CSO Master Plan

Strathmillan District Plan

August 2019

City of Winnipeg

CSO Master Plan

Project No: 470010CH
Document Title: Strathmillan District Plan
Revision: 03
Date: August 15, 2019
Client Name: City of Winnipeg
Project Manager: Ed Sharp
Author: Jack Tinker
File Name: Strathmillan_Plan_Final_CO1MP_08152019_Tracked

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Document History and Status

Revision	Date	Description	By	Review	Approved
0	08/2018	DRAFT for City Comment	SG	ES	
1	02/15/2019	DRAFT 2 for City Review	JT	SG / MF	MF
2	07/2019	Final Draft Submission	JT	MF	MF
3	08/15/2019	Final Submission For CSO Master Plan	MF	MF	SG

Contents

Tables

Figure

1. Strathmillan District

1.1 District Description

Strathmillan district is located on the western edge of the combined sewer (CS) area. The district is bounded by Moorgate district to the east, Ainslie district to the north and west, and the Assiniboine River to the south. Ness Avenue is the northern border, Davidson Street and Conway Street are the eastern border, and Olive Street is the western border. This district has been developed primarily as a residential area, with a small commercial corridor located along Portage Avenue. Figure 39 provides an overview of the sewer district and the location of the proposed Combined Sewer Overflow (CSO) Master Plan control options.

Portage Avenue is the major transportation route that passes through the southern end of Strathmillan district and intersects with Mt. Royal Road, a high traffic route that connects Ness Avenue to Portage Avenue.

Land use in Strathmillan is mostly single-family residential. Approximately 6 ha of this district is classified as greenspace which includes the Strathmillan Lodge Park.

1.2 Development Potential

A portion of Portage Avenue is located within the Strathmillan District. Portage Avenue is identified as Regional Mixed-Use Corridor as part of the OurWinnipeg future development plans. As such, focused intensification along Portage Avenue is to be promoted in the future.

1.3 Existing Sewer System

Strathmillan has an approximate area of 81 ha[1] based on the district boundary. The system consists of a CS system and a land drainage (LDS) system. There is approximately 63 percent (51 ha) separated and no separation ready areas.

The CS system includes a diversion chamber, CS lift station (LS), and two CS outfalls. All domestic wastewater and CS flows collected in Strathmillan districts is routed to Portage Avenue, where the diversion chamber and main CS outfall are located

Two separate LDS systems provide CS separation and stormwater collection for a large portion of the district. The main 1350 mm LDS trunk runs south along Strathmillan Road through the whole of the district, commencing at Ness Avenue and discharges to the Assiniboine River at the district CS outfall. The CS outfall from the diversion chamber was connected to the LDS system during the construction of the LDS system. A second LDS system collects stormwater from the adjacent Ainslie district (between Silver Avenue and Ness Avenue) and discharges through the Strathmillan district in a 2100 mm and 2250 mm LDS trunk located in the back lane between Olive Street and Whytewold Road. The second LDS system discharges to the Assiniboine River via a dedicated LDS outfall, situated east of the Olive LS CS outfall.

A wastewater interceptor passes through the district along Portage Avenue flowing from east to west from the Moorgate district. The diversion chamber is located on Portage Avenue south of intersection with Strathmillan Road. The CS system for the district converges at this diversion chamber where flow is diverted to the interceptor. The interceptor continues west and drains to the Olive LS situated on the district border between Ainslie and Strathmillan.

[1] City of Winnipeg GIS information relied upon for area statistics. The GIS records may vary slightly from the city representation in the InfoWorks sewer model. Therefore, minor discrepancies in the area values reported in Section 1.3 Existing Sewer System, and in Section 1.8 Performance Estimate may occur.

During dry weather flow (DWF) wastewater flows are directed by the diversion chamber weir to the Olive CS LS. DWF wastewater flows from the Ainslie district also discharge into the Olive LS. These flows are then pumped into the 900 mm St. James interceptor sewer on Assiniboine Avenue and transported ultimately to the West End Sewage Treatment Plant (WEWPCC) for treatment.

During wet weather flow (WWF), the diversion chamber weir may be overtopped, and the combined sewage is directed through the 900 mm combined sewer to the 1350 mm Strathmillan CS outfall. The CS outfall pipe connects with the 1350mm LDS trunk sewer pipe. The Strathmillan CS outfall pipe only has a positive gate protection, and must be manually activated under high river level conditions to protect the CS system. Under the conditions where the positive gate is closed however, gravity discharge from the CS outfall is not possible, due to sewage backing up against the positive gate. There is no flood station at this location; however, in the case where high river levels are predicted and the positive gate activation will prevent the outfall operation during a WWF event, temporary flood pumping can be put in place.

