FUNCTIONAL SERVICING REPORT

FOR

BRADFORD HIGHLANDS JOINT VENTURE

PROPOSED

BRADFORD HIGHLANDS RESIDENTIAL SUBDIVISION

PART OF LOT 13, CONCESSION 5

TOWN OF BRADFORD-WEST GWILLIMBURY

COUNTY OF SIMCOE

UEL PROJECT NO. 15011.100

SEPT 20, 2023

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APPENDICES

1.0 INTRODUCTION

Urban Ecosystems Limited, on behalf of Bradford Highlands Joint -Venture, has prepared this Functional Servicing Report (FSR) for the subject lands, generally known as the Bradford Highlands golf course lands, located at 23 Brownlee Drive and 2820, 2824 & 2848 Line 5, on the south side of Line 6 and to the east of Brownlee Drive. The lands are located immediately adjacent to the Bradford Capital Residential Subdivision and are generally considered as an expansion to the Green Valley Community Plan area of the Town of Bradford-West Gwillimbury.

This FSR has been prepared in support of a zoning bylaw amendment and draft plan of subdivision application for the subject lands. The draft plan of subdivision prepared by Malone Given Parsons (MGP) proposes a development consisting of approximately 60 ha of land and approximately 950 units comprised with proposed single detached units, semi-detached units, street townhouse units, back to back townhouse units, park blocks, SWM blocks, open space blocks, sanitary pumping station block and roadway network.

This Report summarizes the development scheme proposal with respect to the following:

- Demonstrate that the proposed development can be serviced with municipal sanitary sewers, storm sewers, water distribution system and stormwater management facilities.
- Ensure that the development is compatible with existing downstream servicing presently available and/or currently proposed by the Town.
- Establish the design criteria and standards to which the development infrastructure is to be developed.
- Review the existing topography, existing road network and existing adjacent developments external to the site with respect to the anticipated site grading concept.

2.0 SITE DESCRIPTION AND LOCATION

The existing site area is approximately 60 hectares (148 acres) and consists of a former 18-hole golf course with a cart shed, and maintenance building. The subject lands are bounded by Line 6 to the north, the rear yards of the Bradford Capital Residential Subdivision homes to the east, existing Brownlee Drive residential homes to the west and the existing North Canal watercourse of the West Holland River to the south, as illustrated in **Figure 1- Site Location**.

The subject lands include approximately 37 meters of direct frontage onto Line 6, approximately 31 meters of direct frontage onto Line 5 and the benefit of access, through existing road allowance blocks, to Inverness Way located within the Bradford Capital Residential Subdivision to accommodate two future road extensions into the subject lands.

The subject lands, further described as having two distinct drainage areas, generally drain in a northwest to southeasterly direction with an overall grade differential of approximately 30 meters. The southerly half of the lands drain towards the existing North Canal watercourse. The northerly half of the lands drain to existing storm sewers located within the Bradford Capital Residential Subdivision, to the east of the subject lands, to an existing culvert crossing Simcoe Road and ultimately outletting to Tributary Watercourse No. 1

A 1200mm diameter municipal storm sewer currently exists within the Inverness Way road allowance of the Bradford Capital Residential Subdivision to serve as the primary stormwater outlet for the northerly portion of this development. A drainage channel outlet to the Canal is available to serve as the primary stormwater outlet for the southerly portion of this development.

A 300 mm diameter municipal watermain currently exists within the Line 6 road allowance and a 250 mm diameter municipal watermain currently exists within the Inverness Way road allowance of the Bradford Capital Residential Subdivision to service this development.

A 300 mm diameter municipal sanitary sewer currently exists within the Inverness Way road allowance of the Bradford Capital Residential Subdivision to service this development.

A road connection to the municipal road network currently exists and/or is accessible at a number of locations, such as Line 6, Inverness Way (two locations) and Line 5.

