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CSO Master Plan

St. Johns District Plan

August 2019

City of Winnipeg

CSO Master Plan

Project No:	470010CH
Document Title:	St. Johns District Plan
Revision:	04
Date:	August 22, 2019
Client Name:	City of Winnipeg
Project Manager:	John Berry
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File Name:	StJohns_Plan_Final_CO1MP_08192019

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Document History and Status

Revision	Date	Description	By	Review	Approved
0	09/14/2018	DRAFT for City Comment	DT	SB MF SG	
1	03/12/2019	DRAFT 2 for City Review	SB	MF	MF
2	07/2019	Final Draft Submission	DT	MF	MF
3	08/15/2019	Revised Final Draft Submission	MF	MF	MF
4	08/19/2019	Final Submission For CSO Master Plan	MF	MF	SG

Contents

Tables

Figure

1. St. Johns District

1.1 District Description

The St. Johns district is located in the northwest sector of the combined sewer (CS) area along the western edge of the Red River and north of Selkirk district. The St. Johns district is approximately bounded by Alfred Avenue and Selkirk Avenue to the south, McPhillips Street to the west, Church Avenue and Atlantic Avenue to the north, and the Red River to the east.

The St. Johns district is primarily residential with single-family residential buildings located from McPhillips Street to Power Street and two-family residential buildings located from McGregor Street to Main Street. Commercial areas are located along Main Street and Mountain Avenue. Greenspace is distributed throughout St. Johns and includes Sinclair Park and Machray Park. There is approximately 9 ha of greenspace.

The Canadian Pacific Railway (CPR) Winnipeg Beach extends north-south through the western portion of the district. Regional roads in the district include Main Street, Salter Street, McGregor Street, Arlington Street and McPhilips Street in a north-south direction and Mountain Avenue and Redwood Avenue in the east-west direction.

1.2 Development

A portion of Main Street is located within the St. John's District. Main Street is identified as Regional Mixed Use Corridor as part of the OurWinnipeg future development plans. As such, focused intensification along Main Street is to be promoted in the future.

1.3 Existing Sewer System

St. John's district encompasses an area of 343 ha[1] and includes a CS system and a storm relief sewer (SRS) system. This district does not include any areas that may be identified as LDS separated or separation ready. St. John's contains a combined SRS and CS outfall pipe, where both systems connect upstream of the outfall gate chamber and are discharged through a single outfall. Additionally, the outfall may act as a high-level relief overflow for the Main Street interceptor. The Hart sewage pump station also discharges to the 2250 mm WWS main interceptor within the St. John's district via a 375 mm WWS secondary interceptor that connects to the interceptor just south of Mountain Avenue at Main Street but has no interaction with the St. John's District CS System.

The CS system includes a diversion chamber, flood pump station (FPS), a combined SRS/CS outfall and outfall gate chamber. A flap gate and sluice gate are installed on this outfall pipe in the outfall gate chamber to control backflow into the CS and SRS systems under high river level conditions along the Red River. The CS system drains towards the St. Johns diversion chamber located on the east side of Main Street at the intersection of Main Street and St. John's Avenue. At this diversion chamber combined sewage from the St. John's district is diverted to the Main Street interceptor under DWF conditions. All CS in excess of the district primary weir capacity spills over the primary weir for the district and flows by gravity through the St. John's CS outfall and may overflow to the Red River. The CS trunk extends from the diversion chamber to the CS outfall located at the eastern end of St. Johns Avenue.

A single CS sewer trunk collects flow from most of the district and flows to the diversion chamber on St. John's Avenue. This 1625 mm by 2025 mm CS trunk extends along St. John's Avenue from the outfall gate chamber to McGregor Street. Multiple lateral sewers extend north and south from this main trunk.

[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

The SRS system includes various interconnections to the CS throughout the district. The main 2900 mm SRS trunk sewer for the district runs along Mountain Avenue with SRS laterals extending north and south. During wet weather flow (WWF) events, the SRS system provides relief to the CS system via the interconnections. Most catch basins are still connected to the CS system; no partial separation has been completed. The SRS uses the same outfall as the CS system and may discharge directly to the Red River. The St. John's SRS System is connected with a portion of SRS system in the Selkirk District on Arlington Avenue and Burrows Avenue, and with the majority of the SRS System in the Jefferson West District via an interconnection at Mountain Avenue and McPhillips Street. There is also a 375 mm diversion pipe within the SRS that will send the SRS flow into the Main Street Interceptor. This diversion pipe is located just west of the intersection of Mountain Avenue and Charles Street. Under WWF conditions this diversion pipe will become surcharged, and all excess CS collected in the SRS will continue to the St. John's outfall to discharge to the river.

During dry weather flow (DWF), the SRS is not required; sanitary sewage flows to the diversion chamber upstream of the CS outfall and is diverted by the primary weir for the St. John's district to a1800 mm secondary interceptor pipe, where it flows by gravity west to connect to the Main Interceptor and eventually to the North End Sewage Treatment Plant (NEWPCC) for treatment.

