CSO Master Plan

Moorgate District Plan

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City of Winnipeg

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CSO Master Plan

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1. Moorgate District

1.1 District Description

Moorgate district is located near the western border of the combined sewer (CS) area and is bounded by Strathmillan district to the west, Ferry Road and Douglas Park districts to the east, and the Winnipeg Airport lands to the north. Ness Avenue and Silver Avenue make up the northern border, Davidson Street forms the western border, and Linwood Street forms the eastern border. The Assiniboine River is located along the southern border. Figure 28 provides an overview of the sewer district and the location of the proposed Combined Sewer Overflow (CSO) Master Plan control options.

Portage Avenue is a major transportation route that passes through Moorgate district along the south border and parallel to the Assiniboine River. Ness Avenue is also a highly travelled route that connects to Portage Avenue via numerous north-south streets.

Land use in Moorgate is mostly single-family residential. Portage Avenue corridor includes a mix of apartments and commercial businesses. The Assiniboine Golf Club is located along the northern edge and the Deer Lodge Centre is located just north of Portage Avenue. Approximately 34 ha of the district is classified as greenspace which includes multiple parcels spread throughout the district. Development in the eastern portion of the district occurred prior to 1925 with other developments added towards the west boundary up to the 1950s. Canadian Forces Base Winnipeg is located to the north of the district.

1.2 Development Potential

A portion of Portage Avenue is located within the Moorgate 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

Moorgate district has a drainage area of approximately 190 hectares (ha)[1] based on the district boundary. The system consists of a CS system and a land drainage sewer (LDS) system. Approximately 29 percent (56 ha) is separated and 2 percent (3 ha) identifiable as separation ready. Storm relief sewers (SRSs) are installed on Lodge Avenue, Ness Avenue, Conway Street, and Sharp Boulevard. Two LDS outfalls are located south of Portage Avenue and discharge to the Assiniboine River. The LDS system also connects into the CS outfall close to the western border, off Portage Avenue.

The CS system includes a diversion structure, lift station and one CS outfall. The CS system drains towards the Moorgate outfall and diversion chamber, located at the southern end of Conway Street at the Assiniboine River. At the outfall, flow is either diverted to the Conway CS lift station (LS) where it is pumped to the St James Interceptor or overflows the diversion weir into the Assiniboine River.

A 1900 mm by 2475 mm egg-shaped trunk sewer running along Moorgate Street collects flow from throughout the district. It connects to a 1900 mm by 2475 mm egg-shaped trunk sewer at the corner of Moorgate Street and Portage Avenue which flows into the outfall.

There is a separate LDS system in the southeast part of district along Portage Avenue and Mandeville Street. This LDS system collects flow and directs it to three LDS outfalls along the Assiniboine River. The areas along Lodge Avenue and Mount Royal Road contain a separate LDS system. The Lodge Avenue

[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.

LDS collects runoff from the road and conveys it to the adjacent Strathmillan district and ultimately to the Strathmillan CS outfall, which is a combined CS/LDS outfall.

During dry weather flow (DWF), the existing weir diverts flow through a 525 mm off-take to the Conway CS LS, where it is pumped through the 250-mm force main to the 375 mm St. James interceptor that takes the wastewater to the West End Sewage Treatment Plant (WEWPCC) for treatment. The Conway CS LS also receives wastewater from the Assiniboine Park Zoo. During wet weather flow (WWF) the weir may be overtopped, and WWF can bypass to the CS outfall into the Assiniboine River.