2.0 SITE DESCRIPTION AND LOCATION Cont'd

The subject lands will require the following infrastructure improvements:

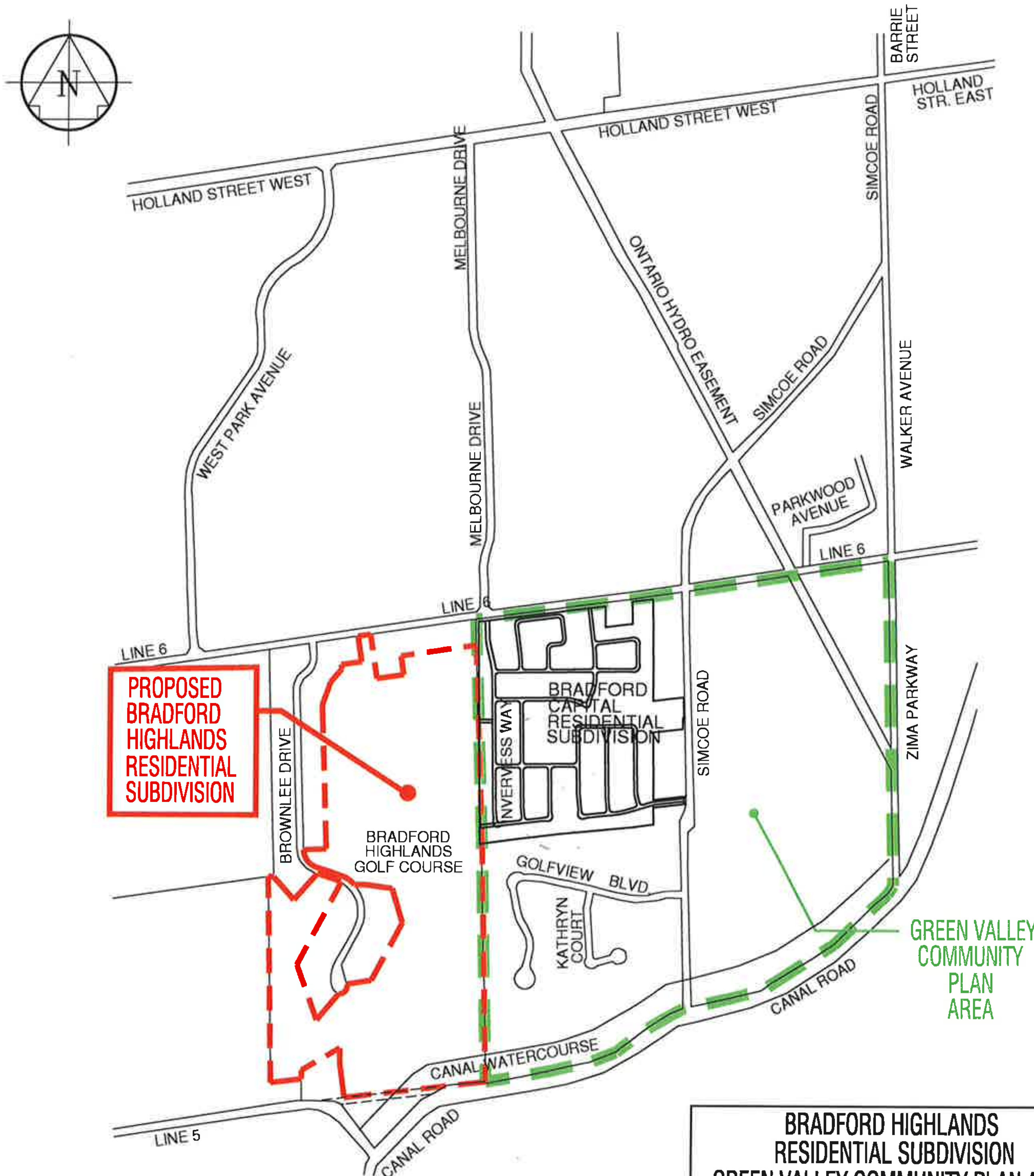
- Extension of the existing sanitary sewer system to service the entire development area.

