) minutes to flush out the influent sampling line after the sample pump has stopped.

Overflow Sampler

The Overflow sample pump starts when the overflow channel level reaches 0.1 meters and the CSO tank cell no.1 level is above 7.7 m (if CSO tank cell no.1 level is unavailable CSO tank cell no.2 is checked to be above 7.0).

(The existing calculation in the PAC is based on the Manning equation.)

For the Main / King CSO Tank overflow weir, the center point elevation is 0.109 m above the floor under the sensor. The sensor is set so that it shows a negative "head" of 0.109 m when the channel is dry (and floor clean).

See Calculated Variables for the equation. The overflow is totalized in the PAC.

The duration of each event is captured in the PAC. The overflow event time will accumulate as long as there is a level detected in the weir above the permissive.

Upon indication of 0.1m level in the overflow channel, an overflow event is activated and the 24-hour timer is reset to zero after the first Overflow bottle is filled. The sample pump is initiated. When the pump's run status is confirmed the sampler may start. Sampling is triggered with one digital signal sent from the PAC every 3 minutes for 72 minutes provided there is still overflow in the channel. Once the first overflow bottle is filled, the influent sampler is pulsed for the balance of the 24 samples necessary to produce a bottle change so that influent and Overflow samplers are synchronized. The second of 2 sample bottles is filled via pulses from the PAC, 24 samples, one each hour for 24 hours together with the influent sampler. Indication of an overflow event occurring appears on the sampler pop-up window.

The Overflow sampler routine works in the same manner as the influent sampler. The same failures are reported to the HMI requiring the same steps necessary to reset. Note than an incorrect bottle number does not fault the sequence.

The end of a sampling event is determined solely by time, i.e., T_0+24 hours. If a bottle is not completely full by T = 24, a forced bottle change occurs. This creates a full sample by cycling the contacts once per three minutes to simulate a full bottle.

The PAC monitors the sample number and keeps track of the bottle numbers filled. As each bottle is filled, the bottle number is trended so the Process Supervisor can inform the operator of the dates to label the bottles collected. When all 8 bottles become full, alarms (a pop-up display and an alarm generated on the alarm summary screen) are sent to SCADA and the program is shut down and will not send any more pulses until it is reset. The SCADA sampling program needs to be reset manually. If the sampler generates a general alarm on SCADA, then the operator retrieving the samples will have to reset the sampler locally. A hardwired general alarm from the sampler does not directly end the sampling sequence; only if the sampler fails to respond to repeated sample requests from the PAC will the sampling sequencing fault. Resetting of the sampling program within SCADA is performed manually from the Sampler Setpoint popup.

Parameters listed in the Table 5-3: HCS04 Effluent Sampler Key Parameters as global variables are available at SCADA in order for adjustments to be made in the future. There may have to be a security level on global variables.

Table 5-3: HCS04 Effluent Sampler Key Parameters

Parameter	Amount	Type of Variable
Sample trigger	Overflow level detected and time-pace as described above	Global
Aliquot	50 ml	ISCO Variable
Number of pulses per sample bottle	24	
Minimal water level for pump	20 mm	Local

Table 5-4: HCS04 Effluent Sampler Programming Parameters

Step	Action	Condition
1	• An Overflow Event is started. • The effluent sample pump is started. • The effluent 24-hour timer is started. • Pulse 24 times at 3-minute intervals (until bottle change)	• Level over weir of 0.1 m and Cell #1 above 7.7m (or if Cell #1 unavailable Cell #2 must be above 7.0m)
	• Confirm bottle change with bottle number update	• Bottle change
2	• Synchronize the influent sampler by rolling over to new bottle, send pulses to influent sample at 1-minute intervals until bottle change. Influent sampler waits for overflow to complete its first 24 samples	• New bottle effluent sampler • New bottle influent sampler
3	• Send a pulse to the overflow sampler and influent sampler simultaneously	• Every hour for 24 hrs. (T+24)
	• Return to Step 1 start Overflow event	• Event-end 24 timed-out level is still above weir

5.1.3 CSO Tank Flushing System

The CSO Tank Flushing System is activated after the CSO Tank has been used to flush away any solids that may remain on the floor of the tank cells. Wash water valves are opened in sequence to fill tipping flush buckets that then dump onto the tank floor, pushing residual waste towards the station Wetwell where it can be pumped towards the Woodward WWTP.

Wash Water Valves

There is one (1) dedicated wash water solenoid valve per pair of backwash tipping flush buckets. The solenoid valves open to fill the flush buckets with water. Valves no.1 to 5 are for washing CSO tank cell no.1, and valves no.6 to 15 are for washing CSO tank cell no.2. The wash water trough has a dedicated solenoid flush valve (no.16) and is located in CSO tank cell no.2. There is one shut-off valve on the main flushing water line that closes to stop water flow on the condition that any wash water solenoid valve fails to close when commended to.

Tipping Flush Buckets

There are 30 tipping flush buckets for backwashing the CSO tank. Flush buckets are numbered (TB01 to TB30). Ten buckets, no.1 to 10, are used to backwash CSO tank cell no.1, and 20 buckets, no.11 to 30, are used to backwash CSO tank cell no.2. The Solenoid-controlled flush bucket fill valves open to fill the flushing buckets with water. Solenoid valve no.1 fills buckets no.1 & 2; valve no.2 fills buckets no.3 & 4, and so on. After the tipping flush bucket is filled, gravity tips the pivoting bucket and the water spills into the CSO tank floor. CSO tank cells no.1 and 2 can be flushed independently.

5.1.4 CSO Tank Lighting System

The main CSO tank lighting system is activated from the SCADA HMI to provide visibility in the CSO tank. There is also an emergency lighting system which can be activated from the SCADA HMI during a power failure.

5.1.5 CSO Tank Supply Fan System

The CSO tank supply fan system is activated during a high combustible gas condition or when the CSO tank lighting system is active.

5.2 SUMMARY OF RELATED DEVICES

There are no additional devices from other controllers related to this station's operation.

Table 5-5: HCS04 Related Devices Summary

SCADA Tag	Equipment Description
N/A	

5.3 PROCESS CONTROL LOGIC

The following subsections describe the operation of the SCADA-connected major equipment. Refer to "Appendix G – Program Variables & Internal Software Parameters" for setpoint information.

5.3.1 Equipment Starting/Opening

In HAND/LOCAL position (Local Mode):

- Sewage lift pump (constant speed) is started by pressing the START button on the MCC unless prevented by an interlock or fault.
- Chamber gate (modulating) is opened by pressing and holding the OPEN button on the MCC until the desired position is obtained unless prevented by an interlock or fault.
- Sample pump (constant speed) is started by pressing the start button on the MCC unless prevented by an interlock or fault.
- There is no local control of the Flush valves.
- Gallery supply fan (constant speed) is started by pressing the START button on the MCC unless prevented by an interlock of fault.

In OFF position (Local Mode):

- Equipment in the OFF position cannot be started.

In AUTO/REMOTE position (SCADA Manual Mode):

- Sewage lift pump (constant speed) is started by clicking on the START button on the SCADA HMI unless prevented by an interlock or fault.
- Chamber gate (modulating) is opened by entering a position setpoint on the SCADA HMI unless prevented by an interlock or fault.
- Sample pump (constant speed) is started by clicking on the START button on the SCADA HMI unless prevented by an interlock or fault.
- Flush valve (discrete) is opened by clicking on the OPEN button on the SCADA HMI unless prevented by an interlock or fault.
- Gallery supply fan (constant speed) is started by clicking on the START button on the SCADA HMI unless prevented by an interlock or fault.

In AUTO/REMOTE position (SCADA Auto Mode):

- Sewage lift pump (constant speed) is started automatically based on setpoints programmed in the PAC, unless prevented by an interlock or fault.
- Chamber gate (modulating) is opened automatically based on setpoints programmed in the PAC, unless prevented by an interlock or fault.
- Sample pump (constant speed) is started automatically based on setpoints programmed in the PAC, unless prevented by an interlock or fault.
- Flush valve (discrete) is opened automatically based on setpoints programmed in the PAC, unless prevented by an interlock or fault.
- Gallery supply fan (constant speed) is started automatically based on setpoints programmed in the PAC, unless prevented by an interlock or fault.

5.3.2 Equipment Running/Positioning

In HAND/LOCAL position (Local Mode):

- Sewage lift pump (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.
- Chamber gate (modulating) maintains position.
- Sample pump (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.
- Flush valve (discrete) maintains position.
- Gallery supply fan (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.

In AUTO/REMOTE position (SCADA Manual Mode):

- Sewage lift pump (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.
- Chamber gate (modulating) maintains position. An interlock will automatically close the gate.
- Sample pump (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.
- Flush valve (discrete) maintains position. An interlock will automatically close the valve.

- Gallery supply fan (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.

In AUTO/REMOTE position (SCADA Auto Mode):

- Sewage lift pump (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.
- Chamber gate (modulating) maintains position. An interlock will automatically close the gate.
- Sample pump (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.
- Flush valve (discrete) maintains position. An interlock will automatically close the valve.
- Gallery supply fan (constant speed) runs at full speed. An interlock or fault will automatically shut down the pump.

5.3.3 Equipment Stopping/Closing

In HAND/LOCAL position (Local Mode):

- Sewage lift pump (constant speed) is stopped by pressing the STOP button on the MCC.
- Chamber gate (modulating) is closed by pressing and holding the CLOSE button on the MCC until the desired position is obtained.
- Sample pump (constant speed) is stopped by pressing the STOP button on the MCC.
- There is no local control of the Flush valves.
- Gallery supply fan (constant speed) is stopped by pressing the STOP button on the MCC.

In AUTO/REMOTE position (SCADA Manual Mode):

- Sewage lift pump (constant speed) is stopped by clicking on the STOP button on the SCADA HMI.
- Chamber gate (modulating) is closed by entering a position setpoint of zero on the SCADA HMI.
- Sample pump (constant speed) is stopped by clicking on the STOP button on the SCADA HMI.
- Flush valve (discrete) is closed by clicking on the CLOSE button on the SCADA HMI.
- Gallery supply fan (constant speed) is stopped by clicking on the STOP button on the SCADA HMI.

In AUTO/REMOTE position (SCADA Auto Mode):

- Sewage lift pump (constant speed) is stopped automatically based on setpoints programmed in the PAC.
- Chamber gate (modulating) is closed automatically based on setpoints programmed in the PAC.
- Sample pump (constant speed) is stopped automatically based on setpoints programmed in the PAC.
- Flush valve (discrete) is closed automatically based on setpoints programmed in the PAC.
- Gallery supply fan (constant speed) is stopped automatically based on setpoints programmed in the PAC.

5.4 MAJOR EQUIPMENT CONTROL LOGIC

5.4.1 Control Modes

Local control mode for a device is attained by placing the selector switch for the device in the LOCAL or HAND position. The selector switch is located on the MCC, by the equipment, or on the equipment control panel. In local mode, the equipment is controlled directly by switches or pushbuttons and all software interlocks are bypassed.

Equipment is transferred to remote mode by placing the selector switch for the device in the REMOTE or AUTO position. In remote mode, the equipment can be controlled in either SCADA manual or SCADA auto modes of control.

Hardwired backup control may be available for some equipment. When the selector switch for a piece of equipment is in the REMOTE or AUTO position, the equipment can be automatically operated by hardwired devices at the station.

The following table summarizes the control modes for the equipment:

Table 5-6: HCS04 Mechanical Equipment Modes of Operation

SCADA Tag	Equipment Description	Local	SCADA Manual	SCADA Auto	Hardwired Backup Control
HCS04SLP0100000	Sewage Lift Pump No.1	☑	☑	☑	
HCS04SLP0200000	Sewage Lift Pump No.2	☑	☑	☑	
HCS04SLP0300000	Sewage Lift Pump No.3	☑	☑	☑	
HCS04SAM0100000	Influent Sampler	☑		☑	
HCS04SAM01VLV01	Influent Backwash Valve	☑	☑	☑	
HCS04SAM0200000	Overflow Sampler	☑		☑	
HCS04SAP0100000	Sample Pump No.1	☑	☑	☑	
HCS04SAP0200000	Sample Pump No.2	☑	☑	☑	
HCS04STN01IV001	Wetwell Inlet Gate	☑	☑	☑	
HCS04STN01IV002	CSO Tank Inlet Gate	☑	☑	☑	
HCS04STN01OV001	CSO Tank Outlet Gate	☑	☑	☑	
HCS04STN01OV002	Influent Well Overflow Gate	☑			
HCS04VCH01IV001	Chamber No.1 Gate	☑	☑	☑	
HCS04VCH04IV001	Chamber No.4 Gate	☑	☑	☑	
HCS04VCH05IV001	Chamber No.5 Gate	☑	☑	☑	
HCS04WWT01SOL01	Cell No.1 Flush Valve No.1	☑	☑	☑	

SCADA Tag	Equipment Description	Local	SCADA Manual	SCADA Auto	Hardwired Backup Control
HCS04WWT01SOL02	Cell No.1 Flush Valve No.2	☑	☑	☑	
HCS04WWT01SOL03	Cell No.1 Flush Valve No.3	☑	☑	☑	
HCS04WWT01SOL04	Cell No.1 Flush Valve No.4	☑	☑	☑	
HCS04WWT01SOL05	Cell No.1 Flush Valve No.5	☑	☑	☑	
HCS04WWT01VLV01	Main Flushing Water Line Shutoff Valve	☑	☑	☑	
HCS04WWT02SOL06	Cell No.2 Flush Valve No.6	☑	☑	☑	
HCS04WWT02SOL07	Cell No.2 Flush Valve No.7	☑	☑	☑	
HCS04WWT02SOL08	Cell No.2 Flush Valve No.8	☑	☑	☑	
HCS04WWT02SOL09	Cell No.2 Flush Valve No.9	☑	☑	☑	
HCS04WWT02SOL10	Cell No.2 Flush Valve No.10	☑	☑	☑	
HCS04WWT02SOL11	Cell No.2 Flush Valve No.11	☑	☑	☑	
HCS04WWT02SOL12	Cell No.2 Flush Valve No.12	☑	☑	☑	
HCS04WWT02SOL13	Cell No.2 Flush Valve No.13	☑	☑	☑	
HCS04WWT02SOL14	Cell No.2 Flush Valve No.14	☑	☑	☑	
HCS04WWT02SOL15	Cell No.2 Flush Valve No.15	☑	☑	☑	
HCS04WWT02SOL16	Cell No.2 Trough Flush Valve No.16	☑	☑	☑	

5.4.2 Hardwired Interlocks

Hardwired interlocks are used for equipment and personnel safety or backup control. These will stop/close the equipment and prevent it from restarting, under specific control modes. All hardwired interlocks are also programmed into the controller to prevent the PAC from attempting to take control under a hardwired interlock condition. The following hardwired interlocks are installed:

Table 5-7: HCS04 Hardwired Interlocks by Device

Device	Interlock	Action / Consequences	Interlock Active In			
			Local	SCADA Manual	SCADA Auto	Latching
HCS04SAP0100000 HCS04SAP0200000	Sample Pump General Fault	Sample pump motor stops. The interlock is unlatched when the general fault is reset.	☑	☑	☑	☑
HCS04SFN0100000 HCS04SFN0200000 HCS04SFN0300000 HCS04SFN0400000 HCS04SFN0500000	Supply Fan General Fault	Supply fan motor stops. The interlock is unlatched when the general fault is reset.	☑	☑	☑	☑
HCS04SLP0100000 HCS04SLP0200000 HCS04SLP0300000	SLP General Fault	Sewage lift pump motor stops. The interlock is unlatched when the general fault is reset.	☑	☑	☑	☑

5.4.3 Backup Control System

There is no hardwired backup control at this site.

5.4.4 Software Interlocks

Software interlocks are used to prevent the operation of equipment in SCADA auto and occasionally SCADA manual modes of control based on specific requirements. In the local mode, all PAC software interlocks are bypassed. Software interlocks are active in the following modes of control:

Table 5-8: HCS04 Software Interlocks By Device

Device	Interlock	Action / Consequences	Interlock Active In			
			Local	SCADA Manual	SCADA Auto	Latching
HCS04SLP0100000 HCS04SLP0200000 HCS04SLP0300000	Generator Running	When generator is running and two sewage lift pumps are running, the third sewage lift pump motor will be interlocked.		☑	☑	
	Wetwell LIT General Fault / Signal Error	PAC will stop the SLP until the fault is cleared / the level signal is re-established.			☑	

Device	Interlock	Action / Consequences	Interlock Active In			
			Local	SCADA Manual	SCADA Auto	Latching
HCS04SFN0100000 HCS04SFN0200000 HCS04SFN0300000 HCS04SFN0400000 HCS04SFN0500000	600V Power Supply Failed	PAC will stop the Gallery Supply Fan		☑	☑	
HCS04STN01LHT01 HCS04STN01LHT02 HCS04STN01LHT03 HCS04STN01LHT04 HCS04STN01LHT05 HCS04STN01LHT06 HCS04STN01LHT07	Area Lighting Contactors C7 Master Interlock	PAC will prevent the lights from turning on.		☑	☑	

5.4.5 Program Variables & Internal Software Parameters

Program variables are values within the PAC logic that are adjustable through the SCADA HMI based on security level authorization.

Internal software parameters are values are entered in the PAC programs that are set at the time of commissioning and not adjustable from the SCADA system.

Refer to "Appendix G – Program Variables and Internal Software Parameters" for a detailed table of program variables and internal software parameters.

5.4.6 Calculated Variables

The following parameters are calculated within the PAC logic:

Table 5-9: HCS04 Calculated Values

Control Parameter	Calculation Description	Variables
Overflow Weir Flow HCS04STN01FIT02CV_	$Q = CLH^{3/2}$	• Q = Flow (m^3/s) • C = Weir Flow Coefficient 1.83 • L = Weir Crest Length 4.5 m • H = "Head" on Weir 0.109 m (when the channel is dry)
CSO Tank Cell No.1 Volume (m^3)	= (Cell No.1 Level) * (Cell No.1 Area)	• Cell No.1 Level (HCS04WWT01LIT01) • Cell No.1 Area 2,890 m

Control Parameter	Calculation Description	Variables
CSO Tank Cell No.2 Volume (m^3)	= (Cell No.2 Level) * (Cell No.2 Area)	• Cell No.2 Level (WWT01LIT02) • Cell No.2 Area 6,890 m
CSO Tank Total Volume (m^3)	= (Cell No.1 Volume) + (Cell No.2 Volume)	• Cell No.1 Volume (m^3) • Cell No.2 Volume (m^3)
Volume Paced Required Samples	= (CSO Tank Volume) / (Sampler Trigger Volume)	• CSO Tank Volume (m^3) • Influent Sampler Trigger Volume 3,060 m^3

5.4.7 Normal Operating Conditions

During normal dry weather station operation, the Wetwell level signal is used by the PAC to control the sewage lift pumps. The PAC program automatically assigns individual sewage lift pump duties (Duty 1, Duty 2, and Standby) based on sewage lift pump availability and runtime. The PAC program also alternates sewage lift pump operation between each duty cycle.

Each sewage lift pump has an individual No Flow Setpoint which is adjustable from the pump pop-up. If a pump is running in SCADA-auto mode and the observed flow fails to exceed the No Flow Setpoint for a set time delay, the pump will stop and a No Flow alarm will be annunciated on the HMI. This alarm will need to be acknowledged before the pump will be allowed to restart under SCADA-auto mode. Note that a No Flow alarm will not stop a pump while operating in SCADA-manual mode but the No Flow alarm will still be annunciated on the HMI.

5.4.8 Normal Backwashing Sequence

For a backwash sequence to start, the level in both CSO tanks must be below 1m. Once the sequence is started the following sequence is followed.