There is an infrequent manual interaction between the Strathmillan district and the 17 Wing Canadian Air Force Base immediately north of the district. A 400 mm force main flows south from 17 Wing in the Ainslie district, passing directly through Strathmillan and connecting to the Strathmillan outfall pipe immediately downstream of the Strathmillan diversion chamber and positive gate structure. The force main is part of the wastewater system surrounding the 17 Wing. 17 Wing has its own on-site wastewater treatment, and the treated sewage is transported via this force main. During normal operating conditions, the treated wastewater is prevented from entering the Strathmillan CS by a valve which is normally kept closed, resulting in the treated wastewater being discharged to the Assiniboine River. The City is instructed to open the valve when treatment capabilities within 17 Wing are offline, at which point the untreated wastewater is allowed to enter the Strathmillan CS upstream of the diversion chamber, so that it may be intercepted with the Strathmillan DWF to the downstream Olive CS LS for treatment by the City of Winnipeg.

The CS outfalls to the Assiniboine River is as follows:

- ID42 (S-MA70053789) – Strathmillan CS Outfall
- ID41 (S-MA20005373) – Ainslie CS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between Strathmillan and the surrounding districts. Each interconnection is shown on Figure 39 and shows gravity and pumped flow from one district to another. Each interconnection is listed as follows:

1.3.1.1 Interceptor Connections – Downstream of Primary Weir

Ainslie

- A 400 mm force main from the 17 Wing base pumps sewage from a pump station in Ainslie on Silver Avenue through Strathmillan district to its outfall without connecting to other CS systems:
  - Ness Ave and Strathmillan Street invert at Ainslie district boundary = 231.93 m
- The Olive SPS pumps sewage through a 450 mm force main into the St James interceptor and into the Ainslie district:
  - Assiniboine Crescent at connection to Olive Lift station = 230.43m

1.3.1.2 Interceptor Connections – Upstream of Primary Weir

Moorgate

- A 375 mm force main pumps sewage from the Conway CS LS and along Portage Avenue into the interceptor sewer system within the Strathmillan district from Moorgate district:

- Portage Avenue and Conway Street invert at Strathmillan district boundary = 232.98 m

1.3.1.3 District Interconnections

Ainslie

CS to CS

- A 600 mm CS sewer flows by gravity from the Ainslie CS system into the Olive CS LS: Assiniboine Crescent at Olive LS invert at Strathmillan district boundary = 226.89 m

LDS to LDS

- The LDS crosses from Strathmillan into Ainslie by gravity flow to the LDS outfall at the Assiniboine River:
  - Assiniboine Crescent east of Olive CS LS, invert at Strathmillan district boundary = 228.86 m
- The 600 mm LDS from Ainslie flows by gravity into Strathmillan east of Olive Street and connects to the 2250 mm LDS that discharges into the Assiniboine River:
  - Olive Street and Portage Avenue invert at Strathmillan district boundary = 228.92 m
- The LDS uses gravity flow and connects to the large LDS in Strathmillan from Ainslie, on the west end of Lodge Avenue:
  - Lodge Avenue at Olive Street back lane invert at Strathmillan district boundary = 230.16 m
- The large 2100 mm LDS on Ness Avenue uses gravity flow to connect into Strathmillan district from Ainslie:
  - Ness Ave at Olive Street back lane invert at Ainslie district boundary = 230.52 m

Moorgate

LDS to LDS

- The LDS uses gravity flow to connect into the LDS system in Strathmillan on the eastern end of Lodge Avenue before Strathmillan Street:
  - Lodge Avenue and Davidson Street invert at Strathmillan district boundary = 231.53 m
- The LDS uses gravity flow to connect into the LDS system in Strathmillan on the eastern end of Bruce Avenue before Strathmillan Street:
  - Bruce Avenue invert at Strathmillan district boundary = 232.55 m
- A 450 mm LDS flows by gravity into Moorgate District on Mount Royal Road:
  - Mount Royal Road and Trail Avenue invert at Strathmillan district boundary = 233.16 m

A district interconnection schematic for the district is included as Figure 1-1**Error! Reference source not found.**. The drawing illustrates the collection areas, interconnections, pumping systems, and discharge points for the existing system.