The CS outfall to the Assiniboine River is as follows:

- ID43 (S-MA70016333) – Moorgate CS Outfall

1.3.1 District-to-District Interconnections

There are five district-to-district interconnections between Moorgate and Strathmillan to the west. Each interconnection is shown in Figure 28 and shows locations of gravity and pumped flow from one district to another. The known district-to-district interconnections are identified as follows:

1.3.1.1 Interceptor Connections – Downstream of Primary Weir

Strathmillan

- The 375 mm interceptor pipe conveys flow from the Conway CS LS along Portage Avenue through Strathmillan district, and then to WEWPCC:
  - Portage Avenue and Conway Street invert at Strathmillan district boundary – 232.98 m

1.3.1.2 District Interconnections

Strathmillan

LDS to LDS

- A 750 mm LDS trunk conveys flow to connect into the LDS system in Strathmillan on the eastern end of Lodge Avenue before Strathmillan Street that flows into the Strathmillan CS Outfall:
  - Lodge Avenue and Davidson Street invert at Strathmillan district boundary – 231.53 m
- A 450 mm LDS trunk conveys flow to connect into the LDS system in Strathmillan on the eastern end of Bruce Avenue before Strathmillan Street that flows into the Strathmillan CS Outfall:
  - Bruce Avenue invert at Strathmillan district boundary – 232.55 m
- A 450 mm LDS trunk conveys flow into Moorgate District on Mount Royal Road, this then flows into the Strathmillan CS Outfall:
  - Mount Royal Road and Traill Avenue invert at Strathmillan district boundary – 233.16 m

Assiniboine Park

Wastewater Sewer (WWS) to CS

- A 250 mm WWS pipe uses gravity to convey flow from Assiniboine Park zoo to Moorgate district to Conway gate chamber then out the outfall
  - To Conway Street from Assiniboine Park invert at district boundary – 223.96 m

A district interconnection schematic is included as Figure 1-1. The drawing illustrates the collection areas, interconnections, pumping systems, and discharge points for the existing system.

