Water and Waste
Eaux et déchets

Environment and Climate
Environmental Stewardship Division
Environmental Compliance and Enforcement Branch
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March 31, 2023
Client File No.: 3205.00
Our File Nos.: S-734, EMS
020-17-08-11-00
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Attention: Yvonne Hawryliuk, MSc, Acting Director

RE: ENVIRONMENT ACT LICENCE NO. 3042

The City of Winnipeg is pleased to submit the enclosed 2022 CSO Annual Report in response to the requirements within the Environment Act Licence No. 3042 submitted to the City of Winnipeg September 4, 2013.

This submission complies with the requirements within Clause 13 of Environment Act Licence No. 3042, Clause C of the November 13, 2019 CSO Master Plan approval letter, the December 23, 2019 annual report outline and the June 7, 2022 CSO Annual Report letter.

Should you have any questions on this submission, please contact Ms. Michelle Paetkau, P. Eng., at 204-986-4904 or by email at mpaetkau@winnipeg.ca.

Sincerely,

Chris W. Carroll
Manager of Wastewater Services

Attachment

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City of Winnipeg
2022 CSO Annual Report

Environment Act Licence No. 3042
Clause 13

Prepared for

Environment and Climate

March 2023

City of Winnipeg 2022 CSO Annual Report

Client File No:	3205.00
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Document History and Status

Revision	Prepared by	Reviewed by	Date	Approved by	Date
01	F.Lee, P.Coote	N.Clinch, A.McMillan, J.Friesen, R.Grosselle, N.Crawford, M.Gajda, B.Raddatz, M.Paetkau, L.Marquardson, C.Wiebe S. Lambert	March 24, 2023	C.Carroll, M.Paetkau	March 30, 2023

Water and Waste Department • Service des eaux et des déchets

Executive Summary

In November 2019, Manitoba Environment and Climate (the Province), formerally known as Manitoba Conservation and Climate, approved the City of Winnipeg's (City) Combined Sewer Overflow (CSO) Master Plan (MP) as part of the City's Combined Sewer Environment Act Licence (EA No. 3042). Clause 13 requires the CSO Annual Report to include a progress report on the CSO Master Plan on or before March 31 of the preceding year (see Section 2.2).

CSO Master Plan Progress

This is the fourth progress report on the CSO Master Plan and covers the year 2022. It includes costs, budget, schedules, completed work, and performance along with 2023 planned contracts and forecasts.

The CSO Master Plan was on schedule and budget for completion by the Provincial deadline of 2045 (Program Scenario 1) in 2022. To meet this timeline, the City will need funding support from both the Provincial and Federal Governments starting in 2023. Without this, the CSO Master Plan will move to a longer implementation timeline of 2095 based on City-only funding (Program Scenario 3).

The CSO Master Plan's estimated capital cost of $1.15 billion in 2019 dollars (see Section 3.2) is based on required infrastructure to meet the 85% control target. In 2022, the City's CSO Master Plan budget was $30 million, providing total available budget of $72 million. A significant amount of the budget is being held over for the large Ferry Road Rutland Trunk contract scheduled for 2024 (see Section 4.2.2). In 2021, City Council recommended a $60 million increase to the CSO Master Plan budget over 4 years from 2024 to 2027 ($15 million a year).

There is no new CSO volume reduction to report this year. Although sewer separation works continue, improvements to the hydraulic model network to reflect the latest separation work were not undertaken in 2022. Improvements to reflect completed separation works are anticipated in future model updates. The CSO volume percent capture remains at 75 percent (Section 4.1). The associated risks and opportunities of the CSO Master Plan are documented in Section 3.9.

Current Year Results

Annual CSO results are primarily impacted by the amount of precipitation and the river levels.

1. Precipitation
   In 2022, there was approximately 74 percent more precipitation for the entire year, and 46 percent more precipitation during the recreation season, when compared to the 1992 Representative Year. Overall, the last ten years have shown an average one percent increase in total precipitation compared to the 1992 Representative Year (Section 5).

2. River Level
   The 2022 river level was higher overall thanthe 1992 Representative Year. It was also higher than the 1-in-5-year average in the recreation season (May – September). This was caused by high precipitation in winter 2021/2022 and throughout the 2022 recreation season.

In 2022, there were 2,046 CSO events with an estimated sewage discharge of 27,524 ML. This represents an increase from 2021 in both the number of CSO events and in overall CSO volume (see Section 5) as a result of the precipitation and river levels in 2022.

In 2022, an additional CSO location was instrumented, increasing the total number from 45 to 46 locations and improving the accuracy of the reported results. In total, 94 percent of the CSO results were validated.

Next Steps

As directed in the CSO Master Plan, the City will continue to work on sewer district separation projects currently underway (see Section 4.5). The 2023 planned capital projects include planning, design, and/or construction in the Armstrong, Ferry Road / Riverbend, Cockburn / Calrossie, Jefferson East, St John's and Hawthorne districts.

The City will also commence water quality monitoring in 2023 to meet the Provincial December 2024 River Water Quality Report deadline.

The City will continue to explore opportunities for sewer system optimization, green infrastructure and additional storage options to improve CSO performance monitoring and volume reduction. Furthermore, the City will continue regular communication with regulatory bodies and stakeholders throughout the delivery of the CSO Master Plan.

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Acronyms and Abbreviations

CEC	Clean Environment Commission
AACE	American Association of Cost Engineers International
AAF	average annual flow
City	City of Winnipeg
CO	Control Option
CS	combined sewer
CSO	combined sewer overflow
DEP	district engineering plan
EA	Environment Act Licence
ECP	Environment, Climate and Parks
EMC	event mean concentrations
GI	green infrastructure
LDS	land drainage sewer
MCC	Manitoba Conservation and Climate
MDS	Manitoba Sustainable Development
NEWPCC	North End Sewage Treatment Plant
No.	Number
NPRI	National Pollutant Release Inventory
O&M	operations and maintenance
PLUM	Planning Land Use Model
POC	pollutants of concern
PWWF	peak wet weather flow
P2	Pollution Prevention Plan
RFP	Request for Proposal
RTC	real time control
SEWPCC	South End Sewage Treatment Plant
SFD	single family dwelling
SOIS	Sewer Overflow Information System
SRS	storm relief sewer
TP	total phosphorus
TN	total nitrogen
WEWPCC	West End Sewage Treatment Plant
WSER	Wastewater Systems Effluent Regulations
WWF	wet weather flow
WWS	wastewater sewer

1. Purpose

The operation of the City of Winnipeg (City)'s combined sewer overflow system is governed by Environment Act Licence (EA) No. 3042. To comply with Clause 13 of EA No. 3042 the City is required to submit an annual report documenting Combined Sewer Overflow (CSO) Master Plan implementation progress and work planned for the subsequent year by March 31 of each year (referred to throughout this document as the "Annual Report").

The Annual Report provides an overview of the cost, budget, schedule, performance, CSO 85 percent volume reduction target, current year CSO results, capital improvements, milestones achieved, and the work plan for the subsequent year. It also provides an overview of the process used to evaluate CSO discharge, which is mandated by Clause 14 of EA No. 3042.

As part of Clause 14 of EA No. 3042, the City must submit an annual CSO Results Report for the preceding year by February 15 of each year. The CSO Results Report estimates the sewage volume that is discharged to receiving streams from CSO events in the preceding year. It complies with the National Pollutant Release Inventory (NPRI) and Wastewater Systems Effluent Regulations (WSER) annual reporting requirements.

2. Recent Changes

This section is to reflect the recent changes to the sewer system, regulations and CSO Master Plan implementation in 2022. Please refer to the 2021 CSO Annual Report for full summary of program background. The City webpage also contains Winnipeg CSO background information with links to past key documents.

Combined sewers are regulated by federal and provincial requirements. On an annual basis, the City submits annual CSO discharge data to NPRI, WSER and the Province to comply with both the federal and provincial regulations.

2.1 Sewer Network Changes

Like many cities in North America, Winnipeg has a combined sewer system. Combined sewers are designed to collect both land drainage (rainwater and snowmelt) and wastewater (sewage from homes and businesses) in the same pipe, and transport both to the sewage treatment plant before being released into the river. In large wet weather events, however, the sewer capacity can be exceeded with excess rainwater or snowmelt, causing the contents of the combined sewers to overflow into the rivers.

Please refer to Appendix A for the list of ongoing and completed projects of 2022 that the City undertook.

Furthermore, the sewer network changes from these projects service the public at large and can, in some instances, accommodate population growth. This is to align with the goals of OurWinnipeg and the Complete Communities Direction Strategy.

2.2 Regulation Changes

The regulation changes in 2022 included the request for development information and the significant event reporting, refer to Section 3.1.5 Planning Projections for further information.

A copy of the Provincial letter on signficiant report reporting can be found in Appendix B.

2.3 CSO Master Plan Changes

There was no changes to the CSO Master Plan Implementation approach in 2022.

3. CSO Master Plan Implementation

The CSO Master Plan began its implementation phase upon the receipt of the Provincial approval letter, see Appendix C, in November 2019. A high level CSO Master Plan Implementation timeline with a number of the future significant milestones is provided in Figure 1.

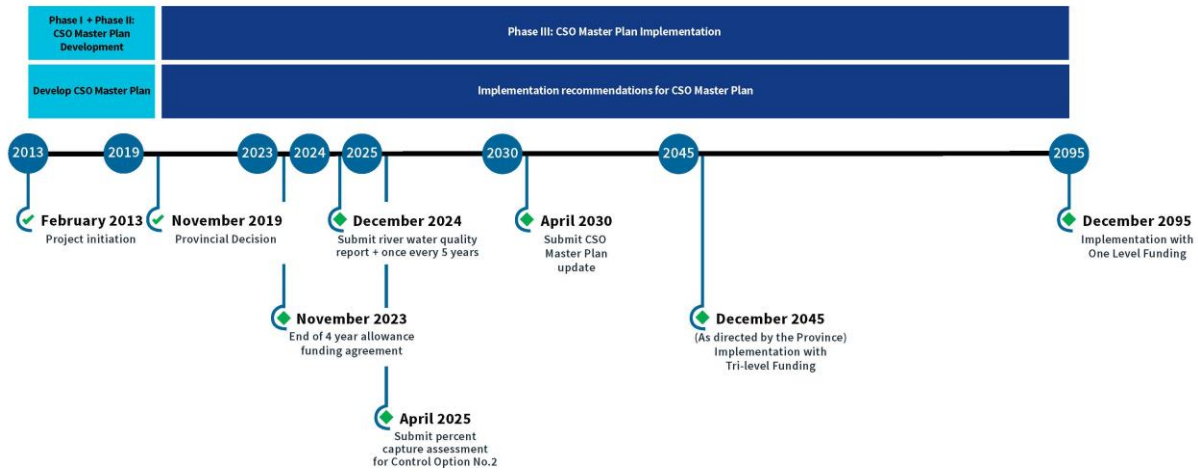


Figure 1 - CSO Master Plan Implementation Timeline

3.1 Master Plan Key Components

The following subsections identify the major considerations in the design of the CSO Master Plan to meet the requirements of EA No. 3042. These considerations will shape the reporting process for implementation of the CSO Master Plan.

3.1.1 Hydraulic Modelling

Monitoring instrumentation and analysis tools are crucial components to the development of the proposed solutions for the CSO Master Plan. At the beginning of the federally mandated CSO reporting period in 2002, no permanent CSO outfall instrumentation was in place. The estimation of percent sewerage volume lost from CSOs was based purely on analytical assumptions up until 2012. With the recommendation from the CEC in 2003, the City invested in CSO event monitoring and volume calculation tools to improve the confidence intervals of CSO estimations. The CSO Monitoring Program commenced in 2009 and by 2013, CSO instruments were successfully installed at 25 locations. Using the available data from the 25 monitored locations, the model estimates of wastewater flows from CSOs were validated.

Due to the difficulties of installing and maintaining instruments in harsh conditions with no local power source, detailed modeling of the combined sewer networks was undertaken to estimate the performance of the remaining combined sewer outfalls. An advanced hydraulic and hydrological model was built to represent the existing wastewater collections system. In 2014, the model was calibrated based on temporary instruments at five locations.

This model was further developed as more monitoring data became available. In 2015, the CSO Master Plan Regional Model was completed, which represented each of the CSO districts and outfalls. By 2015, CSO instruments were successfully installed in 14 additional combined sewer outfalls, bringing the total number of outfalls being monitored to 39. The model was then utilized to produce annual CSO results estimation with validation at the 39 permanent CSO instrumented locations.

In 2017, the City created a CSO overflow validation tool to identify and track differences between what the model estimated and the observed instrumented overflows. This information was used to identify instrument maintenance, model maintenance, and areas for operational improvement.

To utilize the hydraulic software's latest and advanced features, the City upgraded the hydraulic model from sewer systems to an integrated catchment modelling platform software. Changes and impacts resulting from the software conversion process were documented.

In 2020 and 2021, CSO instruments were installed in three additional outfall locations each year. In 2022, one additional outfall location was monitored. The permanent CSO instrumented locations increased from 39 to 46 locations of the total 76 CSO outfalls.

3.1.2 Design Basis

The Preliminary Proposal recommended the Control Option No.1: 85 percent capture in a representative year. This option was the highest ranked of the control options considered in the study and was later approved by the Province in 2017.

3.1.3 Representative Year

The CSO Master Plan adopted the year 1992 as the representative year for annual rainfall intensities and river levels. Based on a detailed review of 53 years of historic rainfall records at the Winnipeg International Airport, it was determined that the year 1992 would be a suitable rainfall year to be representative of typical conditions with respect to accumulated rainfall (i.e. mm per event), number of annual events, and total annual precipitation characteristics.

Similar evaluations of the historic river level records were completed and determined that the year 1992 could also be suitable as representative of typical river level conditions in Winnipeg. As such, the 1992 river level trends and rainfall intensities were used in sophisticated numerical modeling to estimate the volume and frequency of CSO events during the recreation season (May through September, inclusive). It was agreed with the Province as part of the CSO Master Plan Preliminary Proposal development that the year 1992 would form the representative year and would be utilized for planning and evaluation of current and future CSO performance.

3.1.4 Baseline Conditions

The CSO Master Plan was developed with the 2013 year as the baseline year. The Preliminary Proposal, existing hydraulic models, and other CSO related relevant reports were developed based on this baseline condition.

To ensure a common basis for control system sizing and regulatory compliance that is not affected by the annual variations in precipitation and river levels, the CSO Master Plan adapts the 2013 hydraulic model with the 1992 Representative Year precipitation and river levels as the baseline condition for planning and evaluation of control options.

3.1.5 Planning Projections

The Master Plan accounts for population growth in the design process. Clause 8 of EA No. 3042 (see Appendix D) requires no increase in frequency or volume of CSO in the existing system due to new and upgraded land development. Increases in wastewater from growth in population located within a combined sewer district is generally required to be offset with reductions in runoff area.

To demonstrate compliance with the licensing requirements, the City regulates the development process generally by requiring that the post development peak wet weather flows (PWWF) in the combined sewer districts is equal to or less than the pre-development PWWF. As the City continues to regulate the development process and prohibit the use of combined sewers in new developments, it was anticipated that there would be no impact in the combined sewer systems from new development. The CSO Master Plan projections account for an increase in sewage flow only in the separate sewer areas.

In 2020, the City started to use the CSO Master Plan to meet Clause 8 for small developments (e.g. single family and two family) by removing additional flows in the combined sewer areas. Strategic CSO mitigation projects from the CSO Master Plan will be used to offset any additional flows that may come from these small scale developments.

This aligns with the goals of OurWinnipeg and the Complete Communities Direction Strategy by enabling population growth in the intensification target area without costly on-site land drainage management. On July 8, 2021, the Province requested the estimated increase in volume of CSOs caused by small scale developments and the estimated decrease in volume as a result of infrastructure development on the overall combined sewer system on an annual basis. On June 7, 2022, the Province requested a revision on how the estimated volumes are presented. Please see Section 5.7 for the current year's estimates.

3.1.6 CSO Control Technologies

Clause 8 of EA No. 3042 requires the use of green technology and innovative practices in the design and operation of all new and upgraded storm and wastewater infrastructures. Both green and grey infrastructures are considered in the CSO Master Plan design. Green infrastructure (GI) refers to the use of natural hydrologic processes to reduce, store, or attenuate surface runoff from entering the combined or land drainage sewer systems. Many of the GI projects also improve water quality of the surface runoff received. Grey infrastructure refers to the conventional infrastructure projects to address sewer system incapacity, such as pipes and storage tanks.

The control technology selection for each of the combined sewer districts was developed through a two-step approach selection process. The first step of the review included the evaluation of the applicability of sewer control option for the district. This evaluation was based on a number of criteria, including compatibility with existing sewer infrastructure, proximity to the primary CSO outfall/interceptor sewers, and estimated hydraulic performance. The initial solution configurations were implemented within the model based on system hydraulics and then locations were verified with GIS in terms of constructability and feasibility.

The second step of the process included the refinement of the initial control option selection to achieve the 85 percent capture target in the most cost-effective manner. These refinements included:

- A review and further evaluation of sewer districts with screening operational challenges,
- Incorporation of additional complete or partial sewer separation where cost-effective,
- The addition of sewer system control and/or CS-SRS interconnection adjustments to accommodate additional latent storage,
- Incorporation of additional off-line storage where required to provide the remaining volume capture required to meet Control Option No. 1.

Further details to each of these refinements can be found in Section 3.5.4 of CSO Master Plan Part 2.

3.1.7 Water Quality

As per Clause 15 of EA No. 3042, the City developed an Interim Combined Sewer Overflow Monitoring Plan to aid in the development of the CSO Master Plan. The Interim Plan was a multi-year water quality monitoring program that was conducted to collect and update river and CSO water quality data for the development of the CSO Master Plan. The water quality monitoring data was collected in 2014 and 2015. The event mean concentrations (EMC) of the data collected from the 2014 and 2015 water quality monitoring program are provided in Table 1. The EMC of ammonia, nitrate, and total phosphorus (TP) were used to determine pollutant loads in the NRPI reports, while TP, total nitrogen (TN), and nutrient loading were used as the baseline for the water quality modeling and loading assessments for evaluation of control option alternatives for the CSO Master Plan. The assessment indicated that the CSO discharge quality varied by location and between events but was within expected ranges for combined sewer discharges and there was very little difference in performance among the control option alternatives.

Table 2 indicates the number of days the bacteria objective may be exceeded for each alternative. The detailed analysis and results of the CSO Master Plan water quality monitoring work are documented in the Preliminary Proposal.

Table 1 - Pollutants EMC from 2014/2015 Water Quality Monitoring Program

Substance Name	Unit	EMC
[1]Ammonia	mg/L N	5.72
[1]Nitrate-N	mg/L N	0.34
[1,2]Total Phosphorus	mg/L P	2.71
[2]Total Nitrogen	mg/L N	15.25

1 – Parameters used in the NPRI reports

2 –Parameters used in the CSO Master Plan nutrient loading assessments

Table 2 - Potential Plans Bacteria Metrics (CH2MHill et al., 2015)

Plan Alternative	Control Limit	Number of Exceedances (days/year)
-	Baseline	44
1	85% Capture in a representative year	44
2	Four Overflows in a representative year	41
3	Zero Overflows in a representative year	35
4	No More Than Four Overflows per year	39
5	Complete Sewer Separation	42

As per the CSO Master Plan approval letter, the City will be implementing Control Option No. 1 while further evaluating the bacteriological water quality improvement identified for Control Option No. 2. A water quality report will be submitted once every 5 years, starting on December 31, 2024.

The City presented a proposed water quality monitoring plan to meet the 2024 requirements which was accepted by the Province in January 2023. See Section 6 – Water Quality for more information.

The implications of maintaining a percent capture program on water quality will be evaluated and will be provided in the 2030 Master Plan update submission.

3.1.8 Climate Change

Climate change considerations were accounted for in the planning and development of the CSO Master Plan. As documented in the CSO Master Plan Preliminary Proposal, historic precipitation information (1960 to 2012) was reviewed to understand precipitation trends and the impact climate change may have on the precipitation trends over time.

Precipitation trends indicate that climate change is linked to less frequent but larger rainfall events. Winnipeg is expected to experience an increase in the frequency of small rainfall events but a consistent trend for larger events. Since the smaller events can be captured in the CSO control system, it is expected that the trend would not be detrimental to the CSO program performance. However, there is a high degree of uncertainty in long-term trends if the frequency of large events increases.

GI has been identified as an opportunity to improve CSO performance levels and provide resiliency to the potential future impacts of climate change. The City will continue to undertake GI pilot projects to evaluate their benefits and long-term performance for future application. An allowance of 10 percent of the total

CSO Master Plan capital cost estimates has been included for future GI implementation and to achieve regulatory compliance for Clause 8 of EA No. 3042.

Furthermore, prioritizing sewer separation work will provide the program with climate change resiliency. Any additional runoff generated from climate change impacts on precipitation trends will continue to be directed to the land drainage sewers for the districts which have been separated.

The City will continue to monitor and track weather patterns to assess any impact to the CSO Master Plan and the use of 1992 as the representative year to represent the long term typical conditions in the City of Winnipeg.

3.1.9 Public Engagement

The City established a public engagement program to inform, engage, and consult the public on the CSO Master Plan in the first stage of the Master Plan. The public engagement program included multiple public consultation events for the public to provide input. In addition to public consultation events, a Stakeholder Advisory Committee (SAC) was established to provide advice and direction on the study phase.

The general public was engaged through various public presentations and workshops, internet-based tools, including a blog open for public comments, an email Q&A option, a CSO educational video, and media interviews. The information gathered from the public engagement was evaluated and integrated into the Preliminary Proposal.

Upon submission of the Preliminary Proposal, the City continued to inform and educate the public on the development of the Master Plan using the internet-based tools. The City optimized the public webpage dedicated to the CSO Master Plan work by restructuring and updating it to allow more content and the most up-to-date information be made available to the public. The updated website also allows the public to access the information and navigate the website in a more effective and user-friendly manner. A screen capture of the updated City public webpage can be found in Figure 2.

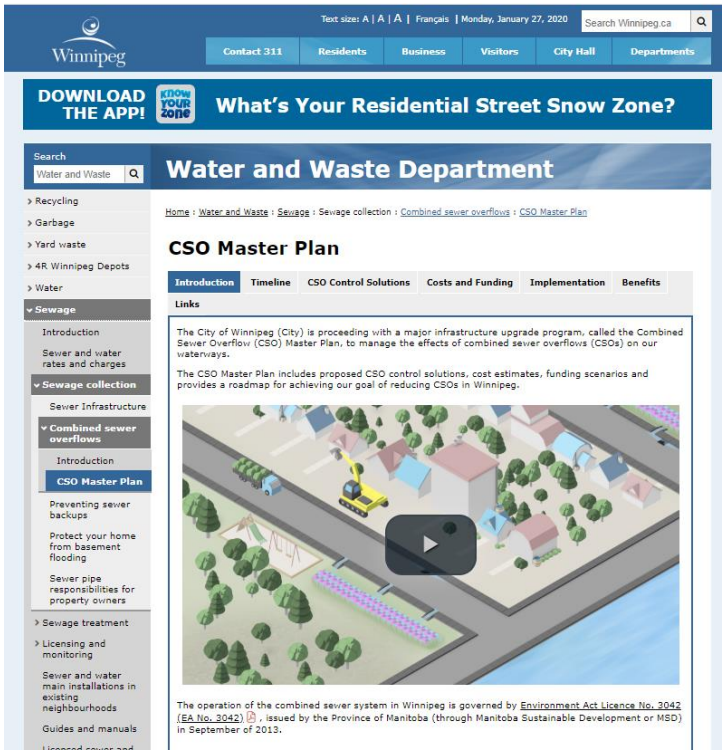


Figure 2 - Screen Capture of the City Webpage

3.1.10 Regulatory Engagement

The City worked closely with the Province to develop the CSO Master Plan. During the development phase of the Master Plan, the City met with two different regulatory groups, a regulatory liaison (management) group and a regulatory working group to raise challenges, report on project progress updates, and to promote collaboration with the regulator to ensure successful program delivery.

3.1.11 District Engineering Plans

The District Engineering Plans (DEPs) were developed to provide conceptual solutions for the Control Option No. 1 performance target (85 percent capture in a representative year) for each of the 43 combined sewer districts.