Backwash CSO Tank Cell No.1:

12. Flush bucket fill valve no.1 is opened for a time period sufficient to tipping flush buckets no.1 & 2;
13. Flush buckets no.1 & 2 are full and tilted then flush bucket fill valve no.1 is closed;
14. Flush bucket fill valve 2 is opened for a time period sufficient to tipping flush buckets no.3 & 4;
15. Flush buckets no.3 & 4 are full and tilted then flush bucket fill valve no.2 is closed;
16. Flush bucket fill valve 3 is opened for a time period sufficient to tipping flush buckets no.5 & 6;
17. Flush buckets no.5 & 6 are full and tilted then flush bucket fill valve no.3 is closed;
18. Flush bucket fill valve 4 is opened for a time period sufficient to tipping flush buckets no.7 & 8;
19. Flush buckets no.7 & 8 are full and tilted then flush bucket fill valve no.4 is closed;
20. Flush bucket fill valve 5 is opened for a time period sufficient to tipping flush buckets no.9 & 10;
21. Flush buckets no.9 & 10 are full and tilted then flush bucket fill valve no.5 is closed.
22. CSO Tank Cell no.1 backwash is completed.

Backwash CSO Tank Cell No.2:

22. Flush bucket fill valve no.6 is opened for a time period sufficient to tipping flush buckets no.11 & 12;
23. Flush buckets no.11 & 12 are full and tilted then flush bucket fill valve no.6 is closed;
24. Flush bucket fill valve no.7 is opened for a time period sufficient to tipping flush buckets no.13 & 14;
25. Flush buckets no.13 & 14 are full and tilted then flush bucket fill valve no.7 is closed;
26. Flush bucket fill valve no.8 is opened for a time period sufficient to tipping flush buckets no.15 & 16;
27. Flush buckets no.15 & 16 are full and tilted then flush bucket fill valve no.8 is closed;
28. Flush bucket fill valve no.9 is opened for a time period sufficient to tipping flush buckets no.17 & 18;
29. Flush buckets no.17 & 18 are full and tilted then flush bucket fill valve no.9 is closed;
30. Flush bucket fill valve no.10 is opened for a time period sufficient to tipping flush buckets no.19 & 20;

31. Flush buckets no.19 & 20 are full and tilted then flush bucket fill valve no.10 is closed;
32. Flush bucket fill valve no.11 is opened for a time period sufficient to tipping flush buckets no.21 & 22;
33. Flush buckets no.21 & 22 are full and tilted then flush bucket fill valve no.11 is closed;
34. Flush bucket fill valve no.12 is opened for a time period sufficient to tipping flush buckets no.23 & 24;
35. Flush buckets no.23 & 24 are full and tilted then flush bucket fill valve no.12 is closed;
36. Flush bucket fill valve no.13 is opened for a time period sufficient to tipping flush buckets no.25 & 26;
37. Flush buckets no.25 & 26 are full and tilted then flush bucket fill valve no.13 is closed;
38. Flush bucket fill valve no.14 is opened for a time period sufficient to tipping flush buckets no.27 & 28;
39. Flush buckets no. 27 & 28 are full and tilted then flush bucket fill valve no.14 is closed;
40. Flush bucket fill valve no.15 is opened for a time period sufficient to tipping flush buckets no.29 & 30;
41. Flush buckets no.29 & 30 are full and tilted then flush bucket fill valve no.15 is closed.
42. CSO Tank Cell no.2 backwash is completed.

After the backwash cycle is complete, flush bucket fill valve no.16 is activated for two minutes to flush the trough. Should any flush bucket fill valve fail to open when commanded as determined by the city water pressure transmitter (no pressure drop), an alarm is annunciated on the SCADA HMI and the next tipping flush buckets fill in the sequence until the entire sequence is complete. Should three (3) or more flush bucket fill valves fail to close when commanded as determined by the city water pressure transmitter (no pressure increase) an alarm is annunciated on the SCADA HMI, the main flushing water line shut-off line is commanded to close and the flush sequence is terminated.

5.4.9 Demo Backwashing Sequence

The DEMO mode is a short cycle, used to demonstrate the backwashing process.

When the DEMO mode is selected from the SCADA HMI, flush bucket fill valve no.1 opens for a time period sufficient to fill tipping flush buckets no. 1 and 2. When full, the flush buckets tip, flush bucket fill valve no.1 closes, and flush bucket fill valve no.2 opens to fill tipping flush buckets no.3 and 4. When full, the flush buckets tip, flush bucket fill valve no.2 closes, and the cycle repeats until the timers set for both flush bucket fill valves time out.

5.4.10 Influent and Overflow Sampler Modes

Table 5-10: HCS04 Sampler Modes

Sampler Mode	Description
7. Inactive	No samples are taken and sampler pumps remain off
8. Time Paced Sample	Time Paced Sampling begins when the level increases above the sampler pump start setpoint. Samples are taken at defined intervals until bottle change (24 samples). The influent sampler uses an intervals of 60 seconds while the overflow sampler uses and interval of 180 seconds.
9. Volume Paced Sample (Influent Sampler only)	After 24 samples have been taken in time paced mode the Influent Sampler is put in volume paced sample mode. A sample is taken for every 4390 m^3 of volume in the CSO tanks. See Calculated Variables for volume paced calculations.
10. Hourly Samples	After 24 samples have been taken by the Overflow Sampler, the Overflow Sampler is put into Hourly Samples mode. The Influent sample is issued a command to finish its current bottle and then sync with the Overflow Sampler. Once synchronized, samples are taken every hour for 24 hours. After 24 samples are taken both samplers are moved to the Inactive state. They will then move to Time Paced Mode if the start conditions are met.

Sampler Mode	Description
11. Finish Bottle	When in Finish Bottle mode, samples will be taken at the minimum allowed interval until the current bottle is finished (24 samples). The Influent Sampler has a minimum sample interval of 60 seconds while the Overflow Sampler has a minimum sample interval of 180 seconds. After the finish bottle sequence is complete the sample event ends.
12. Overflow Sync	When Overflow Hourly Sample Mode begins it moves the Influent Sampler into Finish Bottle mode in order to synchronize the Influent Sampler with the Overflow Sampler. Once synchronized with the Overflow Sampler, the Influent sampler will remain in Overflow Sync Mode until the Overflow Sampler has completed its sequence.

5.4.11 SCADA Auto Starting/Stopping Conditions

In SCADA auto mode the equipment is controlled by the PAC logic. The PAC operates the equipment as follows:

On Rising Wetwell Level:

- Sewage level rises above the Duty 1 start level. Duty 1 sewage lift pump starts.
- Sewage level rises above the Duty 2 start level. Duty 2 sewage lift pump starts.

On Falling Wetwell Level:

- All duty sewage lift pumps run when the sewage level is at or above the Duty 2 start level.
- Sewage level drops below the Duty 2 stop level. Duty 2 sewage lift pump stops.
- Sewage level drops below the Duty 1 stop level. Duty 1 sewage lift pump stops.

Refer to “Figure 5-1: HCS04 Normal Operating Levels” for normal operating levels of the Wetwell.

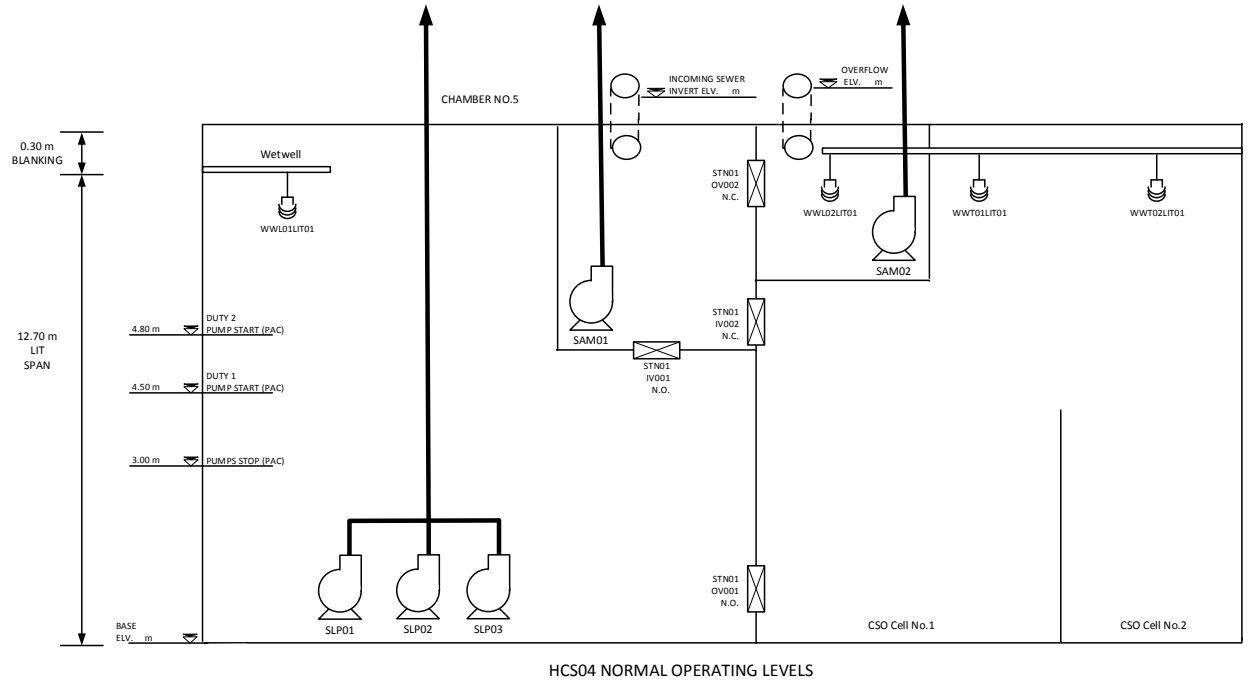


Figure 5-1: HCS04 Normal Operating Levels

5.4.12 Automatic Duty Rotation Modes

When in SCADA auto mode, five (5) automatic duty rotation modes are available.

Table 5-11: HCS04 Duty Rotation Modes

Duty Rotation Mode	Description
13. Cycle End*	Automatic duty rotation will occur after the completion of a pumping cycle, when the sewage lift pumps have stopped. Typically, it is City policy to set all duty stop setpoints at the same level.
14. Cycle End & Runtime*	Automatic duty rotation will occur after the completion of a pumping cycle based on accumulated runtime. The pump with the least amount of runtime will always be placed in the Duty 1 position.
15. Set Time*	Automatic duty rotation will occur at a preset time each day.
16. Set Time & Runtime*	Automatic duty rotation will occur at a preset time, and the pump with the least amount of running time will always be placed in the Duty 1 or lead position.
17. Manual	An operator rotates the sewage lift pump duty assignments via the SCADA HMI.

*For duty rotation modes 1, 2, 3, and 4, automatic duty rotation will always occur if the Duty 1 pump is failed. The next available pump will be automatically rotated into the Duty 1 position.

An available pump is a pump that is in SCADA auto mode, and is not out of service or faulted.

Single Sewage Lift Pump Failure

On failure of the Duty 1 sewage lift pump, the pump will be unavailable and removed from the duty rotation. The Duty 2 sewage lift pump will be moved to the Duty 1 position and the standby sewage lift pump will be moved to the Duty 2 position. This rotation is bumpless if the Duty 2 pump is already running. Otherwise, the new Duty 1 pump will start as required by the PAC. A sewage lift pump that is faulted will not be included in the duty rotation. The pump will be put back into the duty rotation when the fault is cleared and the pump is put into SCADA auto mode.

All Sewage Lift Pumps Fail

Immediate action must be taken by Operations staff to prevent flooding of the station. Contact the process supervisor for further direction.

6 WASTEWATER EVENT MANAGEMENT

This following table describes critical events that present risk to the operation of this station and defines how these events are mitigated through systems and practices built into the SCADA system:

Table 6-1: HCS04 Wastewater Event Management

Hazard and Effect	Risk Level	Critical Risk	Risk Mitigation	Processes & Procedures
SCADA HMI Communications Failure.	Low	No	The Station is able to function without the SCADA HMI connection.	Additional operational resources may be required to monitor and/or operate the station locally while repairs are being made.
PAC Failure. Potential for Wetwell overflow and spillage into the environment.	Med	Yes	The PAC is monitored by SCADA.	Additional operational resources may be required to monitor and/or operate the station locally while repairs are being made.
Mechanical Failure of Sewage Lift Pump	Low	No	There are multiple pumps for redundancy.	Issue work order and follow policies and procedures to replace equipment.
Facility Power Failure	High	Yes	Backup generator power available.	Electrical or Equipment Failure Emergency procedure.
Sabotage - Damage to Equipment/Property. Possible loss of function.	Low	No	Facility is locked and has an alarm system.	Call police and process supervisor.

7 FAULT RESPONSE AND ALARMS

7.1 FAULT RESPONSE OPERATION

7.1.1 Power Failure

Facility Power Failure

In the event of a station power failure, all equipment in the facility that is not backed up by UPS power will shut down.

There is an ATS located at this station for automatic transfer between hydro power and generator power. If hydro power fails, a portable generator can be connected to the station. Once the portable generator is running, the ATS will transfer to generator power. Upon restoration of hydro, the ATS will seamlessly transfer back to hydro power. The portable generator will then need to be shut down and removed from the station.

When power is restored, a sewage lift pump in LOCAL/HAND mode will need to be restarted with the start pushbutton. A sewage lift pump that was in SCADA manual mode prior to the power failure will need to be restarted manually via the SCADA HMI. A sewage lift pump that was in SCADA auto mode will operate based on the PAC control setpoints after a preset delay – no operator intervention is required.

Refer to "Section 8.1 - Electrical Equipment and Standby Power" for more information.

PAC Panel Power Failure

The PAC, instruments, backup control system, and network equipment are powered by a UPS. If power does not return or generator power is not available prior to the UPS battery draining to empty, the PAC and communications equipment will power down, and communications to the station will be lost. Refer to "Appendix C – SCADA HMI Screens and P&IDs" for the UPS pop up screen for status information that is available remotely from the UPS.

7.1.2 SCADA Communication Failure

The HMI and panel computer each send individual heartbeat signals to the PAC every 10 seconds. If no heartbeat signal is received for a period of 120 seconds, the HMI, panel computer, and PAC will set a communication alarm. In the event of an HMI or panel computer to PAC communication failure, the equipment will continue to operate in its last state and the PAC automatic logic will continue to operate equipment in SCADA auto mode of control.

Operations staff is to treat communication alarms as high priority. There is no way to remotely determine if the loss of communications is due to power failure, communication infrastructure failure, or catastrophic failure of the station. No remote alarming will be possible from the station during a communications failure.

7.1.3 PAC Failure

If the station PAC fails, the PAC will not be able to control the pumps or other station equipment. The station will operate on the hardwired backup control systems to control the sewage lift pumps while the PAC is unavailable. The pumps can also be operated manually at the station.

Upon PAC restart, the equipment in SCADA auto mode will restart as required.

7.1.4 Wetwell Level Transmitter Failure

If the Wetwell level transmitter fails, a transmitter fault will be annunciated on the SCADA HMI and any sewage lift pumps running in SCADA Auto mode will be commanded to stop; sewage lift pumps in SCADA Manual or local modes will continue to operate normally.

7.1.5 Flow Transmitter Failure

Upon failure of the station discharge flow transmitter, a transmitter fault will be annunciated on the SCADA HMI and operations will have to visit the site to determine the cause of failure. Until the discharge flow transmitter fault is corrected, the discharge flow will not be able to be accurately measured and the station's flow will remain unconfirmed.

7.1.6 Sluice Gate Failure

If a sluice gate is faulted, an alarm will be annunciated on the SCADA HMI indicating that the gate has failed. The sluice gate will not be able to be operated remotely in SCADA manual mode or SCADA auto mode, and in many cases, local mode.

Fault Conditions that will stop a Sluice Gate

- Torque/Overload Alarm

7.1.7 Sampler Unresponsive

If a sampler fails to annunciate that a sample has been taken after a sample is requested the sample event will end and the associated sampler pump will shut down. The sampler must be manually reset to clear the failure.

Fault Conditions that will stop a Sampler

- Maximum Bottle Limit Exceeded Alarm
- Sampler Failed to take sample – Sequence Error Detected Alarm

7.1.8 Sewage Lift Pump Failure

If a sewage lift pump is faulted, an alarm will be annunciated on the SCADA HMI indicating that the pump has failed. The sewage lift pump will not be able to be operated remotely in SCADA manual mode or SCADA auto mode, and in many cases, local mode. If a sewage lift pump failure occurs while the sewage lift pump is in SCADA auto mode, the PAC will repeatedly attempt to stop the sewage lift pump until the pump stops.

Fault Conditions that will shut down a Sewage Lift Pump

- General Fault
- Facility Power Failure

7.2 ALARMS

All alarms will be displayed on the SCADA HMI and local panel computer. Process setpoints can be changed and alarm setpoints are accessible from the SCADA HMI or local panel computer based on security clearance. Trending of process variables is provided from SCADA HMI or local panel computer.

Note that trends on the local panel computer are not tied to the Hamilton historical database; they are locally logged only. The panel computer is configured to automatically acknowledge all alarms at midnight every day. This clears alarms on the panel computer only. It does not clear alarms on the SCADA HMI system at the Woodward/Dundas Plants.

Appendix E contains a Table of alarms associated with this station and generated by the PAC. All alarms are of the Boolean Data Type and are recorded by the Historian as an alarm.

Note:

- The HMI alarm areas for this station/process area are: HCS04 and HAMC.

- The HMI security area for this process area is: CSOP.
- All pump no-flow alarms are conditioned for a pump only while it is running.
- All analog high high, high, low, and low low alarms are conditioned to only be active when there are no faults on the associated instrument.

7.2.1 Sewage Lift Pump Virtual Alarm Auto-Acknowledge

The PAC is programmed to auto-acknowledge sewage lift pump virtual alarms. When enabled, the PAC will auto-acknowledge all PAC generated virtual alarms after 60 seconds. Up to nine (9) virtual alarms will be auto-acknowledged within a one (1) hour period. If a tenth virtual alarm is triggered within the one (1) hour period, an alarm will be annunciated on the SCADA HMI and virtual alarms will no longer be auto-acknowledged until the Operator acknowledges this alarm.

7.2.2 HMI - Red Screen

Very critical processes in some facilities or areas require immediate attention and action. The City of Hamilton uses a 'Red Screen' on the SCADA HMI to annunciate these alarms. All conditions for a Red Screen are grouped under one (1) SCADA tag (HCS04STN0100000RS_) in the PAC program.

The conditions for the red screen are:

- Overflow Event in Progress OR Flushing Sequence Failed

Refer to the Alarm table in Appendix E for alarms at this station that will cause a Red Screen to be displayed.

7.2.3 Pilot Lights

'System OK' Pilot Light

Under normal conditions, the System OK pilot light is lit. The System OK pilot light is turned off by the PAC when there are any active alarms/faults (including equipment virtual alarms, but excluding SCADA system specific alarms) that are monitored by the PAC. The System OK pilot light will relight once all alarms/faults have been cleared.

'SCADA Alarm' Pilot Light

Under normal conditions, the SCADA Alarm pilot light is off. The 'SCADA alarm' pilot light is turned on by the PAC for SCADA specific set of faults, such as an I/O card fault, UPS fault, DC power supply fault, Ethernet switch fault, etc. Operations are to notify the SCADA Group in the event that this pilot light is lit.

7.2.4 Alarm Horn

There is an alarm horn present at this station; currently, the PAC program does not contain any logic to trigger it.

7.3 Environmental Compliance Approval or Other Regulatory Requirements

Refer to Certificate of Approval No. 3-1455-94-956 issued January 6, 1995.

7.4 Trending of Inputs

The SCADA HMI trend screen uses chart group files to populate the trending configurations for each station. The trends are grouped by station.

The following points are captured from the Historian and trended by the SCADA HMI.