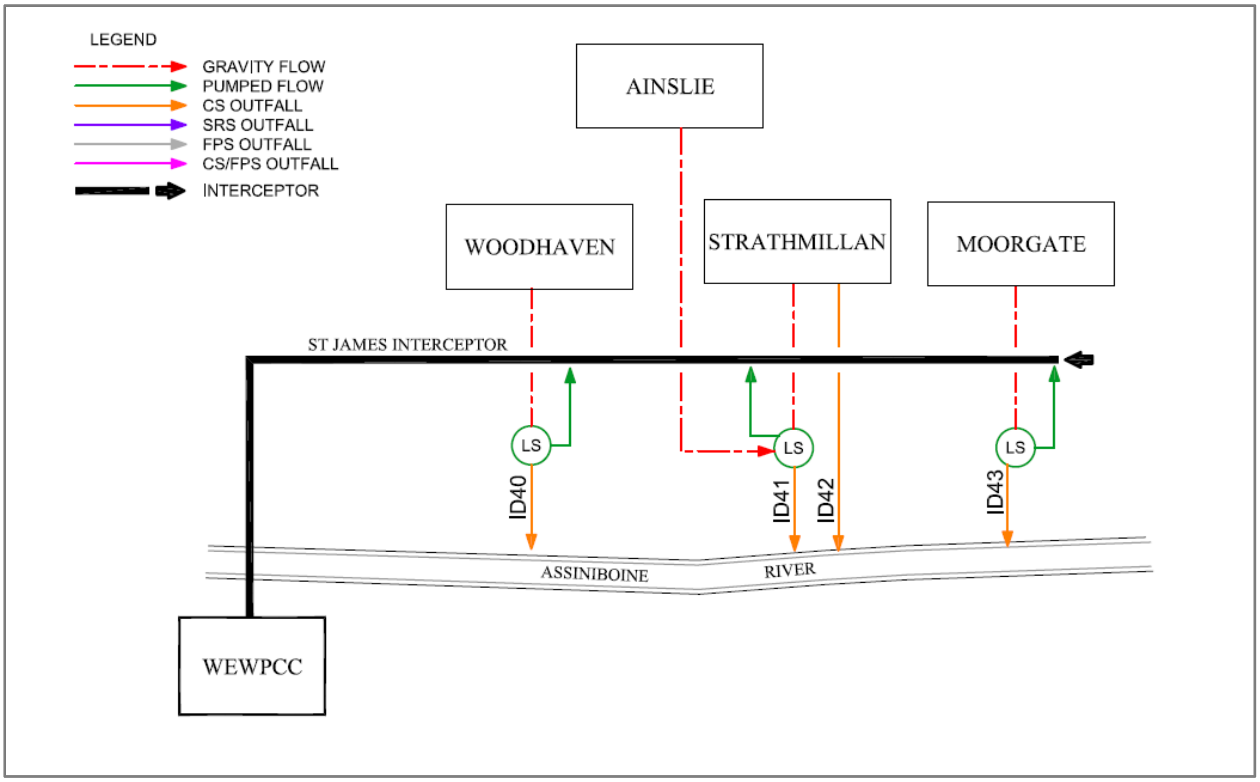


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 28 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 (ID43)	S-RE70015578.1	S-MA70016333	1830 mm	Invert: 226 m
Flood Pumping Outfall (ID87)	N/A	N/A	N/A	
Other Overflows	N/A	N/A	N/A	
Main Sewer Trunk	S-MH20004697.1	S-MA70019493	1930 x 2515 mm	Egg-shaped Invert: 226.71 m
Storm Relief Sewer Outfalls	N/A	N/A	N/A	
Storm Relief Sewer Interconnections	N/A	S-MH20004697 S-MH70019502 S-MH70021238 S-MH70022308 S-TE70021263 S-TE70021285	233.25 231.37 229.48 228.63 228.06 228.86	SRS -CS SRS -CS SRS -CS SRS -CS SRS -CS SRS -CS
Main Trunk Flap Gate	Moorgate_Weir.1	S-CG00000722	1800 mm	Circular Invert: 227.41 m
Main Trunk Sluice Gate	S-CS00000677.1	S-MA70019487	1980 x 2590 mm	Invert: 227.25 m
Off-Take	S-MH20004694.2	S-MA70019465	525 mm	Circular Invert 226.71 m
Dry Well	N/A	N/A	N/A	
Lift Station Total Capacity	N/A	N/A	0.136 m^3/s	2 pumps @ 0.068 m^3/s each

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Lift Station ADWF	N/A	N/A	0.023 m^3/s	
Lift Station Force Main	S-MA70017371A.1	S-MA70017371	250 mm	Discharge Invert 226.73 m
Flood Pump Station Total Capacity	N/A	N/A	N/A	
Pass Forward Flow – First Overflow	N/A	N/A	0.141 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	Moorgate – 225.24
2	Trunk Invert at Off-Take	226.71
3	Top of Weir	227.41
4	Relief Outfall Invert	N/A
5	Relief Interconnection	N/A
6	Sewer District Interconnection at Strathmillan	Invert at district boundary: 28-02 = 231.53
7	Low Basement	230.43
8	Flood Protection Level	230.98

[a] City of Winnipeg Data, 2013

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 Moorgate CS district was included as part of this program. Instruments installed at each of the 39 primary CSO outfall locations has 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	Expected Completion
28 - Moorgate	2005 - Conceptual	Future Work	2013	Partial Separation Work Complete	N/A

Source: Sewer Relief and CSO Abatement Study, 2005

1.5 Ongoing Investment Work

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

1.6 Control Option 1 Projects

1.6.1 Project Selection

The proposed projects selected to meet Control Option 1 – 85 Percent Capture in a Representative Year for the Moorgate sewer district are listed in Table 1-4. The proposed CSO control projects will include sewer separation, in-line storage with screening, and floatable management. 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	-	-	-	✓	✓	-	-	-	✓	✓	✓

Notes:- = not included
✓ = included

The existing CS system is suitable for use as in-line storage. This option would take advantage of the existing pipe networks for additional storage volume. Existing DWF from the collection system will remain the same, and overall district operations will remain the same. A review of the existing separation extent and potential remaining district separation requirement indicated a significant capital cost to reach district separation and this option was not taken forward to achieve the system wide 85 percent capture target.

