1027458 Ontario Inc.

Official Plan Amendment and Zoning By-Law Amendment

Stormwater Management Brief

North Neighbourhood Phase 7 – North of Wyandotte Street East

February 2023 – 22-4866

Table of Contents

1.0 Introduction

Dillon Consulting Limited (Dillon) was retained by 1027458 Ontario Inc. to assist in obtaining the necessary planning approvals associated with a proposed residential development located on the north side of Wyandotte Street East and south of Riverside Drive East, between the future extensions of Clover Avenue and Lublin Avenue, herein referred to as the "subject site", in the City of Windsor. The subject site is Phase 7 of the North Neighbourhood Development, within the Little River Subwatershed.

To support the Official Plan Amendment and Zoning By-law Amendment Application, Dillon has prepared this Stormwater Management (SWM) Brief to document the SWM strategy for the subject site shown on the proposed concept plan presented in Appendix A. This report outlines the proposed SWM strategy, supporting analysis and documentation.

1.1 Background Information

The following background information was reviewed to assist with the development of the proposed SWM strategy.

North Neighbourhood Pond Final Design Report, prepared by Dillon Consulting Limited, 2001.

Design report of the North Neighbourhood Pond.

Stormwater Management Analysis, North Neighbourhood Development, prepared by Dillon Consulting Limited, 2018.

This report presents the stormwater assessment of the North Neighbourhood Development under both existing and future built out conditions.

City of Windsor: East Riverside Flood Risk Assessment, prepared by RWDI, 2019.

This report presents the East Riverside Engineered 1:100 flood elevation.

North Neighbourhood Phase 1 and 2 Detailed Design North of Beverly Glen Street, Stormwater Management Brief, prepared by Dillon Consulting Limited, 2022.

This report presents the stormwater assessment of the proposed Jerome Trunk Sewer, as well as the streets identified on the East Riverside Development Concept Plan dated December 5, 2022, within the Phases 1 and 2 of the North Neighbourhood Subdivision under future built out conditions.

1.2 SWM Design Criteria

The North Neighborhood Subdivision Phase 7 SWM strategy is based on criteria established in the Windsor/Essex Region Stormwater Management Standards Manual (WESMSM) (December 2018) and previous reports.

The corresponding criteria are described below.

Stormwater Quality Control

The North Neighbourhood SWM facility (North Neighbourhood Pond) is designed to provide for a "Normal" Protection Level of water quality treatment to remove 70% of total suspended solids (TSS) from the proposed site runoff.

Water Quantity Control

The proposed SWM plan is designed at a minimum to provide active storage volume for the 1:100 year 24 hour storm (with a 2 hour time interval and using the SCS Type-II distribution) and the 1:100 year 4 hour storm (with 15 minute time intervals and using the Chicago distribution).

Minor System Conveyance

The minor system will be designed to have a level of service to accommodate the 1:5 year 4 hour storm (with 15 minute time intervals and using the Chicago distribution) with the Hydraulic Grade Lines (HGLs) no closer than 0.30 m from the proposed roadway surface.

Major System Conveyance

The major system will be designed to have a level of service to accommodate the 1:100 year design storm, with the peak water surface elevation (WSEL) along the roadway to not exceed 0.30 m above the minimum road grades during the governing 1:100 year event.

Climate Change Resiliency Assessment

The North Neighbourhood Pond performance has been examined under conditions more intense than the 1:100 year design storm event to assess potential impacts of climate change and the facility's resiliency using the Urban Stress Test design storm event. The SWM facility is designed to contain the runoff generated from this design storm event without overtopping its banks.

2.0 Existing Conditions

The 1.65 ha subject site is currently undeveloped vacant land. Based on the available topographic information, runoff from the existing site generally travels southward towards Wyandotte Street East as shallow surface flow, where it is collected by the existing storm sewer.

Ontario Ministry of Agriculture, Food and Rural Affairs' (OMAFRA) soil survey mapping data shows the soils within the subject site land are composed of Clyde Clay (Cc) which is classified as Hydrologic Soil Groups (HSG) D.

There are currently two trunk storm sewers that convey flow to the North Neighbourhood SWM Pond, the Beverly Glen Trunk Sewer and the Wyandotte Street East Trunk Sewer (south of the subject site). The existing drainage of the North Neighbourhood (north of Beverly Glen) is shown on Figure 1. All runoff from the Phase 7 development area is conveyed as shallow overland flow, towards Wyandotte Street East. Minor system flow is collected in the existing trunk storm sewer and conveyed to the North Neighbourhood SWM Pond. Major system flow is conveyed west on Wyandotte Street East where it enters the existing North Neighbourhood Pond.

3.0 Proposed Conditions

The proposed North Neighbourhood Subdivision Phase 7 development includes two (2) multiple dwelling buildings with 308 units total. The proposed Phase 7 drainage plan is shown in Figure 2. The stormwater designs for the other North Neighborhood phases have been completed as separate assignments. A preliminary SWM strategy was developed to manage the runoff from the subject site:

- On-site storm sewers to convey the minor flows from all storms up to and including 1:5 year design storm event, unrestricted, to the existing Wyandotte Street East storm sewer;
- Major flows from all storms up to and including 1:100 year design storm event are conveyed by the proposed parking lot, unrestricted, to the existing Wyandotte Street East ROW to the existing North Neighbourhood SWM Pond; and
- The existing North Neighbourhood SWM Pond provides all necessary stormwater treatment.

3.1 Hydrologic Analysis Methodology

Evaluation of the North Neighbourhood storm drainage system performance was completed with PCSWMM 2017 Professional. The hydrologic and hydraulic calculations completed using PCSWMM include the existing development, development Phases 1 through 6, which are anticipated to be constructed prior to Phase 7, and the proposed Phase 7 development. Model extents and subcatchment parameters are presented in Appendix B.

All external flows conveyed to the North Neighbourhood Pond are also shown in Figure B-1. Minor flows are collected by the proposed local storm sewers and conveyed to the existing SWM pond which provides both quality and quantity control. Major flows are conveyed via the proposed ROW to the existing SWM facility.

The proposed Phase 7 development area, as shown in Figure B-2, consists of multiple dwelling buildings, as such the area has been simulated with an imperviousness of 90%. Subcatchment parameters used in the simulation model can be found in Table B-1.