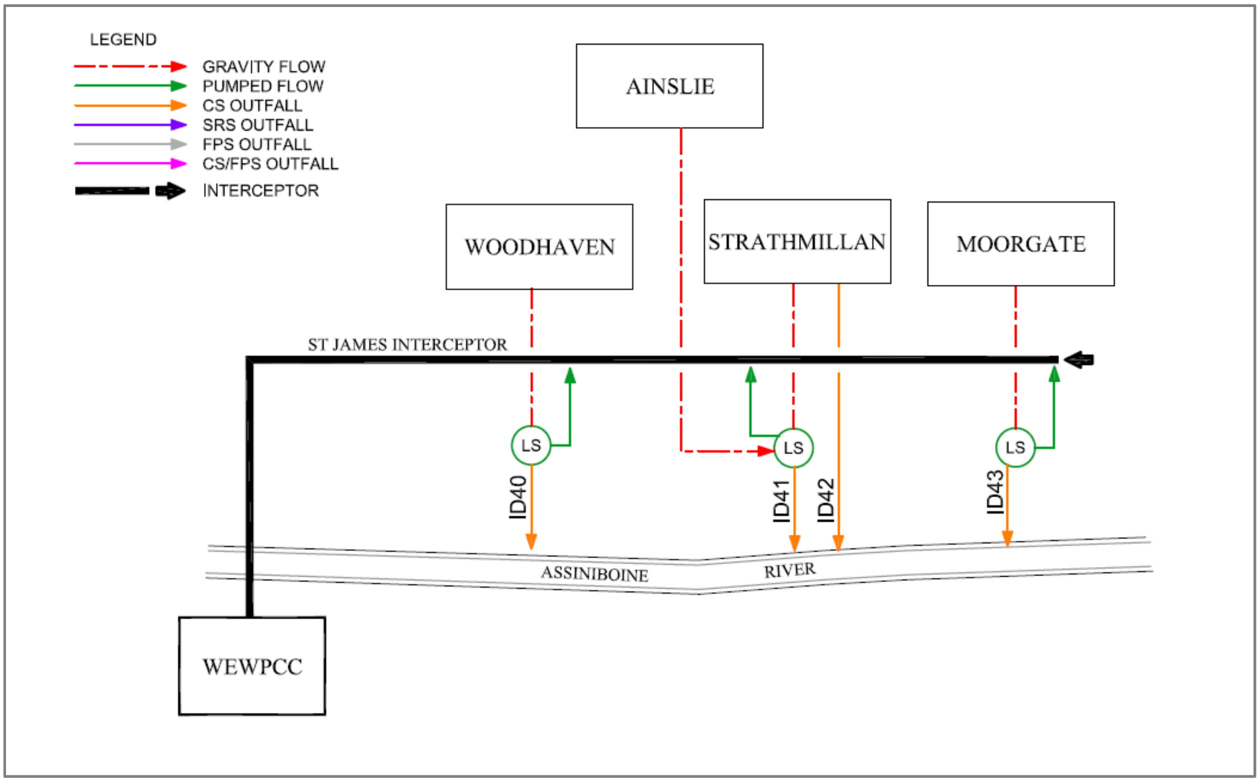

Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 39 and are listed in Table 1-1.

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Combined Sewer Outfall (ID42)	S-TE70022123.1	S-MA70053789	1350 mm	Invert: 226.32 m Circular
Flood Pumping Outfall	N/A	N/A	N/A	No flood pumping station in this district
Other Overflows (ID41)	S-MA20005373.1	S-MA20005373	750 mm	Invert 228.0 m (model assumption) Circular
Main Sewer Trunk	S-TE70022127.1	S-MA70011333	900 mm	Invert: 228.29 m Circular
Storm Relief Sewer Outfalls	N/A	N/A	N/A	No SRS within district.
Storm Relief Sewer Interconnections	N/A	N/A	N/A	No SRS within district.
Main Trunk Flap Gate	S-CG00000923.1	S-CG00000923	750 mm	Invert: 228.30 m Circular
Main Trunk Sluice Gate	S-CG00001143.1	S-CG00001143	762 mm	Invert: 228.67 m Circular
Off-Take	S-TE70022127.2	S-MA70053808	300 mm	Invert: 228.47 m Circular
Wet Well	Olive Lift US.1	S-MA70016561	7.5 m x 2.14 m	

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Lift Station Total Capacity (Olive CS LS)	N/A	N/A	0.308 m^3/s	2 pumps @ 0.154 m^3/s
Lift Station ADWF (Olive CS LS)	N/A	N/A	0.075 m^3/s	
Lift Station Force Main (Olive CS LS)	Olive Lift DS.1	S-MA20005360	450 mm	Discharge Invert 229.44 m
Flood Pump Station Total Capacity	N/A	N/A	N/A	No flood pumping station in this district
Pass Forward Flow – First Overflow	N/A	N/A	0.093 m^3/s	

Notes:

ADWF = average dry-weather flow
GIS = geographic information system
ID = identification
N/A = not applicable

The critical system elevations for the existing system relevant to the development of the CSO control options are listed in Table 1-2. Critical elevation reference points are identified on the district overview and detailed maps.

Table 1-2. Critical Elevations

Reference Point	Item	Elevation (m)[a]
1	Normal Summer River Level	226.06
2	Trunk Invert at Off-Take	228.47
3	Top of Weir	228.86
4	Relief Outfall Invert at Flap Gate	N/A
5	Low Relief Interconnection	N/A
6	Sewer District Low Interconnection	N/A
7	Low Basement	230.43
8	Flood Protection Level	230.98

[a] City of Winnipeg Data, 2013

Due to the absence of an SRS system in the Strathmillan district, the relief outfall invert and relief interconnection are not available.