- Due to grade constraints, sanitary sewers proposed within the southerly portion of this development area will need to drain to a proposed local sanitary pumping station and forcemain in order to outlet to the existing sanitary sewer system.

- Extension of the existing watermain system into the development area to provide water supply and fire protection.

- Installation of a stormwater conveyance system and construction of stormwater management facilities to control post development drainage flows to pre-development levels for all storm events, including providing quality control.

- Construction of a roadway network, including pedestrian sidewalks and walkway linkages.



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UEL

SITE LOCATION

DATE	PROJECT No.	FIGURE
JUNE 2023	15011	FIGURE 1

3.0 OTHER STUDIES AND REPORTS

Various previous studies have been prepared in support of the approval of the Green Valley Community Plan area of the Town of Bradford-West Gwillimbury, in particular,

- Master Environmental Servicing Report (MESP) for Green Valley Community Plan area prepared by R.J. Burnside & Associates Limited, Project No. MSO 09139 dated June 2008.

In addition to the above, other Reports have been prepared to support the approval of adjacent development sites in the area such as the Bradford Capital Residential Subdivision, as follows,

- Stormwater Management Report for Bradford Capital Residential Subdivision prepared by GHD, Project No. 09204 dated October 9, 2009 and revised January 2013.
- Stormwater Management Report for Bradford East Residential Subdivision prepared by GHD, Project No. 09282 dated March 3, 2016.
- External Traffic Impact Study, Green Valley Community, Town of Bradford West Gwillimbury for Bradford East Developments & Bradford Capital Holdings Inc., prepared by Cole Engineering Group Ltd. dated November 2009.
- Internal Functional Traffic Design Study, Green Valley Community (West) Residential Subdivision, Town of Bradford West Gwillimbury for Bradford Capital Holdings Inc., prepared by Cole Engineering Group Ltd. dated October 2009 and revised September 2011.

Subsequently, additional Reports have been prepared to support expansion of development within the Town of Bradford-West Gwillimbury, in particular,

- Simcoe Water and Wastewater Service Delivery Review Report prepared by R.V. Anderson Associates Limited, Project No. RVA 215657 dated January 31, 2022.

This FSR should be read in conjunction with all of the above Reports in order to gain a thorough understanding of this development proposal. This FSR has been prepared in conjunction with the work of these firms to ensure that all municipal services will support their findings and recommendations.

3.0 OTHER STUDIES AND REPORTS Cont'd

In support of the development of the Bradford Highlands Residential Subdivision, a number of additional reports have been prepared for this property, as follows:

- Servicing Brief for Bradford Highlands Residential Subdivision prepared by Urban Ecosystems Limited, Project No. 15011 dated Feb 2, 2017.
- Geotechnical Investigation Report for Bradford Highlands Golf Course Redevelopment prepared by WSP, Project No. 22517668 dated October 17, 2022.
- Water Balance Assessment Report for Bradford Highlands Golf Course Redevelopment prepared by WSP, Project No. 22517668 dated October 17, 2022.
- Preliminary Hydrogeological Assessment Report for Bradford Highlands Golf Course Redevelopment prepared by WSP, Project No. 22517668 dated October 25, 2022.
- Stormwater Management Report for Bradford Highlands Residential Subdivision prepared by KSGS Engineering Corp, Project No. 22010 dated July 2023.

4.0 PROPOSED DEVELOPMENT

This FSR will evaluate the proposed Bradford Highlands Residential Subdivision development consisting of approximately 1000 residential units, two park blocks and two SWM pond blocks to be serviced by municipal water, sanitary and storm sewer systems. A road network system consisting of roads varying in width from 18 m, 20 m and 26 m is proposed to be constructed to Town of Bradford-West Gwillimbury municipal standards including curbs, sidewalks, pavement and sodded boulevards. A copy of the proposed draft plan of subdivision is included in this FSR, as identified in **Figure 2 – Draft Plan of Subdivision**.

Road access to the proposed development will occur at several points including one proposed roadway connection to Line 6 , one proposed roadway connection to Line 5 and two proposed connections to Inverness Way.