During wet weather flow, any flows that exceeds the diversion capacity overtops the primary weir and may be discharged to the river. When the river levels in the Red River adjacent to the St. John's CS/SRS outfall is high, the flap gate on the outfall gate chamber will prevent gravity discharge to the river. Under these conditions, the excess flow is pumped by the St Johns FPS to a point in the St Johns CS Outfall downstream of the flap gate, where it can be discharged to the river by gravity.

The one CS outfall to the Red River (combined CS and SRS outfall) is as follows:

- ID28 (S-MA70007551) – St. Johns CS/SRS Outfall

1.3.1 District-to-District Interconnections

There are several district-to-district interconnections between St. Johns and the surrounding districts. Each interconnection is shown on Figure 38 and shows locations where gravity and pumped flow can cross from one district to another. Each interconnection is listed as follows:

1.3.1.1 Interceptor Connections – Downstream of Primary Weir

Polson

- The 2250 mm Main Interceptor flows by gravity north on Main Street from St. Johns district into Polson district towards the NEWPCC:
  - Invert at St. Johns district boundary 218.82 m (S-MA70008105)

1.3.1.2 Interceptor Connections – Upstream of Primary Weir

Selkirk

- The 2250 mm Main Interceptor flows by gravity into St. Johns district north on Main Street towards the NEWPCC for treatment:
  - Invert at Selkirk district boundary 219.83 m (S-MA00016856)

1.3.1.2 District Interconnections

Selkirk

<u>CS to CS</u>

- A 300 mm CS flows north by gravity on Arlington Street into St. Johns district from Selkirk district:

  - Invert at Selkirk district boundary 228.65 m (S-MA00014590)
- A 300 mm CS flows by gravity northbound on Aikins Street into St. Johns district:
  - Invert at Selkirk district boundary 227.20 m (S-MA00015124)
- A 300 mm CS flows by gravity north on Main Street and connects to the CS network in St. Johns district at the intersection of Main Street and Redwood Avenue:
  - Invert at Selkirk district boundary 227.60 m (S-MA00015398)

<u>SRS to SRS</u>

- A 2150 mm SRS flows by gravity eastbound on Burrows Avenue from St. Johns district into Selkirk district:
  - Invert at Selkirk district boundary 223.64 m (S-MA00014318)
- A 2150 mm SRS flows by gravity northbound on Arlington Street into St. Johns district:
  - Invert at Selkirk district boundary 223.57 m (S-MA00014588)
- High point manhole:
  - 300 mm CS on Selkirk Avenue – 229.19 m (S-MH00008778)
  - 300 mm CS on McGregor Street – 228.33 m (S-MH00013219)
- High sewer overflow:
  - 450 mm SRS on Artillery Street – 229.34 m (S-MH00012613)
  - 250 mm SRS on Alfred Avenue – 229.84 m (S-MH00012868)

Jefferson West

<u>SRS to SRS</u>

- A 2900 mm SRS trunk flows by gravity from Jefferson West district into St. Johns district on Mountain Avenue and connects to the SRS network in St. Johns district:
  - Invert at Jefferson West district boundary 224.78 m (S-MA00010486)

<u>SRS to CS</u>

- A 2150 mm SRS diverts from the CS system in Jefferson West district and flows eastbound by gravity on Burrows Avenue into St. Johns district:
  - Invert at Jefferson West district boundary 224.50 m (S-MA70015831)
- High sewer overflow:
  - Selkirk Avenue and McPhillips Street – 229.68 m (S-MH00008715)
  - Manitoba Avenue and McPhillips Street – 229.43 m (S-MH00008744)
  - Alfred Avenue and McPhillips Street – 229.49 m (S-MH00008303)
  - Aberdeen Avenue and McPhillips Street – 229.19 m (S-MH00008304)
  - McPhillips Street and Mountain Avenue – 225.46 m (S-MH00008426)
  - McPhillips Street and Mountain Avenue – 225.43 m (S-MH00008425)

Polson

<u>CS to WWS</u>

- The 750 mm Interceptor flows west by gravity on Polson Street from Polson district into St. Johns district into the 2250 mm Main Interceptor on Main Street:

- Invert at St. Johns district boundary 219.54 m (S-MA00018028)

CS to CS

- The main 1675 mm by 2150 mm CS trunk in Polson district flows by gravity into St. Johns district at the corner of Polson Avenue and Main Street:
  - Invert at Polson district boundary 222.99 m (S-MA00009348)
- A 925 mm by 1200 mm CS flows southbound on Main Street servicing sections of Polson district and crosses into St. Johns district where it connects to the main CS trunk at the corner of Polson Avenue and Main Street:
  - Invert at St. Johns district boundary 223.45 m (S-MA00009340)

CS to SRS

- A 750 mm SRS relieves the CS system on Machray Avenue in Polson district and flows by gravity southbound on Kildarroch Street into St. Johns district where it connects to the main 2900 mm SRS on Mountain Avenue:
  - Invert at St. Johns district boundary 225.20 m (S-MA00012123)
- A 750 mm SRS flows northbound by gravity on Salter Street and connects to the CS system in Polson district at the intersection of Salter Street and Polson Avenue:
  - Invert at Polson district boundary 224.55 m (S-MA00009212)
- A 450 mm SRS provides relief from the manhole at the intersection of Atlantic Avenue and Aikins Street in St. Johns district and flows by gravity to connect to the main CS in Polson district:
  - Invert at Polson district boundary 224.21 m (S-MA00009270)
- A 375 mm SRS flows southeast by gravity at Cathedral Avenue and Emslie Street from Polson district into St. Johns district:
  - Invert at St. Johns district boundary 225.69 m (S-MA00016728)
- A 450 mm SRS flows south by gravity on Emslie Street from Polson district into St. Johns district:
  - Invert at St. Johns district boundary 225.43 m (S-MA00015777)

