City of Saint John

Request for Proposal

2024-091006P

"ENGINEERING SERVICES – EAST SAINT JOHN COMBINED SEWER SEPARATION STRATEGY"
SAINT JOHN, NB

Sealed proposals, hand delivered or couriered, addressed to Monic MacVicar, CCLP, CPPB, Procurement Specialist, 1st Floor, Municipal Operations Complex, 175 Rothesay Avenue, Saint John, NB, E2J 2B4, and marked on the envelope:

"PROPOSAL 2024-091006P
ENGINEERING SERVICES – EAST SAINT JOHN COMBINED SEWER SEPARATION STRATEGY"

will be received until **4:00:00 p.m**. **Local Time**, Wednesday**, April 24th, 2024**, for Engineering Design and Construction Management Services for the above noted project, as per the Request for Proposal.

The lowest cost or any proposal not necessarily accepted.

Proposals will NOT be opened publicly.

Monic MacVicar, CCLP, CPPB
Procurement Specialist
Supply Chain Management

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SCOPE OF WORK FOR PROPOSAL 2024-091006P

ENGINEERING SERVICES – EAST SAINT JOHN COMBINED SEWER SEPARATION STRATEGY

1. GENERAL:

The City has prepared this document for Consulting Engineering firms wishing to provide their services to the City of Saint John. This request for proposals is to be used as a guide, in combination with good engineering judgment and standard engineering practices and is not intended to be a complete procedural document. It reflects basic standards the Consultant shall adhere to when preparing a proposal or carrying out work for the City.

All engineers working on this project for the City must be a current member, licensee or holder of a certificate of authorization with APEGNB. All Engineering companies working on this project for the City must have a current certificate of authorization with APEGNB.

The Consultant shall in all matters act as a faithful advisor to the City. The Consultant shall keep the City informed on all matters related to design, procurement and construction and all other important aspects forming part of the scope of work.

The Consultant must aggressively and proactively manage the project in the best interest of the City of Saint John. The Consultant will oversee and manage the entire project on behalf of Engineering Services. The proposal shall clearly explain the anticipated structure of project management during each phase.

The Consultant shall be aware of and follow any orders, policies, directives, standards and guidelines issued by any governmental authority, governing all or any part of the work under this RFP.

2. PROJECT DESCRIPTION:

The overall project involves the study of all the existing sewer pipe networks in the East Side of Saint John, and the development of a long-term strategy for separation of these sewers. For the purposes of this proposal the study area is broken-up into two sections as shown in the maps attached to this document. The Consultant will be required to review the existing storm sewer outfalls in the study area and make recommendations on either the renewal or elimination of existing storm sewer outfalls and/or the installation of new storm sewer outfalls that are necessary to achieve the stated goal of combined sewer separation within the project area. This review shall consider the previously completed studies in the East side, which are attached to this RFP document.

When preparing the separation strategy, the successful Consultant shall review existing sewers to ensure existing separated sewers are of sufficient capacity.

The purpose of having two proposal submission areas (A and B) is for costing and scope confirmation. If the City chooses to include both areas "A" and "B" within the scope of work for this project. The consultant shall provide one deliverable that comprehensively investigates the entire project area as decided (A, B or both).

The City of Saint John will use the Consultant's recommendations for separation and necessary upsizing of sewers as a framework for future Capital Program planning/budgeting. Therefore, the recommendations in the Consultants report must be actionable items. In addition, the Consultant shall re-calibrate the City's existing sewer model (using Bentley SewerGEMS) based on the findings from the study as well as determine the capacity gained in the sanitary system upon the completion of each remedial measure. The Consultant shall be responsible for any necessary software licensing to run the model.

The Consultant shall provide recommendations for each property within the investigation zone (s) on whether storm laterals should be installed to the property line. Consideration should be given to the depth of existing storm sewers, alongside the implications of rising sea levels and the heightened frequency of major storm events attributed to long-term climate change.

The Scope of Work for this project shall consider the two (2) areas identified within the east side of Saint John as shown in the attached map. Area "A" and "B" are to be submitted as two separate projects, with separate pricing. Although the City may decide to only move forward with one (1) area; for the purpose of this RFP, the submission and financial proposal shall be provided for <u>each</u> of the two areas. The scope of work remains consistent across both zones, and consultants are expected to provide separate pricing for each zone in their financial proposal. The final study area will be determined based on the proposed prices.

3. PROFESSIONAL SERVICES REQUIRED:

The Consultant will oversee and manage the entire project. The proposal shall indicate the technical services provided for <u>each</u> of the following components of the two (2) project locations identified above.

<u>COMBINED SEWER SEPARATION</u>

The Consultant shall undertake a review of the existing combined sewers within the project area(s). As part of the review, the Consultant shall:

- Break down the study area into individual storm and sanitary sewer catchment areas for analysis based on a review of the sub-catchment delineation currently completed in the existing model.

- Building upon the **preliminary** information provided as background information only, (see attachments) the Consultant shall identify all combined sewers that need separation.
- Develop a comprehensive actionable plan and sequence for future separation projects. This work shall be broken down into actionable project sizes. Sequencing recommendations shall consider best value for money for separation efforts. Sequencing shall be based on an objective rating scheme, not just pipe condition alone. The Consultant's report shall be a stand-alone document. The Consultant shall build upon the Central Peninsula Separation Strategies rating scheme. Potential improvements to the rating system is to be discussed with the City prior to implementation.
- Complete preliminary sizing of the proposed separated sanitary and storm sewers, including any upsizing of existing sewers, where required. Existing pipe sizes need to be checked to confirm capacity.
- Review the existing sanitary and storm sewer infrastructure and identify any areas where the capacity of existing sewers is a concern. The Consultant shall identify these areas and provide recommended upgrading sequence to address the concerns.
- Prepare preliminary cost estimates for each sewer separation project within the study area(s), any additional sewer separation projects identified as part of this project, and for other required upgrades to currently separated sewers to address potential issues are to be provided. Estimates to show breakdown of proposed engineering, construction, contingency, and land acquisition (if required) as separate costs.

The City's existing sewer model for the study area will be provided to the Consultant for use on this project. The Consultant will need to sign documentation ensuring the modelling software will be used on City capital/operations projects only.

The review of the capacities of the new/existing storm sewers shall consider the effects of climate change.

SEWER OUTFALLS

For each individual storm sewer catchment areas within each project area, the Consultant shall:

- Conduct a review of the existing sewer outfalls, including a review of their current capacities, as well as review of the capacities following the proposed sewer separation.
- Determine if any existing outfalls need to be renewed or abandoned and if new outfalls need to be constructed. The Consultant shall determine the required capacity at each outfall to support future sewer separation projects.
- Preliminary review of proposed sewer outfall locations to be completed to confirm that installation of the proposed outfall is technically feasible. The review shall include a site visit to confirm conditions as well as a review to determine the required capacity at each outfall location to support future

sewer separation projects. Concept plan drawings to be provided for each outfall installation and renewal.

- Provide recommendations for installing backflow prevention measures at the storm sewer outfall to mitigate the impact of tidal effects on the outfalls.
- If backflow prevention is recommended, the Consultant shall review each outfall location and provide preliminary location/type of backflow preventer along with preliminary cost estimates for each location.
- Provide scaled drawings showing preliminary alignments for proposed sewer outfalls. Preliminary drawings shall be for proposed projects and sequencing with alignments and profiles being completed as projects are designed.
- Preliminary cost estimates for the renewal of existing outfalls or the construction of new outfalls to be provided, including any recommended backflow prevention. Estimates to show breakdown of proposed engineering, construction, contingency, and land acquisition (if required) as separate costs.

The Consultant must also consider the implications of rising sea levels and the heightened frequency of major storm events attributed to long-term climate change.

COMBINED SEWER OVERFLOW CHAMBER REVIEW

The Consultant shall review the existing inventory of combined sewer overflow (CSO) chambers and:

- Make recommendations on the timing for when these chambers can be abandoned as sewer separation proceeds.
- Shall develop an actionable plan for abandonment of each CSO as sewer separation proceeds.
- Shall also look at any impacts the removal of the CSO's will have on the overall system and provide recommendations to mitigate these impacts (i.e. new/reconfigured overflow piping for wastewater pumping stations).

As indicated above, the stated goal is to eliminate existing CSO chambers. As sewer separation proceeds, it is anticipated that temporary measures will be required to prevent surcharging of separated sanitary sewers from upstream combined sewers. Therefore, the Consultant shall also look at any requirements for short-term or temporary CSO's that may be necessary as sewer separation proceeds. Consultation with NBDOE shall be included regarding the potential use of temporary or short-term CSO's.

STORM SEWER LATERALS

The Consultant shall consider but not be limited to the following:

- How the future separation of roof leaders and footing drains can be achieved.
- Providing clear direction on where new storm sewer laterals should be included in future combined sewer separation projects. For each recommended capital project the Consultant shall recommend if storm laterals should be installed based on considering the unique details of each capital

project. The City does not want an overarching statement but rather direction specific to each capital project proposed.

- The Consultant's recommendations should consider costs to the City, value for money, and reasonableness that private property owners will separate for East Saint John style properties.

Consultants should consider that it is costly for the City to install storm sewer laterals for all properties. For streets that the City has already provided storm sewer laterals, the City has seen very few connections made to the laterals by private property owners. It has been difficult to install storm laterals for all projects as many existing separated storm sewers were installed shallow in the past therefore new separated storm sewers can only be installed so deep as they need to flow into existing shallow storm sewers.

FLOW MONITORING PROGRAM

The Consultant shall include additional flow monitoring within the Eastside (locations "Area A" and Area "B"). This additional flow monitoring shall be used to further calibrate the City's sewer model in support of the sewer separation project.

Regardless of the location(s) chosen (Part "A" and/or Part "B"), the Consultant shall allow for the installation of seventeen (17) flow monitoring sites. If the Consultant believes more (or less) flow meters are required, that should be detailed in the proposal however, to ensure a fair bid process, all Consultants shall provide for a total of seventeen (17) flow meters in their submission. If it is determined through the proposal submission process that more (or less) flow meters will be required based on the Consultant's plan, prior to award of the contract, adjustments may be made based on the unit price provided for a reduction or addition of flow meters. The proposal shall allow for the flow meters to remain in place for eight (8) weeks. Additional flow meters and additional weeks for installed flow meters included in the proposal will be paid for as per the financial proposal.

The Consultant will be required to undertake, but not be limited to, the following tasks, to fully achieve the City of Saint John flow monitoring objectives:

- Study and investigate project area(s) (sewer shed);
- Review existing information (mapping, pump run times, wet well level trending, maintenance reports, etc.);
- Determine appropriate locations for flow monitoring to occur;
- Provide flow monitoring locations to the City so the City can get the sewer lines around the proposed locations flushed prior to installation, using either City forces or the unit rate for sewer flushing provided by the Consultant;
- Provide, install and calibrate flow monitoring devices;
- Provide, install and calibrate rain gauge device;
- Maintain correct operation of flow monitoring and rain gauge devices;
- Retrieve data on a regular basis (including preliminary interpretation of

data as general QA/QC);
- Remove flow monitoring and rain gauge devices;
- Analyze data;
- Report;
- Calibrate existing sanitary sewer and storm water model based on flow meter data; and
- Liaise with City Staff through completion of study.

The Consultant shall indicate in their proposal the number of flow monitoring sites required and provide the rationale for selecting the sites. The proposal shall include seventeen (17) flow meters and one (1) rain gauge as a minimum.

The Consultant shall recommend the most suitable timeframe for completing the flow monitoring process. The Consultant is to consider the optimal timing for flow monitoring to ensure accurate data collection, while considering the date for award and procurement of necessary supplies for monitoring.

Method of Work

The Consultant shall furnish all materials, equipment, labour, traffic control, supervision, and perform all work necessary for flow monitoring of the sewer lines as required.

Portable Flow Monitoring Services:

- The Consultant shall install, calibrate and remove flow monitoring units at various locations within the identified study area.
- The Consultant shall install, calibrate and remove a rain gauge unit within the identified study area.
- The Consultant shall be able to provide at all times adequate flow monitoring units capable of measuring either depth and velocity or discharge directly (use of primary devices such as weir plates or devices that result in substantial reductions in flow capacity in the system is not acceptable).
- The Consultant shall ensure that the flow monitoring units will not cause operational concerns such as, but not limited to, flow interference or obstruction, reduced hydraulic capacity, etc.
- It is the Consultant's responsibility to verify data downloads twice a week to ensure data quality and usability. Regardless of the method used for flow monitoring, whether through remote/cellular downloads or field visits, the Consultant must confirm data suitability at least twice weekly. The Consultant will perform site servicing and in-field maintenance as needed to ensure constant collection of usable flow monitoring data.
- At the end of the flow monitoring timeline and when an acceptable amount of data has been obtained, the Consultant shall remove all

equipment from the site and confirm that it has been done to City of Saint John satisfaction.

Staff Qualifications

Interested Consultants shall include with their submissions the qualifications of all staff involved in the performance of the flow meter installations and data analysis. These qualifications should indicate that the key personnel have related experience, training and required inoculations for the performance of these tasks.

Coordination

Project coordination meetings with City of Saint John staff and the Consultant's representatives are to be held on an as-required basis. The Consultant's representative(s) at all coordination meetings shall be experienced individuals familiar with all aspects of the installation and operation of the flow monitoring units and up-to-date on all field related activities.

Installation

The Consultant shall be fully responsible for installing the flow monitoring units at each location to accurately measure the flows. The Consultant team shall demonstrate qualifications, proven experience and inoculations for personnel required to work around raw sewage (Hepatitis A and B, and tetanus as a minimum).

- The Consultant shall provide all necessary equipment and appropriately trained personnel to install each flow monitoring unit. Equipment shall include, but not be limited to:
    - vehicular and safety equipment required for field operations;
    - continuous gas and oxygen detectors;
    - voice activated two-way communications equipment;
    - confined space ventilation equipment;
    - rescue breathing equipment (positive pressure);
    - signage and traffic control; and
    - mobile generator (for on-site electrical supply).
- All personnel shall be familiar with NB Occupational Health and Safety Requirements and have WHMIS training.
- The Consultant shall install flow meters in optimum locations to obtain accurate and representative results and retrieve data that will comply with objectives. If the Consultant concludes that a site is unsuitable (because of manhole benching, hydraulic conditions, etc.) an alternative site shall be sought by the Consultant to achieve the original objective (alternate site to be approved by the City). Depth and velocity readings are to be confirmed during the installation using alternate measurement devices (tape measure, electromagnetic flux velocity meter, etc.) to

ensure equipment accuracy.

- Any equipment mounted in the manhole shall be securely fastened. The mounting apparatus shall include a release mechanism to allow for equipment removal for servicing and maintenance.

Site Conditions

The Consultant shall perform their own assessment of all matters related to the structural integrity of manholes and sewers, and the flow conditions and air quality at the flow monitoring sites and shall be responsible for worker safety during performance of duties.

Equipment Specifications

- The Consultant shall guarantee that all flow monitoring instruments are adequate to satisfactorily achieve the objectives in monitoring a specific site. The Consultant shall guarantee that data is both representative and accurate.
- Equipment must measure and store, as a minimum, the instantaneous flow and the open conduit depth (even during surcharge conditions). The flow monitoring equipment must have the following minimum requirements:
    - Velocity (if applicable) measurement range of -1.0 to 6.0 m/s (minimum), with a measurement accuracy of 2% or less and a resolution of 0.005 m/s or less,
    - Depth measurement range (with accurate velocity measurement) of 0.05 to 3.0 m (minimum), with a measurement accuracy of +/- 0.008 m or less,
    - Flow measurement resolution should be equal to or less than 0.01 L/s,
    - Flow meters should be capable of a measurement and storage frequency of 5 minutes or less,
    - Low profile or non-contacting flow measurement device so as to reduce the likelihood of initiating a flow obstruction or the accumulation of debris.
- A data recovery of 80% or better at each flow monitoring site must be guaranteed on the entire monitoring period. If 80% data recovery is not realized, the proponent will extend the flow monitoring program at no additional cost until this benchmark is met.
- The Consultant will inspect flow meter installations twice weekly (minimum) to ensure proper meter performance (check for accumulation of solids, check battery capacity and confirm the depth and velocity readings, etc.). All safety procedures (confined space entry, etc.) that are required for meter installation will be adhered to

during the inspections by the Consultant.

- The Consultant shall review the downloaded data weekly and not wait until the end of the 8-week period in order to allow changes to be made to flow meters if required.

Final Reporting/Deliverables

- Supply a Standard Form for each site, including, but not limited to:
  - Calibration measurements.
  - Summary of verification work performed at each flow monitoring location. This summary shall include the results of all verification readings taken for both depth and velocity. Comparison readings with the instrument measurements shall be presented and the corresponding measurement error.
  - Location and characteristics of each site.
- As the objectives may vary based on the monitoring sites, the Consultant shall be able to provide the following information, in order to achieve the goals for each monitoring site:

Raw Data Analysis
- QA/QC of the flow data including a thorough review of other data (depth, velocity, etc.) on a weekly basis at minimum.
- Reconstruction of lost data if possible (using data from previous period when meter was working properly)
- Analysis of the system surcharge dynamics (using depth and velocity data if available, utilization of a computer model is preferred for managing data)

Report
- Instantaneous flow data (table format)
- Daily average flow data (table format)
- Precipitation overlays from rain gauge and nearby climate stations
- Graphs of data (instantaneous flow and daily average flow) for the entire monitoring period with climatic overlay

Data Analysis
- Comparison of the weather and groundwater conditions to "normal" conditions
- Comparisons of the flow data to precipitation events (rainfall and/or snowmelt) and, if applicable, groundwater levels and/or nearby surface water level fluctuations
- Comparison of measured flows to estimates of theoretical population flows at meter locations (using NBDELG guidelines)

    - Estimates of infiltration and inflow
- Final summary report shall be prepared and presented to the City of Saint John.
- Technical specifications on flow monitoring devices used shall be provided.
- All data prepared during program shall be provided in both hard copy and electronic format.

CALIBRATION OF SEWER SYSTEM MODEL

The current model (to be provided to the successful Proponent) was produced using Bentley SewerGEMS. The Consultant shall calibrate and update the model with the information collected in this study.

The Consultant shall also confirm that the sewer model has been updated for any recently noted approved developments within the study area. These sites include but are not limited to:

Potential Future Developments (At time of RFP)

Location	Development
510 Ellerdale	18 units
140 Alma Street	6 units
110 Westmorland	66 units
Linda Court	440 units
Linda Court	700 units

The Potential Future Developments are not to be updated in the model. This information is provided for the Consultant to contribute to their decision making and prioritizing of sewer separations.

STUDY REPORT

The Consultant shall gather the information requested in each location (Parts "A" and "B") into one comprehensive report. The report's recommendations shall be a comprehensive list of **actionable items, listed in a priority sequence** for the location(s) as the City of Saint John will utilize this report for planning/programming future improvements to the sewer system. Recommendations for improvements shall be broken down for each sewer area within the project.

The Consultant shall provide six (6) copies of the draft report and six (6) copies of the final report. The draft report and final report, which includes all text, drawings, maps and sketches, shall also be made available in electronic form.

All reports must be **signed and stamped** by the Consultant's engineer. All reports submitted to the City shall become the property of the City, which may be used and redistributed as the City sees fit. The Consultant is also to provide the fully calibrated

and updated model back to the City which shall become the property of the City, and which may be used and redistributed as the City sees fit.

TIMELINE FOR COMPLETION

The required submission deadlines for this project are: the Consultant shall have the Flow Monitoring Report (Final) submitted to the City by January 17th, 2025; and the Consultant shall have the entire project completed and the Final Report submitted to the City by June 21st, 2025.

GENERAL

Project Initiation

Following award of the project, the Consultant and City of Saint John will have a start-up meeting to clarify project scope and outline the proposed schedule and deliverables. As the City will be relying on this information for future capital budgeting/planning, this project shall be a priority for the Consultant. It is very important to the City for planning purposes to get this project completed as soon as possible.

Other Information

Sewers contain harmful gases, bacteria, micro-organisms, high humidity, odour and insufficient oxygen supply. Health and safety are extremely important and must not be compromised when performing work around sewers. When working on a project for the City of Saint John all parts of the NB Health and Safety Act must be followed. The Consultant must be aware of Part XVII of the NB Health and Safety Act giving the requirements to be met when working in areas deemed to be a confined space. Any person entering a confined space must be aware of the regulations and be trained in health and safety requirements for confined space entry. As stated in the National Guide to Sustainable Municipal Infrastructure, the Consultant shall take all necessary preventive measures when dealing with raw sewerage. The Consultant team shall demonstrate qualifications and proven experience for personnel required to work around raw sewage (Hepatitis A and B, and Tetanus as a minimum).

Any topographic surveys and drawings that are produced (as applicable) shall use the following horizontal and vertical datum: NAD 83 (CSRS) New Brunswick Double Stereographic Projection and the Canadian Geodetic Vertical Datum of 1928 (CGVD28).

The consultant and all sub-consultants must use proper traffic control and warning signage (with approved sign bases) when working or surveying on the streets as per the City's General Specification, latest revision, for construction.

Other than what has been included in this RFP, no additional documents or record information will be made available during the proposal stage. Once the proposal is

awarded, the City's record drawings and data will be made available to the Consultant but no guarantee as to their completeness or accuracy will be made. The Consultant shall send their requests in writing for large amounts of data and allow a reasonable amount of time to retrieve such. The Consultant must contact Infrastructure Development staff directly to gather all pertinent data. The Consultant is expected to meet and be familiar with City staff and their respective roles.

The Consultant shall undertake their work in accordance with the latest revision of the following guiding documents:

- City of Saint John's Storm Drainage Design Criteria Manual, latest revision (with consideration for climate change);
- Atlantic Canada Wastewater Systems Guidelines;
- Atlantic Canada Water Supply Guidelines;
- City of Saint John General Specifications, latest revision;
- Canada-wide Strategy for the Management of Municipal Wastewater Effluent endorsed by the Canadian Council of Ministers of the Environment (CCME); and
- Climate Change Adaptation Plan for Saint John.

Before reports and related documents are sent to the City for review, the Consultant must have other engineers from their firm review them for errors to ensure only high quality work is released.

The Consultant must identify in the proposal the peer reviewers. The Consultant's peer review engineer(s) must send a memo to the City with the final report stating the outcome of the review.

The Consultant shall **not** be responsible for applying for any of the design approvals and permits necessary from all approval agencies, such as the NBDELG, NBNRED and NBDTI, etc. The Consultant shall undertake a review of permitting requirements and provide a summary of applicable permits and relevant agencies that will be required for the work (each relevant project).

4. METHOD OF PAYMENT:

Upon award of the contract the City will execute an agreement with the successful engineering firm for the work to be performed. Payment of fees shall be in accordance with the terms of the Request for Proposal at the rates submitted and accepted in the Consultant's proposal.

The Consultant shall invoice the City, monthly, for the work performed in accordance with the engineering services agreement. The Consultant shall provide a status report with each invoice outlining in detail the scope of the work completed during that month. Payments will not be processed unless the invoice is signed by an authorized

representative of the company, accompanied by a status report in the proper timed based format (hourly rate x hours worked).

A change in the fees may be considered only if the scope of the engineering work is changed at the request of the City's Engineer.

Maximum or upset fee (including HST) will be included in the proposal for this project beyond which no additional payments will be considered unless first submitted by the Consultant in writing and authorized in writing by the City.

Engineering Contingency - The total price stated must also include $50,000 + HST as an engineering contingency for unforeseen work. No part of this contingency shall be expended without the written direction of the City's Engineer, and any part not so expended shall be deducted from the contingency allowance.

5. TERMINATION OF CONTRACT:

The City will reserve the right to terminate the contract with the Engineering Firm at any other time during the course of the work. In such an event, payment will be made only for the work completed up to the time of termination.

The City of Saint John does not, by virtue of any proposal request, commit to an award of this bid, nor does it commit to accepting the proposal submitted, but reserves the right to award this proposal in a manner deemed to be in the best interest of the City.

6. CONTENT OF PROPOSAL:

The Consultant shall confirm a clear understanding of the work to be undertaken as described in the Scope of Work. The proposal must demonstrate that the Consultant and its team have recent and significant experience with this type of work. The Consultant team shall demonstrate their experience with the SewerGEMS modelling program in their submitted proposal. When noting examples of experience gained on similar projects, the proposal must also note which current staff members worked on that project and what their role was. The proposal must specifically address all requirements of the work and any matters related to its successful implementation. The proposal must indicate what role each of the Consultant's team will be carrying out for the project. The Consultant may not substitute the project team members noted in the proposal without permission of the City. When proposing a schedule, the Consultant must also indicate that their workload is such that they will have time to complete the project as promised. If the Consultant is very busy, they should either decline the work or propose a longer schedule at the time of the RFP submission.

The proposal shall include the following sections:

A. TECHNICAL PROPOSAL:

- Table of Contents

- Work Plan and Schedule
- Project Team
- Experience with similar projects

B. FINANCIAL PROPOSAL:

- Maximum or Upset Fee(s) for each of Area "A" and "B"
- Include a contingency allowance of $50,000 in the final grand total project cost.
- All costs are to be sub-totaled (including contingency allowance as per below) with the 15% HST component identified separately and added to arrive at a total cost.
- Billing Rate Summary (hourly billing rates for all key personnel).

Description	Area "A"	Area "B"
Project Management		
Review of Existing Data		
Rainfall and Sewer Flow Monitoring and Analysis		
Model Update		
Hydraulic Modeling & System Analysis		
Technical Reporting		
Sub-total		
Combined Sub-Total (Area A + B)		
Contingency	$50,000.00	
HST (15%)		
TOTAL COST (Area A + B)		

The financial proposal shall include separate prices (including reimbursable expenses) for each Area "A" and Area "B".

A further breakdown is required with the financial proposal to identify all staff participating including hourly rates, hours and reimbursable expenses.

All sub-consultants such as geotechnical, legal survey, electrical, structural and others shall have their fees identified and included in the appropriate part of the proposal.

Additional Funding Submissions

In addition to the Financial Proposal above, unit prices shall be submitted for the following in the Consultant's financial breakdowns. These unit prices will be used if additional work is required (Contingency) or if work is to be removed from the contract (Credit).

- Flow meter ($/meter/month) – including installation and removal
- Meter rental and monitoring of an installed flow meter ($/week)
- Video inspection ($/lineal metre)
- Sewer flushing ($/hr)*

  **The Consultant shall be responsible for removal and proper disposal of all debris and other foreign material removed during the flushing operation. Disposal shall be at the Lancaster Wastewater Treatment Facility. The Consultant will be paid for travel time for the flusher truck between the work site and the disposal site. The Consultant shall have a water truck at their disposal and make effective use of it to convey water to the flusher truck. The City will not pay the Consultant for the time involving demobilization and remobilization required to refill the flusher truck.*

7. EVALUATION CRITERIA:

For the purposes of this proposal call, submissions will be evaluated on the following criteria:

- *QUALITY AND COMPLETENESS* – Has the proposal addressed all of the needs raised? Is the proposal presented in an organized and professional manner? (Criteria weight = 10 points)
- *CONSULTANT'S EXPERIENCE* – Has the proposal demonstrated a level of expertise with the requirements of this project? (Include references for projects of a similar nature.) (Criteria weight = 20 points)
- *EXPERIENCE OF EMPLOYEES / SUB-CONSULTANTS* – Has the proposal demonstrated a level of expertise for the employees of the company and sub-consultants listed? (Include resumes for staff and sub-contractors required.) (Criteria weight = 35 points)
- *METHODOLOGY* – Does the approach to the project outlined in the proposal address, in a realistic sense, attainable goals and is it in keeping with the City's expectations for the project? (Criteria weight = 75 points)
- *VALUE ADDED* – What additional information, technology, process or options has the consultant included in his proposal? Is there value added to the consultant's response for this additional information? (Criteria weight = 10 points)

- *COST* – Cost will be a factor; however, not the only factor to be considered. (Criteria weight = 50 points)

Consultants are advised that proposals will be evaluated solely on the basis of information submitted in accordance with the request for proposals. The City reserves the right, if deemed necessary, to short-list the proposals and to request an additional verbal presentation from each short-listed proponent. The Consultant may supplement their presentation with a summary in written format to clarify points raised during the process.

8. INSURANCE REQUIREMENTS:

The Consulting engineering firm shall obtain and keep in force, during the full duration of this contract, an Errors and Omissions Liability policy with a minimum limit of two (2) million dollars, and two (2) million dollars **per claim**. The policy shall include a clause stating that thirty (30) days notice of cancellation of this policy will be given to the City of Saint John, by the insurers. Provide evidence of this policy.
The Consultant must provide proof of current coverage from WorkSafeNB prior to the start of the work.

The Consultant shall provide evidence of the following insurance coverage:

General Liability with minimum limits of two (2) million dollars per occurrence. The policy shall include:

- Operations of the consultant in connection with this project;
- Products and completed operations coverage;
- Contractual liability with respect to this project;
- The City of Saint John added as an additional named insured;
- A cross liability clause;
- Non-owned automobile;
- Thirty (30) days written notice of cancellation of this policy will be given to the City of Saint John, by the insurers; and
- Standard automobile insurance for owned automobiles with at least the minimum limits allowed by law.

9. FORMALITY CLAUSE:

In order for the City of Saint John to consider any proposal submission as a legally binding offer, on behalf of the Consultant, it is necessary for the Consultant to communicate this formality to the City in the form of an offer which contains the original signature of the individual or representative of the firm who is authorized to act on behalf of the Consultant.

In order to meet this requirement, all proposal submissions to the City of Saint John must be prefaced with a covering letter which contains an original signature of the individual authorized by the Consultant to submit proposals on their behalf.

The covering letter must be on official company letterhead, be dated and be addressed to the attention of the City of Saint John representative specified in the request for proposal document. Additionally, the letter must make reference in the body of the letter to the request for proposal number and project title, as well as to the fact that the enclosed documents constitute a formal proposal offer and finally, the letter must contain the original signature as indicated.

Failure to include the required covering letter as a preface with your proposal will be grounds for immediate rejection on the basis that it is not formal.

10. STANDARD TERMS AND CONDITIONS:

Addenda

Periodically, the City of Saint John is required to issue notification of changes or corrections to a bid document by way of addenda. Normally these notifications will have direct bearing on the cost of a project and will influence bidding. Therefore, it is important that the City have assurances that bidders have in-fact received the notification(s).

Bidders are responsible for obtaining all addenda issued by the City. Addenda may be obtained from the City's website (www.saintjohn.ca) under the menu option "Tender and Proposals".

Bidders are required to sign and include all addenda with their bid submission. Failure to include a copy of all signed addenda with the bid submission may result in rejection of the bid regardless of whether or not the changes noted in the addendum are included in the bid submission.

Advisory Notice(s)

Periodically, the City of Saint John is required to issue clarification notices to a bid document in the form of Advisory Notices. Normally these notifications will not have a direct bearing on the cost of a project and will not influence bidding.

Bidders are responsible for obtaining all advisory notice(s) issued by the City. Advisory Notice(s) may be obtained from the City's website (www.saintjohn.ca) under the menu option "Tenders and Proposals".

Bidders are instructed to sign the Advisory Notice and return it either by fax to (506) 658-4742 or email to supplychainmanagment@saintjohn.ca prior to the closing date.

Failure to comply with the instructions on an advisory may result in rejection of the bid.

Review of Proposals

The evaluation committee may invite proponents to meet with the review committee to make an oral/visual presentation in support of their proposal. The City will provide the meeting venue at its cost. The proponent shall bear its own costs related to such meeting.

Additional Information from Proponents

The City of Saint John reserves the right during evaluation of the bids to seek further information from any proponent and to utilize that information in evaluation and award without becoming obligated to seek further information from any other proponents.

Clarification of Bids

The City of Saint John reserves the right in its sole discretion to clarify any bid after close of bidding without becoming obligated to clarify any other bid.

Negotiation

The City reserves the right in its sole discretion to negotiate the final terms and conditions of the engagement contract with the most probable candidate for award prior to award of the engagement.

Inconsistency between Paper and Electronic Form

If there is any inconsistency between the paper form of a document issued by or on behalf of the City to proponents and the digital, electronic or other computer readable form, the paper form of the document prevails.

Acceptance, Revocation and Rejection of Proposals

The proposal constitutes an offer which shall remain open and irrevocable until ninety (90) days after the date of the proposal opening.