The DEPs are ongoing, live documents. Each of the districts will undergo preliminary and detailed levels of design based on the solutions recommended in the DEPs, and will be updated throughout the implementation phase as required. The current version of the DEPs can be found in the CSO Master Plan Part 3B.

3.2 Capital Cost Summary

A conceptual level Class 5 estimate was developed for the CSO Master Plan. A Class 5 estimate is defined by the *American Association of Cost Engineers International,* (AACE) *Cost Estimate Classification System - As Applied In Engineering, Procurement, and Construction for the Process Industries* (AACE, 1997) as having a project definition of zero to two percent to be used in a conceptual study with an expected range of accuracy from -50 percent to +100 percent.

The total capital cost to implement the CSO Master Plan including the 10 percent GI allowance is estimated as $1,150,400,000 in 2019 dollars. Applying the maximum +100 percent of the Class 5 estimating range, the total capital cost for budgeting purposes is estimated to be $2,300,800,000. The capital cost summary is shown in Table 3.

Table 3 - CSO Master Plan Capital Cost Estimate (2019 Dollars)

Item	2019 Capital Cost Estimate
Class 5 Estimated Capital Costs	$1,045,800,000
Green Infrastructure Allowance (10%)	$104,600,000
Subtotal – Capital Cost Estimate	**$1,150,400,000**
Class 5 Estimate Range of Accuracy: -50% to +100%	$575,200,000 to $2,300,800,000
Total Capital Cost for Budgeting Purposes	**$2,300,800,000**

3.3 Funding Scenarios

The current City funding method for the CSO Master Plan is through the Sewer Utility. The sewer rates have been steadily rising to cover the inflation rate and the costs required for assorted water and wastewater infrastructure upgrades. However, to meet the mandated timeframe in EA No. 3042, an aggressive increase in sewer rates is required and this amount was determined to be unaffordable by utility rate payers. An affordability assessment documented in the Preliminary Proposal suggested that the Master Plan would not be able to meet the licencing requirements based on the current and forecast utility rates without additional external funding support.

Based on the recommendation from the CEC for sharing the cost equally between the Municipal/Provincial/Federal governments, the CSO Master Plan was developed with the following three funding scenarios.

- Scenario 1 – Tri-level funding agreement between the Government of Canada, Manitoba Government, and the City of Winnipeg with each contributing $30 million per year each (a total capital budget of $90 million dollars per year)
- Scenario 2 – Bi-level funding agreement between the City of Winnipeg and either the Manitoba Government or the Government of Canada with each contributing $30 million per year each (a total capital budget of $60 million dollars per year
- Scenario 3 – City-only funding with a total estimated capital budget of $30 million per year.

The funding scenario is based on the following assumptions:

- three percent inflation per year for annual funding and construction costs,
- a four-year initialization period at beginning of program, which includes a two-year allowance for alterations of EA No. 3042 and a two-year allowance for securing Federal and Provincial funding commitments, and
- consistent funding arrangements established throughout the entire implementation period.

The 2019 CSO Master Plan described the funding impacts in detail. The summary of the impact of the three funding scenarios are provided in Table 4.

Table 4 - CSO Master Plan Funding Scenario Evaluation Results (2019 Dollars) (Jacobs, 2019)

Program Scenario	Description	Funding by	Annual Budget	Timeline
Scenario 1	3 Levels of Funding 3 x $30 Million	Tri-level: Government of Canada, Manitoba Government, and the City of Winnipeg	$90 Million	27 years (2047)
Scenario 2	2 Levels of Funding 2 x $30 Million	Bi-Level: City of Winnipeg and either the Manitoba Government or the Government of Canada	$60 Million	39 years (2059)
Scenario 3	City Only $30 Million	One Level: City of Winnipeg Only	$30 Million	75 years (2095)

The City requires funding from the Federal and Provincial governments to meet the 2045 Provincial deadline due to the scale of the work required as per the intent of the 2003 CEC recommendations. However, any changes to inflation rates or delay to annual funding approvals to the request will result in overall project cost increases and a longer implementation timeline.

The CSO Master Plan is currently on schedule and budget for Program Scenario 1. If no additional funding is provided by the Provincial and Federal Governments by 2023 or earlier, the CSO Master Plan will move to the Program Scenario 3 which is based on City only funding and has a longer implementation timeline.

The Program Scenario 1 Capital Budget with three percent annual inflation can be seen in Figure 3.

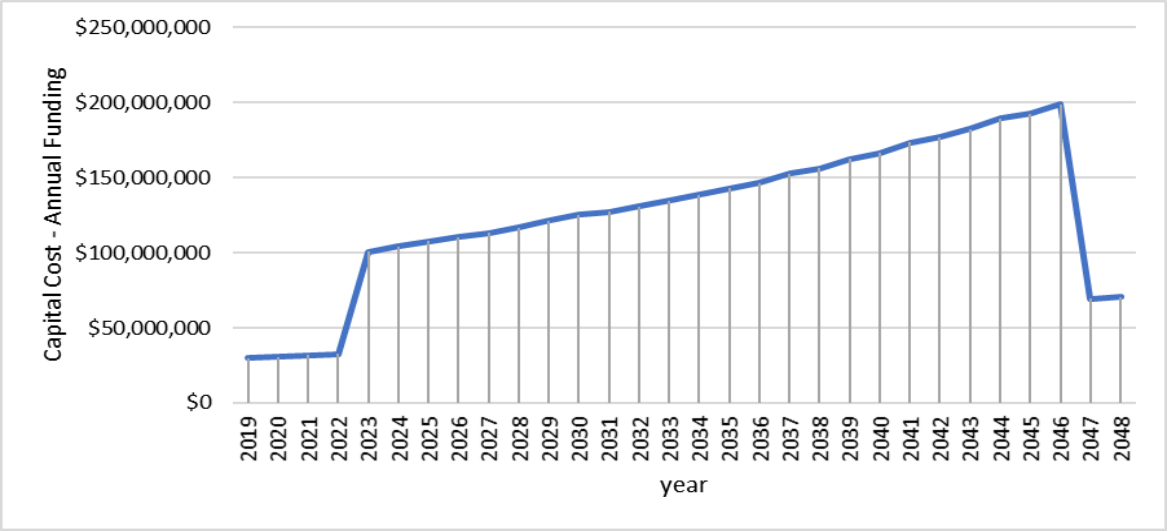


Figure 3 - CSO Master Plan Program Scenario 1 Capital Budget Inflated at Three Percent Annually

3.4 Changes in Funding

In 2022, the City received $30 million from the municipal government towards the Basement Flood Relief and CSO Master Plan Program.

3.5 Design Development of Proposed Projects

The CSO Master Plan and the DEPs were developed to a conceptual level of detail. The individual project selections and designs are based on the hydraulic model evaluations and high level assessments of constructability. It is expected that the proposed projects identified will change and adapt as further information is collected during the program implementation and individual project design studies. This process is illustrated in Figure 4.

Figure 4 - Key Design Stages in Life of a CSO Project

The City plans to complete a number of additional evaluations based on the details presented in the DEPs to form the basis for further design and construction within each of the sewer districts. Each of the proposed projects will undergo a preliminary and detailed design stage to confirm their constructability. A potential approach to the design process would be for several neighboring sewer districts to the district in question under design to be further refined as a package during the preliminary design phase. Additional detail would be collected and evaluated to fully understand the existing sewer system surrounding each specific district prioritized and confirm selection of the optimal CSO control technology. This would be followed by detailed design where the parameters of the control technology would be finalized for construction.

Each of the combined sewer districts with the solutions constructed will be monitored to determine the level of performance achieved. This information will be input into the current hydraulic model and applied as part of future design evaluations. CSO volume monitoring and operation and maintenance of sewer systems will continue for the life of the infrastructure.

3.6 Program Implementation Strategy

In addition to the program criteria, an implementation strategy has been defined in the CSO Master Plan documentation to balance resources, risks, and costs of the projects. Additionally, projects were scheduled based on the funding scenario.

Sewer separation work is an ongoing priority for the program implementation due to the high benefits and low risks. As cost escalation can have significant impacts to the cost of long-term programs, completing more expensive work upfront can reduce the relative impact of cost escalation. Sewer separation reduces basement flooding risk and reduces wet weather runoff to the combined sewer system. It addresses the required CSO reduction targets, while also improving the basement flooding level of service for the area.

There are a number of additional opportunities which require further investigation as part of program implementation, such as GI solutions and floatable management.

GI was assessed separately from the other control options. It was not included in the base solutions because of unknowns and uncertainty with its application. Each district will require a detailed assessment on potential GI locations and will require the development of policies and design standards with engagement and buy-in from residential, commercial, and industrial customers to optimize opportunities. The analysis of the main technology evaluations and pilot studies are scheduled to be completed within the first ten years. This will provide confirmation that these proposed options are appropriate and suitable for the Winnipeg sewerage system. GI and sustainable solutions should be reviewed as part of every sewer infrastructure project to comply with Clause 8 of EA No.3042. GI projects will provide the necessary performance improvements to meet CSO volume capture targets and will assist with mitigating detrimental impacts from climate change. An allowance of 10 percent of the total CSO Master Plan capital cost estimates has been included for future implementation of GI solutions.

The floatables management approach in the CSO Master Plan is based on outfall screening. Screening is not the most effective approach for many of our sewer districts due to many factors including the surrounding environment and the sewer system hydraulics. Floatables management is required for outfalls in which combined sewage is discharged. For districts in which complete sewer separation is to be completed, combined sewage will no longer be discharged from the outfalls in these districts and floatable management will not be required.

The City has identified an alternative approach to screening to address the floatable management requirements, which is similar to a successful program run by the City of Ottawa. This proposed new approach targets source control as a potential alternative to screening. This is expected to achieve similar or better results while eliminating end-of-pipe screening. The alternative floatables management plan provides a significant opportunity to achieve the intended results, while avoiding the high capital and long-term operations and maintenance (O&M) costs of screening facilities.

Additional sewer storage and mechanical control solutions are scheduled to follow sewer separation work. In order to appropriately size and operate this type of infrastructure, sewer network, power, communications, monitoring, and operational infrastructure need to be in place and allow for a detailed understanding of network performance.

3.7 Schedule

The schedule is based on funding and the evaluation of the scope of work involved with each of the districts, CSO volume detriment, cost-benefits analysis, and district prioritization. See Appendix E for the district Program Scenario 1 implementation schedule and Figure 5 for the high level schedule which showsthe implementation strategy more clearly.

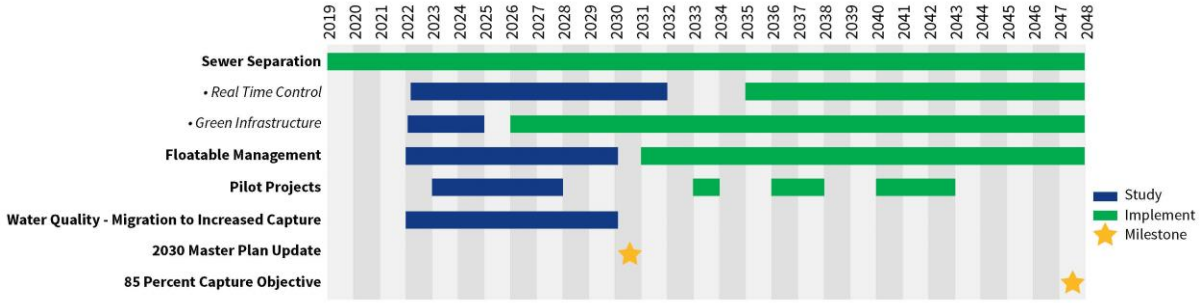


Figure 5 - CSO Master Plan Program Scenario 1 Overview Schedule

3.8 Capital Projects Overview

To achieve 85 percent CSO volume capture in a Representative Year, sewer separation work is a major component and is proposed for 15 districts. A breakdown of the cost for each control technology applied in the CSO Master Plan is shown on Figure 6.

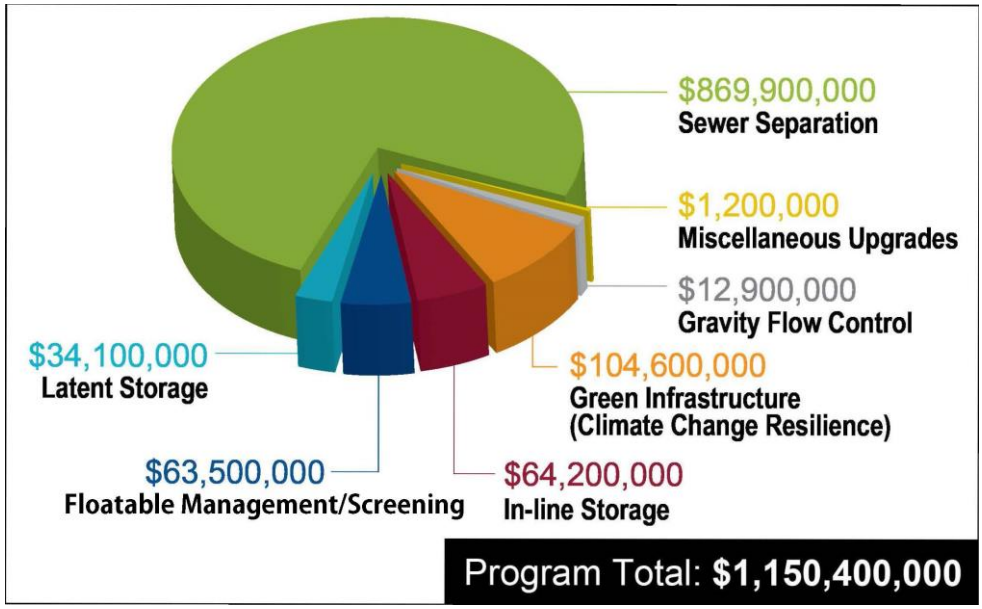


Figure 6 - CSO Master Plan Capital Cost Summary (2019 Dollars)

Figure 7 provides an overview map of the location of the proposed control options for each district.

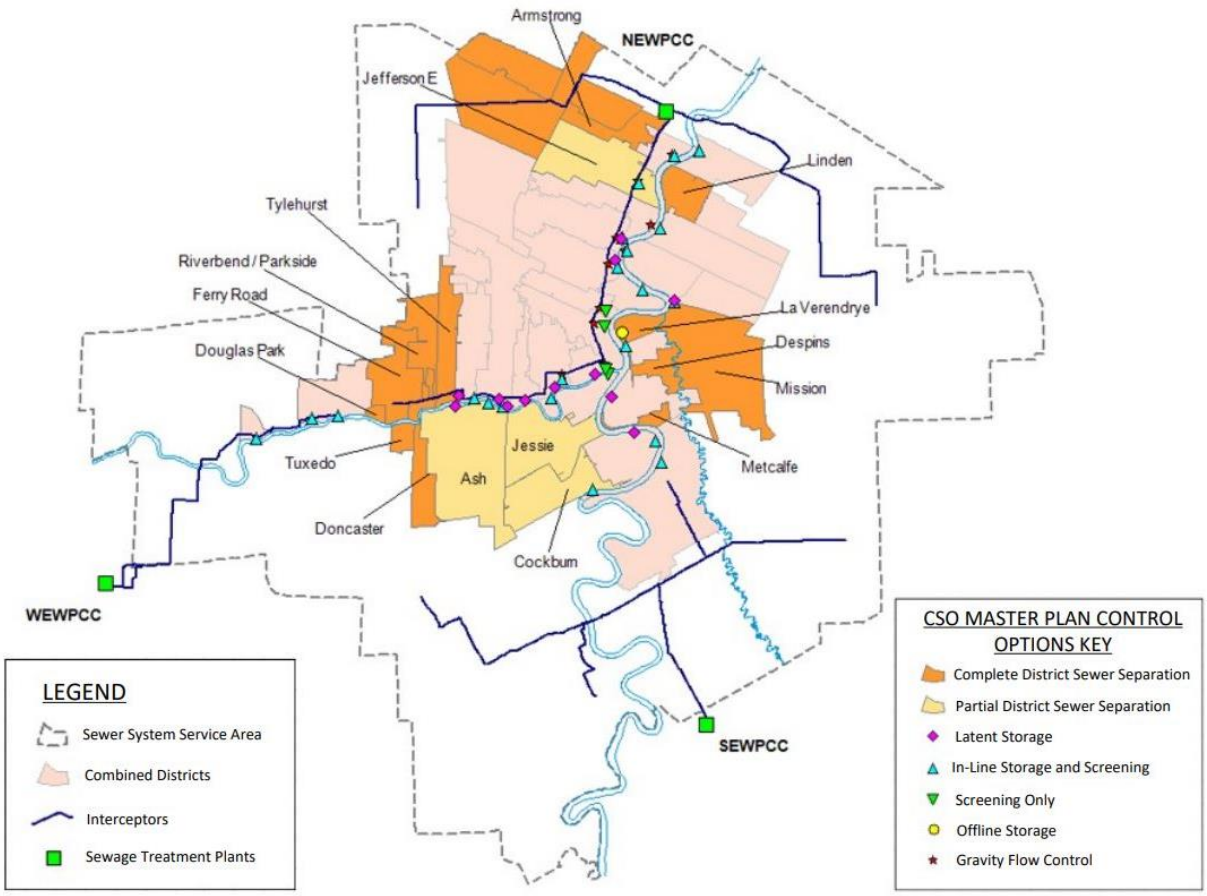


Figure 7 - CSO Master Plan Project Overview Map

3.9 Risks and Opportunities

This section provides an overview of the risks and opportunities identified in the development of the Master Plan.

3.9.1 Risks

Program Implementation

Factors that may pose a risk to the program implementation are as follows:

- Funding – There is a risk that funding from other levels of government will not be available over the life of the CSO Master Plan. The City will continue its work with the available allocated annual budget.
- Technology – There is a risk that implementation of the green and innovative technologies as per Clause 8 of EA No. 3042 may not perform as expected. Technologies that are proven to be successful in other jurisdictions may not apply the same to Winnipeg due to the environment. The City will undertake research and seek for experience and knowledge from other jurisdictions on the technologies prior to implementation.
- Resource – Market fluctuation and insufficient local resources may pose a risk to a cost increase and a delay in implementation schedule.
- Schedule – There are many sources of risk associated with the planning and execution of the program. Such risks include funding shortages or high bid costs, limitation of engineering and construction service capacity, and extended project approvals.

- Migration to Control Option No. 2 – The change in performance target (from Control Option No. 1 to Control Option No. 2) would increase costs and likely increase the timeline of the Master Plan due to the increase level of effort required for the increased CSO volume reduction.

Climate Change

An increase in extreme weather events is a potential risk to the performance of the CSO Master Plan program. The program is based on a 1992 Representative Year. Long-term monitoring of rainfall trends will continue during the execution of the Master Plan to monitor any trends.

Basement Flooding

Modification and upgrade of existing infrastructure may pose a risk to basement flooding due to potential system operation issues.

Program Feasibility and Sustainability

Factors to be considered regarding the feasibility and sustainability of the program include: affordability, public impact, City resources, construction capacity, services overlap, and control option re-evaluation.

Affordability: The City finances its capital and operating budgets for the sewer utility on a user-pay basis through sewer rates. To ensure that the rates are affordable to rate payers, the City takes a longer-term view of rates. The rates have steadily been rising for several years and are expected to continue to rise due to wastewater treatment plant upgrade works and replacement and refurbishment of aging infrastructure.

Public Impact: Sewer separation projects are planned throughout the combined sewer system and will encompass large sections of the sewer districts. Each of these will include large programs that will take several years to complete. This may pose an impact on both the residents and businesses.

City Resources: City resources will need to increase to achieve the new requirements and implement all the components of the CSO Master Plan.

Construction Capacity: With the additional construction projects demand, there is a risk that Winnipeg may not be equipped with sufficient local construction industries to undertake the work, posing a potential risk of a schedule delay.

Services Overlap: There are multiple competing infrastructure needs within the City to consider as well as the possibility of additional requirements in the future that cannot be forecast. Coordination with other City services will be required to minimize impacts and identify planning overlaps.

Control Option re-evaluation: As technologies evolve overtime, there is a risk that the selected control option may need to be re-evaluated to validate the best control option available. This implies that there is a possibility of rejection, which may lead to the need for more costly substitutes.

District Engineering Plan Risks

The District Engineering Plan comprises of individual conceptual solutions to CSO mitigation for each of the combined sewer districts. Each of the risks and opportunities applicable to the control solutions recommended within each sewer district to meet Control Option No. 1 are documented in Part 3B – District Engineering Plans of the CSO Master Plan.

Any changes to the control solution could cascade to a reevaluation of risks associated with each of the specific projects.

3.9.2 Opportunities

A number of opportunities to improve the volume percent capture during the program were identified during the development of the CSO Master Plan. The following section describes the main areas that the City could benefit from during development.

Green Infrastructure

Clause 8 of EA No. 3042 requires the use of green technology in the design and operation of all new and upgraded infrastructures. In the CSO Master Plan, each of the combined sewer district control solutions contains a GI component. GI technologies will be evaluated to promote additional CSO volume storage and sustainability. A budget of 10 percent of the capital program is included in the CSO Master Plan budget for the implementation of the GI technology.

Floatable Management

Clause 12 of EA No. 3042 requires the Master Plan to demonstrate the prevention of floatable materials in CSO effluent. The Master Plan proposed investigating the use of both screening and the alternative floatable management approach to prevent floatable materials from entering the river.

Real Time Control

Real time control (RTC) provides a method of increasing system performance by improving the operation of the system. With Winnipeg's flat topography and large diameter pipe network, application of RTC becomes very valuable as it can adapt and balance the system for real precipitation events that are spatially and temporally distributed. The incorporation of RTC and monitoring instrumentation will provide an increased understanding of operation,a better control on a real time basis, and an optimization of flows in the system and to the treatment plants.

Stakeholder Collaboration

Working together with other stakeholders including industry groups and the public will provide partnership opportunities that may provide additional benefit to the CSO Master Plan. Furthermore, this will provide an opportunity to further engage, communicate, and educate the community on the ongoing work with the program.

Further details associated with both the risks and opportunities of the program can be found in the CSO Master Plan.

4. CSO Master Plan Performance

The 2013 Regional Model Baseline Network with the 1992 Representative Year rainfalland the river levels formed the baseline performance level. The performance of the current year's model network, which is the most recent representation of the sewer network condition, is tracked and reported against the baseline.

4.1 CSO Volume Performance Tracking

The 2013 baseline hydraulic model represents the model conditions for the 2013 sewer network. The 2020 network is the most current model. It provides the best representation of the sewer network condition for the current year 2022. Future updates to the model will be made as construction works are completed and modeling resources allow.

The total CSO volume discharged for the current 2022 year is 5,106 ML, which is 154 ML less than the 2013 baseline CSO volume. The reduction in CSO volume and the overall percent capture demonstrate that the combined sewer relief projects that were undertaken in recent years have improved the overall CSO performance of the collections system. Table 5 presents the CSO performance of the baseline, current year, and the Preliminary Proposal's control target (85 percent capture) under the 1992 Representative Year design event. The total wet weather flow volume captured for 2022 was calculated based on the baseline's dry and wet weather flows in conjunction with the 2022 CSO volume.

Table 5 - CSO Master Plan Performance Tracking

Condition	Total CSO Volume (ML)	Total Dry Weather Flow Volume (ML)	Total Wet Weather Flow Volume Captured (ML)	Target Reduction in CSO Volume (ML)	*Percent Capture (%)
Baseline Performance - 2013 Baseline with 1992 Rep. Year	5,260	7,749	7,317	-	74
Current (2022) Year's Performance - 2020 Network with 1992 Rep. Year	5,106	7,749	7,471	-	75
Target Performance - CSO Preliminary Proposal 85 Percent Capture with 1992 Rep. Year	2,980	7,749	9,593	2,300	85

$$*Percent\ Capture = \frac{(Total\ Dry\ Weather\ Flow\ Volume + Total\ Wet\ Weather\ Flow\ Volume\ Captured)}{(\text{Total CSO Volume}+\text{Total Dry Weather Flow Volume}+\text{Total Wet Weather Flow Volume Captured})}$$

The 2022 CSO volume percent capture was estimated at 75 percent relative to the 2013 baseline year. The improved performance to date is primarily attributed to Capital improvements represented in the model for the Ferry Road completed contracts and Cockburn completed contracts (-108ML). Construction works continue and network changes or improved data will be included in subsequent model updates.

