Flood Risk Mitigation Strategy for the Lower Cove Loop Sewer System

Client: City of Saint John

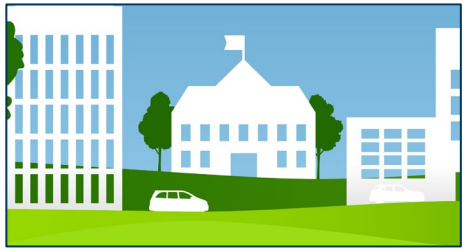
Consultant: CBCL

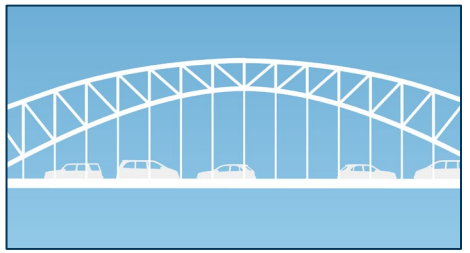
November 9, 2022

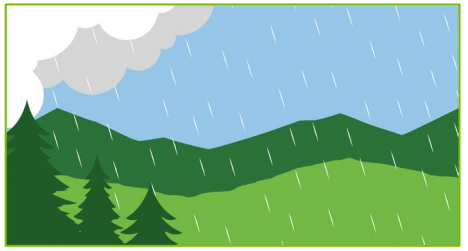
INnovative Solutions

CBCL has 12 offices in five provinces. Our diverse team of over 400 employees is committed to providing technical excellence and exceptional service.

We consider the short and long-term social, environmental, and sustainable effectiveness of every project. Our teams deliver in excess of 1,500 projects a year in multiple sectors.