Table 7-1: HCS04 Trending Points

SCADA Tag	Description
Analog Trending	
HCS04STN01FIT01CV_	Station Discharge Flow Indication
HCS04STN01IV001ZI_	Wetwell Inlet Gate Position Feedback
HCS04STN01IV002ZI_	CSO Tank Inlet Gate Position Feedback
HCS04STN01LIT01CV_	Overflow Weir Level Indication
HCS04STN01OV001ZI_	CSO Tank Outlet Gate Position Feedback
HCS04STN01PIT01CV_	City Water Pressure Indication
HCS04STN01TIT01CV_	Building Temperature Indication
HCS04VCH01IV001ZI_	Chamber No.1 Gate Position Feedback
HCS04VCH01LIT01CV_	Chamber No. 1 Level Indication
HCS04VCH04IV001ZI_	Chamber No.4 Gate Position Feedback
HCS04VCH04LIT01CV_	Chamber No. 4 Level Indication
HCS04VCH05IV001ZI_	Chamber No.5 Gate Position Feedback
HCS04WWL01LIT01CV_	Wetwell Level Indication
HCS04WWT01FIT01CV_	Main Flushing Water Line Flow Indication
HCS04WWT01LIT01CV_	CSO Tank Cell No. 1 Level Indication
HCS04WWT02LIT01CV_	CSO Tank Cell No. 2 Level Indication
Digital Trending	
HCS04SLP0100000MN_	Sewage Lift Pump No.1 Running Status
HCS04SLP0200000MN_	Sewage Lift Pump No.2 Running Status
HCS04SLP0300000MN_	Sewage Lift Pump No.3 Running Status
Calculated Value Trending	
HCS04SAM0100000BNC	Influent Sampler Bottle Count
HCS04SAM0100000HIS	Influent Sampler Pulses per Bottle
HCS04SAM0100000YX_	Influent Event in Progress
HCS04SAM0200000BNC	Overflow Sampler Bottle Count
HCS04SAM0200000HIS	Overflow Sampler Pulses per Bottle
HCS04SAM0200000YX_	Overflow Event in Progress
HCS04SLP0100000RT_	Sewage Lift Pump No.1 Total Runtime
HCS04SLP0200000RT_	Sewage Lift Pump No.2 Total Runtime
HCS04SLP0300000RT_	Sewage Lift Pump No.3 Total Runtime
HCS04STN01FIT01TT_	Station Discharge Flow Total Today
HCS04STN01FIT01TY_	Station Discharge Flow Total Yesterday

SCADA Tag	Description
HCS04STN01FIT01MT_	Station Discharge Flow Total This Month
HCS04STN01FIT01MY_	Station Discharge Flow Total Last Month
HCS04STN01FIT02CV_	Calculated Overflow Weir Flow Indication
HCS04STN01FIT02TT_	Calculated Overflow Weir Flow Total Today
HCS04STN01FIT02TY_	Calculated Overflow Weir Flow Total Yesterday
HCS04STN01FIT02MT_	Calculated Overflow Weir Flow Total This Month
HCS04STN01FIT02MY_	Calculated Overflow Weir Flow Total Last Month
HCS04STN01FIT03TT_	Calculated Cells Inflow Total Today
HCS04STN01FIT03TY_	Calculated Cells Inflow Total Yesterday
Communications Network I/O Trending	
N/A	

7.5 REPORTING

The following points are captured from the Historian and are included in the station daily reports. A Sample Report can be found in Appendix D – Historian Report.

Table 7-2: HCS04 Reporting Variables List

SCADA Tag	Parameter Description	Reporting Variables
Hourly		
HCS04WWT01LIT01CV_	CSO Tank Cell No.1 Level	• Hourly Level (m)
HCS04WWT02LIT01CV_	CSO Tank Cell No.2 Level	• Hourly Level (m)
HCS04STN01LIT01CV_	Overflow Weir Level	• Hourly Level (m)
HCS04SLP0100000MN_	Sewage Lift Pump No.1	• Hourly Runtime (min/hr)
HCS04SLP0200000MN_	Sewage Lift Pump No.2	• Hourly Runtime (min/hr)
HCS04SLP0300000MN_	Sewage Lift Pump No.3	• Hourly Runtime (min/hr)
HCS04STN01FIT01CV_	Station Discharge Flow	• Hourly Flow Rate (L/s)
HCS04STN01PIT01CV_	City Water Pressure Indication	• Hourly Pressure (kPa)
HCS04VCH01LIT01CV_	Chamber No.1 Level Indication	• Hourly Level (m)
HCS04VCH01IV001ZI_	Chamber No. 1 Gate	• Gate Position (%)
HCS04VCH04LIT01CV_	Chamber No.4 Level Indication	• Hourly Level (m)

SCADA Tag	Parameter Description	Reporting Variables
HCS04VCH04IV001ZI_	Chamber No. 4 Gate	• Gate Position (%)
HCS04VCH05IV001ZI_	Chamber No. 5 Gate	• Gate Position (%)
HCS04STN01IV001CV_	Wetwell Inlet Gate	• Gate Position (%)
HCS04STN01IV002CV_	CSO Tank Inlet Gate	• Gate Position (%)
HCS04STN01OV001CV_	CSO Tank Outlet Gate	• Gate Position (%)
HCS04WWL01LIT01CV_	Wetwell Level	• Hourly Level (m)
HCS04STN01FIT02CV_	Calculated Overflow Weir Flow	• Hourly Flow Rate (L/s)
Totals		
HCS04SLP0100000RT_	Sewage Lift Pump No.1	• Daily Runtime Total (hr)
HCS04SLP0200000RT_	Sewage Lift Pump No.2	• Daily Runtime Total (hr)
HCS04SLP0300000RT_	Sewage Lift Pump No.3	• Daily Runtime Total (hr)
HCS04STN01FIT01TY_	Station Discharge Flow	• Daily Flow Total (m^3)

7.6 LOCAL LOGGING

The following analog input point values are stored in an array on the PAC local RAM memory. Data is logged every minute. The data is stored for seven (7) days (10,080 records). Data is stored on a first in, first out basis; older data will be overwritten after seven (7) days.

Table 7-3: HCS04 Local Logging

SCADA Tag	Description	Capture Frequency	Log Time
HCS04STN01FIT01CV_	Station Discharge Flow Indication	1 minute	7 days
HCS04STN01FIT02CV_	Calculated Overflow Weir Flow	1 minute	7 days
HCS04STN01LIT01CV_	Overflow Weir Level Indication	1 minute	7 days
HCS04STN01PIT01CV_	City Water Pressure Indication	1 minute	7 days
HCS04STN01TIT01CV_	Building Temperature Indication	1 minute	7 days
HCS04VCH01LIT01CV_	Chamber No.1 Level Indication	1 minute	7 days
HCS04VCH04LIT01CV_	Chamber No.4 Level Indication	1 minute	7 days
HCS04WWL01LIT01CV_	Wetwell Level Indication	1 minute	7 days
HCS04WWT01FIT01CV_	Main Flushing Water Line Flow Indication	1 minute	7 days
HCS04WWT01LIT01CV_	CSO Tank Cell No.1 Level Indication	1 minute	7 days

SCADA Tag	Description	Capture Frequency	Log Time
HCS04WWT02LIT01CV_	CSO Tank Cell No.2 Level Indication	1 minute	7 days

8 MISCELLANEOUS

8.1 ELECTRICAL EQUIPMENT AND STANDBY POWER

The incoming hydro service for this site is 600V, 3 phase, 4 wire.

An ATS is located at the station, as well as a connection for the portable generator. Once the generator is connected and running at speed, the ATS can be manually switched over to the emergency power position and power will return to the station. The City uses an ATS in manual mode at this station to protect the station equipment from the accidental connection of a generator of the wrong voltage, and to check phase rotation.

The portable generator that is used for this station is not large enough to run more than two (2) sewage lift pumps. When the PAC receives the ATS in Generator/Emergency Position status input, the PAC will automatically limit the number of pumps that can run.

Refer to "Table 8-2: HCS04 Generator Summary" for generator details.

The following major electrical equipment in the station is present and monitored by the SCADA system.

Table 8-1: HCS04 Electrical Equipment Summary

SCADA Tag	Equipment Description
HCS04CP001UPS01	PAC Panel UPS
HCS04ATS0100000	Automatic Transfer Switch

The following table describes the generator:

Table 8-2: HCS04 Generator Summary

Type	Rating	Fuel		Approximate Run Time at Full Load with Full Fuel Tanks
		No. of Tanks	Total Volume (L)	
Portable Generator	350kW, 600V, 3ph	2	1970	16 hours

8.2 HVAC

The following HVAC equipment is present at this station:

- There is a smoke detector (HCS04STN01SKD01) present inside the station that is connected to the SCADA system.
- There are two blower/heater units for heating the station, each with a built in thermostat. The blower/heaters are not monitored or controlled by the SCADA System.
- There is a SCADA monitored building exhaust fan at this station (HCS04STN01EXF01). The fan is controlled by a thermostat mounted on the wall near the fan. The fan is not controllable via the SCADA System.

- There are five (5) SCADA monitored and controlled supply fans at this station (HSC04SFN0100000, HSC04SFN0200000, HSC04SFN0300000, HSC04SFN0400000 and HSC04SFN0500000). These fans are controlled by the PAC to mitigate gas produced at the station.
    - HCS04SFN0100000 Gallery No.1 Supply Fan
    - HCS04SFN0200000 Gallery No.2 Supply Fan
    - HCS04SFN0300000 Gallery No.3 Supply Fan
    - HCS04SFN0400000 Pump/Gate Gallery No.4 Supply Fan
    - HCS04SFN0500000 Pump/Well Chamber Supply Fan
    - HCS04SFN0600000 Pump Well Chamber Supply Fan

8.3 HAZARDOUS GASES

A combustible gas detector is installed in the station Wetwell. The gas monitor monitors combustible gas and sends an analog gas concentration signal in ppm to the PAC. A high combustible gas level will also cause the gas monitor to send a digital High Combustible Gas concentration alarm to the PAC.

8.4 STATION FLOOD

A station flood float is installed at this station. In the event of a station flood, the alarm will be displayed on the SCADA HMI.

8.5 STATION SECURITY

There is a station security system that consists of door contacts (HCS04STN01ESW01) to monitor all doors, and a key-operated security switch (HCS04STN01HSW01) to enable and disable the security system. When a door is opened, an intrusion alarm will be displayed on the SCADA HMI. The person entering must use their key to disarm the security system by turning the security key switch to DISARM. A notification that a station door has opened will always be displayed on the SCADA HMI regardless of whether the security system is armed or disarmed.

To rearm the security system when leaving the station, the key switch should be turned to ‘ARM’ immediately before leaving the station. There will be a 45 second delay before the security system is re-armed to allow for safe exit of the station without tripping the intrusion alarm. Once the security system has been armed, the station has been exited, and all doors are closed and locked, the Process Supervisor is to be called to confirm that they can see the security system armed, the doors closed, and that the intrusion alarm has not been activated.

8.6 PRECIPITATION (RAINFALL) MONITORING

There is no precipitation monitoring at this site.

8.7 STATION LIGHTING

Lighting systems are installed in the West, East, and South galleries and in the West and South sections of the Tank. Emergency lights are powered by an AC emergency inverter system that is available for a prolonged power outage. The contactors for normal and emergency lights are as follows:

- HCS04STN01LHT01 Area C1 Gallery Lights West
- HCS04STN01LHT02 Area C2 Gallery Lights East
- HCS04STN01LHT03 Area C3 Gallery Lights South
- HCS04STN01LHT04 Area C4 Tank Flood Lights West

- HCS04STN01LHT05 Area C5 Tank Flood Lights South
- HCS04STN01LHT06 Area C6 Tank Flood Lights South
- HCS04STN01LHT07 Area C7 Emergency Lights

Controls for lighting areas C1 to C6 are operated through the HMI and interlocked when the station security keyswitch is armed. Emergency lights C7 are interlocked with the area lights when they are in "Auto."

APPENDIX A – SCADA I/O LISTING BY DEVICE

I/O List

The following table details the I/O at this station arranged by major device type.

HCS04 I/O list by Device

Type	SCADA Tag	Description
DI	HCS04ATS0100000XA_	ATS General Alarm (Future)
DI	HCS04ATS0100000YN_	ATS in Remote (Future)
DI	HCS04ATS01JSW01YX_	ATS in Normal/Hydro Power Position
DI	HCS04ATS01JSW02YX_	ATS in Emergency/Generator Power Position
DI	HCS04ATS01LNE01YX_	ATS Normal/Hydro Power Available
DI	HCS04ATS01LNE02YX_	ATS Emergency/Generator Power Available
DI	HCS04CP001DCP01XA_	PAC Panel DC Power Supply Fault
DO	HCS04CP001HRN01MH_	Station Alarm Horn (Future)
DI	HCS04CP001JSW01JA_	PAC Panel Power Fail Alarm
DI	HCS04CP001UPS01MN_	PAC Panel UPS Online
DI	HCS04CP001UPS01XA_	PAC Panel UPS Fault/Low Battery
DO	HCS04GDS0000000MH_	Combustible Gas Alarm Beacon (Future)
DI	HCS04GEN0100000MN_	Generator Running (Future)
DI	HCS04GEN0100000XA_	Generator General Alarm (Future)
DI	HCS04GEN0100000YN_	Generator in Remote (Future)
DI	HCS04GEN01HSW01HAS	Generator E-Stop Activated (Future)
DI	HCS04NAC01NAS01XA_	WAN Panel Ethernet Switch Minor Fault
DI	HCS04NAC01NAS01XA2	WAN Panel Ethernet Switch Major Fault
DO	HCS04PAC0100000XA_	SCADA Alarm Pilot Light
DO	HCS04PAC0100000YX_	System OK Pilot Light
DI	HCS04SAM0000000RES	Influent/Overflow Sampler Program Reset
DI	HCS04SAM0100000BN_	Influent Sampler Bottle Number
DO	HCS04SAM0100000MH_	Influent Sampler Take Sample Command
DI	HCS04SAM0100000ST_	Influent Sampler Sample Mark
DO	HCS04SAM01VLV01CE_	Influent Backwash Close Command (Future)
DO	HCS04SAM01VLV01OP_	Influent Backwash Open Command
DI	HCS04SAM01VLV01WA_	Influent Backwash Valve Overtorque Alarm (Future)
DI	HCS04SAM01VLV01XA_	Influent Backwash Valve General Fault (Future)
DI	HCS04SAM01VLV01YN_	Influent Backwash Valve in Remote
DI	HCS04SAM01VLV01ZH_	Influent Backwash Valve Opened Status
DI	HCS04SAM01VLV01ZL_	Influent Backwash Valve Closed Status (Future)
DI	HCS04SAM0200000BN_	Effluent Sampler Bottle Number
DO	HCS04SAM0200000MH_	Effluent Sampler Take Sample
DI	HCS04SAM0200000ST_	Effluent Sampler Sample Mark
DO	HCS04SAP0100000MB_	Sample Pump No.1 Stop Command
DO	HCS04SAP0100000MH_	Sample Pump No.1 Start Command
DI	HCS04SAP0100000MN_	Sample Pump No.1 Running
DI	HCS04SAP0100000XA_	Sample Pump No.1 General Fault
DI	HCS04SAP0100000YN_	Sample Pump No.1 In Remote

DO	HCS04SAP0200000MB_	Sample Pump No.2 Stop Command
DO	HCS04SAP0200000MH_	Sample Pump No.2 Start Command
DI	HCS04SAP0200000MN_	Sample Pump No.2 Running
DI	HCS04SAP0200000XA_	Sample Pump No.2 General Fault
DI	HCS04SAP0200000YN_	Sample Pump No.2 In Remote
DO	HCS04SFN0100000MB_	Gallery No.1 Supply Fan Stop Command
DO	HCS04SFN0100000MH_	Gallery No.1 Supply Fan Start Command
DI	HCS04SFN0100000MN_	Gallery No.1 Supply Fan Running Status
DI	HCS04SFN0100000XA_	Gallery No.1 Supply Fan General Fault
DI	HCS04SFN0100000YN_	Gallery No.1 Supply Fan In Remote
DO	HCS04SFN0200000MB_	Gallery No.2 Supply Fan Stop Command
DO	HCS04SFN0200000MH_	Gallery No.2 Supply Fan Start Command
DI	HCS04SFN0200000MN_	Gallery No.2 Supply Fan Running Status
DI	HCS04SFN0200000XA_	Gallery No.2 Supply Fan General Fault
DI	HCS04SFN0200000YN_	Gallery No.2 Supply Fan In Remote
DO	HCS04SFN0300000MB_	Gallery No.3 Supply Fan Stop Command
DO	HCS04SFN0300000MH_	Gallery No.3 Supply Fan Start Command
DI	HCS04SFN0300000MN_	Gallery No.3 Supply Fan Running Status
DI	HCS04SFN0300000XA_	Gallery No.3 Supply Fan General Fault
DI	HCS04SFN0300000YN_	Gallery No.3 Supply Fan In Remote
DO	HCS04SFN0400000MB_	Pump/Gate Gallery Supply Fan Stop Command
DO	HCS04SFN0400000MHH	Pump/Gate Gallery Supply Fan Start Fast Command
DO	HCS04SFN0400000MHL	Pump/Gate Gallery Supply Fan Start Slow Command
DI	HCS04SFN0400000MNH	Pump/Gate Gallery Supply Fan Running Fast
DI	HCS04SFN0400000MNL	Pump/Gate Gallery Supply Fan Running Slow
DI	HCS04SFN0400000XA_	Pump/Gate Gallery Supply Fan General Fault
DI	HCS04SFN0400000YN_	Pump/Gate Gallery Supply Fan In Remote
DO	HCS04SFN0500000MB_	Pump/Well Chamber Supply Fan Stop Command
DO	HCS04SFN0500000MH_	Pump/Well Chamber Supply Fan Start Command
DI	HCS04SFN0500000MN_	Pump/Well Chamber Supply Fan Running Status
DI	HCS04SFN0500000XA_	Pump/Well Chamber Supply Fan General Fault
DI	HCS04SFN0500000YN_	Pump/Well Chamber Supply Fan In Remote
DO	HCS04SLP0100000MB_	Sewage Lift Pump No.1 Stop Command
DO	HCS04SLP0100000MH_	Sewage Lift Pump No.1 Start Command
DI	HCS04SLP0100000MN_	Sewage Lift Pump No.1 Running
DI	HCS04SLP0100000XA_	Sewage Lift Pump No.1 General Fault
DI	HCS04SLP0100000XLT	Sewage Lift Pump No.1 Temp/Leak Fault (Future)
DI	HCS04SLP0100000YN_	Sewage Lift Pump No.1 In Remote
DI	HCS04SLP01VFD01XA_	Sewage Lift Pump No.1 VFD Fault (RTC Future)
DO	HCS04SLP0200000MB_	Sewage Lift Pump No.2 Stop Command
DO	HCS04SLP0200000MH_	Sewage Lift Pump No.2 Start Command
DI	HCS04SLP0200000MN_	Sewage Lift Pump No.2 Running
DI	HCS04SLP0200000XA_	Sewage Lift Pump No.2 General Fault
DI	HCS04SLP0200000XLT	Sewage Lift Pump No.2 Temp/Leak Fault (Future)