1.4 Previous Investment Work

Table 1-3 provides a summary of the district status in terms of data capture and study. The most recent study was the *Sewer Relief and CSO Abatement Study* (UMA, 2005). It describes the CSO abatement alternatives and sewer relief implications for both Strathmillan and Moorgate CS districts.

Between 2009 and 2015, the City invested $12 million in the CSO Outfall Monitoring Program. The program was initiated to permanently install instruments in the primary CSO outfalls. The outfall from the Strathmillan CS district, along with the CS outfall within the Ainslie separate sewer district was included as part of this program. Instruments installed at each of the 39 primary CSO outfall locations have a combination of inflow and overflow level meters and flap gate inclinometers if available.

Table 1-3. District Status

District	Most Recent Study	Flow Monitoring	Hydraulic Model	Status	Planned Completion
38 - Strathmillan	2005- Conceptual	Planned in Next 5 Years	2013	Complete	N/A

Source: Sewer Relief and CSO Abatement Study, 2005

1.5 Ongoing Investment Work

There is no ongoing investment work within Strathmillan district that would impact the CSO Master Plan.

There is ongoing maintenance and calibration of permanent instruments installed within the primary outfall within the Strathmillan district, and the primary outfall for the Ainslie district. This consists of monthly site visits in confined entry spaces to verify that physical readings concur with displayed transmitted readings and replacing desiccants where necessary.

1.6 Control Option 1 Projects

The proposed projects selected to meet Control Option 1 – 85 Percent Capture in a Representative Year for the Strathmillan sewer district are listed in **Error! Reference source not found.** The proposed CSO control projects will include in-line storage via a control gate with screening.. Program opportunities including green infrastructure (GI) and real time control (RTC) will also be included as applicable.

Table 1-4. District Control Option

Control Limit	Latent Storage	Flap Gate Control	Gravity Flow Control	Control Gate	In-line Storage	Off-line Storage	Storage / Transport Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
85 Percent Capture in a Representative Year	-	-	-	✓	✓	-	-	-	✓	✓	✓

The Strathmillan district plan includes implementing floatable control and in-line storage to meet the CSO Control Option 1 performance target.

Floatable control will be necessary to capture floatables in the sewage. The primary CS overflow for the district is to be screened under the current CSO control plan to address the floatables management requirements. The installation of a control gate at the primary CS outfall will be required for the screen operation in the Strathmillan district. This control gate installation will provide the mechanism for capture of minor additional in-line storage. It should be noted however that in-line storage for the Strathmillan district is not a cost-effective solution for additional volume capture. The control gate installation is recommended primarily to provide the necessary hydraulic head for screen operations. Should the screening option no longer be required in the Strathmillan district to address the floatables management requirements, it is recommended that alternative measures such as off-line storage or complete separation be investigated in the Strathmillan district to provide the additional volume capture in a more cost effective manner. Additional pass forward capacity at the CSO location provides an improvement to this district’s performance. .

GI and RTC will be applied within each district on a system wide basis with consideration of the entire CS area. The level of implementation for each district will be determined through evaluations completed through district level preliminary design. RTC is not included in detail within each plan and is described further in Section 3 of Part 3A.

1.6.1 In-Line Storage

In-line storage has been proposed as a CSO control for the Strathmillan district. The in-line storage will require the installation of a control gate at the CS outfall. The gate will increase the storage level in the existing CS to provide a slightly higher volume capture, but will primarily be used to provide additional hydraulic head for screening operations.

A standard design was assumed for the control gate, as described in Part 3C. A standard approach was used for conceptual gate sizing by assuming it to be the lesser of the height of half of the site-specific trunk diameter or the maximum height of the gate available. The design criteria for in-line storage are listed in Table 1-5.

Table 1-5. In-Line Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Invert Elevation	228.29 m	
Trunk Height	900 mm	Circular
Gate Height	0.11 m	Gate height based on half trunk diameter assumption
Top of Gate Elevation	228.97 m	
Bypass Weir Height	228.87 m	
Maximum Storage Volume	19 m^3	Option has small storage volume as by-produce of proposed screening installation requirement
Nominal Dewatering Rate	0.353 m^3/s	Based on pass forward flow at Strathmillan CS overflow
RTC Operational Rate	TBD	Future RTC / dewatering review with future assessment

Note:
RTC = Real Time Control
TBD = to be determined

The proposed control gate will cause combined sewage to back-up in the collection system to the extent shown on Figure 39. The extent of the in-line storage and volume is related to the top elevation of the bypass side weir. The level of the top bypass side weir and adjacent control gate level are determined in relation to the critical performance level in the system for basement flooding protection: when the system level increases above the bypass weir crest and proceeds above the top of the control gate during high flow events, the gate drops out of the way. At this point, the district will only provide its original interception capacity via the primary weir for the district, and all excess CS would flow over the weir and discharge to the river. After the sewer levels in the system drops back below the bypass side weir critical performance level, the control gate moves back to its original position to capture the receding limb of the WWF event. The existing gravity discharge will continue with its current operation while the control gate is in either position, with all DWF being diverted to the interceptor pipe.