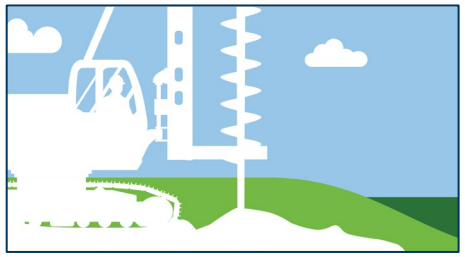

Buildings


Bridges

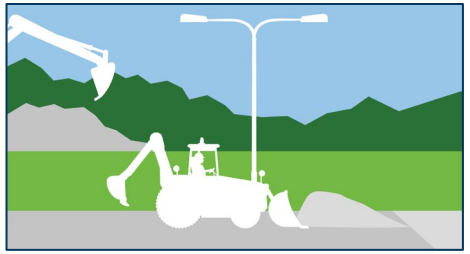

Climate Resilience


Coastal


Environmental

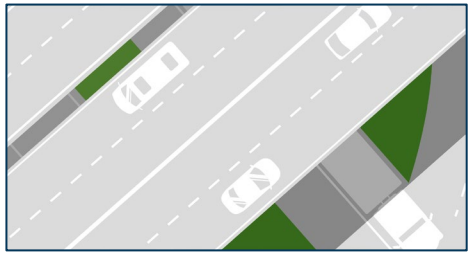

Geotechnical

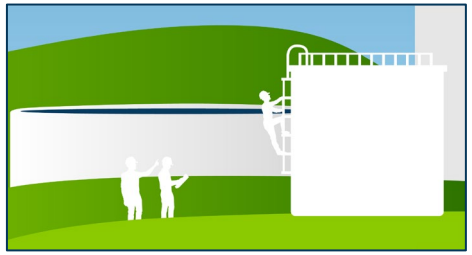

Industrial


Municipal

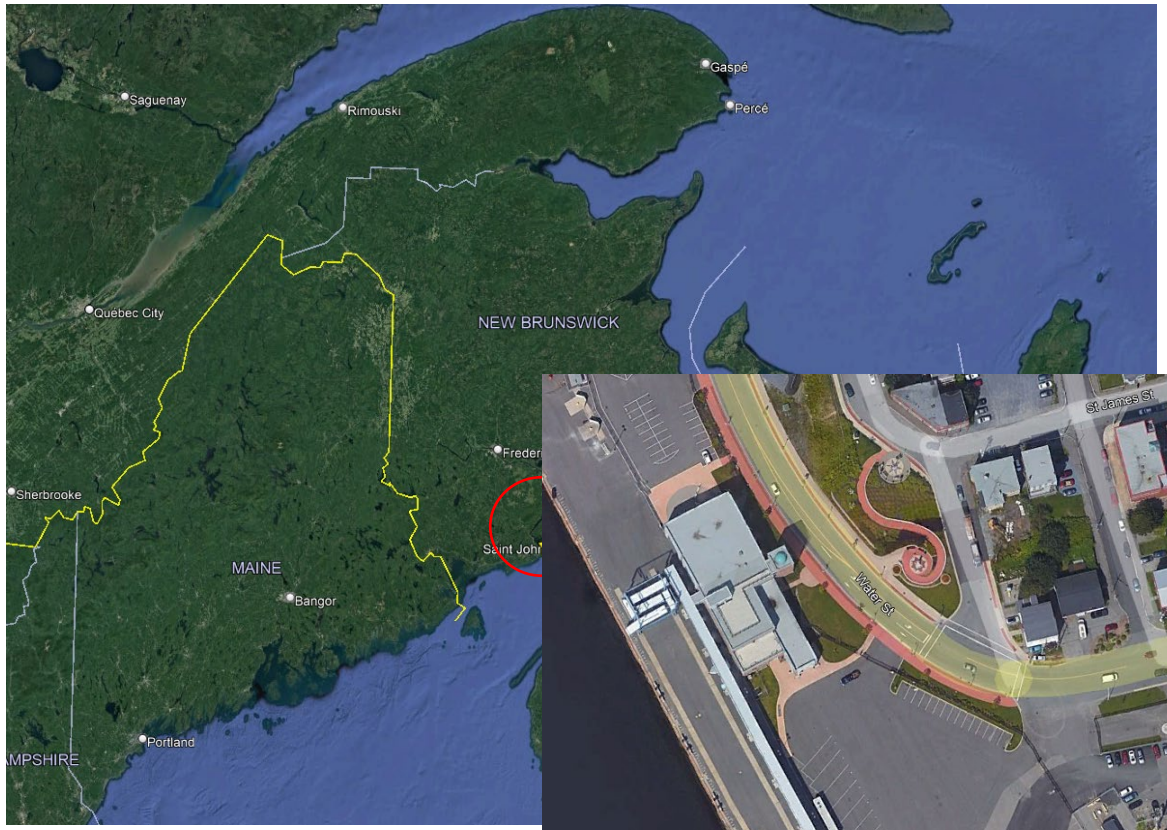

Ports & Marine


Sustainability


Transportation


Water

Project Background



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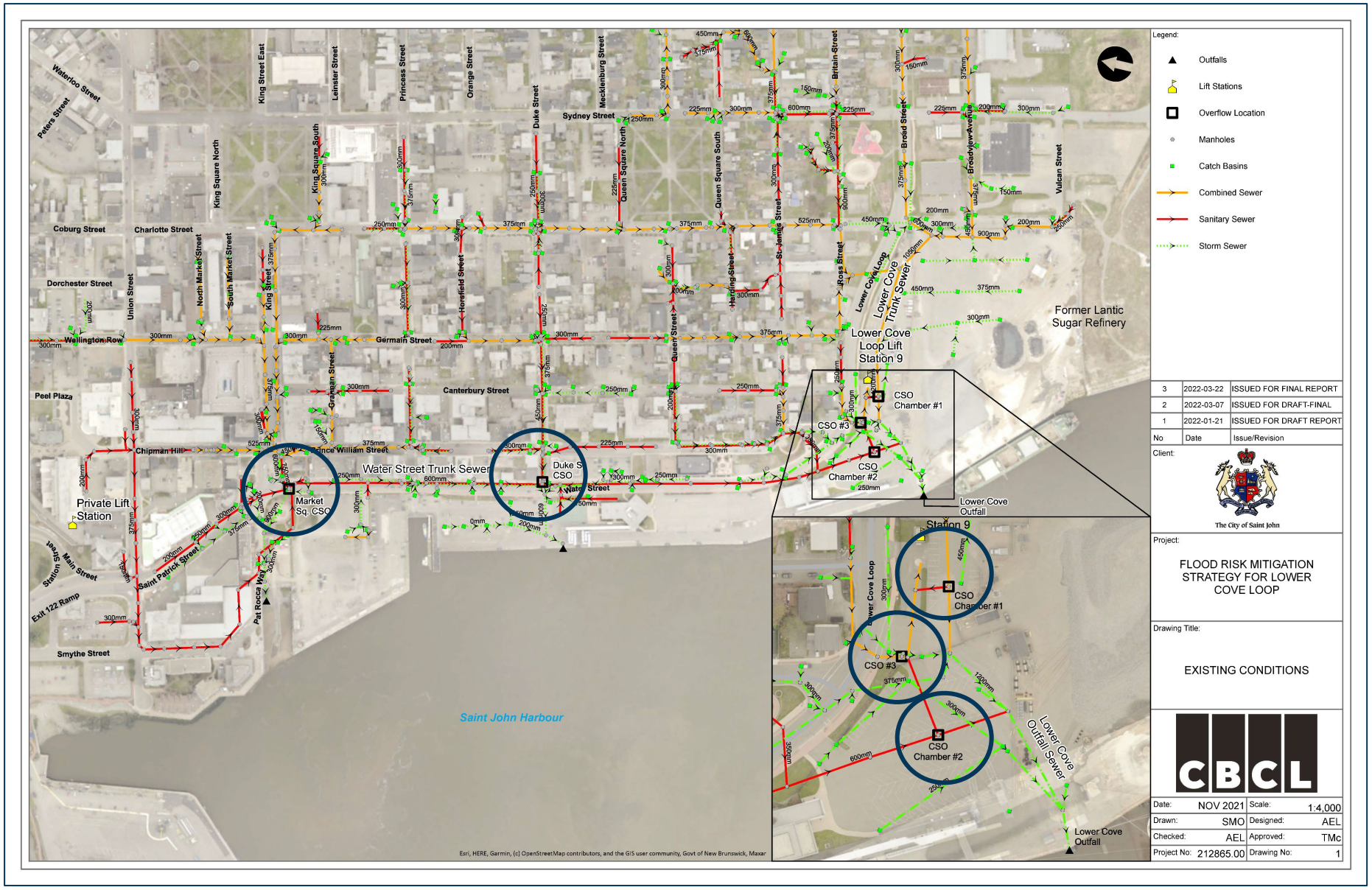
SAINT JOHN

Situation Plan: Lower Cove Loop



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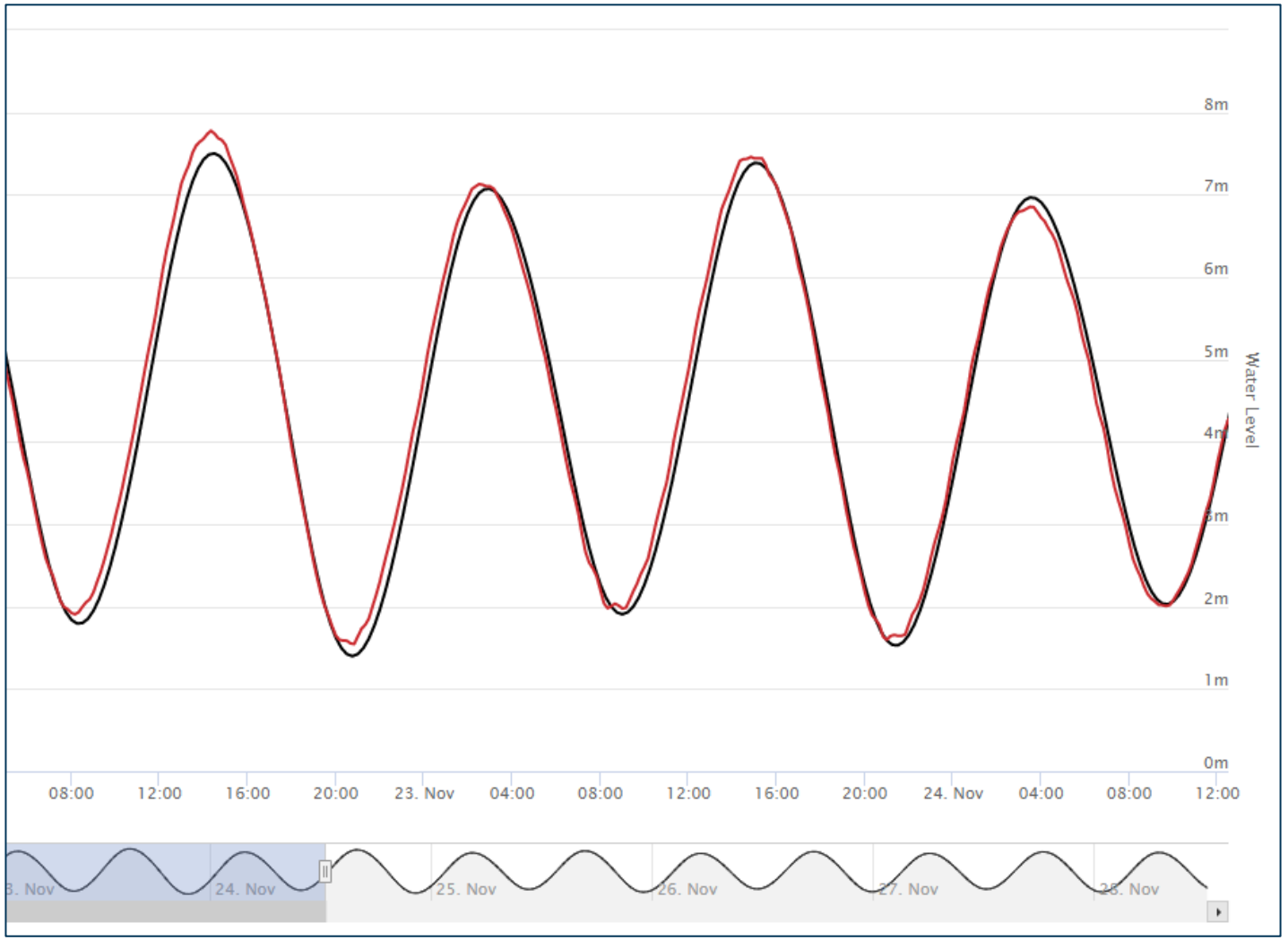
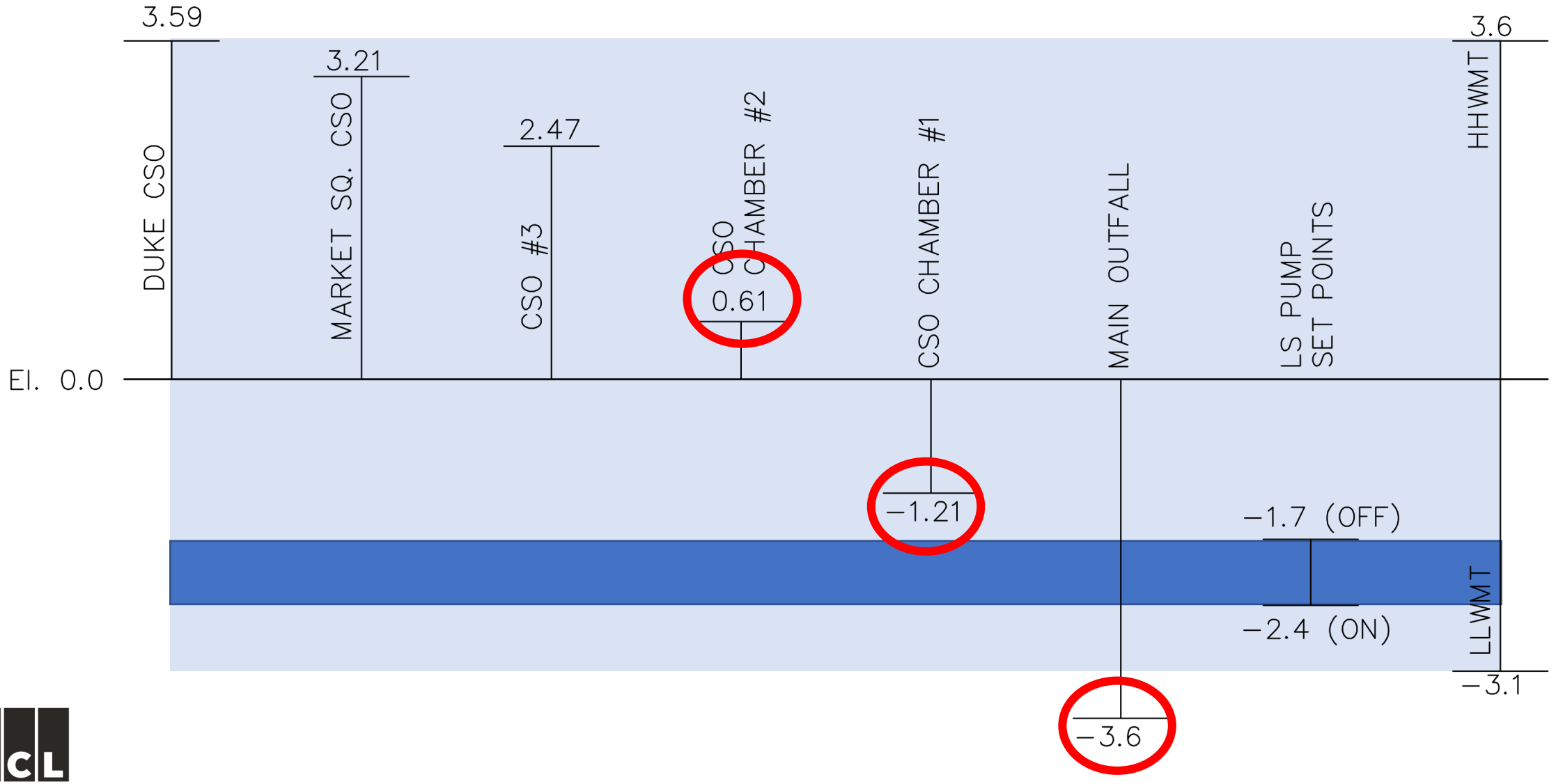
Saint John Harbour Tidal Range Station #65 (Current Conditions)