Two stormwater management facility blocks are proposed for stormwater runoff outlet treatment and conveyance for this development site. The primary objective of the best stormwater management plan is to provide post development control to pre-development levels and to ensure that the quality of the runoff discharging from the site and the flood hazards (upstream, downstream or within the subject property) are not adversely impacted as a result of the proposed development.

Provisions have been made for the retention of the existing swales servicing the adjacent residential lands and acceptance of drainage from the existing Brownlee Drive Estates subdivision.

DRAFT PLAN OF SUBDIVISION

Part of Block 36, Plan 51M-221 and
Part of Lot 13,
Concession 5
(Geographic Township of West Gwillimbury)
Town of Bradford-West Gwillimbury
County of Simcoe

KEY PLAN

SCHEDULE OF LAND USE

Lot/Block	Land Use	Units	Area(ha)
1-440	Single Detached min. 11.6m (38ft)	342	22.13
	Semi Detached min. 7.6m (25ft)	196	
441-498	Street Townhouses min. 6.1m (20ft)	334	7.89
499-507	B2B Townhouses min. 6.4m (21ft)	126	1.35
508-509	Parks		3.06
510-511	Stormwater Management Ponds		4.76
512	Environmental Protection		5.38
513	Compensation		0.42
514	Pumping Station		0.06
515-521	Drainage Blocks		0.24
522-547	Future Development		1.11
Public Roads	Street 'A' 26.0m ROW 1,550m Streets 'B'-'C' 20.0m ROW 570m Streets 'D'-'N' 18.0m ROW 4,350m		13.60
Total	6,470m	998	60.00

OWNER'S AUTHORIZATION

We, Bradford Highlands Joint Venture, hereby authorize Malone Given Parsons Ltd. to prepare and submit this Draft Plan of Subdivision to the County of Simcoe.

Bradford Highlands Joint Venture ____________ Date ____________

SURVEYOR'S CERTIFICATE

I hereby certify that the boundaries of the lands to be subdivided as shown on this Plan and their relationship to the adjacent lands are accurately and correctly shown.

____________ Date ____________

ADDITIONAL INFORMATION

AS REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT, CHAPTER P.13 (R.S.O. 1990).

(a),(e),(f),(g),(j),(l) - As shown of the Draft Plan.
(b),(c) - As shown on the Draft and Key Plan.
(d) - Land to be used in accordance with the Schedule of Land Use.
(i) - Soil is sands, silts, clay and tills.
(h),(k) - Full municipal services to be provided.

NOTE: Contours relate to Canadian Geodetic Datum. Contour interval is 1m with .25m interpolated.