Reserved Rights

The City reserves the right to:

a) Reject an unbalanced Proposal. For the purpose of this section, an unbalanced Proposal is a Proposal containing a unit price which deviates substantially from, or does not fairly represent, reasonable and proper compensation for the unit of work bid or one that contains prices which appear to be so unbalanced as to adversely affect the interests of the City. The City reserves the right to use Proposals submitted in response to other like or similar Requests for Proposals as a guideline in determining if a bid is unbalanced.

b) Amend or modify the scope of a project, and/or cancel or suspend the Bid Solicitation at any time for any reason.

c) Require proponents to provide additional information after the Closing Date for the Bid Solicitation to support or clarify their bids.

d) Not accept any or all bids.

e) Not accept a bid from a bidder who is involved in litigation, arbitration or any other similar proceeding against the City.

f) Reject any or all bids without any obligation, compensation or reimbursement to any bidder or any of its team members.

g) Withdraw a Bid Solicitation and cancel or suspend the Bid Solicitation process.

h) Extend, from time to time, any date, any time period or deadline provided in a Bid Solicitation (including, without limitation, the Bid Solicitation Closing Date), upon written notice to all bidders.

i) Assess and reject a bid on the basis of
   i. information provided by references;
   ii. the bidder's past performance on previous contracts;
   iii. information provided by a bidder pursuant to the City exercising its clarification rights under the Bid Solicitation process;
   iv. the bidder's experience with performing the type and scope of work specified including the bidder's experience;
   v. other relevant information that arises during a Bid Solicitation process.

j) Waive formalities and accept bids which substantially comply with the requirements of the Bid Solicitation.

k) Verify with any bidder or with a third party any information set out in a bid.

l) Disqualify any bidder whose bid contains misrepresentations or any other inaccurate or misleading information.

m) Disqualify any bidder who has engaged in conduct prohibited by the Bid Solicitation documents.

n) Make changes including substantial changes to the bid documents provided that those changes are issued by way of an addendum in the manner set out in the Bid Solicitation documents.

o) Select any bidder other than the bidder whose bid reflects the lowest cost to the City.

p) Cancel a Bid Solicitation process at any stage.

q) Cancel a Bid Solicitation process at any stage and issue a new Bid Solicitation for the same or similar deliverable.

r) Accept any bid in whole or in part.

And these reserved rights are in addition to any other express rights or any other rights which may be implied in the circumstances and the City shall not be liable for any expenses, costs, losses or any direct or indirect damages incurred or suffered by any bidder or any third party resulting from the City exercising any of its express or implied rights under a Bid Solicitation.

Limitation of Liability and Waiver

In every Bid Solicitation, the City shall draft the documents such that each bidder, by submitting a bid, agrees that:

a) Neither the City nor any of its employees, agents, advisers or representatives will be liable, under any circumstances, for any claims arising out of a Bid Solicitation process including but not limited to costs of preparation of the bid, loss of profits, loss of opportunity or any other claim.

b) The bidder waives any claim for any compensation of any kind whatsoever including claims for costs of preparation of the bid, loss of profit or loss of opportunity by reason of the City's decision to not accept the bid submitted by the bidder, to award a contract to any other bidder or to cancel the Bid Solicitation process, and the bidder shall be deemed to have agreed to waive such right or claim.

Proposal Debrief

Immediately following the City's acceptance of a Proposal submitted, the Office of the Purchasing Agent shall send a written notification of award to all unsuccessful proponents disclosing the name of the successful proponent and providing a brief explanation rationalizing the City's selection:

a) For all Requests for Proposals valued at Fifty Thousand Dollars **($50,000.00) or less**, the written notification of award will be the only form of debriefing offered by the City;

b) In the case of Requests for Proposals valued **in excess** of Fifty Thousand Dollars **($50,000.00)**, the Purchasing Agent may, in addition to the notification of award and upon written request from any proponent, provide a more detailed oral debriefing either by phone or in person, as required by

the proponent. During this debriefing, the Purchasing Agent may disclose information such as the total price of the successful proponent and may discuss an overview of the process as well as the strengths and weaknesses of the requesting proponent's proposal.

c) The written request referred to paragraph (ii) shall be submitted to the Office of the Purchasing Agent no later than fifteen (15) business days after the notification of award is issued.

d) The acceptance of the successful Proposal shall not be discussed during a debriefing.

11. SUBMITTALS:

When preparing the Agreement for Engineering Services, the consultant is required to submit a "Business Corporation Act Certificate" to the Engineer.

12. ENQUIRIES:

All enquiries regarding this request for proposals shall be submitted in writing via email, by **4:00:00 pm Local Time on Tuesday, April 16th, 2024**, only to the attention of:

Monic MacVicar, CCLP, CPPB
Procurement Specialist
Supply Chain Management
Email: supplychainmanagement@saintjohn.ca

Responses to enquiries will be in writing and distributed by email to all Consultants registered as having received the Terms of Reference as of the date the response is prepared. The source of the question will not be identified in the response. Verbal information shall not be binding upon the City. Enquiries after the above deadline will not receive a response.

13. ATTACHMENTS:

The following documents are being provided to help the consultants understand what work has been completed with the drainage areas. It is expected that the City shall have a stand-alone document at the end of this work.

Due to the file sizes, only files i to iv have been combined to this RFP. Files v and vi must be downloaded from our website at www.saintjohn.ca, under City Menu, choose the header City Hall and then Tenders and Proposals

i. Draft Consulting Engineering Agreement.
ii. Detailed map of overall project area including pipe information.
iii. Detailed map of Area A & B with Street names.
iv. Central and East Saint John Sanitary Sewer and Storm Water Model Final Report.

v. 2021 Flood Risk reduction and Overflow mitigation Strategy final report.
vi. 2011 Combined Sewer Overflow Reduction - Draft

14. OTHER RELEVANT DOCUMENTS:

- East side Sanitary Sewer and Storm Water Model – to be provided following award of project.
- Granite Net Sewer Condition Information (City of Saint John) – to be provided following award of project.
- City of Saint John General Specifications, latest revision
- To supplement any City GIS information not being fully up to date, the Consultant may need to utilize the City's record drawings, red books, etc. to confirm/validate information.

15. SUBMISSION OF PROPOSALS:

Consultants shall deliver **eight (8)** copies of the Technical Proposal and supporting information and **eight (8)** copies of the Financial Proposal no later than **4:00:00 pm, Local Time, Wednesday, April 24th, 2024,** clearly indicating the Consultant's name and address and marked **"Proposal: 2024-091006P, Engineering Services: East Saint John Combined Sewer Separation Strategy"**, to the attention of:

Monic MacVicar, CCLP, CPPB
Procurement Specialist
Supply Chain Management
175 Rothesay Avenue, 1st Floor
Saint John, NB E2J 2B4

Please note that:

1. Late proposals or proposals submitted by facsimile will be rejected.

2. The City assumes no responsibility for improperly addressed or delivered proposals.

3. The City of Saint John does not, by virtue of this proposal call, commit to an award of this proposal, nor does it commit to accepting the lowest or any proposal submitted, but reserves the right to award this proposal in any manner deemed to be in the best interest of the City.

4. The Financial Proposal is to be submitted in the Consultant's package in a separate sealed envelope, clearly marked as **"Proposal: 2024-091006P, Engineering Services: East Saint John Combined Sewer Separation Strategy",** with the consultant's name and address.

5. Consultants must propose on the entire project – incomplete proposals will be rejected.

Immediately following the closing time, proposal packages will be opened in the Office of the Purchasing Agent. Only the names and addresses of the proponents will be made public at this time via the City's website. No other information about the proposals will be disclosed at that time. Proposals will then be forwarded to an evaluation committee for review and recommendation.

THIS ***CONSULTING ENGINEERING AGREEMENT*** made in triplicate this _____ day of April, 2024 (the “Effective Date”).

BETWEEN:

THE CITY OF SAINT JOHN, having its offices at the City Hall Building at 15 Market Square, Saint John, New Brunswick, a body corporate by Royal Charter, confirmed and amended by Acts of the Legislative Assembly of the Province of New Brunswick, hereinafter called the “City",

OF THE FIRST PART

- and -

CONSULTANT, an extra-provincial corporation registered under the Business Corporations Act, having its head office in the City of CITY, Province of PROVINCE, hereinafter called the “Consultant”,

OF THE SECOND PART

WHEREAS, the City issued a Request for Proposal 2024-091006P for Engineering Services: East Saint John Combined Sewer Separation Strategy [hereinafter referred to as the “Request for Proposal”] attached hereto as Schedule “A”;

WHEREAS, the Consultant submitted a Proposal with respect to the Request for Proposal on March 28th, 2024 [hereinafter referred to as the “Proposal”] which proposal the City has accepted and attached hereto as Schedule “B”;

WHEREAS, the purpose of this Agreement is for Engineering Services: Central Peninsula Combined Sewer Separation Strategy

WHEREAS, the Council on April 29, 2024 resolved that:

The proposal from CONSULTANT, for engineering services for the East Saint John Combined Sewer Separation Strategy project in the amount of $XXX,XXX.XX including HST be accepted and that the Mayor and authorized to execute the appropriate documentation in that regard.

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the mutual covenants and agreements herein and subject to the terms and conditions set out in this Agreement, the parties agree as follows:

1. Definitions

The terms defined in this clause shall for all purposes of this Agreement have the meanings specified unless the context otherwise specifies or requires:

1(1) **City Manager** means the city manager of the City or his designate appointed by resolution of Council;

1(2) **Claims** means any actual or threatened loss, liability, cost, charge, interest, claim, demand, allegation, action, cause of action, proceeding, suit, assessment, reassessment, proposed assessment or reassessment, damage, demand, expense, levy, tax, duty, judgment, award, fine, charge, deficiency, penalty, court proceeding or hearing cost, amount paid in settlement, encumbrance, and/or tangible and intangible property right (including all costs and expenses relating to the foregoing, including legal and other professional adviser and expert fees and expenses), and whether arising by contract, at common or statute law, in tort (including negligence and strict liability), in equity, in property or otherwise of any kind or character howsoever, and howsoever arising; and **Claim** means any one of them;

1(3) **Council** means the elected municipal council of the City;

1(4) **Confidential Information** means information disclosed to or obtained by the Consultant in connection with the fulfillment of the terms of this Agreement and which has been identified by Municipal Operations as information which should be treated as confidential and shall be as defined in section 9;

1(5) **Consultant** means the consulting engineering firm who is currently licensed to practice within the Province of New Brunswick to carry out engineering services required to complete the Project and referred to as CONSULTANT in this Agreement;

1(6) **Consultant Representative** means the person designated by the Consultant with duly vested authority to act on behalf of the Consultant;

1(7) **Dispute** means any dispute, controversy, Claim, disagreement or failure to agree arising out of, in connection with, or relating to the interpretation,

performance or application of the Agreement; and **Disputes** has a corresponding meaning;

1(8) **Information** means all data, site surveys, preliminary investigations, preliminary designs, design reports with cost estimates, detailed designs, record drawings in digital and hard copy format, plans in digital and hard copy format, public consultation process data or reports, construction management and inspection services data or reports, and other materials developed in pursuance of the Project;

1(9) **Municipal Operations** means the Utilities and Infrastructure Services Department of the City of Saint John;

1(10) **Parties** means the City and the Consultant, respectively; and **Party** means individually the City and the Consultant;

1(11) **Project** means the engineering services for the East Saint Combined Sewer Separation Strategy;ohn Combined Sewer Separation Strategy;

1(12) **Proposal** means the proposal submitted by the Consultant entitled Engineering Services – the East Side Combined Sewer Separation Strategy; (Proposal # 2022-091010P);

1(13) **Services** means those design and construction management services as set out in the Request for Proposal and the Proposal and as set forth in this Agreement; and

1(14) **Work** means the scope of the Consultant's services.

2. General

2(1) The City hereby agrees to retain the Consultant to provide the City with the Services and the Consultant hereby agrees to provide the Services to the City, all in accordance with the provisions of this Agreement.

2(2) The Consultant shall carry out the work in accordance with the Request for Proposal and the Proposal and any other written clarification(s) or addendum(s) thereof that has or have been requested and, provided and agreed to by the parties to this Agreement.

3. Term

3(1) The term of this Agreement commences on the Effective Date and construction of the Project is to proceed as outlined in the Request for Proposal.

4. Scope of Services and Responsibilities

4(1) The Consultant shall perform the Services as set out in the Request for Proposal and the Proposal and any other written clarification(s) or addendum(s) thereof that has or have been requested, provided and agreed to by the Parties to this Agreement, and these Services shall include:

(a) Combined Sewer Separation investigation;

(b) Sewer Outfall investigation;

(c) Combined Sewer Overflow Chamber review;

(d) *Flow Monitoring Program;*

(e) Sewer Model Calibration and Update

(f) Study Report

4(2) The Consultant shall perform these Services under the general direction and control of Municipal Operations and with all due and reasonable diligence, professional skills and competence.

5. Fees

5(1) The City shall pay to the Consultant the fees in accordance with the Proposal and the provisions of the Request for Proposal including any other written clarification(s) or addendum(s) thereof that has or have been requested and provided and agreed to by the Parties to this Agreement.

5(2) Municipal Operations will review each invoice submitted by the Consultant within five (5) days after receipt and the City shall pay any undisputed amount

thereunder within forty-five (45) days of the date of submission of such invoice by the Consultant.

5(3) The fees to be paid by the City for the Services performed hereunder shall be inclusive of any applicable sales taxes.

5(4) With respect to any invoice submitted by the Consultant, the City may, without triggering a default under this Agreement, withhold from any payment otherwise due:

(a) any amount incorrectly invoiced, provided that the City timely informs the Consultant of the amounts alleged to be incorrectly invoiced and the basis for any such assertion for review, resolution and rebilling purposes; or

(b) any amount in dispute.

6. Records and Audit

6(1) In order to provide data to support the invoice for fees, the Consultant shall keep a detailed record of hours worked and the billing rate for all staff performing work on the Project. The Consultant agrees that the City may inspect these time records at any reasonable time.

6(2) The Consultant, when requested by the City, shall provide copies of receipts in respect to any disbursements for which the Consultant claims payment.

7. Failure to Perform

7(1) Should the Consultant fail for any cause whatever to perform the Work provided for by this Agreement, or fail to perform the Work in a manner satisfactory to the City, then, in either case, all payments by the City to the Consultant shall cease as of the date of such failure, and the City may appoint its officials, or any other person or persons in the place instead of the Consultant to perform the Work and the Consultant shall have no Claim against the City except for the Work which has been performed by the Consultant under this Agreement up to the time of such failure, without further liability, penalty or obligation to the City under this Agreement, and subject to any amounts that have already been paid to the Consultant.

8. Dismissal and Termination

8(1) In the event that the City, acting reasonably, is dissatisfied with the Work performance by the Consultant or that the Consultant fail to comply with the specifications and the terms and conditions of this Agreement, the Parties agree that the City may dismiss the Consultant at any time on thirty (30) days' prior written notice. The Consultant will accept payment for Work performed to the date of dismissal on a pro-rated basis in accordance with the provisions of this Agreement, in full satisfaction of any and all Claims under this Agreement, without further liability, penalty or obligation to the City under this Agreement, and subject to any amounts that have already been paid to the Consultant.

8(2) This Agreement may be terminated, without cause, by the City upon thirty (30) days' written notice to the Consultant of the City's intention to terminate same.

8(3) In the event of termination of this Agreement by the City, it shall within forty-five (45) calendar days of termination pay the Consultant, for all services rendered and all reimbursable costs incurred by the Consultant up to the date of termination, in accordance with the payment provisions set out in this Agreement, without further liability, penalty or obligation to the City under this Agreement, and subject to any amounts that have already been paid to the Consultant.

8(4) Upon early termination of this Agreement and settlement of accounts, or upon completion of the Consultant's obligations under this Agreement, all information, data, material, sketches, plans, notes, documents, memoranda, specifications or other paper writing belonging to the City and gathered or assembled by the Consultant or their agents, whether in paper or electronic format or otherwise for the purpose of this Agreement, shall forthwith be delivered to the City by the Consultant.

9. Confidential Information

9(1) The Consultant will, both during and following the term of this Agreement, treat as confidential and safeguard any information or document concerning the affairs of the City of which the Consultant acquires knowledge or that comes into its possession by reason of the Work for the City under this Agreement and will not disclose either directly or indirectly any such information or documents to any person, firm or corporation without first obtaining the written permission by the City, except any information or documents as the Consultant determines in its professional judgment should be disclosed to a third party.

9(2) Without limiting the generality of paragraph 9(1):

(a) The Consultant will not use any information acquired through the performance of this Agreement (herein referred to as “findings”) to gain advantage in any other project or undertaking irrespective of the topic, scale, or scope of such project or undertaking;

(b) The Consultant will not disclose any findings during or after the performance of this Agreement;

(c) The Consultant will not respond to any inquiries pertaining to any findings and agrees to refer all such inquiries to the City;

(d) The Consultant will not disclose or use any information that Municipal Operations cannot or may not wish to disclose;

(e) The Consultant shall hold all Confidential Information obtained in trust and confidence for Municipal Operations or the City and shall not disclose, except as required by law, any such Confidential Information, by publication or other means, to any person, company or other government agency nor use same for any other project other than for the benefit of the City as may be authorized by the City in writing; and

Any request for such approval by the City shall specifically state the benefit to the City of the disclosure of the Confidential Information.

10. <u>Liability Insurance</u>

10(1) The Consultant, at no expense to the City, shall obtain and maintain in full force and effect during the term of this Agreement, a policy or policies of insurance with the following minimum limits of liability:

(a) Professional Errors and Omissions Liability Insurance

The Insurance Coverage shall be in the amount of Two Million Dollars ($2,000,000.00) per claim and in the aggregate. When requested, the Consultant shall provide the City proof of Professional Errors and Omissions Liability Insurance carried by the Consultant

and in accordance with the *Engineering and Geoscience Professions Act*, S.N.B. 1999, Chapter 50, and amendments thereto.

(b) Comprehensive General Liability and Automobile Insurance

The Insurance Coverage shall be of not less than Two Million Dollars ($2,000,000.00) per occurrence and in the aggregate for general liability and Two Million Dollars ($2,000,000.00) for automobile insurance. When requested, the Consultant shall provide the City with proof of Comprehensive General Liability and Automobile Insurance (Inclusive Limits) for both owned and non-owned vehicles.

10(2) The policies of insurance required in paragraphs 10(1)(a) & 10(1)(b) must provide that the coverage shall stay in force and not be amended, cancelled or allowed to lapse without thirty (30) days prior written notice being given to the City. The Consultant agrees to furnish to the City a renewal certificate at least ten (10) calendar days prior to the expiration of the policy.

10(3) The policy of insurance required in paragraph 10(1)(b) shall name the City as an additional insured and shall contain a cross-liability clause.

10(4) The Consultant shall obtain and maintain in full force and effect during the term of this Agreement coverage from WorkSafeNB.

10(5) The Consultant shall submit to the City satisfactory evidence of having obtained the insurance coverage required and shall submit certificates of such coverage as well as current coverage from the WorkSafeNB forthwith to the City upon execution of this Agreement.

10(6) Nothing in this section 10 shall be construed as limiting in any way, the indemnification provision contained in this Agreement, or the extent to which the Consultant may be held responsible for payments of damages to persons or property.

11. Project Managers

11(1) The City shall designate a project manager to work directly with the Consultant in the performance of this Agreement.

11(2) The Consultant shall designate a Consultant Representative who shall represent it and be its agent in all consultations with the City during the term of this

Agreement. The Consultant or its Consultant Representative shall attend and assist in all coordination meetings called by the City.

12. Responsibility for Errors

12(1) The Consultant shall be responsible for its work and results under this Agreement. The Consultant, when requested, shall furnish clarification and/or explanation as may be required by the City's representative, regarding any services rendered under this Agreement at no additional cost to the City.

12(2) In the event that an error or omission attributable to the Consultant's negligence, then the Consultant shall, at no cost to the City, provide all necessary design drawings, estimates and other Consultant professional services necessary to rectify and correct the error or omission to the sole satisfaction of the City, acting reasonably, and to participate in any meeting required with regard to the correction.

13. Remedies

13(1) Subject to sections 18 and 19 hereof, upon default by either Party under any terms and conditions of this Agreement, and at any time after the default, either Party shall have all rights and remedies provided by law and by this Agreement.

13(2) No delay or omission by the Parties in exercising any right or remedy shall operate as a waiver of them or of any other right or remedy, and no single or partial exercise of a right or remedy shall preclude any other or further exercise of them or the exercise of any other right or remedy. Furthermore, any Parties may remedy any default by the other Party in any reasonable manner without waiving the default remedied and without waiving any other prior or subsequent default by the defaulting party. All rights and remedies of each Party granted or recognized in this Agreement are cumulative and may be exercised at any time and from time to time independently or in combination.

14. Indemnification

14(1) Subject to subsection 14(2) hereof, but notwithstanding any other clauses herein, the Consultant shall indemnify and save harmless the City from all Claims, or other proceedings by whomsoever claimed, made, brought or prosecuted in any manner and whether in respect of property owned by others or in respect of damage sustained by others based upon or arising out of or in connection with the performance of this Agreement or anything done or purported to be done in any

manner hereunder, but only to the extent that such Claims, or other proceedings are attributable to and caused by the Consultant's negligence, errors or omissions.

14(2) In no event shall the Consultant be obligated to indemnify the City in any manner whatsoever in respect of any Claims, or other proceedings caused by the negligence of the City, or any person for whom the City is responsible.

15. Contract Assignment

15(1) This Agreement cannot be assigned by the Consultant to any other service provider without the express written approval of the City.

16. Performance

16(1) All Parties agree to do everything reasonably necessary to ensure that the terms of this Agreement are met.

17. Non-Performance

17(1) The failure on the part of any Parties to exercise or enforce any right conferred upon it under this Agreement shall not be deemed to be a waiver of any such right or operate to bar the exercise or enforcement thereof at any time or times thereafter.

18. Dispute Resolution

A. Referral to Senior Management

18(1) All Disputes arising out of, or in connection with, this Agreement, or in respect of any legal relationship associated with or derived from this Agreement shall within two (2) Business Days be referred for resolution to the City Manager and the Consultant Representative.

18(2) If the City Manager and Consultant Representative are not able to resolve the Dispute referred to them under this section 18 within seven (7) Business Days following such referral, the matter shall be referred for resolution by way of mediation upon the willingness of the Parties.

B. Mediation

18(3) Despite an agreement to mediate, a Party may apply to a court of competent jurisdiction or other competent authority for interim measures of protection at any time.

18(4) If the Parties resolve to mediate the Dispute referred to them under subsection 18(2), the Parties shall invoke the following mediation process:

(a) Either Party shall immediately declare an impasse and provide written notice to the other within seven (7) Business Days thereof (or such other period as the Parties mutually prescribe) declaring that such party wishes to proceed to mediation and setting out in reasonable detail the issue(s) to be resolved, the proposed time and a list of at least three (3) and not more than five (5) proposed mediators. Each of the proposed mediators shall be an individual:

(i) with at least three (3) years' experience working in an executive capacity or representing clients in the area of public disputes, and

(ii) unless otherwise agreed by the Parties, with no prior connection, affiliation or other formal relationship with either Party.

(b) Upon receipt of such notice, the notified party shall have two (2) Business Days to select one (1) of the proposed mediators as the mediator, failing which the Party providing notice shall select one (1) of its proposed mediators as the mediator. Within seven (7) Business Days following selection of the mediator the matter shall be heard by the mediator.

(c) The mediator shall be entitled to establish his or her own practices and procedures. Each Party shall co-operate fully with the mediator and shall present its case to the mediator orally and/or in writing within (10) Business Days following the mediator's appointment. The mediation shall not be in the nature of arbitration as contemplated by the *Arbitration Act,* SNB 2014, c 100, and the mediator's decision shall not be binding upon the Parties, but shall be considered as a bona fide attempt by the mediator to judiciously resolve the Dispute. The decision of the mediator shall be rendered in a written report, not to exceed two (2) pages in length, delivered to the Parties within ten

(10) Business Days following the last of such presentations. The fees of the mediator shall be shared equally by the Parties.

18(5) The mediation shall be terminated:

(a) By the execution of a settlement agreement by the Parties; or

(b) By a written declaration of one or more parties that the mediation is terminated; or

(c) By a written declaration by the mediator that further efforts at mediation would not be useful.

18(6) The place of mediation shall be the City of Saint John and Province of New Brunswick.

C. Arbitration

18(7) In the event that the Parties are unwilling to mediate their Dispute or that the Dispute between the Parties remain unresolved after mediation has been attempted in good faith, then either the City or the Consultant, upon written notice to the other, may refer the Dispute for determination to a Board of Arbitration consisting of three (3) persons, one (1) chosen by and on behalf of the City, one (1) chosen by and on behalf of the Consultant and the third chosen by these two.

18(8) In case of failure of the two arbitrators appointed by the Parties hereto to agree upon a third arbitrator, such third arbitrator shall be appointed by a Judge of The Court of Queen's Bench of New Brunswick.

18(9) No one shall be appointed or act as arbitrator who is in any way interested, financially or otherwise, in the conduct of the work or in the business or other affairs of either Party.

18(10) Notwithstanding the provisions of the *Arbitration Act,* SNB 2014, c 100, the Board of Arbitration, upon such terms and conditions as are deemed by it to be appropriate, may allow a Party to amend or supplement its claim, defence or reply at any time prior to the date at which the Parties have been notified of the arbitration hearing date, unless the Board of Arbitration considers the delay in amending or supplementing such statements to be prejudicial to a Party. The Board of

Arbitration will not permit a Party to amend or supplement its claim, defence or reply once the arbitration hearing has been scheduled.

18(11) The Board of Arbitration may encourage settlement of the Dispute and, with the written agreement of the Parties, may order that mediation, conciliation or other procedures be used by the Parties at any time during the arbitration proceedings to encourage settlement.

18(12) If, during the arbitration proceedings, the Parties settle the Dispute, the Board of Arbitration shall, upon receiving confirmation of the settlement or determining that there is settlement, terminate the proceedings and, if requested by the Parties, record the settlement in the form of an arbitration award on agreed terms.

18(13) Subject to subsection 18(14), any determination made by the Board of Arbitration shall be final and binding upon the Parties and the cost of such determination shall be apportioned as the Board of Arbitration may decide.

18(14) Either Party may appeal an arbitration decision to The Court of Queen's Bench of New Brunswick: (i) on a question of law; or (ii) on a question of fact; or (iii) on a question of mixed fact and law.

18(15) The place of arbitration shall be the City of Saint John and Province of New Brunswick and the provisions of the *Arbitration Act,* SNB 2014, c 100, New Brunswick, shall apply to the arbitration.

D. <u>Retention of Rights</u>

18(16) It is agreed that no act by either Party shall be construed as a renunciation or waiver of any rights or recourses provided the Party has given the notices required under section 18 and has carried out the instructions as provided in section A of this Part.

18(17) Nothing in section 18 shall be construed in any way to limit a Party from asserting any statutory right to a lien under applicable lien legislation of the jurisdiction of New Brunswick and the assertion of such right by initiating judicial proceedings is not to be construed as a waiver of any right that Party may have under section B of this Part to proceed by way of arbitration to adjudicate the merits of the claim upon which such a lien is based.

19. Force Majeure

19(1) It is agreed between all Parties that neither Parties shall be held responsible for damages caused by delay or failure to perform his undertakings under the terms and conditions of this Agreement when the delay or failure is due to strikes, labour disputes, riots, fires, explosions, war, floods, acts of God, lawful acts of public authorities, or delays or defaults caused by common carriers, which cannot be reasonably foreseen or provided against. After ninety (90) consecutive or cumulative days of the suspension of Party's obligations due to force majeure, the other Party may terminate the Agreement.

20. Time

20(1) This Agreement shall not be enforced or bind any of the Parties, until executed by all the Parties named in it.

21. Notices

21(1) Any notice under this Agreement shall be sufficiently given by personal delivery or by registered letter, postage prepaid, mailed in a Canadian post office and prepaid courier, addressed, in the case of notice to:

The City:	**CONSULTANT:**
Municipal Operations City of Saint John 175 Rothesay Avenue Saint John, New Brunswick E2J 2B4	CONSULTANT. STREET ADDRESS CITY, PROVINCE XXX XXX
Telephone: 506-658-4455	Telephone: XXX-XXX-XXXX

or to any other address as may be designated in writing by the Parties and the date of receipt of any notice by mailing shall be deemed conclusively to be five (5) calendar days after the mailing.

22. Reference to Prior Agreement

22(1) This Agreement supersedes and takes the place of all prior agreements entered into by the Parties with respect to the consulting engineering services for the East Side Combined Sewer Separation Strategy.

23. Amendments

23(1) No change or modification of this Agreement shall be valid unless it is in writing and signed by the Parties.

24. Acknowledgment of Terms and of Entirety

24(1) It is agreed that this written instrument embodies the entire agreement of the Parties with regard to the matters dealt with in it, and that no understandings or agreements, verbal or otherwise, exist between the Parties except as expressly set out in this instrument or as set out in the Request for Proposal or the Proposal or any written clarification(s) or addendum(s) that are included as part of this Agreement.

25. Further Documents

25(1) The Parties agree that each of them shall, upon reasonable request of the other, do or cause to be done all further lawful acts, deeds and assurances whatever for the better performance of the terms and conditions of this Agreement.

26. Validity and Interpretation

26(1) Paragraph headings are inserted solely for convenience of reference, do not form part of this Agreement, and are not to be used as an aid in the interpretation of this Agreement.

26(2) The failure of the Parties to insist upon strict adherence to any term or condition of this Agreement on any occasion shall not be considered a waiver of any right thereafter to insist upon strict adherence to that term or condition or any other term or condition of this Agreement.

26(3) The Schedules to the Agreement form part of and are incorporated into the Agreement as fully and effectively as if they were set forth in the Agreement.

27. Governing Law

27(1) This Agreement shall be governed by and construed in accordance with the laws of the Province of New Brunswick and the federal laws of Canada applicable therein.

28. Successors, Assigns

28(1) This Agreement shall enure to the benefit of and be binding on the successors and assigns of the City and on the successors and permitted assigns of the Consultant.

29. Severability

29(1) It is intended that all provisions of this Agreement shall be fully binding and effective between the Parties, but in the event that any particular provision or provisions or part of one is found to be void, voidable or unenforceable for any reason whatsoever, then the particular provision or provisions or part of the provision shall be deemed severed from the remainder of this Agreement and all other provisions shall remain in full force.

30. Independent Legal Advice

30(1) The Parties acknowledge having obtained their own independent legal advice with respect to the terms of this Agreement prior to its execution.

31. Acknowledgment of Receipt of Copy

31(1) Each Parties acknowledge receipt of a true copy of this Agreement.

(The remainder of this page is intentionally left blank)

IN WITNESS WHEREOF CONSULTANT, has caused this Agreement to be executed in its corporate name, and on its behalf, by its POSITION, and The City of Saint John has caused this Agreement to be executed in its corporate name in the manner prescribed by the *Local Governance Act*, SNB 2017, c 18, and amendments thereto.

SIGNED, SEALED & DELIVERED)
In the presence of:)

CONSULTANT

Per:

_____

Print Name and Title:

_____

I have authority to bind the Consultant

THE CITY OF SAINT JOHN

_____
Donna Noade Reardon, Mayor

_____
Jonathan Taylor, City Clerk

Council Resolution:
March XX, 2024

PROVINCE OF NEW BRUNSWICK

I, EMPLOYEE, of the City of CITY and Province of PROVINCE, MAKE OATH AND SAY:

1. That I am the POSITION of CONSULTANT, a Consultant named in the foregoing instrument and have custody of the corporate seal of the said company and am duly authorized to make this affidavit.

2. That the corporate seal affixed to the foregoing agreement and purporting to be the corporate seal of CONSULTANT, is the corporate seal of CONSULTANT, a Consultant named in the foregoing instrument and it was affixed by the officers authorized to so affix the seal.

3. That the signature of "EMPLOYEE", is my signature, and as the POSITION of CONSULTANT, I am duly authorized to execute the said instrument.

4. THAT the said document was executed as aforesaid at the City of CITY and Province of PROVINCE on the ____ day of March, 2024.