Tide	CGVD28 (m)
Highest Astronomical Tide (HAT)	4.8
Higher High Water Large Tide (HHWLT)	4.6
Higher High Water Mean Tide (HHWMT)	3.6
Mean Water Level (MWL)	0.3
Lower Low Water Mean Tide (LLWMT)	-3.1
Lower Low Water Large Tide (LLWLT)	-4.1
Lowest Astronomical Tide (LAT)	-4.2



Lower Cove Loop Sewer: Key Elevations



Estimated Increased Energy Usage to Pump Tidewater

Lift Station	Volume per High Tide (m^3)	Increased Energy Used per High Tide (kWh)	Increased Energy Used per Year (kWh)
SLS No. 9	1200	109	77,500
SLS No. 8	1200	105	74,000
SLS No. 4	1200	173	123,000
Total	1200	387	275,000

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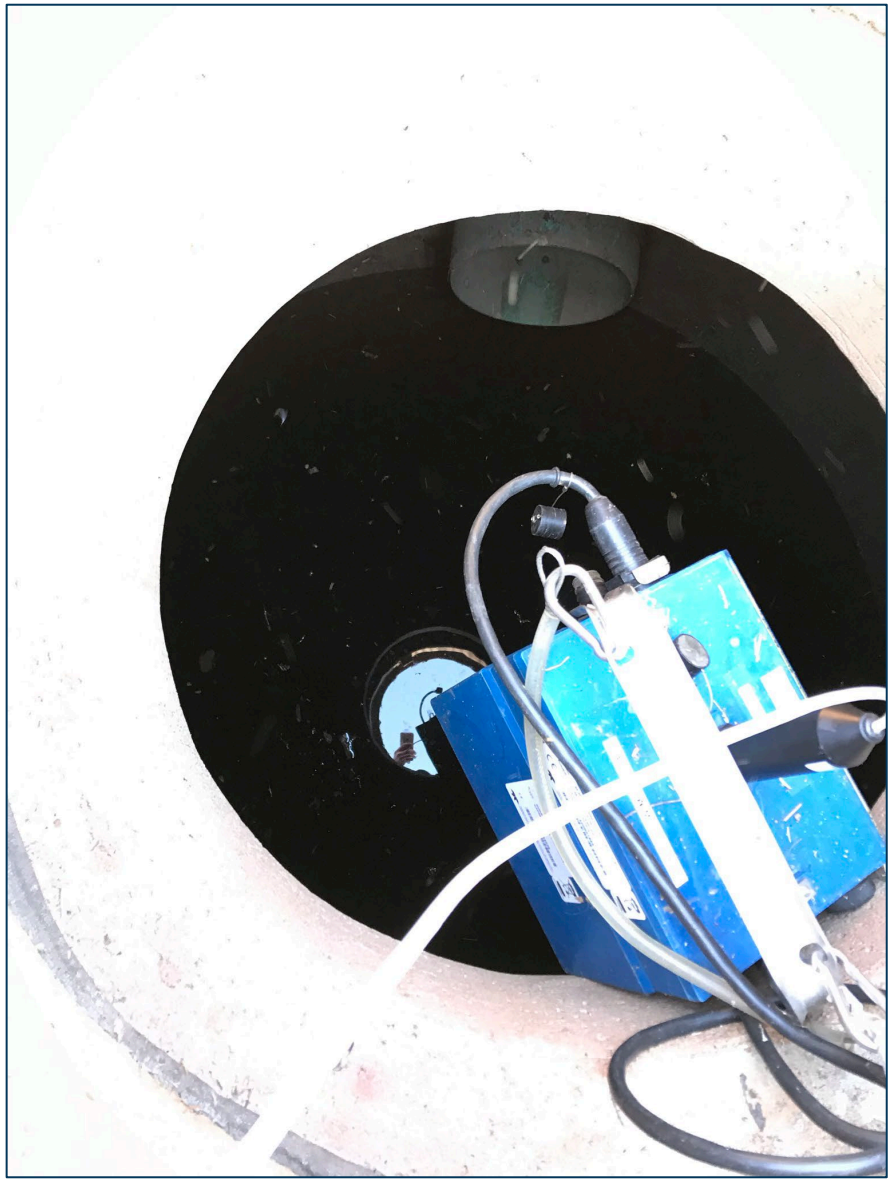
Predicted Saint John Tidal Range Station #65 (Future Conditions)

Tide	Current CGVD28 (m)	2050 SLR[1] CGVD28 (m)	2100 Intermediate SLR[2] CGVD28 (m)	2100 High SLR[3] CGVD28 (m)
Highest Astronomical Tide (HAT)	4.8	5.1	5.7	6.3
Higher High Water Large Tide (HHWLT)	4.6	4.9	5.5	6.2
Higher High Water Mean Tide (HHWMT)	**3.6**	**3.9**	**4.4**	**5.1**
Mean Water Level (MWL)	0.3	0.6	1.2	1.8
Lower Low Water Mean Tide (LLWMT)	**-3.1**	**-2.7**	**-2.2**	**-1.5**
Lower Low Water Large Tide (LLWLT)	-4.1	-3.8	-3.3	-2.6