CS to CS

- A 450 mm SRS flows by gravity from a manhole at the intersection of Main Street and Luxton Avenue where it relieves the CSs and connects to the 925 mm by 1200 mm CS in Polson district:
  - Invert at Polson district boundary 224.05 m (S-MA00009352)
- High point manhole:
  - Tinniswood Street – 229.48 m (S-MH00008542)
  - Radford Street – 229.45 m (S-MH00008556)
  - Monreith Street at Church Avenue – 229.24 m (S-MH00008543)
  - Robertson Street at Church Avenue – 228.90 m (S-MH00010474)
  - Kildarroch Street – 229.08 m (S-MH00010481)
  - Airlies Street at Church Avenue – 228.78 m (S-MH00010493)
  - Minnigaffe Street at Church Avenue – 229.271 m (S-MH00010536)
  - Penninghame Street at Church Avenue – 228.82 m (S-MH00010604)
  - Luxton Avenue – 228.34 m (S-MH00011069)
  - Atlantic Avenue – 227.71 m (S-MH00014025)
  - Bannerman Avenue at Emslie Street – 228.19 m (S-MH00014033)

- Cathedral Avenue at Emslie Street – 227.68 m (S-MH00014021)

- High sewer overflow:
  - Dalton Street at Machray Avenue – 229.35 m (S-MH00010407)
  - Bannerman Avenue – 227.96 m (S-MH00006413)

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.

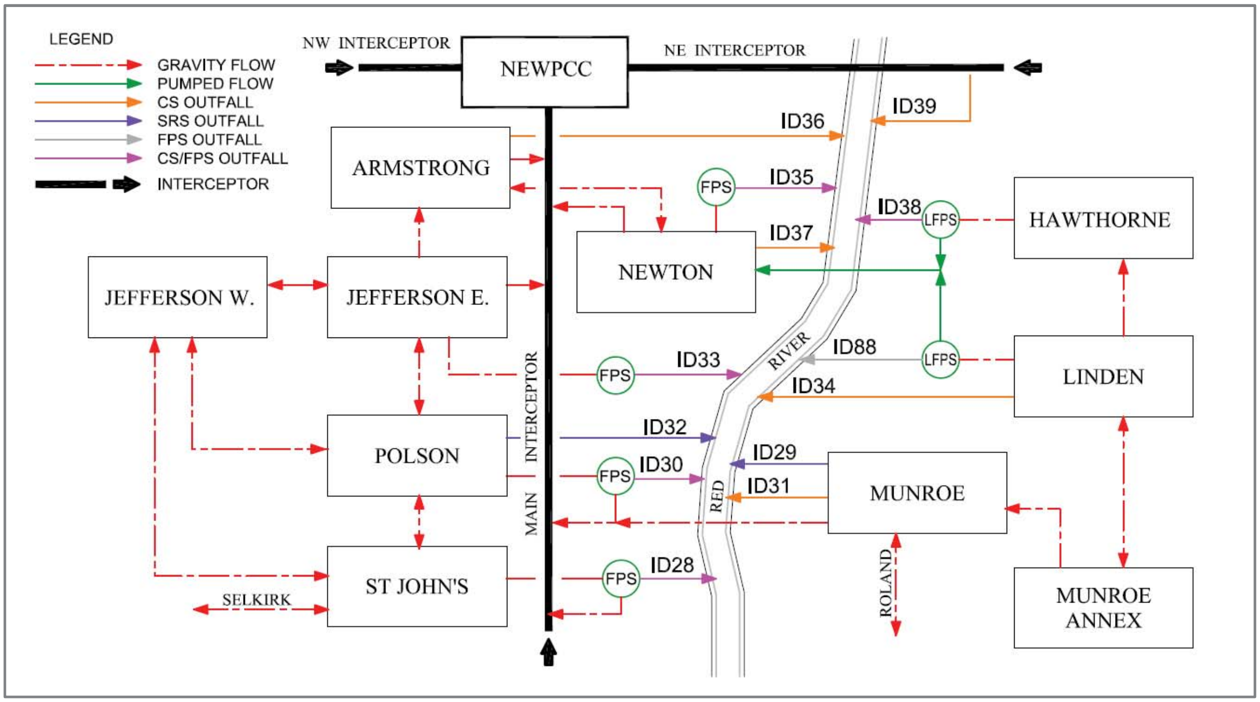


Figure 1-1. District Interconnection Schematic

1.3.2 Asset Information

The main sewer system features for the district are shown on Figure 11 and listed in Table 1-1.