3.2 Regional SWM Facility

Based on the information presented in the North Neighbourhood Pond report completed by Dillon Consulting (December 2001), the following water quality design was incorporated within the pond:

- NWL elevation of 172.50;
- Permanent pool comprised of two forebays, three intermediary basins and three shallow transition areas; and
- Design permanent pool volume of 69,000 m^3.

The stage-storage curve used in the PCSWMM model, developed based on LiDAR and survey of the existing North Neighbourhood Pond, is tabulated in Appendix B.

3.2.1 Quantity Control

Hydrologic and hydraulic calculations were completed using PCSWMM to estimate the peak WSEL in the North Neighbourhood Pond. Simulations were completed for the 1:5 year, 1:100 year, and the UST as defined in the WERSMSM. It is important to note that in addition to the proposed Phase 7 development the hydrologic/hydraulic calculations also include all development phases of the North Neighbourhood Subdivision. The analysis results are presented in Table 3-1. The calculated design water levels presented in the North Neighbourhood Pond Final Design Report are also documented for comparison purposes.

Table 3-1: North Neighbourhood Pond WSEL Summary

Storm Type	Original SWM Pond Design (WSEL) (m)	Proposed SWM Pond Design (WSEL) (m)
Normal Water Level (NWL)	172.50	172.20[2]
Chicago 1:5 year 4 hour[1]	-	173.28
Chicago 1:100 year 4 hour[1]	-	173.89
SCS Type II 1:100 year 24 hour	174.50	174.05
Urban Stress Test[1]	-	174.51
Top of Bank (m)	175.50	175.50

[1] Design storm not used at time of design.

[2] Note the NWL was updated in a previous study.

The data shown in Table 3-1 suggest that the minimum calculated freeboard during the SCS Type II 1:100 year 24 hour event is approximately 1.45 m. The WSEL during the UST event is also shown to be held within the banks. Thus, the pond has sufficient capacity to accommodate the runoff from both the proposed Phase 7 development and the future North Neighbourhood phases.

3.2.2 Quality Control

The water quality requirements were analyzed to verify that the pond provides sufficient water quality control based on current provincial standards. Shown in Table 3-2 are the details of the water quality calculations in comparison to what is currently provided as per the original design.

Table 3-2: Water Quality for North Neighbourhood Pond

Description	Value
Total North Neighbourhood Development Area	141 ha
Overall Weighed Percent Impervious	65%

Description	Value
Total Required Water Quality Unit Volume	123 m^3/ha
Required Permanent Pool Unit Volume	83 m^3/ha
Required Permanent Pool Volume	11,750 m^3
Provided Permanent Pool Volume	69,000 m^3

The existing North Neighbourhood SWM Pond permanent pool volume is sufficient to provide quality control to the runoff from the entire North Neighbourhood Subdivision under ultimate buildout conditions, including the proposed Phase 7 development.

Settling and dispersion calculations previously completed to verify that the pond provides sufficient forebay length were completed as part of the 'North Neighbourhood Development Stormwater Management Analysis (Dillon, 2018)' report. The calculations include the flow contributions from the full buildout of the subdivision, including the Phase 7 development. Due to changes in the design criteria with the release of the WESMSM (December 2018), forebay calculations for the Wyandotte Street East outfall have been reassessed for this brief. Based on these calculations, the required settling length is 38 m, while the required dispersion length is 44 m. The actual distance from the proposed inlet to the pond forebay berm is 90 m, therefore the Wyandotte Street East pond forebay meets the provincial design guidance for water quality treatment. The supporting forebay calculations are presented in Appendix C.

3.3 Minor System

As documented in 'North Neighbourhood Phase 1 and 2 Detailed Design North of Beverly Glen Street Stormwater Management Brief (Dillon, November 2022)' runoff from Phase 7 is collected by the existing Wyandotte Street East trunk storm sewer and conveyed to the existing North Neighbourhood SWM pond. Additionally, the Wyandotte Street East storm sewer was evaluated in the North Neighbourhood Development (Dillon, 2018) report to include flow from the proposed Phase 7 development area. Both reports indicate the existing Wyandotte Street East storm sewer has sufficient capacity to accommodate the runoff from the Phase 7 development area.

The proposed site storm sewers convey the site runoff, unrestricted, to the existing Wyandotte Street East trunk storm by gravity. The storm sewers will accommodate the peak discharges from the 1:5 year storm event. The preliminary proposed storm sewer layout for the Phase 7 development is presented in Figure 2. The PCSWMM model was utilized to evaluate upstream and downstream impacts on the Wyandotte Street East Storm Sewer during the 1:5 year design storm event. Pre-development runoff consisted of an imperviousness of 0% directed to the Wyandotte Street East major system as shallow surface flow. The post-development model included major and minor system flow entering the Wyandotte Street East major and minor systems, respectively. Comparing the HGL in the Wyandotte Street East Storm Sewer from the proposed Phase 7 development to the North Neighbourhood Pond, there was a minor (0.07 m) observed increase in HGLs under developed conditions; however, the HGL is maintained greater than 0.3 m below ground, as per the WESMSM. An HGL comparison is presented in Figure B-3.

3.4 Major System

Major flow routes will be designed to convey runoff as overland flow in the proposed parking lot to the existing Wyandotte Street East ROW, unrestricted, as shown on Figure 2. The performance of the major system will be evaluated for the 1:100 year design storm event to verify ponding depths are less than 0.3 m.

The PCSWMM model was utilized to evaluate upstream and downstream impacts on the Wyandotte Street East major system during the 1:100 year design storm event. Pre-development runoff consisted of an imperviousness of 0% directed to the Wyandotte Street East major system as shallow surface flow. The post-development model included major and minor system flow entering the Wyandotte Street East major and minor systems, respectively. Comparing the HGL in the Wyandotte Street East Major System, there was no observed increase in HGLs under developed conditions. An HGL comparison is presented in Figure B-4.