SWORN TO before me at)
the City of CITY, in the)
Province of PROVINCE)
the ____ day of March, 2024)
)
)
)
_____)
Commissioner of Oaths,)
)

_____

EMPLOYEE

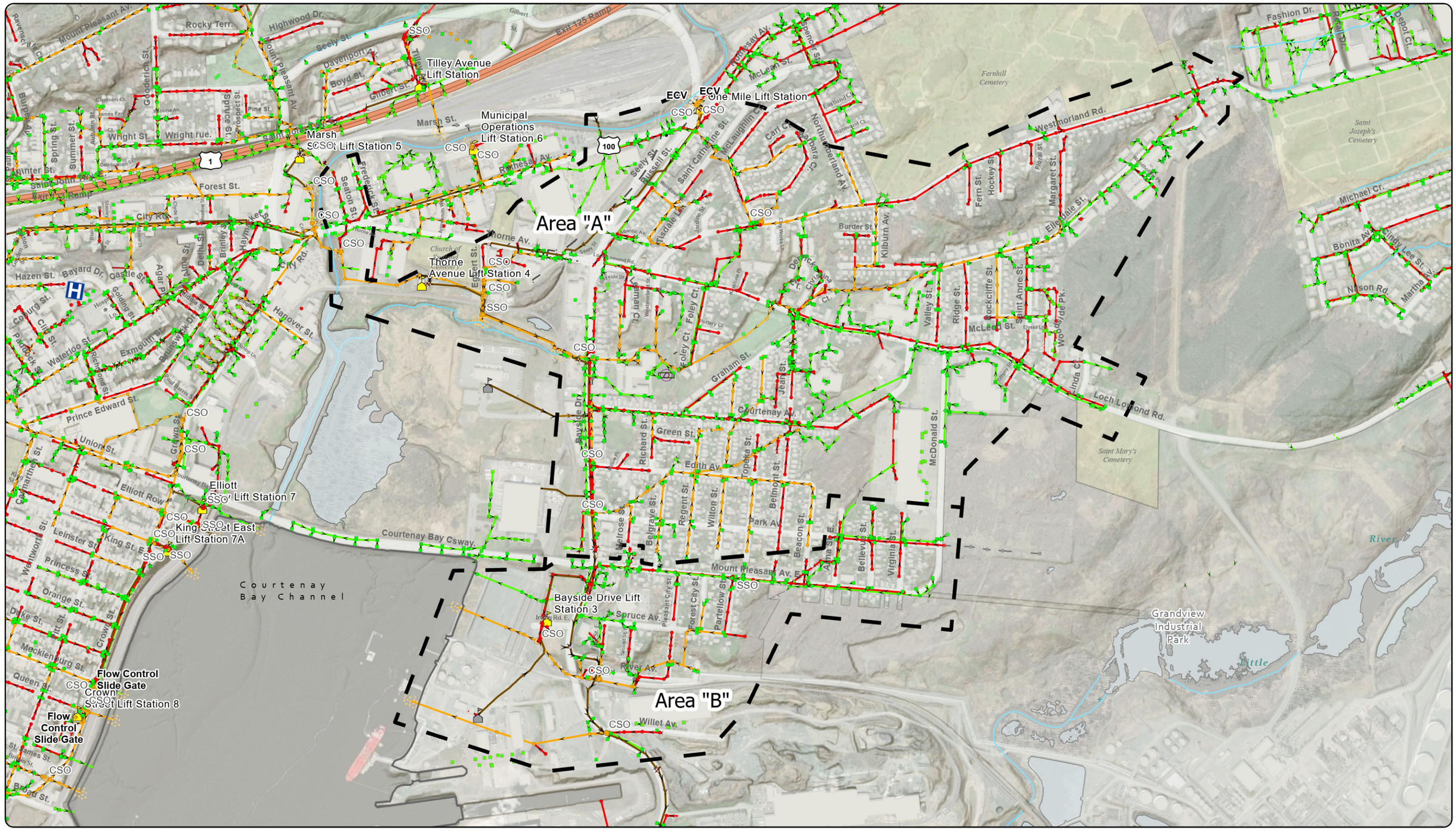
Area "A"

Area "B"

EAST SAINT JOHN
COMBINED SEWER SEPARATION STRATEGY

Feb 26, 2024

- Private Lift Station
- Millidgeville WWTF Scheme
- Lancaster WWTF Scheme
- Eastern WWTF Scheme
- Combined Sewer Discharge Point
- Sanitary Sewer Discharge Point
- Combined Sewer Overflow Manhole
- Combined Sewer Overflow Structure
- Sanitary Sewer Overflow Manhole
- Sanitary Sewer Overflow Structure
- Storm Sewer Overflow Manhole
- Hospital
- Regulated Wetlands
- Industrial Parks
- Recreation Parks
- Mobile Home Park Lots
- Cemetery Boundaries



SAINT JOHN

Project Description:

East Saint John Combined Sewer Separation Strategy
Areas "A" & "B"

Legend:

- Combined Manhole
- Storm Manhole
- Sanitary Forcemain
- Combined Sewer
- Sanitary Manhole
- Storm Catch Basin
- Storm Sewer
- Sanitary Sewer

Drawn By:	A.B.P.
Scale:	Scale: 1:10,000
Date:	Feb 26, 2024
Sheet No:	

Central and East Saint John
Sanitary Sewer and Storm Water Model

Final Report

CBCL

172870.00 • May 2022

	Issued as Final	Tim McCluskey	5/03/2022	Brian Moreau
	Issued for Draft	Brian Moreau	7/15/2020	Jill Durling
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**

Report: 172870.00

May 3rd, 2022

Pierre LeBlanc, P. Eng.
Operations Manager, Saint John Water
175 Rothesay Ave.
Saint John, NB
E2J 2B4

Dear Pierre:

RE: Final Report – Central and East Sanitary Sewer and Storm Water Model

CBCL Limited is pleased to provide the enclosed FINAL report: Central and East Sanitary Sewer and Storm Water Model. The report outlines the data collected and used for the development of the model, overviews the model development process, and provides recommendations for ongoing use and maintenance of the model. All of the data recorded as part of the modelling effort is appended to the report.

The model, constructed in SewerGEMS, includes all of the sanitary, storm, and combined infrastructure located in the sewershed area tributary to the Eastern Wastewater Treatment Facility. It represents the third and final sewershed to be modelled by the City of Saint John. Together with the Millidgeville and West Side Models, the City now has the entire sanitary, storm, and combined sewer networks updated in GIS and modelled in SewerGEMS. These models will be a valuable tool for identifying capacity issues, prioritizing future capital improvements, and assessing capacity for proposed developments.

Once you and the Technical Review Committee have had a chance to review the report, we welcome an opportunity to review any comments you may have and incorporate your feedback into the final version of the report. Please feel free to contact us at any time to discuss.

Yours very truly,

CBCL Limited

Prepared by:
Brian Moreau, P. Eng.
Saint John Manager
(506) 633-6650
brianm@cbcl.ca

Reviewed by:
Tim McCluskey, P. Eng.
Group Lead - Municipal
(506) 633-6650

Project No: 172870.00

Contents

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Chapter 1 Introduction

The City of Saint John engaged CBCL Limited to develop the Central and East Side Sanitary Sewer and Storm Water Model for the Eastern Wastewater Treatment Facility (EWWTF) catchment area. The purpose of the Central and East Sanitary Sewer and Storm Water Model (the Model) is to provide the City of Saint John (the City) with a valuable resource for the management of the overall collection systems.

1.1 Background

The development of the model is part of a larger effort to understand and predict how the whole City's wastewater and storm water collection systems are operating and interacting during dry weather and wet weather events. In 2013, the City began the process of updating their GIS database of sewer infrastructure in order to develop hydraulic models for the entire City. As GIS updates have been completed, hydraulic models have been created in each of the three main sanitary catchments. The three catchments are tributary to each of the major wastewater treatment facilities, as represented on Figure 1.1.

- **Millidgeville WWTF** – the Millidgeville Sanitary Sewer and Storm Water Model was completed by CBCL Limited in 2016.
- **Lancaster WWTF** – the West Saint John Sanitary Sewer and Storm Water Model was completed by CBCL Limited in 2019.
- **Eastern WWTF** – the Central and East Sanitary Sewer and Storm Water Model, completed in 2020 and summarized in this report.

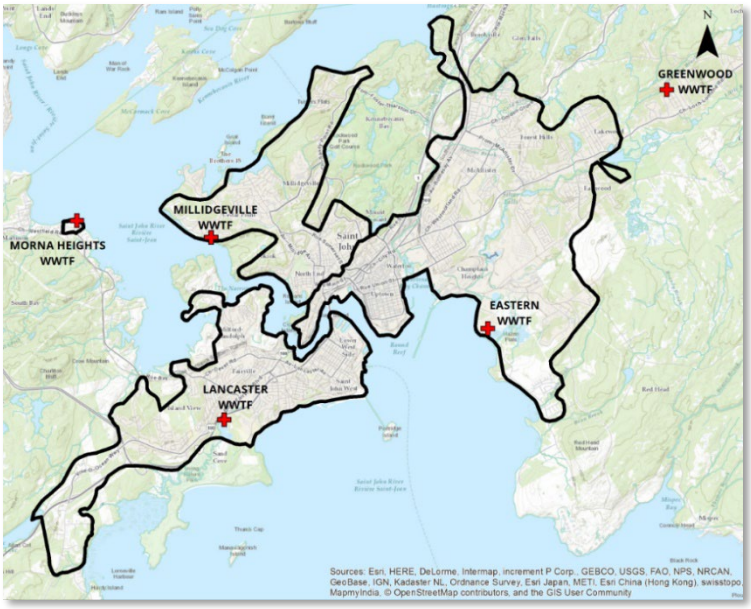

Figure 1.1 - Overview of the City's Model Catchments

Fully dynamic and calibrated hydraulic models are essential in achieving an understanding of the way a combined sewer system reacts to wet weather. System modeling of a sanitary sewer collection system is valuable in identifying ways to reduce inflow and infiltration (I&I), avoiding sanitary overflows and sewer back-ups, and maintaining overall integrity of the system. The model is a useful tool in assessing capacity issues as well as the impacts that may result from proposed developments or sewer system modifications/ reconfigurations.

1.2 Model Catchment

The Eastern WWTF receives wastewater from Central and East Saint John. The Central area was modelled first and was defined as everything tributary to SLS#4, including the areas of: Douglas Avenue, the South Central peninsula, Mount Pleasant, Saint John East, and Westmorland Heights. The East areas were then modelled and merged with the Central model to create the final product. Areas from the East include: Glen Falls, Forest Hills, Lakewood Heights, Eastmount, Silver Falls, Silver Falls Park, Champlain Heights, Midwood, the McAllister Industrial Park, Red Head, and Harbourview. The sanitary, storm, and combined sewer systems contained in the City's GIS area are included in the model, with the exception of any abandoned, private, or disconnected systems.

1.3 Project Deliverables

The following list summarizes the deliverables for the Central and East Sanitary Sewer and Storm Water Modelling project:

1. **Model** – fully operational and calibrated SewerGEMS model of the sanitary, combined, and storm sewer infrastructure in the areas tributary to the Eastern WWTF.
2. **Report** – summary report and maps to outline the work performed, the information contained within the model, and recommendations for ongoing use and maintenance of the model.
3. **Data** – all collected flow meter and rain gauge data are appended to the report.

Chapter 2 Data Collection

The quality of a hydraulic model is directly related to the quality of data and information used in its development. The model elements were imported and refined using the best information available: the City's GIS information, LiDAR elevation data, and lift station information.

Similarly, without proper calibration, results from desktop hydraulic analyses can differ significantly from actual field conditions. Data collected in the field provides valuable insights into actual system hydraulics and the magnitude and timing of peak flows during wet weather events. A flow monitoring program was carried out to use in calibrating the results produced by the model.

The following sections summarize the sources of data used to create and calibrate the model.

2.1 GIS Database

The City has a comprehensive Geographic Information System (GIS) database of wastewater and storm water system infrastructure. Since 2013, the City has been working to improve the accuracy and detail of the database by conducting thorough surveys of all of the accessible structures within the collection system. Survey information has been used to update location and elevation data (x, y, and z) as well as the material, configuration and size of all sewers and structures.

The updated database was provided by the City (December, 2019) and includes several layers, or feature classes, that were used in the development of the model.

GIS Feature Classes used to develop the model	
Wastewater Treatment Facilities	Sewer Fittings
Lift Stations	Sewer Valves
Manholes and Controls	Detention Ponds
Sewer Collection Lines	Ditching
Inlets	Civics
Outfalls	Property parcels
Sewer Structures	Roadways
Sewer Overflow	Curb

2.2 LiDAR

Topographic elevation data, in the form of LiDAR (light detection and ranging), was obtained from the GeoNB Data Catalogue. LiDAR uses laser light to densely sample surfaces remotely, and produce high accuracy x, y, and z measurements. The data is accurate to approximately 15 cm vertically and horizontally. A surface model was created using the LiDAR data to determine overland flow patterns and delineate catchment areas for the storm water system. Elevations from the surface model were also used for any system elements that were not captured in the surveys.

2.3 Lift Stations

There are 26 lift stations included in the model, of a total 41 lift stations that are tributary to the Eastern WWTF. There are 8 private stations and 7 other small stations not included in the model; this was due to insufficient data to model accurately and/or to help improve model run time. Flows entering these stations are represented in the model as direct connections to the system. The location of the lift stations and their tributary areas can be found in Appendix A:

A1 – Overview: Lift Station Locations and Tributary Areas

The City provided all available pertinent information for the lift stations, which included record drawings, SCADA data, pump curves and set points, operation and maintenance models, and efficiency reports. Additionally, site visits were made to several of the lift stations to perform drawdown tests and make field observations. All of the lift station information collected was used to confirm results and refine the model.

The following sections describe what some of the particular data was used for and the table in Appendix D summarizes the data collected.

2.3.1 Record Drawings

Record drawings were used to determine wet well dimensions and storage curves. They also provide additional information and details not contained within the GIS, such as: inlet piping, control structure geometry, and overflow configurations. Figure 2.1 shows an example of detail that was used to input CSO chamber dimensions and elevations in the model.

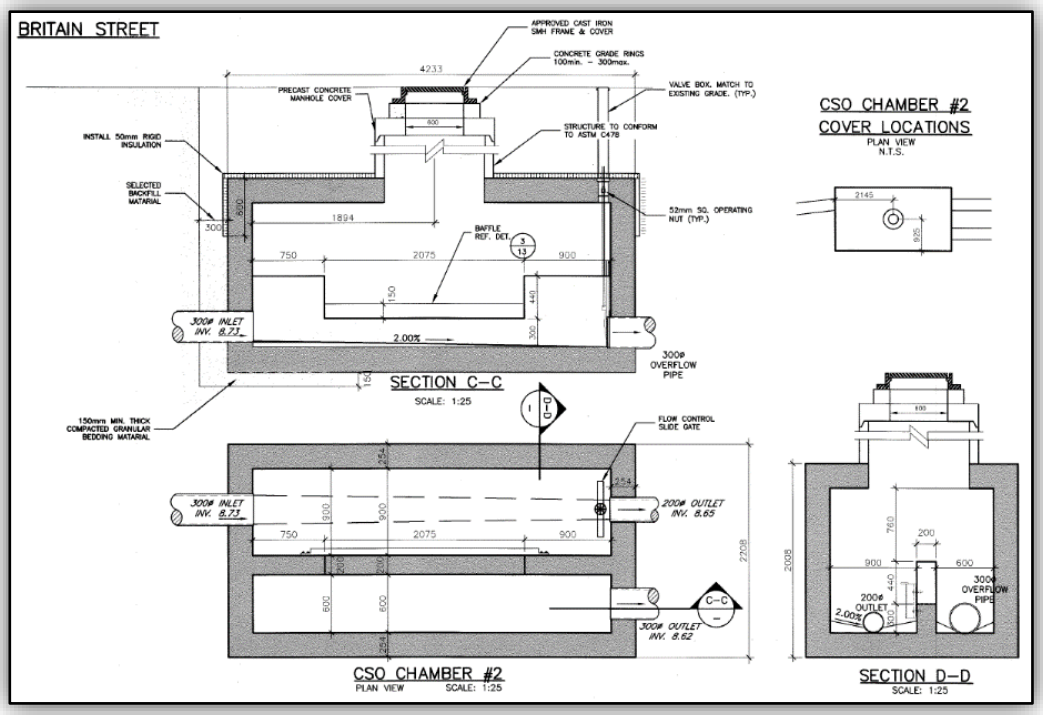

Figure 2.1 - Record Drawing Example, Britain Street CSO Chamber Details

2.3.2 SCADA

Wet well levels, effluent flows, and pump status were used to confirm pump capacity and calculate average inflows and pump run times at the lift stations. The graph below shows an example of SCADA data graphed for a dry weather day at SLS#5 Marsh Street. SCADA data was used during model calibration to ensure lift stations were simulating actual conditions.

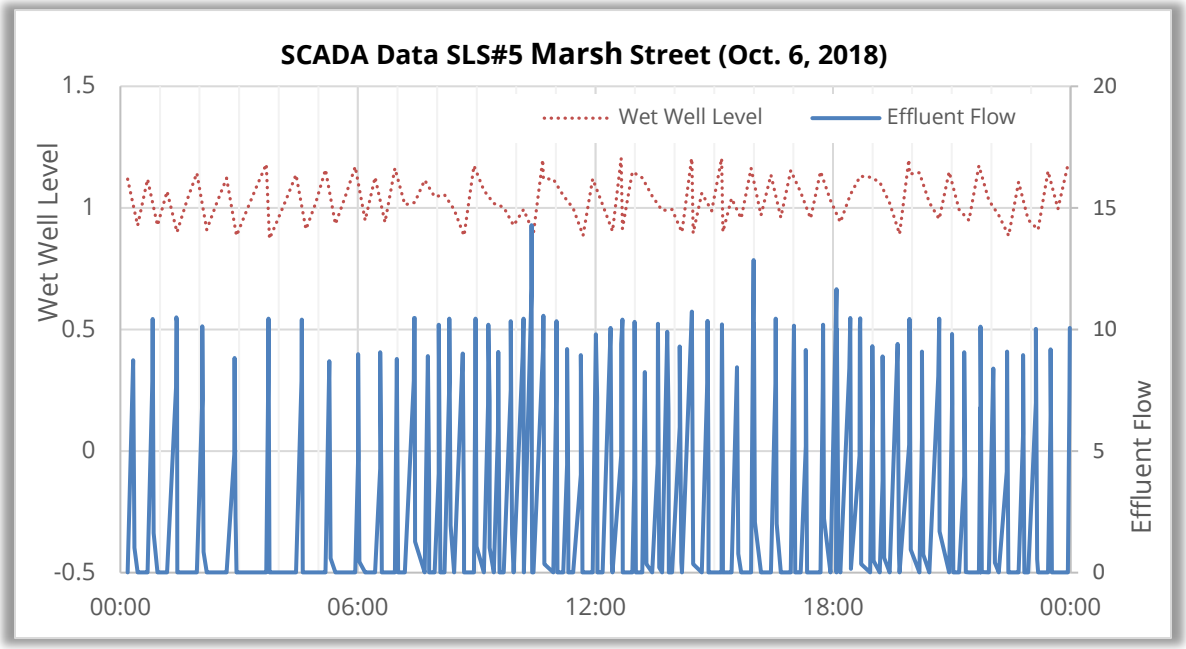

Figure 2.2 – SCADA Example, Marsh Street SLS#5 (Oct. 6, 2018)

2.3.3 Pump Set Points

The City provided the lead and lag set points for all of the pumps in the model. The set points were provided in 2018 to use in the development of the model. An updated list of set points was provided (March 2020) as listed in Table 2.1. These are the set points currently saved in the model. The lift stations are shown on A2 (Appendix A) with the tributary area to each.

Table 2.1 – Pump Set Points, March 26, 2020

Lift Station	SCADA Data Tags	Pump Set Points			
		Lead		Lag	
		On	Off	On	Off
Chesley Drive SLS#10A	Flow, level, pump status	2.30	1.80	2.50	1.80
Harbour Station SLS#10	Flow, level, pump status	2.10	1.20	8.00	1.20
Lower Cove Loop SLS#9	Flow, level	3.00	2.00	8.00	7.00
Crown Street SLS#8	Flow, level, pump status	2.80	1.80	5.00	3.50
King Street East SLS#7A	Flow, level, pump status	1.20	0.60	1.35	0.60
Elliott Row SLS#7	Flow, level, pump status	1.20	0.60	1.20	0.60
Marsh Street SLS#5	Flow, level, pump status	1.20	0.95	5.00	4.00
Municipal SLS#6 Operations	Flow, level, pump status	1.60	1.00	6.00	1.00
One Mile	Flow, level, pump status	3.89	2.97	4.10	3.70
Thorne Avenue SLS#4	Flow, level, pump status	1.50	1.10	2.20	1.10
Bayside Drive SLS#3	Flow, level, pump status	1.95	1.14	2.05	1.14
Bayside Drive SLS#2	Flow, level, pump status	1.50	1.20	1.65	1.20
Red Head Road 50	Flow, level	1.25	0.80	6.00	0.85
Red Head Road 1	Flow, level	1.35	0.75	1.45	0.75
McAllister Industrial Park	Flow, level, pump status	2.30	1.50	2.40	1.50
Woodlawn Park	Flow, level, pump status	2.70	2.20	5.00	2.10
Champlain Drive South	Flow, level, pump status	1.65	1.14	1.83	1.14
York Street	Level, pump status	1.65	1.14	1.80	1.20
McAllister Drive	Flow, level, pump status	1.00	0.60	1.10	0.60
Forest Hills	Flow, level, pump status	2.00	0.80	2.36	0.80
Hickey Road	Flow, level, pump status	2.50	1.50	2.75	1.50
Pauline Street	Flow, level, pump status	1.00	0.60	1.25	0.60
Majors Brook	Inflow, overflow volume, volume pumped, pump control well, pump status	2.30	1.80	2.50	1.80
Simpson Drive	Flow, level, pump status	1.50	1.20	1.80	1.40
Drury Cove	Flow, level, pump status	0.95	0.70	1.40	0.70
Fox Den	Flow, level, pump status	1.10	0.90	1.30	0.90

Note: Flow = Effluent flow; Level = Wet well level

2.4 Flow Monitoring

A flow monitoring program was carried out to provide real flow data for model calibration. The data collected at each site was analyzed and manipulated for use in the model. In general, flows were separated based on dry weather flows (sanitary system), and wet weather flows. Wet weather flows consist of inflow and infiltration (sanitary and combined system) and normal storm flows (storm and combined system). The following sections summarize the activities carried out as part of the flow monitoring program and the data and results that were obtained.

2.4.1 Flow Meters

Flow meters were installed in a total of 14 locations in the model's tributary area, providing a combined 138 weeks of flow monitoring. The flow meters were installed in accordance with City specifications and are the latest technology in area velocity flow meters, using 1MHz Doppler sensors. Flow meter equipment was tested prior to installation and was properly calibrated on-site to the upstream pipe diameter and flow level conditions. The meters were inspected at regular intervals by CBCL staff to confirm measured data, to download and backup data, and to perform any required maintenance. Flow meters were installed and removed by Keel Construction Limited, under the direction of CBCL. Table 2.2 summarizes the installation details for each flow meter location.

There were six flow meters installed in the Central area for a period of approximately 12 weeks, installed on September 20, 2017 and removed on December 11, 2017. The meters were then moved to six locations in the East for a period of approximately nine weeks, installed on December 11, 2017 and removed on February 9, 2018. Two extra meter locations were then selected in the Central area (Meters U1 and U2) to capture flows from uptown. These were installed for approximately six weeks, from February 22, 2018 to April 3, 2018. The location of the rain gauges, and the location of all flow meters and their tributary areas can be found in Appendix A:

A2 – Overview: Flow Meter Locations and Tributary Areas
A3 – Flow Meter Catchments: Central 1-6
A4 – Flow Meter Catchments: Uptown 1-2, East 1-2
A5 – Flow Meter Catchments: East 3-6

Table 2.2 – Flow Meter Installation Locations and Dates

Flow Meter	Location		Sensor	Date Installed	Successful Data?
	Nearest Civic	Manhole ID			
Central 1	199 Chesley Dr.	WWN-SAN-MH-004883	375 mm inlet	Sept. 20, 2017	No data
Central 2	397 City Rd.	WWN-SAN-MH-000837	900 mm outlet	Sept. 20, 2017	4 weeks
Central 3	317 Union St.	WWN-COM-MH-001835	900 mm outlet	Sept. 20, 2017	5 weeks
Central 4	36 Courtenay Ave.	WWN-SAN-MH-001308	375 mm outlet	Sept. 20, 2017	8 weeks
Central 5	18 Christina Ct.	WWN-COM-MH-001932	900 mm outlet	Sept. 20, 2017	11 weeks
Central 6	156 Mecklenburg St.	WWN-COM-MH-005838	600 mm outlet	Sept. 20, 2017	11 weeks
Uptown 1	10 Market Sq.	WWN-SAN-MH-004726	600 mm outlet	Feb. 22, 2018	6 weeks
Uptown 2	50 Water St.	WWN-SAN-MH-202217	600 mm outlet	Feb. 22, 2018	1 week
East 1	5 Parkhill Dr.	WWN-SAN-MH-010571	450 mm outlet	Dec. 11, 2017	7 weeks
East 2	47 Consumers Dr.	WWN-SAN-MH-177588	450 mm outlet	Dec. 11, 2017	No data
East 3	114 Todd St.	WWN-COM-MH-010908	300 mm outlet	Dec. 11, 2017	6 weeks
East 4	23 Fish Hatchery Rd.	WWN-SAN-MH-003418	750 mm outlet	Dec. 11, 2017	6 weeks
East 5	1455 Hickey Rd.	WWN-SAN-MH-003984	300 mm outlet	Dec. 11, 2017	5 weeks
East 6	916 Bayside Dr.	WWN-SAN-MH-004514	300 mm outlet	Dec. 11, 2017	3 weeks

A copy of the raw recorded meter data can be found in Appendix B.

2.4.2 Rain Gauges

Wet weather can be highly centralized and variable across relatively short distances; therefore, it was important to collect rainfall data within the model area during metering periods. This allowed the wet weather calibration to be performed on local data and then compared to the Environment Canada weather station data at the Saint John Airport, which is outside of the model area. Rainfall data was recorded at 5-minute intervals to correspond with results from the flow meters.

Two rainfall gauges were installed for the duration of the flow monitoring program: RAIN1 was installed at 14 King Street, and RAIN2 was installed at 78 Broadway Avenue. The recorded data was consistent between the two gauging locations. Figures 2.3 and 2.4 show the rainfall recorded during the Central and East flow monitoring phases. Representative wet weather events and dry weather days were selected for use in the model, as described below.

A copy of the raw recorded rainfall data is included in Appendix C.

2.4.2.1 Wet Weather Days

There were several rain events captured throughout the flow monitoring period. The events circled in the rainfall graphs met all of the following wet weather criteria and were chosen as calibration events:

- Total rainfall amount greater than 5 mm.
- Rainfall intensity greater than 6 mm/hr for more than 5 min (i.e. for more than one recording interval).
- Total rainfall consistent between gauging locations.

2.4.2.2 Dry Weather Days

Dry weather days, ideally, meet all of the following requirements:

- Enough time after any rainfall for any inflow and infiltration to be out of the system and for flows to return to 'normal.
- Ideally a high-usage weekday.
- No additional unaccountable flow (e.g. flushing, etc.).

The suitable dry weather days that were identified preceded each of the wet weather events (in general). Some of these days fell on weekends; however, when the flow patterns were analyzed they were consistent with the adjacent weekday patterns.

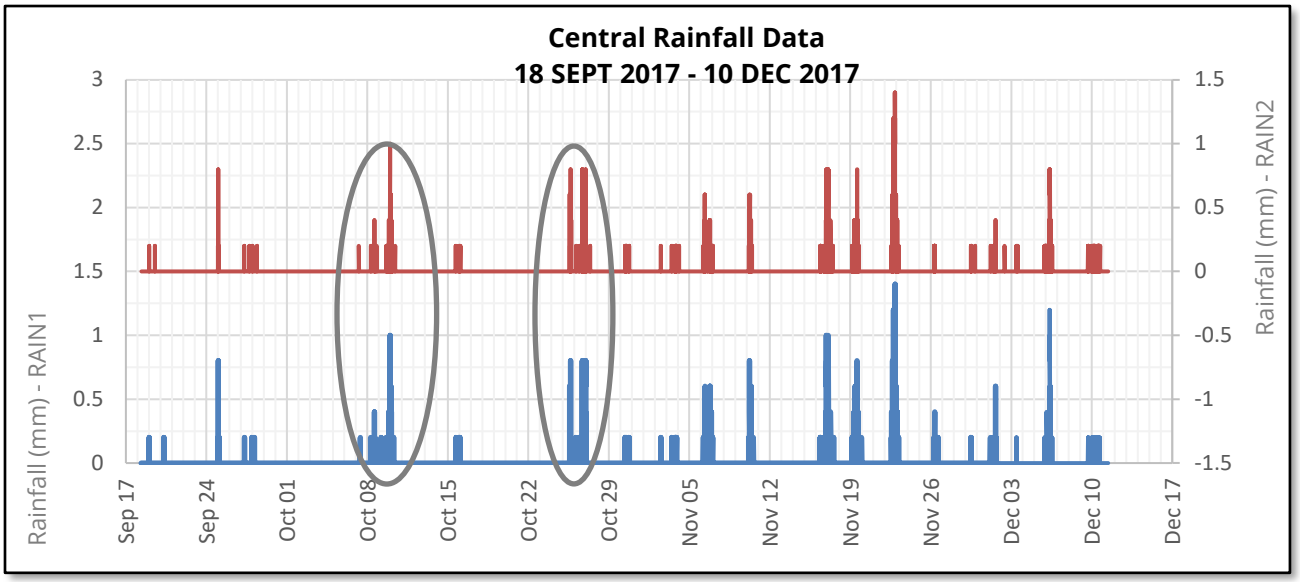

Figure 2.3 – Recorded Central Rainfall Data (18 Sept 2017 – 10 Dec 2017)

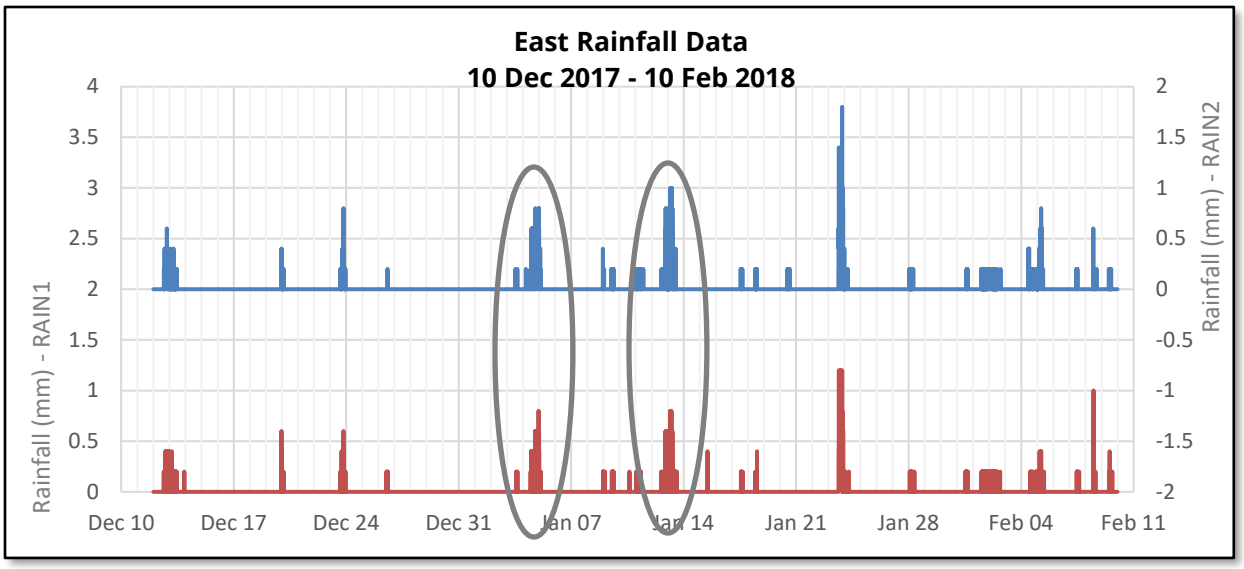

Figure 2.4 – Recorded East Rainfall Data (10 Dec 2017 – 10 Feb 2018)

2.4.3 Tides

Many of the outfalls within the model area have outlets in the Saint John Harbour and the connected watercourses, and therefore have the potential to be affected by the tides. The tides in Saint John Harbour are semi-diurnal with a 14-day spring-neap[1] cycle. The tidal height (higher high water) is 7.7 m Chart Datum (CD) for mean tides and 8.9 m CD for large tides (2018 Canadian Tide and Current Tables). A summary of tidal heights, extremes, and mean water levels are shown in Table 2.3, as measured by the permanent tide gauge maintained by DFO and located at the Bay Ferry Wharf. The values are shown as both Chart Datum and Geodetic Datum (which is 4.19 m below chart datum).