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Combined Sewer/SRS Outfall (ID28)	S-CO70007985.1	S-MA70007551	3000 mm	Red River Invert: 220.66 m
Flood Pumping Outfall (ID28)	S-CO70007985.1	S-MA70007551	3000 mm	Red River Invert: 220.66 m
Other Overflows	N/A	N/A	N/A	
Main Trunk	S-TE00006659.1	S-MA00015615	1625 x 2025 mm	Egg-shaped Invert: 223.28 m
SRS Interconnections	N/A	N/A	N/A	89 SRS - CS
Main Trunk Flap Gate	S-TE70026922.2	S-CG00000886	3000 mm	Invert: 221.97 m
Main Trunk Sluice Gate	S-CS00000450.1	S-CG00001019	1330 x 1330 mm	Invert: 221.17 m
Off-Take	S-TE00006662.2	S-MA70017206	600 mm	Invert 223.06 m
Dry Well	N/A	N/A	N/A	

Table 1-1. Sewer District Existing Asset Information

Asset	Asset ID (Model)	Asset ID (GIS)	Characteristics	Comments
Lift Station Total Capacity	N/A	S-MA70017206 [(1)]	600 mm [(1)]	2.265 m3/s [(1)] (minimum pff 0.058 m^3/s downstream)
ADWF	N/A	N/A	0.045 m^3/s	
Lift Station Force Main	N/A	N/A	N/A	St Johns is a gravity discharge district.
Flood Pump Station Total Capacity	N/A	N/A	3.8 m^3/s	2 x 1.4 m^3/s 2 x 0.52 m^3/s
Pass Forward Flow – First Overflow	N/A	N/A	0.311 m^3/s	

Notes:

[(1)] – Gravity pipe replacing Lift Station as St Johns is a gravity discharge district
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	St. Johns – 223.68
2	Trunk Invert at Off-Take	N/A
3	Top of Weir	223.77
4	Relief Outfall Invert at Flap Gate	N/A
5	Low Relief Interconnection (S-MH00013765)	221.76
6	Sewer District Interconnection (Polson)	222.96
7	Low Basement	229.97
8	Flood Protection Level (St. Johns)	229.14

[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 completed in St. Johns was the Flood Relief Study (IDE, 1980). A storm relief sewer (SRS) system was installed in the district as a result of this study. No other work has been completed on the district sewer system since that time.

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 St. John's Combined Sewer 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	Planned Completion
38 – St. Johns	1980	Future Work	2013	Study Complete	N/A

Source: Report on Flood Relief Study, 1980

1.5 Ongoing Investment Work

There is ongoing maintenance and calibration of permanent instruments installed within the primary outfall within the St. John's district. This consists of monthly site visits in confined entry spaces to ensure physical readings concur with displayed transmitted readings, and replacing desiccants where necessary.

1.6 Control Option 1 Projects

1.6.1 Project Selection

The St. Johns district has latent storage, in-line storage via control gate, gravity flow control, and floatable control via screening proposed to meet CSO Control Option 1. Program opportunities including green infrastructure (GI) and real time control (RTC) will also be included as applicable.

Table 1-4 provides an overview of the control options included in the 85 percent capture in a representative year option.

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 and SRS systems are suitable for use as in-line and latent storage. These control options will take advantage of the existing CS pipe network for additional storage volume. Existing DWF from the collection system will remain the same, and overall district operations will remain the same.

A gravity flow controller is proposed on the CS system to optimize the dewatering rate from the district back into the Main Street interceptor. St. Johns district discharges to the interceptor by gravity; therefore, it will also require a method of flow control to optimize and control the discharge rate to the interceptor for future dewatering RTC controls. Refer to Section 3.3.5 of Part 2 for discussion on the interaction of the gravity control on the system for all gravity discharge locations.

Floatable control will be necessary to capture any undesirable 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. Screens will be installed downstream of the diversion chamber located near Main Street and St. Johns Avenue.

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.

1.6.1 Latent Storage

Latent storage is proposed as an alternative control option for the St. Johns district. Latent storage will use the existing St. Johns SRS system. It is proposed to isolate the SRS from the CS outfall system, the St Johns district has a shared CS outfall (S-MA70007551) via the installation of a new flap gate. The proposed location of the new flap gate chamber is shown on Figure 38-02. The latent storage level in the system is controlled by river level and the resulting backpressure of the river level on the St. Johns SRS outfall flap gate, as explained in Part 3C. The latent storage design criteria are identified in Table 1-5. As noted in Section 1.3, the district has a gravity connection directly to the Main Interceptor sewer. This proposal allows the City to control and monitor the latent storage discharge needed as part of the future RTC controls. This will also isolate the SRS system from reverse flow and acting as overflow from Main Street Interceptor under spatial rainfall conditions.

Table 1-5. Latent Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Invert Elevation	221.97 m	New Flap Gate invert
NSWL	223.68 m	
Trunk Diameter	2900 mm	
Design Depth in Trunk	1710 mm	
Maximum Storage Volume	8204 m^3	
Force main	300 mm	
Flap Gate Control	N/A	
Lift Station	Yes	
Nominal Dewatering Rate	0.085 m^3/s	Based on 24-hour emptying requirement
RTC Operational Rate	TBD	Future RTC/ dewatering assessment.