4.2 Financial Tracking

The CSO Master Plan developed an overall capital cost in 2019 dollars for each of the combined sewer districts. It includes a 53 percent makeup on construction cost for engineering, burdens and contingency, and a 10 percent allowance for GI. The cost is based on a Class 5 level of estimate. The following section provides the financial status of the program. The financial budget is provided based on the current year's actual spend with a three-year window forecast. As preliminary design is completed for a district, updated class 3 cost estimates will be prepared and utilized in the financial tracking process.

4.2.1 Capital Cost Estimation Tracking

No new City wide capital cost estimates have been created since the August 2019 submission of the CSO Master Plan.

4.2.2 Budget Tracking

The CSO Master Plan is on schedule and budget for Program Scenario 1. If no additional funding is provided by both the Province and Federal Governments by 2023 or earlier, the CSO Master Plan will move to the Program Scenario 3, which is based on City only funding and has a longer implementation timeline.

In 2022, the City Council approved $30 million for the CSO Master Plan budget.A three-year window budget of the CSO Master Plan and revised 2022 annual budget is presented in Table 6 below.

Table 6 - CSO Master Plan (2019 Dollar Values) and Revised 2022 Annual Budget Difference

	2022 to 2024 Capital Budget Forecast			
	Year 1	Year 2	Year 3	
	2022	2023	2024	Average
CSO Master Plan Forecast	$32,786,411	$33,770,003	$34,783,103	$33,779,839
Budget Forecast (in 2022 values)	$30,000,000	$28,000,000	$47,000,000	$35,000,000
% Deviation	-8%	-17%	+35%	+4%

The CSO Master Plan 2022 budget was $30 million with an additional $42 million budget holdover from 2021. This budget is being held to award the Ferry Road Contract 6, which is scheduled for 2024. Ferry Road Contract 6 is a large strategic tunneling project with a Class 3 estimate of $60 million, which is greater than the available annual budget. The CSO Master Plan budget ask under City only funding for 2023 is $87 million. A signficiant portion of the 2023 budget is planned for the Rutland Trunk. See Table 7 below.

Table 7 - 2023 to 2025 Capital Budget Forecast (2022 Dollars)

Budget Source	Budget	2022 Committed Capital Projects To Date	2022 Forecast Capital Projects	% of Annual Budget Committed
2021 (hold over)	$42,173,158			
2022 Budget	$30,000,000	$12,537,102		17%
Total Budget Available	$72,173,158			
2022 (hold over)	$59,636,056			
2023 Budget	$28,000,000		$27,060,000	31%
Total Budget Available	$87,636,056			
2023 (hold over)	$60,498,378			
2024 Budget	$47,000,000		$106,672,678	99%
Total Budget Available	$107,498,378			
2024 (hold over)	$825,700			
2025 Budget	$41,500,000		$42,077,678	99%
Total Budget Available	$42,325,700			

Approximately $12.5 million was invested in 2022. Since 2019, the approximate cumulative committed capital spend is $71 million. Where projects are completed under budget unspent committed funds are returned to the CSO Budget. The CSO Master Plan and 2022 actual and forecast annual capital spend with a three-year window are provided in Figure 8.

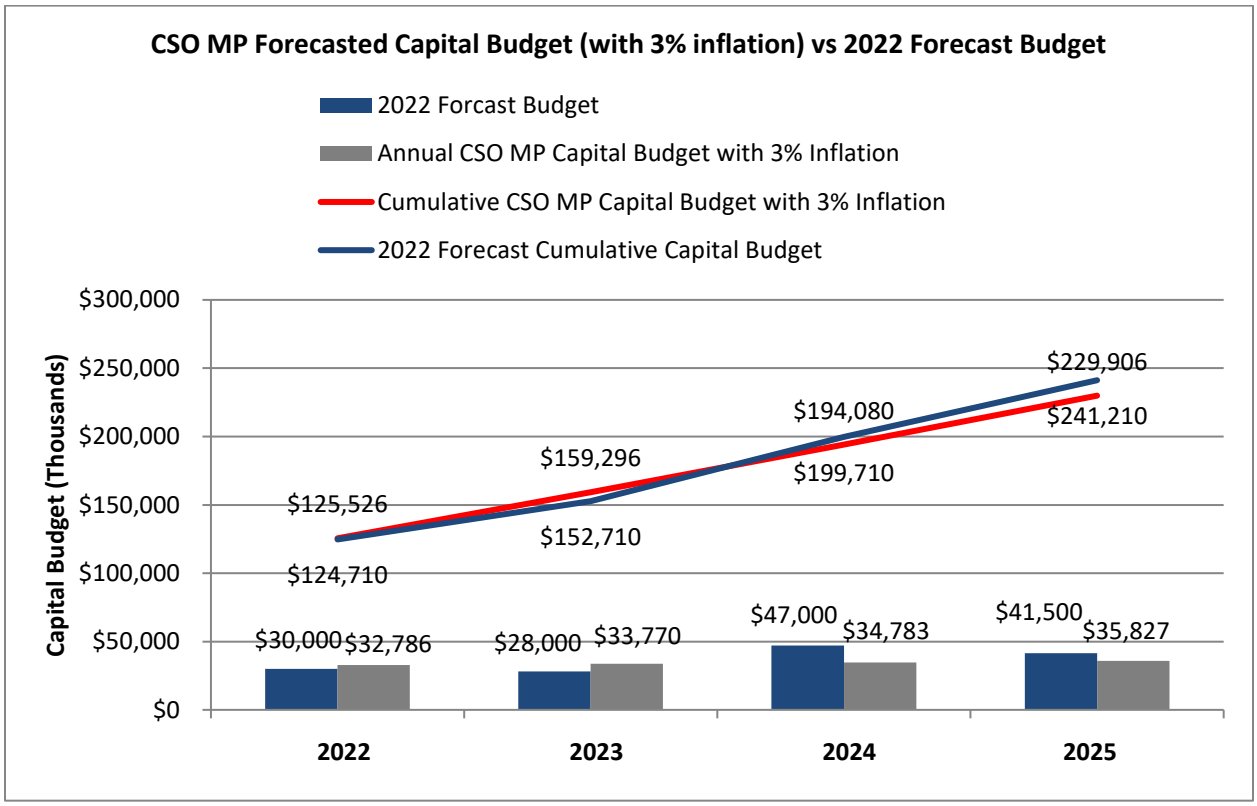


Figure 8 - CSO Master Plan and 2022 Actual and Forecast Capital Budget

4.3 Schedule Tracking

The CSO Master Plan schedule is based on the Program Scenario 1 budget with districts strategically prioritized based on implementation strategy and CSO volume reduction.

The proposed and actual construction implementation schedule for 2022 along with the CSO Master Plan forecast 2023 to 2025 (three-year window) is illustrated in Appendix F.

4.4 Districts Design Status

The design status for each of the combined sewer districts is illustrated in Appendix G. Colored cells represent the design stage status for the specific district as of December 31, 2022.

4.5 Capital Projects Tracking

The list of completed and/or ongoing projects from 2022, with the associated scope, targeted costs, actual cost, and CSO volume reduction are provided in Appendix A.

The list of forecasted work for 2023 and the corresponding capital project's estimated CSO volume reduction are provided in Appendix H.

4.6 Milestones

The 2022 awarded projects and the 2023 planned projects milestones are summarized in Table 8 and Table 9, respectively.

The planned award dates and the actual award dates are compared to demonstrate the project progress. Based on the existing progress and the implementation schedule from the CSO Master Plan, all current projects are on schedule.

In addition to the project work, any Provincial and Federal submissions are also considered as milestones. The milestones for the Federal and Provincial submissions are provided in Section 10.

Table 8 - 2022 Past Projects Milestone

2022 Committed Projects	Targeted Award Date	Actual Award Date	Comment
CSO Sewer Relief Projects			
NEWPCC			
Hawthorne Consultant Assignment 1	2022	December 2022	
Jefferson East Construction Contract 6A	2022	January 2022	
Jefferson East Construction Contract 6B	2022	April 2022	
Jefferson East Construction Contract 7A	2022	December 2022	
St John's (Redwood) Consultant Assignment 1	2022	January 2022	
SEWPCC			
Cockburn / Calrossie Consultant Assignment 5	2022	May 2022	
CSO Monitoring Program			
Rainfall Monitoring Program	2022	April 2022	Provision, Installation, Data Hosting and Maintenance for a Rainfall Network Service

Table 9 - 2022 Planned Projects Milestone

2023 Planned Projects	Targeted Award Date	Comment
CSO Sewer Relief Projects		
NEWPCC		
Ferry Road / Riverbed Consultant Assignment 5	2023	
Jefferson East Construction Contract 8A	2023	
Jefferson East Construction Contract 9	2023	
Armstrong Consultant Assignment 2	2023	
Armstrong Construction Contract	2023	Phasing of work is unknown, pending on the completion of preliminary design
Hawthorne Construction Contract	2023	Phasing of work is unknown, pending on the completion of preliminary design
SEWPCC		
Cockburn East Consultant Assignment 1	2023	
Cockburn / Calrossie Construction Contract 9A	2023	
CSO Monitoring Program		
Rainfall Monitoring Program	2023	
River, Stream and Combined Sewer Overflow Discharge Water Quality Monitoring	2023	-
Note: The above status is subject to change pending on available budget and resource.		

4.7 City Investments on CSO Mitigation to Date

The 2022 CSO Master Plan is ongoing and completed contracts are documented in Appendix A. Last year's Annual Report tracked approximately $157.9 million in infrastructure investment since 2013. The budget for the next six years is forecast to be $240 million. Please refer to past reports for past project investments. The 2022 CSO Master Plan investment ($12.5 million) increases the committed infrastructure investment since 2013 to approximately $170 million.

5. Current Year 2022

The City reports annually on CSO events and volumes estimates. The amount of rainfall and the level of the river during rainfall events have the most impact on CSO results and sewer network performance.

The annual precipitation in 2022 was greater than the 1992 Representative Year and the previous year, 2021. The year 2022 had approximately 74 percent more rainfall than the Representative Year and double the rainfall of 2021. The rainfall events that were greater than or equal to a 1-in-10-year rainfall event in 2022 accounted for 15 percent of CSOs.

The river levels in 2022 were higher than the 1-in-5-year average and the 1992 Representative Year at the beginning of the recreation season. The 2022 levels fell and became comparable to the 1-in-5-year average at the end of the recreation season in August.

5.1 CSO Results 2022

Based on the approach outlined in Section 5.6, the 2022 results are provided in Table 10. The location and event volumes are submitted federally and provincially every year on or before February 15 for the proceeding reporting year. The results are also made public on the City webpage by July 31 for the proceeding reporting year.

Table 10 - CSO Overview Results 2022

Source of Data	Number of Combined Sewer Outfalls	Number of events	Volume of events (ML)
CSO Instrumentation & Detailed Hydraulic Model	46	870	10,734
Detailed Hydraulic Model	30	342	1,531
Flood Pumped Data	N/A	834	15,258
Total	76	2,046	27,524

The total number of CSO events for 2022 was 2,046, which is an average of 27 events per outfall (based on 76 outfalls). The total estimated annual sewage discharged from CSOs for 2022 is 27,524 ML. These values were based on the 46 instrumented locations along with the hydraulic model.

There are currently 41 flood pump locations. This number includes temporary flood pumps, which are installed in specific locations where required based on river levels.

In 2022, 94 percent of the CSO result values were validated against observed instrumentation data.

5.2 Rainfall 2022

The 1992 Representative Year and 2022 current year's rainfall events are reviewed and analyzed to understand the impact rainfall events have on CSOs. Table 11 summarizes the amount of precipitation and the number of rainfall events in both 1992 and 2022 based on the single rain gauge at the Forks.

The total amount of rain that fell in 2022 was approximately 74 percent more than the 1992 Representative Year. The 2022 recreation season was 46 percent wetter than the 1992 Representative Year. The 2022 shoulder season (January through April and October through December) accounted for 24 percent of the total annual precipitation and was approximately three times greater than the precipitation of the shoulder season of the 1992 Representative Year. There were eight rainfall events that were greater than 5 mm that were recorded outside of the recreation period.

Table 11 - Single Rain Gauge at the Forks

	1992		2022	
	Annual	Rec Season	Annual	Rec Season
Total precipitation (mm)	478	326	677	476
Estimated rainfall (mm)	362	326	630	476
% deviation from average rainfall			74%	46%
Number of Events ≥5mm	22	20	34	26
% deviation from average			55%	30%

The comparison between the total annual precipitation and the 1992 Representative Year precipitation over the last several years is illustrated in Figure 9.

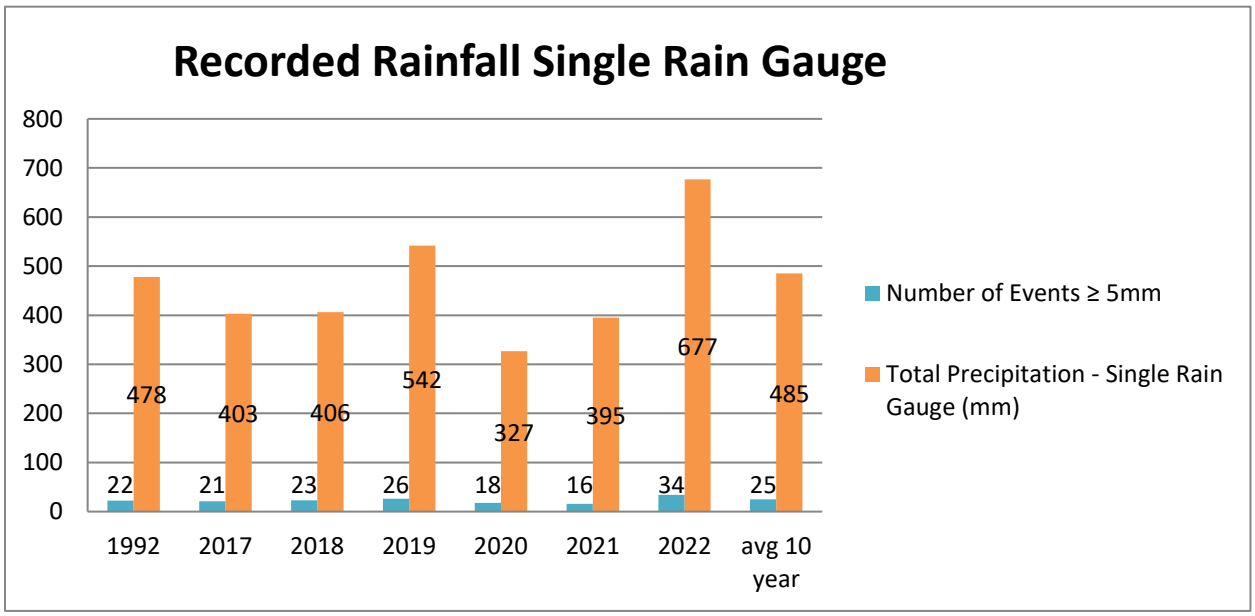


Figure 9 - Total Precipitation Yearly Trend Single Rain Gauge

To capture the spatial variation of the rainfall and further improve CSO event, duration, and volume estimation, the City uses its network of 36 rain gauges.

Instruments are typically operational from May 1st to September 30th but, weather permitting, can be activated as early as March and turned off as late as November. In 2022, there were 16 rain gauges associated with the combined sewer districts and their data was used from April 1st to October 31st. Two Environment Canada rain gauges (the Forks and Airport gauges) are within the combined sewer district and were used to supplement data outside for the remaining months of the year.

The average annual rainfall recorded by the City's combined sewer districts' rain gauges was 660 mm. The McPhillips Pump Station and the Pan Am Pool rain gauge locations were out of service and not providing reliable data from April 1st to May 1st and September 5th to October 31st, respectively. Overwise, the missing rain gauge data was minimal and interspersed throughout the recreation season. The missing data from the rain gauges was supplemented with mean rainfall data of the operating City's rain gauges. Overall, 2022 had 97 percent of rain gauge coverage for the recreation season.

5.3 River Elevations 2022

The 2022 river levels were higher than the 1-in-5-year average and 1992 Representative Year river levels. They were significantly higher from mid-April to mid-July. The river levels of 1992, 2022, and the 1-in-5-year event are illustrated in Figure 10.

As discussed in Section 5.2, 2022 had signficantly more precipitation than the 1992 Representative Year. The high river levels in spring 2022 were attributed to the high precipitation in the winter of 2021-2022 and the spring melt. The fluctuation in the river level was a direct response to the precipitation. The increased precipitation during peak river levels resulted in ingress into the sewer system, causing flood pump activations, which led to a further increase in river levels. The 2022 river level remained high until mid-June. In August, the river level eventually returned to the normal summer water level set by the control at the St. Andrew's Lock and Dam.

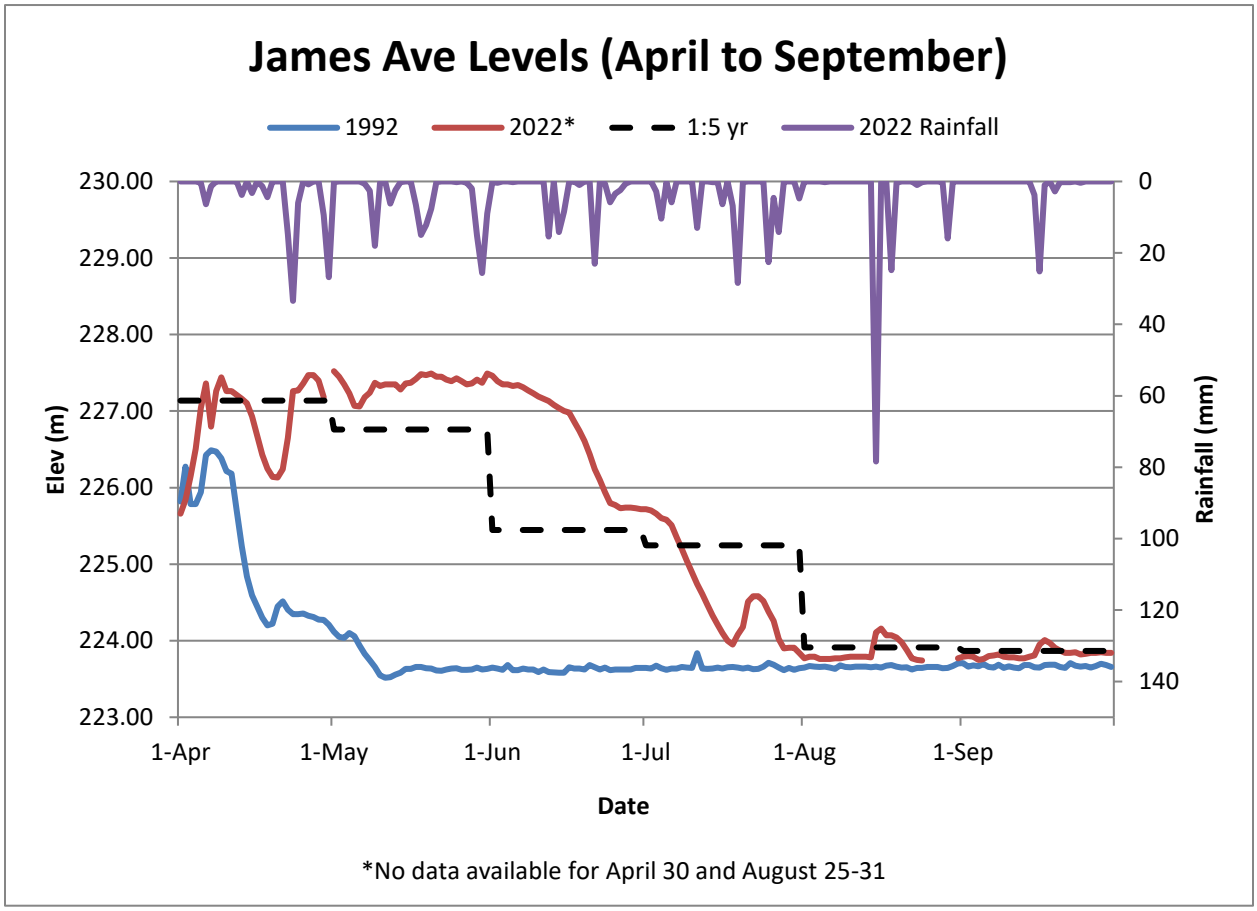


Figure 10 - James Ave River Level Comparison

5.4 Treatment Plant Flows 2022

For 2022, the total citywide treated sewage volume was 121,510 ML which was approximately 48 percent more than 2021 (82,287 ML). The average annual flows (AAF) distributed between the wastewater treatment plants were as follows

- North End Sewage Treatment Plant (NEWPCC) - 231 ML/day
- South End Sewage Treatment Plant (SEWPCC) - 72 ML/day
- West End Sewage Treatment Plant (WEWPCC) - 30 ML/day

The distribution of the treated sewage volume at each of the sewage treatment plants was similar to 2021 and past years.

- NEWPCC - 84,414 ML (69%)
- SEWPCC - 26,098 ML (22%)
- WEWPCC - 10,998 ML (9%)

In 2022, approximately 18 percent of the total annual citywide sewage was lost due to overflows and 82 percent of the annual sewage flow was captured and sent to sewage treatment plants. The estimated sewage lost from the individual NEWPCC, SEWPCC, and WEWPCC collection systems was 25,396 ML, 1,593 ML, and 534 ML, respectively.

5.5 Collections System Operational Observations 2022

Infrastructure and outfall monitoring instruments require regular maintenance.

All outfall monitoring instruments were maintained throughout 2022. Non-functional instruments were either recalibrated, replaced or are being investigated as part of the maintenance process. The City continues to provide regular maintenance to all monitoring instruments at the CSO outfalls to maintain data quality for CSO Reporting. The record of the 2022 operational observations are documented in the 2022 Annual CSO Results Report, which was submitted to the Province on February 8, 2023.

Additional information related to untreated sewer discharge is documented on the City webpage: https://legacy.winnipeg.ca/waterandwaste/sewage/service_int2022.stm

5.6 Reporting Process

The 2022 CSO annual reporting process was based on the City Regional Model 2020 network representation. The model was validated using 46 instrumented CSO outfalls.

5.6.1 Hydraulic Model Maintenance

The City model network needs to be continually updated to better represent the current year's performance.

The City will strive to continually work on updating the hydraulic model based on available information, including past studies, field surveys, and record drawings, to reflect on any past and recent sewer infrastructure upgrades. To ensure that the network is representative of its expected performance, during updates, the model is calibrated based on the instrumented data. The level of discrepancy between the predicted model results and the instrumented data is used to validate the model. Upon completion of the model updates, sensitivity checks are undertaken. All changes associated with model maintenance are documented.

5.6.2 CSO Reporting Limitations

Due to the complexities associated with snowmelt, it is not currently possible to numerically model the CSO events as a result of snowmelt at the un-instrumented locations. Therefore, CSO analyses of un-instrumented locations is limited to CSO overflows caused by rainfall.

The foregoing calculations of CSO volumes are estimates based on hydraulic model representation of the sewer network based on best available information. The field observed data also has limitations. The estimating process is an engineering estimating process which meets Federal guidance for appropriate estimation and includes processes for addressing assumptions for continuous improvement. Model results for the current year are based on observed rainfall data and annual results are validated based on overflow detection instrumentation installed at the 46 of the 76 CSO locations.

Annual model updates should be completed on a regular basis. There will always be network changes or improved data that is not available at the time of the current update but will be included in subsequent updates. The current year network will be the best available representation of the City sewer system and

willconstantly improve. The 2020 network is currently the best available representation of the City sewer system.

5.7 Clause 8 Compliance

To comply with the Province's July 8, 2021 and June 7, 2022 requests, the estimated increase in volume of CSOs caused by small scale developments and the estimated decrease in volume of CSOs caused by infrastructure development are outlined below. These volumes are a result of the land drainage runoff flow.

For a small scale development, the estimated increase in volume to the combined sewer system is approximately 1 m^3 for a 5-year rainfall event as illustrated in **Table 12** to Table 15.

The estimate was based on three development scenarios:

- Going from a single family dwelling (SFD) to two duplexes,
- Going from a SFD to two SFDs, and
- Going from a SFD to two SFDs with secondary suites.