Table 2.3 - Saint John Harbour Tidal Heights

Parameter	Chart Datum (m)	Geodetic Datum (m CGVD28)
Higher High Water Large Tide (HHWLT)	8.9	4.71
Higher High Water Mean Tide (HHWMT)	7.7	3.51
Mean Water Level (MWL)	4.4	0.21
Geodetic Datum (GD)	4.19	0
Lower Low Water Mean Tide (LLWMT)	1.0	-3.19
Lower Low Water Large Tide (LLWLT)	0.0	-4.19
Recorded Extreme Low	-0.4	-4.59

Note: Geodetic Datum (GD) is 4.19 m relative to Saint John Chart Datum (CD). Note: A higher high water large tide is an average of the highest predicted astronomical tide expected over a 19 year cycle.

[1] A neap tide is a tide in which the tidal range is the least because the tide-generating forces of the sun and moon oppose each other, which occurs twice a month on the first and third quarters of the moon. The sun and moon forces aligning on the second and fourth quarter produce 'spring tides', in which the tidal range is the greatest.

Chapter 3 Model Development

CBCL used SewerGems to develop a model for the entire area tributary to the Eastern WWTF. This Chapter is anticipated to provide a clear summary of how the data from Chapter 2 was input to the software to create a reliable and comprehensive tool that the City can use for analysis and management of their sanitary sewer and storm water infrastructure.

3.1 Software

The model was developed using Bentley's SewerGEMS software. This software is a comprehensive computer model for the analysis of quantitative and qualitative problems associated with urban runoff and wastewater collection. The software is versatile and user-friendly and can be used within several platforms, including ArcGIS, and AutoCAD. The model solves complete dynamic flow routing equations for accurate simulation of backwater due to inline restrictions, looped connections, surcharging, and pressure flow. The modeling software is ideal for the integration of sanitary and storm water loads in the combined sewer network.

3.1.1 Numerical Solvers

SewerGEMS is capable of running four numerical solvers: Explicit (SWMM), Implicit (SewerGEMS), GVF Convex (SewerCAD), and GVF Rational (StormCAD). For complex wet weather flow modelling involving a number of lift stations, detention/ retention systems, and storm events, the Explicit SWMM solver is recommended for a model of this size. The Bentley Implicit solver computes much faster and is an alternative to consider when running less complex scenarios for smaller sub-areas within the model.

3.1.2 Scenarios

SewerGEMS is set up to toggle back and forth between multiple scenarios for easy comparison between variables. A scenario is defined by the calculation options (a numerical solver) as well as options for all of the following alternatives:

- Active Topology
- User Data Extensions
- Physical
- Boundary Condition
- Initial Settings
- Hydrology
- Output
- Infiltration and Inflow
- Rainfall Runoff Water Quality
- Sanitary Loading
- Headloss
- Operational
- Design
- System Flows
- SCADA
- Energy Cost

The alternative settings form the basis of the scenario, including the storm event being analysed and the active or inactive elements during the simulation. The particulars of the alternatives for a given scenario are important details to consider when running a scenario. Scenarios in the Central and East Model are set up to include:

- Theoretical Dry Weather Flow Simulation.
- Metered Dry Weather Flow Simulation.
- Metered Wet Weather Flow Simulation.
- Design Storm Wet Weather Flow Simulation.

3.2 Model Elements

The model was developed to include all significant sanitary, storm, and combined sewer infrastructure in the area tributary to the Eastern WWTF. As mentioned in Chapter 2, the model was developed primarily from the City's GIS database. The following sections outline the ten model element types, the information attached to them, and where it came from.

3.2.1 Manholes

More than 7,300 manholes were imported to the model from the 'Manholes_Controls' GIS layer. Information from the following data fields was brought over from the GIS:

- Location.
- Diameter.
- Elevation – rim, and invert.
- Category – storm, sanitary, or combined.
- Notes – from field survey.

Overflow chambers are also modelled as a manhole element. There is a note attached to each overflow location to easily distinguish them from typical manholes. Chamber dimensions taken from record drawings are attached to each of these. Any weir or check valve information is attached to the connected pipes.

3.2.2 Catch Basins

More than 6,000 catch basins were imported to the model from the 'Manholes Controls' GIS layer. Information from the following data fields was brought over from the GIS:

- Location.
- Diameter.
- Elevation – rim, and invert.
- Category – storm, sanitary, or combined.
- Notes – from field survey.

3.2.3 Outfalls

More than 450 outfalls were imported to the model from the 'Sewer_Outfalls' GIS layer. Information from the following data fields was brought over from the GIS:

- Location.
- Elevation – rim, and invert.
- Category – storm, sanitary, or combined.
- Notes – from field survey.

3.2.4 Conduit

Over 380 km of pipe was imported to the model from the GIS layer named 'Sewer_Collection_Lines'. The following fields were imported to the conduits element:

- Start and Stop nodes – used to connect sewers to structures.
- Invert elevations – at start and stop.
- Category – storm, sanitary, or combined.
- Diameter.
- Material.

Overflow chambers are modelled as a manhole element; however, if there is a weir in the structure it is modelled in the conduit element. Check valves, located at overflows or at outfalls, are also attached to the conduit element.

3.2.5 Wet Wells

The 'lift stations' layer in the GIS was used to situate 26 wet well locations in the model. There are a total of 41 lift stations tributary to the Eastern WWTF; however several have very small inflows or insufficient data available (including 8 private stations). Flows entering these stations were modelled as direct connections.

An example of how a lift station is set up in the model is shown in Figure 3.1 (pump elements connected to a wet well element). This is how the model is set up at the Chesley Drive Lift Station.

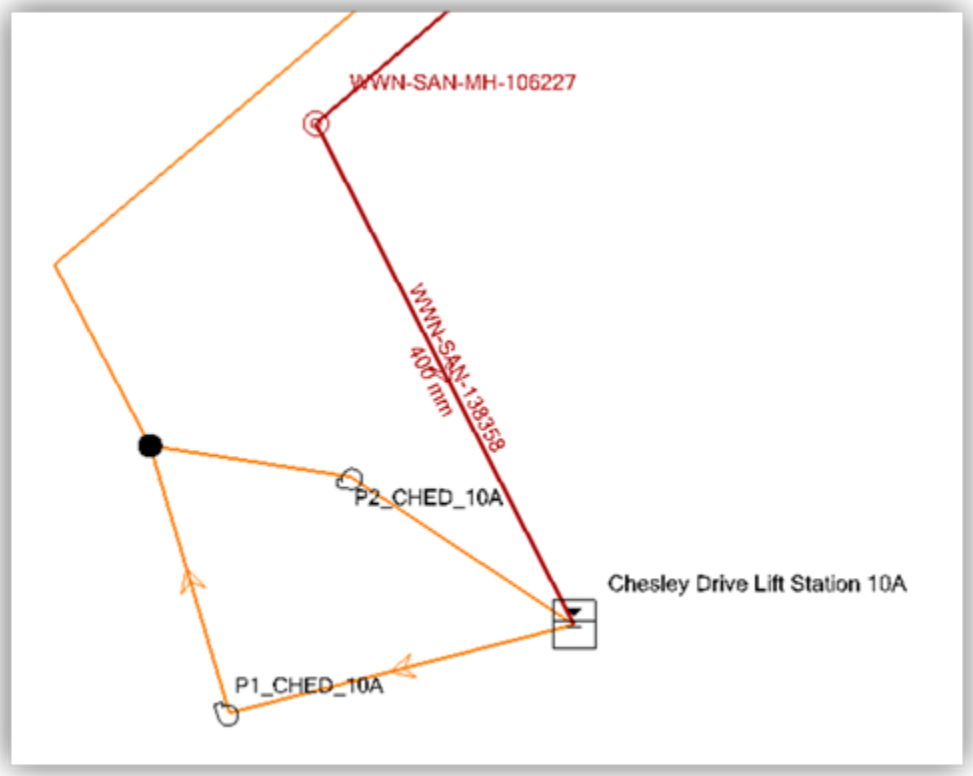

Figure 3.1 – Model Snapshot: Lift Station Example

3.2.6 Pumps

There are 47 pump elements in the model. These were input manually at each lift station location. Pump curves and operational data (lead and lag set points) are attached to each pump, based on data provided by the City. Information about the pumps (such as model, date installed, etc.) was recorded in the notes section for each pump element, when available.

3.2.7 Pressure Pipe

There is just over 26 km of forcemain input to the model within the pressure pipe element. The location and diameter were taken from the City's GIS layer 'Sewer_Collection_Lines'.

3.2.8 Pressure Junction

Pressure junctions are used to connect pressure pipes in the model. These elements contain a ground elevation and invert elevation that were estimated from the surface model or nearby elements. There are 57 pressure junctions in the model and they are primarily used to represent the start of a forcemain, allowing multiple pumps to be connected to the pressure pipe.

3.2.9 Transitions

The transitions element in the model is used in locations where two pipes need to be connected but there is no manhole or other node/ structure. The most common example is where a catch basin lead is connected to a storm sewer pipe rather than the typical connection at a manhole. The 'sewer fittings' GIS layer was used to import these locations.

3.2.10 Catchments

Over 6,000 storm drainage catchments were delineated based on the surface model that was created using the LiDAR data. The entire Eastern WWTF catchment and beyond (anything that drains to the Eastern WWTF catchment) is included. The City's GIS layers for roadways, curbs, culverts, ditches, and storm sewers were taken into consideration to determine the catchment boundaries.

The model area was divided into eight smaller areas, and then sub-catchments were delineated to each catch basin and inlet structure. Catchment characteristics were assigned to each individual sub-catchment based on current land use data, soil conditions, aerial images, and the surface model.

- The average slope across each catchment was calculated along the maximum overland flow path based (determined using the surface model elevation profile).
- Infiltration parameters were applied using the Green-Ampt model. Values for soil suction head, conductivity, and initial moisture deficit were estimated based on surficial geology and soils mapping.
- Catchment impervious values were determined based on the City's sub-zonal classification system, by overlaying storm catchments with the City's land use mapping in ZoneSJ. Average impervious values were assigned based on the City's Storm Drainage Design Criteria Manual (SDDCM) for industrial, commercial and residential development. Where development classification was not defined, aerial imaging was referenced to determine appropriate values. Table 3.1 outlines the percent impervious values that were used.

Table 3.1 – Percent Impervious Values by Sub-Zone

Zone	Sub-Zones	% Impervious
Residential	Urban Centre	95
	High-Rise	95
	Mid-Rise	90
	Low-Rise	85
	Two Unit	75
	One-Unit	65
	Suburban	55
	Mini Home	85
	Rural Settlement	50
	Rural	50
Commercial	Uptown	95
	Waterfront	95
	Business Park	90
	Regional	85
	General	80
	Mixed	75
	Local	75
	Rural General	65
Industrial	Light	85
	Medium	90
	Heavy	95
	Landfill	95
	Transportation	95
Community	Neighborhood Facility	70
	Major Community Facility	80
Pit and Quarry		90
Park		10
Environmental Protection		5
Future Development		0
Rural		5

3.3 Sanitary Flows

Sanitary flows were added into the model in two different ways (saved under two different model scenarios).

1. **Theoretical flows** – were estimated for each user (over 8,000 civics) based on the Atlantic Canada Wastewater Guidelines Manual (ACWG). The calculation uses a per capita daily flow rate of 340 L/person/day applied to population estimates and dwelling units for the area tributary to the flow meter. The theoretical estimate also includes estimates for recreational, commercial, industrial, and institutional buildings.
2. **Measured flows** – were estimated based on recorded lift station and flow meter data. Drawings A1 and A2 show all of the areas for which recorded data was available – all areas tributary to a flow meter and/or a recording lift station. For the areas outside of the shaded region (that did not have measured data) flows were estimated based on measured data for areas with similar characteristics.

Table 3.2 – Measured Dry Weather Sanitary Flows

Flow Meter	Category	Measured Average Flow (L/sec)
Central 1	SAN	-
Central 2	SAN	37
Central 3	COM	4
Central 4	SAN	6
Central 5	SAN	12
Central 6	COM	15
Uptown 1	SAN	6
Uptown 2	SAN	15
East 1	SAN	22
East 2	SAN	-
East 3	COM	6
East 4	SAN	14
East 5	SAN	3
East 6	SAN	2

A pattern was applied to each of the flows to account for typical daily fluctuations. For the theoretical flows, a generic pattern was used for all flow inputs based on peak factors and the ACWG Manual. For the measured flows, typical dry weather days were analyzed at each flow meter location to determine appropriate patterns. Patterns were copied to catchments with similar characteristics. Figure 3.2 shows an example of several dry weather days and flow patterns recorded during the month of October, 2017 at Meter Central 4.

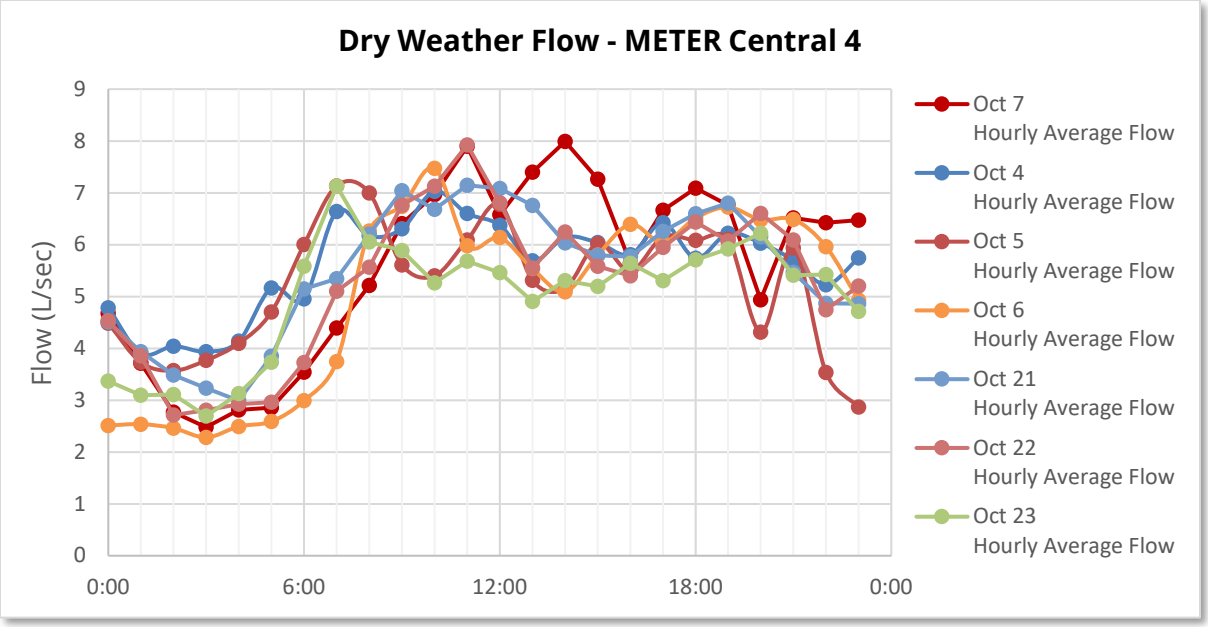

Figure 3.2 – Dry Weather Flow Example: Flow Meter Central 4

3.4 Inflow and Infiltration

A significant portion of the model area is still a combined system, particularly in the South Central Peninsula. However, all of the flow meters located on sanitary sewer lines also showed signs of rapid inflow. This could be attributed to direct catch basin connections or unknown residential connections such as sump pumps and roof leaders. Table 3.3 summarizes the wet weather flows recorded at the sanitary meter sites during the flow meter period.

Some sources of I&I are expected in typical separated sanitary sewer systems, particularly infiltration through leaky pipes and manholes. When inflows become too great, capacity issues in the sanitary system can result.

Table 3.3 - Measured Wet Weather Sanitary Flows

Flow Meter	Connected Drainage Area (ha)	Connected Catch basins (#)	Dry Weather Average Flow (L/sec)	Wet Weather Peak Flow (L/sec)
Meter C1	49	29	-	-
Meter C2	55	126	37	237
Meter C3	27	134	4	290
Meter C4	10	13	6	21
Meter C5	43	104	12	177
Meter C6	13	48	15	201
Meter U1	13	#	6	42
Meter U2	24	#	15	74
Meter E1	86	0	22	155
Meter E2	86	0	-	-
Meter E3	43	8	6	36
Meter E4	94	0	14	91
Meter E5	37	0	3	22
Meter E6	56	0	2	13

3.5 Storm Flows

Over 6,000 storm catchments were delineated to each catch basin and inlet structure within the study area. Each storm catchment contains run-off attributes which dictate the sewershed's simulated response to wet weather. The flow length is defined for each catchment and influences the time of peak runoff flows. Model parameters such as flow length, characteristic width, or percent routed were manually adjusted until simulated flows produced runoff that was expected for each area.

Manual calibration based on a trial and error approach is time consuming and can sometimes be inaccurate. Using the sensitivity and error analysis tools in EPA SWMM, a sensitivity-based automatic tuning for calibrating SWMM RUNOFF, assisted in streamlining the storm water calibration process.

The sensitivity-based genetic algorithm calibration method consists of 4 components:

1. Sensitivity analysis.
2. Calibration.
3. Determination of the limit or range of the calibration parameters.
4. Performance evaluation of the calibrated model.

Using the sensitivity analysis feature, a set of attributes were narrowed down which will have the greatest effect on calibration and an applicable calibration range for each attribute was determined. Theoretically, adjusting a parameter outside of this range would have a modest effect on calibration.

To ensure that force fitting was not occurring during the calibration process, attribute manipulation was performed over all storm catchment elements. Once the best fit was achieved for the majority of catchments, adjustments were made to the "Subarea Routing" and "Percent Routed" attributes to further tailor each storm basin.

"Subarea Routing" refers to the path that runoff travels from the subareas of the catchment. Each catchment is represented by two subareas, based on the percent impervious entered:

Pervious area	**Impervious area**
Portion of the catchment where rainfall can seep/ infiltrate (e.g. grass lawn, forest)	Portion of the catchment where rainfall cannot seep/ infiltrate (e.g. roof tops, pavement)

There are three options for how the subareas are routed in the model:

- Impervious to pervious (e.g. paved driveway drains to lawn and then outlet).
- Pervious to impervious (e.g. lawn drains to paved driveway and then outlet).
- Both to outlet (e.g. lawn and paved driveway both drain to outlet independently) – this is the most conservative of the three options and was used most often in the model.

Additionally, a percentage can also be applied to the subareas being routed. For example, "Percent routed" set to 80% specifies that percentage of the pervious area runoff can be directed to the impervious area and then the outlet (and the remaining 20 percent would be routed directly to the outlet). If "Subarea routing" is set to "Both to outlet", then the "Percent routed" field is ignored.

3.6 Tidal Influence

There are several outfalls in the Central and East Model area that discharge to the Saint John Harbour, which has a huge tidal range. Tides can range from -4.19 to 4.71 meters (geodetic). Much of the sewer infrastructure along the coast is below the high tide level and therefore has the potential to be affected by the tides. Figure 3.5 shows an example of recorded tidal influence at the Lower Cove Loop Lift Station in December, 2017. A high amount of inflow and infiltration could contribute to the levels recorded at the station; a malfunctioning check valve could also impact these levels.

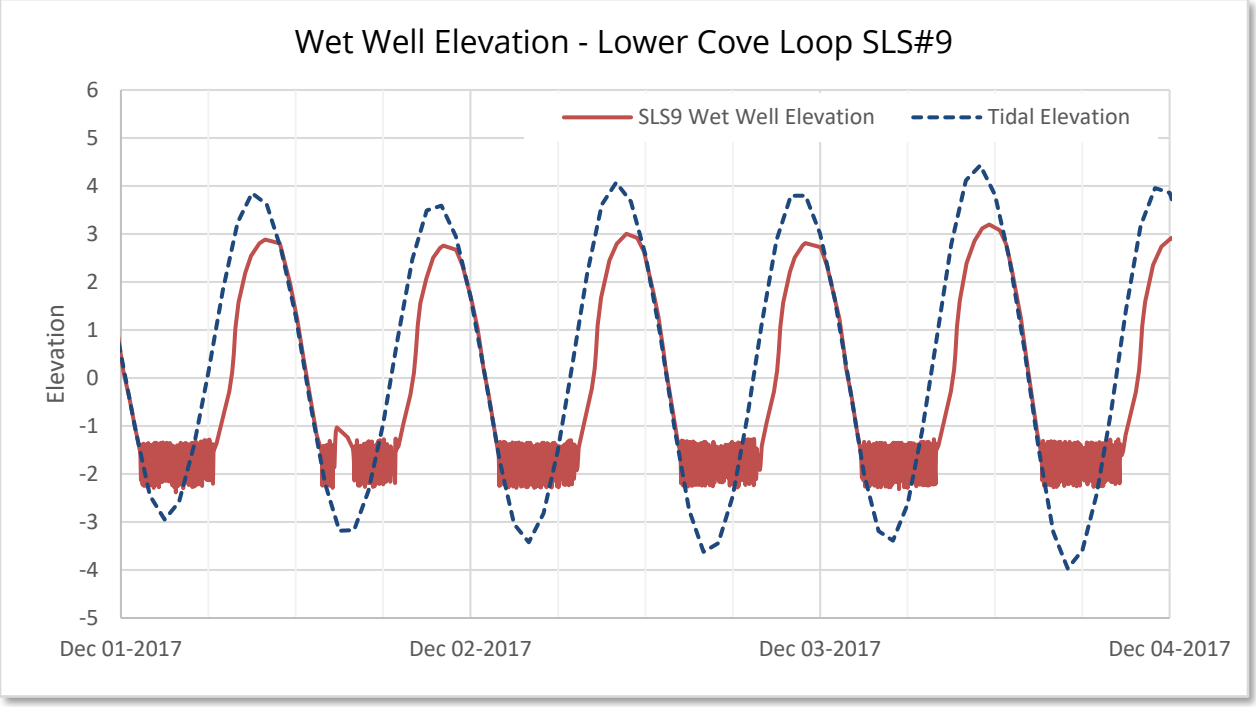

Figure 3.3 – Tidal Influence Example: Wet Well Elevation, Lower Cove Loop SLS#9

There are also a number of outfalls that discharge further upstream, to Marsh Creek and Little River, which also have potential to be affected (directly or indirectly) by high tidal elevations. Table 3.4 summarizes the lift station outfall locations and elevations.

Table 3.4 – Lift Station Outfall Invert Elevations

Lift Station	Label	Location	Overflow Elevation
Bayside Drive SLS#3	WWN-SAN-LS-2448	Saint John Harbour	6.11 at LS
Bayside Drive SLS#2	WWN-SAN-LS-0449	Little River	3.96
Thorne Avenue SLS#4	WWN-SAN-LS-3252	Saint John Harbour	3.81
Marsh Street SLS#5	WWN-SAN-LS-3652	Marsh Creek	0.68
Municipal Operations SLS#6	WWN-SAN-LS-2051	Marsh Creek	0.24
Elliott Row SLS#7	WWN-SAN-LS-2049	Saint John Harbour	10.20
King Street East SLS#7A	WWN-SAN-LS-2048	Saint John Harbour	17.25
Crown Street SLS#8	WWN-SAN-LS-2050	Saint John Harbour	4.53
Lower Cove Loop SLS#9	WWN-SAN-LS-2047	Saint John Harbour	-1.21
Harbour Station SLS#10	WWN-SAN-LS-1650	Saint John Harbour	2.76
Chesley Drive SLS#10A	WWN-SAN-LS-1651	Saint John Harbour	4.06
Hickey Road	WWN-SAN-LS-0020	Little River	41.05
Major's Brook	WWN-SAN-LS-0015	Marsh Creek (trib. to)	1.11
One Mile Lift Station	WWN-SAN-LS-0005	Marsh Creek	1.00
Red Head Road 1	WWN-SAN-LS-0047	Saint John Harbour	10.63
Red Head Road 50	WWN-SAN-LS-0048	N/A	N/A
Champlain Drive South	WWN-SAN-LS-0022	Septic Tank	48.67
Drury Cove	WWN-SAN-LS-0045	Kennebecasis River	0.51
Fox Den	WWN-SAN-LS-0046	Kennebecasis River	10.51
McAllister Drive	WWN-SAN-LS-0043	N/A	N/A
McAllister Industrial Park	WWN-SAN-LS-0042	Hazen Creek	6.23
Pauline Street	WWN-SAN-LS-0017	Mystery Lake	53.00
Simpson Drive	WWN-SAN-LS-0014	Marsh Creek	0.64*
Walter Street Ejector	WWN-SAN-LS-0016	Gutter	2.50
Woodlawn Park	WWN-SAN-LS-0019	Beyea Brook	8.78
York Street	WWN-SAN-LS-0021	Septic Tank	48.89

* Estimated

3.7 Climate Change

Changes in extreme weather have been observed across North America to be increasing in frequency, intensity, and/or duration over the last several decades (Intergovernmental Panel on Climate Change, 2013). The pattern of increasing global temperatures and regional changes in intensity and frequency of flooding or drought are trends that would be expected from a warming planet (US EPA, 2012). Climate scientists project that climate change will cause extreme rainfall events to occur more intensely and frequently in the future as global temperatures continue on an upward trend (US EPA, 2012). The climate parameters which are most likely to impact the operation of sanitary and storm sewer infrastructure in the City of Saint John are increased precipitation, drought, flooding, and sea level rise (SLR).

For this assessment, the impacts of increased rainfall, SLR, and riverine or storm surge flooding are discussed and were considered when making recommendations for the future. It is worth noting that low flows in the collection system due to drought conditions (low rainfall, high temperatures) can lead to septic conditions, odour, and complications at the treatment facility. Although not studied as part of this assessment, winter rainfall following icy and snowy conditions and freeze up can lead to flooding as ditches are full of snow and catch basins may be covered with snow and ice. Winter flooding may occur more frequently in the future as daily temperatures become increasingly variable.

3.7.1 Increased Rainfall

Increasing the peak rainfall in the 1-in-100 year design storm by certain percentage (i.e. 20%) is one acceptable quantitative method to account for the projected future increase in rainfall intensity by adding a “safety factor”. Climate change tools now exist to project future rainfall intensities based on empirical relationships (increase in temperature) and global circulation model (GCM) projections. The most commonly used tools in Canada include:

1. IDF-CC tool (Western University).
2. Clausius-Clapeyron equation (Westra et al., 2014).
3. Gary Lines Tool (Lines et al. 2009 report).
4. Statistical downscaling model software.

These tools can be used to determine an expected increase in local rainfall for various time horizons (ex. 2050 and 2100) and emission scenarios (ex. “business as usual”). Although the application of climate model tools is outside of the current project scope, it could be used to validate the “safety factor” method by confirming an appropriate projected increase for the Saint John region.

3.7.2 Sea Level Rise

By 2100, sea level is likely to rise globally by at least one meter, based on the Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5, 2013). There are expected to be regional differences, with the northeastern coast of North America potentially

experiencing a sea level rise rate higher than the global average. Site specific considerations, such as subsidence and isostatic adjustments, are often made to account for regional factors which may differ from global projections (e.g. the Bay of Fundy). These regional adjustments have a greater impact on shorter term projections (lower projected levels) then on long term projections (higher projected levels) as the regional adjustment factors are relatively insignificant at a projected SLR increase of two meters or higher.

Sea level rise can impact lift stations, treatment facilities, outfalls, and underground infrastructure along the coastline. An example of impacts to municipal infrastructure is overflows being restricted during wet weather events causing lift station wet wells to surcharge. Climate change will only accelerate sea level rise, causing increased risks of coastal erosion and flooding.

The City's Storm Drainage Criteria Manual currently requires the use of a 0.5 m increase in tide levels to account for climate change. The IPCC AR5 estimates that the upper-bound Global Mean sea level rise could be in the order of 1.0 m by year 2100. This upper-bound projection is for the Representative Concentration Pathways (RCP) RCP8.5 scenario (i.e. business-as-usual, high-emission case). At the time of this modelling exercise, there was insufficient evidence to evaluate the probability of specific levels above this 1.0 m projection.

The Canadian Extreme Water Level Adaptation Tool (CAN-EWLAT), developed by DFO and based on the study by Zhai et al. (2014), is used to account for local factors. CAN-EWLAT is a science-based planning tool for climate change adaptation of coastal infrastructure related to future water-level extremes. It was developed to provide SLR allowances for DFO harbours across Canada. Allowances are estimates of changes in the elevation of a site that would maintain the same frequency of inundation that the site has experienced historically. CAN-EWLAT was used as a benchmark to forecast relative SLR at Saint John. The tool estimates an upper-bound relative SLR of approximately 0.47 m by 2070 and 0.93 m by 2100. These are in relation to the 2010 level for the IPCC AR5 2013 RCP8.5 scenario.

Work by Daigle for the NB Government (2017) was also based on IPCC AR5. This report, *Sea-level Rise and Flooding Estimates for New Brunswick Coastal Sections*, presents SLR estimates for Saint John, NB of 0.86m (+/-0.38) and 1.51m (+/-0.38) (the later includes West Antarctic ice sheet component) at 2100 based on RCP8.5 (business as usual) scenario. However, studies subsequent to the IPCC 2013 and DFO 2014 study suggests that previous Global Mean Sea Level (GMSL) predictions are too modest. These studies updated the scientifically supported upper-end GMSL projections, including recent studies of the potential for rapid ice melt in Greenland and Antarctica. DFO's Han et al. study (2016) revisited mean sea level rise scenarios to include a High Scenario for Saint John of 1.84m projected SLR to year 2100 relative to 2010 (based on RCP8.5).

Subsequently, a 2017 National Oceanic and Atmospheric Administration (NOAA) publication (Sweet W. et al, 2017) presented a year 2100 GMSL forecast range discretized

into six GMSL rise scenarios: a Low (0.3m), Intermediate-Low (0.5m), Intermediate (1.0m), Intermediate-High (1.5m), High (2.0m), and Extreme (2.5m). A key finding of this study is that along regions of the Northeast Atlantic (Virginia coast and northward), regional SLR is projected to be greater than the updated global average for almost all future scenarios (e.g. by 0.3 to 0.5 m under the Intermediate scenario by year 2100).

Given these findings, the 2014 DFO estimates based on IPCC AR5 RCP8.5 can now be considered Intermediate projections, with High and Extreme SLR scenarios in the range of 1.0 to 1.5 m higher than previously anticipated. For planning purposes where long-term risk management is paramount, the following approach is recommended, as per NOAA 2017:

- Define a scientifically plausible upper-bound scenario, which in the present case would be the *high (*or *extreme)* GMSLR projection, and use it as a guide for overall risk and long-term adaptation strategy; and
- Define an *intermediate* GMSLR projection as baseline for shorter-term planning.

NOAA SLR projections are based on GMSL and are therefore appropriate for long term planning, near the end of the century and longer. For shorter term planning for the years 2050-2070, DFO estimates are more appropriate as allowances are made for site specific conditions.

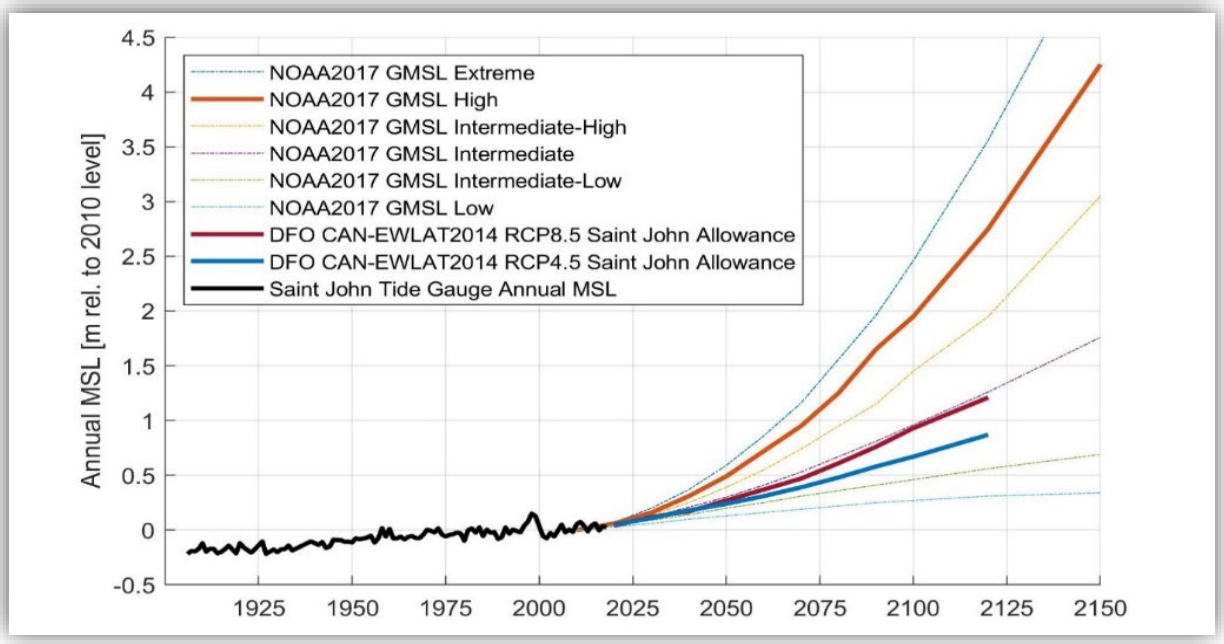

Figure 3.4 – SLR Scenarios for Saint John: Low, medium, and high scenarios used for subsequent flood probability analyses are shown in bold lines.