Note:

NSWL - normal summer water level
RTC – Real Time Control

Latent storage is accessible and has a lower risk than other storage types. In order to facilitate an operational latent system, a latent pump station and interconnecting pipes will be required to access the storage. A conceptual layout for the pump station and force main is shown on Figure 38-02. The pump station will be located adjacent to the SRS outfall gate chamber at the edge of St. Johns Avenue. The latent force main will pump to the manhole along the Main Interceptor on Main Street (S-TE00006649). The pump station will operate to dewater the SRS system in preparation for the next runoff event, the requirement for the system to be ready for the next event within a 24-hour period after completion of the previous event. The existing SRS system has a gravity discharge connection directly to the Main Interceptor via a 375mm diameter pipe and this has been replaced in this latent storage proposal. However, the inclusion of the latent pump station will allow the City to control the discharge flows for the future RTC considerations.

Figure 38 identifies the extent of the SRS system within Selkirk district that would be used for latent storage. The maximum storage level is directly related to the NSWL, and the size and depth of the SRS system. Once the level in the SRS exceeds the river level, the flap gate opens, and the combined sewage in the SRS system is discharged to the river.

The river level backpressure will keep the SRS flap gate closed and system level maintained at or below the NSWL. This level utilizes 59 percent of the SRS pipe height and it was found that additional flap gate control is not recommended as required to meet the Control Option 1 requirements. In situations where non modelled assessments are to be completed, the actual river levels will be both lower and higher than the NSWL level at various points throughout an annual year. Where the level is below NSWL, the latent volume will be less than predicted during the MP assessment, while conversely when the level is above the NSWL, the latent volume will be more than predicted. The continuous assessment is seen as a conservative approach since the majority of the representative year rainfall events occur when the river levels are higher than the NSWL.

The lowest interconnection between the combined sewer and relief pipe systems is higher than the proposed latent and in-line storage control levels, meaning that the two systems would function independently.

As described in the standard details in Part 3C wet well sizing for the latent pump station will be determined based on the final pump selection, operation and dewatering capacity required. The interconnecting piping between the new gate chamber and the pump station would be sized to provide sufficient flow to the pumps while all pumps are operating.

1.6.2 In-Line Storage

In-line storage is proposed as a CSO control for the St. Johns district. 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 and 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. The standard approach used for conceptual gate sizing was to assume 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 the in-line storage are listed in Table 1-6.

Table 1-6. In-Line Storage Conceptual Design Criteria

Item	Elevation/Dimension	Comment
Invert Elevation	223.28 m	Downstream invert of lowest pipe at diversion chamber
Trunk Diameter	1625 x 2025 mm	
Gate Height	0.62 m	Gate height based on half trunk diameter assumption
Top of Gate Elevation	224.39 m	
Maximum Storage Volume	188 m^3	
Nominal Dewatering Rate	0.058 m^3/s	Based on minimum pass forward rate for gravity discharge district (pipe full capacity)
RTC Operational Rate	TBD	Future RTC/ dewatering assessment

Notes:

NSWL = normal summer water level
RTC = real time control

The proposed control gate will cause combined sewage to back-up within the collection system to the extent shown on Figure 38. 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 existing DWF diversion will continue with its current operation, with all DWF being diverted to the Main Interceptor.

Figure 38-01 provides an overview of the conceptual location and configuration of the control gate and screening chambers. The proposed control gate will be installed in a new chamber within the trunk sewer alignment and located west of the Selkirk FPS. The dimensions of a new chamber to provide an allowance for a side weir for floatables control are 5.1 m in length and 3.0 m in width to accommodate the gate, with an allowance for a longitudinal overflow weir. The existing sewer configuration may have to be modified to allow the installation of the in-line gate and screening chambers. The physical requirements for the off-take and station sizing for a modification to pumping capacity have not been considered in detail, but they will be required in the future as part of an RTC program or FPS rehabilitation or replacement project. It is envisaged that a road closure would be necessary to allow construction activities to occur with minor disruptions to local residents. Road access could be achieved via adjacent local roads and the location within the local street is adjacent to the St John’s Park reducing resident disruptions.

The lowest interconnection between the combined sewer and relief pipe systems is higher than the proposed latent and in-line storage control levels, meaning that the two systems would function independently.

The nominal rate for dewatering is determined by the performance of the existing pipe capacity as the district is a gravity discharge district. As such the flows will vary over the duration of a rainfall event and has been nominated for a gravity flow control device. Any future consideration, for RTC improvements, would be completed with spatial rainfall as any reduction to the existing pipe capacity/operation for large events will adversely affect the overflow at this district. The control device would be set to a rate similar to the existing pipe full capacity to allow the set limit to be known. This would allow the future RTC control the ability to capture and treat more volume for localized storms in other districts by using the excess interceptor capacity made available by restricting the pass forward flows through the control device where the runoff is less.

1.6.3 Gravity Flow Control

St. Johns district does not include a lift station (LS) and discharges directly to the Main interceptor by gravity. A flow control device will be required to control the diversion rate and the level of in-line storage for future RTC and dewatering assessments.

A standard flow control device was selected as described in Part 3C. This controller is considered suitable for the immediate dewatering rate control and future RTC applications. The device will include flow measurement and a gate to control the flow rate. This has been taken as part of the City’s future vision to develop a fully integrated CS system network and will be needed to review flows during spatial rainfall WWF scenarios. The CSO Master Plan assessment utilized a uniform rainfall event and no further investigative work has been completed within the CSO Master Plan.