3.5 Floodproofing

As per the WESMSM, the minimum lowest opening into all buildings shall be at least 0.3 m above the Regulatory Flood Level or on-site calculated 1:100 year water storage elevation, whichever is greater. The East Riverside Engineered 1:100 year flood elevation is 176 m (RWDI, 2019). Therefore; the Lowest Opening Elevation (LOE) for all buildings in the proposed development must be greater than or equal to the higher of the following two criteria:

- East Riverside Engineered 1:100 year flood elevation (176 m) plus 0.3 m freeboard; or
- Calculated on-site 1:100 year High Water Level (HWL) plus 0.3 m freeboard.

The on-site 1:100 year High Water Level will be calculated during detailed design to confirm the required minimum floodproofing elevation.

4.0 Future Conditions

Phase 7 is the final stage of the North Neighbourhood Development. The analysis results presented in Section 3.0 show that the SWM Pond has sufficient capacity to accommodate runoff from all future development phases under developed conditions.

5.0 Conclusions

Dillon has prepared a preliminary stormwater strategy to support the proposed North Neighbourhood Subdivision Phase 7 development. The preliminary stormwater strategy is designed to meet the corresponding local and provincial SWM policies such that the development of this site will not result in adverse effects on the downstream receiving water systems. The proposed SWM strategy includes:

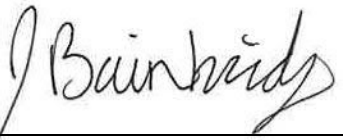
- A local storm sewer to convey the 1:5 year design storm event without surcharging closer than 0.30m from the proposed roadway surface.
- The proposed ROWs will be designed to convey the 1:100 year design storm event with levels below 0.3 m.
- The North Neighbourhood Pond to provide the required quality and quantity storage.

The existing North Neighbourhood Pond has sufficient capacity to accommodate the runoff from the proposed Phase 7 development and all other development phases, while meeting the WERSMSM guidelines for freeboard during the governing 1:100 year event and without overtopping the pond during the UST event. The existing facility is also designed to provide quality control to the runoff from the proposed Phase 7 development and future conditions development.

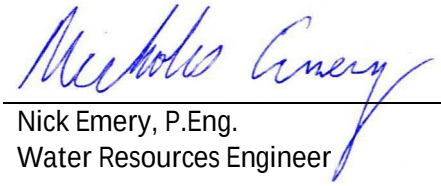
This report is respectfully submitted for review and approval. Please contact the undersigned should you have any questions or require any additional information.

Sincerely,

DILLON CONSULTING LIMITED

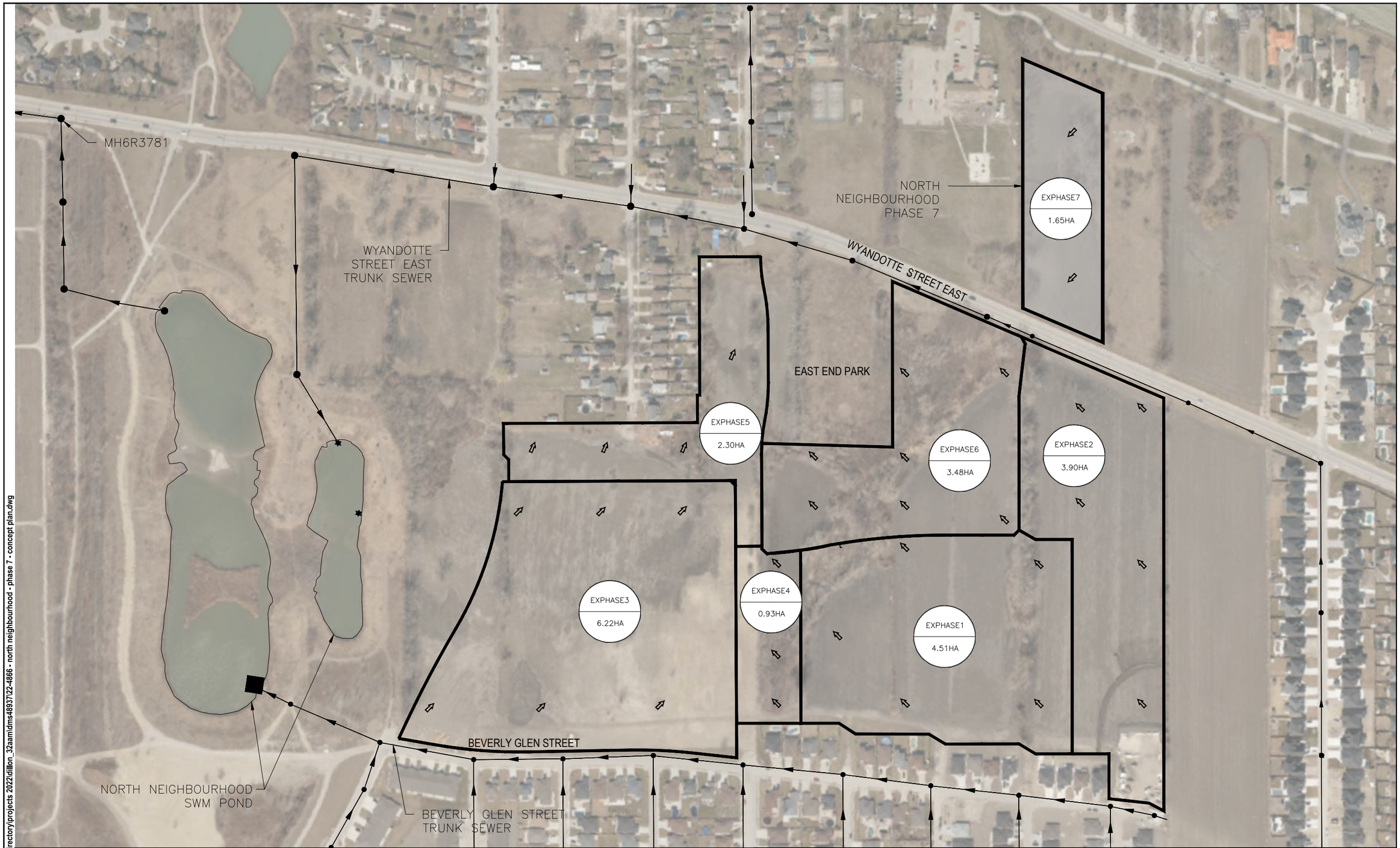


Jennifer Bainbridge, P.Eng.
Water Resources Engineer



Nick Emery, P.Eng.
Water Resources Engineer

Figures



LEGEND

- EXISTING STORM SEWER AND MAINTENANCE HOLE
- SUBJECT SITE LIMITS
- OVERLAND FLOW ROUTE DIRECTION
- NAME / AREA — CATCHMENT ID / CATCHMENT AREA (Ha)