Scale: 1:2000

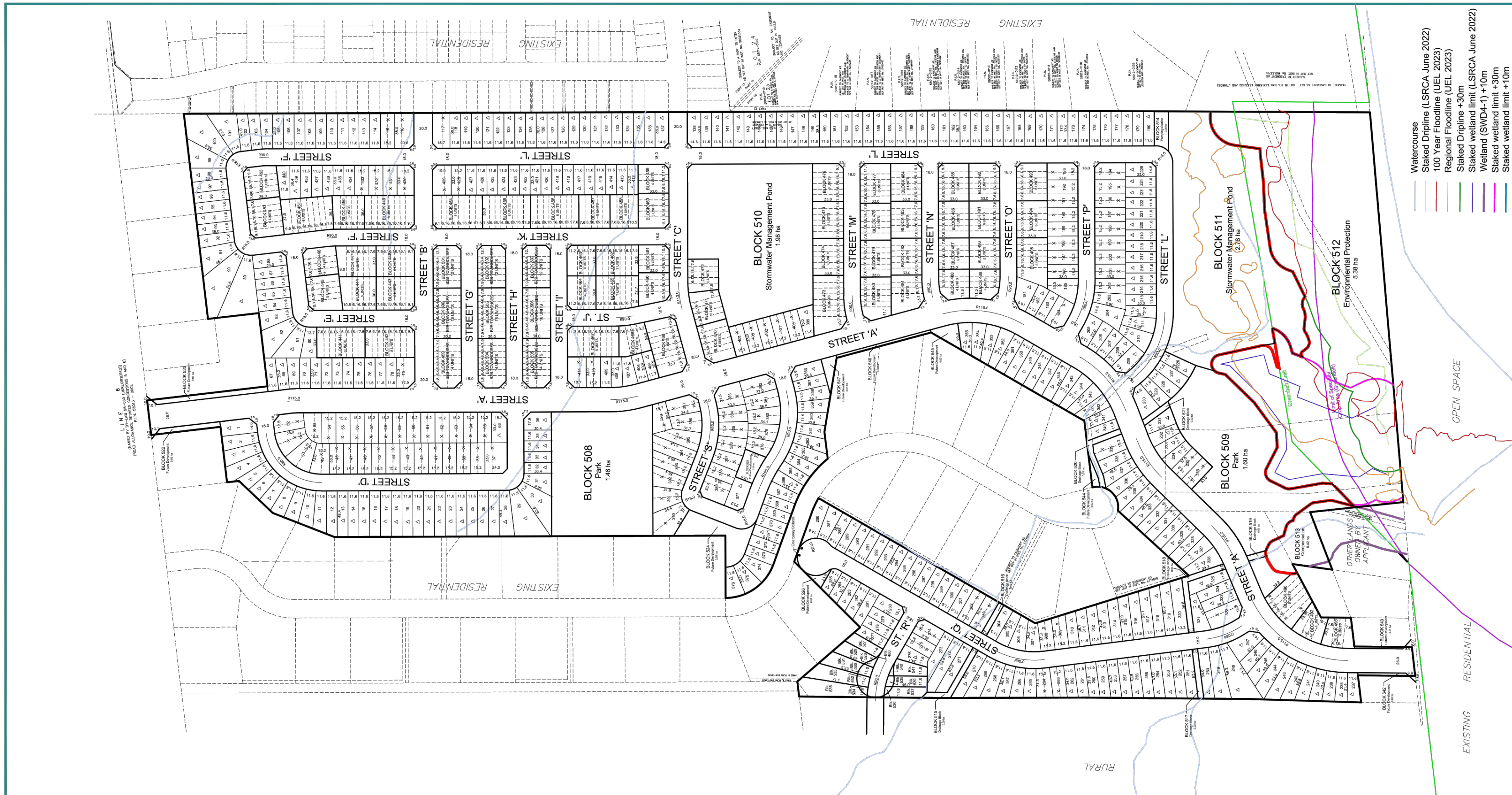
0 25 50 100 150 200m

Date	Revision	By
02/11/20		GP
13/02/21		GP
24/11/21		GP
01/12/21		GP
16/12/21		GP
26/05/22		GP
29/08/23		GP

Prepared For:

Malone Given Parsons.
140 Renfrew Drive, Suite 201 | Markham, ON | L3R
905 513 0170 | mgp.ca

MGP File: 15-2422



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DRAFT PLAN OF SUBDIVISION

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 2

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5.0 WATER SUPPLY

The Master Environmental Servicing Report (MESP) prepared by R.J. Burnside & Associates in June 2008, established the general water supply and distribution principles for the Green Valley Community Plan (GVCP) study area, which can also be extended to apply to the subject lands.

The design criteria established in the MESP for water distribution, as summarized in Table 9.1 of MESP document is as follows:

Average Day Demand - 372 l/capita *day

Maximum Day Factor - 1.80

Peak Hour Factor - 2.70

Evaluation Criteria
- 350 kPa (50 psi) to 552 kPa (80psi) static pressure
- 280 kPa (40 psi) minimum pressure during peak hour demand
- 140 kPa (20psi) minimum pressure at fire node and residual pressure throughout distribution network during fire event
- 100 l/s minimum required fire flow (Fire Underwriters Survey guidelines)

The water distribution system for this subdivision is located in the Town of Bradford West Gwillimbury Pressure Zone No. 1 area, which includes the lowest ground elevations in the Town. Pressure reducing valves will therefore be required for the development of the subject lands as this area will experience some of the highest pressures in the distribution system.