DI	HCS04SLP0200000YN_	Sewage Lift Pump No.2 In Remote
DI	HCS04SLP02VFD01XA_	Sewage Lift Pump No.2 VFD Fault (RTC Future)
DO	HCS04SLP0300000MB_	Sewage Lift Pump No.3 Stop Command
DO	HCS04SLP0300000MH_	Sewage Lift Pump No.3 Start Command
DI	HCS04SLP0300000MN_	Sewage Lift Pump No.3 Running
DI	HCS04SLP0300000XA_	Sewage Lift Pump No.3 General Fault
DI	HCS04SLP0300000XLT	Sewage Lift Pump No.3 Temp/Leak Fault (Future)
DI	HCS04SLP0300000YN_	Sewage Lift Pump No.3 In Remote
DI	HCS04STN01ESW01ZSH	Door Contact
DI	HCS04STN01ESW02ZSH	Wetwell Hatch Contact (Future)
AI	HCS04STN01FIT01FI_	Station Flow Indication
DI	HCS04STN01FIT01XA_	Station Flow Transmitter General Fault (Future)
DI	HCS04STN01HSW01YX_	Station Security Key Switch Status
DO	HCS04STN01IV001CE_	Pump Station Inlet Gate Analog Override Close Command (Future)
DO	HCS04STN01IV001OP_	Pump Station Inlet Gate Analog Override Open Command (Future)
DI	HCS04STN01IV001WA_	Pump Station Inlet Gate Overtorque Alarm (Future)
DI	HCS04STN01IV001XA_	Pump Station Inlet Gate General Fault (Future)
DI	HCS04STN01IV001YN_	Pump Station Inlet Gate In Remote
AO	HCS04STN01IV001ZC_	Pump Station Inlet Gate Position Setpoint
DI	HCS04STN01IV001ZH_	Pump Station Inlet Gate Opened Status (Future)
AI	HCS04STN01IV001ZI_	Pump Station Inlet Gate Position Indication
DI	HCS04STN01IV001ZL_	Pump Station Inlet Gate Closed Status (Future)
DO	HCS04STN01IV002CE_	Cells Inlet Gate Analog Override Close Command (Future)
DO	HCS04STN01IV002OP_	Cells Inlet Gate Analog Override Open Command (Future)
DI	HCS04STN01IV002WA_	Cells Inlet Gate Overtorque Alarm (Future)
DI	HCS04STN01IV002XA_	Cells Inlet Gate General Fault (Future)
DI	HCS04STN01IV002YN_	Cells Inlet Gate In Remote
AO	HCS04STN01IV002ZC_	Cells Inlet Gate Position Setpoint
DI	HCS04STN01IV002ZH_	Cells Inlet Gate Opened Status (Future)
AI	HCS04STN01IV002ZI_	Cells Inlet Gate Position Indication
DI	HCS04STN01IV002ZL_	Cells Inlet Gate Closed Status (Future)
DI	HCS04STN01JSW01JA_	600 VAC Power Supply Failed Alarm
DO	HCS04STN01LHT01LOK	Area Lighting Contactors C1 - C6 Master Interlock
DO	HCS04STN01LHT01MH_	Area C1 Gallery Lights West On Command
DI	HCS04STN01LHT01MN_	Area C1 Gallery Lights West On Status
DI	HCS04STN01LHT01YN_	Area C1 Gallery Lights West In Remote (Future)
DO	HCS04STN01LHT02LOK	Area Lighting Contactor C7 Master Interlock
DO	HCS04STN01LHT02MH_	Area C2 Gallery Lights East On Command
DI	HCS04STN01LHT02MN_	Area C2 Gallery Lights East On Status
DI	HCS04STN01LHT02YN_	Area C2 Gallery Lights East In Remote (Future)
DO	HCS04STN01LHT03MH_	Area C3 Gallery Lights South On Command
DI	HCS04STN01LHT03MN_	Area C3 Gallery Lights South On Status
DI	HCS04STN01LHT03YN_	Area C3 Gallery Lights South In Remote (Future)
DO	HCS04STN01LHT04MH_	Area C4 Tank Flood Lights West On Command

DI	HCS04STN01LHT04MN_	Area C4 Tank Flood Lights West On Status
DI	HCS04STN01LHT04YN_	Area C4 Tank Flood Lights West In Remote (Future)
DO	HCS04STN01LHT05MH_	Area C5 Tank Flood Lights South On Command
DI	HCS04STN01LHT05MN_	Area C5 Tank Flood Lights South On Status
DI	HCS04STN01LHT05YN_	Area C5 Tank Flood Lights South In Remote (Future)
DO	HCS04STN01LHT06MH_	Area C6 Tank Flood Lights South On Command
DI	HCS04STN01LHT06MN_	Area C6 Tank Flood Lights South On Status
DI	HCS04STN01LHT06YN_	Area C6 Tank Flood Lights South In Remote (Future)
DO	HCS04STN01LHT07MH_	Area C7 Emergency Lights On Command
DI	HCS04STN01LHT07MN_	Area C7 Emergency Lights On Status
DI	HCS04STN01LHT07YN_	Area C7 Emergency Lights In Remote (Future)
AI	HCS04STN01LIT01LI_	Overflow Weir Level Indication
DI	HCS04STN01LIT01XA_	Overflow Weir Level Transmitter General Fault
DI	HCS04STN01LSH01LHH	Station Flood Alarm
DO	HCS04STN01OV001CE_	Cells Outlet Gate Analog Override Close Command (Future)
DO	HCS04STN01OV001OP_	Cells Outlet Gate Analog Override Open Command (Future)
DI	HCS04STN01OV001WA_	Cells Outlet Gate Overtorque Alarm (Future)
DI	HCS04STN01OV001XA_	Cells Outlet Gate General Fault (Future)
DI	HCS04STN01OV001YN_	Cells Outlet Gate In Remote
AO	HCS04STN01OV001ZC_	Cells Outlet Gate Position Setpoint
DI	HCS04STN01OV001ZH_	Cells Outlet Gate Opened Status (Future)
AI	HCS04STN01OV001ZI_	Cells Outlet Gate Position Indication
DI	HCS04STN01OV001ZL_	Cells Outlet Gate Closed Status (Future)
AI	HCS04STN01PIT01PI_	City Water Pressure Indication
DI	HCS04STN01SKD01XA_	Building Smoke/Fire Alarm
AI	HCS04STN01TIT01TI_	Building Temperature Indication
DO	HCS04VCH01IV001CE_	Chamber No.1 Gate Analog Override Close Command (Future)
DO	HCS04VCH01IV001OP_	Chamber No.1 Gate Analog Override Open Command (Future)
DI	HCS04VCH01IV001WA_	Chamber No.1 Gate Overtorque Alarm (Future)
DI	HCS04VCH01IV001XA_	Chamber No.1 Gate General Fault (Future)
DI	HCS04VCH01IV001YN_	Chamber No.1 Gate In Remote
AO	HCS04VCH01IV001ZC_	Chamber No.1 Gate Position Setpoint
DI	HCS04VCH01IV001ZH_	Chamber No.1 Gate Opened Status (Future)
AI	HCS04VCH01IV001ZI_	Chamber No.1 Gate Position Indication
DI	HCS04VCH01IV001ZL_	Chamber No.1 Gate Closed Status (Future)
AI	HCS04VCH01LIT01LI_	Chamber No.1 Level Indication
DI	HCS04VCH01LIT01XA_	Chamber No.1 Level Transmitter General Fault (Future)
DO	HCS04VCH04IV001CE_	Chamber No.4 Gate Analog Override Close Command (Future)
DO	HCS04VCH04IV001OP_	Chamber No.4 Gate Analog Override Open Command (Future)
DI	HCS04VCH04IV001WA_	Chamber No.4 Gate Overtorque Alarm (Future)
DI	HCS04VCH04IV001XA_	Chamber No.4 Gate General Fault (Future)
DI	HCS04VCH04IV001YN_	Chamber No.4 Gate In Remote
AO	HCS04VCH04IV001ZC_	Chamber No.4 Gate Position Setpoint
DI	HCS04VCH04IV001ZH_	Chamber No.4 Gate Opened Status (Future)

AI	HCS04VCH04IV001ZI_	Chamber No.4 Gate Position Indication
DI	HCS04VCH04IV001ZL_	Chamber No.4 Gate Closed Status (Future)
AI	HCS04VCH04LIT01LI_	Chamber No.4 Level Indication
DI	HCS04VCH04LIT01XA_	Chamber No.4 Level Transmitter General Fault (Future)
DO	HCS04VCH05IV001CE_	Chamber No.5 Gate Analog Override Close Command (Future)
DO	HCS04VCH05IV001OP_	Chamber No.5 Gate Analog Override Open Command (Future)
DI	HCS04VCH05IV001WA_	Chamber No.5 Gate Overtorque Alarm (Future)
DI	HCS04VCH05IV001XA_	Chamber No.5 Gate General Fault (Future)
DI	HCS04VCH05IV001YN_	Chamber No.5 Gate In Remote
AO	HCS04VCH05IV001ZC_	Chamber No.5 Gate Position Setpoint
DI	HCS04VCH05IV001ZH_	Chamber No.5 Gate Opened Status (Future)
AI	HCS04VCH05IV001ZI_	Chamber No.5 Gate Position Indication
DI	HCS04VCH05IV001ZL_	Chamber No.5 Gate Closed Status (Future)
AI	HCS04WWL01LIT01LI_	Wetwell Level Indication
DI	HCS04WWL01LIT01XA_	Wetwell Level Transmitter General Fault
AI	HCS04WWT01FIT01FI_	Main Flushing Water Line Flow Indication
DI	HCS04WWT01FIT01XA_	Main Flushing Water Line Flow Transmitter General Fault
AI	HCS04WWT01LIT01LI_	Cell No.1 Level Indication
DI	HCS04WWT01LIT01XA_	Cell No.1 Level Transmitter General Fault (Future)
DO	HCS04WWT01SOL01MH_	Cell No.1 Flush Valve No.1 Open Command
DO	HCS04WWT01SOL02MH_	Cell No.1 Flush Valve No.2 Open Command
DO	HCS04WWT01SOL03MH_	Cell No.1 Flush Valve No.3 Open Command
DO	HCS04WWT01SOL04MH_	Cell No.1 Flush Valve No.4 Open Command
DO	HCS04WWT01SOL05MH_	Cell No.1 Flush Valve No.5 Open Command
DO	HCS04WWT01VLV01CE_	Main Flushing Water Line Shutoff Valve Close Command
DO	HCS04WWT01VLV01OP_	Main Flushing Water Line Shutoff Valve Open Command
DI	HCS04WWT01VLV01WA_	Main Flushing Water Line Shutoff Valve Overtorque Alarm
DI	HCS04WWT01VLV01XA_	Main Flushing Water Line Shutoff Valve General Fault
DI	HCS04WWT01VLV01YN_	Main Flushing Water Line Shutoff Valve In Remote
DI	HCS04WWT01VLV01ZH_	Main Flushing Water Line Shutoff Valve Opened Status
DI	HCS04WWT01VLV01ZL_	Main Flushing Water Line Shutoff Valve Closed Status
AI	HCS04WWT02LIT01LI_	Cell No.2 Level Indication
DI	HCS04WWT02LIT01XA_	Cell No.2 Level Transmitter General Fault (Future)
DO	HCS04WWT02SOL06MH_	Cell No.2 Flush Valve No.6 Open Command
DO	HCS04WWT02SOL07MH_	Cell No.2 Flush Valve No.7 Open Command
DO	HCS04WWT02SOL08MH_	Cell No.2 Flush Valve No.8 Open Command
DO	HCS04WWT02SOL09MH_	Cell No.2 Flush Valve No.9 Open Command
DO	HCS04WWT02SOL10MH_	Cell No.2 Flush Valve No.10 Open Command
DO	HCS04WWT02SOL11MH_	Cell No.2 Flush Valve No.11 Open Command
DO	HCS04WWT02SOL12MH_	Cell No.2 Flush Valve No.12 Open Command
DO	HCS04WWT02SOL13MH_	Cell No.2 Flush Valve No.13 Open Command
DO	HCS04WWT02SOL14MH_	Cell No.2 Flush Valve No.14 Open Command
DO	HCS04WWT02SOL15MH_	Cell No.2 Flush Valve No.15 Open Command
DO	HCS04WWT02SOL16MH_	Cell No.2 Trough Flush Valve No.16 Open Command

APPENDIX B – SCADA I/O LISTING BY CARD ASSIGNMENT

I/O List

The following table details the I/O at this station arranged by card layout.

HCS04 I/O list by Card

Platform: ControlLogix
Processor: 1756-L73
Power Supply: 1756-PA75 x 3

Rack	Slot	Pts	Card Type	Card Model
0	0	N/A	CPU	1756-L63
	1	N/A	ETHERNET CARD	1756-ENBT
	2	N/A	ETHERNET CARD	1756-ENBT
	3	N/A	ETHERNET CARD	1756-ENBT
	4	N/A	SPARE	N/A
	5	16	DIGITAL OUTPUT	1756-OW16I
	6	16	DIGITAL OUTPUT	1756-OW16I
	7	16	DIGITAL OUTPUT	1756-OW16I
	8	16	DIGITAL OUTPUT	1756-OW16I
	9	16	DIGITAL OUTPUT	1756-OW16I
	10	16	DIGITAL OUTPUT	1756-OW16I
	11	N/A	SPARE	N/A
	12	N/A	SPARE	N/A
	13	6	ANALOG OUTPUT	1756-OF6CI
	14	6	ANALOG OUTPUT	1756-OF6CI
	15	N/A	SPARE	N/A
	16	N/A	SPARE	N/A
1	0	N/A	ETHERNET CARD	1756-ENBT
	1	N/A	SPARE	N/A
	2	16	DIGITAL INPUT	1756-IV16
	3	16	DIGITAL INPUT	1756-IV16
	4	16	DIGITAL INPUT	1756-IV16
	5	16	DIGITAL INPUT	1756-IV16
	6	16	DIGITAL INPUT	1756-IV16
	7	16	DIGITAL INPUT	1756-IV16
	8	16	DIGITAL INPUT	1756-IV16
	9	16	DIGITAL INPUT	1756-IV16
	10	16	DIGITAL INPUT	1756-IV16
	11	16	DIGITAL INPUT	1756-IV16
	12	16	DIGITAL INPUT	1756-IV16
	13	16	DIGITAL INPUT	1756-IV16
	14	16	DIGITAL INPUT	1756-IV16

	15	16	DIGITAL INPUT	1756-IV16
	16	16	DIGITAL INPUT	1756-IV16
2	0	N/A	ETHERNET CARD	1756-ENBT
	1	N/A	SPARE	N/A
	2	16	DIGITAL INPUT	1756-IV16
	3	16	DIGITAL INPUT	1756-IV16
	4	16	DIGITAL INPUT	1756-IV16
	5	N/A	SPARE	N/A
	6	N/A	SPARE	N/A
	7	N/A	SPARE	N/A
	8	6	ANALOG INPUT	1756-IF6I
	9	6	ANALOG INPUT	1756-IF6I
	10	6	ANALOG INPUT	1756-IF6I
	11	6	ANALOG INPUT	1756-IF6I
	12	6	ANALOG INPUT	1756-IF6I
	13	6	ANALOG INPUT	1756-IF6I
	14	6	ANALOG INPUT	1756-IF6I
	15	6	ANALOG INPUT	1756-IF6I
	16	N/A	SPARE	N/A

Rack	Slot	Pt	SCADA Tag	Description
0	0			Processor
0	1			Ethernet Card
0	2			Ethernet Card
0	3			Ethernet Card
0	4			Spare
0	5	0	HCS04STN01IV001OP_	Pump Station Inlet Gate Analog Override Open Command (Future)
	DO	1	HCS04STN01IV001CE_	Pump Station Inlet Gate Analog Override Close Command (Future)
		2	HCS04VCH01IV001OP_	Chamber No.1 Gate Analog Override Open Command (Future)
		3	HCS04VCH01IV001CE_	Chamber No.1 Gate Analog Override Close Command (Future)
		4	HCS04SLP0100000MH_	Sewage Lift Pump No.1 Start Command
		5	HCS04SLP0100000MB_	Sewage Lift Pump No.1 Stop Command
		6	HCS04SAM0100000MH_	Influent Sampler Take Sample Command
		7	HCS04SAM01VLV01CE_	Influent Backwash Close Command (Future)
		8	HCS04SAM01VLV01OP_	Influent Backwash Open Command
		9		
		10		
		11		
		12	HCS04STN01LHT01LOK	Area Lighting Contactors C1 - C6 Master Interlock
		13	HCS04STN01LHT01MH_	Area C1 Gallery Lights West On Command
		14	HCS04SFN0100000MH_	Gallery No.1 Supply Fan Start Command
		15	HCS04SFN0100000MB_	Gallery No.1 Supply Fan Stop Command

0	6	0	HCS04STN01OV001OP_	Cells Outlet Gate Analog Override Open Command (Future)
	DO	1	HCS04STN01OV001CE_	Cells Outlet Gate Analog Override Close Command (Future)
		2	HCS04SAP0100000MH_	Sample Pump No.1 Start Command
		3	HCS04SAP0100000MB_	Sample Pump No.1 Stop Command
		4	HCS04SLP0200000MH_	Sewage Lift Pump No.2 Start Command
		5	HCS04SLP0200000MB_	Sewage Lift Pump No.2 Stop Command
		6	HCS04WWT01SOL01MH_	Cell No.1 Flush Valve No.1 Open Command
		7	HCS04WWT01SOL02MH_	Cell No.1 Flush Valve No.2 Open Command
		8	HCS04WWT01SOL03MH_	Cell No.1 Flush Valve No.3 Open Command
		9	HCS04WWT02SOL06MH_	Cell No.2 Flush Valve No.6 Open Command
		10	HCS04WWT02SOL07MH_	Cell No.2 Flush Valve No.7 Open Command
		11	HCS04WWT02SOL08MH_	Cell No.2 Flush Valve No.8 Open Command
		12	HCS04STN01LHT02LOK	Area Lighting Contactor C7 Master Interlock
		13	HCS04STN01LHT02MH_	Area C2 Gallery Lights East On Command
		14	HCS04SFN0200000MH_	Gallery No.2 Supply Fan Start Command
		15	HCS04SFN0200000MB_	Gallery No.2 Supply Fan Stop Command
0	7	0	HCS04STN01IV002OP_	Cells Inlet Gate Analog Override Open Command (Future)
	DO	1	HCS04STN01IV002CE_	Cells Inlet Gate Analog Override Close Command (Future)
		2	HCS04SAP0200000MH_	Sample Pump No.2 Start Command
		3	HCS04SAP0200000MB_	Sample Pump No.2 Stop Command
		4	HCS04SLP0300000MH_	Sewage Lift Pump No.3 Start Command
		5	HCS04SLP0300000MB_	Sewage Lift Pump No.3 Stop Command
		6	HCS04SAM0200000MH_	Effluent Sampler Take Sample
		7	HCS04WWT01SOL04MH_	Cell No.1 Flush Valve No.4 Open Command
		8	HCS04WWT01SOL05MH_	Cell No.1 Flush Valve No.5 Open Command
		9	HCS04WWT02SOL09MH_	Cell No.2 Flush Valve No.9 Open Command
		10	HCS04WWT02SOL10MH_	Cell No.2 Flush Valve No.10 Open Command
		11	HCS04WWT02SOL11MH_	Cell No.2 Flush Valve No.11 Open Command
		12	HCS04WWT02SOL12MH_	Cell No.2 Flush Valve No.12 Open Command
		13	HCS04STN01LHT03MH_	Area C3 Gallery Lights South On Command
		14	HCS04SFN0300000MH_	Gallery No.3 Supply Fan Start Command
		15	HCS04SFN0300000MB_	Gallery No.3 Supply Fan Stop Command
0	8	0		
	DO	1		
		2	HCS04VCH04IV001OP_	Chamber No.4 Gate Analog Override Open Command (Future)
		3	HCS04VCH04IV001CE_	Chamber No.4 Gate Analog Override Close Command (Future)
		4	HCS04WWT01VLV01CE_	Main Flushing Water Line Shutoff Valve Close Command
		5	HCS04WWT01VLV01OP_	Main Flushing Water Line Shutoff Valve Open Command
		6		
		7	HCS04WWT02SOL13MH_	Cell No.2 Flush Valve No.13 Open Command
		8	HCS04WWT02SOL14MH_	Cell No.2 Flush Valve No.14 Open Command
		9	HCS04WWT02SOL15MH_	Cell No.2 Flush Valve No.15 Open Command
		10	HCS04WWT02SOL16MH_	Cell No.2 Trough Flush Valve No.16 Open Command