DILLON CONSULTING

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DATE	JANUARY 2023	SCALE	1:1500

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WYANDOTTE STREET EAST TRUNK SEWER

COPERNICUS/JEROME STREET TRUNK SEWER

PHASE 5: 30 TOWNHOMES

PHASE 6: 447 UNITS

PHASE 7: 308 UNITS

WYANDOTTE STREET EAST

CLOVER AVENUE

EAST END PARK

FUTPHASE7
1.65HA

FUTPHASE5
2.30HA

FUTPHASE2
3.90HA

FUTPHASE6
3.48HA

JEROME STREET

COPERNICUS STREET

FUTPHASE4
0.93HA

FUTPHASE3
6.22HA

FUTPHASE1
4.51HA

FLORENCE AVENUE

THUNDERBAY AVENUE

IVANHILL AVENUE

CLOVER AVENUE

FREDERICA AVENUE

PEARSON AVENUE

LUBIN AVENUE

ICEWATER AVENUE

PHASE 2: 82 LOTS

BEVERLY GLEN STREET

NORTH NEIGHBOURHOOD SWM POND

BEVERLY GLEN STREET TRUNK SEWER

PHASE 3: 117 TOWNHOMES

PHASE 4: 11 LOTS

PHASE 1: 81 LOTS

LEGEND

PROPOSED STORM SEWER AND MAINTENANCE HOLE

EXISTING STORM SEWER AND MAINTENANCE HOLE

SUBJECT SITE LIMITS

OVERLAND FLOW ROUTE DIRECTION

NAME / AREA — CATCHMENT ID / CATCHMENT AREA (Ha)

DILLON CONSULTING

DATE JANUARY 2023 | SCALE 1:1500

PROJECT: NORTH NEIGHBOURHOOD PHASE 7

PROJECT NO.: 22-4866

TITLE: POST DEVELOPMENT DRAINAGE AREAS

FIGURE NO.: 2

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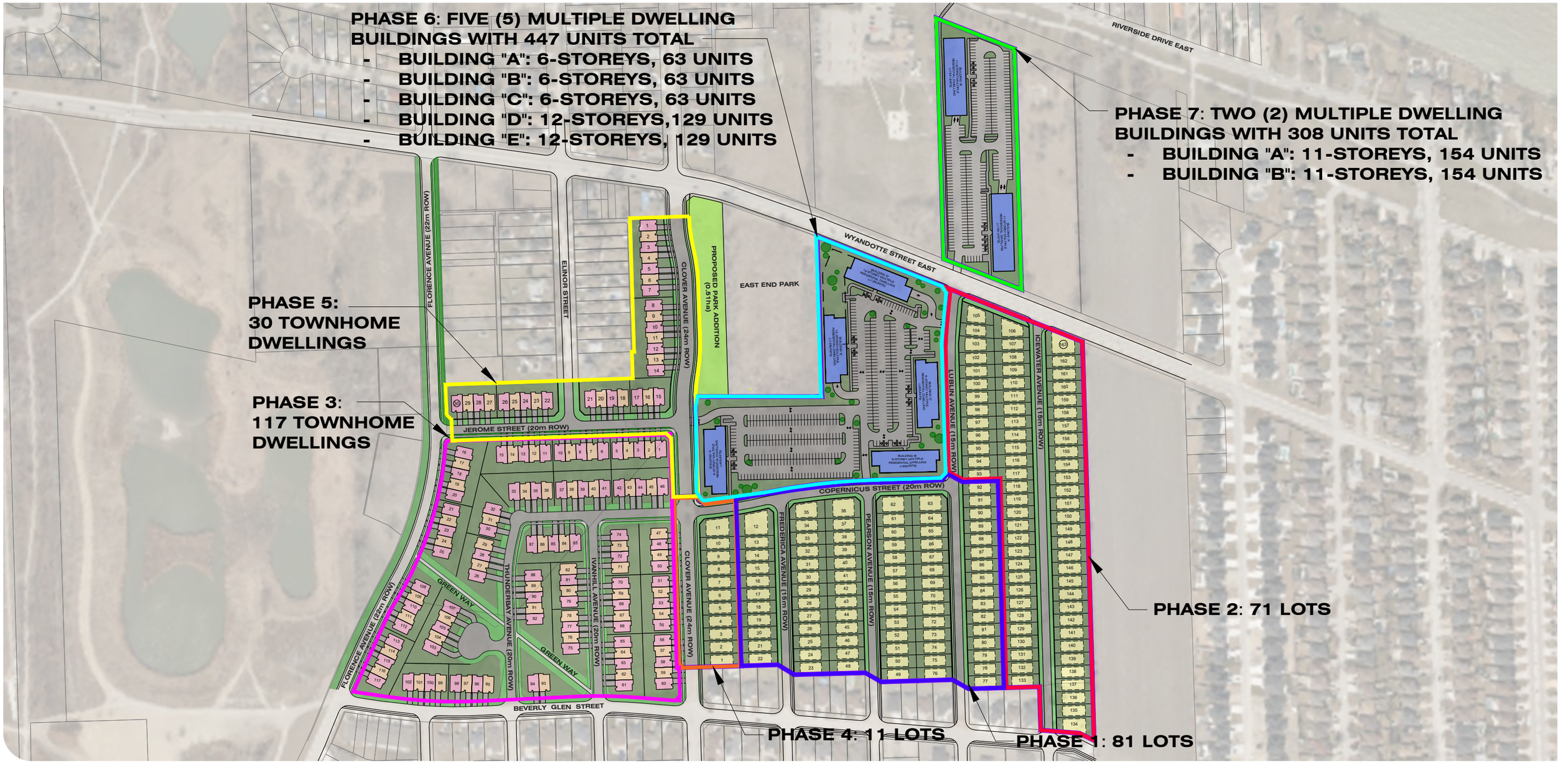
Appendix A