Table 12 - Pre and Post Development Land Drainage Runoff Flow Estimate Example 1 for Two Duplexes

SFD to 2 duplexes						
Lot	**"C"-value**	**Existing**	**Post Lot 2**	**Post Lot 1**	**Post Total**	**Increase**
Total Area		557 m^2	279 m^2	279 m^2	557 m^2	
Building and Paved Area	0.9	180 m^2	120 m^2	140 m^2	260 m^2	
Gravel Area	0.5	0 m^2	0 m^2	0 m^2	0 m^2	
Pervious Area	0.1	377 m^2	159 m^2	139 m^2	297 m^2	
Weighted C-value		0.36	0.44	0.50	0.47	
Storage		21.7 m3			22.4 m3	0.7 m3
Q_{stm}		**6.1 L/s**	**3.8 L/s**	**4.3 L/s**	**8.0 L/s**	**32.07%**

Note: Q uses t_c of 10 min and intesity of 109.5 mm/hr

Note: Storage is for a 5 year event

Table 13 - Pre and Post Development Land Drainage Runoff Flow Estimate Example 2 for Two Duplexes

SFD to 2 duplexes						
Lot	**"C"-value**	**Existing**	**Post Lot 2**	**Post Lot 1**	**Post Total**	**Increase**
Total Area		557 m^2	279 m^2	279 m^2	557 m^2	
Building and Paved Area	0.9	130 m^2	150 m^2	150 m^2	300 m^2	
Gravel Area	0.5	0 m^2	0 m^2	0 m^2	0 m^2	
Pervious Area	0.1	427 m^2	129 m^2	129 m^2	257 m^2	
Weighted C-value		0.29	0.53	0.53	0.53	
Storage		21.3 m3			22.8 m3	1.5 m3
Q_{stm}		**4.9 L/s**	**4.5 L/s**	**4.5 L/s**	**9.0 L/s**	**85.18%**

Note: Q uses t_c of 10 min and intesity of 109.5 mm/hr

Note: Storage is for a 5 year event

Table 14 - Pre and Post development Land Drainage Runoff Flow Estimate Example for Two SFDs

SFD to 2 SFD						
Lot	**"C"-value**	**Existing**	**Post Lot 2**	**Post Lot 1**	**Post Total**	**Increase**
Total Area		474 m²	238 m²	238 m²	475 m²	
Building and Paved Area	0.9	151 m²	130 m²	130 m²	260 m²	
Gravel Area	0.5	0 m²	0 m²	0 m²		
Pervious Area	0.1	323 m²	108 m²	108 m²	215 m²	
Weighted C-value		0.35	0.54	0.54	0.54	
Storage		18.5 m3			19.5 m3	1.0 m3
Q_{stm}		**5.1 L/s**	**3.9 L/s**	**3.9 L/s**	**7.8 L/s**	**51.94%**

Note: Q uses t_c of 10 min and intensity of 109.5 mm/hr

Note: Storage is for a 5 year event

Table 15 - Pre and Post Development Land Drainage Runoff Flow Estimate Example for Two SFDs with Secondary Suites

SFD to 2 SFD w/ Secondary Suites						
Lot	**"C"-value**	**Existing**	**Post Lot 2**	**Post Lot 1**	**Post Total**	**Increase**
Total Area		557 m²	280 m²	280 m²	559 m²	
Building and Paved Area	0.9	200 m²	138 m²	138 m²	276 m²	
Gravel Area	0.5	0 m²	0 m²	0 m²	0 m²	
Pervious Area	0.1	357 m²	142 m²	142 m²	283 m²	
Weighted C-value		0.39	0.49	0.49	0.5	
Storage		21.9 m3			22.6 m3	0.7 m3
Q_{stm}		**6.6 L/s**	**4.2 L/s**	**4.2 L/s**	**8.4 L/s**	**28.27%**

Note: Q uses t_c of 10 min and intensity of 109.5 mm/hr

Note: Storage is for a 5 year event

In 2022, the increase due to small scale developments was 1,140 m^3 for a 5-year rainfall event. The decreased combined sewer volume completed in 2022 resulting from sewer separation work is 0 m^3 for a 5-year rainfall event. Table 16 provides a summary of 2021 and 2022 yearly, cumulative and net increase and decrease in combined sewer volume, based on sewer separation work completed. Table 17 provides a summary of 2021 and 2022 yearly, cumulative and net increase and decrease in combined sewer volume, based on sewer separation work in progress.

The cumulative increase in combined sewer volume since 2014 is 5,064 m^3. The cumulative decrease in combined sewer volume since 2014 is 57,000 m^3.

The 2022 net effect of the cumulative increase and decrease in combined sewer volume is a decrease of 51,936 m^3.

Table 16 - Cumulative Reduction in Combined Sewer Volume based on Completed Sewer Separation Work

Reporting Year	Yearly Increase in Combined Sewer Volume (m3)	Yearly Decrease in Combined Sewer Volume (m3)	Cumulative Increase in Combined Sewer Volume since 2014 and up to Reporting Year (m3)	Cumulative Decrease in Combined Sewer Volume since 2014 and up to Reporting Year (m3)	Net Effect of the Cumulative Reduction in Combined Sewer Volume since 2014 and up to Reporting Year (m3)
2021	1,169	0	3,924	57,000	53,076
2022	1,140	0	5,064	57,000	51,936

Table 17 - Cumulative Reduction in Combined Sewer Volume based on Sewer Separation Work in Progress

	*Yearly Decrease in Combined Sewer Volume (m3)	*Cumulative Decrease in Combined Sewer Volume (m3)	*Net effect of the Cumulative Reduction in Combined Sewer Volume (m3)
2021	38,247	95,247	91,323
2022	0	95,247	90,183
*Assumed values are based on ongoing projects			

6. Water Quality

The water quality objective of the CSO Master Plan is to reduce bacterial loadings to the Red and Assiniboine Rivers by reducing the volume of CSOs discharged. The City plans to collect CSO water samples and model river quality data to track the river water quality throughout the CSO program.

The water quality monitoring data collected in 2014 and 2015, as described in Section 3.1.7, was used for the 2022 NPRI reporting and will be continually used until a new data becomes available with the next Water Quality Monitoring Plan.

The 2019 CSO Master Plan Provincial Approval Letter (see Appendix C) required the City to prepare the Water Quality Monitoring Plan and final report by December 31, 2024. The City presented and submitted a Proposed Water Quality Monitoring Plan in 2022. Following input from the Province, the plan was revised and resubmitted in January 2023 and accepted by the Province. The City issued a Request For Proposal in January 2023. A copy of the Proposed Water Quality Monitoring Plan is in Appendix I. Sampling will occur in the 2023 open water season.

The City is conducting bi-weekly river and stream water quality monitoring for pollutants of concern (POC), including nutrients, dissolved oxygen, and bacteria. In 2022, monitoring was undertaken at eleven locations along the Red and Assiniboine Rivers and at eight locations on selected small streams. The monitoring data provides an updated characterization of the health of Winnipeg's waterways. These reports are published on the City of Winnipeg webpage:

https://legacy.winnipeg.ca/waterandwaste/sewage/monitoring/RiversSmallStreams.stm.

7. Climate Change

Changes to local precipitation patterns may affect the relative performance of the CSO Master Plan as an increase in duration and/or intensity of rainfall events could lead to an increase in the volume of overflows and the number of overflow events. The CSO Master Plan includes strategies to address the potential impacts resulting from climate change.

To provide resilience to the impacts of climate change, the CSO Master Plan incorporates the use of GI and RTC to improve the performance levels. Combined sewer separation work will be prioritized to reduce CSOs from entering rivers and GI will be used to provide the necessary additional performance improvements to mitigate any detrimental impacts from changing precipitation trends. The City has included an allowance of 10 percent of the total CSO Master Plan capital cost estimated for the GI implementation to provide climate change resiliency while meeting compliance with Clause 8 of EA No. 3042.

The City will continue to monitor and track weather patterns to asses any impact to the CSO Master Plan, including the continued use of 1992 as the representative year. The assessment of the impact of climate change on the performance of the CSO program will be provided in the 2030 CSO Master Plan update.

8. Pollution Prevention Plan

The City has a Pollution Prevention Program. Completion of a Pollution Prevention (P2) Plan is part of a comprehensive plan to protect the sewage collection and treatment system, our rivers and lakes, and the environment. This is a process that shifts the focus from municipal wastewater treatment to the control of pollutants at the source by:

- avoiding the use of pollutants wherever possible,
- reducing the amount of pollutants that reach the wastewater system, if avoiding is not possible, and
- eliminating pollutants wherever possible by replacing products with more environmentally friendly products.

In 2022, 601 active businesses were part of the Pollution Prevention Program. Businesses that are a part of the Pollution Prevention Program are required to submit a P2 Plan outlining the source of the pollutants and measures to prevent, eliminate, or reduce the discharge of those pollutions to the wastewater and/or land drainage system. The City performed inspections, collected samples, provided reviews, and approvals of the P2 Plans to ensure proper measures are in place to protect the environment.

The purpose of the City of Winnipeg Sewer By-Law is to protect public safety, the environment, and the City infrastructure by setting and regulating sewage discharge limits into the sewer systems and natural water courses.

For further information, refer to the following webpages:

- Winnipeg Pollution Prevention Plan webpage: http://www.winnipeg.ca/waterandwaste/sewage/pollutionPrevention/default.stm
- Winnipeg Sewer By-Law webpage: https://winnipeg.ca/waterandwaste/sewage/projects/sewerBy-law/default.stm#tab-background

In addition to the Pollution Prevention Program, the City is continually working towards reducing the number of CSOs through:

- Data improvement
- System understanding
- Opportunistic separation
- System optimizations
- Implementing the CSO Master Plan

For further information on the Winnipeg CSO Master Plan, refer to the project development page:

https://wwdengage.winnipeg.ca/cso-mp/

9. Communications

Maintaining an open engagement with stakeholders is essential to the success of the CSO Master Plan. The City will continue to engage with public and the Provincial regulator on progress of the CSO Master Plan execution.

9.1 Public Engagement

The City maintains regular communication with the public during the execution of the CSO Master Plan and will continue as the CSO Master Plan progresses. Prior to the implementation of the sewer relief work, construction notices are issued to residents and property owners to inform them on the background and planned construction work in their neighbourhood.

All City Council and committee meetings are available for viewing on the City website to inform the public of the progress of CSO management work in the city. Agendas are published in advance of the meeting and the public is allowed to present their views as well. In 2022, the Public Service presented an update to the Standing Policy Committee on Water and Waste, Riverbend Management and the Environment, and Council on the 2021 CSO Annual Report on June 7, 2022.

The City will continually maintain an open and transparent engagement program with the public, including regular updates on the City website.

9.1.1 Public Education

The City website contains important information relating to the CSO Master Plan. The website serves as a public education tool to provide Winnipeg residents information on the Master Plan and its benefits. Animated videos and plain language descriptions illustrate and clearly describe the operation of our complex combined sewer systems. The City website also contains information about CSO relief projects and the annual CSO discharge results.

9.1.2 Public Notification System

The City introduced a public notification system called the Sewer Overflow Information System (SOIS) in 2004 to notify the public on the likelihood of overflows as a result of the recommendation from the 2003 Clean Environment Commission hearings. This system indicated the likelihood of overflows into the Red and Assiniboine Rivers based on readings of high-water sensors in the sewers at various overflow locations along with the City's rivers and other monitoring indicators.

In 2013, the City was requested to develop a plan to accommodate a new, enhanced public notification system that would provide a near real-time indication of CSO notifications with overflow occurrences and duration by December 31, 2015 to comply with Clause 10 of EA No. 3042. The CSO Public Notification System Plan, describing the development and implementation plan of the enhanced public notification system, was submitted to the Province on December 15, 2015, and was later approved.

The enhanced public notification system was in the development phase between 2017 and 2021 to test it for reliability and accuracy of the CSO notification predictions. It is linked to the most current hydraulic model for the City of Winnipeg CS system, along with rainfall and outfall instrumentation data at each of the 46 of the 76 combined sewer outfalls. The City engaged with the Province in May 2022 and launched the enhanced public notification system in July 2022.

The newly launched City of Winnipeg CSO Public Notification Tool notifies the public when a CSO is occurring and estimates its duration in near real-time. Further information related to the tool is available on the City of Winnipeg website:

https://legacy.winnipeg.ca/waterandwaste/sewage/csoNotification.stm.

9.2 Regulatory Engagement

In 2022, the City had a virtual meeting with the province on April 29, 2022 to provide an overview of the 2021 CSO Annual Report. The meeting minutes are provided in Appendix J.

9.3 Other Agencies/Initiatives

Undertaking major sewer infrastructure upgrades in an interconnected sewer network is complex as changes in flow and capacity of one area of the system impacts other areas. During the execution of the CSO Master Plan, it is important to consider all ongoing initiatives. The following section describes the ongoing initiatives that are considered while delivering the CSO Master Plan. Projects related to GI can be found in Section 11.2.1 Green Infrastructure.

9.3.1 OurWinnipeg

The OurWinnipeg 2045 Development Plan is the City's 25-year development plan that provides the vision, goals, and policies to increase the quality of life for all residents. It guides growth and change for the City to accommodate future residential growth in a sustainable manner. To support the successful delivery of the vision, Complete Communities 2.0 was developed.

The Complete Communities 2.0 is a direction strategy of OurWinnipeg. It is a city-wide secondary plan that guides growth, development, and land use in Winnipeg. With the population increase, the treatment and conveyance demand are also expected to increase. There is a demand for more capacity to service future population growth. The CSO Master Plan incorporates a 35-year design horizon into the design and planning of sewer infrastructure. It uses the City's Planning and Land Use Model (PLUM) forecast data to account for future development and population growth.

10. Compliance

This section provides an overview and summary of the City's compliance with the regulatory requirements.

As discussed in Section **Error! Reference source not found.**, combined sewers are regulated by a number of federal and provincial requirements. The City reports on CSO discharge data to NPRI, WSER, and the Province on an annual basis to demonstrate regulatory compliance. Table 18 provides a list of required regulatory deliverables with their associated regulators, deadlines, and submission dates.

Table 18 - Regulatory Submissions

Deliverable	Regulator	Reporting Period	Deliverable Deadline	Submission Date
Federal Submission				
2022 CSO Annual Results	WSER	Jan 1 - Dec 31, 2022	Feb 15, 2023	Feb 15, 2023
2022 NPRI CSO Annual Report	Canadian Environmental Protection Act, 1999	Jan 1 - Dec 31, 2022	June 1, 2023	N/A
Provincial Submission				
2022 CSO Annual Results	EA No. 3042 Clause 14	Jan 1 - Dec 31, 2022	Feb 15, 2023	Feb 8, 2023
2022 CSO Annual Report	EA No. 3042 Clause 13	Jan 1 - Dec 31, 2022	March 31, 2023	March 31, 2023
CSO Quarterly Results	EA No. 3042 Clause 14	Every Quarter	15th of May, Aug and Nov of the reporting year	May 12, Aug 11, and Nov 3 of 2022
Significant CSO Event Reporting	EA No. 3042 Clause 14	Event Dependent - Rainfall Events ≥ 1:10 year	Within 10 days of the event	June 27, 2022 August 18, 2022

Annual CSO Result Submissions

In compliance with both WSER and Clause 14 of EA No. 3042, the City is required to submit the Federal and Provincial CSO Annual Result that consist of CSO outfall data from both the instrumented and non-instrumented locations on or before February 15 for the subsequent year. The non-instrumented locations are supplemented with hydraulic modeling data and rainfall estimations to improve confidence in results.

The 2022 CSO Annual Results were validated, completed, and submitted to both the Provincial and Federal governments on February 8, and February 15, 2023, respectively.

In addition to the Federal and Provincial CSO annual results submission, additional annual submissions include the CSO Annual Report and the NPRI CSO Annual Report, which are due on or before March 31 and June 1 of the preceding year.

Quarterly CSO Result Submissions

The Quarterly CSO Results Reports consist of event, volume, and duration estimation data based on the instrumented outfall sites. The results are not validated and are submitted 45 days after the end of the quarterly reporting period as per Clause 14 of EA No. 3042.

The three 2022 Quarterly CSO Results deliverables were completed and submitted to the Province on May 12, 2022, August 11, 2022, and November 3, 2022, in accordance with the mandated deadlines.

Significant Event Report Submissions

In addition to the annual and quarterly CSO results submissions, the City was mandated to report on any significant CSO events that are greater than or equal to 1:10 year rainfall event. In 2022, two significant CSO events were reported. On June 27 and August 18, 2022, the City experienced a 1 in 50 year storm and a 1 in 10 year storm, respectively.

From the review of 2022 data, the City noted there was an additional 1 in 10 year storm that occurred on August 15-16, 2022. The list of overflows is documented in the 2022 CSO Annual Results.

Starting in 2023, significant event reporting is no longer required by the Province following the launch of the City CSO Public Notification System, see Section 2.2 Regulation Changes.

CSO Master Plan Submissions

Additional submissions related to the CSO Master Plan development and implementation is provided in Table 19. This table provides a list of submission milestones pursuant to EA No. 3042.

Table 19 - CSO Master Plan Submission Milestone

Deliverable	Original Targeted Date	Actual Completion Date
Public Education Plan	31-Dec-13	9-Dec-13
Interim Monitoring Plan	31-Jan-14	28-Apr-14
CSO Public Notification Plan	31-Dec-15	15-Dec-15
CSO Preliminary Proposal	31-Dec-15	17-Dec-15
CSO Master Plan	31-Aug-19	28-Aug-19
River Water Quality Report	31-Dec-24	TBD
Percent Capture Assessment for Control Option No. 2	30-April-25	TBD
CSO Master Plan Update	30-April-30	TBD
CSO Master Plan Implementation	31-Dec-45	TBD

The City demonstrates compliance with EA No. 3042 and all CSO Federal reporting requirements.

11. Risks and Opportunities

There are a number of risks and opportunities associated with the CSO Master Plan due to the complexity of the project that need to be tracked and managed (see Section 3.9 for other risks associated with the Master Plan).

11.1 Risks

The CSO Master Plan documents a number of program implementation risks, which can affect the budget, capital costs, feasibility, and schedule.

The DEPs comprise of individual conceptual solutions to CSO mitigation for each of the combined sewer districts. Each of the risks and opportunities applicable to the control solutions recommended within each sewer district to meet Control Option No. 1 are documented in Part 3B – District Engineering Plans of the CSO Master Plan.

Risks are also tracked on a project by project basis. Any changes to the control solution could cascade to a reevaluation of risks associated with each of the specific projects.

11.1.1 Risks Tracking

As part of the Master Plan, initially identified risks as well as new risks that arise will need to be managed. Some significant recent risks which are being tracked and will need to be assessed with regards to their impact on the CSO Master Plan are identified below:

- The November 2019 CSO Master Plan acceptance letter issued by the Province included a requirement for water quality monitoring every five years. The resources and funding needed to meet this requirement were not included in the CSO Master Plan.
- In 2021, the City proposed a strategic approach to remove the Clause 8 requirements for smaller developments in combined sewer areas. Any increases in CSO volume associated with these developments is to be mitigated by the CSO Master Plan improvements. The cost to offset any increase in discharges to combined sewer to ensure future control targets are met have not yet been included in the CSO Master Plan.
- Additional City resources are required to deliver the CSO Master Plan and for compliance with EA No. 3042 and associated Provincial correspondence requirements (see Section 2.3).

11.2 Opportunities

A number of opportunities to improve the volume percent capture during the program were identified during the development of the CSO Master Plan. The following section describes the main areas that the City could benefit from in the coming years in the implementation phase of the program.

11.2.1 Green Infrastructure

Implementation of GI technologies in the design and operation of all new and upgraded infrastructure could promote long term sustainability in CSO volume reduction performance. A budget of 10 percent of the capital program is included in the CSO Master Plan budget for the GI implementation.

The GI pilot projects that have been undertaken to date include the North East Exchange District Engineering Study and aspects of the Cockburn Sewer Separation Project. Pre and post flow monitoring will take place to determine the suitability and performance of GI in Winnipeg's cold climate and heavy clay soils to confirm its benefits to the collections system.

In 2022, additional green infrastructure opportunities are being reviewed in the Armstrong Preliminary Design Project.

North East Exchange District Engineering Study

The City undertook a pilot study in 2017 using a soil retention green technology, Strata cells, for the reconstruction of John Hirsh Place in the North East exchange district. Past studies have demonstrated that Strata cells promote tree growth and reduce loading on combined sewers. To demonstrate tangible benefits from the study, the City undertook flow monitoring prior to construction and completed post construction flow monitoring in 2022 to evaluate performance.

The 2022 flow monitoring data showed a delay in runoff response from the catchment aligned with expected performance. Future monitoring will be undertaken to understand how the solution performs.

11.2.2 Floatable Management

Clause 12 of EA No. 3042 requires the Master Plan to demonstrate the prevention of floatable materials in CSO effluent. As described in Section 3.9.2, the CSO Master Plan includes the use of end of pipe screening to the primary CSO outfall in each CS district where it was determined to be hydraulically feasible and where complete sewer separation of the district was not recommended. In addition to the traditional approach to floatables management, the Master Plan has identified an alternative approach to eliminate the floatables where the floatables will be captured at the surface runoff level before it enters the sewer system.

There are high capital costs, long-term O&M costs, and other risks associated with screen facilities. This alternative floatable management approach will undergo a trial to determine its feasibility as an opportunity for addressing the floatable management requirements at a lower life cycle cost compared to screen facilities currently being recommended. The assessment of the alternative floatables management approach will lead to a better understanding of system floatables and determine the most efficient long term approach to managing floatables. An allowance has been included in the cost estimates to pilot this alternative floatables management approach.

11.2.3 Real Time Control

The incorporation of RTC and monitoring instrumentation will provide an increased understanding of operation and a better control on a real time basis, and the optimization of flows in the system and to the treatment plants. This will also provide opportunities to enhance the public notification system. A feasibility study of the requirements for RTC incorporation is anticipated to take place in the coming years as per the CSO Master Plan's schedule.

12. Record Keeping and Documentation

In compliance with Clause 16 of EA No. 3042, the City will comply with sampling record requirements, requirements for summaries of laboratory analytical results of grab samples and CSO event and location records. The City will make records available to an Environment Officer upon request and, within three months of the end of each year (or earlier as directed with regards to the CSO Annual results), the City will post the results on the public webpage as required by Clause 10 of the Licence.

In compliance with subsection 46(8) of The Canadian Environmental Protection Act, City of Winnipeg Water and Waste will retain copies of all information on which reports are based, including any calculations, measurements, and other related data, for a minimum period of three years. This information will currently be kept at City of Winnipeg Water and Waste offices located at 1199 Pacific Avenue.

13. Next Steps

The next steps are to implement the control technologies recommended as per the CSO Master Plan.

The 2023 planned capital construction projects, preliminary design, and other planned work are provided in Table 9. A summary of the 2023 planned capital projects includes:

- Planning and design of control technologies in Armstrong, Jefferson East, Ferry Road, St John's, Hawthorne and Cockburn districts,
- Construction in Jefferson East and Hawthorne McCleod Creek,
- River, Stream and CSO Discharge Water Quality Monitoring, and
- Execution of the Rainfall Monitoring Program.

The City will continue to explore opportunities to further promote CSO volume reduction, and maintain regular communication with regulatory bodies and the public on the progress of the CSO Master Plan performance.

14. References

AACE International. 1997. *Cost Estimate Classification System – As Applied In Engineering, Procurement, and Construction for the Process Industries*. AACE International Recommended Practice No. 18R-97. (pg. 3-46).

CH2M HILL Canada Ltd, XCG Consultants Ltd, Dillon Consulting. 2015. *CSO Master Plan Preliminary Report.* Prepared for: City of Winnipeg, Water and Waste Department. Winnipeg, Manitoba. December 2015.

City of Winnipeg. 2021. *2020 CSO Annual Results Report*. City of Winnipeg. Water and Water Department. February 11, 2021.

Jacobs Engineering Group. 2019. *CSO Master Plan.* Prepared for: City of Winnipeg, Water and Waste Department. Winnipeg, Manitoba. August 2019.

Manitoba Conservation and Water Stewardship (MCWS). 2013. *Environment Act Licence No. 3042.* Client File No.: 3205.00. September 4, 2013.

Wardrop Engineering Inc. (Wardrop), TetrES Consultants Inc., CH2M Hill Canada and EM Services Inc. 2002. *Combined Sewer Overflow Management Study* (2002 CSO Study). Final Report. Prepared for: City of Winnipeg, Water and Waste Department. November 2002.