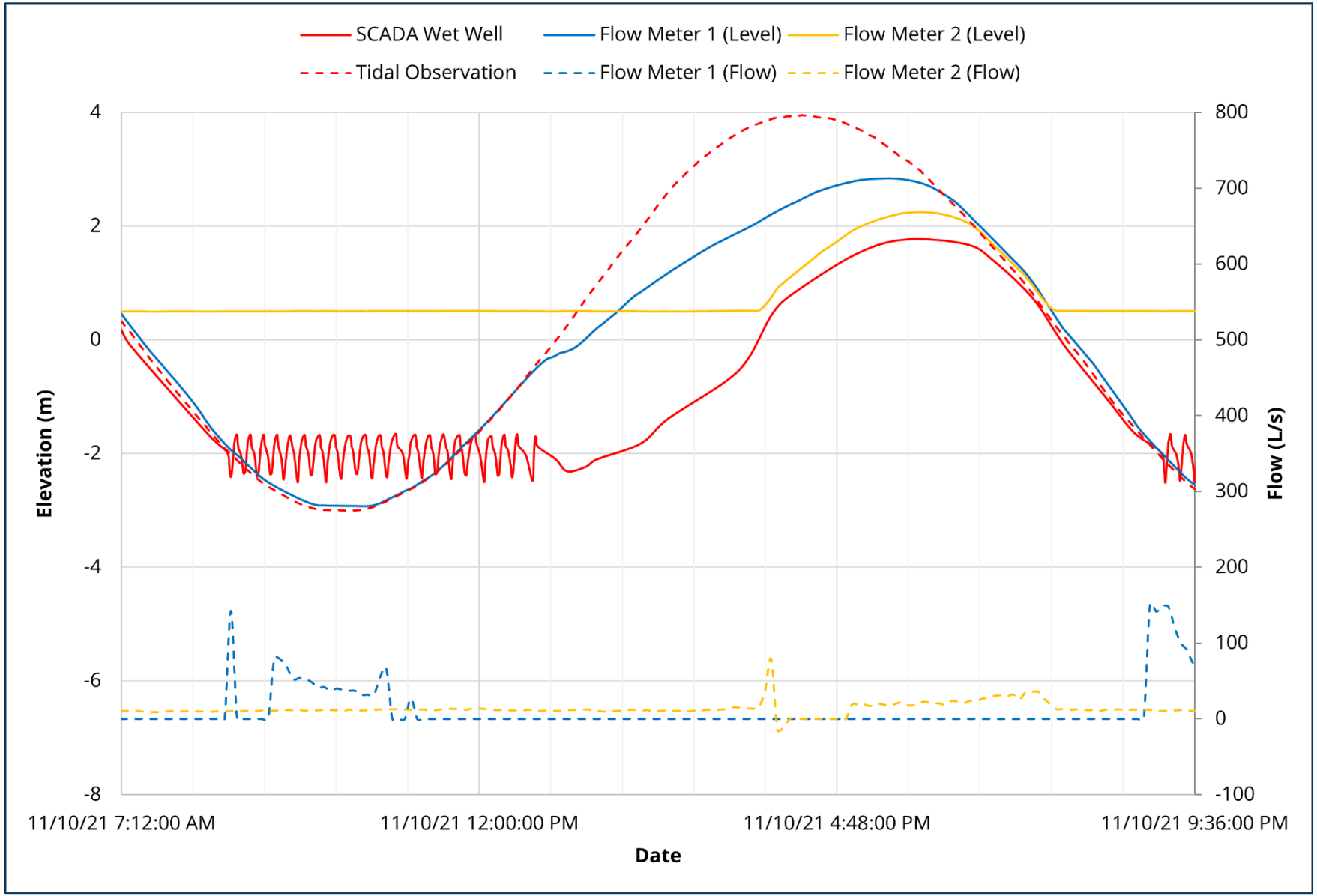
[1] - Sea Level Rise: 0.31 metres sea level rise to 2050 (RCP 8.5)
[2] - Moderate Sea Level Rise: 0.86 metres sea level rise to 2100 (RCP 8.5)
[3] - High Sea Level Rise: 1.51 metres sea level rise to 2100 (RCP 8.5 + Antarctic Ice Sheet Scenario)

Field Programs

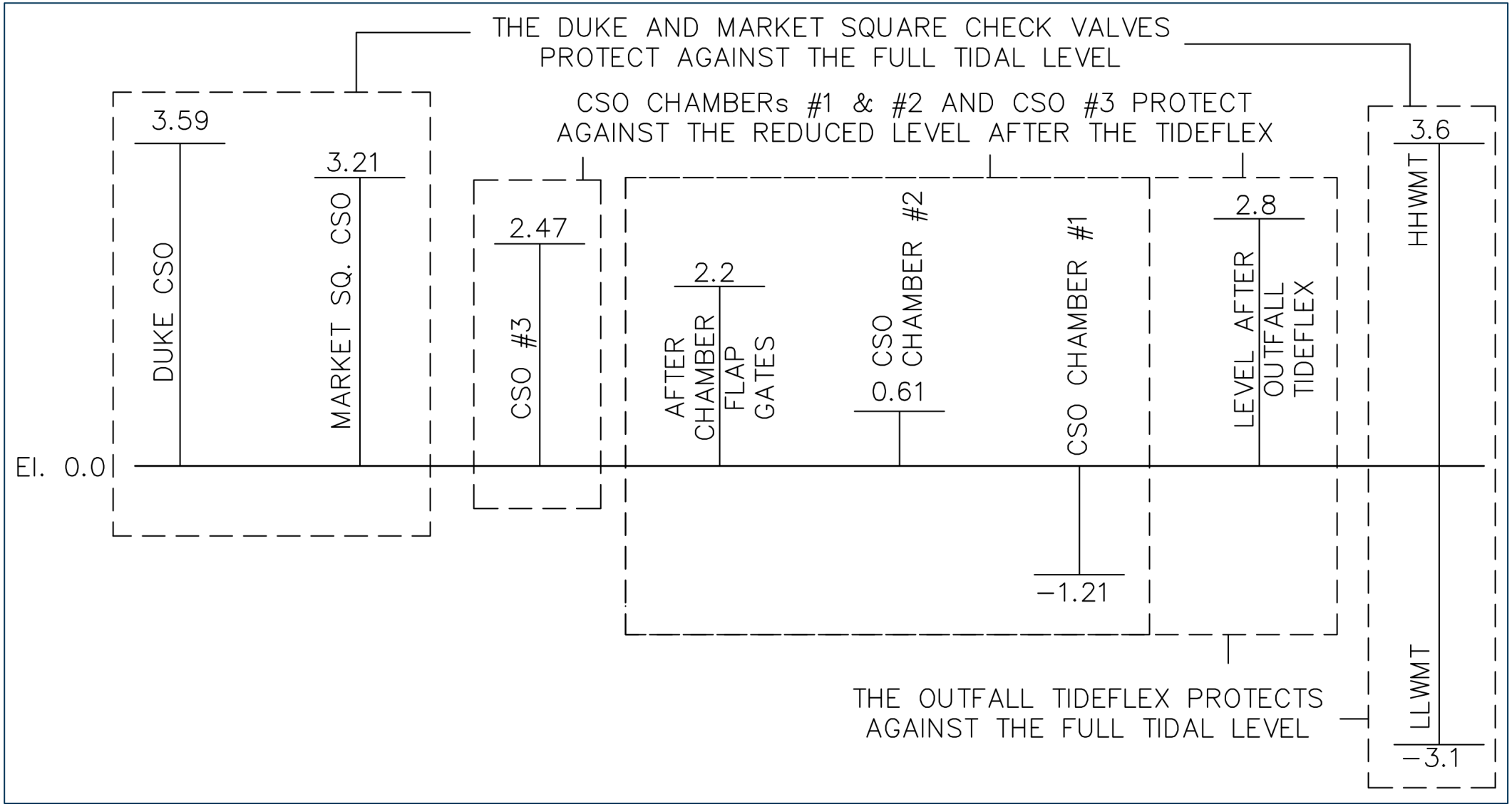
- Drone Inspections
- Flow Metering Program
- Salinity Testing
- Water Level Measurements
- CSO Chamber Inspections



Dry Weather


SCADA Wet Well
Flow Meter 1 (Level)
Flow Meter 2 (Level)
Tidal Observation
Flow Meter 1 (Flow)
Flow Meter 2 (Flow)
4
2
0
-2
-4
-6
-8
800
700
600
500
400
300
200
100
0
-100
Elevation (m)
Flow (L/s)
11/10/21 7:12:00 AM
11/10/21 12:00:00 PM
11/10/21 4:48:00 PM
11/10/21 9:36:00 PM
Date