Based on the results of Water CAD computer modelling, a 250 mm diameter watermain connection to Line 6 and two 250 mm diameter watermain connections to Inverness Way, located within the Bradford Capital Residential Subdivision, are proposed to service this development.

Internal lengths of 150 mm, 200mm and 250 mm diameter watermains are proposed to make up the balance of the internal water distribution system providing a looped system to ensure security of supply.

A pressure reducing valve, to the south of the Line 6 watermain connection, will also be required in the design of the water distribution network system for the subject lands.

5.0 WATER SUPPLY Cont'd

The proposed water distribution system network for this development is illustrated in **Figure 3a, 3b and 3c– Water Servicing Plan.**

A Watermain Network Analysis completed by Municipal Engineering Solutions, utilizing the Town's current Water Distribution System model, confirms that adequate water supply and pressures are achievable throughout the proposed subdivision. A copy of the Watermain Network Analysis is provided in **Appendix 1** of this Report.

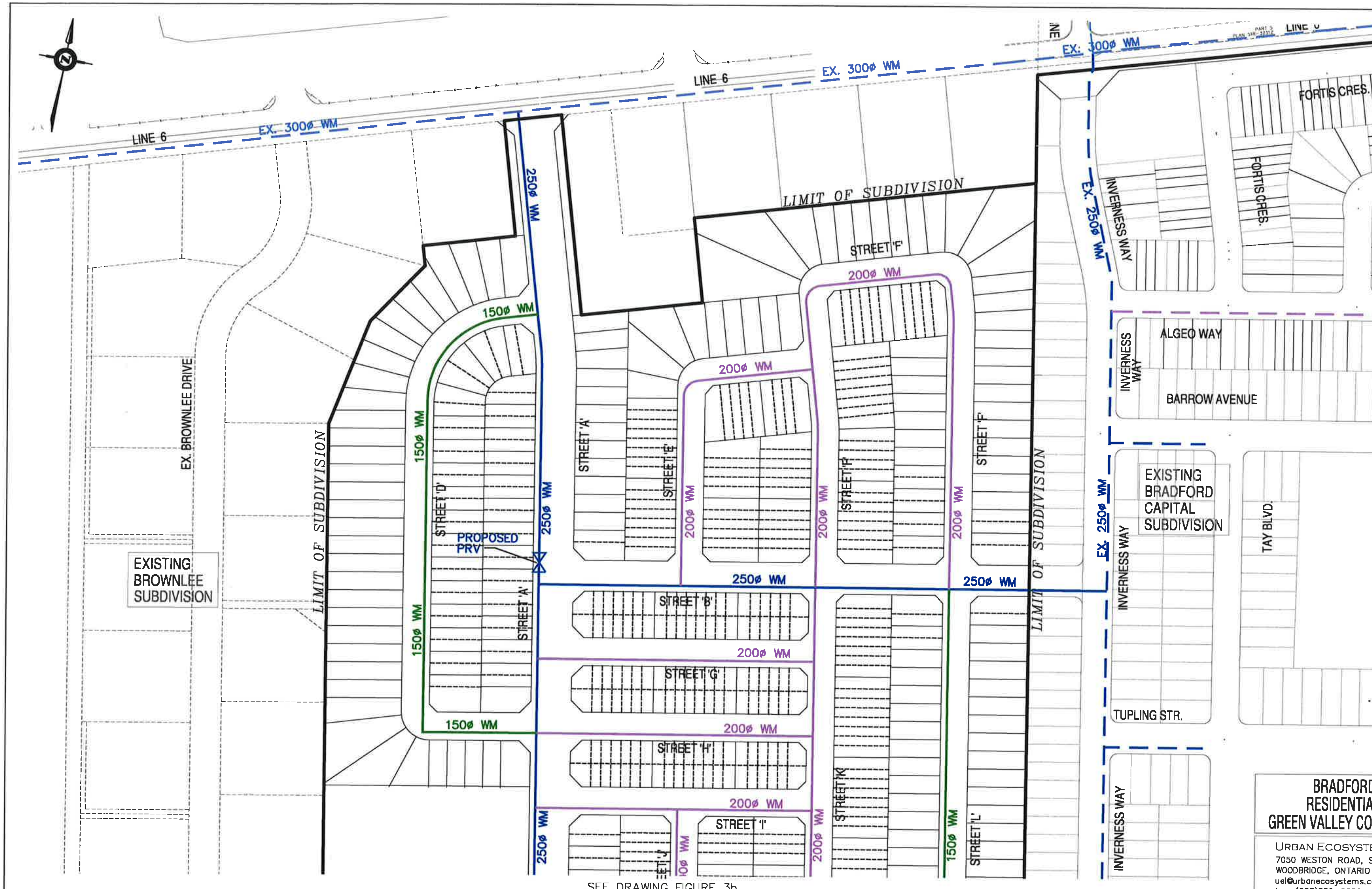
At detailed design stage and also upon finalizing of the development phasing strategy, the water distribution modeling may require updating to ensure that the water distribution network for each phase provides sufficient pressures and flows.