		11		
		12		
		13	HCS04STN01LHT04MH_	Area C4 Tank Flood Lights West On Command
		14	HCS04SFN0500000MH_	Pump/Well Chamber Supply Fan Start Command
		15	HCS04SFN0500000MB_	Pump/Well Chamber Supply Fan Stop Command
0	9	0		
	DO	1		
		2	HCS04VCH05IV001OP_	Chamber No.5 Gate Analog Override Open Command (Future)
		3	HCS04VCH05IV001CE_	Chamber No.5 Gate Analog Override Close Command (Future)
		4		
		5		
		6		
		7		
		8		
		9	HCS04SFN0400000MHH	Pump/Gate Gallery Supply Fan Start Fast Command
		10	HCS04SFN0400000MHL	Pump/Gate Gallery Supply Fan Start Slow Command
		11	HCS04SFN0400000MB_	Pump/Gate Gallery Supply Fan Stop Command
		12		
		13	HCS04STN01LHT05MH_	Area C5 Tank Flood Lights South On Command
		14		
		15		
0	10	0	HCS04GDS0000000MH_	Combustible Gas Alarm Beacon (Future)
	DO	1	HCS04CP001HRN01MH_	Station Alarm Horn (Future)
		2		
		3		
		4		
		5		
		6		
		7		
		8	HCS04PAC0100000YX_	System OK Pilot Light
		9	HCS04PAC0100000XA_	SCADA Alarm Pilot Light
		10		
		11		
		12		
		13	HCS04STN01LHT06MH_	Area C6 Tank Flood Lights South On Command
		14	HCS04STN01LHT07MH_	Area C7 Emergency Lights On Command
		15		
0	11			Spare
0	12			Spare
0	13	0	HCS04VCH01IV001ZC_	Chamber No.1 Gate Position Setpoint
	AO	1		
		2	HCS04VCH05IV001ZC_	Chamber No.5 Gate Position Setpoint

		3	HCS04STN01IV001ZC_	Pump Station Inlet Gate Position Setpoint
		4	HCS04STN01IV002ZC_	Cells Inlet Gate Position Setpoint
		5		
0	14	0		
	AO	1	HCS04VCH04IV001ZC_	Chamber No.4 Gate Position Setpoint
		2		
		3	HCS04STN01OV001ZC_	Cells Outlet Gate Position Setpoint
		4		
		5		
0	15			Spare
0	16			Spare
1	0			Ethernet Card
	1			Spare
	2	0	HCS04VCH01IV001YN_	Chamber No.1 Gate In Remote
	DI	1	HCS04VCH01IV001XA_	Chamber No.1 Gate General Fault (Future)
		2	HCS04VCH01IV001WA_	Chamber No.1 Gate Overtorque Alarm (Future)
		3	HCS04VCH01IV001ZH_	Chamber No.1 Gate Opened Status (Future)
		4	HCS04VCH01IV001ZL_	Chamber No.1 Gate Closed Status (Future)
		5		
		6		
		7	HCS04STN01FIT01XA_	Station Flow Transmitter General Fault (Future)
		8	HCS04SLP0100000YN_	Sewage Lift Pump No.1 In Remote
		9	HCS04SLP0100000XA_	Sewage Lift Pump No.1 General Fault
		10	HCS04SLP0100000MN_	Sewage Lift Pump No.1 Running
		11	HCS04SLP0100000XLT	Sewage Lift Pump No.1 Temp/Leak Fault (Future)
		12	HCS04SLP01VFD01XA_	Sewage Lift Pump No.1 VFD Fault (RTC Future)
		13		
		14	HCS04VCH01LIT01XA_	Chamber No.1 Level Transmitter General Fault (Future)
		15		
1	3	0	HCS04VCH04IV001YN_	Chamber No.4 Gate In Remote
	DI	1	HCS04VCH04IV001XA_	Chamber No.4 Gate General Fault (Future)
		2	HCS04VCH04IV001WA_	Chamber No.4 Gate Overtorque Alarm (Future)
		3	HCS04VCH04IV001ZH_	Chamber No.4 Gate Opened Status (Future)
		4	HCS04VCH04IV001ZL_	Chamber No.4 Gate Closed Status (Future)
		5		
		6		
		7		
		8	HCS04SLP0200000YN_	Sewage Lift Pump No.2 In Remote
		9	HCS04SLP0200000XA_	Sewage Lift Pump No.2 General Fault
		10	HCS04SLP0200000MN_	Sewage Lift Pump No.2 Running
		11	HCS04SLP0200000XLT	Sewage Lift Pump No.2 Temp/Leak Fault (Future)
		12	HCS04SLP02VFD01XA_	Sewage Lift Pump No.2 VFD Fault (RTC Future)

		13	HCS04VCH04LIT01XA_	Chamber No.4 Level Transmitter General Fault (Future)
		14		
		15		
1	4	0	HCS04VCH05IV001YN_	Chamber No.5 Gate In Remote
	DI	1	HCS04VCH05IV001XA_	Chamber No.5 Gate General Fault (Future)
		2	HCS04VCH05IV001WA_	Chamber No.5 Gate Overtorque Alarm (Future)
		3	HCS04VCH05IV001ZH_	Chamber No.5 Gate Opened Status (Future)
		4	HCS04VCH05IV001ZL_	Chamber No.5 Gate Closed Status (Future)
		5		
		6		
		7		
		8	HCS04SLP0300000YN_	Sewage Lift Pump No.3 In Remote
		9	HCS04SLP0300000XA_	Sewage Lift Pump No.3 General Fault
		10	HCS04SLP0300000MN_	Sewage Lift Pump No.3 Running
		11	HCS04SLP0300000XLT	Sewage Lift Pump No.3 Temp/Leak Fault (Future)
		12		
		13		
		14		
		15		
1	5	0	HCS04STN01IV001YN_	Pump Station Inlet Gate In Remote
	DI	1	HCS04STN01IV001XA_	Pump Station Inlet Gate General Fault (Future)
		2	HCS04STN01IV001WA_	Pump Station Inlet Gate Overtorque Alarm (Future)
		3	HCS04STN01IV001ZH_	Pump Station Inlet Gate Opened Status (Future)
		4	HCS04STN01IV001ZL_	Pump Station Inlet Gate Closed Status (Future)
		5	HCS04SAP0100000YN_	Sample Pump No.1 In Remote
		6	HCS04SAP0100000XA_	Sample Pump No.1 General Fault
		7	HCS04SAP0100000MN_	Sample Pump No.1 Running
		8	HCS04WWT01LIT01XA_	Cell No.1 Level Transmitter General Fault (Future)
		9		
		10	HCS04WWT01VLV01WA_	Main Flushing Water Line Shutoff Valve Overtorque Alarm
		11	HCS04WWT01VLV01XA_	Main Flushing Water Line Shutoff Valve General Fault
		12	HCS04WWT01VLV01YN_	Main Flushing Water Line Shutoff Valve In Remote
		13	HCS04WWT01VLV01ZH_	Main Flushing Water Line Shutoff Valve Opened Status
		14	HCS04WWT01VLV01ZL_	Main Flushing Water Line Shutoff Valve Closed Status
		15	HCS04WWT01FIT01XA_	Main Flushing Water Line Flow Transmitter General Fault
1	6	0	HCS04STN01IV002YN_	Cells Inlet Gate In Remote
	DI	1	HCS04STN01IV002XA_	Cells Inlet Gate General Fault (Future)
		2	HCS04STN01IV002WA_	Cells Inlet Gate Overtorque Alarm (Future)
		3	HCS04STN01IV002ZH_	Cells Inlet Gate Opened Status (Future)
		4	HCS04STN01IV002ZL_	Cells Inlet Gate Closed Status (Future)
		5	HCS04SAP0200000YN_	Sample Pump No.2 In Remote
		6	HCS04SAP0200000XA_	Sample Pump No.2 General Fault
		7	HCS04SAP0200000MN_	Sample Pump No.2 Running

		8	HCS04WWT02LIT01XA_	Cell No.2 Level Transmitter General Fault (Future)
		9		
		10		
		11		
		12		
		13		
		14		
		15		
1	7	0	HCS04STN01OV001YN_	Cells Outlet Gate In Remote
	DI	1	HCS04STN01OV001XA_	Cells Outlet Gate General Fault (Future)
		2	HCS04STN01OV001WA_	Cells Outlet Gate Overtorque Alarm (Future)
		3	HCS04STN01OV001ZH_	Cells Outlet Gate Opened Status (Future)
		4	HCS04STN01OV001ZL_	Cells Outlet Gate Closed Status (Future)
		5		
		6		
		7		
		8		
		9		
		10		
		11		
		12		
		13		
		14		
		15		
1	8	0		
	DI	1		
		2		
		3		
		4		
		5		
		6		
		7		
		8		
		9		
		10		
		11		
		12		
		13		
		14		
		15		
1	9	0	–	–
	DI	1		–
		2		–

		3		–
		4		–
		5		–
		6		–
		7		–
		8		–
		9		–
		10		–
		11		–
		12		–
		13		–
		14		–
		15		
1	10	0	–	–
	DI	1		–
		2		–
		3		–
		4		–
		5		–
		6		–
		7		–
		8		–
		9		–
		10		–
		11		–
		12		–
		13		–
		14		–
		15		
1	11	0	–	–
	DI	1		–
		2		–
		3		–
		4		–
		5		–
		6		–
		7		–
		8		–
		9		–
		10		–
		11		–
		12		–
		13		–

		14		–
		15	–	–
1	12	0	HCS04SFN0100000YN_	Gallery No.1 Supply Fan In Remote
	DI	1	HCS04SFN0100000XA_	Gallery No.1 Supply Fan General Fault
		2	HCS04SFN0100000MN_	Gallery No.1 Supply Fan Running Status
		3	HCS04STN01LHT01YN_	Area C1 Gallery Lights West In Remote (Future)
		4	HCS04STN01LHT01MN_	Area C1 Gallery Lights West On Status
		5	HCS04STN01LHT02YN_	Area C2 Gallery Lights East In Remote (Future)
		6	HCS04STN01LHT02MN_	Area C2 Gallery Lights East On Status
		7		
		8	HCS04STN01LIT01XA_	Overflow Weir Level Transmitter General Fault
		9	HCS04WWL01LIT01XA_	Wetwell Level Transmitter General Fault
		10		
		11		
		12		
		13		
		14		
		15		
1	13	0	HCS04SFN0200000YN_	Gallery No.2 Supply Fan In Remote
	DI	1	HCS04SFN0200000XA_	Gallery No.2 Supply Fan General Fault
		2	HCS04SFN0200000MN_	Gallery No.2 Supply Fan Running Status
		3	HCS04STN01LHT03YN_	Area C3 Gallery Lights South In Remote (Future)
		4	HCS04STN01LHT03MN_	Area C3 Gallery Lights South On Status
		5	HCS04STN01LHT04YN_	Area C4 Tank Flood Lights West In Remote (Future)
		6	HCS04STN01LHT04MN_	Area C4 Tank Flood Lights West On Status
		7		
		8		
		9		
		10		
		11		
		12		
		13		
		14		
		15		
1	14	0	HCS04SFN0300000YN_	Gallery No.3 Supply Fan In Remote
	DI	1	HCS04SFN0300000XA_	Gallery No.3 Supply Fan General Fault
		2	HCS04SFN0300000MN_	Gallery No.3 Supply Fan Running Status
		3	HCS04STN01LHT05YN_	Area C5 Tank Flood Lights South In Remote (Future)
		4	HCS04STN01LHT05MN_	Area C5 Tank Flood Lights South On Status
		5	HCS04STN01LHT06YN_	Area C6 Tank Flood Lights South In Remote (Future)
		6	HCS04STN01LHT06MN_	Area C6 Tank Flood Lights South On Status
		7		
		8		

		9		
		10		
		11		
		12		
		13		
		14		
		15		
1	15	0	HCS04SFN0500000YN_	Pump/Well Chamber Supply Fan In Remote
	DI	1	HCS04SFN0500000XA_	Pump/Well Chamber Supply Fan General Fault
		2	HCS04SFN0500000MN_	Pump/Well Chamber Supply Fan Running Status
		3	HCS04STN01LHT07YN_	Area C7 Emergency Lights In Remote (Future)
		4	HCS04STN01LHT07MN_	Area C7 Emergency Lights On Status
		5	HCS04STN01JSW01JA_	600 VAC Power Supply Failed Alarm
		6	HCS04GDS01GIT01XA_	Control Room Combustible Gas Monitor General Fault (Future)
		7	HCS04GDS03GIT01XA_	West Stairs Combustible Gas Monitor General Fault (Future)
		8	HCS04GDS05GIT01XA_	East Stairs Combustible Gas Monitor General Fault (Future)
		9	HCS04GDS07GIT01XA_	Pump Room Fumes Combustible Gas Monitor General Fault (Future)
		10	HCS04GDS09GIT01XA_	West Stairs Oxygen Monitor General Fault (Future)
		11		
		12		
		13		
		14		
		15		
1	16	0		
	DI	1		
		2		
		3		
		4		
		5		
		6		
		7		
		8	HCS04GDS02GIT01XA_	Pump Room Combustible Gas Monitor General Fault (Future)
		9	HCS04GDS04GIT01XA_	Access 1 Combustible Gas Monitor General Fault (Future)
		10	HCS04GDS06GIT01XA_	Access 3 Combustible Gas Monitor General Fault (Future)
		11	HCS04GDS08GIT01XA_	Control Room Oxygen Monitor General Fault (Future)
		12	HCS04GDS10GIT01XA_	East Stairs Oxygen Monitor General Fault (Future)
		13		
		14		
		15		
2	0			Ethernet Card
2	1			Spare
2	2	0	HCS04SFN0400000YN_	Pump/Gate Gallery Supply Fan In Remote

	DI	1	HCS04SFN0400000MNH	Pump/Gate Gallery Supply Fan Running Fast
		2	HCS04SFN0400000MNL	Pump/Gate Gallery Supply Fan Running Slow
		3	HCS04SFN0400000XA_	Pump/Gate Gallery Supply Fan General Fault
		4		
		5	HCS04SAM0100000BN_	Influent Sampler Bottle Number
		6	HCS04SAM0100000ST_	Influent Sampler Sample Mark
		7	HCS04SAM01VLV01YN_	Influent Backwash Valve in Remote
		8	HCS04SAM01VLV01ZH_	Influent Backwash Valve Opened Status
		9	HCS04SAM01VLV01ZL_	Influent Backwash Valve Closed Status (Future)
		10	HCS04SAM01VLV01XA_	Influent Backwash Valve General Fault (Future)
		11	HCS04SAM01VLV01WA_	Influent Backwash Valve Overtorque Alarm (Future)
		12	HCS04SAM0200000BN_	Effluent Sampler Bottle Number
		13	HCS04SAM0200000ST_	Effluent Sampler Sample Mark
		14	HCS04SAM0000000RES	Influent/Overflow Sampler Program Reset
		15		
2	3	0	HCS04ATS0100000YN_	ATS in Remote (Future)
	DI	1	HCS04ATS0100000XA_	ATS General Alarm (Future)
		2	HCS04ATS01LNE01YX_	ATS Normal/Hydro Power Available
		3	HCS04ATS01LNE02YX_	ATS Emergency/Generator Power Available
		4	HCS04ATS01JSW01YX_	ATS in Normal/Hydro Power Position
		5	HCS04ATS01JSW02YX_	ATS in Emergency/Generator Power Position
		6		
		7		
		8	HCS04GEN0100000YN_	Generator in Remote (Future)
		9	HCS04GEN01HSW01HAS	Generator E-Stop Activated (Future)
		10	HCS04GEN0100000XA_	Generator General Alarm (Future)
		11	HCS04GEN0100000MN_	Generator Running (Future)
		12		
		13		
		14		
		15		
2	4	0	HCS04STN01HSW01YX_	Station Security Key Switch Status
	DI	1	HCS04STN01ESW01ZSH	Door Contact
		2	HCS04STN01ESW02ZSH	Wetwell Hatch Contact (Future)
		3	HCS04STN01SKD01XA_	Building Smoke/Fire Alarm
		4	HCS04STN01LSH01LHH	Station Flood Alarm
		5	HCS04CP001JSW01JA_	PAC Panel Power Fail Alarm
		6	HCS04CP001UPS01MN_	PAC Panel UPS Online
		7	HCS04CP001UPS01XA_	PAC Panel UPS Fault/Low Battery
		8	HCS04NAC01NAS01XA_	WAN Panel Ethernet Switch Minor Fault
		9	HCS04NAC01NAS01XA2	WAN Panel Ethernet Switch Major Fault
		10	HCS04CP001DCP01XA_	PAC Panel DC Power Supply Fault
		11		

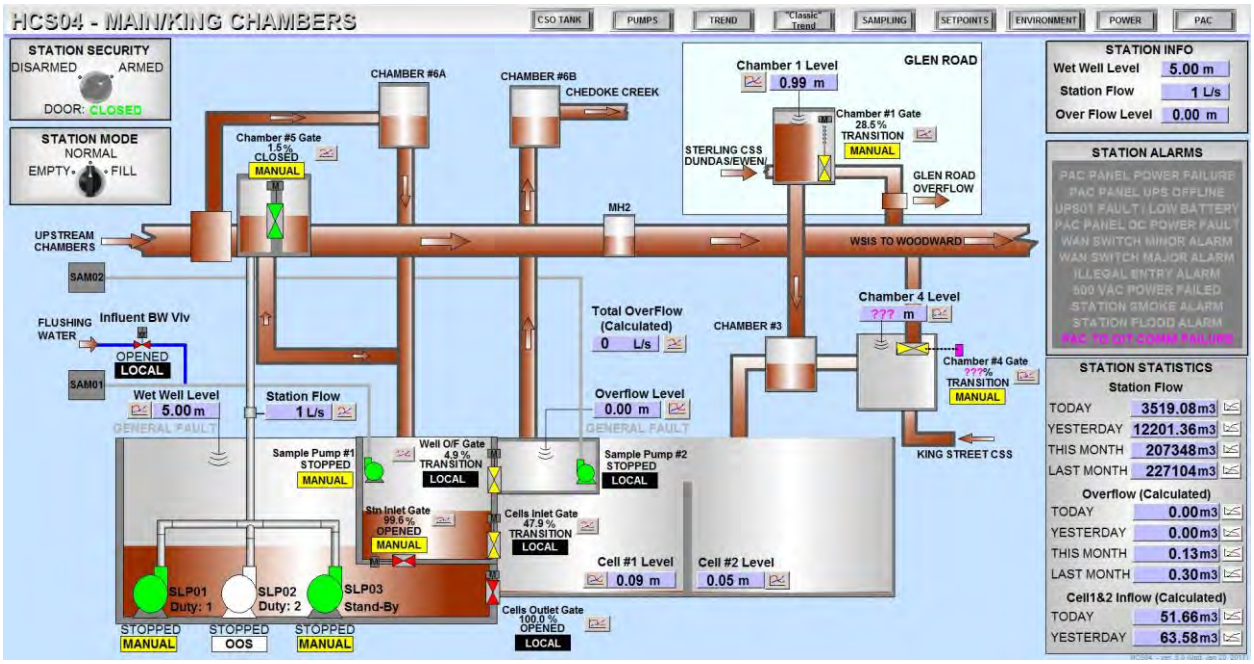
		12		
		13		
		14		
		15		
2	5			Spare
2	6			Spare
2	7			Spare
2	8	0	HCS04VCH01IV001ZI_	Chamber No.1 Gate Position Indication
	AI	1		
		2		
		3		
		4		
		5	HCS04VCH01LIT01LI_	Chamber No.1 Level Indication
2	9	0	HCS04VCH04IV001ZI_	Chamber No.4 Gate Position Indication
	AI	1		
		2	HCS04VCH04LIT01LI_	Chamber No.4 Level Indication
		3		
		4	HCS04WWT01FIT01FI_	Main Flushing Water Line Flow Indication
		5	HCS04STN01PIT01PI_	City Water Pressure Indication
2	10	0	HCS04VCH05IV001ZI_	Chamber No.5 Gate Position Indication
	AI	1		
		2		
		3		
		4		
		5		
2	11	0	HCS04STN01IV001ZI_	Pump Station Inlet Gate Position Indication
	AI	1	HCS04STN01IV002ZI_	Cells Inlet Gate Position Indication
		2		
		3		
		4		
		5	HCS04WWT01LIT01LI_	Cell No.1 Level Indication
2	12	0	HCS04STN01OV001ZI_	Cells Outlet Gate Position Indication
	AI	1		
		2		
		3		
		4		
		5	HCS04WWT02LIT01LI_	Cell No.2 Level Indication
2	13	0	HCS04STN01LIT01LI_	Overflow Weir Level Indication
	AI	1	HCS04WWL01LIT01LI_	Wetwell Level Indication
		2		
		3	HCS04STN01FIT01FI_	Station Flow Indication
		4		