Tides compared to CSO Thresholds and Sewer System



CSO Thresholds and Sea Level Rise

Location	Threshold Elevation (m)	Present Exceedance	2100 Intermediate SLR Exceedance
CSO Chamber #1	-1.21	66% (5,762 hrs/yr)	77% (6,777 hrs/yr)
CSO Chamber #2	0.61	46% (4,034 hrs/yr)	55% (4,838 hrs/yr)
CSO #3	2.47	22% (1,899 hrs/yr)	34% (3,001 hrs/yr)
Duke Street CSO	3.59	3.1% (273 hrs/yr)	17% (1460hrs/yr)
Market Square CSO	3.21	7.8% (686 hrs/yr)	24% (2,067 hrs/yr)
SLS No. 9 Wet Well Cover	5.4	0% (0 hrs/yr)	0.1% (2.2 hrs/yr)
SLS No. 9 Control Building Slab	5.5	0% (0 hrs/yr)	0.1% (0.5 hrs/yr)

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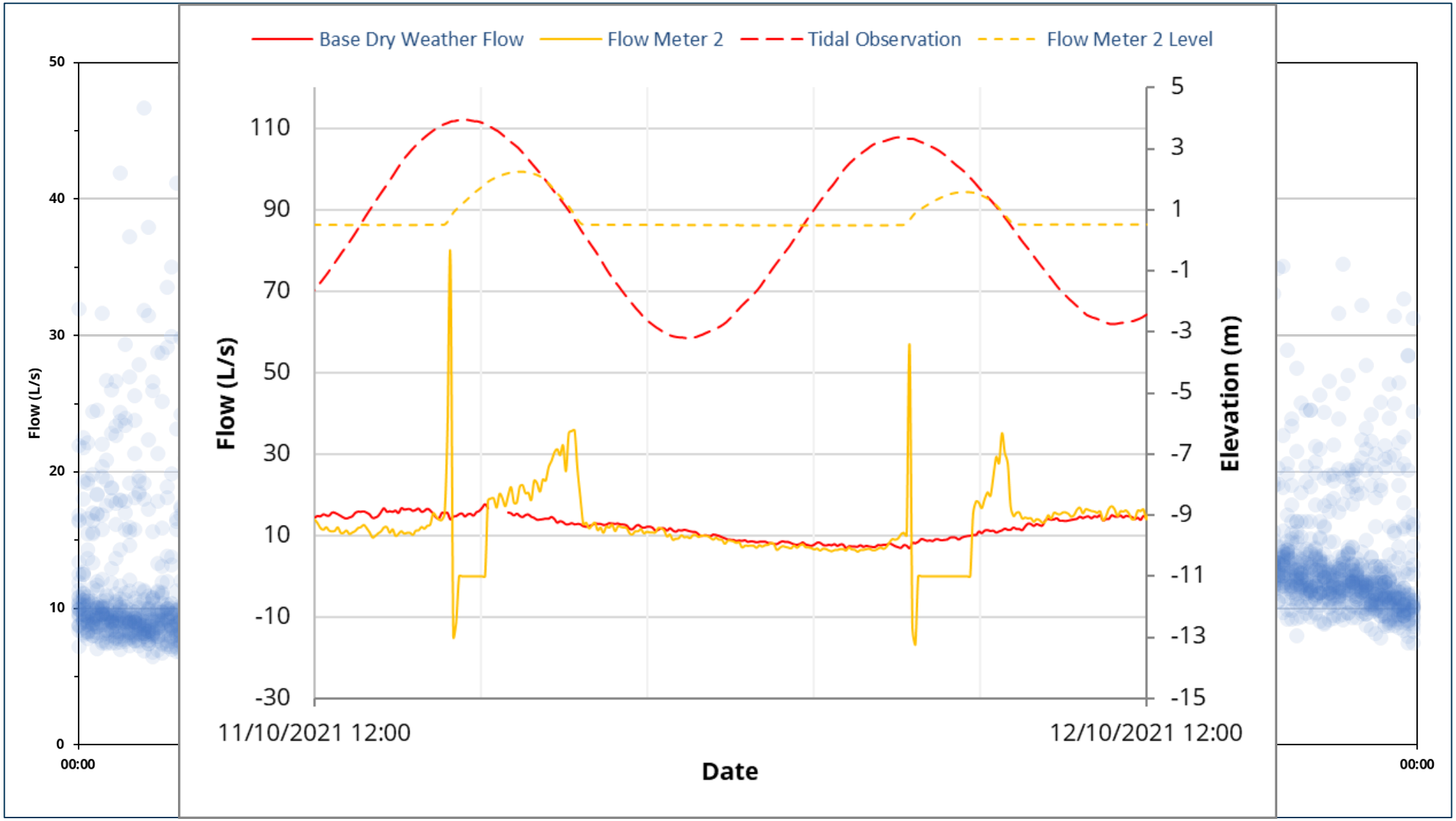
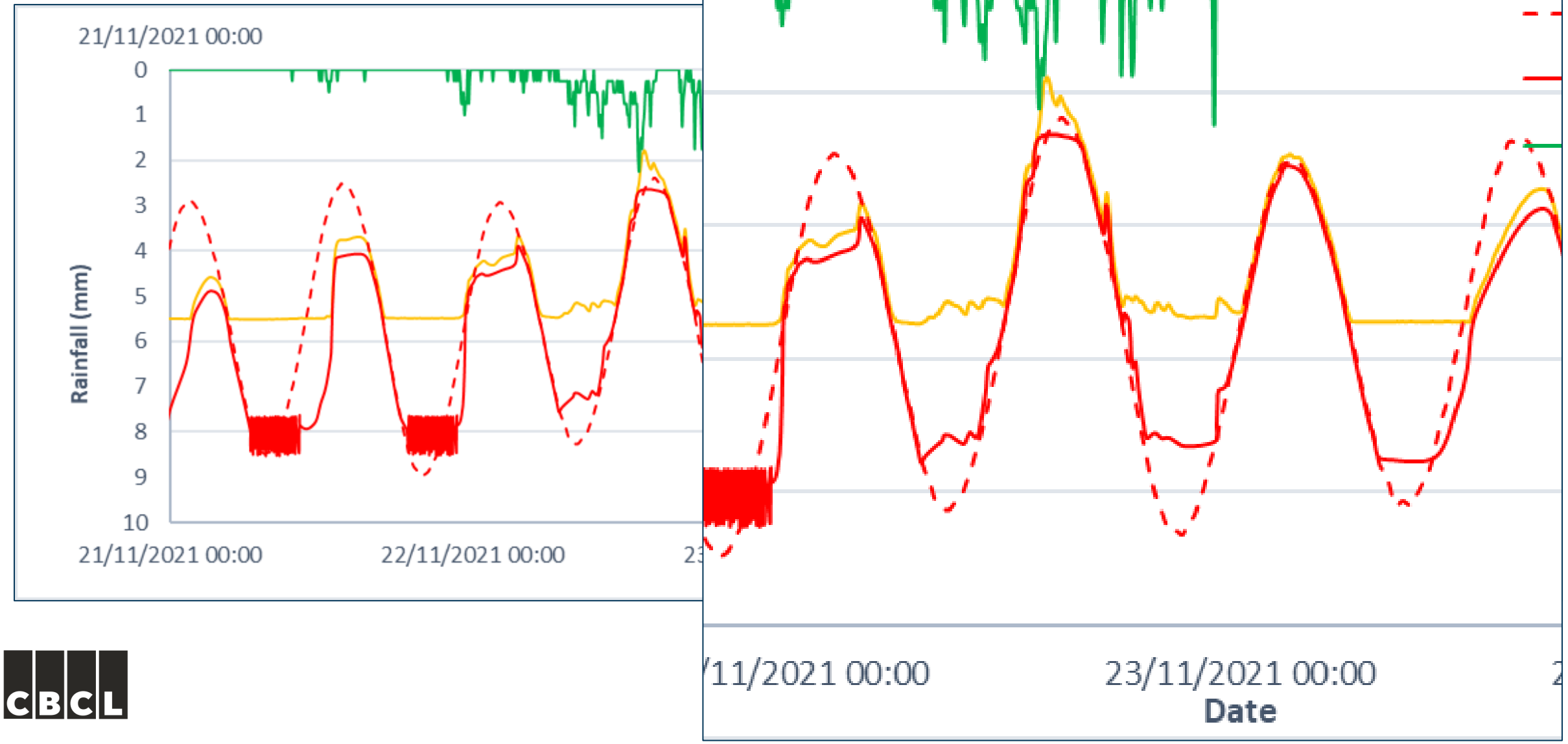
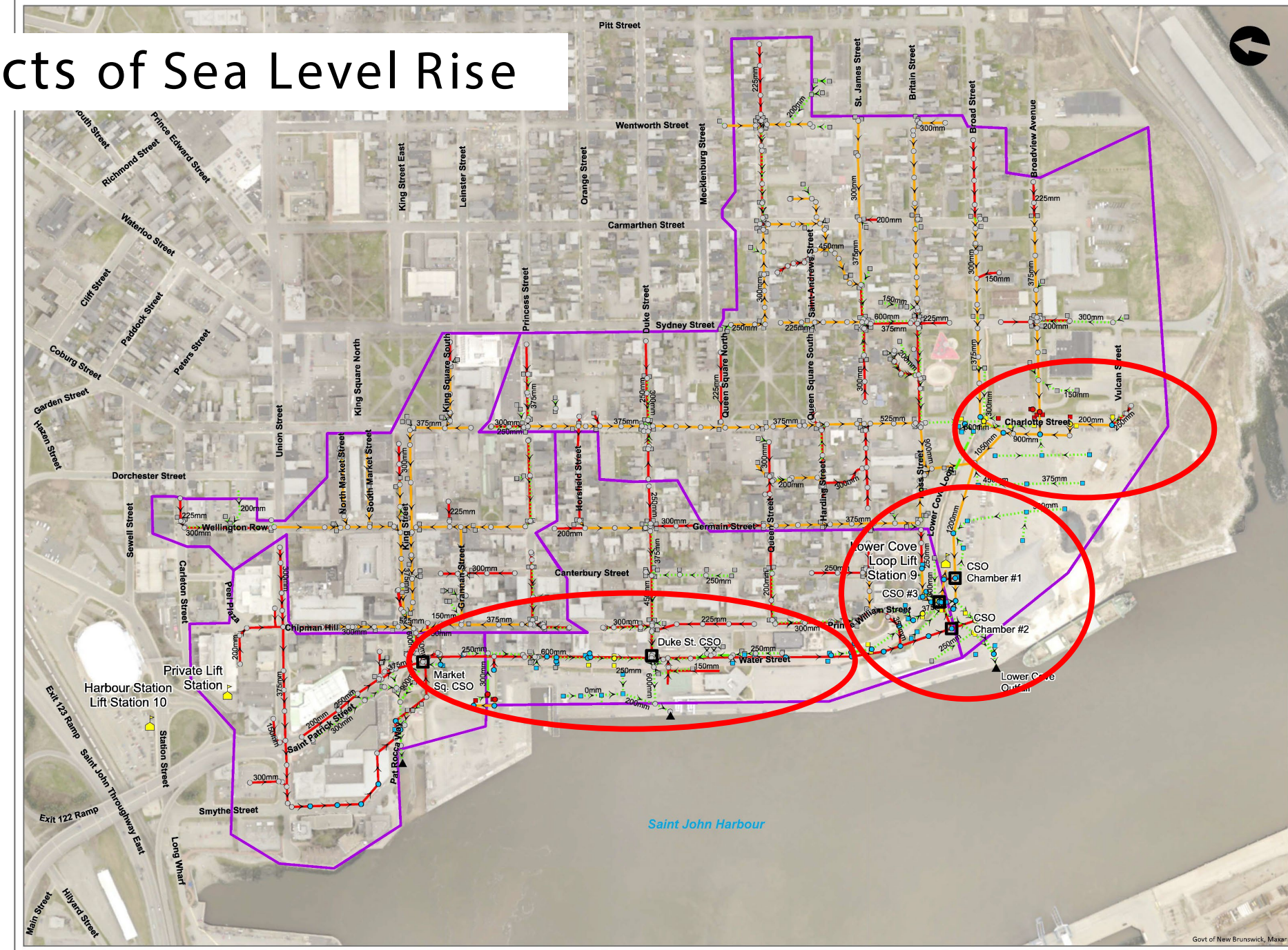
Flow Meter #2