Conceptual Development Plan – Master Phasing Plan



1027458 ONTARIO INC.
EAST RIVERSIDE DEVELOPMENT
NORTH NEIGHBOURHOOD

CONCEPTUAL DEVELOPMENT PLAN
MASTER PHASING PLAN
FIGURE A-1

SUBJECT AREA PHASE 1 (± 4.51ha)
SUBJECT AREA PHASE 2 (± 3.90ha)
SUBJECT AREA PHASE 3 (± 6.22ha)
SUBJECT AREA PHASE 4 (± 0.93ha)
SUBJECT AREA PHASE 5 (±2.30ha)
SUBJECT AREA PHASE 6 (± 3.48ha)
SUBJECT AREA PHASE 7 (± 1.65ha)

PROPOSED TOWNHOMES
PROPOSED SINGLE DETACHED DWELLINGS
MULTI-UNIT RESIDENTIAL BUILDINGS
PROPOSED ROW
PROPOSED PARK LANDS

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SOURCE: MAPPMYCITY WINDSOR AERIAL (2021)

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DESIGNED BY: MRU

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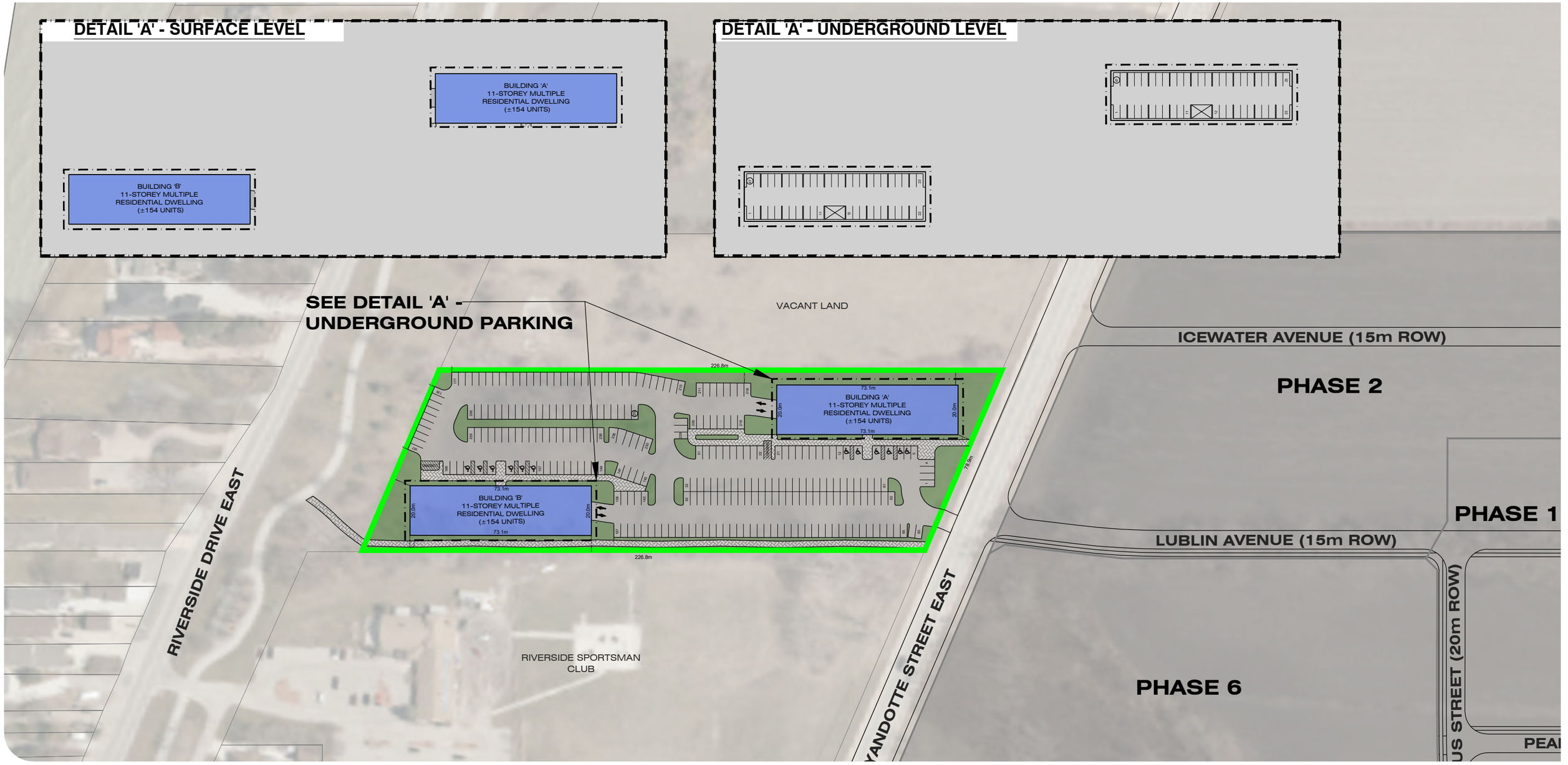

1027458 ONTARIO INC.
EAST RIVERSIDE DEVELOPMENT
NORTH NEIGHBOURHOOD

PHASE 7 -
CONCEPTUAL DEVELOPMENT PLAN
FIGURE A-2

SUBJECT AREA
PHASE 7 (± 1.65ha)

PROPOSED MULTIPLE
DWELLING RESIDENTIAL

PROPOSED LANDSCAPED
AREA

PROPOSED SIDEWALK

PROPOSED PAVEMENT

SITE MATRIX

FRONT YARD DEPTH	- 6.0m
BACK YARD DEPTH	- 7.5m
SIDE YARD DEPTH	- 6.0m
UNIT COUNT	- 308 units
PROPOSED PARKING	- 373 spaces
PROPOSED PARKING RATIO:	1.21
REQUIRED PARKING RATIO:	1.25

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SOURCE:COUNTY OF ESSEX AERIAL (2021)