Table 3.5 – Saint John SLR Projections for RCP 8.5 at 2100

Scenario	Geodetic Datum (m CGVD28)	Source
Total Change 2010 - 2100	0.93	CAN-EWLAT (DFO, 2014)
Total Change 2010 - 2100	0.86 +/- 0.38	Provincial Study (Daigle, 2017)
Total Change 2010 – 2100 (including 0.65m for ice melt)	1.51 +/- 0.38	Provincial Study (Daigle, 2017)
Total Change 2010 – 2100 (including ice melt)	1.84	Han et al. study (DFO, 2016)
2100 Intermediate-High (GMSL + regional factors)	1.5	NOAA (Sweet W. et al, 2017)
200 - 2100 Projected High (GMSL + regional factors)	2.0	NOAA (Sweet W. et al, 2017)
2000 – 2100 Projected Extreme (GMSL + regional factors)	2.5	NOAA (Sweet W. et al, 2017)

NOAA estimates are relative to 2000 and therefore 0.1m has been reduced from the projected SLR to account for the existing increase in sea level from years 2000 – 2018. This will provide the City with a preliminary scan of potentially impacted infrastructure. Ultimately, a detailed analysis of the site-specific impacts of SLR is required to determine if a true vulnerability exists.

Finally, as also highlighted by Daigle (2017), the science of SLR will keep evolving with updated observations and improving model predictions. Implications for infrastructure and coastal flooding will need to be re-evaluated with periodic updates in SLR projections.

3.7.3 Coastal Flooding and Storm Surge

Storm surge flooding is the difference between the observed water level during a storm and the predicted astronomical tide level at the time of flooding. Storm surge is an important factor in determining appropriate flood resilient infrastructure designs above SLR. Infrastructure with a capacity to sustain a temporary high water level and drain following a flooding event without damage or loss could be considered flood resilient. The highest ever storm surge event recorded by the Saint John tide gauge was recorded on February 2, 1976 at 1.5 m (R. J. Daigle, 2017) above high tide. The Saxby Gale storm surge occurred in 1869 and is commonly referred to as the largest documented storm surge event to have occurred along the Bay of Fundy. The estimated level is in the order of 1.7 – 2.1 m based on anecdotal reports (R. J. Daigle, 2017).

Storm surge levels, defined by their return period event, can be added on top of SLR projections to account for the local impacts of wind or low air pressure systems during a storm over the life cycle of the asset. The Daigle report (commissioned by DELG) outlines Saint John specific SLR and storm surge projections for planning purposes as summarized in Table 3.6.

Table 3.6 – Components of Upper Bound Water Levels for Saint John Coastal Section (RJ Daigle Enviro, 2017)

Storm Surge (m)		HHWLT (m CGVD28)	2100 SLR (m)	West Antarctic Ice Sheet Contribution (m)	Total (m CGVD28)
1:100yr RP	1.5	4.7	1.23	0.65	8.0
Saxby Gale	2.0	4.7	1.23	0.65	8.5

HHWLT = Higher high water large tide for Saint John
West Antarctic Ice Sheet Contribution is an optional addition that accounts for the potential collapse of the ice sheet and the relative increase in SLR that would result if this occurs.
2100 SLR was adjusted from 1.24 to 1.23 m to account for the predictions being relative to 2000.

It is emphasized that the above elevations represent a worst-case representation of extreme flooding, because they are based on a high SLR scenario the assumption that the 1% probability storm surge coincides with the HHWLT (it rarely does). In addition, the concept of using return periods for extreme flood levels and expecting a given probability of occurrence within a certain lifetime is rendered invalid by SLR as the process is not statistically stationary anymore. Rather than adding a return period storm surge event on top of projected SLR, a probabilistic analysis of extreme total water level (i.e. including tide and storm surge) may be used. This is a preferred representation of future potential flooding scenarios as it considered the probability of all water level components contributing simultaneously and accounts for the frequency of extreme flood levels increasing each year with SLR.

Chapter 4 Recommendations

4.1 Model Maintenance

The Central and East Sanitary Sewer and Storm Water Model represents the third and final sewershed to be modelled by the City of Saint John. Together with the Millidgeville and West Side Models, the City now has the entire sanitary, storm, and combined sewer networks updated in GIS and modelled in SewerGEMS. These models represent a significant undertaking by the City and are a valuable tool for identifying capacity issues, prioritizing future capital improvements, and assessing capacity for proposed developments.

In order for the model to remain relevant and reliable, it will be important to regularly update the information contained within it. As an example, the Millidgeville model was completed in 2015 and is currently undergoing an update in 2020, including new flow monitoring data and inclusion of new developments and capital projects constructed in the past five plus years (survey and GIS updates for the Millidgeville model were completed in 2013).

Some key aspects of the model that should regularly be assessed for accuracy and updated accordingly are outlined below.

1. **Infrastructure** – Ongoing updates for infrastructure projects, including new developments and capital work, are recommended. When updates are made to the City's GIS database, corresponding updates can be made to the model as well. It may be more appropriate to wait until several GIS updates are made, and then conveying those updates to the model all at once. The proposed frequency for updating infrastructure in the model varies – these updates could be carried out as often as every year or up to as much as every five years at most.

2. **Flows** – Ongoing regular flow metering is recommended to provide updated data for the model and insight into what is going on in the system. Meter data can provide valuable insight into capacity issues, I&I problem areas, and even volume/ frequency of overflows. Alternatively, meters can also be positioned to provide an overall snapshot of the system in general. Flows should be added to the model for new developments, as they occur or at a chosen frequency.

3. **Lift Stations** – Ongoing monitoring of lift station flows (SCADA) is also recommended. Trends for effluent flows, wet well levels, and even pump run status can be used to get an idea of what is happening in the catchment. If any major changes are observed, the model can be updated accordingly. When pumps are replaced, or other lift station renovations are carried out, pump curves and updates to the model should be made accordingly. Pump set points should be updated and checked regularly as well.

4.2 Model Use

The model can be applied for a number of assessments and analysis – it is recommended that the level of service be established in the existing storm and sanitary systems and facilities and confirm the impacts on systems from existing constraints, projected storm events, and projected growth. The City will also be utilizing the model to complete capacity assessments related to new development proposals. The following sections provide some recommendations related to model use.

4.2.1 Baseline Conditions Assessment

A baseline conditions assessment should be completed for the storm water and sanitary sewer systems to assess existing capacity in dry weather and wet weather (including a range of rainfall events). The results of such an assessment would represent an overall characterization of the system, showing capacity risks that inherently include natural weather variability, and support the management of the City's wastewater in accordance with the Canada-wide Strategy for the Management of Municipal Wastewater Effluent (CCME). The baseline conditions assessment would determine the following for the Central and East model area:

- Capacity issue under dry and wet weather.
- Locations where sewers are near capacity.
- Number of overflows per year (or return period of overflows).
- Average total number of overflows per year.
- Rainfall threshold at which an overflow would begin.

In addition, an understanding of the level of risk of capacity issues associated with each portion of the system can be identified. This can be very valuable in identifying remediation strategies and level of urgency for implementation.

4.2.2 Capacity Analysis for New Development

In order to complete a localized capacity assessment for new development using the model it is recommended to use the most up-to-date calibrated version of the model. The level of effort for a capacity assessment will depend on the model maintenance frequency and level of detail. In general, it is recommended to check (and update where necessary) the following:

- Verify infrastructure (pipe and manhole locations, connections, inverts, diameters, etc.).
- Verify flow inputs (design flows per capita, catch basin connections and catchments, flow meter information).
- Verify lift station inputs (pump set points, pump curves, connections and overflows).

An understanding of the system upstream and downstream of the proposed development is essential to evaluating results. A sensitivity analysis can be valuable in assessing capacity and model results in particular areas. Overall, it is important to remember that model results carry a certain level of uncertainty and are only as reliable as the data and inputs used to construct the model.

Prepared by:
Brian Moreau, P. Eng.
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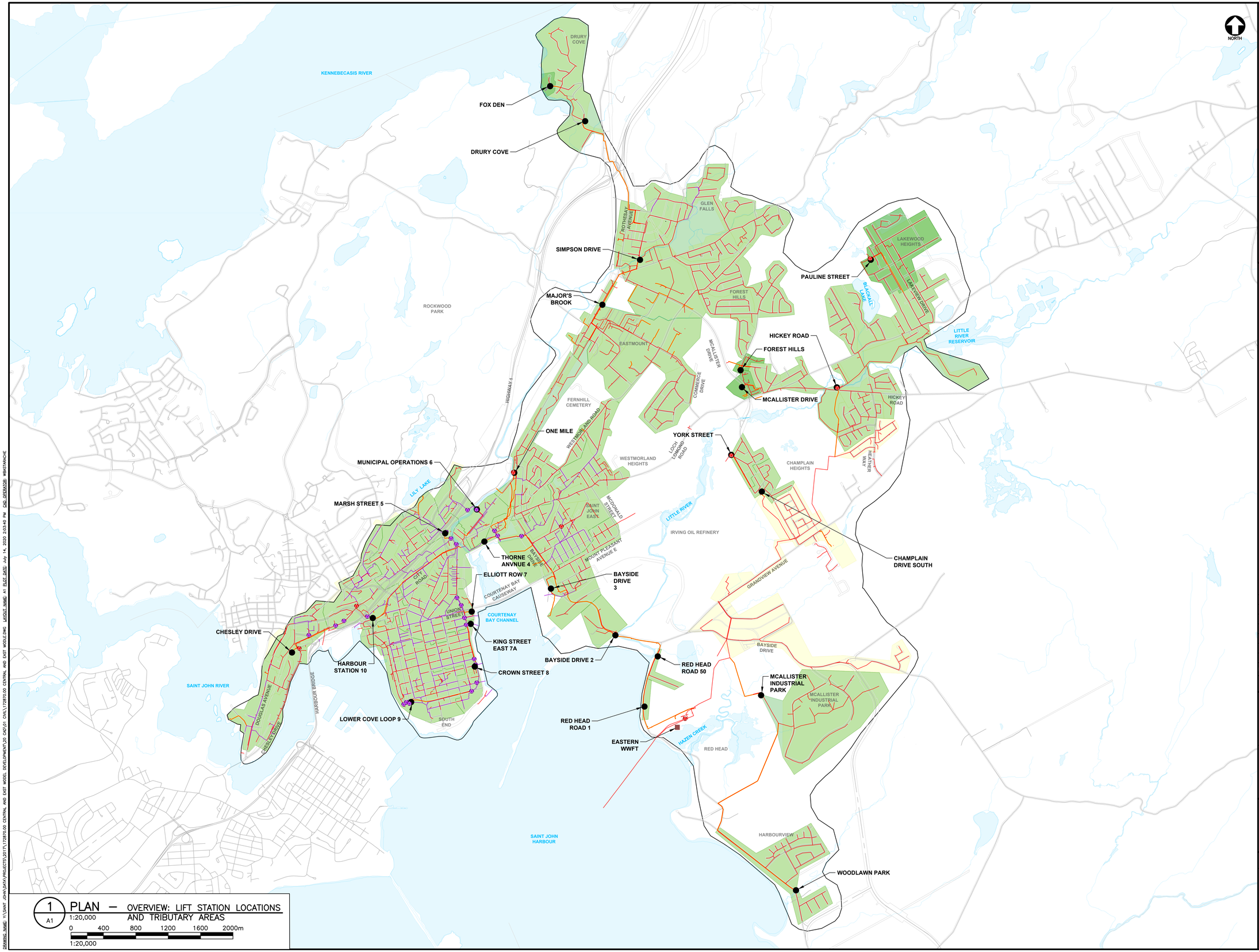
Reviewed by:
Tim McCluskey, P. Eng.
Group Lead, Municipal

APPENDIX A

Maps: Central and East Model



LEGEND

- SANITARY LIFT STATION
- WASTEWATER TREATMENT FACILITY
- FORCEMAIN
- SANITARY SEWER
- SANITARY OVERFLOW LOCATIONS
- COMBINED SEWER
- COMBINED OVERFLOW LOCATIONS
- LIFT STATION TRIBUTARY AREAS
- EWWTF SEWERSHEDS
- AREAS OF OVERLAPPING (TRIBUTARY / SEWERSHED AREAS)
- MODEL AREA

1 A1 PLAN – OVERVIEW: LIFT STATION LOCATIONS AND TRIBUTARY AREAS

1:20,000

0 400 800 1200 1600 2000m

1:20,000

No.	Description	Date	
A	ISSUED FOR DRAFT REPORT	15.07.20	BMM

Revision or Issue

CIVIL

CENTRAL AND EAST SANITARY SEWER AND STORM WATER MODEL DEVELOPMENT

OVERVIEW: LIFT STATION LOCATIONS AND TRIBUTARY AREAS

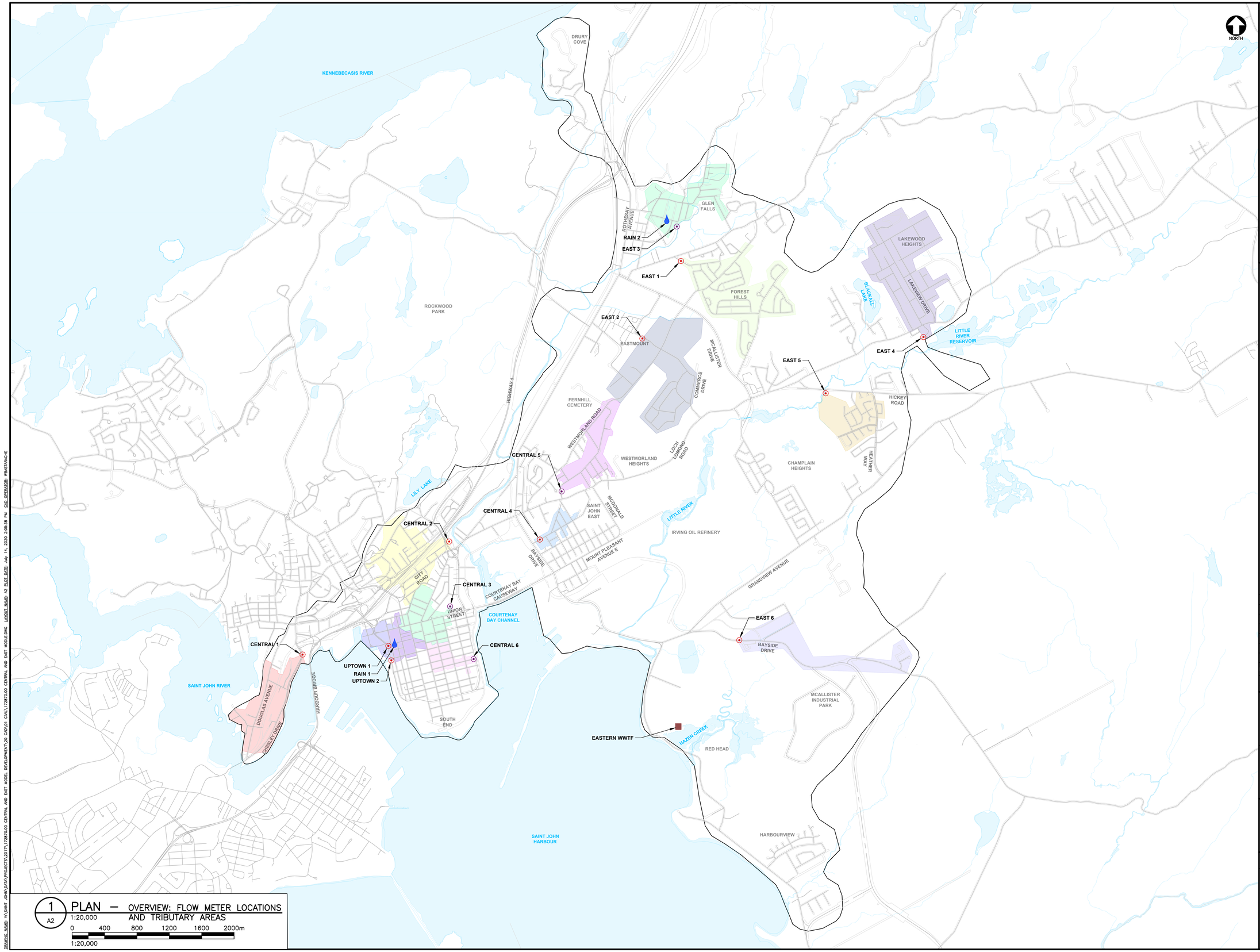
CBCL No	Contract No	Date	Scale
172870.00	2017-091010P	JUNE 2020	AS SHOWN

Designed	Drawn
JED	WMB
Checked	Approved
JED	BMM

Sheet No 1 of 6

Figure No A1

DRAWING NAME: Y:\SAINT JOHN\DATA\PROJECTS\2017\172870.00 CENTRAL AND EAST MODEL DEVELOPMENT\20 CAD\01 CIVIL\172870.00 CENTRAL AND EAST MODELING LAYOUT NAME: A1 PLOT DATE: July 14, 2020 2:53:40 PM CAD OPERATOR: WBASTARACHE



LEGEND

- COMBINED FLOW METER
- COMBINED OVERFLOW LOCATIONS
- SANITARY FLOW METER
- SANITARY OVERFLOW LOCATIONS
- RAIN GAUGES
- WASTEWATER TREATMENT FACILITY
- MODEL AREA

1 / A2 PLAN – OVERVIEW: FLOW METER LOCATIONS AND TRIBUTARY AREAS

1:20,000

0 400 800 1200 1600 2000m

1:20,000

No.	Description	Date	
A	ISSUED FOR DRAFT REPORT	15.07.20	BMM

Revision or Issue

CIVIL

CENTRAL AND EAST SANITARY SEWER AND STORM WATER MODEL DEVELOPMENT

OVERVIEW: FLOW METER LOCATIONS AND TRIBUTARY AREAS

CBCL

CBCL No	Contract No	Date	Scale
172870.00	2017-091010P	JUNE 2020	AS SHOWN

Designed	Drawn
JED	WMB
Checked	Approved
JED	BMM

Sheet No 2 of 6

Figure No **A2**

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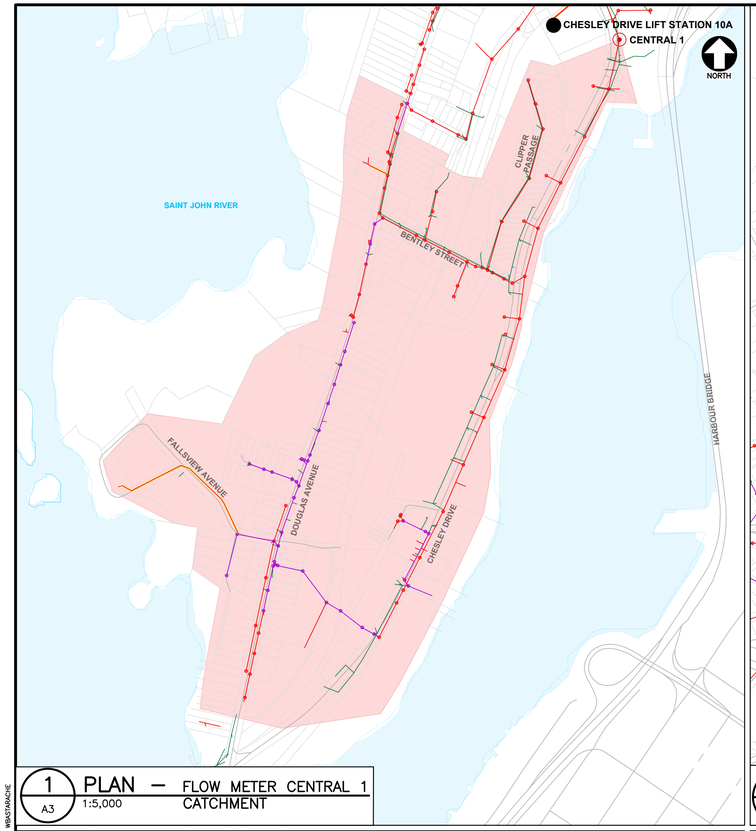
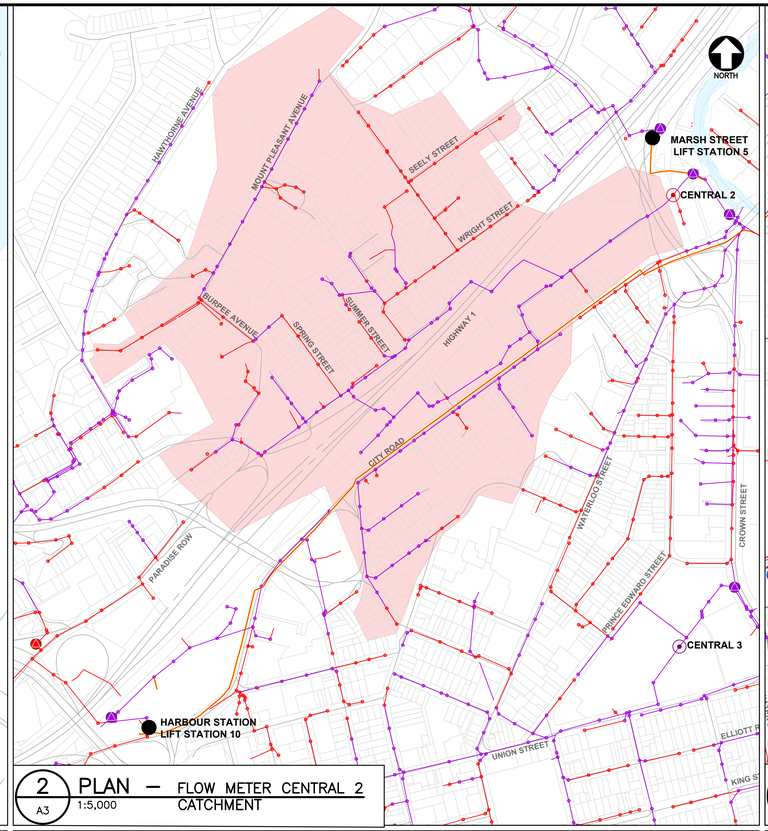
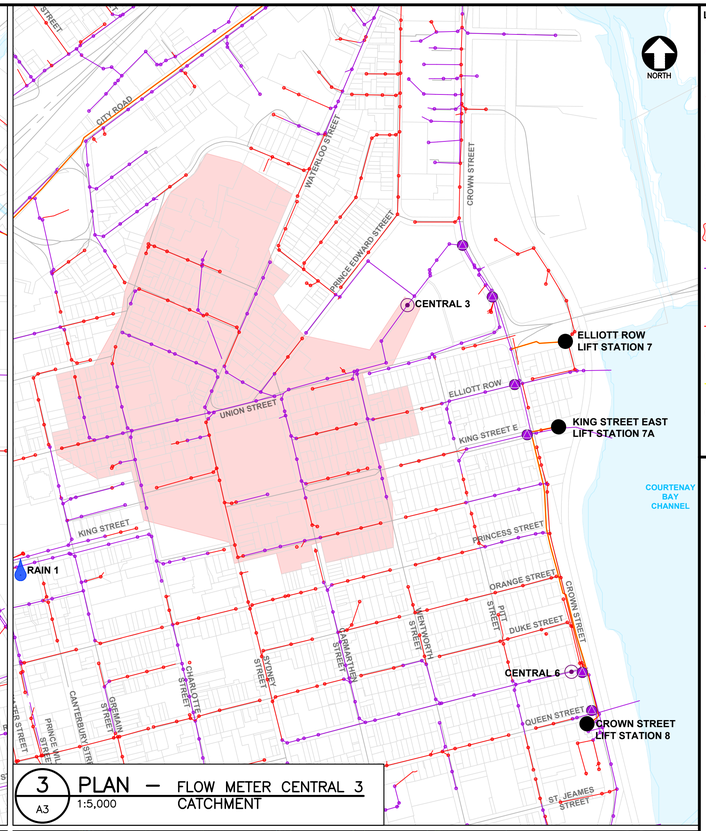


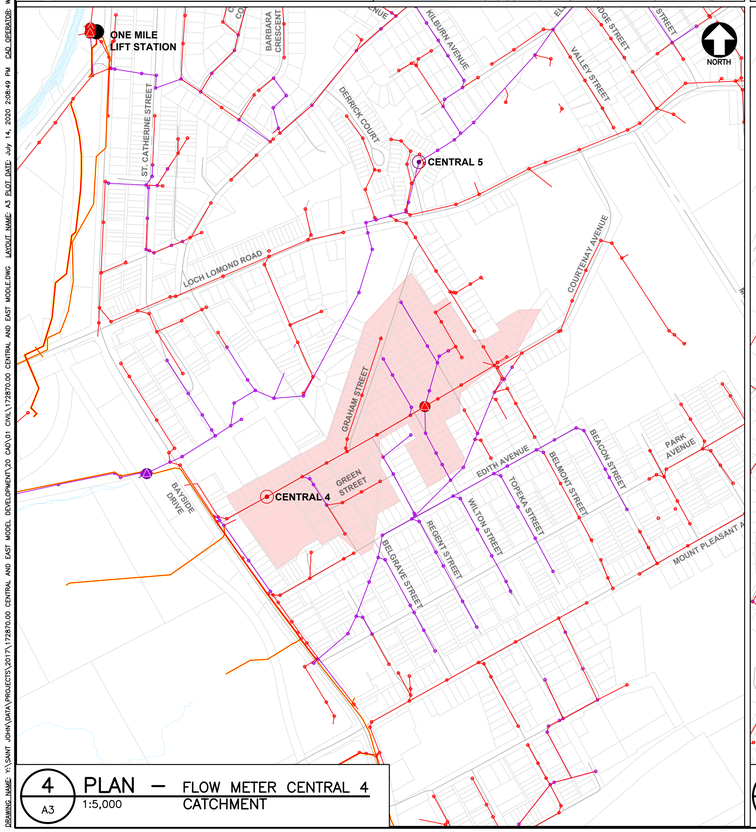
1 A3 PLAN – FLOW METER CENTRAL 1 CATCHMENT 1:5,000



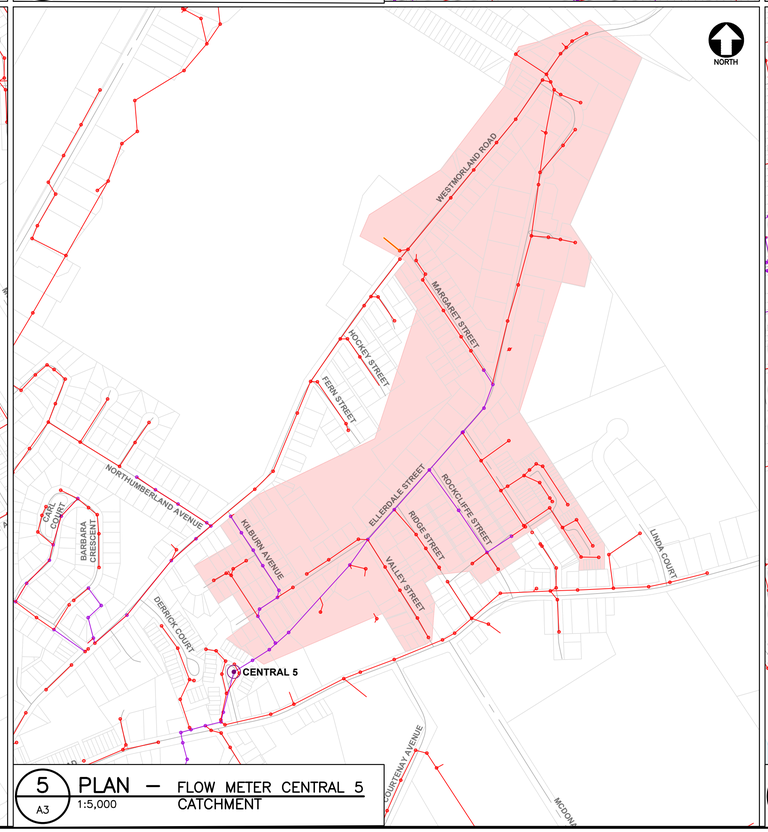
2 A3 PLAN – FLOW METER CENTRAL 2 CATCHMENT 1:5,000



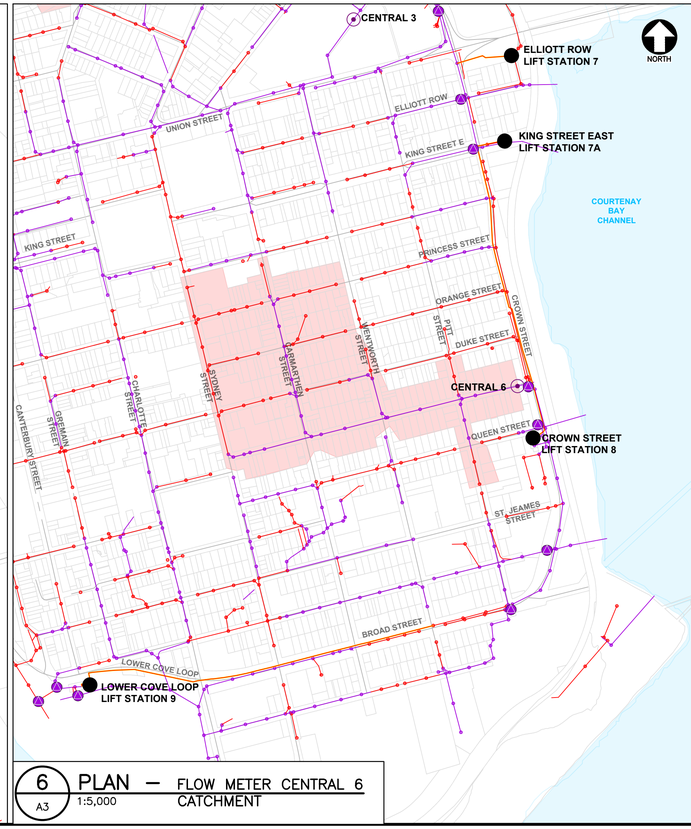
3 A3 PLAN – FLOW METER CENTRAL 3 CATCHMENT 1:5,000



4 A3 PLAN – FLOW METER CENTRAL 4 CATCHMENT 1:5,000



5 A3 PLAN – FLOW METER CENTRAL 5 CATCHMENT 1:5,000



6 A3 PLAN – FLOW METER CENTRAL 6 CATCHMENT 1:5,000

LEGEND

- COMBINED OVERFLOW LOCATIONS
- SANITARY OVERFLOW LOCATIONS
- COMBINED FLOW METER
- SANITARY FLOW METER
- RAIN GAUGE
- FLOW METER CATCHMENTS
- COMBINED SEWER
- COMBINED MANHOLE
- SANITARY SEWER
- SANITARY MANHOLE
- FORCEMAIN
- SANITARY LIFT STATION