Base Dry Weather Flow
Flow Meter 2
Tidal Observation
Flow Meter 2 Level
Flow (L/s)
110
90
70
50
30
10
-10
-30
Elevation (m)
5
3
1
-1
-3
-5
-7
-9
-11
-13
-15
11/10/2021 12:00
12/10/2021 12:00
Date
50
40
30
20
10
0
00:00
00:00

Wet Weather Flows



Impacts of Sea Level Rise



Legend:

- Outfalls
- Lift Stations
- Overflow Location

Manholes

- Current HHWLT (4.6m)
- 2050 HHWLT (4.9m)
- 2100 HHWLT - Intermediate (5.5m)
- Above 5.5m

Catch Basins

- Current HHWLT (4.6m)
- 2050 HHWLT (4.9m)
- 2100 HHWLT - Intermediate (5.5m)
- Above 5.5m
- Combined Sewer
- Sanitary Sewer
- Storm Sewer
- Sewershed

No	Date	Issue/Revision
3	2022-03-22	ISSUED FOR FINAL REPORT
2	2022-03-07	ISSUED FOR DRAFT-FINAL
1	2022-01-21	ISSUED FOR DRAFT REPORT

The City of Saint John

Project:

FLOOD RISK MITIGATION STRATEGY FOR LOWER COVE LOOP

Drawing Title:

SEWER INFRASTRUCTURE - TIDAL FLOODING

CBCL

Date:	JAN 2022	Scale:	1:5,000
Drawn:	SMO	Designed:	AEL
Checked:	AEL	Approved:	TMc
Project No:	212865.00	Drawing No:	6

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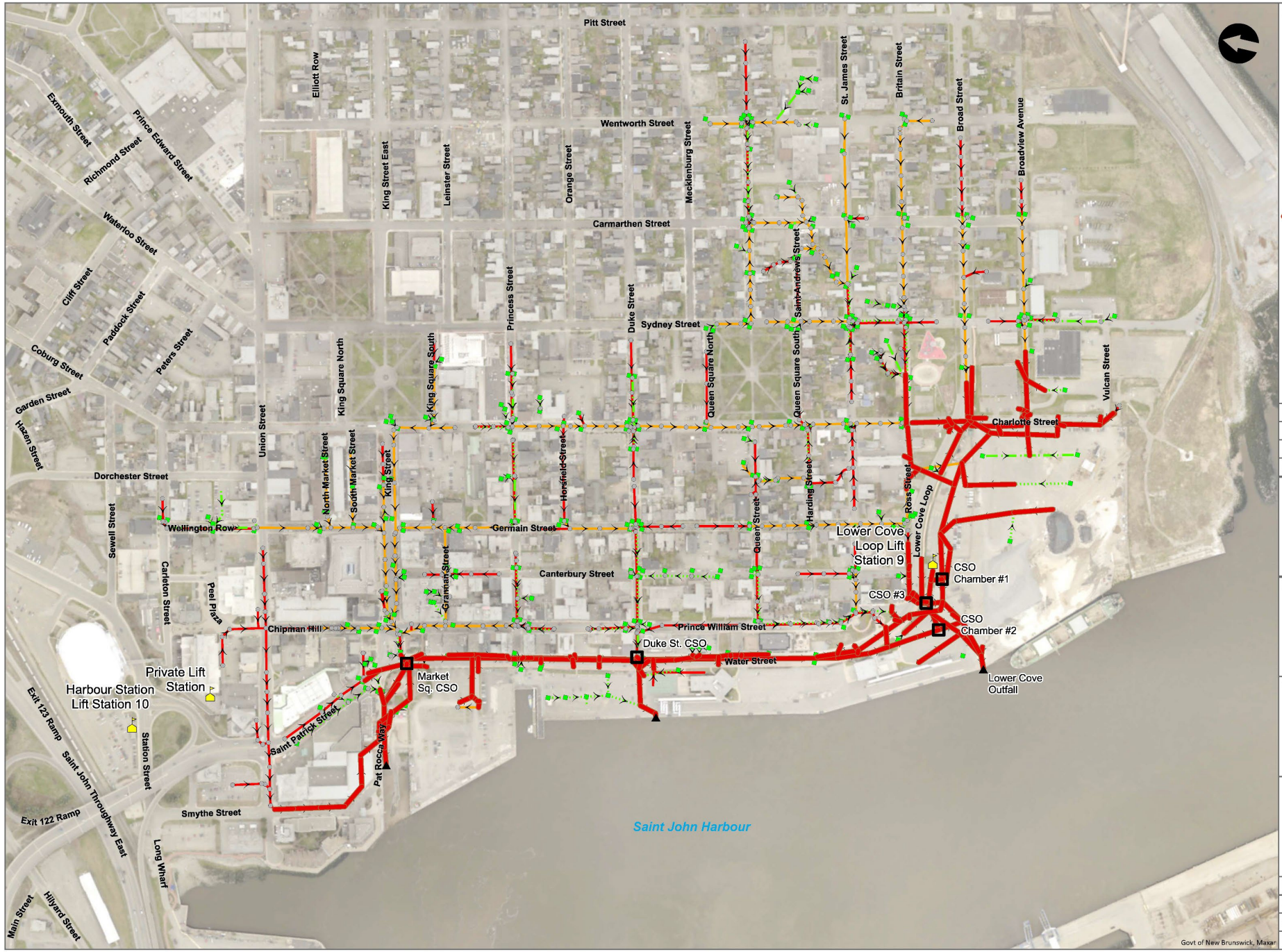