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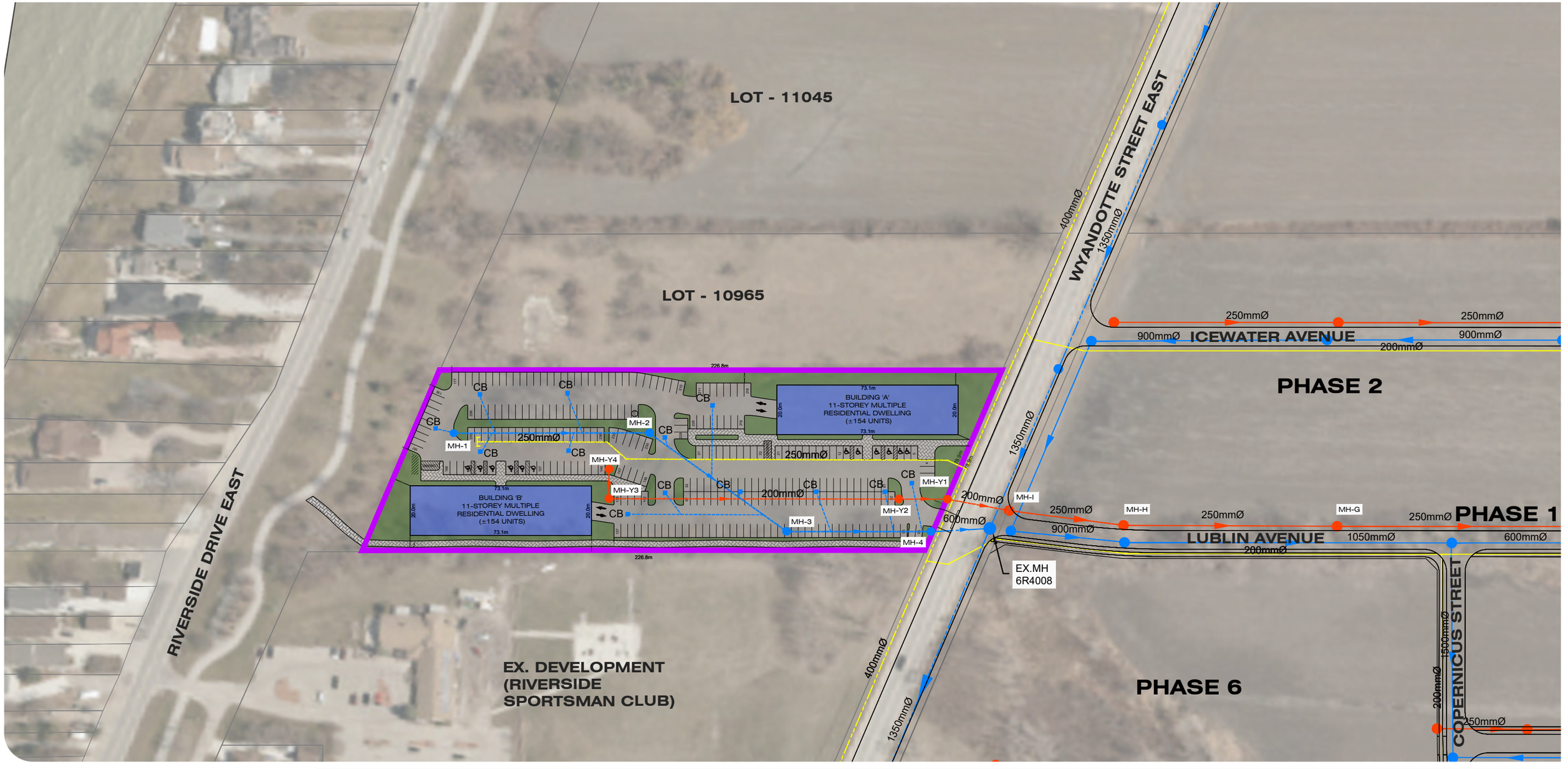

1027458 ONTARIO INC.
EAST RIVERSIDE DEVELOPMENT
NORTH NEIGHBOURHOOD - NORTH OF WYANDOTTE - CITY OF WINDSOR

PHASE 7 -
CONCEPTUAL SERVICING PLAN
FIGURE A-3

- SUBJECT AREA PHASE 7 (± 1.65ha)
- PROPOSED LANDSCAPED AREA
- PROPOSED PAVEMENT
- PROPOSED MULTIPLE RESIDENTIAL
- PROPOSED SIDEWALK
- PLANNED TO BE CONSTRUCTED PHASES 1-5 SANITARY SEWER
- PLANNED TO BE CONSTRUCTED PHASES 1-5 STORM SEWER
- PLANNED TO BE CONSTRUCTED PHASES 1-5 WATER LINE
- PROPOSED PHASE 7 SANITARY SEWER
- PROPOSED PHASE 7 STORM SEWER
- PROPOSED PHASE 7 WATER LINE
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATER LINE