Appendix A – 2022 Ongoing / Completed Capital Projects

2022 Ongoing / Completed Capital Projects

Project Name	District	Contract #	Project Type	Description	Class of Estimate	Baseline Budget	Committed Cost	Targeted Completion Date	Actual Completion Date	Volume Reduction (m3)	Comments
NEWPCC											
Ferry Road / Riverbend - Consultant Assignment 4	Ferry Road / Riverbend	439-2010	Sewer Separation	Phase 4 Works include preliminary design, geotechnical investigation and public engagement, for construction Contract #6. It also includes detailed design and contract administration for Contracts #7A, 7B and 7C as part of the Ferry Road and Riverbend Combined Sewer Relief Works.	Class 3	$1,700,000	$2,000,000	2020	2022	N/A	Complete
Jefferson East - Consultant Assignment 2	Jefferson East	440-2010	Sewer Separation	Professional Consulting Services for Detailed Design and Contract Administrator Construction Contract #5 for the Jefferson East Combined Sewer District.	Class 3	$2,500,000	$2,600,000	2021	2021	N/A	Complete
Jefferson East - Consultant Assignment 3	Jefferson East	440-2010	Sewer Separation	Professional Consulting Services for Detailed Design and Contract Administrator Construction Contracts #6 to #10 for the Jefferson East Combined Sewer District.	Class 3	$2,500,000	$3,500,000	2025	TBD	N/A	Ongoing
Jefferson East - Construction Contract 6A	Jefferson East	862-2021	Sewer Separation	Sewer separation and new land drainage system will be installed along Main Street (Kingsbury Avenue to Jefferson Avenue)	Class 3	$3,000,000	$3,000,000	2022	2022	32,385	Complete
Jefferson East - Construction Contract 6B	Jefferson East	863-2021	Sewer Separation	Sewer separation and new land drainage system will be installed from Salter to Main Street at Burrin Avenue, Belmont Avenue, Hartford Avenue and Perth Avenue, and from Burrin Avenue to Hartford Avenue at Aikins Street	Class 3	$3,000,000	$2,100,000	2023	TBD		Ongoing
Jefferson East - Construction Contract 7A	Jefferson East	556-2022	Sewer Separation	Connection and constructions of land drainage sewers on Salter Street from Semple Avenue to Jefferson Avenue, and on Kilbride Avenue, Belmont Avenue, Hartford Avenue and Perth Avenue from Powers Street to Aikins Street	Class 3	$5,000,000	$4,400,000	2023	TBD	13,879	C7 has been separated into C7A and C7B

Armstrong - Consultant Assignment 1	Armstrong	943-2020	Sewer Separation	Professional Consulting Services for Armstrong Combined Sewer District Preliminary Design	Class 3	$3,000,000	$1,500,000	2023	TBD	N/A	Ongoing
Hawthorne - Consulting Assignment 1	Hawthorne	802-2022	Basement Flood Relief	Professional Consulting Services for McLeod Creek Drainage Improvements	Class 3	$1,000,000	$425,000	2023	TBD	N/A	Ongoing
St John's (Redwood) Consultant Assignment 1	St John's	528-2021	Sewer Separation	Professional Consulting Services for 2022 Redwood Reconstruction Project	Class 3	$80,000	$78,000	2023	TBD	N/A	Ongoing
SEWPCC											
Cockburn / Calrossie - Consultant Assignment 4	Cockburn / Calrossie	441-2010	Sewer Separation	Development of alternative conceptual design separation services for Professional Consulting Services Detailed Design and Contract Administration Services Cockburn and Calrossie Combined Sewer Relief Works	Class 3	$1,000,000	$1,000,000	2022	2022	N/A	Complete
Cockburn / Calrossie - Consultant Assignment 5 / Over Expenditure	Cockburn / Calrossie	441-2010	Sewer Separation	Professional Consulting Services for Detailed Design and Dontract Administration Services for Phase 5 of the Cockburn and Calrossie Combined Sewer Relief Works	Class 3	$2,100,000	$2,200,000	2025	TBD	N/A	Ongoing
Cockburn / Calrossie - Construction Contract 6B	Cockburn / Calrossie	212-2020	Sewer Separation	Sewer separation and new land drainage system will be installed at Carter Avenue and Weatherdon Avenuebetween Stafford Street and Pembina Highway, Wentworth Street, Lilac Street and Arbuthnot Street	Class 3	$9,000,000	$5,300,000	2022	TBD	4,385	Ongoing
Cockburn / Calrossie - Construction Contract 7	Cockburn / Calrossie	537-2021	Sewer Separation	Sewer separation and new land drainage system will be installed at Harrow Street, Grant Avenue, Weatherdon Avenue, Carter Avenue, Hector Avenue, Ebby Avenue, Harrow Street E, and Sparling Avenue	Class 3	$8,500,000	$6,900,000	2022	TBD	9,813	Ongoing
Overall System											
Flow Monitoring Program Instrumentation Supply	N/A	817-2019 Ext 1	Flow Monitoring Program	Supply and delivery of wireless portable area velocity sewer flow meters from Aug 1, 2021 to July 31, 2023	N/A	$80,000	$76,000	2023	TBD	N/A	Ongoing
Rainfall Monitoring Program - Web Based Data Management and Analysis Service	N/A	87-2017 Ext 4	Rainfall Monitoring Program	Web based data management and analysis service for rainfall monitoring network from May 16, 2021 to May 15, 2022	N/A	$20,000	$14,000	2022	2022	N/A	Complete

Rainfall Monitoring Program - Supply, Installation and Operation	N/A	86-2017 Ext 4	Rainfall Monitoring Program	Installation, operation and maintenance of rain gauge equipment for Rainfall Monitoring Program from April 1, 2021 to March 31, 2022	N/A	$70,000	$64,000	2022	2022	N/A	Complete
Rainfall Monitoring Program - Provision, Installation, Data Hosting and Maintenance	N/A	910-2021	Rainfall Monitoring Program	Provision, Installation, Data Hosting and Maintenance for a Rainfall Network Service from May 1, 2022 to March 31, 2023	N/A	$90,000	$90,000	2023	2023	N/A	Ongoing

Estimated values

Committed costs are subject to change as projects progress

Note:

1) All costs are rounded to the nearest relevant whole number
2) The table includes the list of projects that were either in progress or completed in the year of 2022. The list of historic projects is referenced in the past CSO Annual Reports.

Appendix B – Provincial Letter on Notification Plan

Manitoba
Environment, Climate and Parks
Environmental Compliance and Enforcement Branch
1007 Century Street Winnipeg, Manitoba, Canada R3H 0W4
T 204-945-7100 **F** 204-948-2338
www.manitoba.ca

Client File. 3205.10

January 13, 2023

Chris Carroll, P.Eng., MBA
Manager of Wastewater Services Division
110-1199 Pacific Avenue
Winnipeg Manitoba R3E 3S8
ccarroll@winnipeg.ca

Dear Chris Carroll:

RE: Combined Sewer Overflow - Environment Act Licence 3042
Clause 14 – Notification Plan
Removal of Requirement to Submit Significant Rainfall Event Notifications

Environment, Climate and Parks has been reviewing the requirements of Clause 14 of Environment Act Licence 3042. The approved plan, which was submitted in April of 2014, required regular notification of Combined Sewer Overflow (CSO) events in the form of quarterly and annual reporting of all CSO events, and the reporting of unique or significant events as required.

In July of 2022, the real time online public notification system was completed as required in Clause 10 of the licence. Now that this system is active, it has been determined that significant rainfall events will no longer be required to be reported to the department. The quarterly and annual reporting of all CSO events is still required to be submitted.

If you have any questions regarding this change, please contact Julie Froese, Environment Officer, Environmental Compliance and Enforcement Branch at Julie.Froese@gov.mb.ca or 204-945-7104.

Sincerely,

WR

Warren Rospad
A/Director

c. Michael A. Jack, CAO - City of Winnipeg
Cynthia Wiebe, Renee Grossele, Susan Lambert, Michele Paetkau – City of Winnipeg, Water & Waste Department
Public Registry
James Capotosto, Siobhan Burland Ross, Bereket Assefa - Environmental Approvals
Yvonne Hawryliuk, Nada Suresh, Julie Froese - Environmental Compliance and Enforcement

Appendix C – 2019 CSO Master Plan Provincial Approval Letter

Manitoba
Conservation and Climate
Environmental Stewardship Division
Environmental Approvals Branch
1007 Century Street, Winnipeg Manitoba R3H 0W4
T 204 945-8321 **F** 204-945-5229
www.gov.mb.ca/sd/

File No. 3205.10
Environment Act Licence No. 3042

November 13, 2019

Chris Carroll, P.Eng., MBA
Manager of Wastewater Services Division
110-1199 Pacific Avenue
Winnipeg Manitoba R3E 3S8
Email: ccarroll@winnipeg.ca

Dear Chris Carroll:

Thank you for your submission of the Combined Sewer Overflow (CSO) Master Plan dated August 28, 2019 that sets out the roadmap for implementing a long term program in order to meet the control target objective of 85 percent capture in the Representative Year as required by Clause 11 of Environment Act Licence No. 3042 (Licence).

The November 24, 2017 approval letter required the City to submit, for approval, a Master Plan including detailed engineering plans, proposed monitoring plans, and an implementation schedule for Control Option No. 1 (i.e., 85% capture in a representative year) as identified in the CSO Master Plan Preliminary Proposal on or before August 31, 2019 and for Control Option No. 2 (i.e., four overflows in a representative year) as identified in the CSO Master Plan Preliminary Proposal on or before April 30, 2030.

Upon review of the CSO Master Plan, I hereby approve the implementation of the CSO Master Plan with the following conditions:

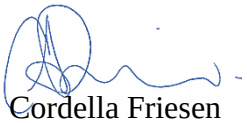
a) The Licencee shall submit for approval an outline of the content of the annual report as required by Clause 13 of the Licence by December 31, 2019;
b) The Licencee shall, prior to submission of the annual report, submit a monitoring plan for approval;
c) The Licencee shall include in the annual report the monitoring report, the proposed planning for the year ahead, and the milestones achieved;
d) The Licencee shall, from the date of issue of this Letter, collect CSO water samples and model river quality data every 5 years to demonstrate improvements in the river water quality due to implementation of Control Option No. 1. The next river water quality report is due December 31, 2024;
e) The Licencee shall carry out an assessment of the impact of climate change to the performance of the CSO program and shall include the assessment report along with the CSO Master Plan for Control Option No. 2 which is due April 30, 2030; and
f) The Licencee shall, on or before April 30, 2025, submit for approval a report demonstrating that the percent capture performance measure, an alternative to Control Option No. 2 as proposed in the CSO Master Plan dated August 28, 2019,

will provide equivalent water quality protection to Control Option No. 2 (i.e., four overflows in a representative year).

The City of Winnipeg shall implement the CSO Master Plan for Control Option No. 1 by December 31, 2045, unless otherwise approved by the Director.

Should you have any questions regarding the foregoing, please contact Asit Dey, Environment Engineer, at (204) 945-2614 or by email at asit.dey@gov.mb.ca.

Yours sincerely,



Cordella Friesen
Director
The Environment Act

c: Duane Griffin/Patrick Coote, City of Winnipeg
Shannon Kohler/Yvonne Hawryliuk/Nada Suresh, Conservation and Climate
Public registries

Appendix D – Clause 8 Provincial Approval Letters

Winnipeg | Water and Waste
Eaux et déchets

April 19, 2020

Client File No.: 3205.00
Our File Nos S-734, S-734(A) EMS
020-17-08-11-00
020-17-08-11-0N

Manitoba Conservation and Climate
Environmental Stewardship Division
Environmental Compliance and Enforcement Branch
1007 Century Street
Winnipeg, MB R3H 0W4

Attention: Yvonne Hawryliuk, MSc - Provincial Manager

RE: ENVIRONMENT ACT LICENCE NO. 3042 CLAUSE 8

This letter is in response to your March 18, 2021 letter requesting the City of Winnipeg (City) provide additional information that demonstrates compliance with Clause 8. Specifically, an estimated volume that small scale developments have increased to the combined sewer system and the estimated volume offset through various technology or infrastructure developments.

The City is providing this information below for the overall combined sewer shed.

It is estimated that a small scale development within a combined sewer district will increase the volume to the combined sewer system by approximately $1m^3$ for a 5 year rainfall event. A review of small scale developments since 2014 in combined sewer districts has been conducted and it has been determined that approximately 2800 have been accepted. From 2014 to 2020, small scale developments have increased the volume to the combined sewer system by approximately $2,800m^3$ for a 5 year rainfall event.

It is estimated that the sewer separation work completed up to 2020 in the Cockburn Calrossie combined sewer district has decreased the volume of land drainage to the combined sewer system by approximately $57,000m^3$ for a 5 year rainfall event.

This information will be submitted on an annual basis starting with the 2021 CSO Annual Report.

Should you have any questions on this please contact Michelle Paetkau at 204-986-4904 or by email at mpaetkau@winnipeg.ca.

Sincerely,

M Paetkau

Michelle Paetkau, P. Eng.
Acting Branch Head for Wastewater Planning and Project Delivery

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109-1199 Pacific Avenue, Winnipeg, Manitoba R3E 3S8
DIVISION DES EAUX USÉES
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developments is small and may not be measurable on a single development basis but will grow as this type of development continues.

If the CSO Master Plan is not utilized as a strategic approach to meet Clause 8 requirements, then property owners of these smaller developments will need to accommodate on-site land drainage management to meet Clause 8. On-site land drainage management may limit development and the City's desire to densify older neighbourhoods by adding complexity to the proposed development (e.g. underground storage tank or catch basin leads with above ground storage) and maintenance for the prospective owners.

Larger scale developments in combined sewer districts will continue to comply with Clause 8 via land drainage discharge restrictions in order to offset increased wastewater contributions.

Regarding public engagement, the Department provided information to a representative of the Glenwood Neighbourhood Association via email. There were no registered delegations at the City's Standing Policy Committee on Water and Waste, Riverbank Management, and the Environment meeting on December 1, 2020. The Department is not aware of any other residential enquiries.

Should you have any questions on this please contact Michelle Paetkau at 204-986-4904 or by email at mpaetkau@winnipeg.ca.

Sincerely,

Michelle Paetkau, P. Eng.
Acting Branch Head for Wastewater Planning and Project Delivery

Geoff Patton, P. Eng.
Manager of Engineering Services Division

MP/dr

c: Siobhan Burland Ross, M. Eng., P. Eng., Manitoba Conservation and Climate (email)
M.L. Geer, CPA, CA, Water and Waste Department (email)
G.K. Patton, P. Eng., Water and Waste Department (email)
R. Grosselle, Water and Waste Department (email)
M. Paetkau, Water and Waste Department (email)
Chris Carroll, Water and Waste Department (email)

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August 28, 2020

Client File: 3205.00
Licence No: 3042

Michelle Paetkau, P. Eng
Acting Branch Head
Wastewater Planning and Project Delivery
110-1199 Pacific Avenue
Winnipeg MB R3E 3S8
Email: mpaetkau@winnipeg.ca

Dear Michelle Paetkau:

RE: Combined Sewage Overflow (CSO) Environment Act Licence 3042
Application of Clause 8

This letter is in follow up to the meeting of February 27, 2020 between Manitoba Conservation and Climate and the Water and Waste Department, regarding the interpretation and application of Clause 8 of Environment Act Licence 3042.

It was agreed upon at the above meeting that the City of Winnipeg would provide Conservation and Climate with a document outlining the strategies and measures the City of Winnipeg will implement to comply with the requirements of Clause 8, namely that there be no increase in the frequency or volume of combined sewer overflows due to development. Conservation and Climate is yet to receive this document. Please submit to Environmental Compliance and Enforcement by September 30, 2020.

In addition, CC has received concerns from the public about how this clause is being applied in the Glenwood neighbourhood. In order to address the concerns and determine compliance, CC is requiring that the City of Winnipeg demonstrate how Clause 8 is being applied within that sewershed by providing supporting documents by September 11, 2020.

If you have any questions, please contact Julie Froese, Environment Officer, Environmental Compliance and Enforcement Branch at Julie.Froese@gov.mb.ca, or 204-945-7104.

Yours sincerely,

Yvonne Hawryliuk
Provincial Manager, Environmental Compliance and Enforcement

c: P. Coote, Water and Waste Department, City of Winnipeg
S. Burland Ross/ A. Dey, Environmental Approvals Branch
P. Crocker/ N. Suresh/ J. Froese, Environmental Compliance and Enforcement Branch

Winnipeg | Water and Waste
Eaux et déchets

December 21, 2020

Client File No.: 3205.00
Our File Nos S-734, S-734(A) EMS
020-17-08-11-00
020-17-08-11-0N

Manitoba Conservation and Climate
Environmental Stewardship Division
Environmental Compliance and Enforcement
1007 Century Street
Winnipeg, MB R3H 0W4

Attention: Yvonne Hawryliuk, Provincial Manager, Environmental Compliance and Enforcement

RE: ENVIRONMENT ACT LICENCE NO. 3042 CLAUSE 8

This letter is in response to your August 28, 2020 letter regarding the City of Winnipeg's (City) implementation strategies and measures to comply with Environment Act Licence No. 3042 Clause 8.

The City recommends using the Combined Sewer Overflow Master Plan (CSO Master Plan) to meet Clause 8 by removing wastewater and/or land drainage contributions from the combined sewer system from multiple areas of the City in order to offset any additional wastewater and/or land drainage contributions from small scale developments. This applies for the following small scale developments in combined sewer districts:

- New single-family dwellings which are replacing older, smaller homes built prior to 1990
    - Homes built prior to 1990 have weeping tiles connected to the sewer service pipe
- New two-family dwellings which are replacing older, smaller homes built prior to 1990
    - Homes built prior to 1990 have weeping tiles connected to the sewer service pipe
- Residential, commercial and industrial interior renovations/small additions
- New single-family and two-family dwellings on vacant land
- Lot splits, with new small scale development, where the original single-family or two-family dwelling remains

The current City of Winnipeg Sewer Bylaw 106/2018 does not require the restriction of a land drainage discharge rate for a single-family or two-family property on a lot with an area of less than 1,000 square metres (Part 9 Section 64(2)).

Increases in wastewater and/or land drainage contributions from the small scale developments identified above are proposed to be offset by sewer separation works in the CSO Master Plan. As previously stated, the City is currently constructing sewer separation works in the Cockburn Calrossie combined sewer district which will reduce combined sewer overflow volume by approximately 183,000 m3. The incremental contributions from the identified small scale

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Tim Shanks, M. Eng., P. Eng.
Acting Manager of Engineering Services Division

MP/dr

c: Siobhan Burland Ross, M. Eng., P. Eng., Manitoba Conservation and Climate (email)
M.L. Geer, CPA, CA, Water and Waste Department (email)
T. Shanks, M. Eng., P. Eng., Water and Waste Department (email)
R. Grosselle, Water and Waste Department (email)
M. Paetkau, Water and Waste Department (email)
C. Carroll, Water and Waste Department (email)

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March 18, 2021

File No.: 3205.00
Licence No.: 3042

Michelle Paetkau, P. Eng., Acting Branch Head
Wastewater Planning and Project Delivery
110-1199 Pacific Avenue
Winnipeg MB R3E 3S8
Email: mpaetkau@winnipeg.ca

Dear Michelle Paetkau:

RE: Combined Sewage Overflow (CSO) Environment Act Licence 3042
Application of Clause 8

Manitoba Conservation and Climate, Environmental Compliance and Enforcement Branch acknowledges the receipt of your letter, dated December 21, 2020 in response to Manitoba Conservation and Climate's letter dated August 28, 2020 on the above subject.

Manitoba Conservation and Climate has reviewed the information provided and has determined to fully assess compliance with Clause 8 that additional information is required. Specifically, an estimated volume that developments have increased flows to CSO and the estimated volume offset through various technology or infrastructure developments is required. Manitoba Conservation and Climate is requesting that the above information be provided by April 19, 2021. The information can be provided by sewer district, or for the overall sewershed.

Going forward, this information will be required to be submitted on an annual basis. CSO Annual report outline was initially approved on January 17, 2020. This approval is hereby amended to include the above requested information starting within the 2021 CSO Annual report.

If you have any questions, please contact Julie Froese, Environment Officer, Environmental Compliance and Enforcement Branch at Julie.Froese@gov.mb.ca, or 204-945-7104.

Yours sincerely,

Kristal Harman
Director, Environmental Compliance and Enforcement

c: Geoff Patton, P. Eng., Manager of Engineering Services Division
P. Coote, Water and Waste Department, City of Winnipeg
S. Burland Ross/ A. Dey, Environmental Approvals Branch
N. Suresh/J. Froese, Environmental Compliance and Enforcement Branch

Manitoba
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File No.: 3205.10

July 8, 2021

Michelle Paetkau, P. Eng.
Acting Branch Head
Wastewater Planning and Project Delivery
110-1199 Pacific Avenue
Winnipeg MB R3E 3S8
Email: mpaetkau@winnipeg.ca

Dear Michelle Paetkau:

This will acknowledge receipt of your letter dated April 19, 2021, in response to our March 18, 2021, letter requesting clarification on your December 21, 2020, submission.

Conservation and Climate has reviewed all the information provided on the estimated increase in volume of Combined Sewer Overflows caused by infill developments and the estimated decrease in volume as a result of infrastructure development on the overall Combined Sewer system, and has determined it satisfies the intent set out in Clause 8 of Environment Act Licence No. 3042. Future compliance with respect to Clause 8 will be assessed through our review of the information provided in the Combined Sewer Overflow (CSO) Annual Reports, starting with 2021 as requested in our March 18, 2021 letter.

As per your letter dated December 21, 2020, the City's strategy to meet Clause 8 provides offsets by sewer separation projects being completed under the CSO Master Plan for the following: increases in wastewater and/or land drainage contributions from new single and two family dwellings replacing older homes; renovations and small additions for residential, industrial, and commercial properties; and new homes on vacant land and lot splits with small scale development where the existing building remains. Further, you have also stated that larger scale developments in combined sewer districts will continue to comply with Clause 8 via land drainage discharges restriction in order to offset increased wastewater contributions.

In addition, Conservation and Climate wishes to confirm that the proposed strategy regarding small development compliance with Clause 8 applies to the overall combined sewer district for the purpose of interpretation of the above Environment Act Licence. It should be noted that the city and Conservation and Climate are of the same understanding regarding the interpretation of 'sewershed' as the overall combined sewer district and using the CSO Master Plan to achieve the Clause 8 requirements as per the deliberations at the recent CSO Milestone meeting held on May 10, 2021. The City should continue to review developments on a case by case basis to enforce compliance with Clause 8 at the broad sewershed level, the CSO Master Plan and other City standards (e.g. Sewer-By-Law, Basement Flood Relief, etc.) as required.