Legend:

- Outfalls
- Lift Stations
- Overflow Location
- Manholes
- Catch Basins
- Combined Sewer
- Sanitary Sewer
- Storm Sewer
- Surcharged Sewer - Scenario 1,2

Scenario 1: Dry weather flow - Simulates sewer surcharging at high tide and dry weather with failed tidal gates.

Scenario 2: Low intensity precipitation event - Simulates sewer surcharging from a low intensity precipitation event at high tide with functioning tide gates.

2	2022-03-22	ISSUED FOR FINAL REPORT
1	2022-03-10	ISSUED FOR DRAFT-FINAL
No	Date	Issue/Revision

The City of Saint John

Project:

FLOOD RISK MITIGATION STRATEGY FOR LOWER COVE LOOP

Drawing Title:

SURCHARGED SEWER - CURRENT HHWMT (3.6m)

CBCL

Date:	NOV 2021	Scale:	1:5,000
Drawn:	SMO	Designed:	AEL
Checked:	AEL	Approved:	TMc
Project No:	212865.00	Drawing No:	7

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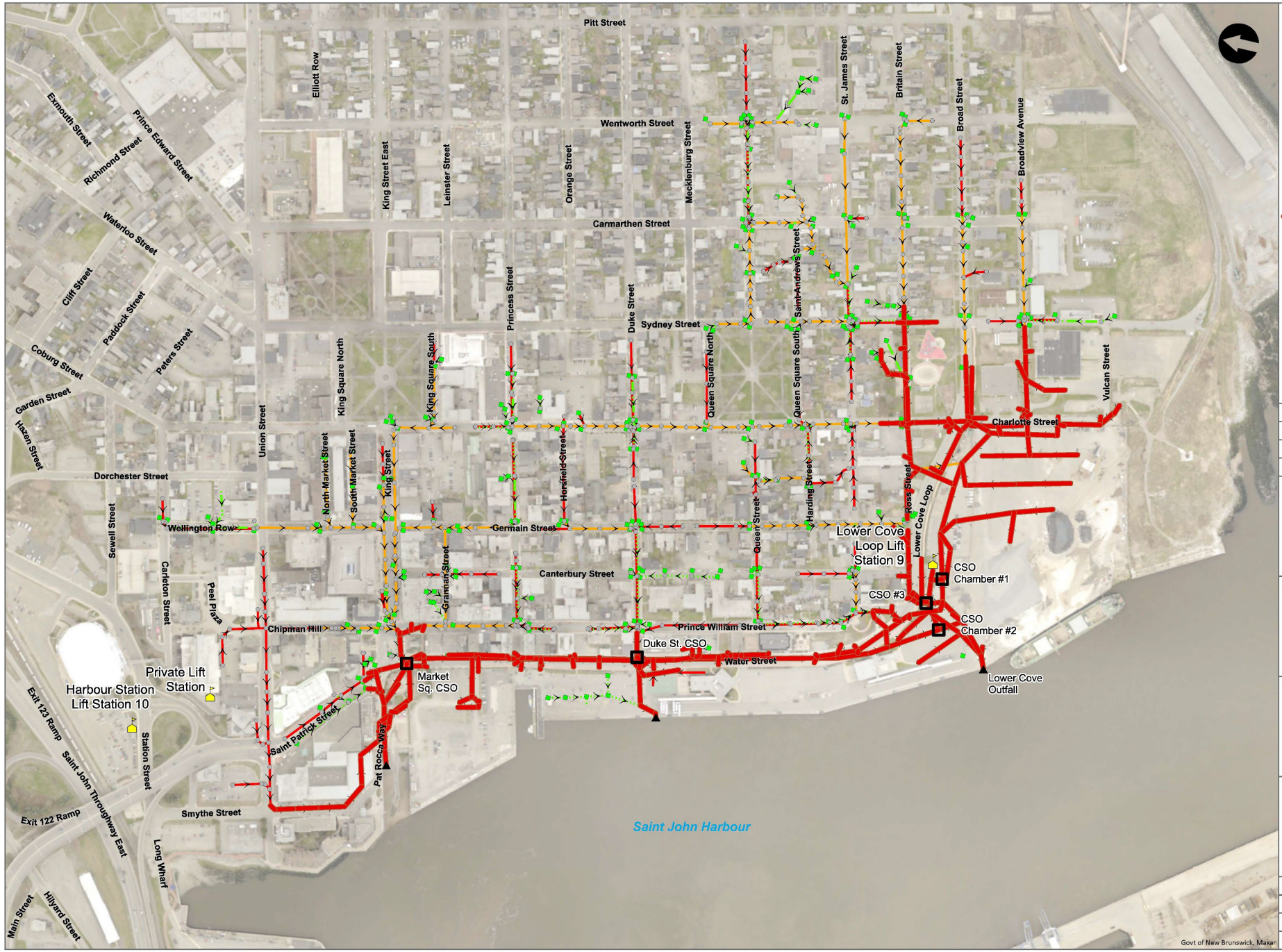

Legend:

- Outfalls
- Lift Stations
- Overflow Location
- Manholes
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2	2022-03-22	ISSUED FOR FINAL REPORT
1	2022-03-10	ISSUED FOR DRAFT-FINAL

The City of Saint John

Project:

FLOOD RISK MITIGATION STRATEGY FOR LOWER COVE LOOP

Drawing Title:

SURCHARGED SEWERS AT CURRENT HHWLT (4.6m)

CBCL

Date:	NOV 2021	Scale:	1:5,000
Drawn:	SMO	Designed:	AEL
Checked:	AEL	Approved:	TMc
Project No:	212865.00	Drawing No:	8