All primary overflow locations are to be screened under the current CSO control plan. Installation of a control gate will be required for the screen operation, and it will provide the mechanism for capture of the in-line storage.

Floatable control will be necessary to capture floatables in the sewage. Floatables will be captured with all implemented control options to some extent, but screening may be added as required to reach the desired level of capture.

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.

1.6.2 In-Line Storage

In-line storage has been proposed as a CSO control for Moorgate 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 an overall higher volume capture and 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	226.71 m	N/A
Trunk Diameter	1930 x 2515 mm	Egg-shaped
Gate Height	0.58 m	Gate height based on half trunk diameter assumption
Top of Gate Elevation	227.99 m	N/A
Bypass Weir Elevation	227.89 m	N/A
Maximum Storage Volume	633 m^3	N/A
Nominal Dewatering Rate	0.136 m^3/s	Based on existing CS LS capacity
RTC Operational Rate	TBD	Future RTC / dewatering review on performance

The proposed control gate will cause combined sewage to back-up in the collection system to the extent shown on Figure 28. 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 of the bypass side weir and adjacent control gate level are determined in relation to the critical performance levels 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 CS LS will continue with its current operation while the control gate is in either position, with all DWF being diverted to the CS LS and pumped. The CS LS will further dewater the in-line storage provided during a WWF event as downstream capacity becomes available.

Figure 28-01 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 CS LS. The dimensions of the chamber will be 6 m in length and 3.2 m in width to accommodate the gate, with an allowance for a longitudinal overflow weir. DWF will continue to be diverted to the lift station through the off-take pipe and pumped through the 250-mm force main into the 375-mm interceptor pipe. This flows through Strathmillan and eventually to the WEWPCC for treatment. 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 station sizing for a modification to pumping capacity have not been considered in detail, but they may be required in the future as part of an RTC program or CS LS rehabilitation or replacement project. The proposed gate chamber (also the screening chamber) are within the existing City of Winnipeg Right-Of-Way (ROW) associated with the existing CS LS and CS outfall. The location is such that residential properties border both side of the site with Portage Avenue as the north limit of the City ROW. Construction work could potentially affect the traffic on this main route and cause disruptions. The existing sewer configuration including construction of an additional off-take may have to be completed to accommodate the new control gate chamber. This will be confirmed in future design assessments

The nominal rate for dewatering is set at the existing CS LS capacity. The dewatering rate includes both the DWF and WWF components of the district flows. 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. Any future considerations, for RTC improvements, would be completed with spatial rainfall as any reduction to the existing capacity for large events will adversely affect the overflows at this district. This future RTC control will provide the ability to capture and treat more volume for localized storms by using either district in-line storage or excess interceptor capacity where the runoff volume is less. Further assessment of the impact of the RTC and future dewatering arrangement will be necessary to review the downstream impacts (i.e., on Strathmillan district).

1.6.3 Floatables Management

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

The type and size of screens depend on the specific station configuration and the hydraulic 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	227.99 m	
Bypass Weir Crest	227.89	
Normal Summer River Level	225.24 m	
Maximum Screen Head	2.65 m	
Peak Screening Rate	0.59 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 28-01. The screens will operate once levels within the sewer surpass the bypass weir elevation. The side bypass weir upstream of the gate will direct initial overflow 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 provision of screening pumps is dependent on final level assessment within the existing infrastructure and the Moorgate trunk. This will be confirmed during the future assessment stage.

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 3.5 m in length and 2.5 m in width. The existing sewer configuration including the off-take and the CS LS force main may have to be modified to accommodate the new chamber.

1.6.4 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.

Moorgate has been classified as a high GI potential district. Land use in Moorgate 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 make would be an ideal location for green roofs.

1.6.5 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 report.

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 Conway CS LS, which may require more frequent and longer duration pump run times. Lower velocities in the CS trunks may create additional debris deposition and require more frequent 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 screenings pumped back to the interception system via a small pump and force main may be required. Additional maintenance for the pumps will be required at regular intervals in line with typical list station maintenance and after screening event. The frequency of a screened event will correlate to the number overflows identified for the district.