Figure 39-01 provides an overview of the conceptual location and configuration of the control gate, bypass weir and screening chambers. The proposed control gate will be installed in a new chamber within the existing trunk sewer alignment near the existing primary weir. The dimensions of the chamber will be 5 m in length and 2.5 m in width to accommodate the gate, with an allowance for a longitudinal overflow weir. The existing sewer configuration including the off-take, 300 mm CS sewer, proposed 300 mm relief pipe and the CS LS force main may have to be modified to accommodate the new chamber. Further optimization of the gate chamber size may be provided if a decision is made not to include screening.

The physical requirements for the off-take and chamber sizing for a modification to existing pipe capacity have not been considered in detail, but they will be required in the future as part of an RTC program or LS rehabilitation or replacement project. The proposed location adjacent to the existing gate chamber has been situated entirely within the City owned land. However, the location of the existing infrastructure is within a residential area and will cause local disruptions which may require relocation to the main street or if the alternative floatables management approach is adopted not implemented at this location.

It should also be noted that the existing 300 mm offtake pipe at the Strathmillan primary weir is under capacity due to the high levels of groundwater inflow this district receives in the summer months. This will restrict the performance of the overflow, and not allow for the required levels of in-line storage. To counter this, it is also recommended that a 15 m section of 300 mm relief pipe be connected from the diversion weir to the existing interceptor, to complement the existing 300 mm offtake. This will allow for reduced overflows at the Strathmillan outfall and increase the amount of intercepted CS transported into the interceptor system, fully utilizing the in-line storage provided by the control gate. The addition of this pipe was assessed and does not cause additional overflows at the Olive outfall downstream for the representative year assessment. The existing sewer configuration may also require the relocation of the existing off-take pipe to be completed, if the future detailed design establishes that the proposed gate chamber cannot encompass the existing primary weir chamber. This will allow CS flows captured by the proposed control gate to be diverted to the Olive CS LS, ensuring that the system performs as per the existing conditions. The existing primary weir would remain in place to allow flow diversion to continue when the control gate is in its lowered position.

The nominal rate for dewatering of the district is set at the existing CS LS capacity. This allows dewatering through the existing interceptor system within 24 hours following the runoff event, allowing it to recover in time for a subsequent event. Future RTC / dewatering assessment will be necessary to define additional rates. This would provide some flexibility in the ability to increase the dewatering rate for spatial rainfall events. This would dewater the district more quickly, to capture and treat more volume for these localized storms by using the excess interceptor capacity where the runoff is less.

1.6.2 Floatables Management

Floatables management will require installation of a screening system to capture floatable materials. The off-line screens would be designed to maintain the current level of basement flooding protection.

The type and size of screens depend on the specific station configuration and the head available for operation. A standard design was assumed for screening and is described in Part 3C. The design criteria for screening, with an in-line control gate implemented, are listed in Table 1-6.

Table 1-6. Floatables Management Conceptual Design Criteria

Item	Elevation/Dimension/Rate	Comment
Top of Gate	228.97 m	
Bypass Weir Crest	228.87 m	
Normal Summer River Level	226.06 m	
Maximum Screen Head	2.81 m	
Peak Screening Rate	0.55 m^3/s	
Screen Size	1.5 m wide x 1 m high	Modelled Screen Size

The proposed side bypass overflow weir and screening chamber will be located adjacent to the proposed control gate and existing CS trunk, as shown on Figure 39-01. The screens will operate with the control gate in its raised position. A side bypass weir upstream of the gate will direct the flow to the screens located in the new screening chamber, with screened flow discharged to the downstream side of the gate to the river. The screening chamber may include screenings pumps with a discharge returning the screened material to the CS LS for routing to the WEWPCC for removal.

The dimensions for the screen chamber to accommodate influent from the side weir, the screen area, and the routing of the discharge piping downstream of the gate are 3 m in length and 3 m in width. The existing sewer configuration including the off-take, connection from the 17 Wing area, the 300 mm CS sewer and the proposed 300 mm relief pipe, may have to be modified to accommodate the new chamber.

1.6.3 Green Infrastructure

The approach to GI is described in Section 5.2.1 of Part 2 of the CSO Master Plan. Opportunities for the application of GI will be evaluated and applied with any projects completed in the district. Opportunistic GI will be evaluated for the entire district during any preliminary design completed. The land use, topography and soil classification for the district was reviewed to identify the most applicable GI controls.