The flow control will be installed at an optimal location on the connecting sewer downstream of the diversion chamber within the offtake pipe or secondary interceptor, but upstream of the Main interceptor. Figure 38-01 identifies a conceptual location for the installation of the flow controller. A small chamber or manhole with access for cleaning and maintenance will be required. The flow controller will operate independently and require minimal operation interaction. The diversion weir height at the St. Johns CS outfall may have to be adjusted to match the hydraulic performance of the flow controller. The structure would be located on the boulevard of Main Street and minor road closures would be required to provide sufficient working space during construction. This would cause disruptions to the street traffic along Main Street, but this would only be for a minimum amount of time during construction.

1.6.4 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 overflow which discharges over the existing weir will be directed to the screens located in a new screening chamber, with screened flow discharged to the downstream side of the screening chamber to the river.

The type and size of screens depend on the LS and the hydraulic head available for operation. A generic design was assumed for screening and is described in Part 3C. The design criteria for screening with gate control implemented, are listed in Table 1-7.

Table 1-7. Floatables Management Conceptual Design Criteria

Item	Elevation/Dimension/Rate	Comment
Top of Gate	224.39 m	
Bypass Weir Crest	224.29 m	
NSWL	223.68 m	
Maximum Screen Head	0.607 m	
Peak Screening Rate	1.2 m^3/s	
Screen Size	1.5 m x 1.0 m	Modelled Screen Size

The proposed side overflow weir and screening chamber would be located adjacent to the existing combined trunk sewer, as shown on Figure 38-01. The screens will operate once levels within the sewer surpassed the in-line control elevation. A side weir upstream of the gate will direct the 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 would include screenings pumps with a discharge returning the screened material back to the interceptor and on to the NEWPCC for removal. As this will be constructed with the control gate chamber, construction activity disruptions will be the same.

The dimensions for the screen chamber to accommodate influent from the side weir, the screen area, and the routing of discharge downstream of the gate are 4.3 m in length and 3.1 m in width.

1.6.5 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 will be reviewed to identify applicable GI controls.

St. Johns has been classified as a medium GI potential district. Land use in St. Johns is mix of residential and commercial. The east end of the district is bounded by the Red River. This district would be an ideal location for cisterns/rain barrels, and rain garden bioretention within the residential areas. Commercial areas are suitable to green roofs and parking lot areas are ideal for paved porous pavement.

1.6.6 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.

The latent storage would take advantage of the SRS infrastructure already in place, therefore, minimal additional maintenance will need to be anticipated. The proposed latent LSPS will require regular maintenance that would depend on the frequency of operation. The flap gate proposed will require maintenance inspection for continued assurance that the flap gate would open during WWF events.

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.

The flow controller will require the installation of a chamber and flow control equipment. Monitoring and control instrumentation will be required. The flow controller will operate independently and require minimal operation interaction. Regular maintenance of the flow controller chamber and appurtenances will be required.

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 summarized in Table 1-8.

Table 1-8. InfoWorks CS District Model Data

Model Version	Total Area (ha)	Contributing Area (ha)	Population	% Impervious	% Impervious
2013 Baseline	325	325	15,929	70	N/A
2037 Master Plan – Control Option 1	325	325	15,929	70	Lat St, SC, IS

Notes:

SC = Screening

IS = In-line Storage
Lat St = Latent Storage

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 1-9 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. Table 1-9 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 1-9. Performance Summary – Control Option 1

Control Option	Preliminary Proposal	Master Plan			
	Annual Overflow Volume (m^3) [a]	Annual Overflow Volume (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [c]
Baseline (2013)	332,572	181,444	-	12	0.314 m^3/s
Latent Storage	335,263 [b]	- [d]	-	-	0.314 m^3/s
In-line & Latent Storage		- [d]	-	17	0.157 m^3/s
Tunnel, In-line & Latent Storage	72,428	N/A	N/A	N/A	N/A
Control Option 1	**72,428**	**- [d]**	**- [d]**	**- [d]**	**- [d]**

[a] Direct gravity connection from SRS system to Main Street Interceptor not included in Preliminary Proposal modelling assessment

[b] Latent and In-Line Storage were not simulated independently during the Preliminary Proposal assessment

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

[d] Model instability issues encountered with the St John's district as part of the Master Plan performance evaluation for overall City of Winnipeg sewer network. The individual district performance values were instead utilized for the control option performance evaluation, and are shown in the table below. Improvements to be investigated, CO1MP proposals allows system wide 85 percent capture target to be achieved.

Table 1-10. Performance Summary – Control Option 1 (Individual Model)

Control Option	Master Plan Overflow Reduction (m^3)	Overflow Reduction (m^3)	Number of Overflows	Pass Forward Flow at First Overflow [a]
Revised Baseline (2013)	149,432	-	17	0.314 m^3/s
Latent Storage	146,112	3,320		0.314 m^3/s
Latent & In-line Storage	125,828	20,284	17	0.157 m^3/s
Control Option 1	**125,828**	**23,604**	**17**	**0.157 m^3/s**

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

The revisions to the baseline model performance is attributed to the updates to the InfoWorks model through the model maintenance process including the addition of a gravity discharge from the St Johns SRS system directly to the Main Interceptor. The performance of the district is seemingly negative due to the interaction of this gravity discharge district with the adjacent districts. No single change to the adjacent system for the 85 percent capture has been selected as the main contributor. The reduction in pass forward flows is attributed to the increase in CS in-line storage and the overflow profile being the same but the interaction with the Main Interceptor sewer being at a higher level for an extended period while other districts are contributing to the flows in the interceptor.