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 Included in Model
2013 Baseline	195	195	5,311	37	N/A
2037 Master Plan – Control Option 1	195	195	5,311	37	IS, SC

Notes:

IS – In-line Storage

SC – Screening

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.

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 [a]
Baseline (2013)	65,328	64,937	-	20	0.157 m^3/s
In-line Storage	68,104	57,419 [b]	7,515	18	0.160 m^3/s
Control Option 1	**68,104**	**57,419 [b]**	**7,515**	**18**	**0.160 m^3/s**

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

b The benefit for this district is offset due to a modelled increase of overflow volume in the downstream Strathmillan district. Therefore, the proposed control option for this district should be programmed for after the Strathmillan control option construction.

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

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. District Cost Estimate – Control Option 1

Control Option	2014 Preliminary Proposal Capital Cost	2019 CSO Master Plan Capital Cost	2019 Annual Operations and Maintenance Cost	2019 Total Operations and Maintenance (Over 35-year period)
In-Line Storage	N/A [a b]	$2,590,000	$40,000	$940,000
Screens		$2,450,000 [c]	$50,000	$1,100,000
Subtotal	**N/A**	**$5,040,000**	**$90,000**	**$2,040,000**
Opportunities	N/A	$500,000	$10,000	$200,000
District Total	**N/A**	**$5,540,000**	**$100,000**	**$2,240,000**

[a] Screening and In-line not included in the Preliminary Proposal 2015 costing

[b] Solution developed as refinement to Preliminary Proposal work following submission of Preliminary Proposal costs. Costs for this item of work to be $3,050,000 in 2014 dollars.

[c] Cost for bespoke screenings return pump/force main not included in Master Plan as well 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 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	
	Screening	Screening was not included in the Preliminary Proposal estimate	
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 Moorgate district would be classified as a low potential for implementation of complete sewer separation as the only feasible approach to achieve the 98 percent capture future performance target in the representative year. However, opportunistic sewer separation within a portion of the district may be completed in conjunction with other major infrastructure work to address future performance targets. In addition, green infrastructure and off-line tank or tunnel storage may be utilized in key locations to provide additional storage and increase capture volume.

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	• Opportunistic Separation Increased use of GI • Off-line Tank / Tunnel Storage

The control options selected for the Moorgate district has been aligned for the 85 percent capture performance target based on the system wide basis, and the requirement for screening at all primary outfalls. The proposed solutions in the Moorgate district are influenced by the downstream Strathmillan district and these two districts should be assessed together. The expandability of the district to the future performance target will be restricted depending on the interaction of the system wide performance.