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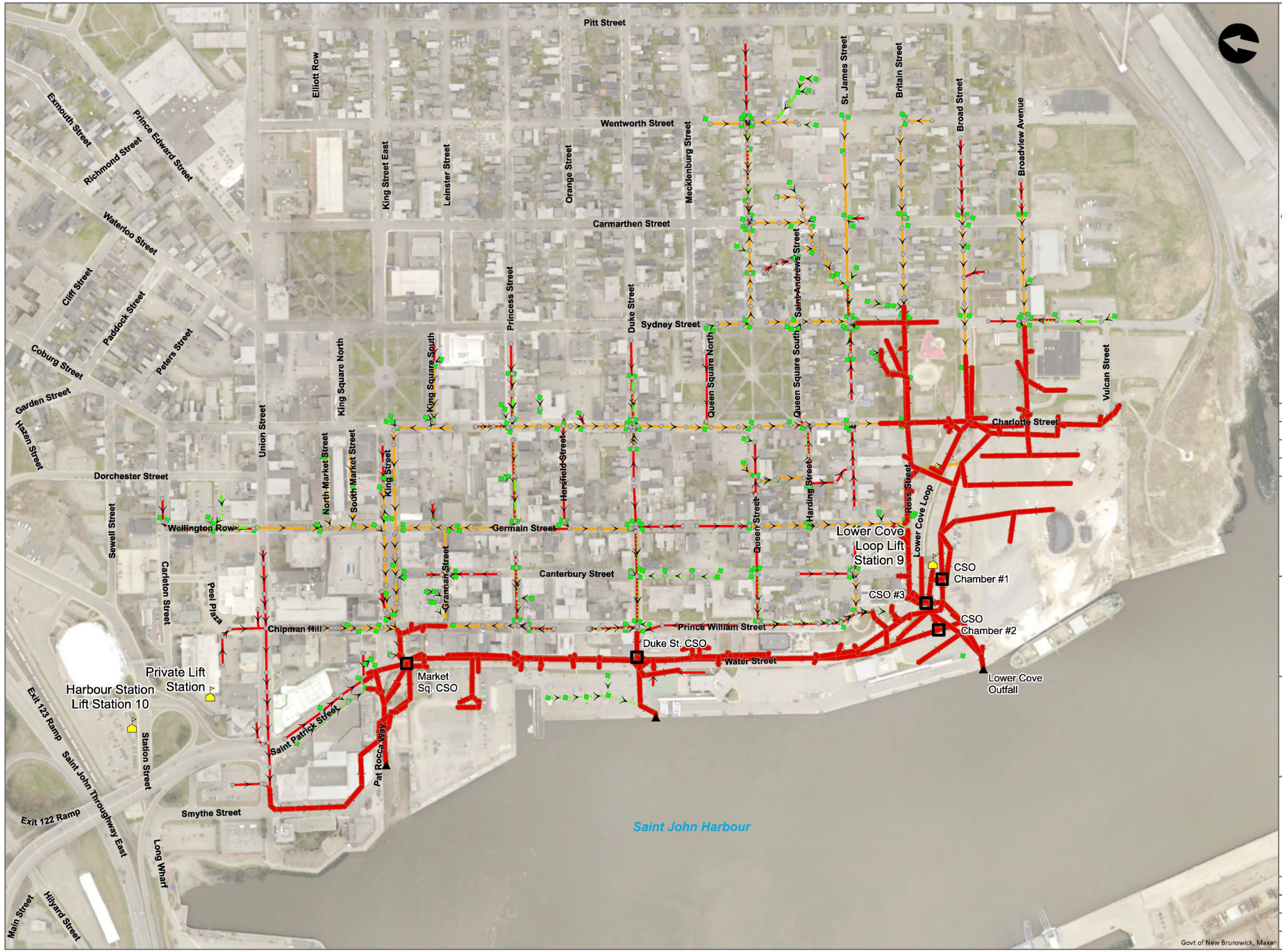

Legend:

- Outfalls
- Lift Stations
- Overflow Location
- Manholes
- Catch Basins
- Combined Sewer
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1	2022-03-10	ISSUED FOR DRAFT-FINAL

The City of Saint John

Project:

FLOOD RISK MITIGATION STRATEGY FOR LOWER COVE LOOP

Drawing Title:

SURCHARGED SEWERS AT 2050 HHWLT (4.9m)

CBCL

Date:	NOV 2021	Scale:	1:5,000
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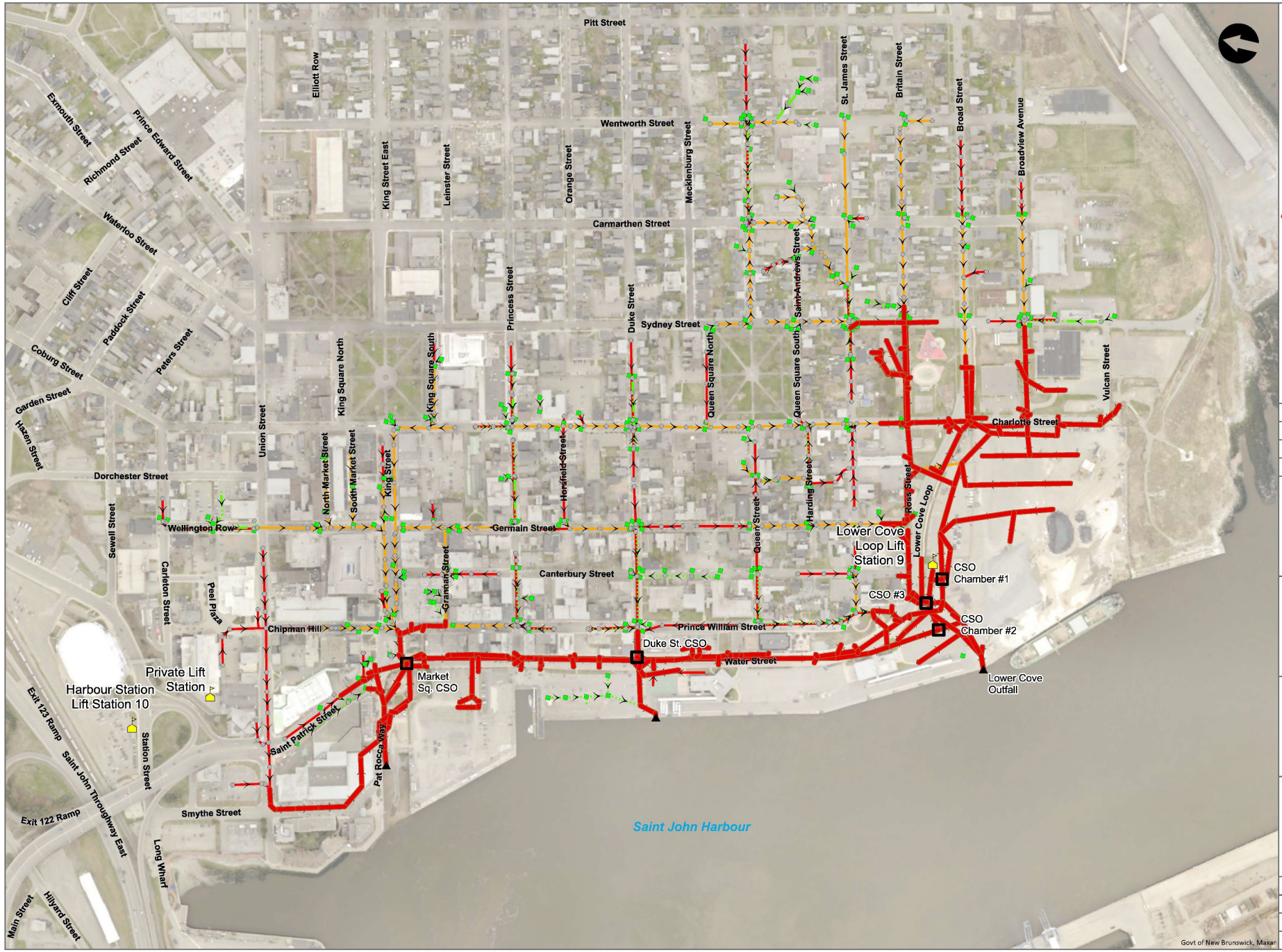
Checked:	AEL	Approved:	TMc
Project No:	212865.00	Drawing No:	9



Legend:

- Outfalls
- Lift Stations
- Overflow Location
- Manholes
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1	2022-03-10	ISSUED FOR DRAFT-FINAL

The City of Saint John

Project:

FLOOD RISK MITIGATION STRATEGY FOR LOWER COVE LOOP

Drawing Title:

SURCHARGED SEWERS AT 2100 HHWLT (5.5m)

Date:	NOV 2021	Scale:	1:5,000
Drawn:	SMO	Designed:	AEL
Checked:	AEL	Approved:	TMc
Project No:	212865.00	Drawing No:	10

Key Recommendations

Impacts of Sea Level Rise on Combined Sewers

- Short-Term: Rehabilitate leaky tidal control structures
- Intermediate-Term: Move CSOs above tidal range
- Long-Term: Full Sewer Separation