The percent capture performance measure is not included in Table 1-9, 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 1-11. The cost estimates are a Class 5 planning level estimates with a level of accuracy of minus 50 to plus 100 percent.

Table 1-11. 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 Cost (Over 35-year period)
Latent Storage	N/A [a]	$3,140,000 [c]	$88,000	$1,890,000
Gravity Flow Control	N/A	$1,350,000	$34,000	$740,000
In-Line Storage	$7,740,000 [b]	$2,570,000 [d]	$44,000	$940,000
Screening		$3,220,000 [e]	$48,000	$1,040,000
Offline Tunnel Storage	$6,960,000	N/A	N/A	N/A
Offline Tank Storage	$21,550,000	N/A	N/A	N/A
Subtotal	**$36,240,000**	**$10,280,000**	**$215,000**	**$4,610,000**
Opportunities	N/A	$1,030,000	$21,000	$460,000
District Total	**$36,240,000**	**$11,310,000**	**$236,000**	**$5,070,000**

[a] Latent Storage not included in the Preliminary Proposal

[b] In-line Storage and Screening not costed separately in the Preliminary Proposal

Table 1-11. 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 Cost (Over 35-year period)

[c] Flap gate at new latent storage chamber not included in Master Plan costs.

[d] Cost associated with new off-take construction, as required, to accommodate control gate and screening chambers in location and allow intercepted CS flow to reach existing St John's gravity discharge was not included in Master Plan

[e] Cost for bespoke screenings 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 opportunities, with no additional cost 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 1-12.

Table 1-12. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
Control Options	Latent Storage	Not included in the preliminary estimate.	Added for the Master Plan to ensure the flows can be controlled for future RTC measures.
	Gravity Flow Controller	A flow controller was not included in the preliminary estimate	Added for the Master Plan to further reduce overflows.
	In-Line Storage	Updates to pricing and scope of work as part of Master Plan assessment.	
	Removal of Offline Tunnel Storage	Found to not be required to meeting Control Option 1 target during Master Plan assessment.	

Table 1-12. Cost Estimate Tracking Table

Changed Item	Change	Reason	Comments
	Removal of Offline Tank Storage	Found to not be required to meeting Control Option 1 target during Master Plan assessment.	
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 1-13 provides a description of how the regulatory target adjustment could be met by building off the proposed work identified in Control Option 1.

Overall the St Johns 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 increased capture volume. The existing SRS system could potentially be further utilized via the inclusion of flap gate control and flows to the Main Interceptor controlled further through the isolation of the gravity connection from the SRS to CS system on Mountain Avenue, although the removal of this connection will require additional infrastructure to ensure overflow volumes are improved.

Table 1-13. Upgrade to 98 Percent Capture in a Representative Year Summary

Upgrade Option	Viable Migration Options
98 Percent Capture in a Representative Year	• Opportunistic Sewer Separation • Increased use of GI • Further revisions to latent storage (flap gate control) • Off-Line Storage (Tank/Tunnel)

The control options for the St Johns district has been aligned for the 85 percent capture performance target based on the system wide evaluation basis. The interaction with the main interceptor and adjacent districts makes the expandability of this district to meet the 98 percent capture target potentially difficult without the increased isolation of the district or removal/storing of wet weather flows in the system.

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 as part of the CSO Master Plan 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 1-14.