		5	HCS04STN01TIT01TI_ Building Temperature Indication
2	14	0	
	AI	1	
		2	
		3	
		4	
		5	
2	15	0	
	AI	1	
		2	
		3	
		4	
		5	
2	16		Spare

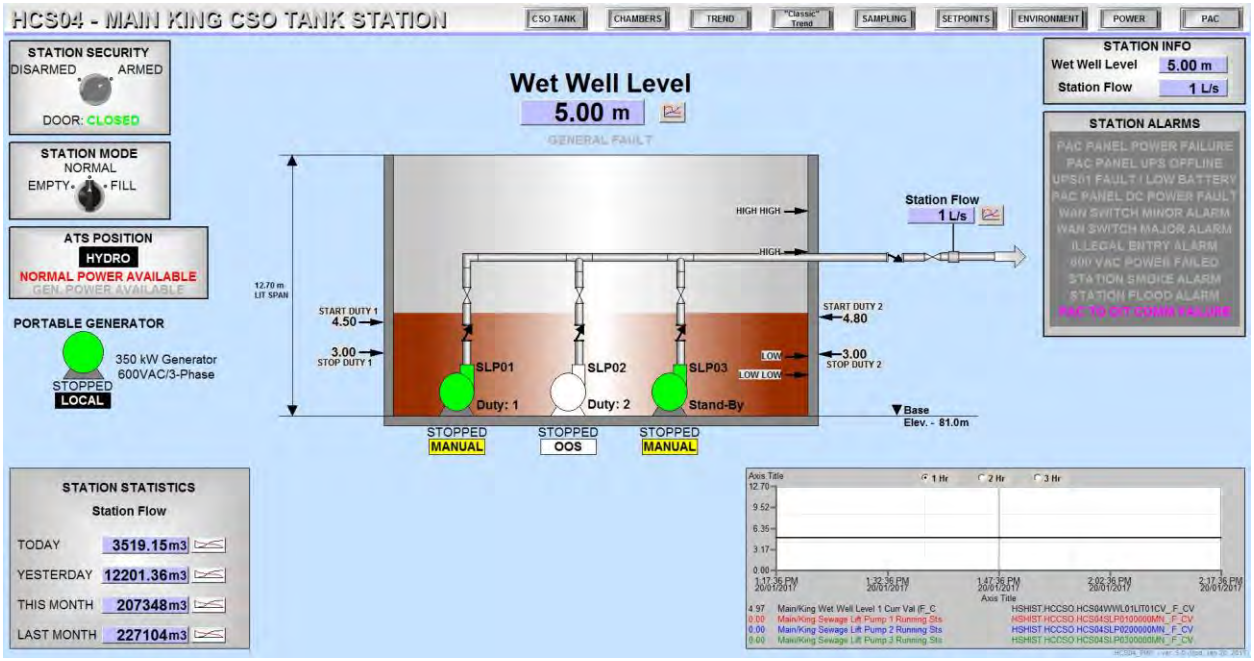
APPENDIX C – SCADA HMI SCREENS AND P&IDS

HMI Screens

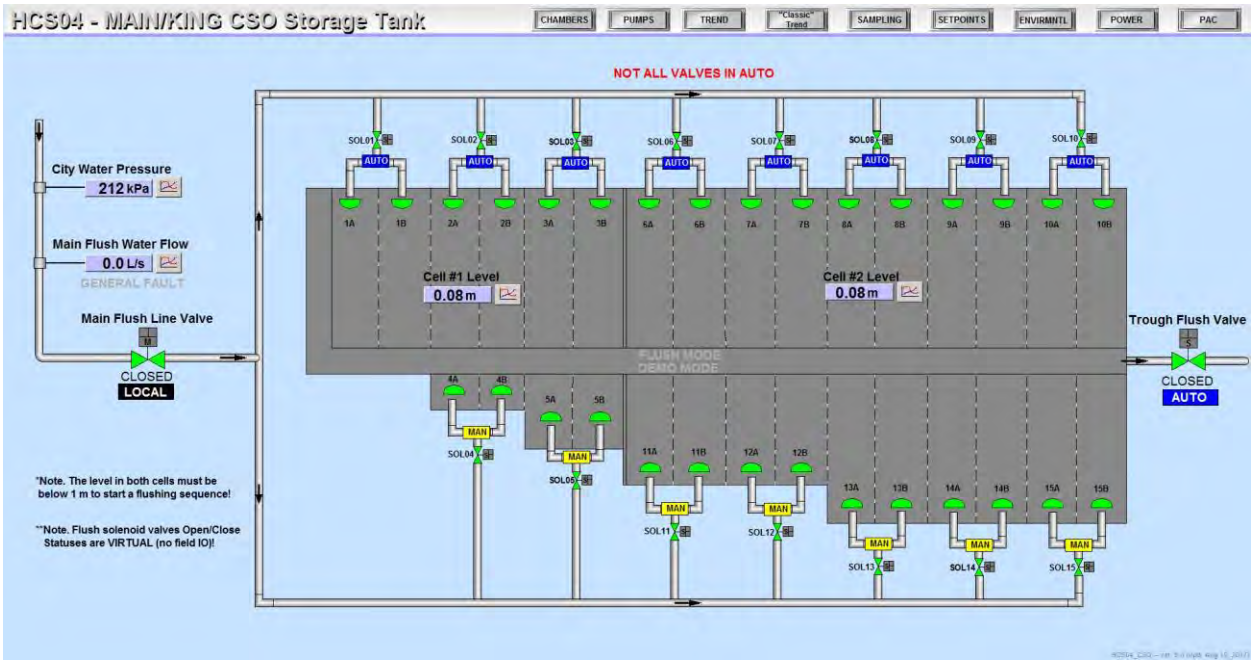
Below are screen captures of the HMI screens at this station. For detailed SCADA HMI screen information, Refer to the HCS04 Operations and Maintenance Manual.



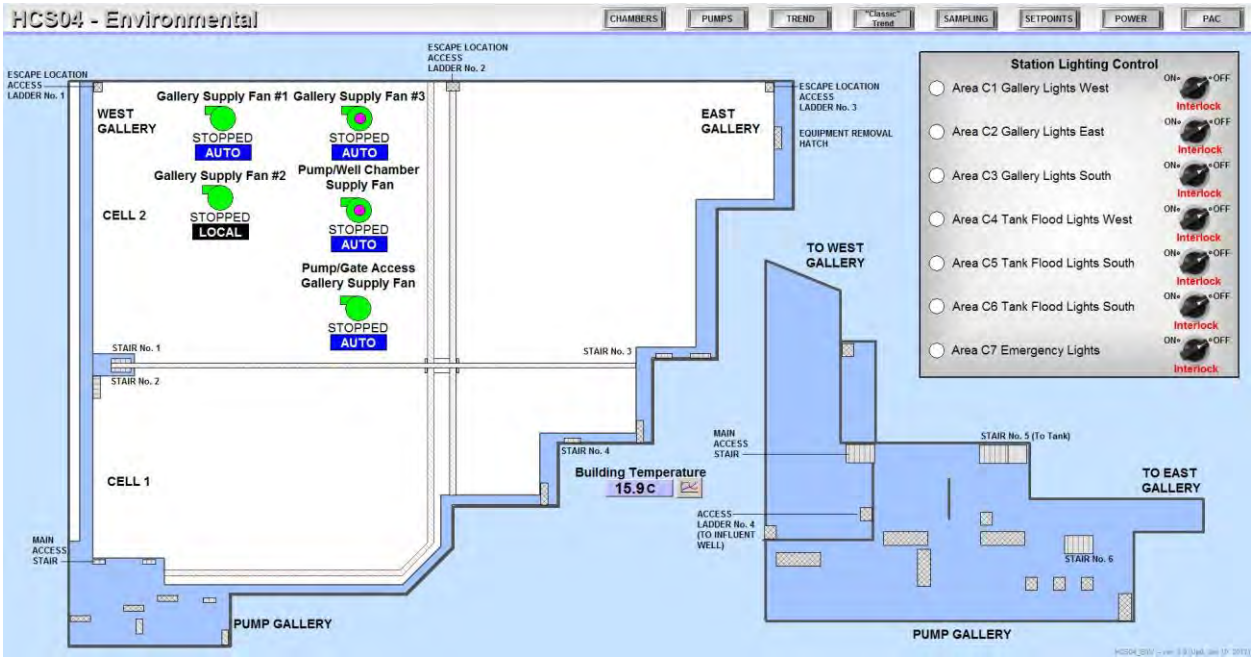
HCS04 HMI Screen – Main Overview



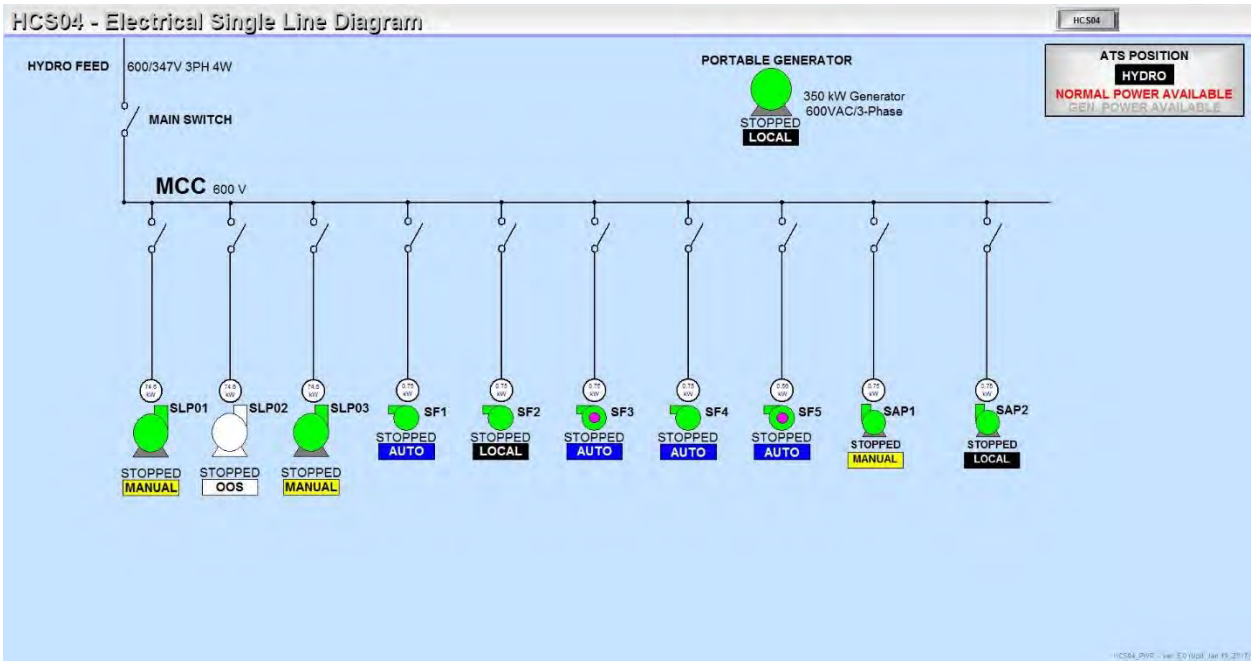
HCS04 HMI Screen – Wetwell



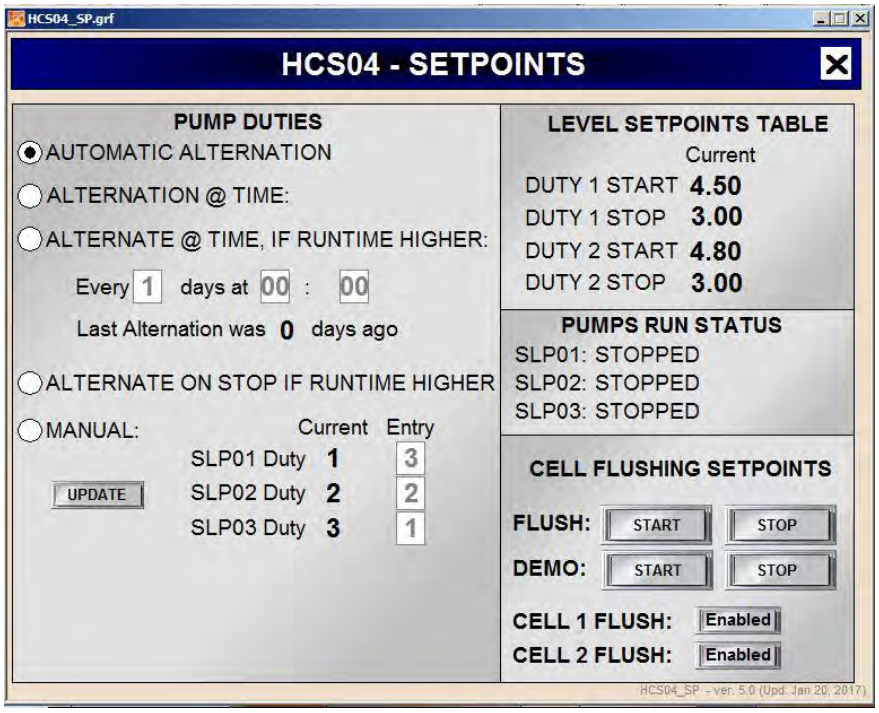
HCS04 HMI Screen – CSO Tank Overview



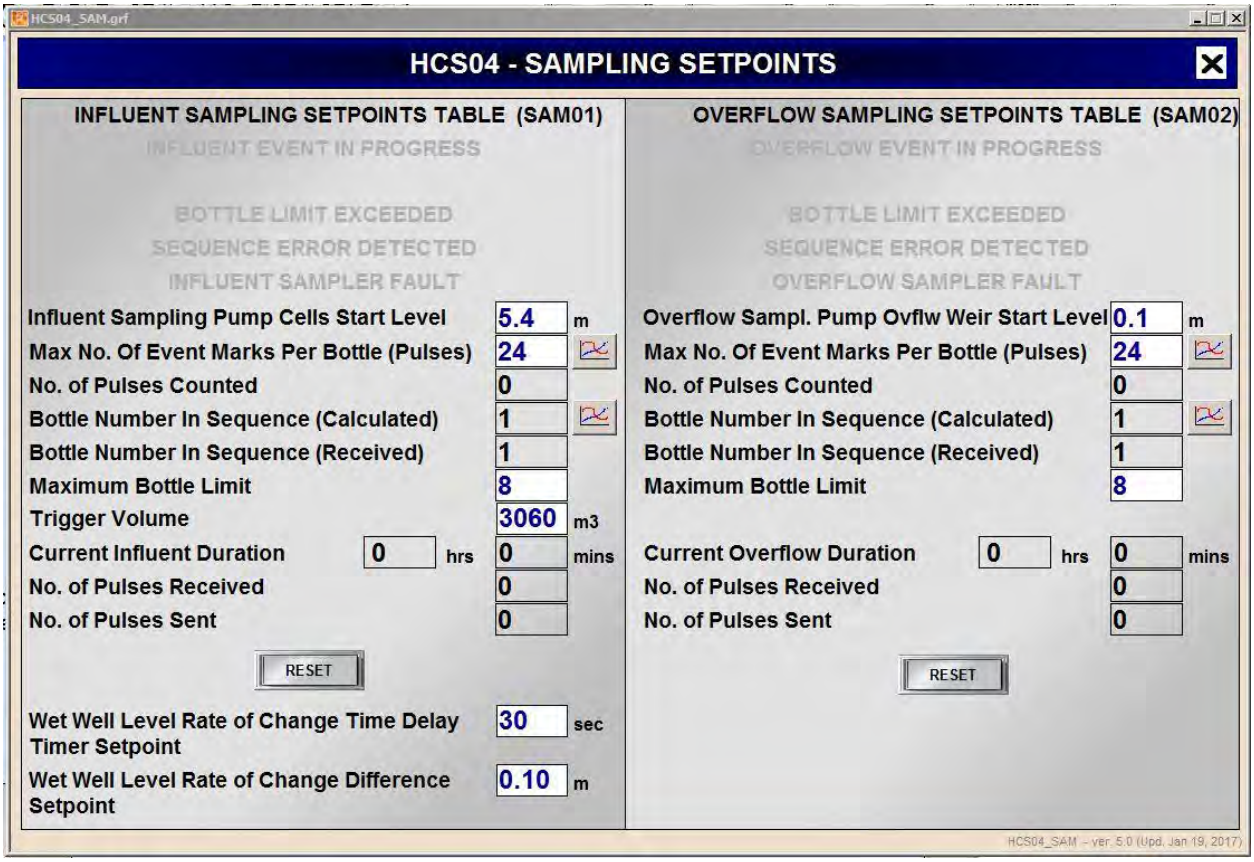
HCS04 HMI Screen – Environmental



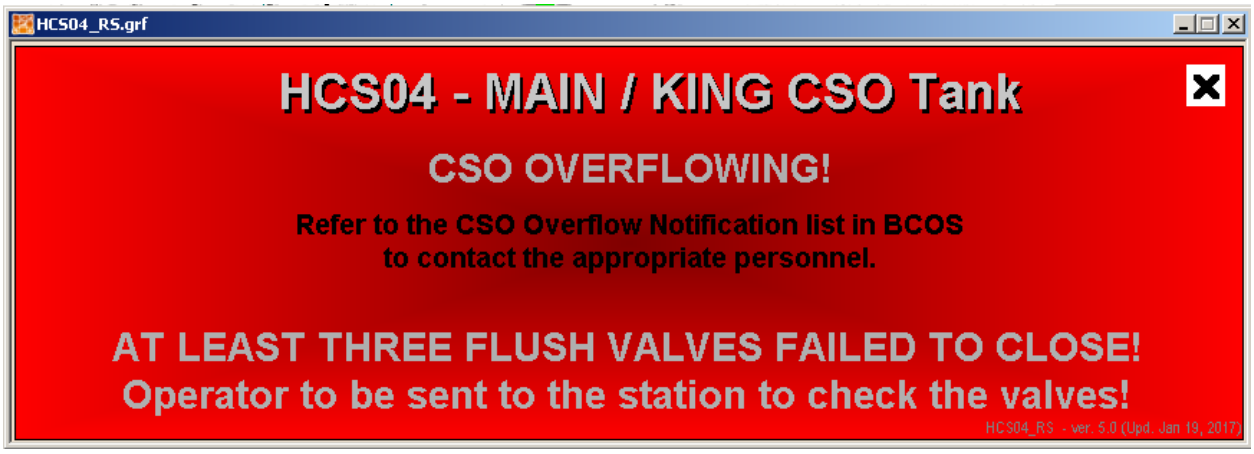
HCS04 HMI Screen – Power



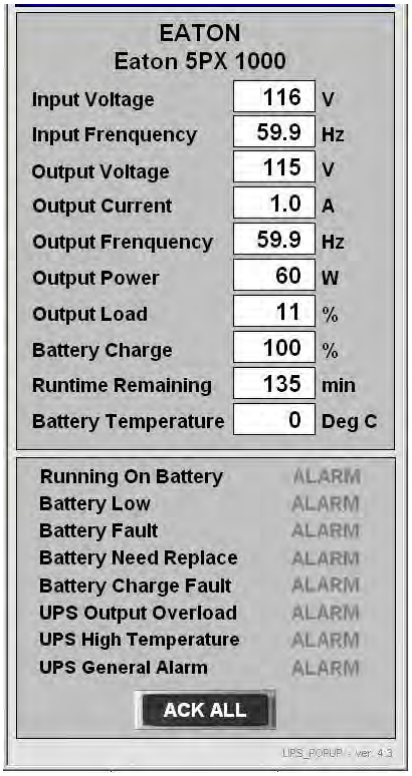
HCS04 HMI Screen – Setpoints Popup



HCS04 HMI Screen – Sampling Popup



HCS04 HMI Screen – Red Screen Popup



HMI Screen – SNMP UPS Popup

Piping and Instrumentation Diagram

The following is the P&ID for this station

APPENDIX D – HISTORIAN REPORT

Historian Report

Below is the e.RIS report for this station.