Strathmillan has been classified as a high GI potential district. Land use in Strathmillan is mostly single-family residential. Portage Avenue corridor includes a mix of apartments and commercial businesses. This means the district would be an ideal location for bioswales, permeable paved roadways, cisterns/rain barrels, and rain gardens. The flat roof commercial buildings along Portage Avenue would also be an ideal location for green roofs.

1.6.4 Real Time Control

The approach to RTC is described in Section 5.2.2 of Part 2 of the CSO Master Plan. The application of RTC will be evaluated and applied on a district by district basis through the CSO Master Plan projects with long term consideration for implementation on a system wide basis.

1.7 System Operations and Maintenance

System operations and maintenance (O&M) changes will be required to address the proposed control options. This section identifies general O&M requirements for each control option proposed for the district. More specific details on the assumptions used for quantifying the O&M requirements are described in Part 3C of the CSO Master Plan.

In-line storage will impact the existing sewer and will require the addition of a new chamber and a moving gate at the outfall. In-line storage dewatering will be controlled with the existing Clifton CS LS, which will require more frequent and longer duration pump run times. Lower velocities will occur in the CS trunk in the vicinity of the control gate due to lower pass forward flows, and may create additional debris deposition requiring cleaning. Additional system monitoring, and level controls will be installed, which will require regular scheduled maintenance.

Floatable control with outfall screening will require the addition of another chamber with screening equipment installed. The chamber will be installed adjacent to the control gate chamber and will operate in conjunction with it. Screening operation will occur during WWF events that surpass the in-line storage control level. WWF will be directed from the main CS trunk, over the side weir in the control gate chamber and through the screens to discharge into the river. The screens will operate intermittently during wet weather events and will likely require operations review and maintenance after each event. The frequency of a screened event will correlate to the number overflows identified for the district. Having the screenings pumped back to the interceptor system via a small LS and force main will be required. The screenings return will require O&M inspection after each event to assess the performance of the return pump system.

1.8 Performance Estimate

An InfoWorks CS hydraulic model was created as part of the CSO Master Plan development. Two versions of the sewer system model were created and used to measure system performance. The 2013 Baseline model represents the sewer system baseline in the year 2013 and the 2037 Master Plan – Control Option 1 model, which includes the proposed control options in the year 2037. A summary of relevant model data is provided in Table 1-7.

Table 1-7. InfoWorks CS District Model Data

Model Version	Total Area (ha)	Contributing Area (ha)	Population	% Impervious	Control Options Added To Model
2013 Baseline	473	473	12,227	19	N/A
2037 Master Plan – Control Option 1	473	473	12,227	19	IS, SC

Notes:
IS = In-line Storage
SC = Screening

No influence from the 17 Wing site was modelled as part of the 1992 representative year assessment as this has a controlled discharge to the Strathmillan system which can be programmed to coincide with DWFW periods and not influence the CSO performance.

No change to the future population was completed as from a wastewater generation perspective from the update to the 2013 Baseline Model to the 2037 Master Plan Model. The population generating all future wastewater will be the same due to Clause 8 of Environment Act Licence 3042 being in effect for the CS district.

City of Winnipeg hydraulic model relied upon for area statistics. The hydraulic model representation may vary slightly from the City of Winnipeg GIS Records. Therefore, minor discrepancies in the area values reported in Section 1.3 Existing Sewer System, and in Section 1.8 Performance Estimate may occur.

The performance results listed in Table 1-8 are for the hydraulic model simulations using the year-round 1992 representative year. The table lists the results for the Baseline, for each individual control option and for the proposed CSO Master Plan - Control Option 1. The Baseline and Control Option 1 performance numbers represent the comparison between the existing system and the proposed control options, the table also includes overflow volumes specific to each individual control option; these are listed to provide an indication of benefit gained only and are independent volume reductions.

As mentioned in the Section 1.3 there is an interaction with the Strathmillan district and the 17 Wing on-site private wastewater treatment system. Since the discharge of untreated sewage from 17 Wing base to the Strathmillan district is infrequent based on the 17 Wing treatment system maintenance requirements, no flows from 17 Wing have been included in the Strathmillan district assessment of the 1992 representative year.

Table 1-8. Performance Summary – Control Option 1

Control Option	Preliminary Proposal Annual Overflow Volume (m^3)	Master Plan Annual Overflow Volume (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [c]
Baseline (2013)	39,590	39,684	-	18	0.042 m^3/s
In-line Storage	41,117	43,678	- 3,994 [b]	18	0.042 m^3/s
In-line & Relief Pipe	N/A [a]	18,936	24,742	15	0.130 m^3/s
Control Option 1	**41,117**	**18,936**	**20,745**	**15**	**0.130 m^3/s**

[a] Relief sewer pipe was not simulated during the Preliminary Proposal assessment.

[b] Minor improvement to district on individual district model basis. Influenced by upstream Moorgate district and proposed options. Districts of Strathmillan and Moorgate to be developed as one project to ensure that the temporary worsening of the CSO

performance does not occur at this district

[c] Pass forward flows assessed on the 1-year design rainfall event

The percent capture performance measure is not included in Table 1-8, as it is applicable to the entire CS system and not for each district individually.