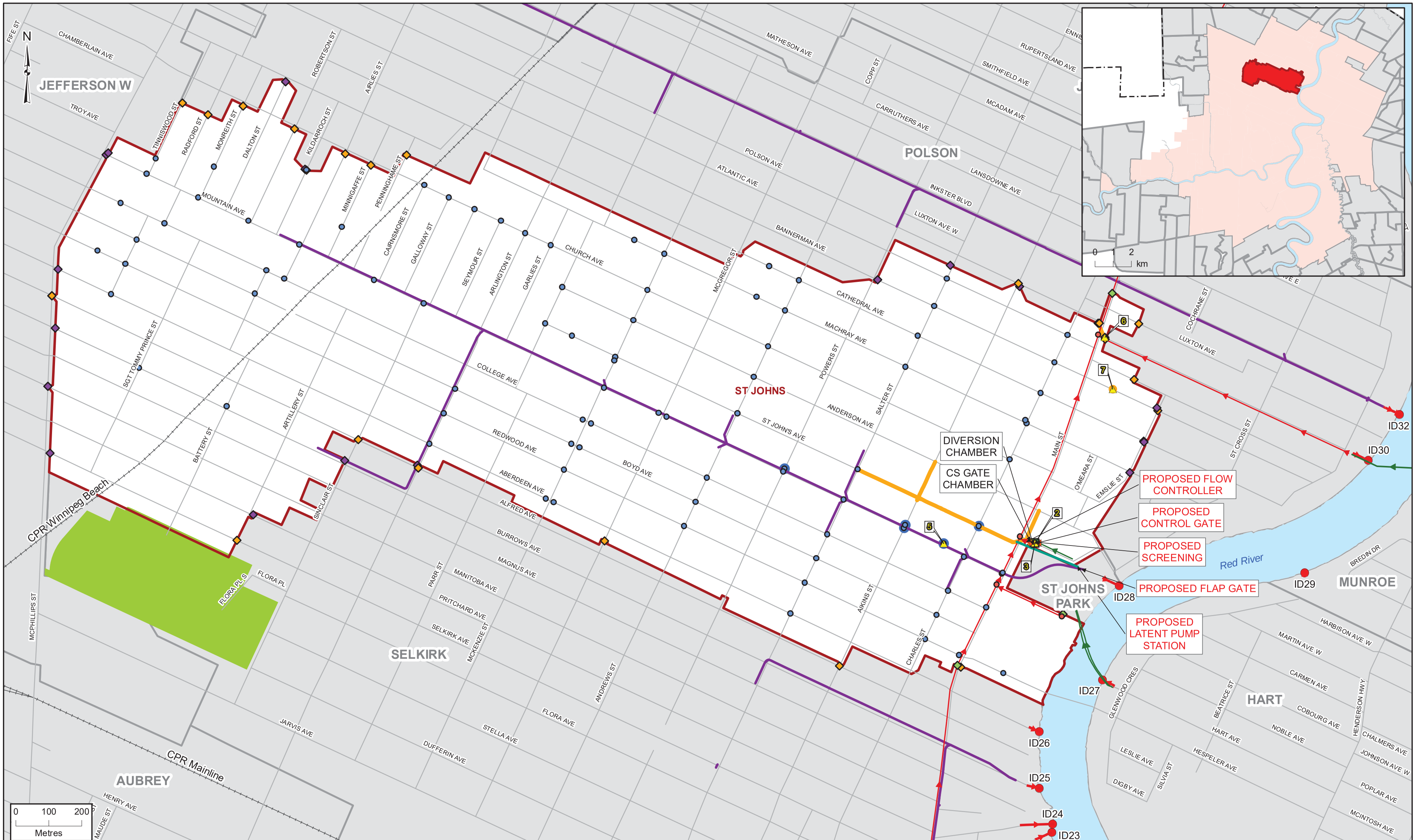
Table 1-14. Control Option 1 Significant Risks and Opportunities

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	R	-	-	-	-	-	-
2	Existing Lift Station	-	R	-	-	-	-	R	-
3	Flood Pumping Station	-	-	-	-	-	-	-	-
4	Construction Disruption	-	-	-	-	-	-	-	-
5	Implementation Schedule	-	-	-	-	-	-	R	-
6	Sewer Condition	R	R	-	-	-	-	-	-
7	Sewer Conflicts	R	R	-	-	-	-	-	-
8	Program Cost	O	O	-	-	-	-	-	O
9	Approvals and Permits	-	-	-	-	-	R	-	-
10	Land Acquisition	-	-	-	-	-	R	-	-
11	Technology Assumptions	R	-	-	-	-	O	O	-
12	Operations and Maintenance	R	R	-	-	-	R	O	R
13	Volume Capture Performance	O	O	-	-	-	O	O	-
14	Treatment	R	R	-	-	-	O	O	R

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

1.12 References

I.D. Engineering (IDE). 1980. *Flood relief study - St. John's and Polson districts and the Sisler ward*. Prepared for the City of Winnipeg.



LEGEND

- Primary Weir
- Critical Elevation
- CSO Outfall
- Low CS Manhole
- Low SRS Connection

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

District Boundary Crossing
- CS
- SRS
- WWS

- Interceptor Sewer
- Force Main
- Street
- Railway

- District Boundary
- Watercourse
- Greenspace

CSO MASTER PLAN PROPOSED SOLUTIONS

- Proposed Control Gate
- Latent Force Main
- Latent Storage Limit
- Extent of In-line Storage

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 38
District Overview Map
Sewer District: St. Johns
City of Winnipeg
Combined Sewer Overflow Master Plan

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LEGEND

- Primary Weir
- Critical Elevation
- Manhole
- Force Main

Sewer By Type
- CS
- WWS

Control Structure Type
- Gate Chamber

Pump Station Type
- Diversion Chamber

CSO MASTER PLAN
PROPOSED SOLUTIONS
- Proposed Latent Force Main
- Control Gate
- Screening
- Flow Controller

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 38-01
Control Gate, Screening and Flow Control
Sewer District: St. Johns
City of Winnipeg
Combined Sewer Overflow Master Plan

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LEGEND

Primary Weir
Critical Elevation
Manhole
Force Main

Sewer By Type: CS, SRS, WWS

Control Structure Type: Gate Chamber

Pump Station Type: Diversion Chamber

CSO MASTER PLAN
PROPOSED SOLUTIONS

Proposed Latent Force Main
Flap Gate
Control Gate
Screening
Flow Controller
Latent Pump

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 38-02
Latent SRS Control
Sewer District: St. Johns
City of Winnipeg
Combined Sewer Overflow Master Plan

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