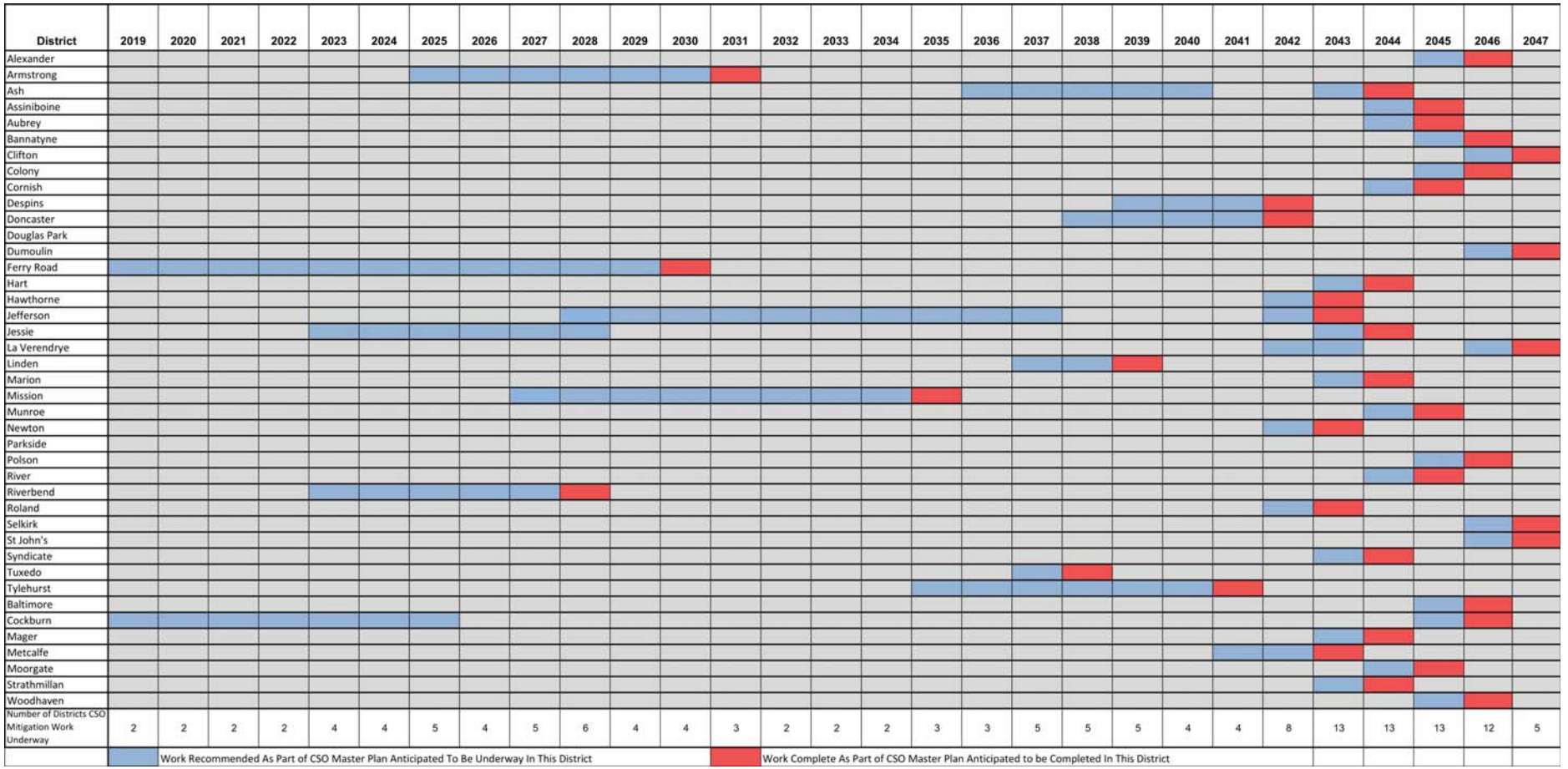
If you have any questions, please contact Yvonne Hawryliuk, Provincial Manager, Environmental Compliance and Enforcement Branch, at Yvonne.Hawryliuk@gov.mb.ca or 204-945-5305.

Sincerely,

Kristal Harman, Director
Environmental Compliance and Enforcement

c: Y. Hawryliuk/N. Suresh/J. Froese, Environmental Compliance and Enforcement Branch
L. Pyles/S. Burland Ross/ B. Assefa, Environmental Approvals Branch
G. Patton, P. Eng., Manager of Engineering Services Division
M.L. Geer, CPA, CA, Water and Waste Department
R. Grosselle, Water and Waste Department
C. Carroll, Water and Waste Department
P. Coote, Water and Waste Department, City of Winnipeg

Appendix E – District Program Scenario 1 Implementation Schedule



CSO Master Plan Program Scenario 1 Sewer District Based Implementation Schedule (Jacobs, 2019)

Appendix F - CSO Master Plan Program Scenario 1 Tracked Against Actual Implementation Schedule 3 Year Window

CSO Master Plan (MP) and Actual Implementation Schedule					
		Current Year	Forecasted Schedule		
District	**Schedule Type**	**2022**	**2023**	**2024**	**2025**
Ferry Road	MP				
	Actual				
Jefferson East	MP				
	Actual				
Jessie	MP				
	Actual				
Riverbend	MP				
	Actual				
Cockburn	MP				
	Actual				
	Construction implementation to be underway as per CSO Master Plan				
	Actual status as per 2022 Year End Evaluation				

Appendix G - District Plans Design Status

District Plans Design Status

	Completion Progress			
CS Districts	**Conceptual Design**	**Preliminary Design**	**Detailed Design**	**Construction**
Woodhaven				
Strathmillan				
Moorgate				
Douglas Park				
Ferry Road				
Tuxedo				
Doncaster				
Parkside				
Riverbend				
Tylehurst				
Clifton				
Ash				
Aubrey				
Cornish				
Colony				
River				
Assiniboine				
Cockburn				
Baltimore				
Metcalfe				
Mager				
Jessie				
Marion				
Despins				
Dumoulin				
La Verendrye				
Bannatyne				
Alexander				
Mission				
Roland				
Syndicate				
Selkirk				
Hart				
St John's				
Polson				
Munroe				
Jefferson E				
Jefferson W				
Linden				
Newton				
Armstrong				
Hawthorne				
	Represents progress as of December 31, 2022			

Appendix H - 2023 Planned Capital Projects

2023 Planned Capital Projects

Project Name	District	Project Type	Class of Estimate	Forecasted Budget	Volume Reduction (m3)
NEWPCC					
Ferry Road / Riverbend Consulting Assignment 5	Ferry Road / Riverbend	Sewer Separation	Class 3	2,500,000	N/A
Jefferson East Construction Contract 8A - Construction of land drainage sewers on Andrews Street from Semple Avenue to Perth Avenue. Kilbride, Belmont, Hartford Avenue from McGregor Street to Powers Street.	Jefferson East	Sewer Separation	Class 3	$2,500,000	9,143
Jefferson East Construction Contract 9 - Construction of land drainage sewers on McGregor Street from Partridge Avenue to Semple Avenue. Forest Avenue, Royal, Kingsbury, Burrin Avenue from CNR Railway to Andrews Street.	Jefferson East	Sewer Separation	Class 3	$3,000,000	12,619
Armstrong – Consultant Assignment 2	Armstrong	Sewer Separation	Class 3	$3,000,000	N/A
Armstrong – Construction – phasing of work TBD	Armstrong	Sewer Separation	Class 3	$4,000,000	TBD
Hawthorne – Construction – phasing of work TBD	Hawthorne	Basement Flood Relief	Class 3	$4,000,000	TBD
St John's Redwood Construction Contract 1	St John's	Sewer Separation	Class 3	$700,000	TBD
SEWPCC					
Cockburn East - Consultant Assignment 1	Cockburn	Sewer Separation	Class 3	$1,200,000	N/A
Cockburn / Calrossie - Construction Contract 9A - Construction of land drainage sewers on Taylor Avenue from Wilton Street to Poseidon Bay	Cockburn / Calrossie	Sewer Separation	Class 3	$9,000,000	13,542 between C9A and C9B
Overall System					
Rainfall Monitoring Program – Operation and Maintenance	N/A	Rainfall Monitoring Program	Class 3	$130,000	N/A
River, Stream and Combined Sewer Overflow Discharge Water Quality Monitoring	N/A	Water Quality Monitoring	Class 3	$1,300,000	N/A
Note: The status of the planned contracts is subject to change pending available budget and resources.					
	Estimated values				

Appendix I – Water Quality Monitoring Plan

Water and Waste Department • Service des eaux et des déchets

City of Winnipeg
Water Quality Monitoring Plan

Environment Act No. 3042

Prepared for

Manitoba Environment, Climate and Parks

January 2023

City of Winnipeg Water Quality Monitoring Plan

Client File No: 3205.00
City File No. S-1259

Document Title: City of Winnipeg Water Quality Monitoring Plan
Revision: V02
Date: January 06, 2023
Prepared by: City of Winnipeg Water and Waste Department
Wastewater Planning and Project Delivery Branch
Patrick Coote, P.Eng.
Arash Kiayee, P.Eng.

Document History and Status

Revision	Prepared by	Date	Reviewed by	Date	Approved by	Date
Version 01	AK, PTC	30/3/2022	PTC	7/6/2022	PTC	9/26/2022
Version 02	PTC	04/01/2023	MP, SML	05/01/2023	PTC	06/01/2023

Executive Summary

The Water Quality Monitoring Plan outlines the City of Winnipeg (City) proposed approach to fulfill a requirement in the Manitoba Environment, Climate and Parks (formerly known as Manitoba Conservation and Climate) approval letter dated November 13, 2019. According to that letter, the City is required to collect combined sewer overflow (CSO) water samples and model river quality data every five years to demonstrate improvements in the river water quality due to implementation of Control Option No. 1 (85% capture in the 1992 representative year). The first river water quality report is due December 31, 2024.

The sampling program will track river and stream water quality under both dry and wet weather conditions. The information will be used to monitor in-stream water quality within the City and at the boundaries. The in-stream river and small stream sampling program will collect grab samples at nine (9) locations along the Red and Assiniboine Rivers and six (6) locations on small streams during dry and wet weather conditions.

The monitoring plan also discusses the feasibility of collecting CSO samples during wet weather periods, and proposes representative outfall locations for sample collection.

Samples will be tested and analyzed for concentrations of pollutants of concern (POC) including escherichia coli (E. coli), total phosphorus (TP), total nitrogen (TN), ammonia, and total suspended solids (TSS).

The river bacteria water quality data will be modeled to better understand its performance against Manitoba Water Quality Standards, Objectives and Guidelines (MWQSOG) thresholds.

Contents

Tables

Figures

Acronyms and Abbreviations

BOD	biochemical oxygen demand
$CBOD_5$	five day carbonaceous biochemical oxygen demand
cfu	colony-forming unit
City	City of Winnipeg
CSO	combined sewer overflow
DWO	dry weather overflow
DYNHYD	Dimensional Hydrodynamic Flow Model
EA	Environment Act
E. coli	escherichia coli
EMC	event mean concentrations
HEC	Hydrologic Engineering Center
ID	identification
LDS	land drainage sewer
MECP	Manitoba Environment, Climate and Parks
mg/L	milligram per liter
ml	milliliter
ML	megaliter
MPN	most probable number
MWQSOG	Manitoba Water Quality Standards Objectives and Guidelines
No.	Number
NPDES	National Pollutant Discharge Elimination System
NPRI	National Pollutant Release Inventory
PH	Potential of hydrogen
POC	pollutants of concern
SCADA	Supervisory control and data acquisition
SOIS	Sewer Overflow Information System
SSO	sanitary sewer overflow
TKN	total keldahl nitrogen
TM	technical memorandum
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
U.S. EPA	United States Environmental Protection Agency
WASP	Water Quality Analysis Simulation Program
WPCC	Water Pollution Control Centre
WWF	wet weather flow
XP-SWMM	Extreme Programming Storm Water Management Model

1. Purpose

This Water Quality Monitoring Plan is being submitted in conformance with a requirement in the Manitoba Environment, Climate and Parks (formerly known as Manitoba Conservation and Climate) approval letter dated November 13, 2019. The City of Winnipeg shall, from the date of issuance of the letter, collect combined sewer overflow (CSO) water samples and model river quality data every five years to demonstrate improvements in the river water quality due to implementation of Control Option No. 1, which refers to 85% capture in the 1992 representative year. The next river water quality report is due December 31, 2024.

The purpose of this Water Quality Monitoring Plan is to outline the work components, the proposed monitoring locations, the pollutants to be tested, and the timelines of the program.

This document provides background water quality monitoring to date, describes the rationale for the monitoring plan, and provides basic information on the sample collection approach. It also provides perspective on the planning details with the recognition that the plan will evolve as more site-specific field information is gathered and assessed and be adjusted as the program proceeds.

2. Background

As per the CSO Master Plan approval letter, dated November 13, 2019, the City of Winnipeg (City) will continue to work toward implementing 85% CSO capture in the 1992 representative year (Control Option No. 1) while further evaluating the volume reduction equivalent to a minimum of four (4) overflows in the 1992 representative year (Control Option No. 2). A water quality report will be submitted once every five years, starting on December 31, 2024. The implications of maintaining a percent capture program on water quality will be evaluated and will be provided in the 2030 Master Plan update submission.

The City has undertaken monitoring programs in the past and currently carries out monitoring programs relating to the operation of the collection system and its impact on water quality.

- Since 1977, the City has carried out a bi-weekly water quality monitoring program of the rivers and small streams during open water season (typically May – October, inclusive) at regular intervals to measure the health of Winnipeg's waterways.
- The 2002 CSO Management Study encompassed all of the available data with respect to water quality of the CSOs and the receiving environment as well as data from various related Water Quality monitoring campaigns.
- The 2014-2015 Water Quality Monitoring Program was carried out during 2014 and 2015 and included CSO and stream monitoring, which was used to develop event mean concentration (EMCs) for the CSO discharges and for the stream boundary flows. The monitoring was carried out for dry weather conditions, wet weather conditions, and for CSO discharges. This work was followed by a water quality modeling.
- The City's CSO Outfall Monitoring as of 2021 has installed instrumentation at 45 combined sewer discharge locations to monitor levels and flap gate inclination. These instruments are used to monitor the sewage collection system and report on overflows.
- The 2021 Dry Weather Overflow Water Quality Assessment was completed to evaluate the impact of Dry Weather Overflows (DWOs) on the receiving waterbodies within the City and downstream, including Lake Winnipeg.
- The City has recently created a near real time CSO Notification Tool alert when CSOs discharge to our rivers. The CSO Notification Tool can be accessed on the City's website at: MyUtilityInfo – Water and Waste Department – City of Winnipeg.

2.1 Bi-weekly River & Stream Water Quality Monitoring

Since 1977, the City has carried out a water quality monitoring program of the rivers and streams at regular intervals during the open water season (typically May – October, inclusive) to measure the health of Winnipeg's waterways. Samples are collected at 11 locations along the Red and Assiniboine rivers and at eight (8) locations on selected small streams. Testing is carried out for 17 parameters including nutrients, dissolved oxygen, and bacteria. The results are posted on the City's website.

The September 29, 2021 river survey monitoring report and July 15, 2021, small stream survey monitoring reports are attached in Appendix A as examples. The reports identify the sample locations and the parameters tested. The tables include location IDs to correspond to monitoring map locations. The river and stream sampling locations are shown on a map attached in Appendix B.

2.2 2002 CSO Management Study

The 2002 CSO Management Study was a comprehensive multi-year study that commenced in 1994, and concluded in 2002. The study incorporated river and discharge water quality data going back to 1988. It was undertaken in four phases as follows:

- Phase 1 – Wet Weather Flow (WWF) Management: Issues and Objectives
- Phase 2 – Addressing the WWF Problems
- Phase 3 – Potential Plans for Cleaner Rivers

- Phase 4 – Proposed Implementation Plan

The study included dry and wet weather river monitoring and small stream monitoring for various parameters (see Phase 1 Technical Memorandum for CSO Management Study – TM 4 Receiving Stream). Figure 1 shows 1988 River Monitoring Program Sampling Locations.

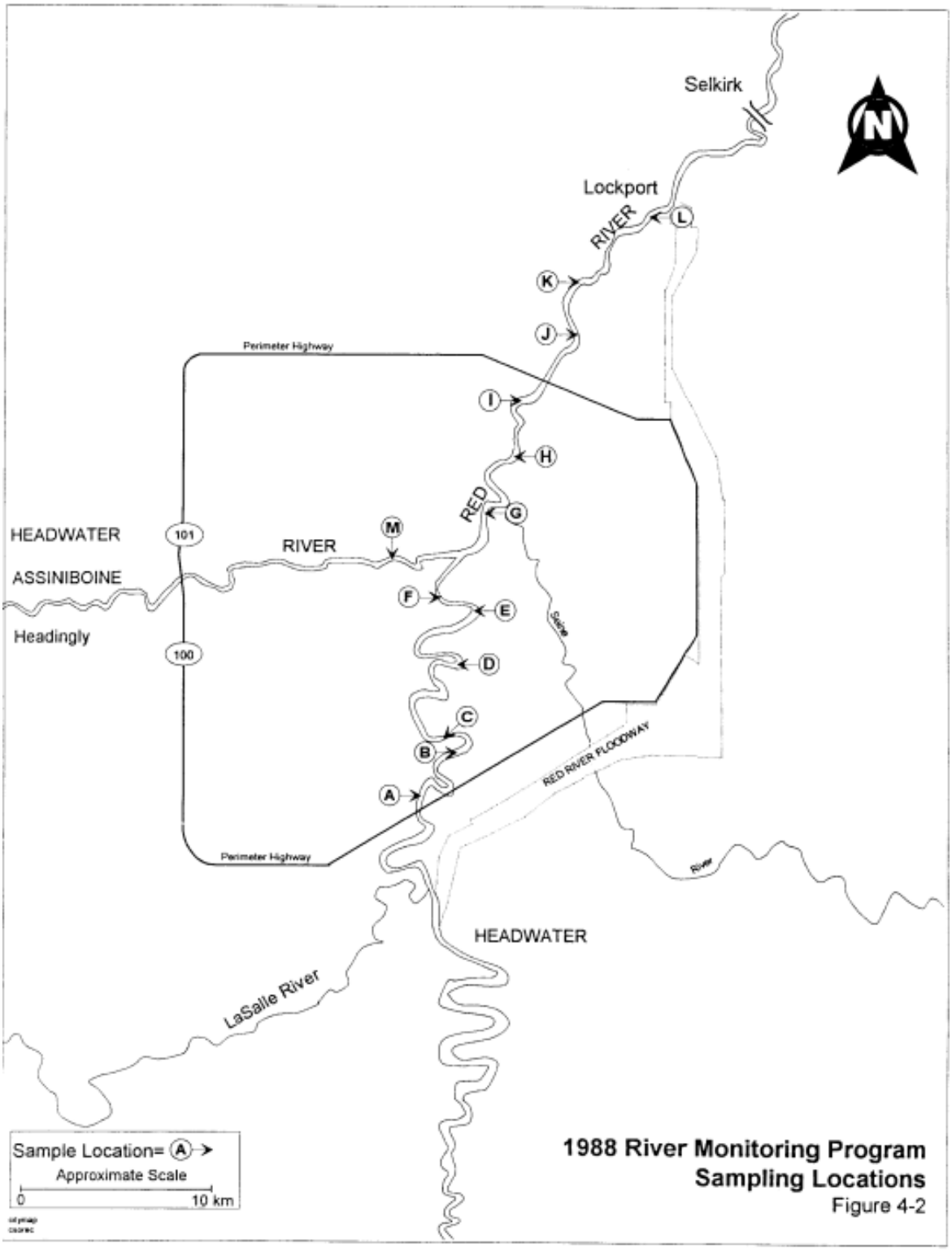


Figure 1 – 1988 River River Monitoring Program Sampling Locations

Technical Memorandum (TM) No. 4 – Receiving Streams of Phase 1 TM for CSO Managenent Study (June 1994) documented the review of previous studies and monitoring done on the Red and Assiniboine rivers from 1977 to 1993.

Discharge water quality monitoring was carried out at the Aubrey outfall to collect overflow discharge quality information and assess its treatability (Phase 3 TM – Appendix No. 3 – Treatability, 1997).

Hydraulic conditions were modeled using Extreme Programming Storm Water Management Model (XP-SWMM) computer software. Applied United States Environmental Protection Agency (U.S. EPA) Dimensional Hydrodynamic Flow Model (DYNHYD), along with the Hydrologic Engineering Center steady-state model (HEC2) were used to define hydraulic characteristics and travel times of the rivers. Detailed hydraulic information from DYNHYD was used to set up a cascading-pool description with the U.S. EPA Water Quality Analysis Simulation Program (WASP) model. The WASP software was then used to simulate river quality under dry and wet weather conditions.

The results of the analysis on CSO data collected between 1989 to 1992 in eight stations[1] indicated that the EMC were evenly distributed and no one station exhibited consistently high or low values.

Based on the 2002 CSO Management Study, the finding of no significant linear correlation between event mean concentrations (i.e., the typical quality of the CSO) and runoff volumes is important in that it means that it is not likely that the size of storms for different monitored events will have biased the EMC. Further, it indicates that refinement of methods to account for precipitation and runoff characteristics, antecedent conditions, etc. are not warranted, particularly for planning level studies. Accordingly, the EMC were applied to the dry and wet weather hydrographs to estimate loadings to the river for the various contaminants. EMC for CSO five day carbonaceous biochemical oxygen demand ($CBOD_{5)}$) and total suspended solids average 110 mg/L and 845 mg/L, respectively. These EMCs were based on the results of local sampling programs. The EMC for Fecal Coliforms used for the modeling of City discharges to the Rivers are provided in Table 1.

Table 1 – Fecal Coliform Event Mean Concentrations

Source		Fecal Coliform Density (Geometric Mean) cfu/100 mL
Water Pollution Control Centre (WPCC)	Average Dry Weather Flow	200,000
	Peak Dry Weather Flow	200,000
	Peak Wet Weather Flow	2,400,000
Land Drainage Sewer (LDS)	Direct to Stream	40,000
	Pond Discharge	20,000
CSO		2,400,000
Sanitary Sewer Overflow (SSO)		10,000,000
Interceptor	CSO	2,400,000
	SSO	10,000,000
Source: CSO Management Study – Final Report – Table 7-2, Wardrop Engineering Inc./TetrES Consultants Inc. in Association with CH2M Canada Limited and EMA Services Limited, November 2002		

2.3 2014–2015 Water Quality Monitoring Program

As per Clause 15 of Environment Act (EA) No. 3042, the City developed an Interim CSO Monitoring Plan to aid in the development of the CSO Master Plan. Based on the plan, a water quality monitoring program

[1] Reported in CSO Management Study, Phase 2 Technical Memorandum #1 – Problem Definition, Wardrop Engineering Inc. et al., 1995

was conducted in 2014 and 2015 to collect and update river and CSO water quality data for the development of the CSO Master Plan.

The water quality monitoring was targeted to dry and wet weather events. The river and stream monitoring for this portion of the program included the collection of samples at nine locations along the Red and Assiniboine rivers and at five locations on select small streams. Testing was carried out for 15 parameters. The results are posted on the City's website at https://winnipeg.ca/waterandwaste/sewage/monitoring/RiversSmallStreams.stm.

Computer models were used to estimate runoff from rainfall and snowmelt and river water quality based on pollutant loads for the baseline conditions. The escherichia coli (E. coli) bacteria regulatory limit of 200 cfu/100mL was shown to be met during dry weather conditions, but spiking above the limit during the rainfalls, with the elevated levels lasting a couple of days before returning to original levels. There was an absence of observed dry weather discharges during the dry day river and stream monitoring and absence of predicted DWOs.

Observed data and analysis for CSO total phosphorus (TP) and total nitrogen (TN) concluded that nutrient loading had only a small contribution to Lake Winnipeg at 0.3% and 0.1%, respectively, and was not an issue for the rivers.

EMC were created based on the data collected from the 2014 and 2015 water quality monitoring program are shown in Table 2. The EMC for TP and TN were used as the baseline for the water quality modeling and loading assessments for evaluation of control option alternatives for the CSO Master Plan.

EMC for ammonia, TN and TP are used to determine pollutant loads in the NRPI reports. The assessment indicated that the CSO discharge quality varied by location and between events but was within expected ranges for combined sewer discharges.

Table 2 – CSO Discharge Pollutants EMC from 2014-2015 Water Quality Monitoring Program

Substance Name	Unit	EMC
Ammonia[1]	mg/L N	5.72
Nitrate-N[1]	mg/L N	0.34
Total Phosphorus[1,2]	mg/L P	2.71
Total Nitrogen[2]	mg/L N	15.25
E. Coli[2]	MPN/100 mL	1.8×10^6

1. Parameters used in the NPRI reports
2. Parameters used in the CSO Master Plan nutrient loading assessments

A comparison between the data collected during 2002 and 2014-2015 water quality studies, and the ranges referenced in U.S.EPA is shown in Table 3.

Table 3 – Comparison of CSO Pollutants

Type	BOD_5 (mg/L)	Total P (mg/L)	Total N (mg/L)	TSS (mg/L)	*Bacteria*
2015 CSO Discharge[1]	13 – 410	0.5 – 10	3.4 – 55.5	73 – 2125	300,000 – 21,000,000 MPN/100 mL (E. coli)
2002 CSO Discharge[2]	14 – 191	1 – 4	8 – 26	184 – 720	100,000 – 34,000,000 cfu/100 mL (Fecal Coliform)
EPA – CSOs[3]	3.9 – 696	0.1 – 20.8	0 – 82.1	1 – 4420	3 – 40,000,000 cfu/100 mL (Fecal Coliform)

1. 2014-2015 Water Quality Monitoring Program
2. Phase 1 Technical Memorandum for CSO Management Study – Problem Definition – TM No. 1 – Table 2-7, Wardrop Engineering Inc. et al., June 1994
3. 2004 NPDES CSO Report to Congress – Chapter 4 Characterization of CSOs and SSOs, U.S. EPA, August 2004

2.4 CSO Outfall Monitoring

In 2009, the City began investing in CSO outfall event monitoring at 39 outfalls ($12 million up to 2019). Since 2013, the City has invested an additional $10 million to date for combined sewer outfall and gate chamber rehabilitation projects. This additional instrumentation and outfall chamber work increased the total CSO outfall event monitoring to 45 outfalls as of 2021. CSO monitored outfall locations are identified in the attached Appendix C.