1.9 Cost Estimates

Cost estimates were prepared during the development of the Preliminary Proposal and have been updated for the CSO Master Plan. The CSO Master Plan cost estimates have been prepared for each control option, with overall program costs summarized and described in Section 3.4 of Part 3A. The cost estimate for each control option relevant to the district as determined in the Preliminary Proposal and updated for the CSO Master Plan are identified in Table 1-9. The cost estimates are a Class 5 planning level estimates with a level of accuracy of minus 50 percent to plus 100 percent.

Table 1-9. Cost Estimates – Control Option 1

Control Option	2014 Preliminary Proposal Capital Cost	2019 CSO Master Plan Capital Cost	2019 Annual Operations and Maintenance Costs	2019 Total Operations and Maintenance Cost (Over 35-year Period)
In-line Control Gate	$0 [a]	$2,190,000 [b]	$39,000	$840,000
Screening	$0 [a]	$2,360,000 [c]	$48,000	$1,020,000
Relief Pipe	N/A	$30,000	$0	$0
Subtotal	**$0**	**$4,580,000**	**$87,000**	**$1,860,000**
Opportunities	N/A	$460,000	$9,000	$190,000
District Total	**$0 [a]**	**$5,040,000**	**$95,000**	**$2,050,000**

[a] Screening and In-line not included in the initial Preliminary Proposal 2015 costing. Solution developed as refinement to Preliminary Proposal work following submission of Preliminary Proposal costs. Costs for these items of work found to be $1,710,000 in 2014 dollars

[b] Cost associated with new off-take construction, as required, to accommodate control gate and screening chambers in location and allow intercepted CS flows to reach existing Strathmillan gravity pipe was not included in Master Plan

[c] Cost for bespoke screening return/force main not included in Master Plan as will depend on selection of screen and type of screening return system selected

The estimates include changes to the control option selection since the Preliminary Proposal, updated construction costs, and the addition of GI opportunities. The calculations for the CSO Master Plan cost estimate includes the following:

- Capital costs and O&M costs are reported in terms of present value.
- A fixed allowance of 10 percent has been included for GI, with no additional costs for RTC. This has been listed as part of the Opportunities costs.
- The Preliminary Proposal capital cost is in 2014-dollar values.
- The CSO Master Plan capital cost is based on the control options presented in this plan and in 2019-dollar values.
- The 2019 Total Annual Operations and Maintenance (over 35-year period) cost component is the present value costs of each annual O&M cost under the assumption that each control option was initiated in 2019.

- The 2019 Annual Operations and Maintenance Costs were based on the estimated additional O&M costs annually for each control option in 2019 dollars.
- Future costs will be inflated to the year of construction.

Cost estimates were prepared during the development of the Preliminary Proposal and updated for Phase 3 during the CSO Master Plan development. The differences identified between the Preliminary Proposal and the CSO Master Plan are accounting for the progression from an initial estimate used to compare a series of control options, to an estimate focusing on a specific level of control for each district. Any significant differences between the Preliminary Proposal and CSO Master Plan estimates are identified in Table 1-10.

Table 1-10. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	Control Gate	A control gate was not included in the Preliminary Proposal estimate	Added for the MP to further reduce overflows
	Screening	Screening was not included in the Preliminary Proposal estimate	Added in conjunction with the Control Gate
	Relief pipe	Requirement for additional off-take relief pipe not known in Preliminary Proposal assessment.	Added in conjunction with the Control Gate
Opportunities	A fixed allowance of 10 percent has been included for program opportunities	Preliminary Proposal estimate did not include a cost for GI opportunities	
Lifecycle Cost	The lifecycle costs have been adjusted to 35 years	City of Winnipeg Asset Management Approach	
Cost escalation from 2014 to 2019	Capital Costs have been inflated to 2019 values based on an assumed value of 3 percent per for construction inflation.	Preliminary Proposal estimates were based on 2014-dollar values.	

1.10 Meeting Future Performance Targets

The regulatory process requires consideration for upgrading Control Option 1 to another higher-level performance target. For the purposes of this CSO Master Plan, the future performance target is 98 percent capture for the representative year measured on a system-wide basis. This target will permit the number of overflows and percent capture to vary by district to meet 98 percent capture. Table 1-11 provides a description of how the regulatory target adjustment could be met by building off the proposed work identified for Control Option 1.