No.	Description	Date	
A	ISSUED FOR DRAFT REPORT	15.07.20	BMM

Revision or Issue

CIVIL

CENTRAL AND EAST SANITARY SEWER AND STORM WATER MODEL DEVELOPMENT

FLOW METER CATCHMENTS: CENTRAL 1–6

CBCL No	Contract No	Date	Scale
172870.00	2017–091010P	JUNE 2020	AS SHOWN

Designed	Drawn
JED	WMB
Checked	Approved
JED	BMM

Sheet No 3 of 6

Figure No **A3**

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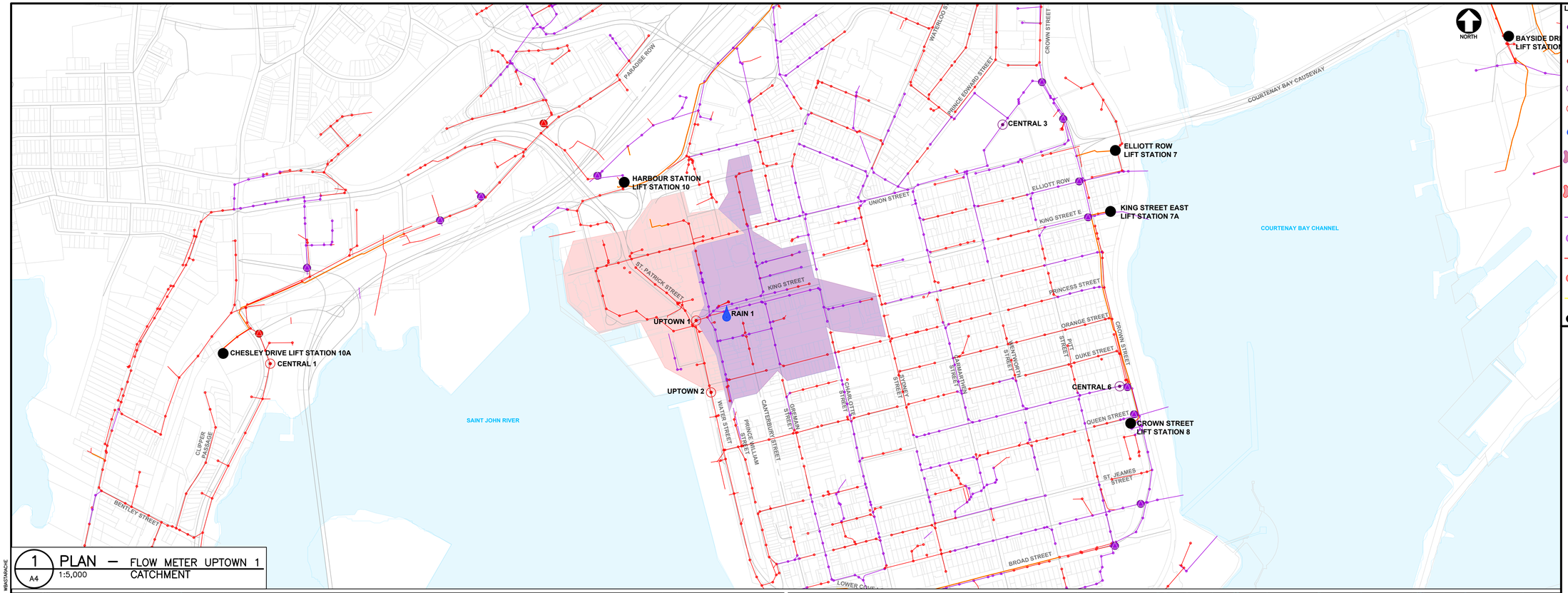
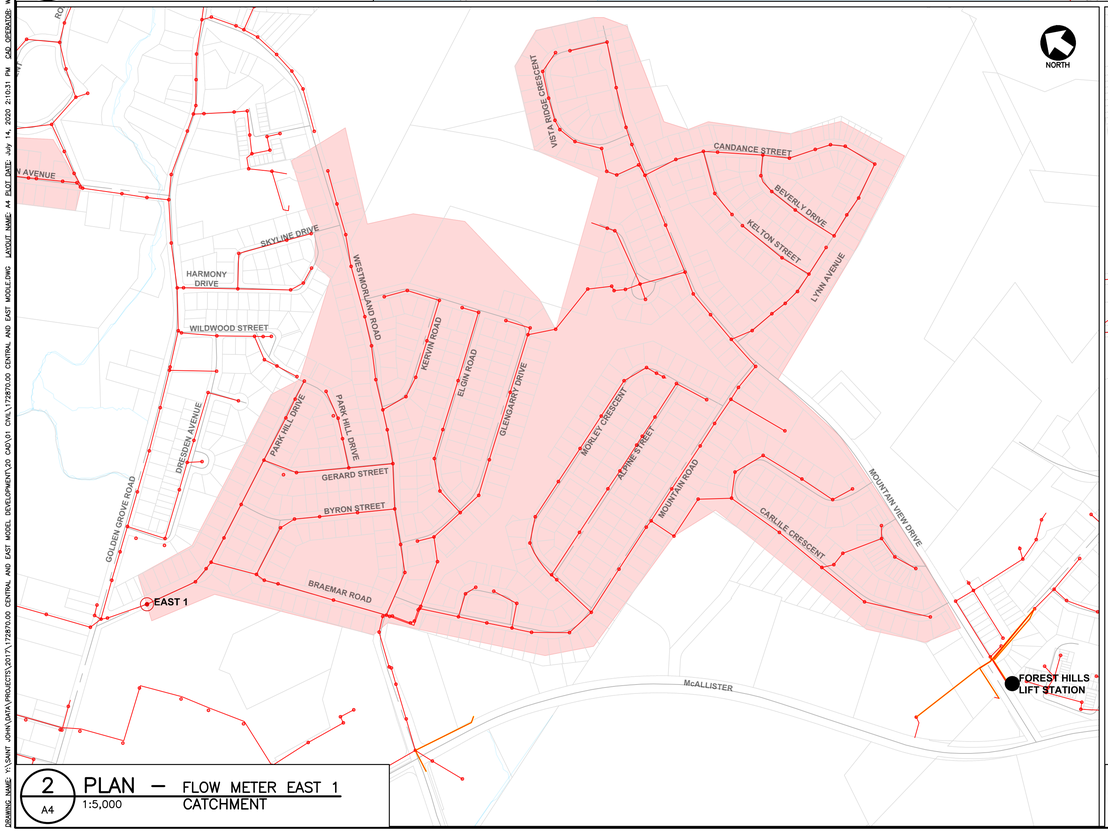
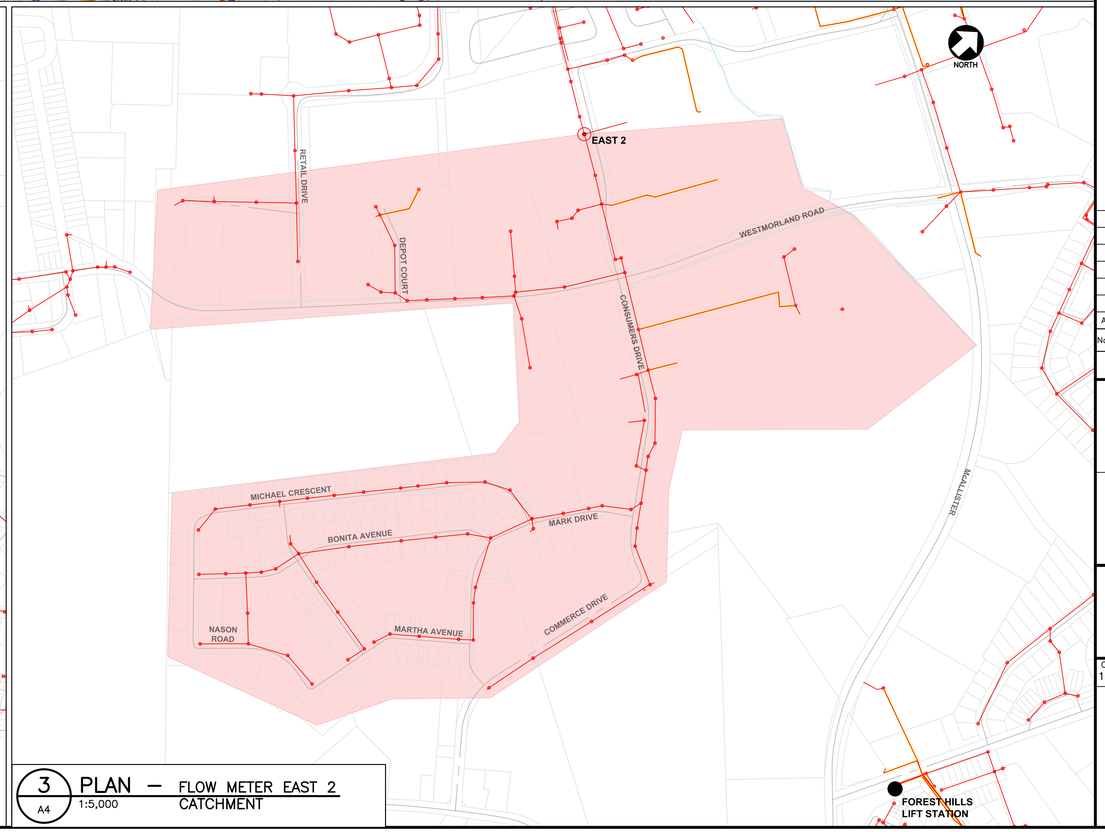


1 A4 PLAN – FLOW METER UPTOWN 1 CATCHMENT
1:5,000



2 A4 PLAN – FLOW METER EAST 1 CATCHMENT
1:5,000



3 A4 PLAN – FLOW METER EAST 2 CATCHMENT
1:5,000

LEGEND
- COMBINED OVERFLOW LOCATIONS
- SANITARY OVERFLOW LOCATIONS
- COMBINED FLOW METER
- SANITARY FLOW METER
- RAIN GAUGE
- UPTOWN 1 FLOW METER CATCHMENT
- UPTOWN 2 FLOW METER CATCHMENT
- COMBINED SEWER
- COMBINED MANHOLE
- SANITARY SEWER
- SANITARY MANHOLE
- FORCEMAIN
- SANITARY LIFT STATION

No.	Description	Date	
A	ISSUED FOR DRAFT REPORT	15.07.20	BMM

Revision or Issue

Saint John Water

CIVIL

CENTRAL AND EAST SANITARY SEWER AND STORM WATER MODEL DEVELOPMENT

FLOW METER CATCHMENTS: UPTOWN 1–2, EAST 1–2

CBCL

CBCL No	Contract No	Date	Scale
172870.00	2017-091010P	JUNE 2020	AS SHOWN

Designed	Drawn
JED	WMB
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JED	BMM

Sheet No 4 of 6

Figure No **A4**

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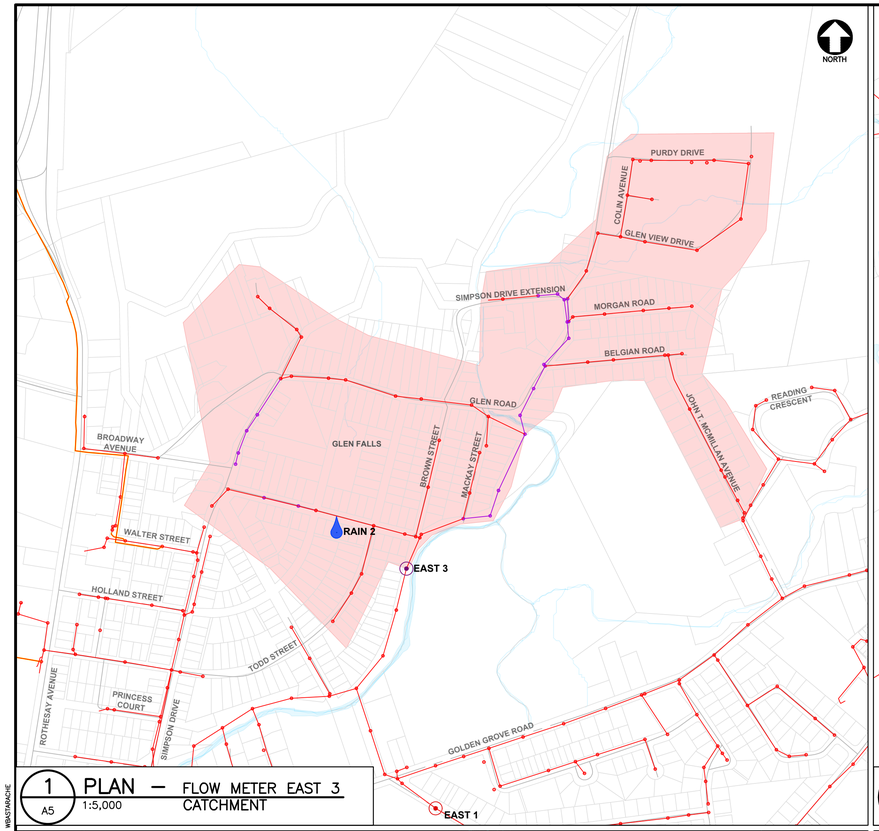
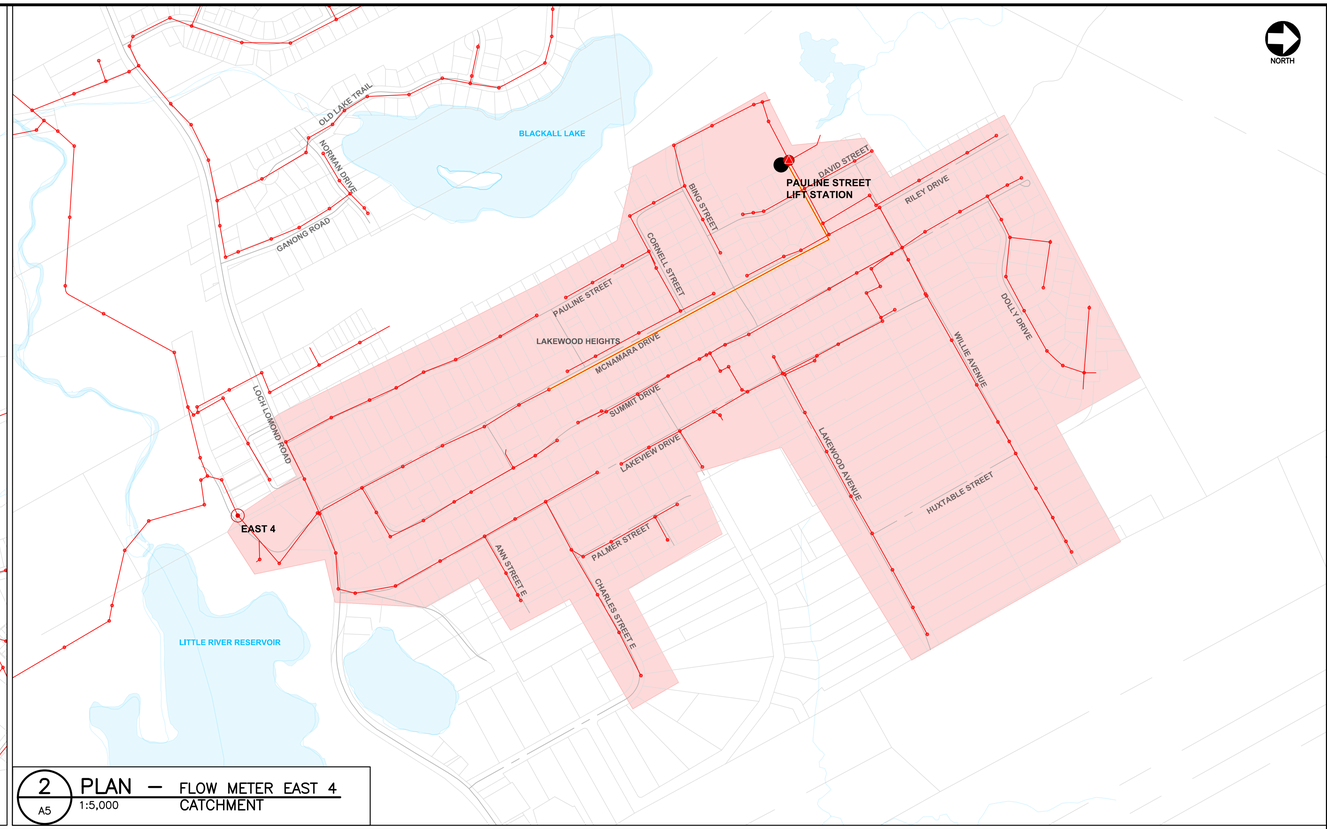
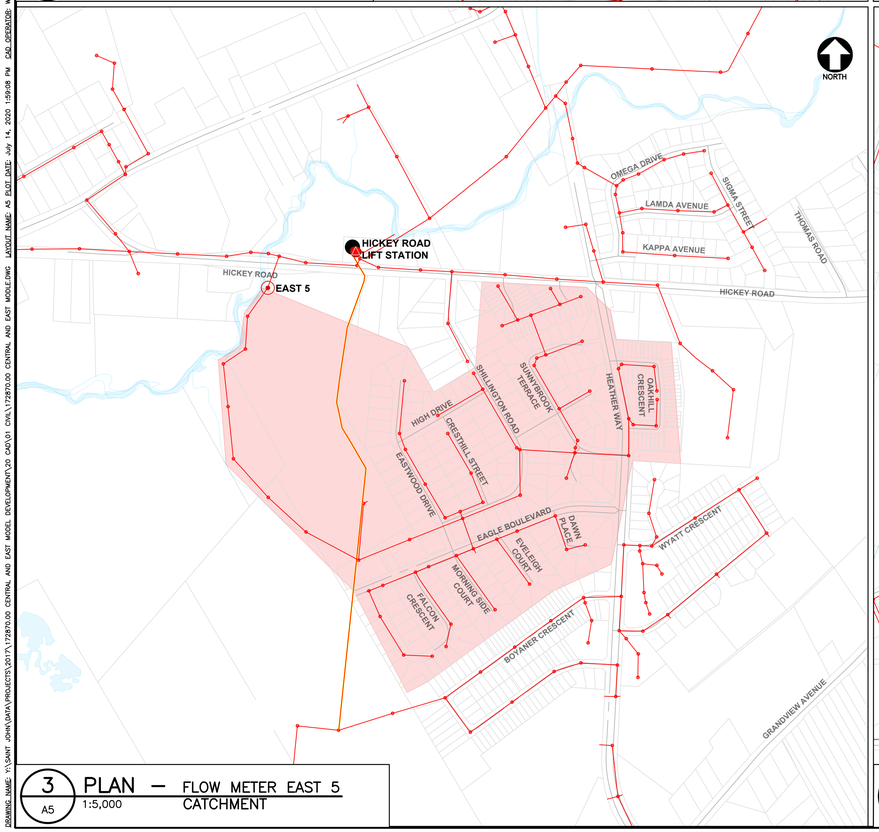


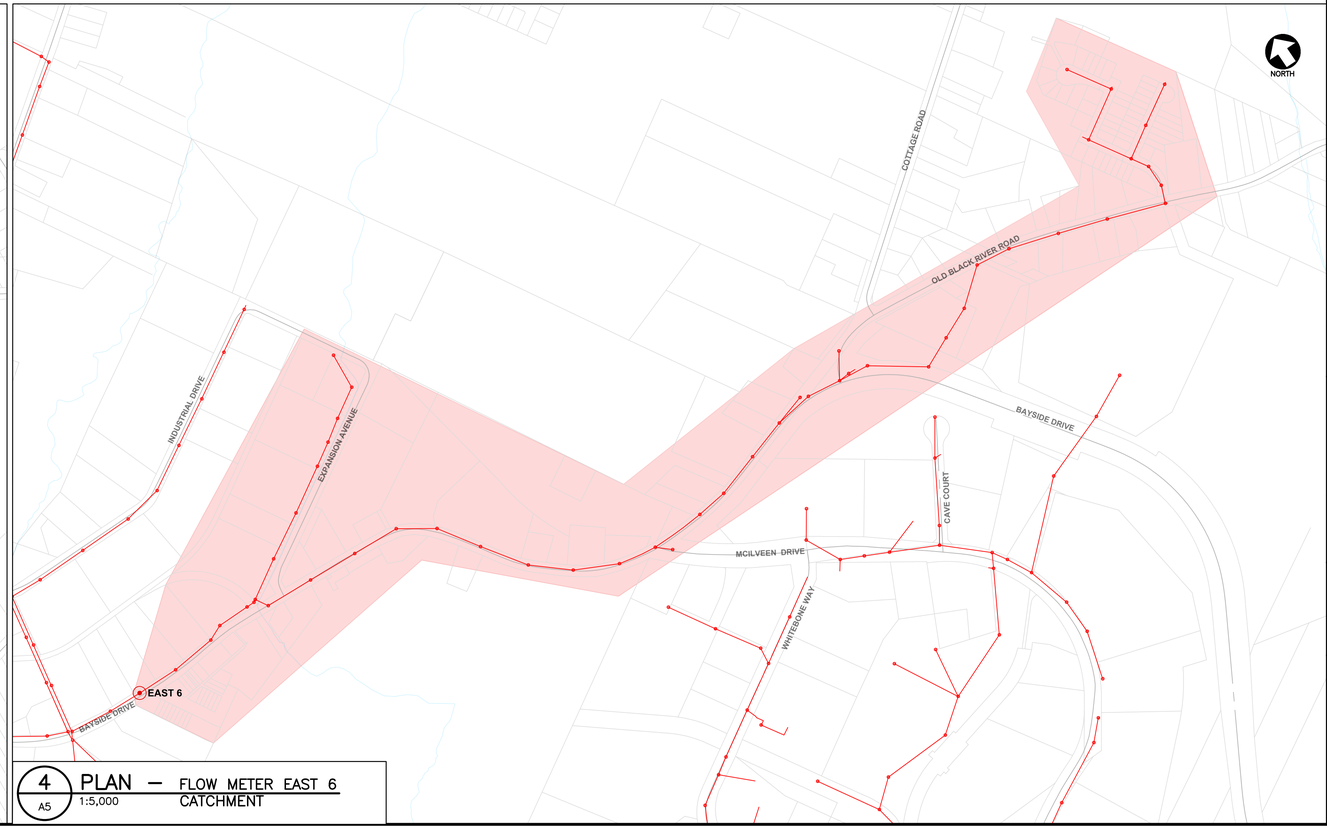
1 PLAN – FLOW METER EAST 3 CATCHMENT
A5 1:5,000



2 PLAN – FLOW METER EAST 4 CATCHMENT
A5 1:5,000



3 PLAN – FLOW METER EAST 5 CATCHMENT
A5 1:5,000



4 PLAN – FLOW METER EAST 6 CATCHMENT
A5 1:5,000

LEGEND

- COMBINED OVERFLOW LOCATIONS
- SANITARY OVERFLOW LOCATIONS
- COMBINED FLOW METER
- SANITARY FLOW METER
- RAIN GAUGE
- FLOW METER CATCHMENTS
- COMBINED SEWER
- COMBINED MANHOLE
- SANITARY SEWER
- SANITARY MANHOLE
- FORCEMAIN
- SANITARY LIFT STATION

No.	Description	Date	
A	ISSUED FOR DRAFT REPORT	15.07.20	BMM

Revision or Issue

CIVIL

CENTRAL AND EAST SANITARY SEWER AND STORM WATER MODEL DEVELOPMENT

FLOW METER CATCHMENTS: EAST 3–6

CBCL

CBCL No	Contract No	Date	Scale
172870.00	2017-091010P	JUNE 2020	AS SHOWN

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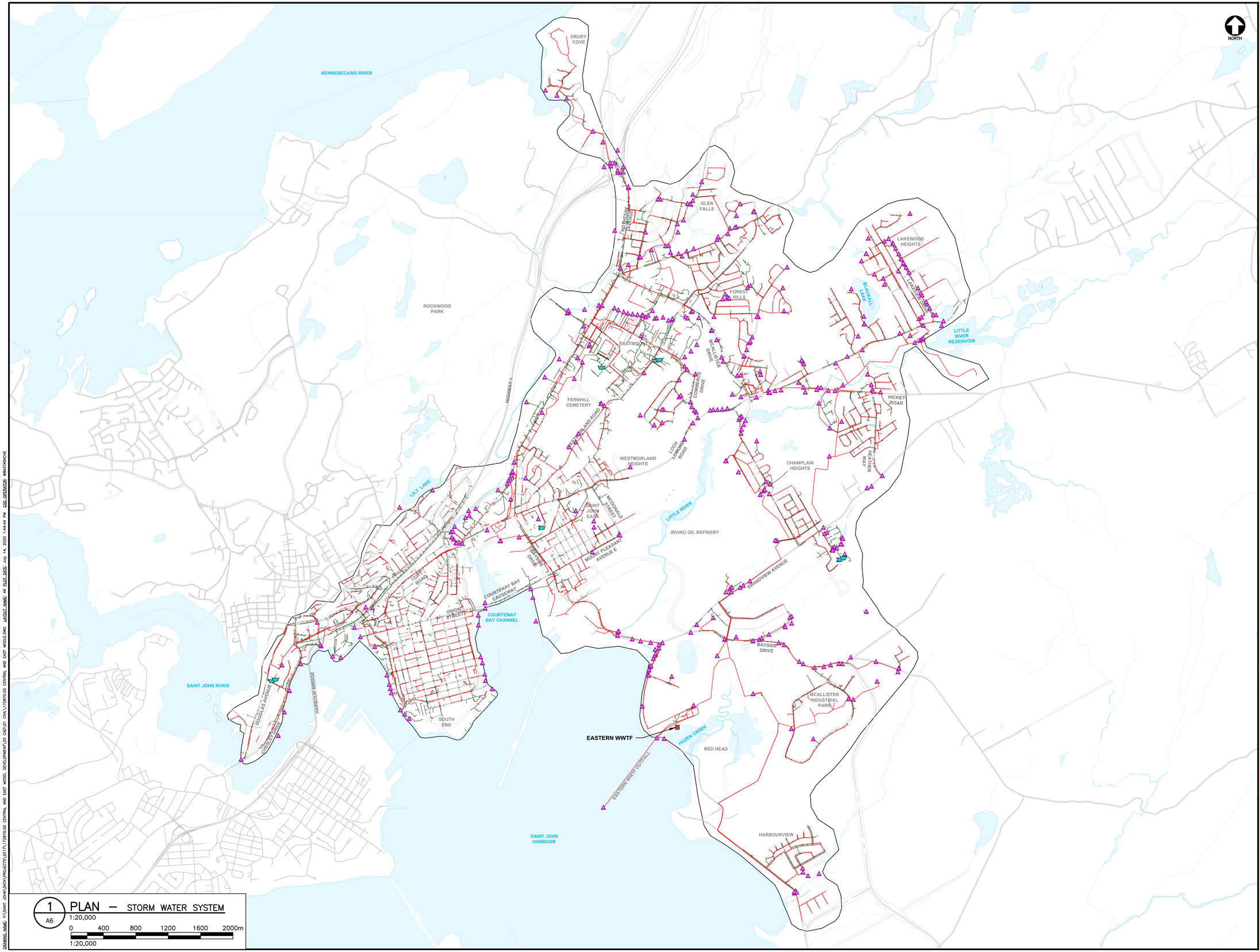
JED	WMB
Checked	Approved
JED	BMM