This program provides observed data which is uploaded directly to the City's Supervisory control and data acquisition (SCADA) system to monitor the performance of the overflows. This observed data also allows for analysis of the overflow performance over time and can be used to improve model prediction.

2.5 2021 Dry Weather Overflow Water Quality Assessment

The 2021 dry weather water quality assessment was completed to evaluate the impact of DWOs on the receiving waterbodies within the City and Lake Winnipeg. Results from the City's DWO sample set were analyzed to determine the concentration of the select Pollutants of Concern (POC) including TP, TN and E. coli.

The study showed that DWOs do not significantly contribute to nutrient loading within the rivers or Lake Winnipeg. DWOs were shown to account for approximately 0.000050% of the nitrogen loading and 0.00013% of the phosphorus loading to Lake Winnipeg.

The WASP model results indicated that DWOs will increase the bacteria levels within the rivers, but that the level of bacteria in the rivers will rise only marginally following a typical DWO and will not increase above the regulatory guideline of 200 MPN/100 mL. Levels decrease back to baseline within 24 to 36 hours after the event begins. The increase in the level of bacteria from a DWO is limited to within the City limit with no increase above the regulatory guideline level simulated at the Lockport model location.

The Dry Weather Overflow Water Quality Assessment Report was submitted to Manitoba Environment, Climate and Parks (MECP) on December 24, 2021. Based on the response received on July 13, 2022 from MECP, sampling is no longer required for all DWO events. Sampling will still be required for overflow events that exceed 5 hours in duration, or if the expected flow will exceed 0.5 ML.

2.6 CSO Notification Tool

The CSO Notification Tool utilizes outfall instrumentation, a network of rain gauges and sewer computer model simulations to determine if an overflow has occurred in near real-time. It also pulls forecasting radar data, allowing the user to see if an overflow is likely to occur within the next 12 hours.

The CSO Notification Tool satisfies Clause 10 of EA No. 3042, and replaces the Sewer Overflow Information System (SOIS). The SOIS system alerted to the probability of an overflow somewhere in the City. The CSO Notification Tool provides overflow alerts for every combined sewer outfall through the open water season.

3. Water Quality Monitoring

Water quality monitoring is to be implemented to assess, track and report river and stream water quality performance during the implementation of the CSO Master Plan at the boundaries and through the City with reports required every five (5) years. In addition, CSO discharge monitoring is proposed to be implemented at two (2) outfall locations to confirm the data gathered from the previous studies.

The forthcoming water quality monitoring program is planned to be carried out starting in May 2023 in time to be used for the river water quality monitoring report due December 31, 2024. The program may extend into 2024 if sufficient data is not obtained. Sufficient data will be determined by the City and consultant based on analysis of the data against the requirements of the water quality monitoring.

The program timing will be aligned with the normal periods dry weather and for wet weather events, the extent of data collection will depend on suitable dry weather periods and the occurrence of wet weather events. The existing river water quality monitoring will continue as normal. The existing river quality monitoring program allows for continued monitoring of the river water quality at boundary locations.

Many factors may limit the City's ability to conduct a monitoring plan during the open water season such as flooding, high river levels, safety, equipment procurement, etc. When the monitoring program for each sampling season concludes, sufficient time will be required to analyze the raw data and prepare reports.

Monitoring water quality is required to comply with Provincial requirements and will provide data that can be used in CSO Master Plan evaluations and compliance reporting.

3.1 Proposed Approach for Water Quality Monitoring

The river water quality monitoring will capture water quality samples at City boundaries (upstream and downstream of the City) to assess conditions throughout the City. Wastewater treatment plant effluent discharge samples will be included in the water quality analysis to provide information on the plant wet weather discharge quality. CSO discharge samples will also be collected and analyzed to fine-tune the EMCs derived from previous studies.

3.1.1 Water Quality Parameters

The 2002 CSO Study and the 2019 CSO Master Plan (based on the 2014-2015 Water Quality Monitoring Program) identified bacteria as the most significant pollutant of concern, and the proposed monitoring program will support the 2030 CSO Master Plan modeling for bacteria, as well as loading assessments for nutrients and other POC.

The water quality parameters measured in previous studies and those proposed for the upcoming Water Quality Monitoring study are shown in Table 4.

Table 4 – Previously Measured and Proposed Water Quality Parameters

Parameter	Rivers & Small Streams Survey Monitoring Reports[1]	NPRI Report[2]	2002 CSO Study[3]	EA No. 3042	2014-2015 Water Quality Monitoring Program (Rivers & Streams)[4]	2021 DWO Water Quality Assessment[5]	MWQSOG[6]	Effluent Quality Limits (EA No. 3042)	Proposed for 2023-2024 Water Quality Monitoring	Comments
Temperature	✓	-	-	-	✓	-	-	-	✓	In-situ
Dissolved Oxygen	✓	-	-	-	-	-	-	-	-	In-situ
Oxygen Saturation	✓	-	-	-	-	-	-	-	-	
Biochemical Oxygen Demand	✓	-	✓	✓	✓	✓	✓	50 mg/L	✓	
pH	✓	-	-	-	✓	-	-	-	✓	
Total Solids	✓	-	-	-	-	-	-	-	-	

Parameter	Rivers & Small Streams Survey Monitoring Reports[1]	NPRI Report[2]	2002 CSO Study[3]	EA No. 3042	2014-2015 Water Quality Monitoring Program (Rivers & Streams)[4]	2021 DWO Water Quality Assessment[5]	MWQSOG[6]	Effluent Quality Limits (EA No. 3042)	Proposed for 2023-2024 Water Quality Monitoring	Comments
Total Suspended Solids	✓		✓	✓	✓	✓	✓	50 mg/L	✓	
Turbidity	✓	-	-	-	-	-	-	-	-	
Total Organic Carbon	✓	-	-	-	-	-	-	-	-	
Chlorophyll a	✓		-	-	-	-	-	-	-	
Ammonia Nitrogen	✓	✓	-	-	✓	✓	✓	-	✓	
Nitrite Nitrogen	-	-	-	-	✓	-	-	-		
Nitrate Nitrogen	✓	✓	-	-	✓	-	-	-	✓	
Total Kjeldahl Nitrogen (TKN)	-	-	-	-	✓	-	-	-	-	
Total Nitrogen	✓		✓		✓	✓		-	✓	Secondary POC
Soluble Phosphorus	✓	-	-	-	-	-	-	-	-	
Total Phosphorus	✓	✓	✓	✓	✓	✓	✓	1 mg/L	✓	Secondary POC
E. coli	✓	-	-	✓	✓	✓	✓	1000 MPN/100 mL	✓	Primary POC
Fecal Coliform	✓	-	✓	-	✓	-	✓	-	-	
Conductivity	-	-	-	-	✓	-	-	-	-	

Sources:
1. https://winnipeg.ca/waterandwaste/sewage/monitoring/RiversSmallStreams.stm
2. Report to the National Pollutant Release Inventory (NPRI) Program
3. 2002 CSO Management Study – Phase 1 – TM1, Wardrop et al., June 1994, Table 2-7
4. CSO Master Plan Water Quality Monitoring Program, CH2M et al., December 2015, Table 2
5. Dry Weather Overflow Water Quality Assessment, Jacobs, November 2021, Table 3-2
6. Manitoba Water Quality Standards, Objectives, and Guidelines, Manitoba Water Stewardship, November 2011, Table 1

The proposed parameters for 2023/2024 water quality monitoring include EA No.3042 parameters of biochemical oxygen demand (BOD), total suspended solids (TSS), TP and E. coli. Additional parameters to be monitored include PH, temperature, Ammonia Nitrate, TN and Nitrate Nitrogen.

3.1.2 CSO Discharge Water Quality Monitoring

The 2002 CSO Study reviewed prior research from a wide range of locations and found that discharge quality from CSOs was highly variable, and the overall loadings from CSOs were essentially uncorrelated with runoff volume. The intuitive first flush effect had been periodically but not consistently observed, the discharge concentrations changed from time to time and comparisons between locations which would have been expected to be similar were often quite different.

In addition, the 2014-2015 water quality monitoring program showed that CSO discharge was also highly variable and there was no discernable trend in the values of POC based on the locations sampled during 2015 or the intensity or duration of rainfall causing the overflow.

The 2014-2015 data were compared to the 2002 data to reassess and update the POCs identified previously. The data gathered during the 2014-2015 water quality program were used as the baseline for the water quality modeling and loading assessments used in the potential plan evaluations. The results from the two studies matched closely and are consistent with results from published information (i.e. they are within typical ranges for combined sewage).

The results of both data sets provided similar estimations of the values for each constituent.

Since the discharge sampling results from the two studies matched closely, and are consistent with results from published information, it is expected that results from additional sets collected would be similar showing a consistently repeated trend (see Table 5). Instead, the EMCs from the previous two studies, coupled with limited new CSO discharge monitoring will be used in this study. The impacts of the CSOs on the waterbodies will be assessed by additional river monitoring before, during, and after a rainfall event. This will ensure that CSO impacts are addressed in the study.

Table 5 – EMC values for select Pollutants of Concern

Parameter	Unit	2002 CSO Study EMC[1]	2015 Master Plan EMC[2]
Bacteria[3]	MPN/100 mL	2.4×10^6	1.5×10^6
Total Phosphorus	mg/L	3.0	3.1
Total Nitrogen	mg/L	15.0	17.8

Notes:
1. Source: CSO Management Study, Phase 1, TM 1, Table 2-8 & Phase 2, TM 1, page 16.
2. Source: CSO Master Plan Water Quality Monitoring Program, December 2015, Table 2 (average values of samples collected at eight outfall locations)
3. 2002 value is fecal coliforms and 2015 value is *E. coli*.

Event mean concentrations developed as part of the CSO MP and were used in conjunction with volume reduction to estimate improvements in water quality.

3.1.2.1 Proposed CSO Discharge Water Quality Monitoring Approach

The City is proposing CSO discharge monitoring at two (2) outfall locations, representative of the runoff and discharge sources throughout the City.

The locations will be selected to ensure city-wide representation. The select locations will be outfitted with an autosampler and set to collect discharge samples following a qualified wet weather event.

Feasibility of monitoring discharges from the locations monitored in 2014/2015 will be reviewed to ensure any changes to these locations have not impacted the ability to successfully monitor discharges. Site conditions (e.g. weather, river levels, etc.) will have an impact on when the samplers can be installed.

The proposed locations will be investigated to ensure they are suitable for the installation and regular access of the samplers based on the following:

- Suitable room is available for the sampler to be housed for the monitoring period.
- The sampler can be installed and removed safely and does not interfere with the operation of the structure.
- Safe regular access to the sampler can be achieved with minimal risk to the operator.
- There is suitable and safe access to and from the outfall structure where the sampler is installed.
- High river levels do not prohibit the safe and reliable installation and operation of the monitoring equipment.

The site locations will be maintained until a satisfactory set of data is collected and then moved to different locations. A satisfactory set of data will require the samplers to successfully capture 3-4 significant wet weather events.

An assessment of the results will be required to determine if the sampling for the event was satisfactory. The minimum requirements will be several hours of overflow with the sampler working properly. Other factors will be considered based on review of the results. Conditions such as low inter-

event times or too few samples may impact the results to such an extent that they do not prove to be representative.

The use of composite sample instead of multiple discrete samples to minimize the cost of sample testing will be considered.

2002 and 2014/2015 CSO discharge monitoring results from the two studies matched closely and are consistent with results from published information (i.e. typical ranges for combined sewage).

3.1.2.2 CSO Discharge Water Quality Monitoring Challenges

To capture CSO discharge water quality samples equipment needs to be installed in the outfall and has to be accessible to collect samples. The equipment needs to be triggered to activate and all be connected to a power source. The complexity of the trigger, arrangement of sampling equipment and its size limit the locations this work can feasibly be completed at. Automatic samplers collect samples as the discharge is occurring and can take samples at designated times to get an impression of the water quality changes through the event. Going to site when a storm is occurring to take a grab sample is not good practices as it would be impossible to determine how relevant it was to the overall discharge.

Installing automatic samplers requires feasibility assessments, designing layout of the equipment and trigger levels, testing, sample collection and testing. For the 2015/2015 work, it cost close to $0.5M and would be estimated to cost $1M to repeat this work in the future. The 2014/2015 work utilized the CSO Monitoring program contractor who had knowledge of all the Outfall locations and we already mobilized in Winnipeg. The City has had challenges with obtaining specialized contractors of this nature and any contractor bidding would need to include feasibility assessment portions of the work to their bids.

All designers and municipalities try to limit entries into underground confined spaces as it poses health and safety risks to operators. One off studies and investigations can fall into a lower risk category as they are low frequency but when we have long term programs where multiple entries are required over many years these confined space locations need to be designed for frequent safe access. The CSO outfall chambers are not designed for high frequency use so there is a potential larger cost to modifying these chambers and the embankments for safe operator frequent use.

The CSO MP is focused on investing in reducing the volume of CSO discharging into our rivers, while discharge monitoring represents a significant cost and time constraint on City resources to manage, which will take funds and time from eliminating the problem.

3.1.3 River Water Quality Monitoring Frequency

The monitoring plan will include river water quality monitoring for dry and wet weather. The dry weather flow monitoring will establish a baseline in the absence of wet weather inflows. The resulting water quality will provide an indication of the natural state of the river with wastewater treatment plant effluents and upstream sources as inputs. The wet weather flow monitoring will provide information on the impact from wet weather flows, including discharges from land drainage sewers, CSOs, wastewater treatment plants, and direct runoff on the river as they flow through the City.

This proposed approach aligns with the 2014/2015 approach.

The key components include:

- Collect two (2) dry weather river and stream water quality sample sets to assess performance in dry weather
    - Three (3) preceding dry days to trigger monitoring
    - Ideally a week day and a weekend day
    - Collect grab samples on a once daily cycle for three consecutive days
    - The dry weather sampling will terminate before the full three-day period if rain occurs.
- Collect three (3) wet weather sample sets to assess performance in wet weather
    - Wet weather events that result in majority of CSO location discharges to trigger monitoring

- Collect samples for three (3) consecutive days

- Have an accredited laboratory complete the analysis in accordance with the methods prescribed in "Standard Methods for the Examination of Water and Wastewater" or in accordance with an equivalent analytical methodology approved by the Director
- Update the monitoring protocol
- Incorporate key learnings into CSO MP evaluations and planning for future water quality monitoring

3.1.4 River Water Quality Monitoring Locations

River water quality measurements during dry and wet weather events will be taken to assess river water quality. The locations proposed for the river sampling are listed below in Table 6 and Table 7, and are shown in Figure 2.

Table 6 – River Sampling Locations

Bridge Location	Map ID	Bi-weekly Rivers Survey Monitoring	Proposed for 2023-2024 Water Quality Monitoring	Sampling Description
Headingley Bridge	R1	✓	✓	Upstream Assiniboine boundary
West Perimeter Bridge	R2	✓	×	
Assiniboine Park Foot Bridge	R3	✓	✓	Assiniboine Intermediate
Main Street Bridge	R4	✓	×	
Osborne Street Bridge	Rx1	×	✓	Assiniboine CSO
St. Adolphe Pierre Delorme Bridge	R5	✓	✓	Upstream Red boundary
South Perimeter Bridge	R6	✓	×	
Fort Garry Bridge	R7	✓	✓	Red upstream
Norwood Bridge	R8	✓	✓	Red CSO
Redwood Bridge	R9	✓	✓	Red and Assiniboine CSO
Provencher Bridge	Rx2	×	✓	Red and Assiniboine CSO
North Perimeter Bridge	R10	✓	✓	Red and Assiniboine CSO
Lockport Bridge	R11	✓	✓	Downstream Red boundary
Total Number of Monitoring Locations		**11**	**10**	**N/A**

Table 7 – Small Stream Sampling Locations

Small Stream Location	Map ID	Bi-weekly Small Streams Survey Monitoring	Proposed for 2023-2024 Water Quality Minitoring	Sampling Description
Sturgeon Creek @ Perimeter	S1	✓	×	
Sturgeon Creek @ Portage Ave.	S2	✓	✓	
Truro Creek @ Portage Ave.	S3	✓	✓	
Omands Creek	S4	✓	✓	
La Salle River	S5	✓	✓	

Small Stream Location	Map ID	Bi-weekly Small Streams Survey Monitoring	Proposed for 2023-2024 Water Quality Minitoring	Sampling Description
Seine River @ Hwy 59	S6	✓	×	
Seine River @ Provencher Blvd.	S7	✓	✓	
Bunns Creek	S8	✓	✓	
Total Number of Monitoring Locations		**8**	**6**	

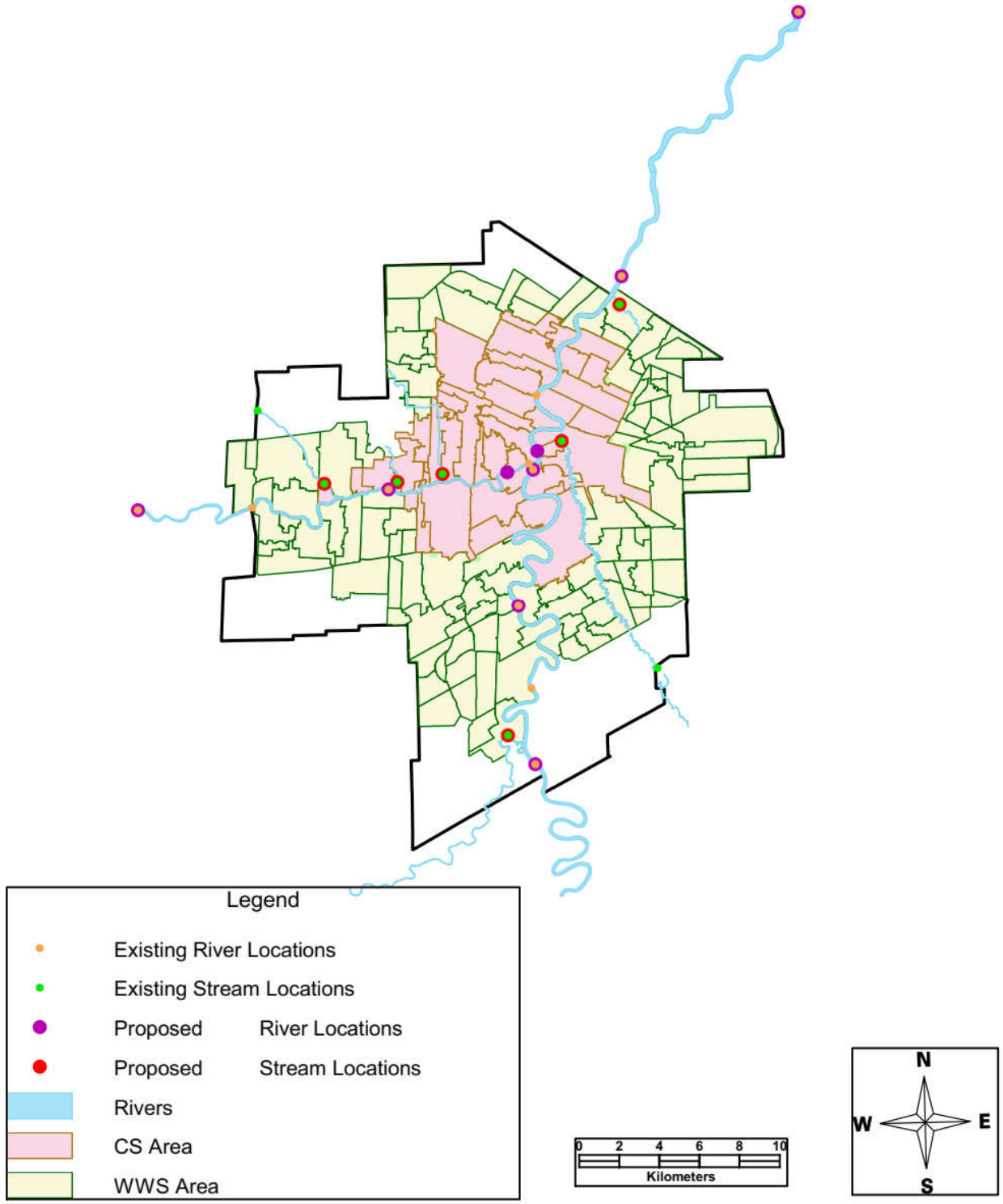


Figure 2 – River and Stream Sampling Locations Map

Figure 2 shows potential sampling locations for the rivers and streams program. The stream and river locations are shown in red and purpule circles, respectively. The small green and orange circles indicate the locations that are already included as part of the City's existing sampling program. A detailed Monitoring Locations Plan is included as Appendix C.

The upstream and downstream boundary conditions are required to calibrate and verify the river water quality model and evaluate the impacts of CSOs on the rivers. Quantification of the upstream sources and

downstream outflows is essential to developing an accurate tool for evaluating system performance. The information will be used to build an understanding of the benefits of a CSO program in general and of the incremental improvements between programs designed to meet various performance targets.

Information under wet weather conditions will be collected at the study area boundaries to add perspective on the loading sources. Grab samples will be taken across the rivers under the in-stream monitoring program from roadway bridges as is currently done for the river monitoring program at the Headingley, St. Adolphe and Lockport bridges.

The upstream monitoring will provide perspective on the water quality prior to entering the urban zone, and the downstream perspective on the urban impacts. The findings and results of the monitoring programs will be included in River Water Quality Monitoring Report.

River and stream water quality data will be compared to Manitoba Water Quality Standards Objectives and Guidelines (MWQSOG) thresholds for performance assessment. Modeling will be undertaken where there are changes to values that may impact predicted design performance.

In summary, the proposed monitoring plan will include:

- Existing In-Stream River Water Quality Monitoring: Grab samples will continue to be taken from the existing current sampling locations over the course of the monitoring season.
- Additional In-Stream River Water Quality Monitoring: Grab samples will be taken from 15 sampling locations upstream and downstream of the combined sewer system to assess the impact of CSOs on the rivers, after prolonged dry periods (3 days or greater) and after significant rainfall events (10 mm depths of greater).
- Sewer System Outfall Level Instrumentation: Instrumentation installed at outfall locations in addition to river profile information will be used to estimate sewer flows.