SITE MATRIX

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Appendix B

Model Extents and Input Parameters

Figure B-1: Full Model Extents to North Neighbourhood Pond

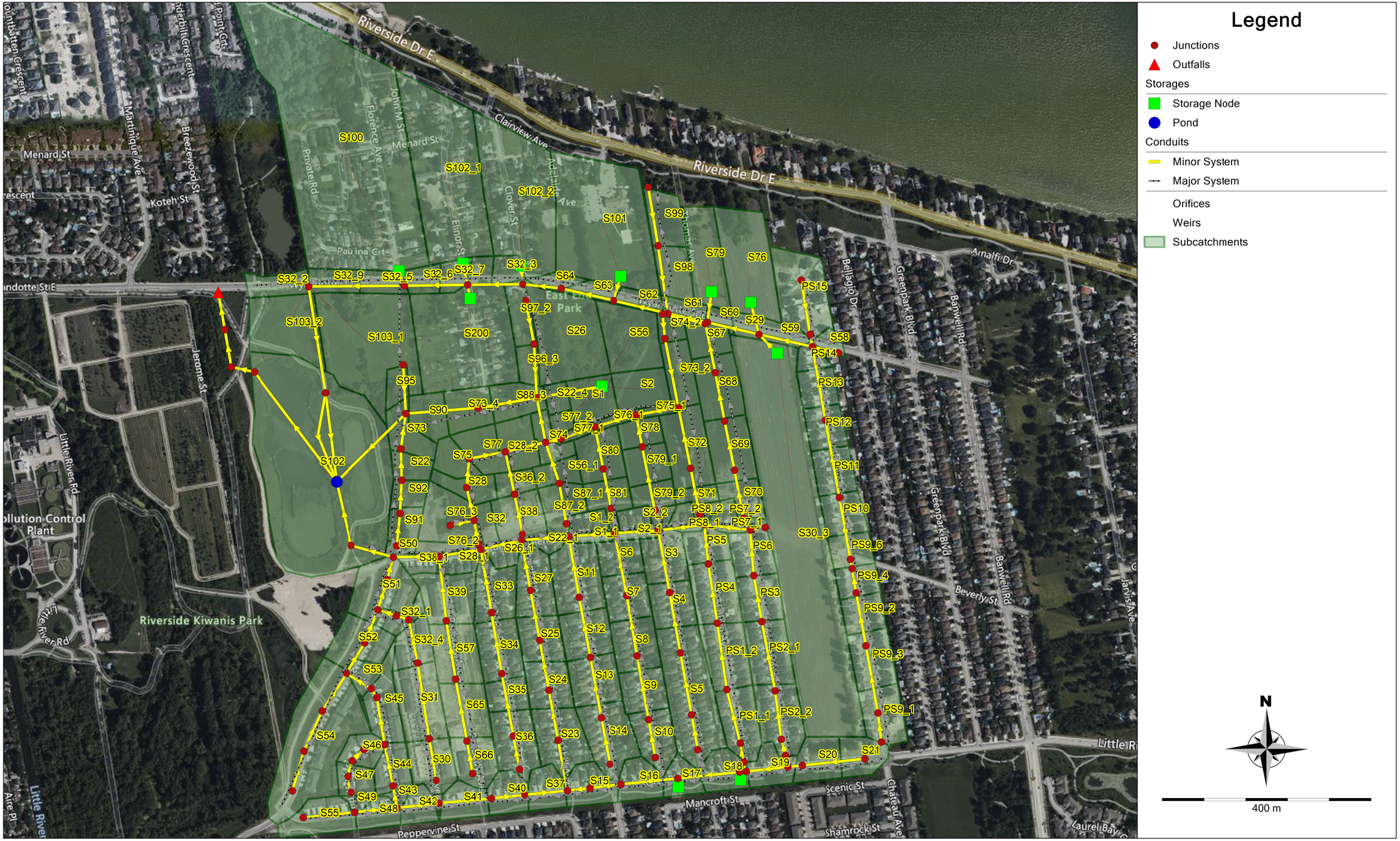


Figure B-2: Phase 7 Development Model Extents

Proposed Phase 7 Development Area Subcatchment Parameters

							Green-Ampt		
Name	Area (ha)	Imperv. (%)	N Imperv	N Perv	Dstore Imperv (mm)	Dstore Perv (mm)	Suction Head (mm)	Conductivity (mm/hr)	Initial Deficit (frac.)
S98	0.6367	90	0.013	0.15	2.5	7.5	180	0.5	0.1
S99	0.6754	90	0.013	0.15	2.5	7.5	180	0.5	0.1

North Neighbourhood Stage Storage Curve

Depth (m)	Elevation (m)	Area (m^2)	Incremental Volume (m^3)	Cumulative Volume (m^3)
0	168.5	16,304	0	0
4	172.5	42,114	112,829	112,829
4.25	172.75	43,861	10,746	123,575
4.5	173	45,621	11,185	134,759
4.75	173.25	47,393	11,626	146,385
5	173.5	49,178	12,071	158,456
5.25	173.75	50,975	12,518	170,975
5.5	174	52,785	12,969	183,944
5.75	174.25	54,607	13,423	197,367
6	174.5	56,442	13,880	211,248
6.25	174.75	58,289	14,341	225,589
6.5	175	60,149	14,804	240,393
6.75	175.25	62,022	15,271	255,663
7	175.5	63,908	15,741	271,404

Figure B-3: Pre- and Post- Development HGL along Wyandotte Street East Storm Sewer