HCS04 - Main/King St. Combined Sewer Overflow Tank

Daily Report: Sunday, November 27, 2016
<Sewage>

Rep: 154 HC: 05
Index: 184

Hamilton

The City of Hamilton

Time	MPS Wet Well Level (m)	MPS Flow East (ML/d)	MPS Flow West (ML/d)	Cell 1 Level (m)	Cell 2 Level (m)	Overflow Level (m)	SLP01 Runtime (min)	SLP02 Runtime (min)	SLP03 Runtime (min)	Pumping Rate (m^3)	PS Flow Rate (L/s)	PS Flow Total (m^3)	Pot. Water Pressure (kPa)
00:00	65.50	110.21	127.78	0.04	0.07	0.00	0.00	0.00	39.00	877.50	158.57	433.12	18.18
01:00	65.83	109.17	126.71	0.04	0.07	0.00	0.00	0.00	0.00	0.00	1.05	574.77	18.21
02:00	65.94	110.66	129.09	0.05	0.07	0.00	0.00	0.00	0.00	0.00	1.05	578.55	18.23
03:00	65.91	100.82	145.33	0.05	0.07	0.00	0.00	0.00	0.00	0.00	1.05	582.33	18.26
04:00	65.33	87.51	168.34	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	586.11	18.29
05:00	65.10	86.71	106.16	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	589.92	18.33
06:00	65.15	71.17	91.27	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	593.76	18.34
07:00	65.10	86.82	106.20	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	597.54	18.35
08:00	65.21	82.02	97.02	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	601.32	18.40
09:00	65.14	103.15	116.46	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	605.10	18.41
10:00	65.31	100.16	110.88	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	608.88	18.43
11:00	65.77	101.10	112.84	0.05	0.08	0.00	0.00	0.00	0.00	0.00	1.05	612.66	18.45
12:00	65.98	145.25	160.82	0.05	0.07	0.00	0.00	0.00	0.00	0.00	1.05	616.44	18.45
13:00	65.94	155.12	150.46	0.05	0.07	0.00	0.00	59.00	0.00	1327.50	313.84	1259.47	18.45
14:00	65.93	154.80	166.92	0.05	0.06	0.00	0.00	60.00	0.00	1350.00	300.51	2373.42	18.45
15:00	66.01	155.59	169.61	0.05	0.06	0.00	0.00	8.00	0.00	180.00	39.23	2971.80	18.42
16:00	66.04	155.35	151.07	0.05	0.06	0.00	0.00	0.00	0.00	0.00	1.05	2975.57	18.40
17:00	65.99	154.76	132.39	0.05	0.06	0.00	0.00	0.00	0.00	0.00	1.05	2979.35	18.38
18:00	65.95	152.35	124.22	0.05	0.06	0.00	0.00	0.00	0.00	0.00	1.05	2983.13	18.32
19:00	65.97	152.11	127.94	0.05	0.06	0.00	0.00	0.00	0.00	0.00	1.05	2986.91	18.35
20:00	65.95	150.79	129.53	0.05	0.06	0.00	0.00	0.00	0.00	0.00	1.05	2990.69	18.42
21:00	65.88	146.10	145.14	0.05	0.06	0.00	0.00	0.00	58.00	1305.00	256.52	3518.79	18.45
22:00	65.82	139.60	132.75	0.05	0.06	0.00	0.00	0.00	60.00	1350.00	253.99	4452.46	18.49
23:00	65.77	134.65	136.35	0.05	0.05	0.00	0.00	0.00	39.00	877.50	157.24	5259.85	18.53
Average	65.69	122.75	131.89	0.05	0.07	0.00	0.00	5.29	8.17	302.81	62.41	1763.83	18.37
Minimum	65.10	71.17	91.27	0.04	0.05	0.00	0.00	0.00	0.00	0.00	1.05	433.12	18.18
Maximum	66.04	155.59	169.61	0.05	0.08	0.00	0.00	60.00	60.00	1350.00	313.84	5259.85	18.53
Total										7267.50			

	SLP01 Runtime (h)	SLP02 Runtime (h)	SLP03 Runtime (h)	Total Flow (m^3)
28Nov 00:00	3222.09	1284.73	3656.72	5398.24

HCS04 - Main/King St. Combined Sewer Overflow Pumping Station

Daily Report: Sunday, November 27, 2016
<Sewage>

Rep: 155 HC: 06
Index: 185

Hamilton

The City of Hamilton

Time	MPS Wet Well Level (m)	MPS Flow East (ML/d)	MPS Flow West (ML/d)	Chamber 1 Level (m)	Chamber 1 Gate Pos. (%)	Chamber 4 Level (m)	Chamber 4 Gate Pos. (%)	Chamber 5 Gate Pos. (%)	Cells Out Gate Pos. (%)	Inf Well OF Gate Pos. (%)	Wet Well Level (m)	Stn Inlet Gate Pos. (%)	Cells Inlet Gate Pos. (%)	Overflow Flow (L/s)
00:00	65.50	110.21	127.78	0.91	33.73	0.00	8.53	28.76	100.00	4.71	3.22	99.40	47.81	0.00
01:00	65.83	109.17	126.71	0.87	33.73	0.00	8.53	28.76	100.00	4.71	3.15	99.39	47.81	0.00
02:00	65.94	110.66	129.09	0.80	33.73	0.00	8.53	28.76	100.00	4.70	3.26	99.38	47.80	0.00
03:00	65.91	100.82	145.33	0.69	33.73	0.00	8.53	28.76	100.00	4.70	3.33	99.38	47.80	0.00
04:00	65.33	87.51	168.34	0.70	33.73	0.00	8.53	28.76	100.00	4.69	3.38	99.37	47.80	0.00
05:00	65.10	86.71	106.16	0.58	33.73	0.00	8.53	28.76	100.00	4.70	3.43	99.37	47.80	0.00
06:00	65.15	71.17	91.27	0.71	33.73	0.00	8.53	28.76	100.00	4.74	3.46	99.42	47.81	0.00
07:00	65.10	86.82	106.20	0.56	33.73	0.00	8.53	28.76	100.00	4.76	3.53	99.45	47.82	0.00
08:00	65.21	82.02	97.02	0.62	33.73	0.00	8.53	28.76	100.00	4.74	3.59	99.42	47.81	0.00
09:00	65.14	103.15	116.46	0.81	33.72	0.00	8.53	28.76	100.00	4.73	3.63	99.41	47.81	0.00
10:00	65.31	100.16	110.88	0.89	33.73	0.00	8.53	28.76	100.00	4.72	3.72	99.40	47.81	0.00
11:00	65.77	101.10	112.84	0.97	33.73	0.00	8.53	28.76	100.00	4.72	4.01	99.40	47.81	0.00
12:00	65.98	145.25	160.82	0.96	33.73	0.00	8.53	28.76	100.00	4.72	4.36	99.39	47.81	0.00
13:00	65.94	155.12	150.46	0.96	33.73	0.00	8.53	28.76	100.00	4.72	4.26	99.40	47.81	0.00
14:00	65.93	154.80	166.92	0.96	33.73	0.00	8.53	28.76	100.00	4.72	3.59	99.40	47.81	0.00
15:00	66.01	155.59	169.61	0.95	33.73	0.00	8.53	28.76	100.00	4.71	3.19	99.39	47.81	0.00
16:00	66.04	155.35	151.07	0.93	33.73	0.00	8.53	28.76	100.00	4.71	3.57	99.39	47.81	0.00
17:00	65.99	154.76	132.39	0.93	33.73	0.00	8.53	28.76	100.00	4.71	3.82	99.38	47.81	0.00
18:00	65.95	152.35	124.22	0.93	33.73	0.00	8.53	28.76	100.00	4.72	4.02	99.40	47.81	0.00
19:00	65.97	152.11	127.94	0.95	33.73	0.00	8.53	28.76	100.00	4.75	4.23	99.45	47.82	0.00
20:00	65.95	150.79	129.53	0.94	33.73	0.00	8.53	28.76	100.00	4.74	4.43	99.43	47.82	0.00
21:00	65.88	146.10	145.14	0.95	33.73	0.00	8.53	28.76	100.00	4.73	4.32	99.42	47.81	0.00
22:00	65.82	139.60	132.75	0.94	33.73	0.00	8.53	28.76	100.00	4.72	3.86	99.40	47.81	0.00
23:00	65.77	134.65	136.35	0.93	33.73	0.00	8.53	28.76	100.00	4.71	3.21	99.40	47.81	0.00
Average	65.69	122.75	131.89	0.85	33.73	0.00	8.53	28.76	100.00	4.72	3.69	99.40	47.81	0.00
Minimum	65.10	71.17	91.27	0.56	33.72	0.00	8.53	28.76	100.00	4.69	3.15	99.37	47.80	0.00
Maximum	66.04	155.59	169.61	0.97	33.73	0.00	8.53	28.76	100.00	4.76	4.43	99.45	47.82	0.00

APPENDIX E – ALARM TABLE

Alarms

All alarms are of the Boolean type and can be acknowledged at the SCADA HMI by any operator, supervisor or administrator security level.

HCS04 Alarms

SCADA Tag	Alarm Description	Units	Priority	Sig. Digits	Default	Delay Timer (sec)	MOE (Y/N)
Station / Building							
HCS04STN01SKD01XA_	Station Smoke Alarm	N/A	H	N/A	N/A	10	N
HCS04STN01LSH01LHH	Station Flood Alarm	N/A	H	N/A	N/A	0	N
HCS04STN01ESW01XA_	Station Illegal Entry	sec	L	N/A	N/A	45	N
HCS04STN01TIT01AHH	Station Temperature HIHI	°C	L	4	40.0	10	N
HCS04STN01TIT01AAH	Station Temperature HI	°C	L	4	35.0	10	N
HCS04STN01TIT01AAL	Station Temperature LO	°C	L	4	10.0	10	N
HCS04STN01TIT01ALL	Station Temperature LOLO	°C	L	4	5.0	10	N
HCS04STN01TIT01ER_	Station Temperature Signal Error	N/A	L	N/A	N/A	10	N
Power							
HCS04STN01JSW01XA_	Station 600 VAC Power Failure	N/A	HH	N/A	N/A	60	N
HCS04ATS0100000XA2	ATS Position Error	N/A	L	N/A	N/A	60	N
HCS04GEN0100000SF_	Portable Generator Fail to Start	N/A	L	N/A	N/A	60	N
HCS04GEN0100000XF_	Portable Generator Fail to Stop	N/A	L	N/A	N/A	3600	N
HCS04GEN0100000XA_	Portable Generator Diesel Fuel Low	N/A	L	N/A	N/A	0	N
WAN Panel							
HCS04NAC01NAS01XA_	WAN Panel Ethernet Switch Minor Fault	N/A	HH	N/A	N/A	0	N
HCS04NAC01NAS01XA2	WAN Panel Ethernet Switch Major Fault	N/A	HH	N/A	N/A	0	N
PAC Control Panel							
HCS04PAC0100000COM	PAC to HMI Communication Failure	N/A	HH	N/A	N/A	120	N
HCS04PAC01OIT01COM	PAC to Panel Computer Communication Failure	N/A	HH	N/A	N/A	60	N
HCS04PAC0100000XAM	PAC I/O Fault	N/A	HH	N/A	N/A	0	N
HCS04PAC0100000PXF	PAC Major Fault	N/A	HH	N/A	N/A	0	N
HCS04PAC0100000MXB	PAC Battery Low	N/A	HH	N/A	N/A	0	N

SCADA Tag	Alarm Description	Units	Priority	Sig. Digits	Default	Delay Timer (sec)	MOE (Y/N)
HCS04PAC0100000MXP	PAC Minor Fault	N/A	HH	N/A	N/A	0	N
HCS04PAC0100000MXI	PAC Minor I/O Fault	N/A	HH	N/A	N/A	0	N
HCS04PAC0100000OVF	PAC Overflow Fault	N/A	HH	N/A	N/A	0	N
HCS04CP001JSW01JA_	PAC Panel AC Power Failure	N/A	HH	N/A	N/A	10	N
HCS04CP001DCP01XA_	PAC Panel DC Power Fault	N/A	HH	N/A	N/A	10	N
HCS04CP001UPS01MN_	UPS Offline	N/A	HH	N/A	N/A	0	N
HCS04CP001UPS01XA_	UPS General Fault / Low Battery	N/A	HH	N/A	N/A	0	N
Sewage Lift Pumps (No.1-3)							
HCS04SLP0100000SF_ To HCS04SLP0300000SF_	Sewage Lift Pump Failed To Start	N/A	L	N/A	N/A	30	N
HCS04SLP0100000XF_ To HCS04SLP0300000XF_	Sewage Lift Pump Failed To Stop	N/A	L	N/A	N/A	30	N
HCS04SLP0100000SU_ To HCS04SLP0300000SU_	Sewage Lift Pump Uncommanded Start	N/A	L	N/A	N/A	0	N
HCS04SLP0100000XU_ To HCS04SLP0300000XU_	Sewage Lift Pump Uncommanded Stop	N/A	L	N/A	N/A	0	N
HCS04SLP0100000XAF To HCS04SLP0300000XAF	Sewage Lift Pump General Fault	N/A	M	N/A	N/A	0	N
HCS04SLP0100000NF_ To HCS04SLP0300000NF_	Sewage Lift Pump No Flow	N/A	M	N/A	N/A	45	N
HCS04SLP0100000AAA To HCS04SLP0300000AAA	Sewage Lift Pump Auto Acknowledge Alarm	N/A	L	N/A	N/A	0	N
Sample Pumps							
HCS04SAP0100000SF_ HCS04SAP0200000SF_	Sample Pump Failed To Start	N/A	L	N/A	N/A	30	N
HCS04SAP0100000XF_ HCS04SAP0200000XF_	Sample Pump Failed To Stop	N/A	L	N/A	N/A	30	N

SCADA Tag	Alarm Description	Units	Priority	Sig. Digits	Default	Delay Timer (sec)	MOE (Y/N)
HCS04SAP0100000SU_ HCS04SAP0200000SU_	Sample Pump Uncommanded Start	N/A	L	N/A	N/A	0	N
HCS04SAP0100000XU_ HCS04SAP0200000XU_	Sample Pump Uncommanded Stop	N/A	L	N/A	N/A	0	N
HCS04SAP0100000XAF HCS04SAP0200000XAF	Sample Pump General Fault	N/A	M	N/A	N/A	0	N
HCS04SAP0100000AAA HCS04SAP0200000AAA	Sample Pump Auto Acknowledge Alarm	N/A	L	N/A	N/A	0	N
Fans							
HCS04SFN0100000SF_ To HCS04SFN0300000SF_ HCS04SFN0500000SF_	Supply Fan Failed To Start	N/A	L	N/A	N/A	30	N
HCS04SFN0100000XF_ To HCS04SFN0300000XF_ HCS04SFN0500000XF_	Supply Fan Failed To Stop	N/A	L	N/A	N/A	30	N
HCS04SFN0100000SU_ To HCS04SFN0300000SU_ HCS04SFN0500000SU_	Supply Fan Uncommanded Start	N/A	L	N/A	N/A	0	N
HCS04SFN0100000XU_ To HCS04SFN0300000XU_ HCS04SFN0500000XU_	Supply Fan Uncommanded Stop	N/A	L	N/A	N/A	0	N
HCS04SFN0100000XAF To HCS04SFN0300000XAF HCS04SFN0500000XAF	Supply Fan General Fault	N/A	M	N/A	N/A	0	N
HCS04SFN0100000AAA To HCS04SFN0300000AAA HCS04SFN0500000AAA	Supply Fan Auto Acknowledge Alarm	N/A	L	N/A	N/A	0	N
HCS04SFN0100000SFH	Supply Fan No.4 Failed To Start Fast	N/A	L	N/A	N/A	30	N

SCADA Tag	Alarm Description	Units	Priority	Sig. Digits	Default	Delay Timer (sec)	MOE (Y/N)
HCS04SFN0100000SFL	Supply Fan No.4 Failed To Start Slow	N/A	L	N/A	N/A	30	N
HCS04SFN0100000XF_	Supply Fan No.4 Failed To Stop	N/A	L	N/A	N/A	30	N
HCS04SFN0100000SUH	Supply Fan No.4 Uncommanded Start Fast	N/A	L	N/A	N/A	0	N
HCS04SFN0100000SUl	Supply Fan No.4 Uncommanded Start Slow	N/A	L	N/A	N/A	0	N
HCS04SFN0100000XU_	Supply Fan No.4 Uncommanded Stop	N/A	L	N/A	N/A	0	N
HCS04SFN0100000XAF	Supply Fan No.4 General Fault	N/A	M	N/A	N/A	0	N
Samplers							
HCS04SAM01VLV01FO_	Influent Backwash Valve Fail to Open	N/A	L	N/A	N/A	30	N
HCS04SAM01VLV01CF_	Influent Backwash Valve Fail to Close	N/A	L	N/A	N/A	30	N
HCS04SAM01VLV01OU_	Influent Backwash Valve Uncommanded Open	N/A	L	N/A	N/A	0	N
HCS04SAM01VLV01CU_	Influent Backwash Valve Uncommanded Close	N/A	L	N/A	N/A	0	N
HCS04SAM0100000XA2 HCS04SAM0200000XA2	Sampler Sequence Failed	N/A		N/A	N/A	0	N
HCS04SAM0100000XA3 HCS04SAM0200000XA3	Sampler Bottle Limit Reached	N/A		N/A	N/A	0	N
Gates							
HCS04STN01IV001ZA_ HCS04STN01IV002ZA_ HCS04STN01OV001ZA_ HCS04STN01OV002ZA_ HCS04VCH01IV001ZA_ HCS04VCH04IV001ZA_	Gate Position Deviation	N/A	L	N/A	N/A	120	N
HCS04VCH05IV001ZA_	Chamber No.5 Gate Position Deviation	N/A	L	N/A	N/A	390	N

SCADA Tag	Alarm Description	Units	Priority	Sig. Digits	Default	Delay Timer (sec)	MOE (Y/N)
HCS04STN01IV001ZIA HCS04STN01IV002ZIA HCS04STN01OV001ZIA HCS04VCH01IV001ZIA HCS04VCH04IV001ZIA	Gate Position Signal Error	N/A	L	N/A	N/A	10	N
HCS04VCH05IV001ZIA	Chamber No.5 Gate Position Signal Error	N/A	L	N/A	N/A	5	N
Valves							
HCS04WWT01VLV01FO_	Main Flushing Water Line Shutoff Valve Failed to Open	N/A	L	N/A	N/A	10	N
HCS04WWT01VLV01CF_	Main Flushing Water Line Shutoff Valve Failed to Close	N/A	L	N/A	N/A	10	N
HCS04WWT01VLV01OU_	Main Flushing Water Line Shutoff Valve Uncommanded Open	N/A	L	N/A	N/A	0	N
HCS04WWT01VLV01CU_	Main Flushing Water Line Shutoff Valve Uncommanded Close	N/A	L	N/A	N/A	0	N
HCS04WWT01VLV01XA_	Main Flushing Water Line Shutoff Valve General Fault	N/A	M	N/A	N/A	0	N
HCS04WWT01VLV01WA_	Main Flushing Water Line Shutoff Valve Over-Torque	N/A	L	N/A	N/A	0	N
HCS04WWT01SOL01FO_ To HCS04WWT01SOL05FO_ HCS04WWT02SOL06FO_ To HCS04WWT02SOL15FO_	Flushing Valve Fail to Open	N/A	L	N/A	N/A	30	N
HCS04WWT01SOL01CF_ To HCS04WWT01SOL05CF_ HCS04WWT02SOL06CF_ To HCS04WWT02SOL15CF_	Flushing Valve Fail to Close	N/A	L	N/A	N/A	30	N
Level							
HCS04WWL01LIT01AHH	Wetwell Level HIHI	m	L	3	10.0	10	N
HCS04WWL01LIT01AAH	Wetwell Level HI	m	L	3	8.0	10	N
HCS04WWL01LIT01AAL	Wetwell Level LO	m	L	3	2.9	10	N