Sheet No 5 of 6

Figure No **A5**



1 A6 PLAN – STORM WATER SYSTEM

1:20,000

0 400 800 1200 1600 2000m

1:20,000

LEGEND

- STORM SEWER
- STORMWATER STORAGE FACILITY
- OUTFALLS
- DRAINAGE CHANNELS
- MODEL AREA
- SANITARY SEWER

No.	Description	Date	
A	ISSUED FOR DRAFT REPORT	15.07.20	BMM

Revision or Issue

CIVIL

CENTRAL AND EAST SANITARY SEWER AND STORM WATER MODEL DEVELOPMENT

OVERVIEW: STORM WATER SYSTEM

CBCL

CBCL No	Contract No	Date	Scale
172870.00	2017-091010P	JUNE 2020	AS SHOWN

Designed	Drawn
JED	WMB
Checked	Approved
JED	BMM

Sheet No 6 of 6

Figure No **A6**

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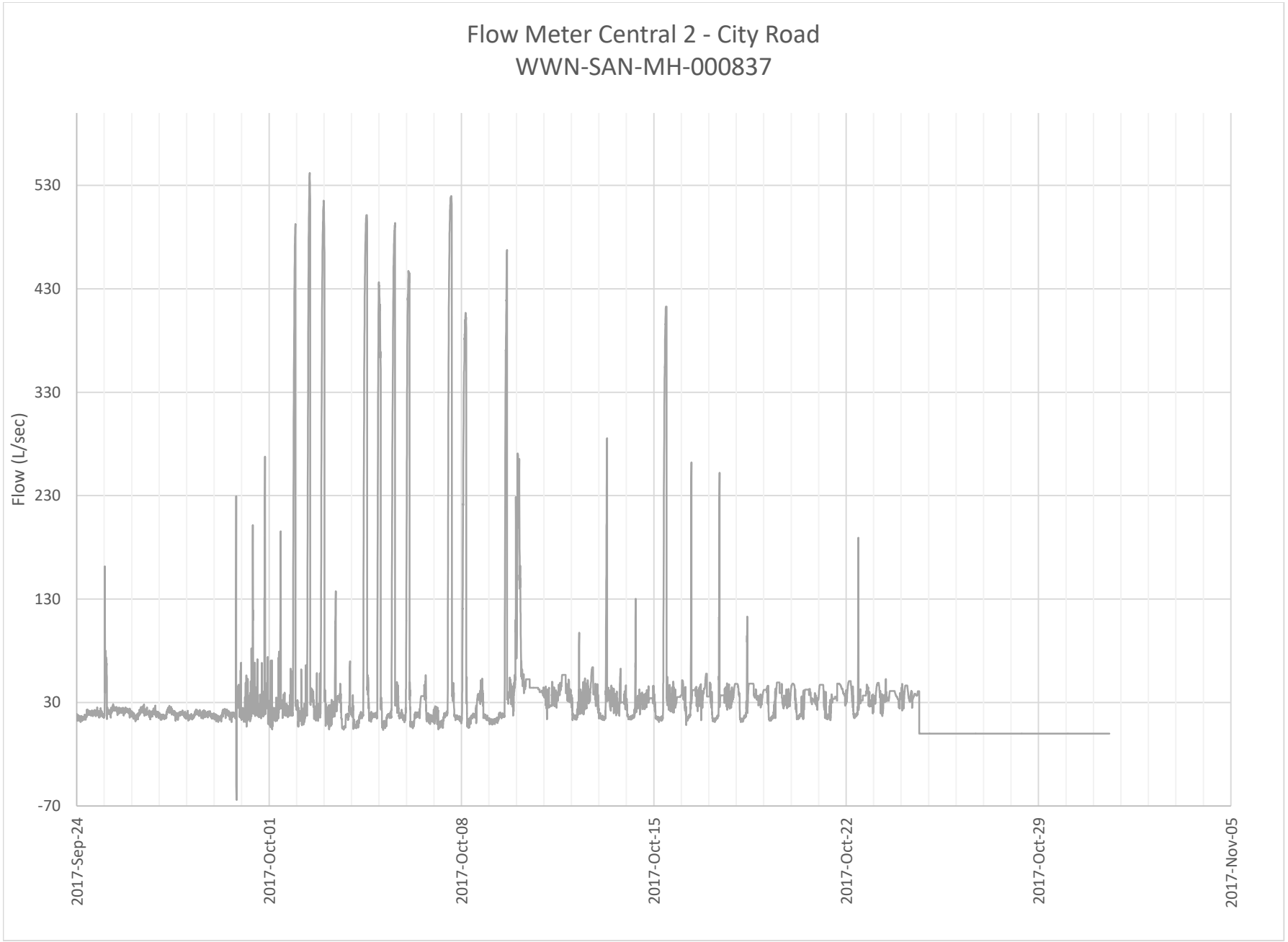
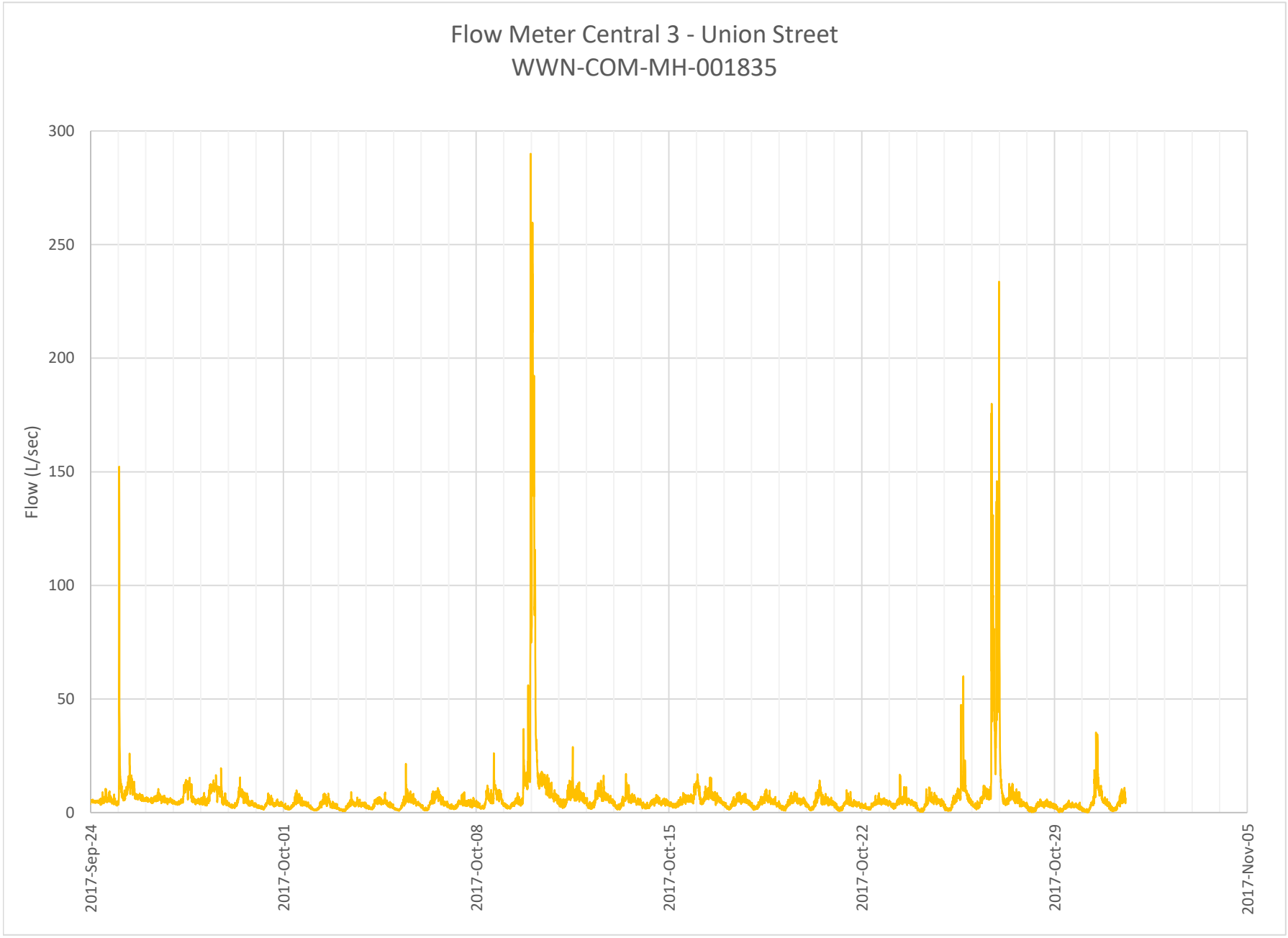
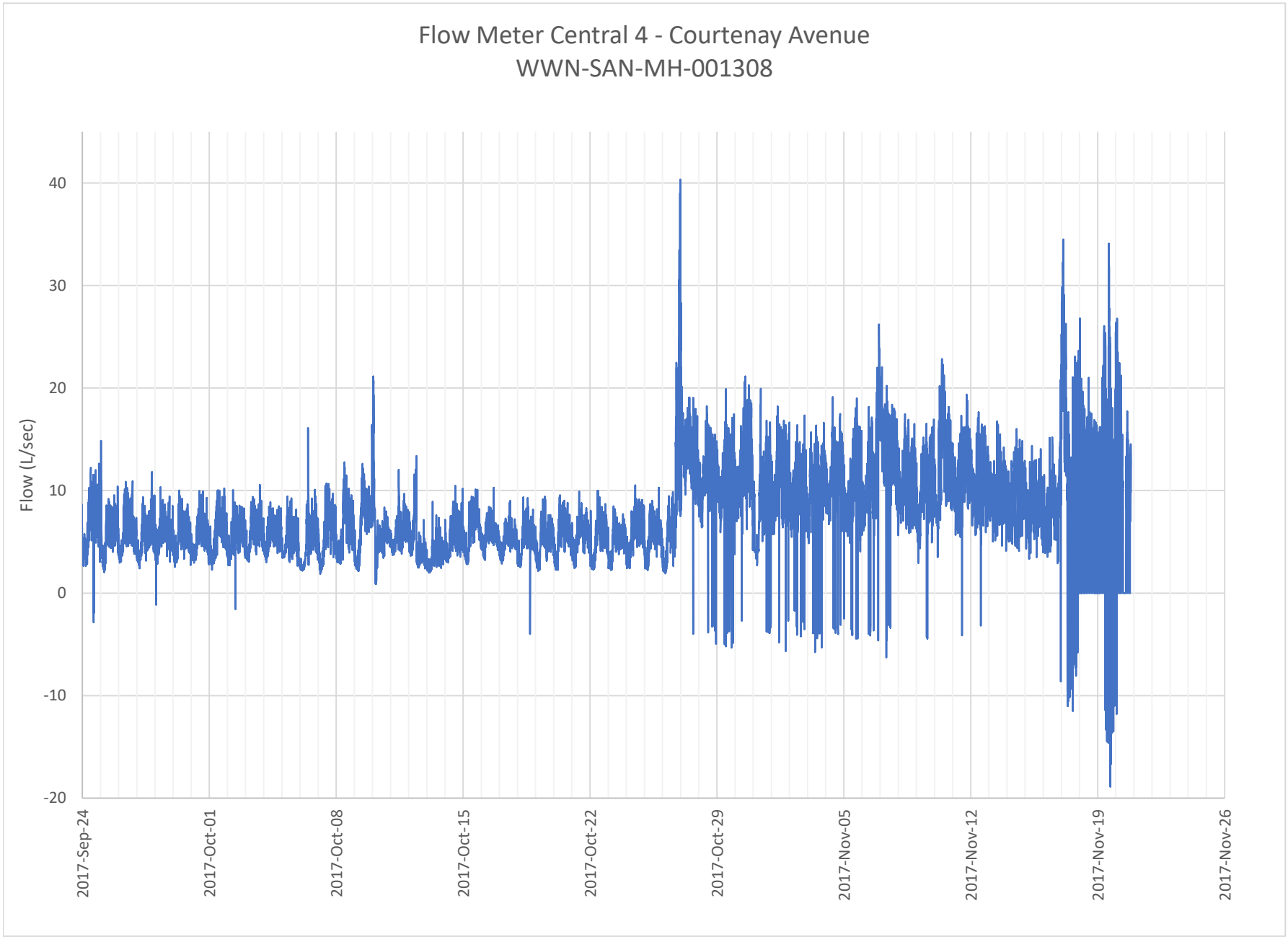
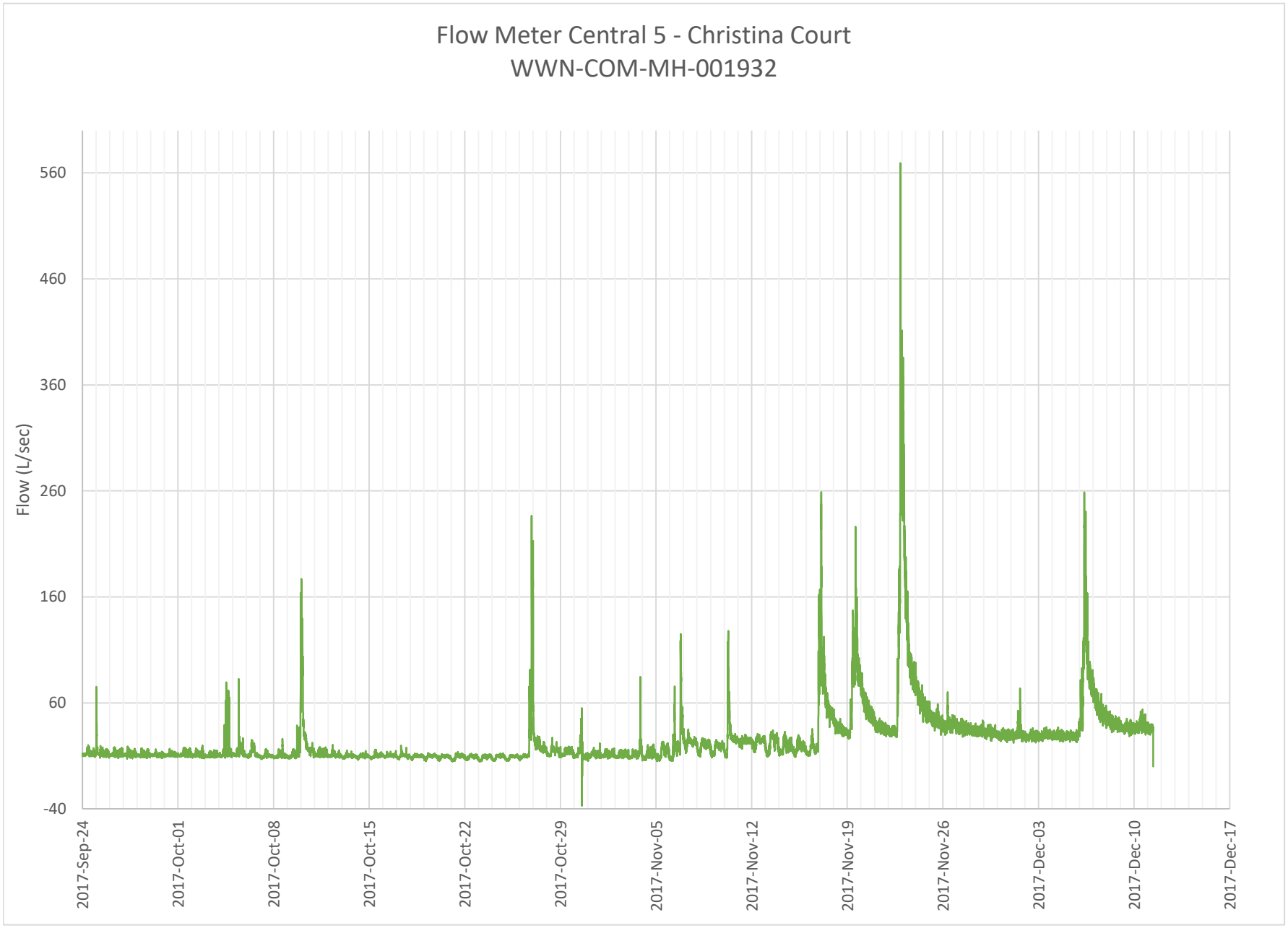
APPENDIX B

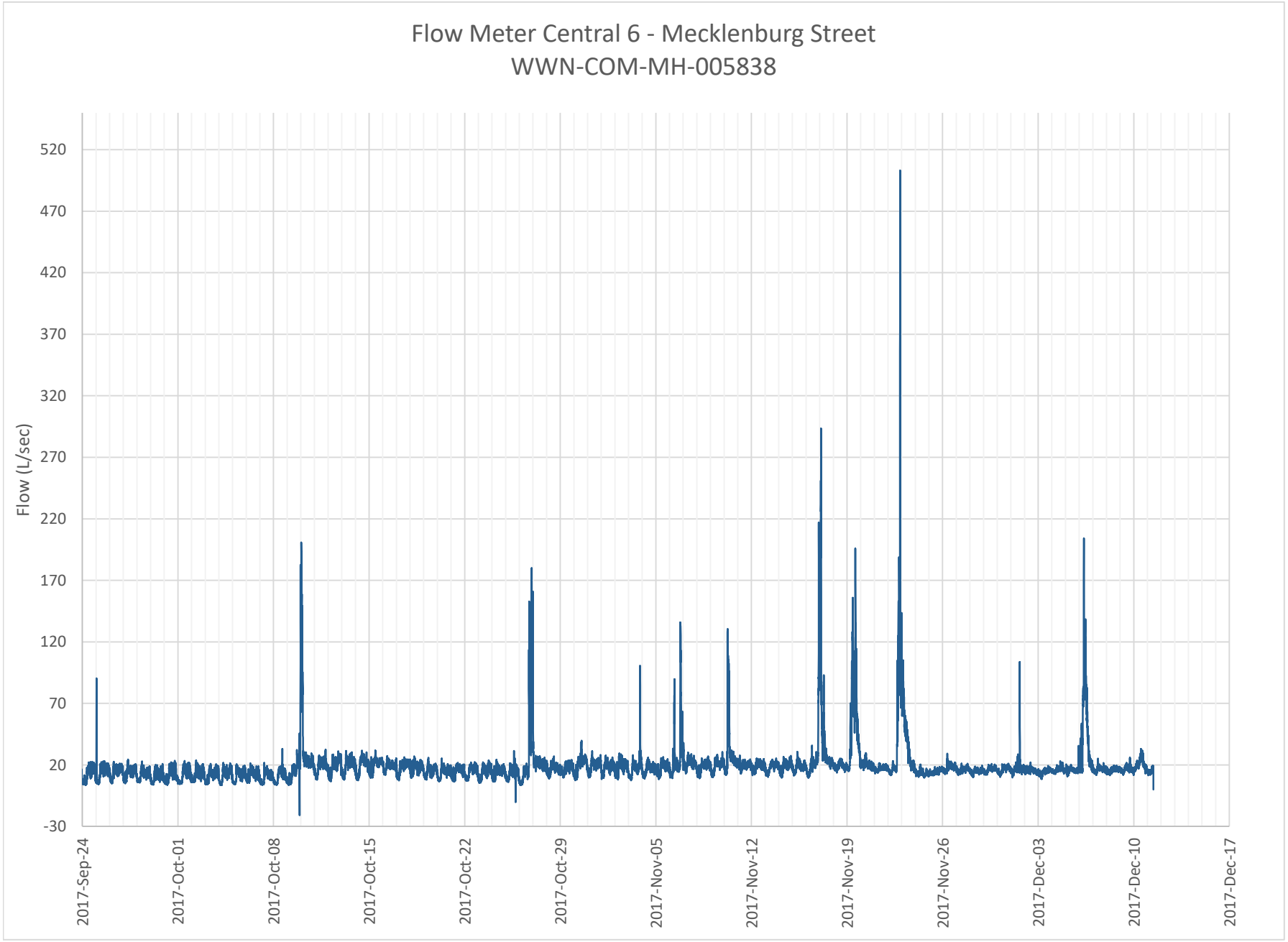
Recorded Flow Meter Data


Flow Meter Central 2 - City Road
WWN-SAN-MH-000837
Flow (L/sec)
530
430
330
230
130
30
-70
2017-Sep-24
2017-Oct-01
2017-Oct-08
2017-Oct-15
2017-Oct-22
2017-Oct-29
2017-Nov-05


Flow Meter Central 3 - Union Street
WWN-COM-MH-001835
Flow (L/sec)
300
250
200
150
100
50
0
2017-Sep-24
2017-Oct-01
2017-Oct-08
2017-Oct-15
2017-Oct-22
2017-Oct-29
2017-Nov-05


Flow Meter Central 4 - Courtenay Avenue
WWN-SAN-MH-001308
Flow (L/sec)
40
30
20
10
0
-10
-20
2017-Sep-24
2017-Oct-01
2017-Oct-08
2017-Oct-15
2017-Oct-22
2017-Oct-29
2017-Nov-05
2017-Nov-12
2017-Nov-19
2017-Nov-26


Flow Meter Central 5 - Christina Court
WWN-COM-MH-001932
Flow (L/sec)
560
460
360
260
160
60
-40
2017-Sep-24
2017-Oct-01
2017-Oct-08
2017-Oct-15
2017-Oct-22
2017-Oct-29
2017-Nov-05
2017-Nov-12
2017-Nov-19
2017-Nov-26
2017-Dec-03
2017-Dec-10
2017-Dec-17


Flow Meter Central 6 - Mecklenburg Street
WWN-COM-MH-005838
Flow (L/sec)
520
470
420
370
320
270
220
170
120
70
20
-30
2017-Sep-24
2017-Oct-01
2017-Oct-08
2017-Oct-15
2017-Oct-22
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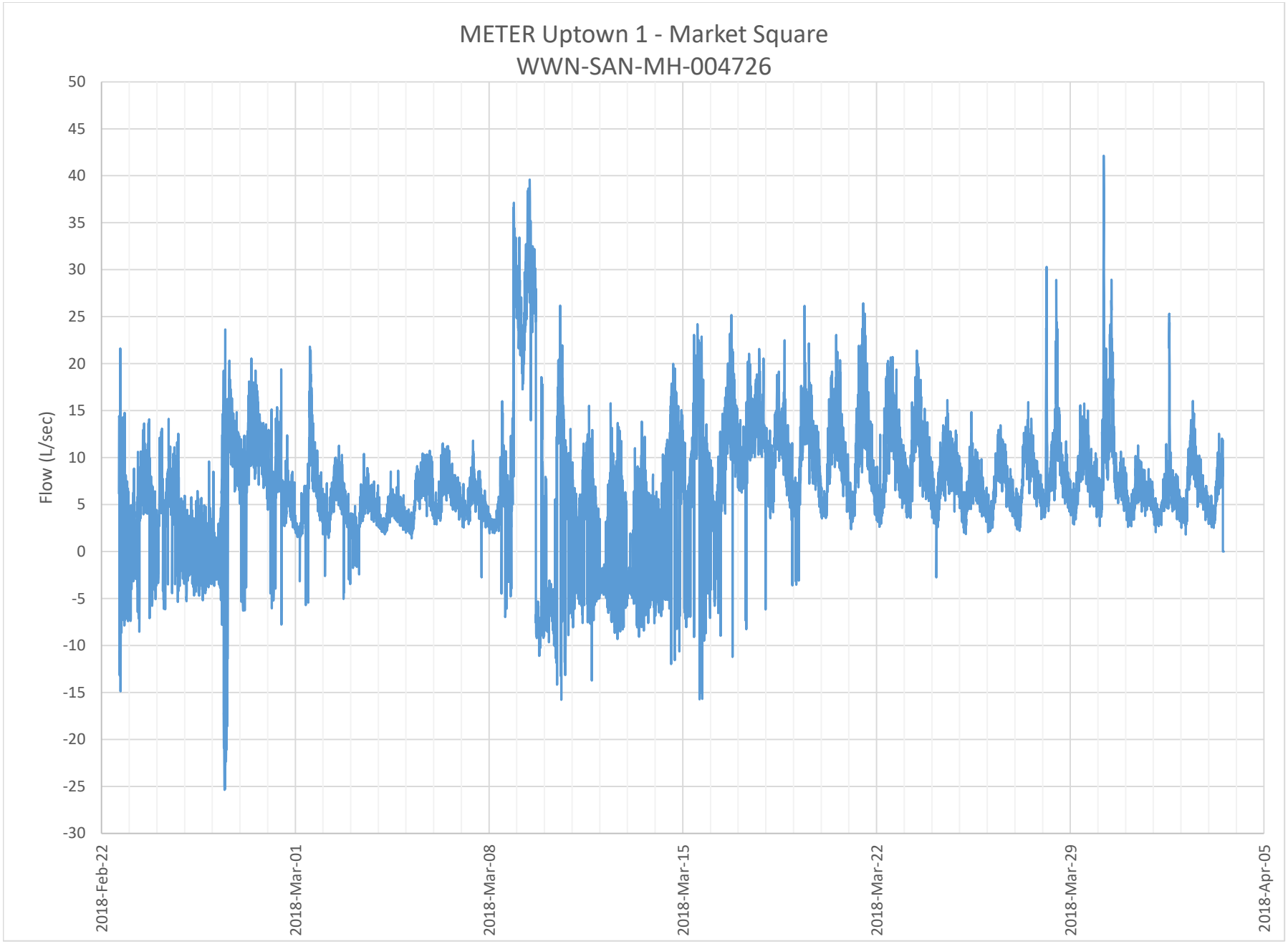
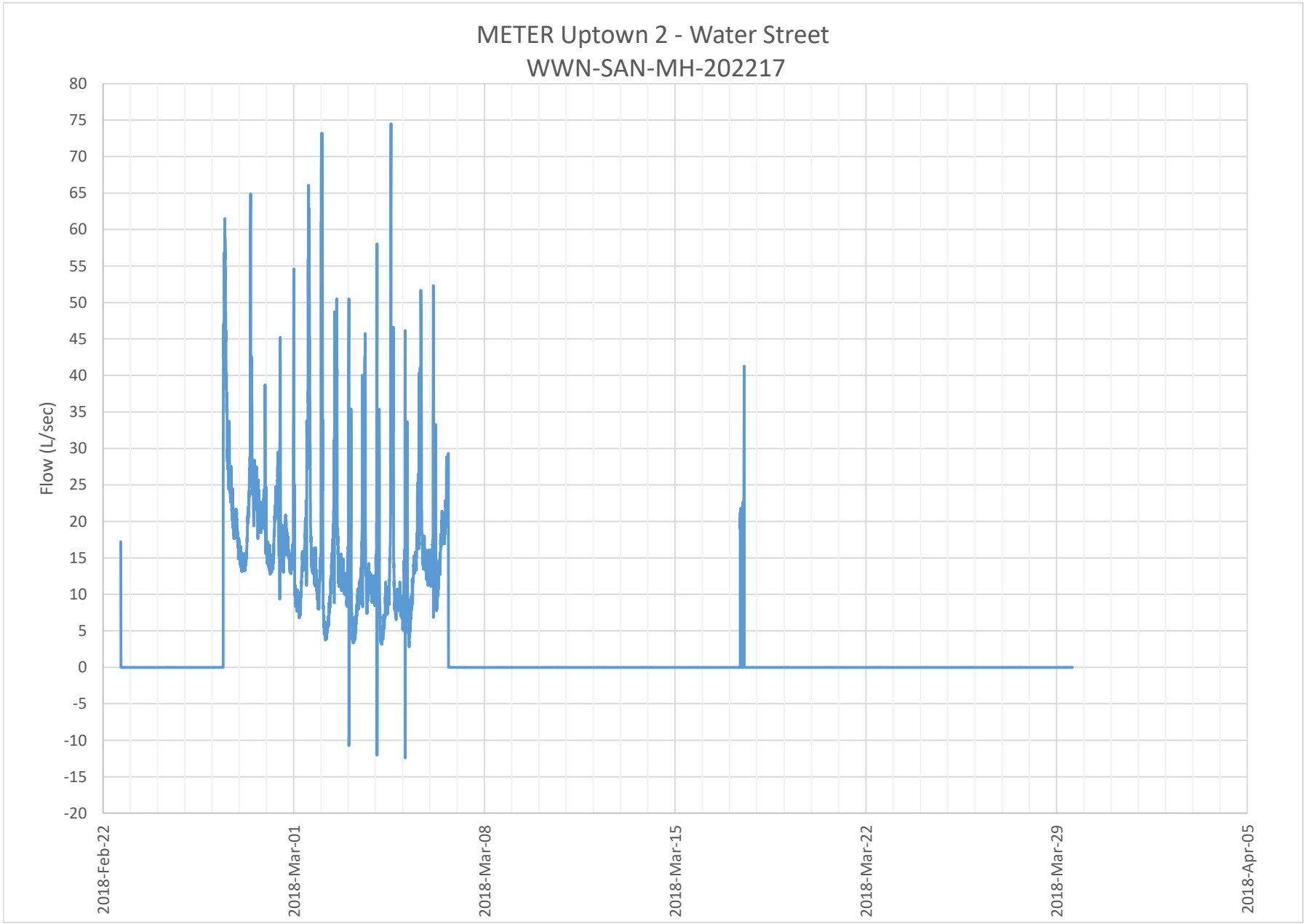
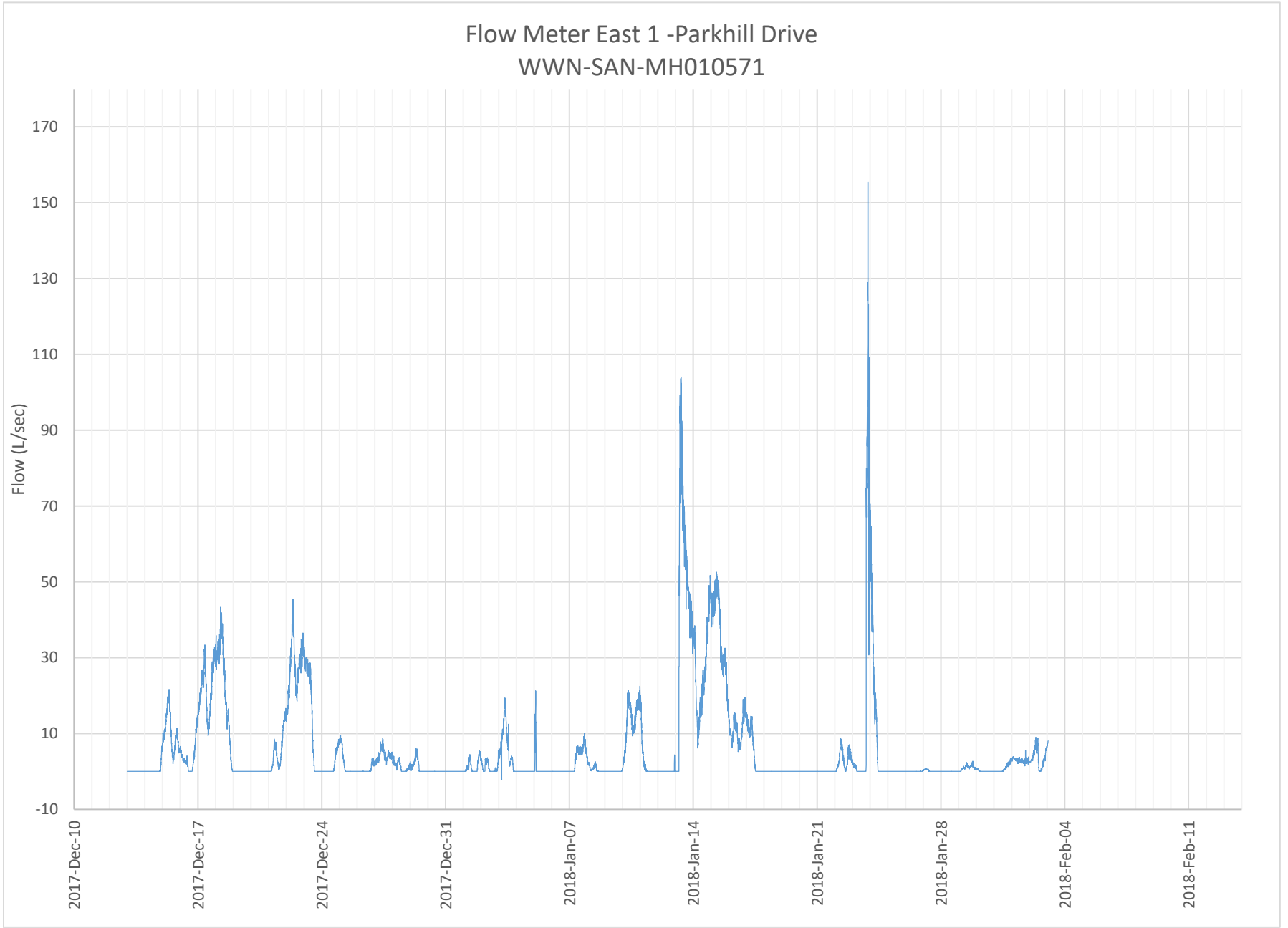
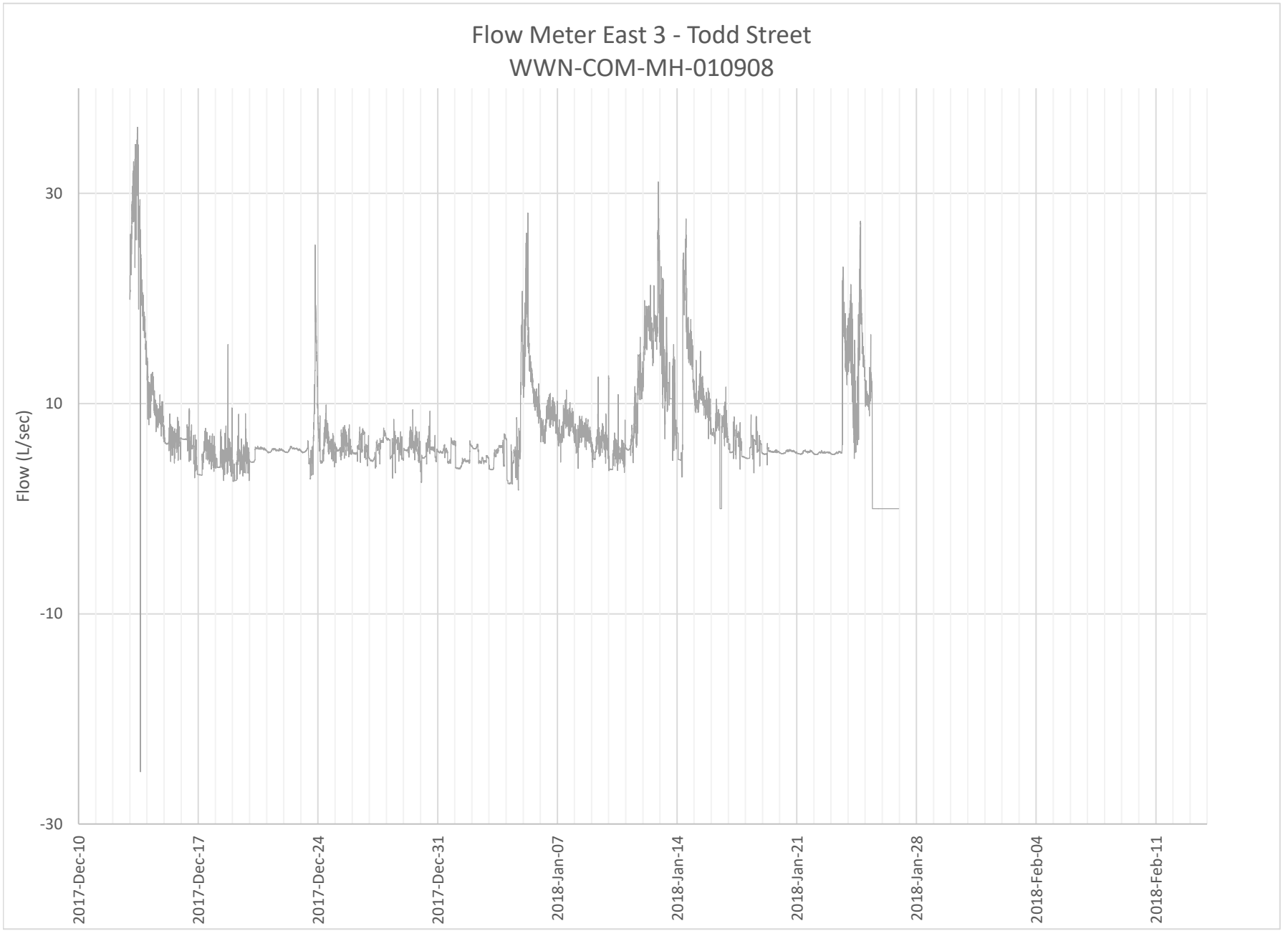
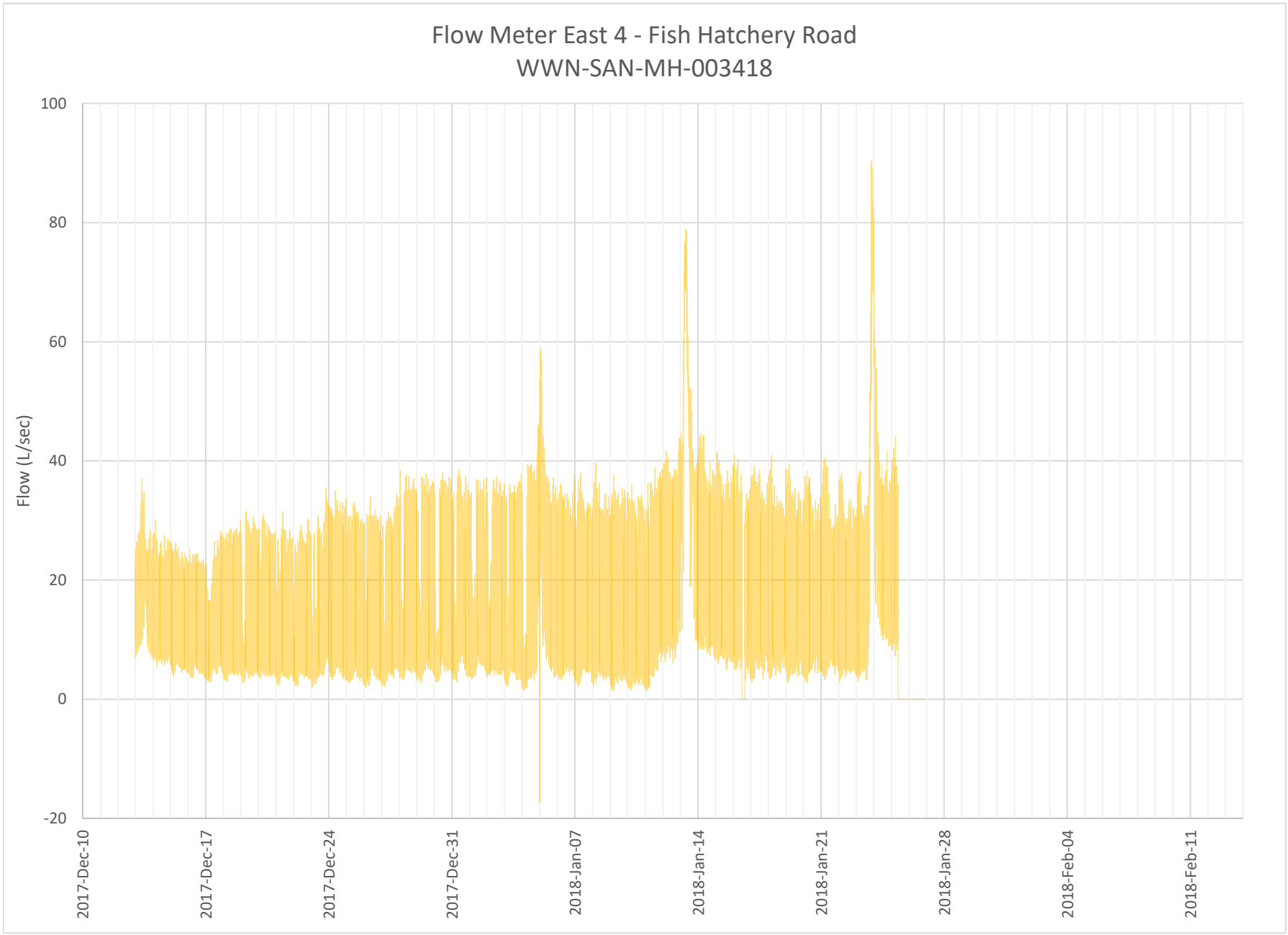
2017-Nov-26
2017-Dec-03
2017-Dec-10
2017-Dec-17