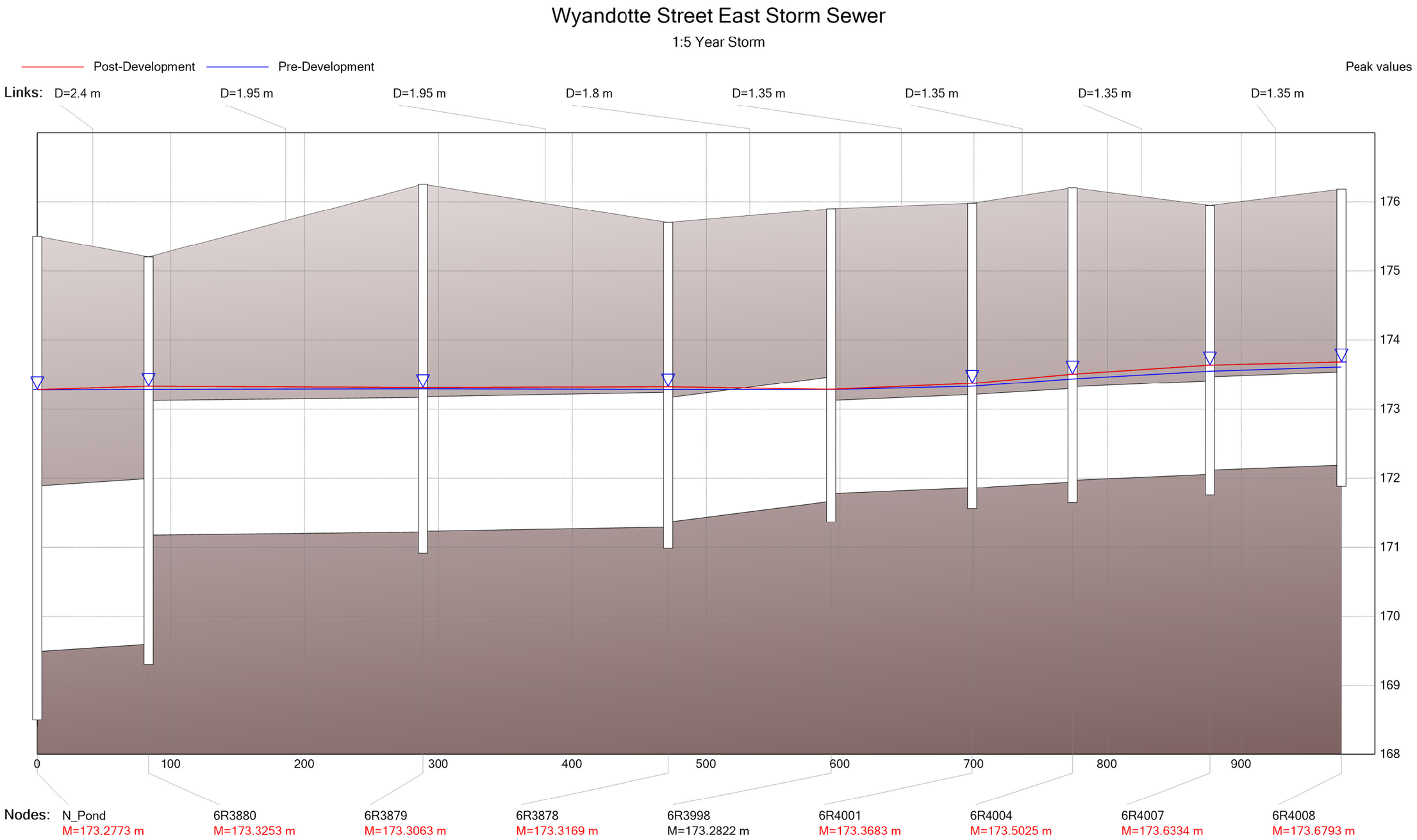
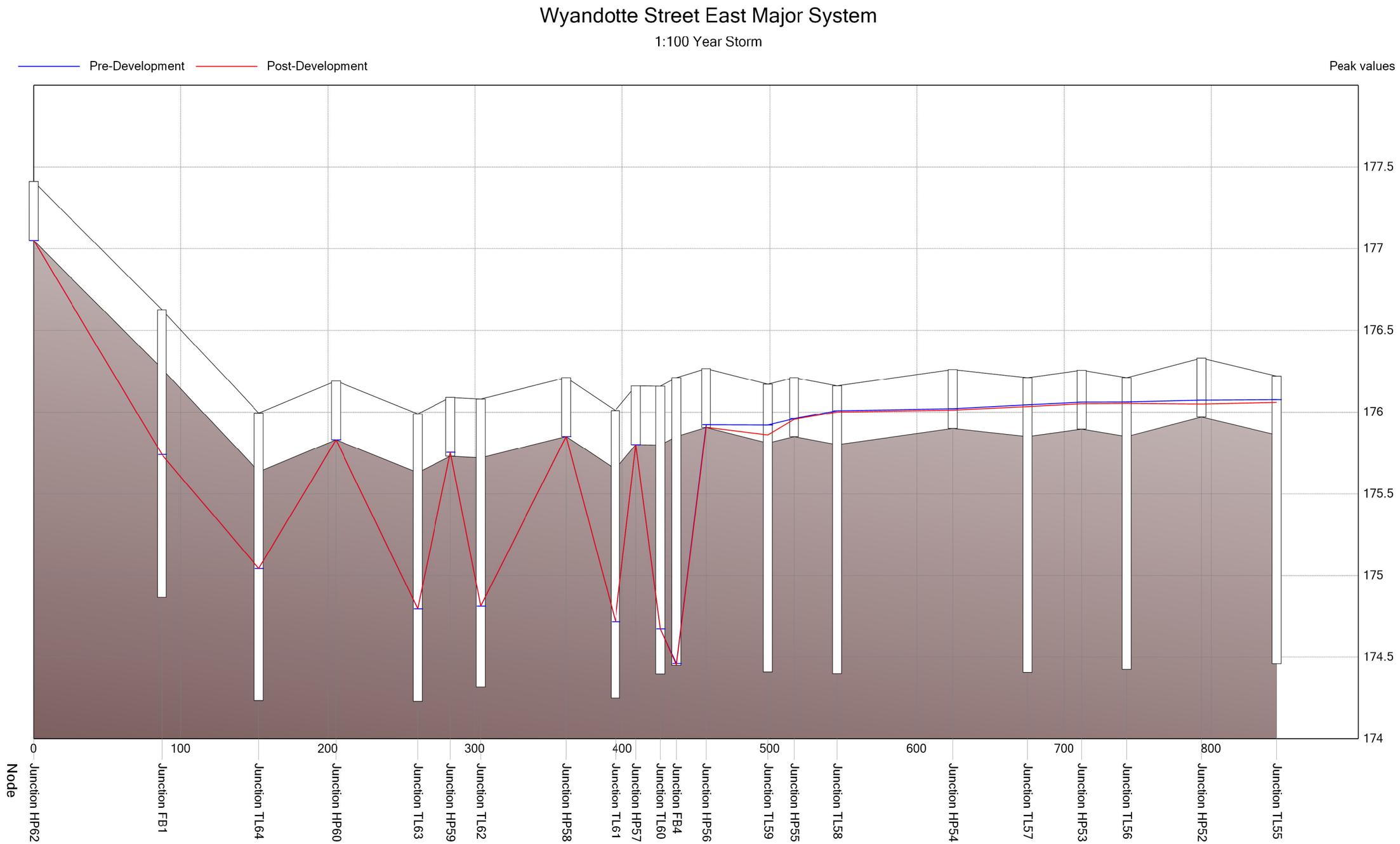


Figure B-4: Pre- and Post- Development HGL along Wyandotte Street East Major System



Appendix C

Forebay Calculations

Wyandotte Inlet

Required Forebay Length

Parameters:

Length to width ratio of forebay, r =	2.0:1	
Peak outflow (25 mm storm), Q_p =	0.21	m^3/s (24hr ext. det)
Target particle size =	150	mm
Settling velocity, V_s =	0.0003	m/s

Forebay Settling Length, Dist

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

= 38 m

Check Dispersion Length, Dist $_2$

Desired velocity in forebay, V_f =	0.2	m/s
Inlet flowrate , Q_5 =	3.88	m^3/s
Depth in forebay, d =	3.5	m

$$Dist_2 = \frac{\delta Q}{dV_f}$$

= 44 m

Therefore, the dispersion length of 44 m governs the design.

Required Length:	**=**	**44**	**m**
Provided Length:	**=**	**90**	**m**