Although the watermain network analysis for this development has been prepared utilizing the Town current water model, the actual water modeling of the distribution system will be completed by the Town's Development Engineer.

In addition to the above, the County of Simcoe recently released a Simcoe Water and Wastewater Service Delivery Review Report, prepared by R.V. Anderson Associates Limited (RVA), Project No. RVA 215657 dated January 31, 2022, which reviewed and summarized the drinking water systems capacities for all municipalities within the County.
Based on the above Report, the County has concluded, that based on approximated current operating conditions and populations, that spare capacity exists to accommodate the water requirements anticipated for future growth within the municipalities.
An excerpt from the Simcoe Water and Wastewater Service Delivery Review Report, prepared by R.V. Anderson Associates Limited (RVA), Project No. RVA 215657 dated January 31, 2022 is provided in **Appendix 2** of this Report.

Table 3.5 Drinking Water Spare Capacity Analysis Results Table, included in the RVA Report, indicates that for the Bradford West Gwillimbury municipality, the total drinking water spare capacity is currently approx. 9,726 cu.m/day representing a spare (equivalent population) capacity ranging from approx. 12,000 to 23,000 population.

Although the above Table 3.5 identifies an opportunity for capacity for the subject lands, allocation of capacity would be subject to the Town of Bradford-West Gwillimbury Servicing Allocation Policy and Council Approval.



LEGEND

150ø WATERMAIN	EX. 150ø WATERMAIN
200ø WATERMAIN	EX. 200ø WATERMAIN
250ø WATERMAIN	EX. 300ø WATERMAIN

BRADFORD HIGHLANDS
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WATER SERVICING PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 3a