Appendix A – Winnipeg River and Stream Sampling Report Examples

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2021 RIVERS SURVEY MONITORING REPORT

Survey Date:	**September 29, 2021**	**Assiniboine River Sampling Locations**				**Red River Sampling Locations**						
Parameter	**Unit**	**HEADINGLY BRIDGE (R1)**	**WEST PERIMETER BRIDGE (R2)**	**ASSINIBOINE PARK FOOT BRIDGE (R3)**	**MAIN STREET BRIDGE (R4)**	**SOUTH FLOODWAY CONTROL* (R5)**	**SOUTH PERIMETER BRIDGE (R6)**	**FORT GARRY BRIDGE (R7)**	**NORWOOD BRIDGE (R8)**	**REDWOOD BRIDGE (R9)**	**NORTH PERIMETER BRIDGE (R10)**	**LOCKPORT BRIDGE (R11)**
Sample Number		**427651**	**427657**	**427646**	**427655**	**427659**	**427665**	**427660**	**427663**	**427664**	**427662**	**427661**
Temperature	° C	17.7	17.6	17.3	17.8	17.0	16.7	18.1	16.7	16.4	16.3	16.8
Dissolved Oxygen	mg/L	9.7	9.8	8.9	8.7	10.5	9.9	8.8	7.4	7.6	8.3	7.5
Oxygen Saturation	%	102	102	93	91	108	103	93	76	78	84	77
Biochemical Oxygen Demand	mg/L	4	<4	<4	<4	<4	<4	<4	<4	<4	<4	7
pH	units	8.67	8.69	8.60	8.58	8.73	8.77	8.48	8.32	8.37	7.96	7.96
Total Solids	mg/L	696	712	678	682	758	762	760	758	732	708	732
Total Suspended Solids	mg/L	63	65	43	27	54	31	18	14	15	8	4
Turbidity	n.t.u.	31	34	29	21	32	20	11	7	8	5	3
Total Organic Carbon	mg/L	10.9	9.7	9.5	10.3	10.4	10.6	10.8	11.2	10.6	11.9	10.9
Chlorophyll a	ug/L	40.1	32.7	33.4	36.7	29.4	16.0	11.3	6.7	14.7	18.7	4.7
Ammonia Nitrogen	mg/L N	0.007	0.011	0.009	0.135	0.050	0.021	0.804	0.873	0.414	>2.00	1.18
Nitrate Nitrogen	mg/L N	<0.003	0.020	0.006	0.017	nr	0.032	0.211	0.207	0.145	0.280	0.365
Total Nitrogen	mg/L N	<0.2	<0.2	<0.2	0.5	0.3	<0.2	1.3	1.5	0.8	3.9	2.5
Soluble Phosphorus	mg/L P	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr
Total Phosphorus	mg/L P	0.13	0.14	0.11	0.13	0.10	0.08	0.20	0.19	0.15	0.43	0.35
Escherichia Coliform	MPN/100 mL	180	300	310	120	440	60	<10	20	70	40	10
Fecal Coliform	MPN/100 mL	250	410	290	50	200	130	20	<10	20	20	<10

Notes: ns - no sample na - not analyzed nr - no result

Red River elevation at South Floodway control gates: 734.02 ft
Weather conditions during monitoring:
Wind Direction: South (S)
Wind Speed: 28 km/h
Cloud Coverage: 25%
Precipitation: <0.1 mm
Air Temperature: 26°C

Compiled By: H. Demchenko
Compliance Reporting Technician

Approved By: C.Diduck
Analytical Services Branch Head

Date Compiled: 30-Mar-22

File: N:\Environmental Standards\Analytical Services\WQ Data\Rivers & Small Streams\Rivers

Water and Waste
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City of Winnipeg
Water and Waste Department

2021 SMALL STREAMS SURVEY MONITORING REPORT

Survey Date:	**July 15, 2021**	**Small Streams Sampling Locations**							
Parameter	**Unit**	**SEINE RIVER @ HWY 59 (S6)**	**SEINE RIVER @ PROVENCHER BLVD (S7)**	**STURGEON CREEK @ PERIMETER (S1)**	**STURGEON CREEK @ PORTAGE AVE (S2)**	**OMANDS CREEK @ PORTAGE AVE (S4)**	**LA SALLE RIVER @ HWY 75 (S5)**	**BUNNS CREEK @ BONNER AVE (S8)**	**TRURO CREEK @ PORTAGE AVE (S3)**
Sample Number		**407661**	**407662**	**407658**	**407660**	**407655**	**407651**	**407647**	**407663**
Temperature	° C	22.4	23.1	20.2	21.4	24.2	23.9	ns	ns
Dissolved Oxygen	mg/L	7.1	6.4	8.4	6.6	3.9	7.7	ns	ns
Oxygen Saturation	%	81	74	92	75	42	92	ns	ns
Biochemical Oxygen Demand	mg/L	<4	<4	4	<4	>15	4	ns	ns
pH	units	8.08	8.06	7.73	8.36	7.51	7.73	ns	ns
Total Solids	mg/L	388	362	1,500	1,360	1,310	704	ns	ns
Total Suspended Solids	mg/L	65	3	<3	<3.0	21	21	ns	ns
Turbidity	n.t.u.	46	5	2	1	8	17	ns	ns
Total Organic Carbon	mg/L	18.8	20.0	9.1	12.4	27.0	14.2	ns	ns
Chlorophyll a	ug/L	4.0	2.7	20.0	2.7	100.0	29.4	ns	ns
Ammonia Nitrogen	mg/L N	0.063	0.057	0.023	0.062	0.034	0.030	ns	ns
Nitrate Nitrogen	mg/L N	0.014	0.003	<0.003	0.024	<0.003	<0.003	ns	ns
Total Nitrogen	mg/L N	1.1	1.0	0.7	1.0	1.8	1.5	ns	ns
Soluble Phosphorus	mg/L P	0.13	0.27	0.04	0.15	0.25	0.60	ns	ns
Total Phosphorus	mg/L P	0.25	0.33	0.13	0.22	0.63	0.85	ns	ns
Escherichia Coliform	MPN/100 mL	60	20	20	20	500	30	ns	ns
Fecal Coliform	MPN/100 mL	40	20	60	50	14,100	50	ns	ns

Notes: ns - no sample na - not analyzed nr - no result

Weather conditions during monitoring:
Wind Direction: South (S)
Wind Speed: 19 km/h
Cloud Coverage: 0%
Precipitation: <0.1 mm
Air Temperature: 13°C

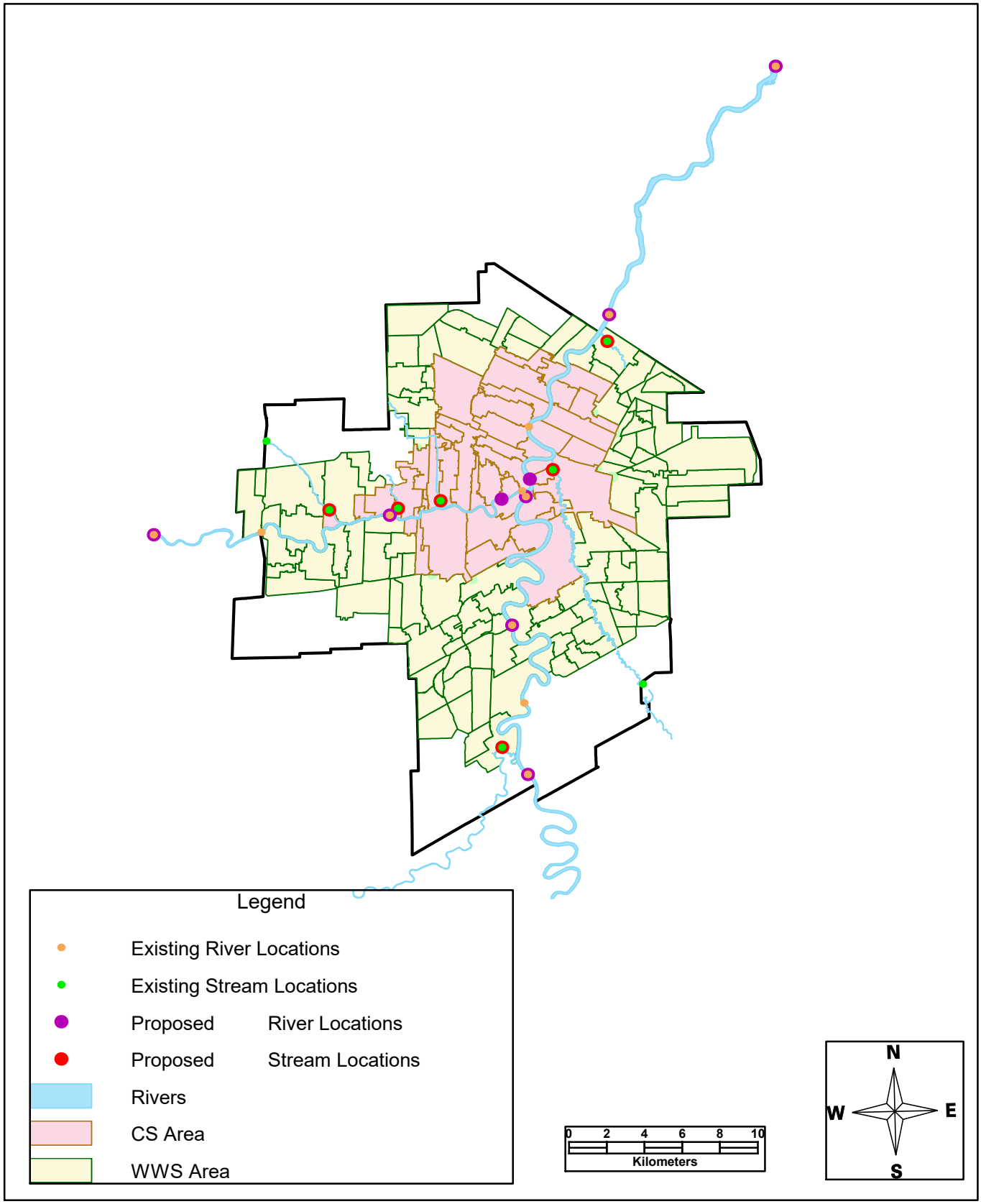
Compiled By: H. Demchenko
Compliance Reporting Technician

Approved By: C.Diduck
Analytical Services Branch Head

Date Compiled: 12-Aug-21

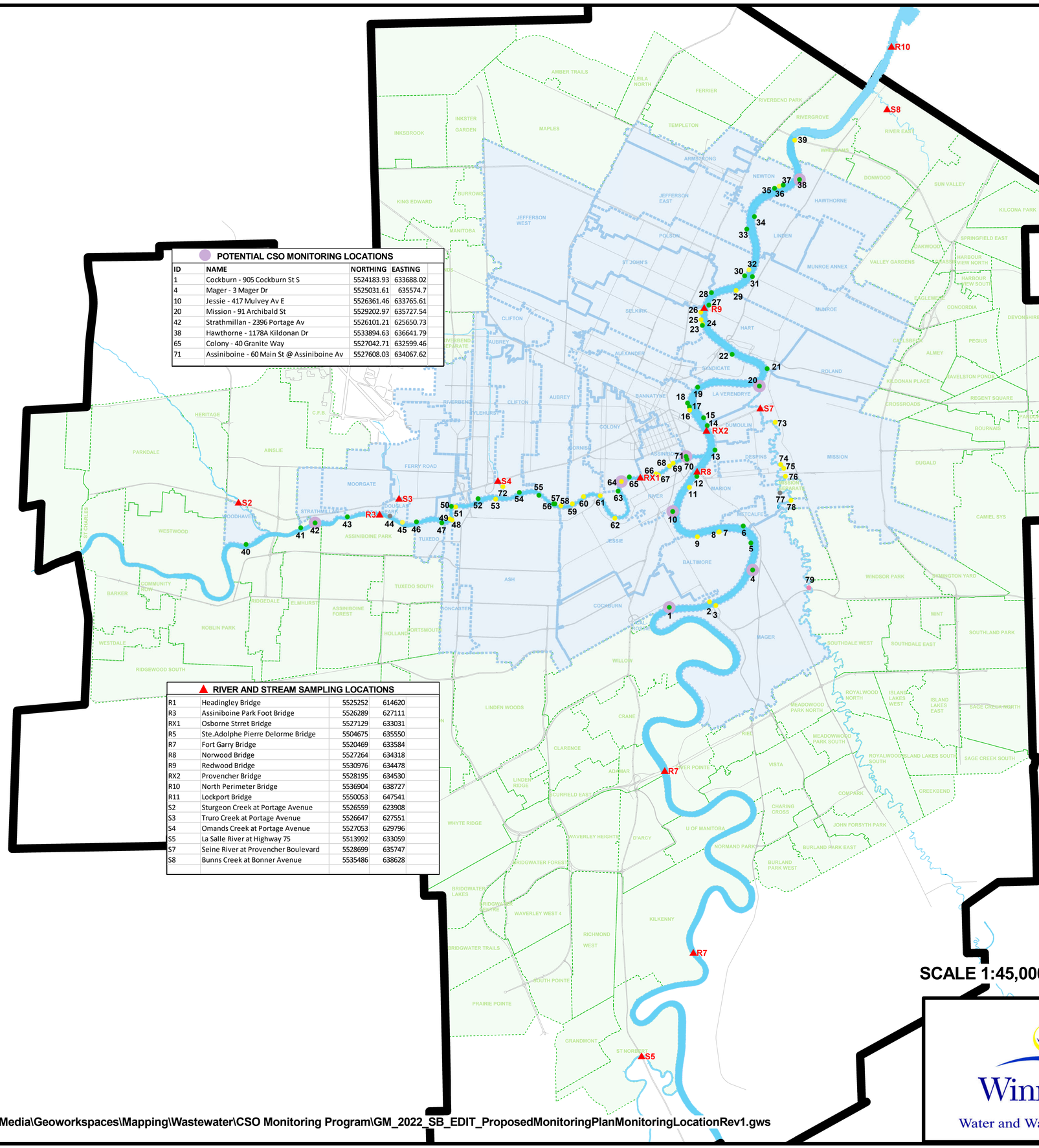
File: N:\Environmental Standards\Analytical Services\WQ Data\Rivers & Small Streams\Streams

Appendix B – Winnipeg River and Stream Sample Locations



River and Stream Monitoring Locations

Appendix C – Monitoring Locations Plan



POTENTIAL CSO MONITORING LOCATIONS

ID	NAME	NORTHING	EASTING
1	Cockburn - 905 Cockburn St S	5524183.93	633688.02
4	Mager - 3 Mager Dr	5525031.61	635574.7
10	Jessie - 417 Mulvey Av E	5526361.46	633765.61
20	Mission - 91 Archibald St	5529202.97	635727.54
42	Strathmillan - 2396 Portage Av	5526101.21	625650.73
38	Hawthorne - 1178A Kildonan Dr	5533894.63	636641.79
65	Colony - 40 Granite Way	5527042.71	632599.46
71	Assiniboine - 60 Main St @ Assiniboine Av	5527608.03	634067.62

RIVER AND STREAM SAMPLING LOCATIONS

R1	Headingley Bridge	5525252	614620
R3	Assiniboine Park Foot Bridge	5526289	627111
RX1	Osborne Strret Bridge	5527129	633031
R5	Ste.Adolphe Pierre Delorme Bridge	5504675	635550
R7	Fort Garry Bridge	5520469	633584
R8	Norwood Bridge	5527264	634318
R9	Redwood Bridge	5530976	634478
RX2	Provencher Bridge	5528195	634530
R10	North Perimeter Bridge	5536904	638727
R11	Lockport Bridge	5550053	647541
S2	Sturgeon Creek at Portage Avenue	5526559	623908
S3	Truro Creek at Portage Avenue	5526647	627551
S4	Omands Creek at Portage Avenue	5527053	629796
S5	La Salle River at Highway 75	5513992	633059
S7	Seine River at Provencher Boulevard	5528699	635747
S8	Bunns Creek at Bonner Avenue	5535486	638628

CSO OUTFALL LOCATION TABLE

ID	NAME LOCATION	NORTHING	EASTING	ID	NAME LOCATION	NORTHING	EASTING
1	Cockburn - 905 Cockburn St S	5524183.93	633688.02	41	Olive - 2461 Assiniboine Cr	5525990.44	625326.52
2	Churchill Dr @ Osborne St	5524310.8	634599.42	42	Strathmillan - 2396 Portage Av	5526101.21	625650.73
3	Kingston Row @ Edinburgh St	5524228.84	634741.95	43	Conway - 2200 Portage Av	5526240.85	626382.3
4	Mager - 3 Mager Dr	5525031.61	635574.7	44	~~44 Deer Lodge~~	5526256.84	627346.34
5	Baltimore - 250 Churchill Dr	5525648.3	635535.37	45	82 Douglas Park	5526114.99	627627.63
6	Metcalfe - 242 Metcalfe Av	5526033.61	635362.25	46	Ferry - 40 Ferry Rd	5526125.99	627945.39
7	Eccles St @ Churchill Dr	5525901.02	634818.35	47	Chataway - 1810 Wellington Cr	5526104.15	628520.25
8	Eccles St @ Churchill Dr	5525896.26	634805.41	48	Doncaster St @ Wellington Cr	5526167.98	628757.3
9	80 Churchill Dr	5525789.6	634324.78	49	Parkside Dr @ Assiniboine Av	5526191.15	628705.16
10	Jessie - 417 Mulvey Av E	5526361.46	633765.61	50	Riverbend Gate Chamber - 125 Parkside Dr	5526476.07	628739.83
11	Lyndale Dr @ Walmer St	5526911.71	634144.24	51	Opposite 1620 Wellington Cr	5526464.16	628837.83
12	Marion - 6 Lyndale Dr	5527159.5	634312.39	52	Tylehurst - 499 Tylehurst St	5526651.06	629348.25
13	Despins - 465 Tache Av	5527755.6	634722.67	53	West of 1345 Wellington Cr	5526640.61	629745.9
14	Dumoulin - 691 Tache Av	5528311.83	634546.08	54	Clifton - 1256 Wolseley Ave	5526795.8	630283.55
15	La Verendrye - 745 Tache Av	5528489.37	634464.19	55	Ash - 1057 Wellington Cr	5526728.49	630727.79
16	Lombard Av @ Waterfront Dr	5528658.05	634149.96	56	1020 Palmerston Av	5526533.41	631061.81
17	McDermot Av @ Waterfront Dr	5528733.6	634143.73	57	Aubrey - 1016 Palmerston Av	5527144.99	632783.72
18	Bannatyne - 20 Ship St	5528819.56	634101.44	58	980 Palmerston Av	5526533.84	631088.34
19	Galt - 401 Waterfront Dr	5529178.41	634329.48	59	Arlington Av @ Palmerston Av	5526490.39	631226.01
20	Mission - 91 Archibald St	5529202.97	635727.54	60	850 Palmerston Av	5526534.29	631484.93
21	Roland - 16 Watt St	5529600.23	635903.81	61	Cornish Av @ Maryland St	5526697.53	631739.43
22	Syndicate - 200 Syndicate St @ Rover	5529925.03	635109.88	62	393 Wellington Cr @ Grosvenor Av	5526718.57	632117.59
23	Selkirk - 108 Selkirk Av	5530580.4	634435.88	63	Cornish - 1 Cornish Av @ Langside St	5526207.92	632450.02
24	100 Pritchard Av	5530605.89	634442.75	64	Balmoral St @ Spence St	5526825.14	632521.82
25	123 Burrows Av	5530712.13	634408.32	65	Colony - 40 Granite Way	5527042.71	632599.46
26	150 Aberdeen Av	5530883.2	634401.13	66	Kennedy St @ Assiniboine Av	5527214.49	633386.7
27	Hart - 3 Hart Av	5531043.61	634584.9	67	River Av @ Cauchon St	5527189.9	633439.4
28	St John's - 20 Anderson Av	5531325.47	634642.3	68	348 Assiniboine Av @ Hargrave St	5527392.83	633692.43
29	380 Henderson Hw	5531374.72	635199.59	69	318 Assiniboine Av @ Donald St	5527458.35	633774.81
30	Polson - 75 Scotia St	5531705.51	635394.18	70	Mayfair - 105 Mayfair Av @ Main St	5527544.39	634087.52
31	Munroe - 530 Henderson Hwy	5531686.81	635569.92	71	Assiniboine - 60 Main St @ Assiniboine Av	5527608.03	634067.62
32	Scotia St @ Inkster Bv	5531843.14	635491.94	72	Strathcona St @ Portage Av	5526926.19	629911.77
33	Jefferson E - 299 Scotia St	5532767.33	635442.85	73	496 Plinguet St	5528387.53	636086.66
34	Linden - 856 Kildonan Dr	5533051.09	635614.84	74	493 Cherrier St	5527426.83	636208.96
35	Newton - 469 Scotia St	5533696.48	636070.9	75	500 Doucet St	5527339.32	636280.25
36	Armstrong Av @ Scotia St	5533743.88	636176.9	76	516 Prosper St	5527160.01	636315.68
37	10 Riverview Dr -(Kildonan Park)	5533771.55	636267.5	77	~~Dubuc St @ Seine St~~	5526783.55	636193.96
38	Hawthorne - 1178A Kildonan Dr	5533894.63	636641.79	78	Gareau St @ Evans St	5526611.51	636443.11
39	Whellams Ln @ Tamarind Dr	5534788.8	636528.17	79	~~Comanche Rd @ Iroquois Bay~~	5524631.67	636853.16
40	Woodhaven - 2784 Assiniboine Av	5525615.9	624080				

Legend	
A	Instrumented site (45 Sites)
B	Non Instrumented site (31 Sites)
*	Abandoned
**	Seperated

Winnipeg
Water and Waste Department

PROPOSED MONITORING PLAN
Monitoring Locations
DECEMBER 2022

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Appendix J – 2022 Record of Meeting Minutes

Minutes for CSO Reporting Milestone Meeting – 2021 CSO Annual Report

Meeting Date:	April 29, 2022	**File No(s):** S-734 020-17-08-ON, 020-17-08-11-00 Client File No.: 3205.00	
Date Issued:	May 3, 2022		
Time:	2:00 PM – 3:30 PM		
Location:	Microsoft Temas Meeting		

ATTENDEES LIST:

Province of Manitoba Environment, Climate and Parks:	Present: Bereket Assefa (BA), Julie Froese (JF), Joy Kennedy (JK), Kaitlin Sawisky (KS), Kelly-Anne Richmond (KAR), Nada Suresh (NS), Siobhan Burland-Ross (SBR), Yvonne Hawryliuk (YH)		
City of Winnipeg:	Present: Florence Lee (FL), Michelle Paetkau (MP), Patrick Coote (PTC) Regret: Linda McCusker		
Recorded by:	Florence Lee	**Start:** 2:00 PM	**Adjourn:** 3:38 PM

Item no.:	Discussion:	Action by:
1.0	Truth and Reconciliation and Acknowledgement	**Info**
2.0	Introduction	**Info**
3.0	2021 CSO Annual Report Presentation by PTC and FL • Background • CSO Master Plan Implementation • CSO Master Plan Performance • 2021 Annual CSO Results Summary • 2021 Results Analysis • Operational Observations • Status of Reporting • CSO Public Notification System	**Info**
4.0	**Q&A**	
4.1	MP asked the Province to provide the list of individuals who would require access to the Public Notification Tool.	**Province**
4.2	NS – Will future sewer infrastructure upgrades be included in the Public Notification Tool?	**Info**

	• PTC – upgraded sewer infrastructure are intended to be included in the Public Notification Tool but the frequency of updates is resource dependent. Any changes to the tool will first undergo the development stage for testing prior to going live.	
4.3	YH – Is the Public Notification Tool currently in the trial phase? Can you confirm if it has been made available to the public? What is the estimated timeline for the public release? • MP - The Tool has not been made available to the public. The Tool underwent testing the past few years since 2017, and it is now ready to be shared with the Province. The intent is to release the tool to the public in 2022 Q3.	
4.4	YH raised concerns regarding the Clause 8 section of the report. The Province will issue a letter to outline the specifics.	**Province**
4.5	NS - As there was no model maintenance undertaken in 2021, why was volume reduction displayed in the report? • PTC – The source of the volume reduction is from the completed contracts and the planned contracts.	**Info**
4.6	JF indicated confusion in the terminology used to describe the network that did not receive model maintenance in 2021 in the report. • PTC - The City will make notes and provide better clarify in the future.	**City**
4.7	NS suggested the report to be restructured such that the historic background of Master Plan to be moved to the Appendix to allow the report to be more concise. • PTC – the City will review the structure of the report.	**City**
4.8	JF – What has been completed on Green Infrastructure (GI)? What is the status? • PTC indicated the evaluation of GI opportunities is included on a district level. Currently, the City is reviewing the GI opportunities in the Armstrong CSD Preliminary Design. PTC shared examples of some of the GI opportunities in the district. A decision matrix and public engagement will be included prior to implementation. • Other GI work that the City completed to date includes the installation of strata cells in the North East Exchange district in 2016. The City plans to undertake post flow monitoring this summer to understand its benefits.	**Info**
4.9	NS suggested to include more GI content in the report. • PTC - Work that had been completed in the reporting year were reported. As work progresses, more GI content will be provided.	**Info**
4.10	NS – Have the official funding requests be submitted to either the Provincial or the Federal Government? • MP - No official funding requests have been submitted. The City is in the process of negotiating provincial funding for the treatment plant projects. • PTC - There needs to be an applicable federal government infrastructure fund that the City can apply to for federal funding.	**Info**
5.0	**Others**	
5.1	MP indicated that the 2021 CSO Annual Report and other relevant information on the CSO Master Plan are planned to be published several days before the June 7, 2022 Standing Policy Committee meeting, to align with the scheduled CSO Master Plan annual financial updates to Council. The City will notify the Province when it releases the material to the public.	**City**

The next meeting will be in May 2023.

Please report errors or omissions in the above minutes to:
Florence Lee (204) 986-6428 or by e-mail at FLee@winnipeg.ca within two weeks from distribution,
Otherwise, it will be assumed these minutes are accurate and accepted.