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

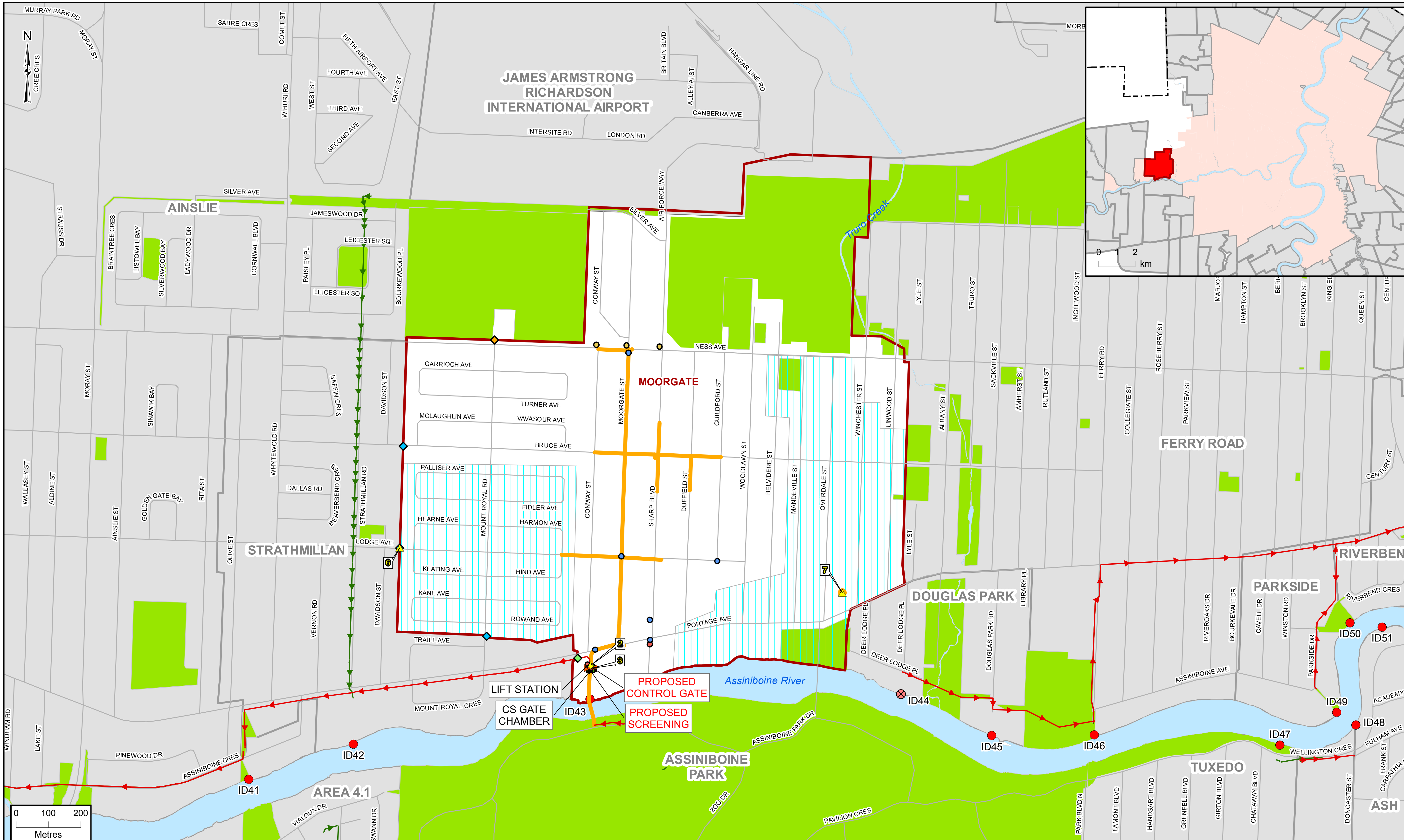
Table 1-12. Control Option 1 Significant Risks and Opportunities

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
9	Approvals and Permits	-	-	-	-	-	R	-	-
10	Land Acquisition	-	-	-	-	-	R	-	-
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 City of Winnipeg, Water and Waste Department. August



LEGEND

- Primary Weir
- Critical Elevation
- Decommissioned Outfall
- CSO Outfall
- Low CS Manhole

Inter-System Connection
- CS - LDS
- CS - WWS
- SRS - CS

District Boundary Crossing
- CS
- LDS
- WWS

- Interceptor Sewer
- Force Main
- Street
- District Boundary
- Watercourse
- Greenspace

CSO MASTER PLAN PROPOSED SOLUTIONS

- Proposed Control Gate
- 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 28
District Overview Map
Sewer District: Moorgate
City of Winnipeg
Combined Sewer Overflow Master Plan

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LEGEND

Primary Weir
Critical Elevation
CSO Outfall
Manhole
Flap Gate
Pump Location
Force Main
Sewer By Type
CS
SRS
WWS
Control Structure Type
Gate Chamber
Pump Station Type
Lift Station

CSO MASTER PLAN
PROPOSED SOLUTIONS
Control Gate
Screening

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 28-01
Control Gate and Screening
Sewer District: Moorgate
City of Winnipeg
Combined Sewer Overflow Master Plan

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