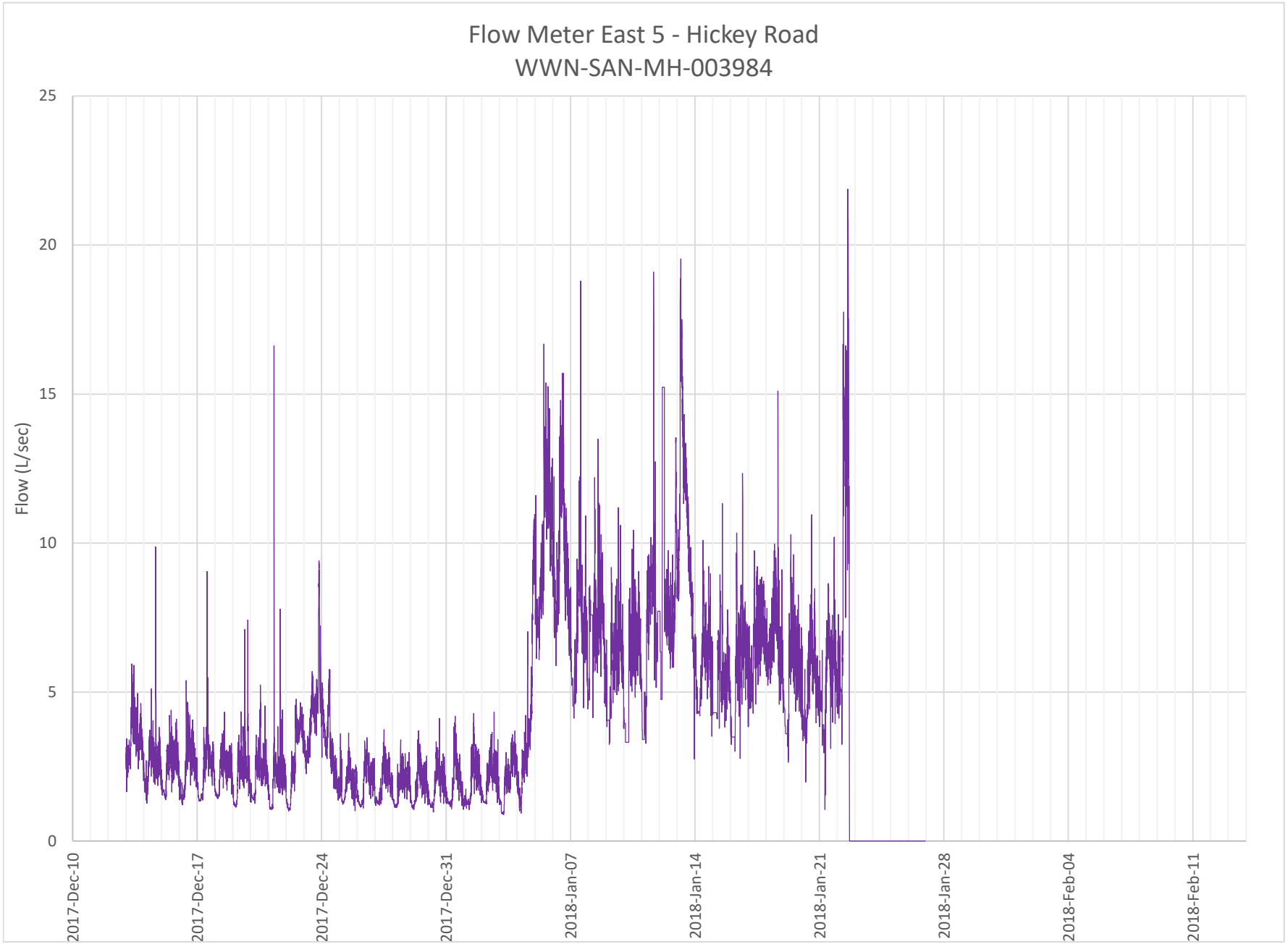

METER Uptown 1 - Market Square
WWN-SAN-MH-004726
Flow (L/sec)
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
2018-Feb-22
2018-Mar-01
2018-Mar-08
2018-Mar-15
2018-Mar-22
2018-Mar-29
2018-Apr-05

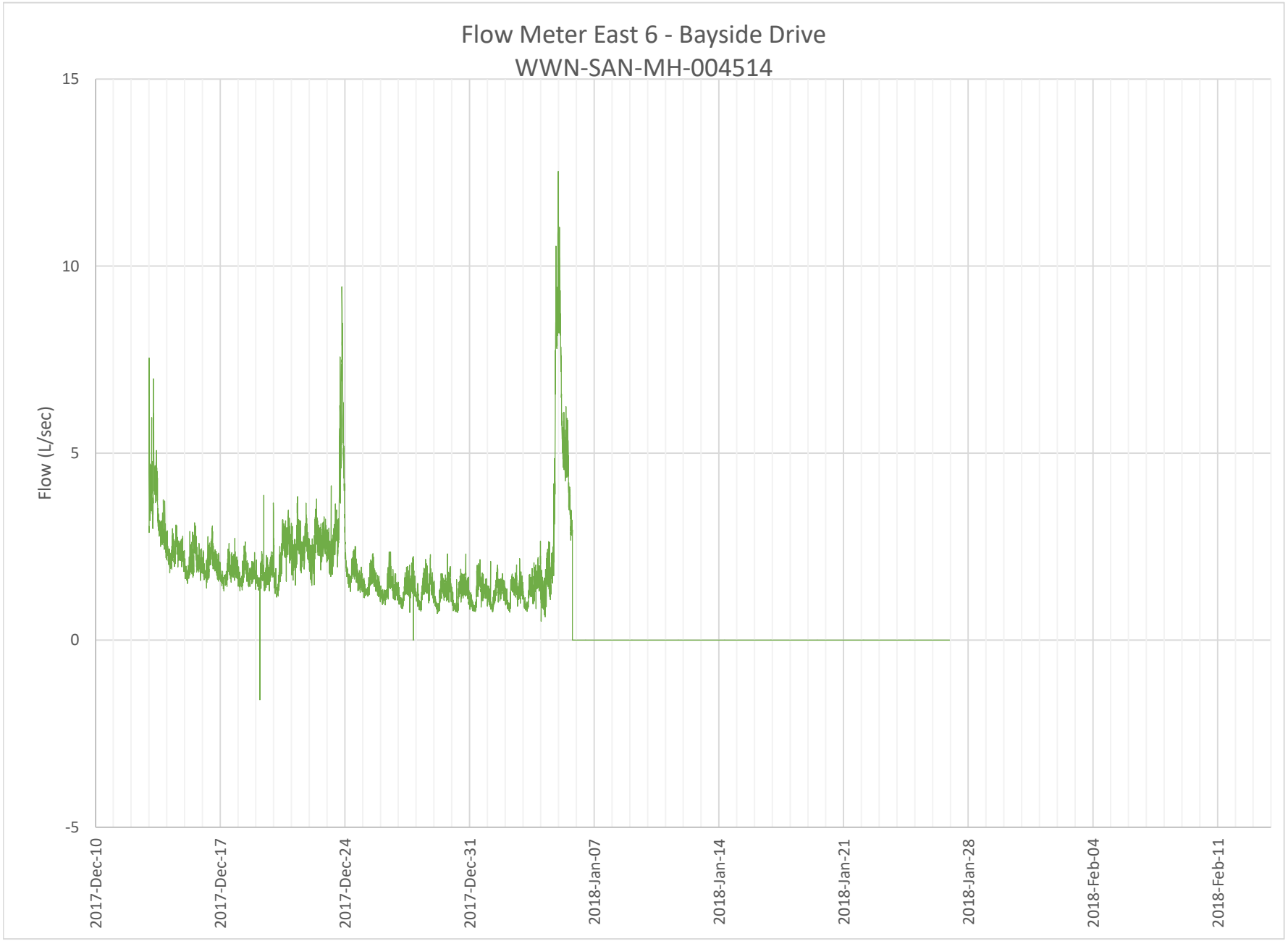

METER Uptown 2 - Water Street
WWN-SAN-MH-202217
Flow (L/sec)
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
2018-Feb-22
2018-Mar-01
2018-Mar-08
2018-Mar-15
2018-Mar-22
2018-Mar-29
2018-Apr-05


Flow Meter East 1 -Parkhill Drive
WWN-SAN-MH010571
Flow (L/sec)
170
150
130
110
90
70
50
30
10
-10
2017-Dec-10
2017-Dec-17
2017-Dec-24
2017-Dec-31
2018-Jan-07
2018-Jan-14
2018-Jan-21
2018-Jan-28
2018-Feb-04
2018-Feb-11


Flow Meter East 3 - Todd Street
WWN-COM-MH-010908
Flow (L/sec)
30
10
-10
-30
2017-Dec-10
2017-Dec-17
2017-Dec-24
2017-Dec-31
2018-Jan-07
2018-Jan-14
2018-Jan-21
2018-Jan-28
2018-Feb-04
2018-Feb-11

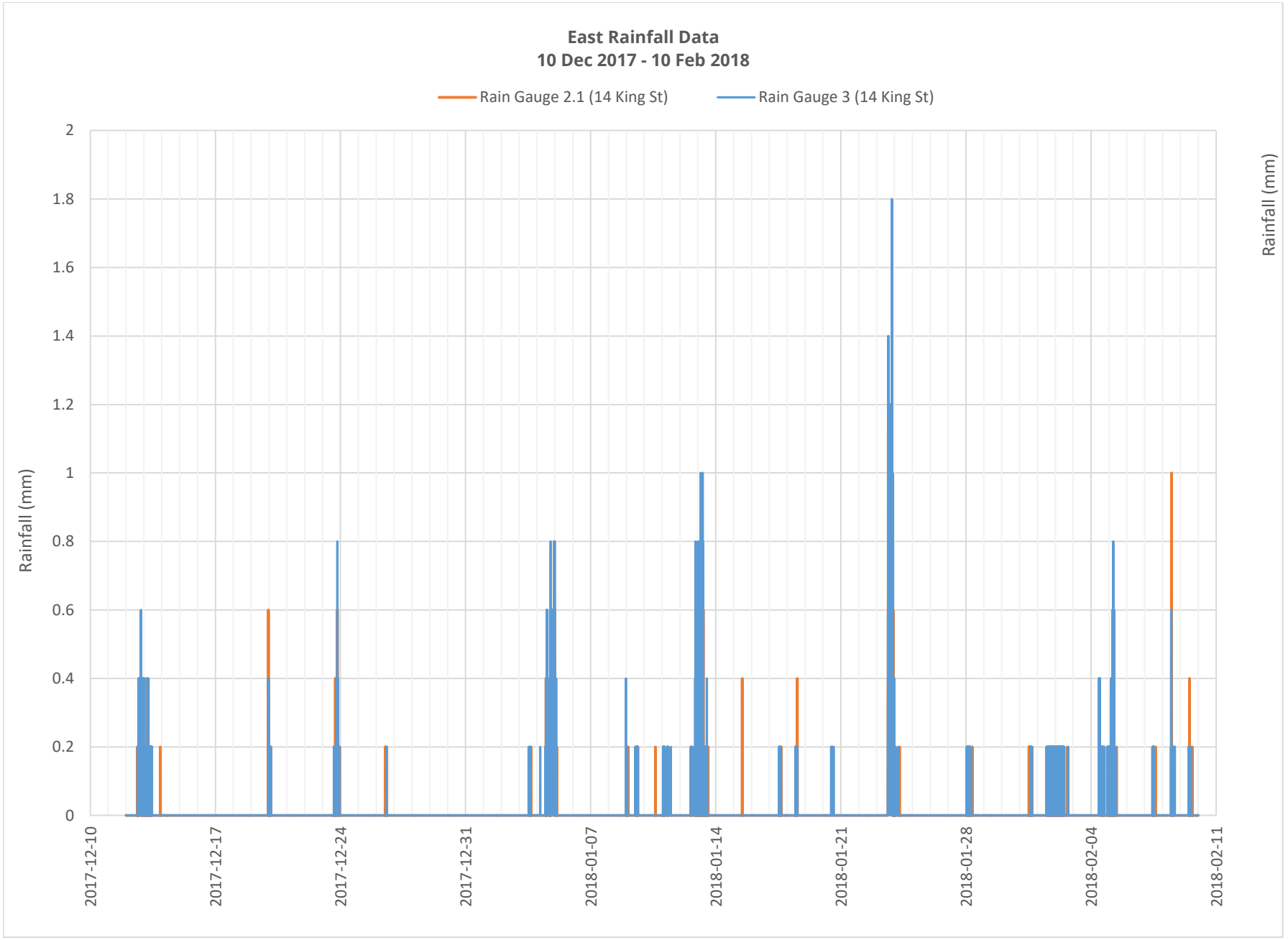

Flow Meter East 4 - Fish Hatchery Road
WWN-SAN-MH-003418
Flow (L/sec)
100
80
60
40
20
0
-20
2017-Dec-10
2017-Dec-17
2017-Dec-24
2017-Dec-31
2018-Jan-07
2018-Jan-14
2018-Jan-21
2018-Jan-28
2018-Feb-04
2018-Feb-11

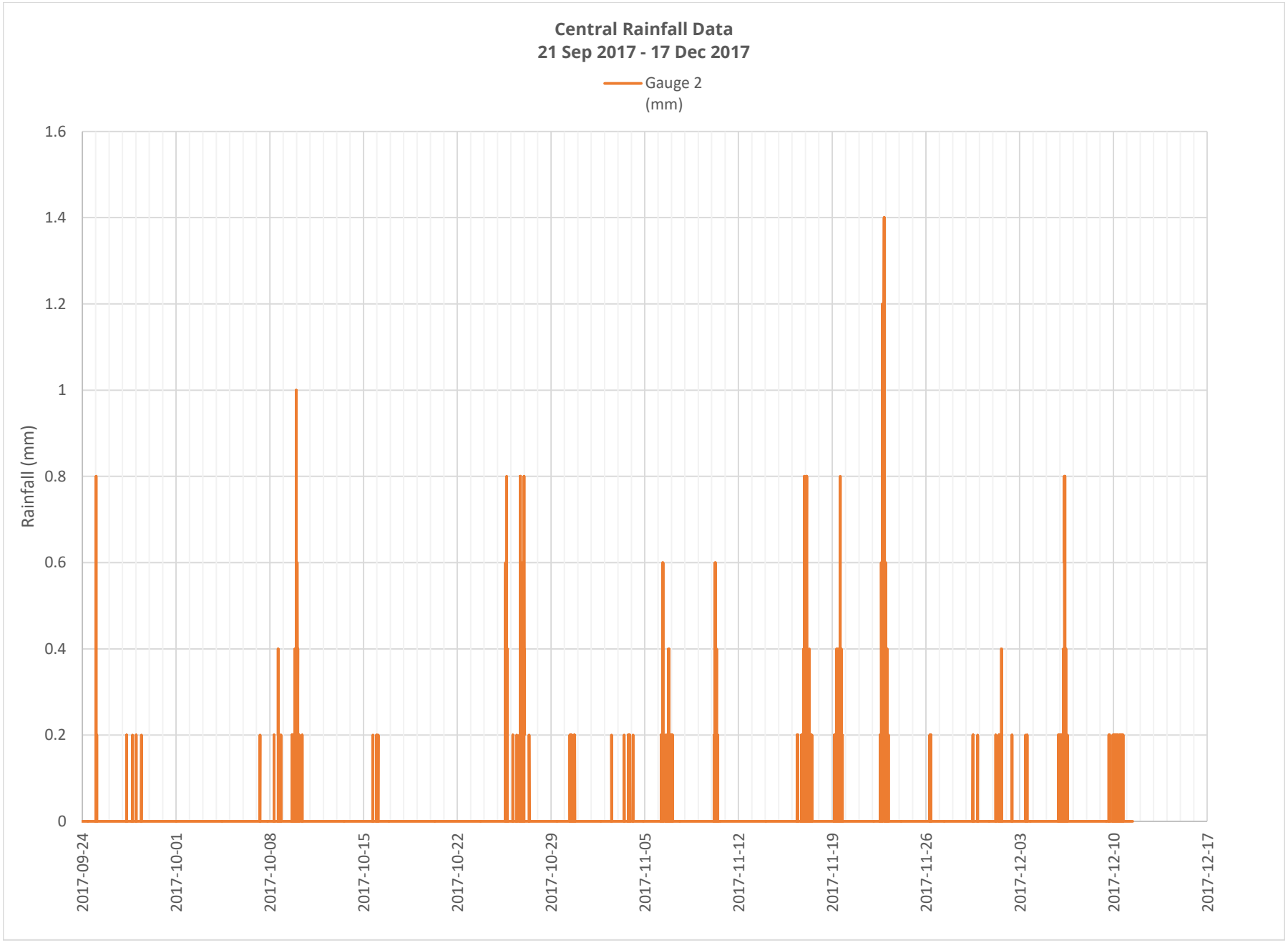

Flow Meter East 5 - Hickey Road
WWN-SAN-MH-003984
Flow (L/sec)
25
20
15
10
5
0
2017-Dec-10
2017-Dec-17
2017-Dec-24
2017-Dec-31
2018-Jan-07
2018-Jan-14
2018-Jan-21
2018-Jan-28
2018-Feb-04
2018-Feb-11

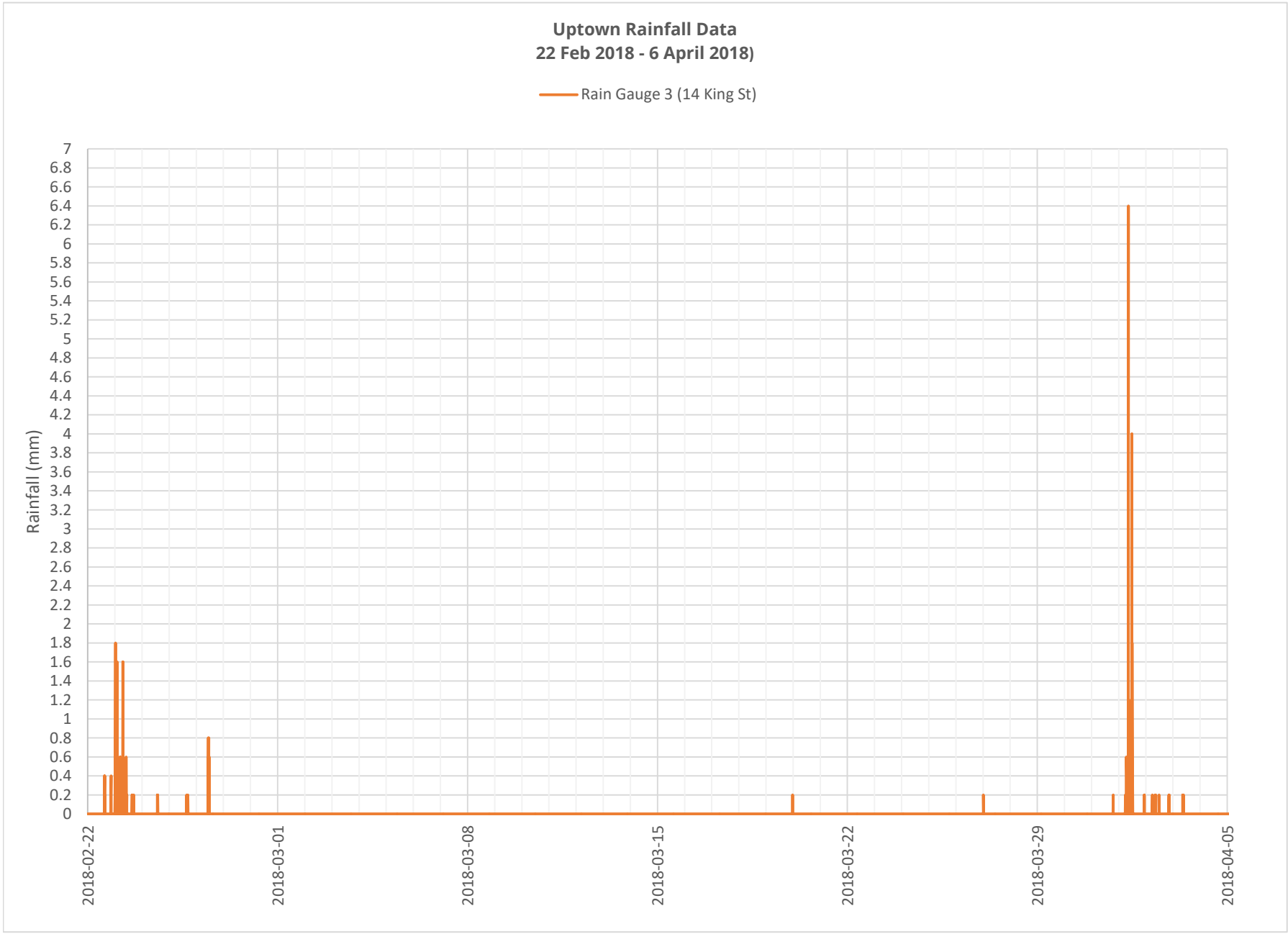

Flow Meter East 6 - Bayside Drive
WWN-SAN-MH-004514
Flow (L/sec)
15
10
5
0
-5
2017-Dec-10
2017-Dec-17
2017-Dec-24
2017-Dec-31
2018-Jan-07
2018-Jan-14
2018-Jan-21
2018-Jan-28
2018-Feb-04
2018-Feb-11

APPENDIX C

Recorded Rain Gauge Data


East Rainfall Data
10 Dec 2017 - 10 Feb 2018
Rain Gauge 2.1 (14 King St)
Rain Gauge 3 (14 King St)
Rainfall (mm)
Rainfall (mm)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2017-12-10
2017-12-17
2017-12-24
2017-12-31
2018-01-07
2018-01-14
2018-01-21
2018-01-28
2018-02-04
2018-02-11


Central Rainfall Data
21 Sep 2017 - 17 Dec 2017
Gauge 2
(mm)
Rainfall (mm)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2017-09-24
2017-10-01
2017-10-08
2017-10-15
2017-10-22
2017-10-29
2017-11-05
2017-11-12
2017-11-19
2017-11-26
2017-12-03
2017-12-10
2017-12-17


Uptown Rainfall Data
22 Feb 2018 - 6 April 2018)
Rain Gauge 3 (14 King St)
Rainfall (mm)
7
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2018-02-22
2018-03-01
2018-03-08
2018-03-15
2018-03-22
2018-03-29
2018-04-05

APPENDIX D

Lift Station Data Summary

Lift Station	Operation and Maintenance Manual	Record Drawings	Pumping Data	Drawdown Test	Other Supporting Documents
SLS#4 Thorne Avenue	X	Thorne Avenue Lift Station #4 Contract No. 2010-01 (Sheet 1 to Sheet 85)	Technical specifications, performance curve, VFD curve, VFD analysis, duty analysis, and dimensional drawing (2017-03-15)		
SLS#5 Marsh Street			Technical specification, performance curve, duty analysis, and dimensional drawing (2012-08-14)	15/11/2017	
SLS#6 Municipal Operations		Rothesay Avenue- Sanitary Lift Station #6 & Force Main- Overall plan, civil site plan, plan and profiles, CSO chamber details, architectural details, mechanical plan, and electrical site plan, details and diagrams (Sheet 1 to Sheet 15)		15/11/2017	
SLS#7 Elliott Row			Performance curve (2012-06-18)	16/11/2017	
SLS#7A King Street East			Performance curve (2012-06-18)	16/11/2017	
SLS#8 Crown Street	X	Crown Street SLS No. 8 & Force Main- Profile and plans, CSO details, civil, architectural, structural, mechanical, and electrical (Sheet 1 to Sheet 23)	Data sheet, performance curve, and installation plan (2011-06-27)	15/11/2017	
SLS#9 Lower Cove Loop	X	Lower Cove Loop Sanitary Lift Station No. 9 & Force Main- Plan and profiles, CSO chambers, grading plan, mechanical, architectural, structural, and electrical (Sheet 1 to Sheet 17)	Technical specification, performance curve, and duty analysis (2017-08-06)	15/11/2017	Shop drawing review
SLS#10 Harbour Station	X	Harbour Station SLS No.10 & Force Main- Plan and profiles, civil, architectural, mechanical, electrical, and structural (Sheet 1 to Sheet 21)	Hydraulic datasheet and construction datasheet (2010-12-22)	16/11/2017	
SLS#10A Chesley Drive	X	Chesley Drive Sanitary Lift Station No. 10A Force Main & Sewer- Profile and plans, miscellaneous details, chamber detail, arhitectural, structural, mechanical, and electrical (Sheet 1 to Sheet 24)	Pumping unit data sheet, pumping unit curve, and pumping unit dimensional drawing (2011-10-07)	16/11/2017	
Lily Lake Pavilion		Lily Lake Pavillion Wastewater Pumping Station & Valve Chamber- Details and site plan (Sheet 1 and Sheet 1)			
Douglas Avenue	X	Douglas Avenue (Bentley Street to Claredon Street) Water, Sanitary and Storm Sewer Renewal, and Lift Station Installation- Key plan and general notes, plan and profiles, douglas avenue lift station, and electrical (Sheet 1 to Sheet 10)			
Fallsview	X	Fallsview Park- Watermain and sanitary forcemain, sanitary lift station, aluminum hatch cover for sanitary lift station and electrical (Sheet 1 to Sheet 4)			
Private					
Bayside Drive 3	X	Bayside Drive Sanitary Lift Station #3, Force Main and Sewer- Overall site plan, civil, plan and profiling, chamber details, architectural, mechanical, and electrical (Sheet 1 to Sheet 14)	Performance curve (2016-11-11)		Service and repair instructions as well as a parts list
Hickey Road	X	Hickey Road- Wastewater Lift Station Upgrades- Site plan, bypass pumping plan, mechanical, and details (Sheet 1 to Sheet 6)			Hickey Road WWPS- Mechnical and Electrical Upgrade Study (2010-02-10), Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS03 Hickey Road (2008-02), Hickey Road Drainage Basin Study (2006-07-24), and Lakewood Heights Sanitary Infrastructure Assessment (2013-06)
Majors Brook Drive					
Major's Brook		Marsh Creek Sewerage Scheme-			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS36 Major Brook (2008-02)
One Mile		Marsh Creek Sewerage Scheme- Glen falls pumping station, rothesay avenue pumping station, sewage treatment plant, control and instrumentation, location plan, and flow chart (Sheet 1 to 31), Rothesay Avenue Pump Station- Pump and piping, electrical renovations, and fresh air ductwork (Sheet 1 to Sheet 3), Rothesay Avenue and Simpson Dirve Wastewater Pumping Stations Mechnical and Electrical Systems Upgrades- General notes and key plan, rothesay avenue pumping station removal plan and sections, proposed plan and sections, dry and wet well electrical upgrades, simpson drive pumping station removal plan and section, proposed plan and section, dry and well electrical upgrades, and miscellaneous details (Sheet 1 to Sheet 8), and Rothesay Avenue Pumping Station- Renovations (Sheet 1 of 1).			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS30 Rothesay Avenue (2008-02)

Lift Station	Operation and Maintenance Manual	Record Drawings	Pumping Data	Drawdown Test	Other Supporting Documents
Red Head Road 1	X	Red Head Road- Sanitary Lift Stations #1 and #50- Overall plan, civil site plan and section, architectural details, structural plan, mechanical plan, electrical floor plan and site plan, and SLS #1 and SLS #50 control diagrams (Sheet 1 to Sheet 11).			Effluent flow, pump 1 and 2 run status
Red Head Road 50	X	Red Head Road- Sanitary Lift Stations #1 and #50- Overall plan, civil site plan and section, architectural details, structural plan, mechanical plan, electrical floor plan and site plan, and SLS #1 and SLS #50 contral diagrams (Sheet 1 to Sheet 11)			Pump 1, 2 and 3 run status as well as wet well level
Champlain Drive South		Little River Sewerage Scheme Constract D Champlain Heights Collector System- Plan and profile as well as construction details (Sheet 1 to Sheet 7)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS01 Champlain South (2008-04)
Drury Cove	X	Drury Cove Development INC. Saint John, New Brunswick, Wasterwater Pumping Station and Force Main Rothesay Avenue and Rothesay Road (Walter Street to Drury Cove Road)- Sheets, site plan, wet well details, control building, miscellaneous details, environmental details and electrical as well as control details (Sheet 5520 to Sheet 5533)	-		Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS28 Drury Cove (2008-04)
Fox Den	X	Drury Cove Development INC. Saint John, New Brunswick, Highlands of Drury Cove- Phase II, Fox Point Drive- Fox Den Court Streets, Services and Wastewater Pumping Station- Key plan, roads, and wastewater pumping station #1 (Sheet 1 to Sheet 4) and City of Saint John Drury Cove Fox Den Lift Station- Schematic wiring diagrams, enclosure door layout, field wiring details, level details, fuse table, material list and general notes (728-43-091A to 728-43-091H)	Performance curve (2005-04-13)		Adjustable frequency AC drive user manual, RSLogix500 project report, packing list, lift station design, multiranger instruction manual, and PowerFlex 40 adjustable frequency AC drive quick start guide
McAllister Drive		Shamrock Reality LTD. Highmeadow Park McAllister Drive Saint John- Services stage I-phase 1 & 2 (Sheet 1 of 1), MacAllister Wastewater Pumping Station Electrical Service Repair- Wastewater pumping station details (Sheet 1 of 1), and MacAllister Wastewater Pumping Station- Control panel wiring (Sheet 1 of 1)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS04 McAllister Drive (2008-04)
McAllister Industrial Park		Hazen Creek Sewage Treatment Plant (Sheet 1 to 78)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS08 McAllister Park (2008-02)
Pauline Street		Little River Sewerage Scheme Constract B Champlain Heights Collector System- Piping, structural, miscellaneous details, architectural, electrical and mechanical (Sheet 1 to Sheet 11)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS06 Pauline Street (2008-02) and Lakewood Heights Sanitary Infrastructure Assessment (2013-06)
Simpson Drive		Marsh Creek Sewerage Scheme- Glen falls pumping station, rothesay avenue pumping station, sewage treatment plant, control and instrumentation, location plan, and flow chart (Sheet 1 to 31), Simpson Drive Pumping Station- Renovations (Sheet 1 of 1), Modfications to the Glen Falls Pumping Station- Section and details (Sheet 1 of 1), Modifications to the Glen Falls Pumping Station- Plan sections and details and wet well access ladder (Sheet 1 to Sheet 2), and Rothesay Avenue and Simpson Drive Wastewater Pumping Stations Mechnical and Electrical Systems Upgrades- General notes and key plan, rothesay avenue pumping station removal plan and sections, proposed plan and sections, dry and wet well electrical upgrades, simpson drive pumping station removal plan and section, proposed plan and section dry and well electrical upgrades, and miscellaneous details (Sheet 1 to Sheet 8)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS31 Simpson Drive (2008-02)
Walter Street Ejector		Sewage Lift Station and Sanitary Sewer Extension- Plan/profile and detail plan (Sheet 1 to Sheet 2)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS32 Walter Street (2008-04)
Woodlawn Park	X	Woodlawn Park Subdivision External Servicing (Sheet 1 to Sheet 14)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS05 Woodlawn Park (2008-02)
York Street	X	Little River Sewerage Scheme Constract D Champlain Heights Collector System- Plan and profile as well as construction details (Sheet 1 to Sheet 7)			Energy Feasibility Study – Saint John Water & Wastewater Facilities WWPS02 York Street (2008-04)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