Overall the Strathmillan district would be classified as a high potential for implementation of complete sewer separation as a feasible approach to achieve the 98 percent capture in the representative year future performance target. The non-separation measures recommended as part of this district engineering plan to meet Control Option 1, specifically in-line storage via control gate and additional relief piping and floatables management via off-line screening, are therefore at risk of becoming redundant and unnecessary when the measures to achieve future performance targets are pursued. As a result, these measures should not be pursued until the requirements to meet future performance targets are more defined. Should it be confirmed that complete separation is the recommended solution to meet future performance targets, then complete separation will likely be pursued to address Control Option 1 instead of implementing the non-separation measures. This will be with the understanding that while initially complete separation is less cost-effective to meet Control Option 1, it is the most cost effective solution to meet the future performance target and removes the capital costs on short term temporary solutions. The focused use of green infrastructure at key locations would also be utilized to provide volume capture benefits.

Table 1-11. Upgrade to 98 Percent Capture in a Representative Year Summary

Upgrade Option	Viable Migration Options
98 Percent Capture in a Representative Year	• Complete Sewer Separation • Increased use of GI

The Strathmillan district control options have been aligned for the 85 percent capture performance target based on the system wide basis. The expandability of this district to meet the 98 percent capture would not align with the proposed options for the 85 percent capture target. The future higher level of percent capture indicate that complete sewer separation would be most applicable in this district.

The cost for upgrading to meet an enhanced performance target depends on the summation of all changes made to control options in individual districts and has not been fully estimated at this stage of master planning. The Phase In approach is to be presented in detail in a second submission for 98 percent capture in a representative year, due on or before April 30, 2030.

1.11 Risks and Opportunities

The CSO Master Plan and implementation program are large and complex, with many risks having both negative and positive effects. The objective of this section is to identify significant risks and opportunities for each control option within a district.

The CSO Master Plan has considered risks and opportunities on a program and project delivery level, as described in Section 5 of Part 2 of the CSO Master Plan. A Risk And Opportunity Control Option Matrix covering the district control options has been developed and is included as part of Appendix D in Part 3B. The identification of the most significant risks and opportunities relevant to this district are provided in Table 1-12.

Table 1-12. Control Option 1 Significant Risks and Opportunities

Risk Number	Risk Component	Latent Storage / Flap Gate Control	In-line Storage / Control Gate	Off-line Storage Tank	Off-line Storage Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
1	Basement Flooding Protection	-	R	-	-	-	-	-	-
2	Existing Lift Station	-	R	-	-	-	-	R	-
3	Flood Pumping Station	-	-	-	-	-	-	-	-
4	Construction Disruption	-	-	-	-	-	-	-	-
5	Implementation Schedule	-	-	-	-	-	-	R	-
6	Sewer Condition	-	R	-	-	-	-	-	-
7	Sewer Conflicts	-	R	-	-	-	-	-	-
8	Program Cost	-	O	-	-	-	-	-	O
9	Approvals and Permits	-	-	-	-	-	R	-	-
10	Land Acquisition	-	-	-	-	-	R	-	-

Table 1-12. Control Option 1 Significant Risks and Opportunities

Risk Number	Risk Component	Latent Storage / Flap Gate Control	In-line Storage / Control Gate	Off-line Storage Tank	Off-line Storage Tunnel	Sewer Separation	Green Infrastructure	Real Time Control	Floatable Management
11	Technology Assumptions	-	-	-	-	-	O	O	-
12	Operations and Maintenance	-	R	-	-	-	R	O	R
13	Volume Capture Performance	-	O	-	-	-	O	O	-
14	Treatment	-	R	-	-	-	O	O	R

Risks and opportunities will require further review and actions at the time of project implementation.

1.12 References

UMA Engineering, Ltd. (UMA). 2005. *Sewer Relief and CSO Abatement Study*. Prepared for. Month of publication.

LEGEND

Primary Weir	Inter-System Connection	District Boundary Crossing	Interceptor Sewer	District Boundary
Critical Elevation	CS - LDS	CS	Force Main	Watercourse
CSO Outfall	CS - WWS	LDS	Street	Greenspace
Low CS Manhole		WWS		

CSO MASTER PLAN PROPOSED SOLUTIONS

- Proposed Control Gate
- Duplicate Pipe
- Extent of In-line Storage
- Sewer Separation - Complete

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

Notes:
1. Map data source - City of Winnipeg, 2013

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 39
District Overview Map
Sewer District: Strathmillan
City of Winnipeg
Combined Sewer Overflow Master Plan

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LEGEND

- Primary Weir
- Critical Elevation
- CSO Outfall
- Manhole
- Flap Gate
- Force Main
- Sewer By Type
  - CS
  - LDS
  - WWS
- Control Structure Type
  - Gate Chamber

CSO MASTER PLAN PROPOSED SOLUTIONS

- Duplicate Pipe
- Control Gate
- Screening

ALL PROPOSED SOLUTIONS SHOWN IN RED TEXT

JACOBS

Notes:
1. Map data source - City of Winnipeg, 2013

Winnipeg

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

FIGURE 39-01
Control Gate and Screening
Sewer District: Strathmillan
City of Winnipeg
Combined Sewer Overflow Master Plan

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