SCADA Tag	Alarm Description	Units	Priority	Sig. Digits	Default	Delay Timer (sec)	MOE (Y/N)
HCS04WWL01LIT01ALL	Wetwell Level LOLO	m	L	3	2.0	10	N
HCS04WWL01LIT01XAF	Wetwell Level Transmitter General Fault	N/A	L	N/A	N/A	0	N
HCS04WWL01LIT01ER_	Wetwell Level Transmitter Signal Error	N/A	L	N/A	N/A	10	N
HCS04WWT01LIT01AHH HCS04WWT02LIT01AHH	CSO Tank Cell Level HIHI	m	L	3	10.0	10	N
HCS04WWT01LIT01AAH HCS04WWT02LIT01AAH	CSO Tank Cell Level HI	m	L	3	8.0	10	N
HCS04WWT01LIT01AAL HCS04WWT02LIT01AAL	CSO Tank Cell Level LO	m	L	3	0.0	10	N
HCS04WWT01LIT01ALL HCS04WWT02LIT01ALL	CSO Tank Cell Level LOLO	m	L	3	0.0	10	N
HCS04WWT01LIT01ER_ HCS04WWT02LIT01ER_	CSO Tank Cell Level Transmitter Signal Error	N/A	L	N/A	N/A	10	N
HCS04STN01LIT01AHH	Overflow Weir Level HIHI	m	L	3	0.1	10	N
HCS04STN01LIT01AAH	Overflow Weir Level HI	m	L	3	0.1	10	N
HCS04STN01LIT01AAL	Overflow Weir Level LO	m	L	3	0.0	10	N
HCS04STN01LIT01ALL	Overflow Weir Level LOLO	m	L	3	0.0	10	N
HCS04STN01LIT01XAF	Overflow Weir Level Transmitter General Fault	N/A	L	N/A	N/A	0	N
HCS04STN01LIT01ER_	Overflow Weir Level Transmitter Signal Error	N/A	L	N/A	N/A	10	N
HCS04VCH01LIT01AHH	Chamber No.1 Level HIHI	m	L	3	1.08	10	N
HCS04VCH01LIT01AAH	Chamber No.1 Level HI	m	L	3	1.05	10	N
HCS04VCH01LIT01AAL	Chamber No.1 Level LO	m	L	3	0.0	10	N
HCS04VCH01LIT01ALL	Chamber No.1 Level LOLO	m	L	3	0.0	10	N
HCS04VCH01LIT01ER_	Chamber No.1 Level Transmitter Signal Error	N/A	L	N/A	N/A	10	N
HCS04VCH04LIT01AHH	Chamber No.4 Level HIHI	m	L	3	1.17	10	N
HCS04VCH04LIT01AAH	Chamber No.4 Level HI	m	L	3	0.90	10	N
HCS04VCH04LIT01AAL	Chamber No.4 Level LO	m	L	3	0.0	10	N
HCS04VCH04LIT01ALL	Chamber No.4 Level LOLO	m	L	3	0.0	10	N

SCADA Tag	Alarm Description	Units	Priority	Sig. Digits	Default	Delay Timer (sec)	MOE (Y/N)
HCS04VCH04LIT01ER_	Chamber No.4 Level Transmitter Signal Error	N/A	L	N/A	N/A	10	N
Flow							
HCS04STN01FIT01AHH	Station Flow HIHI	L/s	L	3	950	10	N
HCS04STN01FIT01AAH	Station Flow HI	L/s	L	3	750	10	N
HCS04STN01FIT01AAL	Station Flow LO	L/s	L	3	150	10	N
HCS04STN01FIT01ALL	Station Flow LOLO	L/s	L	3	100	10	N
HCS04STN01FIT01ER_	Station Flow Transmitter Signal Error	N/A	L	N/A	N/A	10	N
HCS04WWT01FIT01AHH	Main Flushing Water Line Flow HIHI	L/s	L	3	9.0	10	N
HCS04WWT01FIT01AAH	Main Flushing Water Line Flow HI	L/s	L	3	7.0	10	N
HCS04WWT01FIT01AAL	Main Flushing Water Line Flow LO	L/s	L	3	3.0	10	N
HCS04WWT01FIT01ALL	Main Flushing Water Line Flow LOLO	L/s	L	3	1.0	10	N
HCS04WWT01FIT01ER_	Main Flushing Water Line Flow Transmitter Signal Error	N/A	L	N/A	N/A	10	N
HCS04WWT01FIT01XAF	Main Flushing Water Line Flow Transmitter General Fault	N/A	L	N/A	N/A	0	N
Pressure							
HCS04STN01PIT01AHH	City Water Pressure HIHI	kPa	L	3	260	10	N
HCS04STN01PIT01AAH	City Water Pressure HI	kPa	L	3	245	10	N
HCS04STN01PIT01AAL	City Water Pressure LO	kPa	L	3	180	10	N
HCS04STN01PIT01ALL	City Water Pressure LOLO	kPa	L	3	150	10	N
HCS04STN01PIT01ER_	City Water Pressure Transmitter Signal Error	N/A	L	N/A	N/A	10	N
Red Screen (HCS04STN0100000RS_)							
HCS04BWS0100000XA_	Flushing Sequence Failed	N/A	HH	N/A	N/A	0	N
HCS04STN01LIT01XA2	Overflow Event in Progress	N/A	HH	N/A	N/A	0	N

APPENDIX F – MESSAGE TABLE

Message Table

There is no messaging for this site.

APPENDIX G – PROGRAM VARIABLES & INTERNAL SOFTWARE PARAMETERS

Program Variables

These variables are adjustable at the SCADA HMI or panel computer based on security level.

HCS04 Program Variables

SCADA Tag	Description	Data Type	Units	Sig. Digits	Input Range		Default	Security Level
					MIN	MAX		
HCS04STN0100000MOD	Tank Mode	INT	N/A	1	1	3	1	CSOP
HCS04STN01LHT01CMH	C1 Gallery Lights West On	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT01CMB	C1 Gallery Lights West Off	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT02CMH	C2 Gallery Lights East On	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT02CMB	C2 Gallery Lights East Off	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT03CMH	C3 Gallery Lights South On	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT03CMB	C3 Gallery Lights South Off	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT04CMH	C4 Tank Flood Lights West On	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT04CMB	C4 Tank Flood Lights West Off	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT05CMH	C5 Tank Flood Lights South On	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT05CMB	C5 Tank Flood Lights South Off	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT06CMH	C6 Tank Flood Lights South On	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT06CMB	C6 Tank Flood Lights South Off	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT07CMH	C7 Emergency Lights On	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04STN01LHT07CMB	C7 Emergency Lights Off	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04SLPDY00000MOD	Duty Rotation Mode Selection	INT	N/A	N/A	0	5	0	CSOP
HCS04SLPDY00000P1_	DUTY 1 Selection	INT	N/A	1	1	3	1	CSOP

SCADA Tag	Description	Data Type	Units	Sig. Digits	Input Range		Default	Security Level
					MIN	MAX		
HCS04SLPDY00000P2_	DUTY 2 Selection	INT	N/A	1	1	3	2	CSOP
HCS04SLPDY00000P3_	STANDBY Selection	INT	N/A	1	1	3	3	CSOP
HCS04SLPDY00000DTU	Duty Rotation Table Update	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04SLPDY00000DYH	Duty Rotation Set Time Hours	INT	hr	2	0	23	2	CSOP
HCS04SLPDY00000DYM	Duty Rotation Set Time Minutes	INT	min	2	0	59	0	CSOP
HCS04SLPDY00000NDR	Duty Rotation Days before Rotation	INT	day	3	1	365	1	CSOP
HCS04BWS0100000CMH	Flushing Sequence Start Request	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04BWS0100000CMB	Flushing Sequence Stop Request	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04BWS0200000CMH	Demo Mode Flushing Sequence Start Request	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04BWS0200000CMB	Demo Mode Flushing Sequence Stop Request	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04WWT0100000ENA	Cell No.1 Flushing Enable	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04WWT0200000ENA	Cell No.2 Flushing Enable	BOOL	N/A	N/A	OFF	ON	OFF	CSOP
HCS04SAP0100000SP_	Influent Sampling Pump Start Level	REAL	m	4	0	12.70	5.40	CSOP
HCS04SAM0100000HIS	Influent Number of Event Marks per Bottle	INT	N/A	3	0	100	24	SUPER
HCS04SAM0100000BLT	Influent Max Bottle Limit	DINT	N/A	3	0	100	8	CSOP
HCS04SAM0100000VC_	Trigger Volume	REAL	m^3	5	0	10000	3060	CSOP
HCS04SAM0100000AK2	Influent Reset	BOOL	N/A	N/A	OFF	ON	OFF	SUPER
HCS04SAM0100000SMR	Wetwell Level ROC Time Delay	DINT	sec	3	0	600	30	CSOP

SCADA Tag	Description	Data Type	Units	Sig. Digits	Input Range		Default	Security Level
					MIN	MAX		
HCS04SAM0100000SP_	Wetwell Level ROC Difference	REAL	m	4	0	12.70	0.10	CSOP
HCS04SAP0200000SP_	Overflow Sampling Pump Start Level	REAL	m	3	0	2.70	0.10	CSOP
HCS04SAM0200000HIS	Overflow Number of Event Marks per Bottle	INT	N/A	3	0	100	24	SUPER
HCS04SAM0200000BLT	Overflow Max Bottle Limit	DINT	N/A	3	0	100	8	CSOP
HCS04SAM0200000AK2	Overflow Reset	BOOL	N/A	N/A	OFF	ON	OFF	SUPER
HCS04GEN0100000TO_	Portable Generator Fuel Consumption Time Setpoint	REAL	hr	2	0	1000	25	CSOP

For all analog alarms found in the Alarm Table, there are accompanying alarm setpoints and alarm enable/disable program variables.

The input range for these alarms is based on the span of the instrument associated with the alarm; the instruments associated with this site can be found in Table 2-5: HCS04 Instrumentation Summary.

The tagging for the analogs is as follows:

HCS04 Analog Alarm Program Variables

Analog Alarm Description	SCADA Tag - Fragment 8		Program Variable Security Level
	Analog Alarm Enable / Disable	Analog Alarm Setpoint	
High High	HHE	HHS	ADM
High	HAE	HIS	SUP
Low	LAE	LAS	SUP
Low Low	LLE	LLS	ADM

Internal Software Parameters

These variables are set at the time of commissioning and are not adjustable at the SCADA HMI or panel computer.

HCS04 Internal Software Parameters

SCADA Tag	Description	Data Type	Units	Sig. Digits	Input Range		Default
					MIN	MAX	
HCS04SLPDY00000D1T	DUTY 1 Start Setpoint	REAL	m	3	0	12.7	4.50
HCS04SLPDY00000D1P	DUTY 1 Stop Setpoint	REAL	m	3	0	12.7	3.00
HCS04SLPDY00000D2T	DUTY 2 Start Setpoint	REAL	m	3	0	12.7	4.80
HCS04SLPDY00000D2P	DUTY 2 Stop Setpoint	REAL	m	3	0	12.7	3.00

HCS04 Internal Software Delay Parameters

Parameter	Value	Description
Pump Minimum On Timer	30 seconds	Minimum time a pump must run once started before it will accept a pump auto stop command. A manual stop command will override this interlock and will issue a pump stop command immediately. This feature is used to prevent rapid starting/stopping of the pumps.
Pump Minimum Off Timer	30 seconds	Minimum time a pump must remain off after stopping before it will accept a pump auto start command. A manual start command will override this interlock and will issue a pump start command immediately. This feature is used to prevent rapid starting/stopping of the pumps.
Valve Open Timer Delay	2 seconds	Minimum time required for the open condition of a valve to be true before the auto open command is issued to the valve AOI.
Valve Close Timer Delay	2 seconds	Minimum time required for the close condition of a valve to be true before the auto close command is issued to the valve AOI.
Valve Minimum Opened Timer	10 seconds	Minimum time a valve must remain opened after opening before it will accept a valve auto close command.
Valve Minimum Closed Timer	10 seconds	Minimum time a valve must remain closed after closing before it will accept a valve auto open command.
Pump Duty Start Delay Time	10 seconds	Minimum time required for the starting condition of a pump to be true before the auto start command is issued to the pump AOI. For example, if a five (5) second pump on timer delay is used at a wet well the level in the wet well must be above the duty 1 start level setpoint for five (5) seconds before the auto start command is issued.
Pump Stop Delay Time	10 seconds	Minimum time required for the stopping condition of a pump to be true before the auto stop command is issued to the pump AOI.
Non-Concurrent Start Delay	10 seconds	Delay between the starting of pumps to prevent unnecessary current draw.

Parameter	Value	Description
Backup System Remote Interrupt Time	2 seconds	Timer that remote interrupts are latched on before unlatching.
Disable Backup System Remote Interrupt Time	24 hours	The Backup System Remote Interrupt can be disabled for up to 24 hours before it is re-enabled.
Wetwell Level Differential Alarm Debounce Time	10 seconds	Time delay to ensure a proper Wetwell level differential alarm signal is transmitted.
Debounce Timer(s)	5 seconds	Time delay to ensure a proper low pressure, high pressure, low flow, high flow and heat trace alarm signal is transmitted.
Door Contact Vibration Filter	2 seconds	Timer during which the door contact has to be enabled before registering.

APPENDIX H – REFERENCE SITE PHOTOS

Site Reference Photos

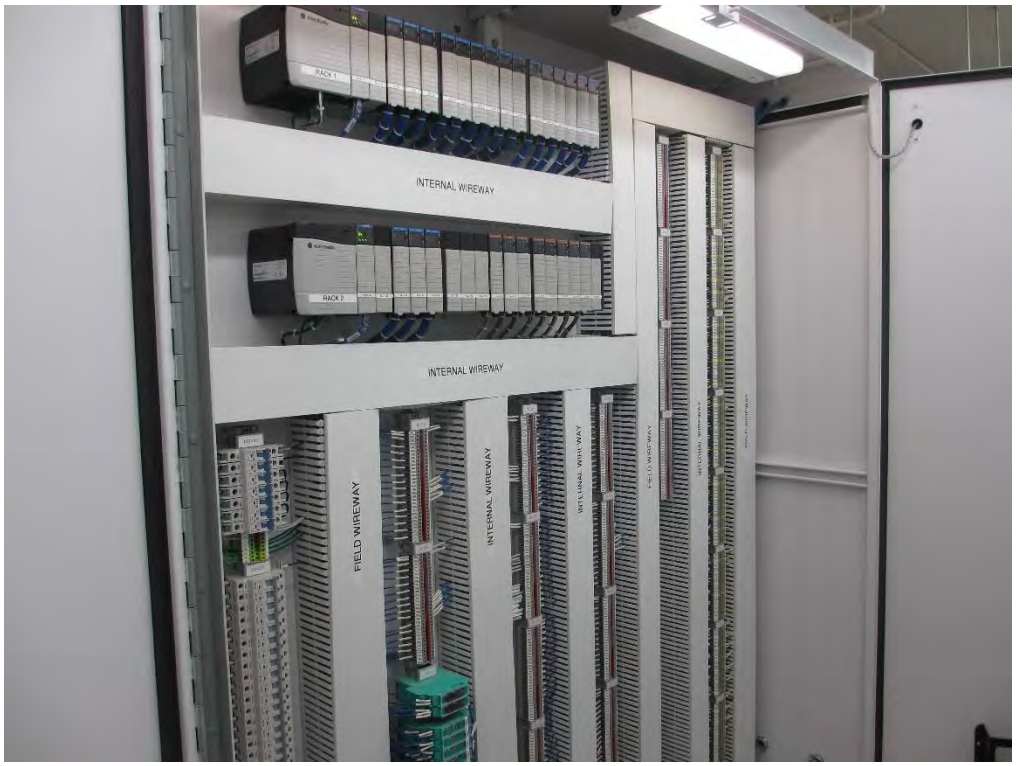
These photos show the general layout of the station and where the major equipment is located.

HCS04 - Station Exterior Layout

HCS04 - Station Interior Layout No.1

HCS04 - Station Interior Layout No.2

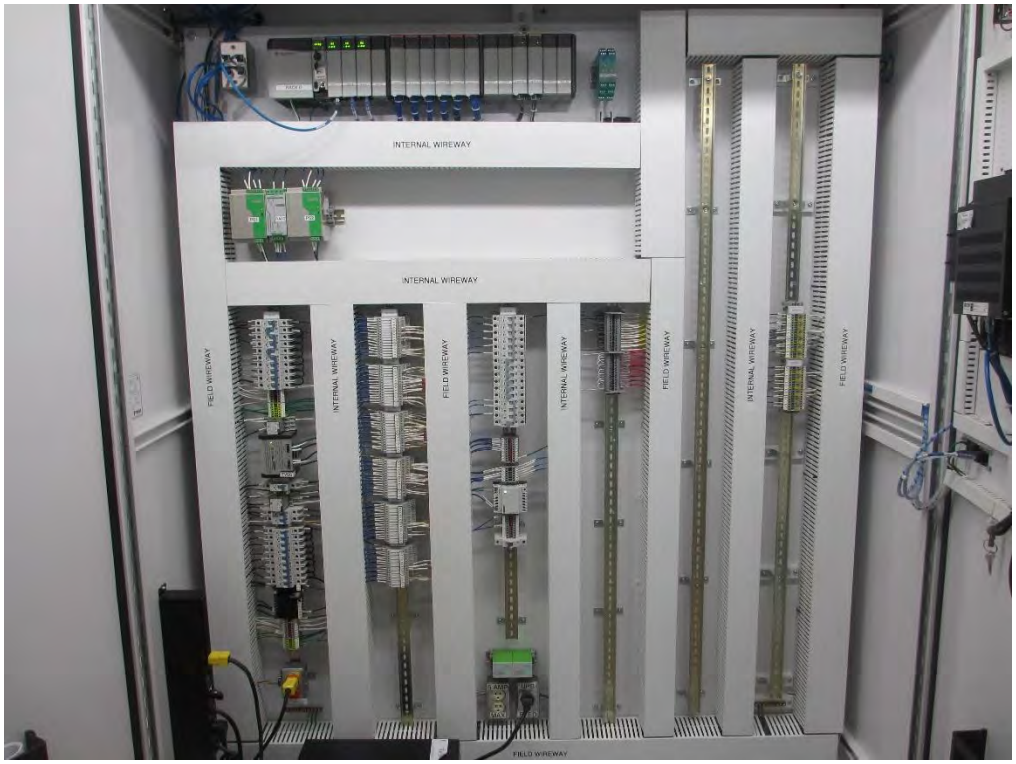
HCS04 - Electrical Equipment Layout



HCS04 - PAC Panel CP001 Interior Layout

HCS04 – PAC Panel CP001 Exterior Layout

HCS04 - PAC Panel CP002 Exterior Layout



HCS04 - PAC Panel CP002 Interior Layout

HCS04 - WAN Panel Layout

HCS04 – Sewage Lift Pump Nameplate

APPENDIX I – FLOOR PLAN

Station Floor Plan

The floor plan shows the general layout of the station and where the major equipment is located.