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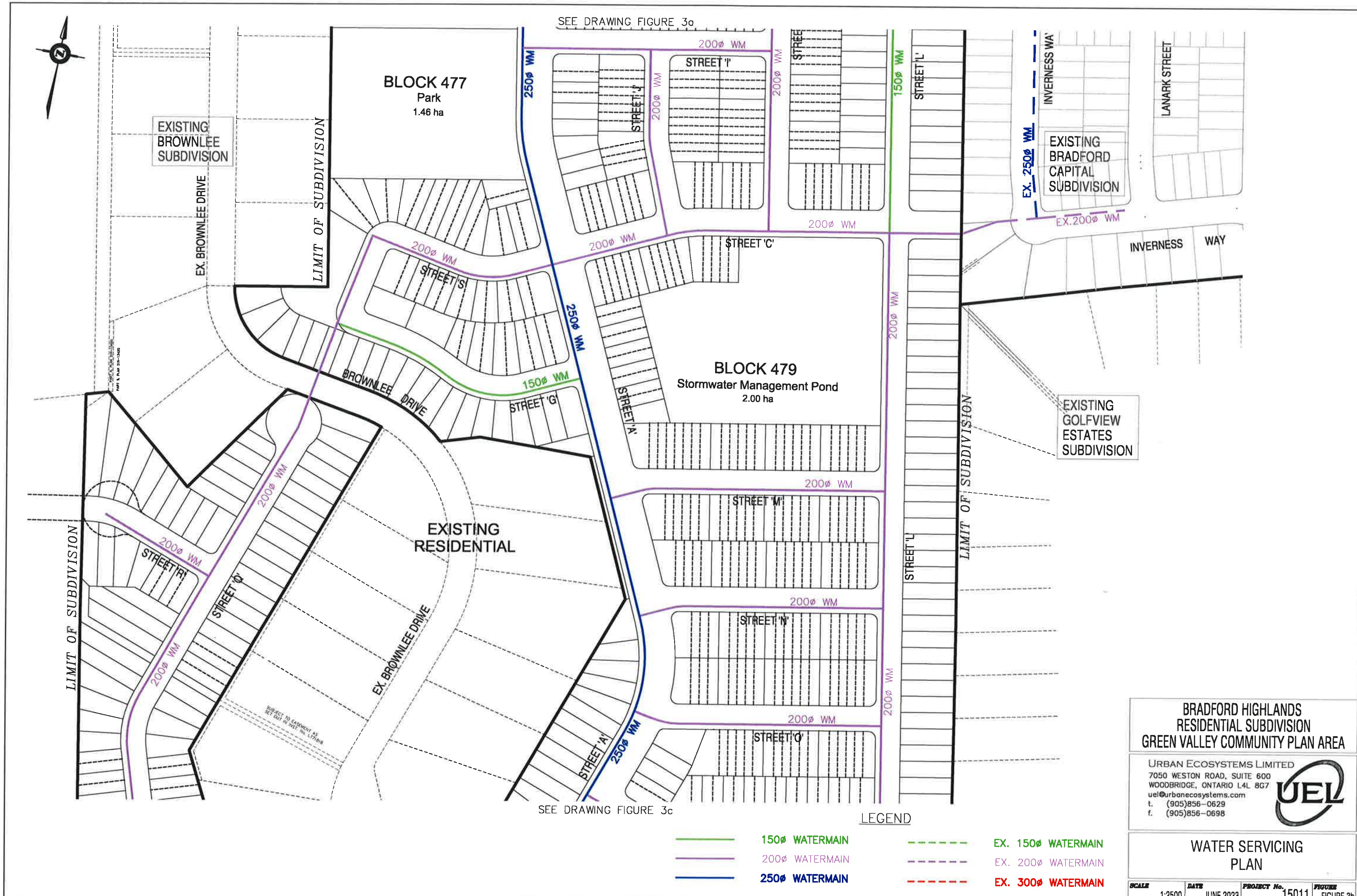
SEE DRAWING FIGURE 3a
BLOCK 477
Park
1.46 ha
EXISTING BROWNLEE SUBDIVISION
EX. BROWNLEE DRIVE
LIMIT OF SUBDIVISION
250ø WM
200ø WM
150ø WM
STREET 'I'
STREET 'J'
STREET 'L'
STREET 'C'
STREET 'S'
STREET 'G'
STREET 'A'
STREET 'M'
STREET 'N'
STREET 'O'
STREET 'Q'
STREET 'R'
BROWNLEE DRIVE
BLOCK 479
Stormwater Management Pond
2.00 ha
INVERNESS WAY
LANARK STREET
EX. 250ø WM
EX.200ø WM
EXISTING BRADFORD CAPITAL SUBDIVISION
EXISTING GOLFVIEW ESTATES SUBDIVISION
EXISTING RESIDENTIAL
EX. BROWNLEE DRIVE
SEE DRAWING FIGURE 3c
LEGEND
150ø WATERMAIN
200ø WATERMAIN
250ø WATERMAIN
EX. 150ø WATERMAIN
EX. 200ø WATERMAIN
EX. 300ø WATERMAIN
BRADFORD HIGHLANDS RESIDENTIAL SUBDIVISION
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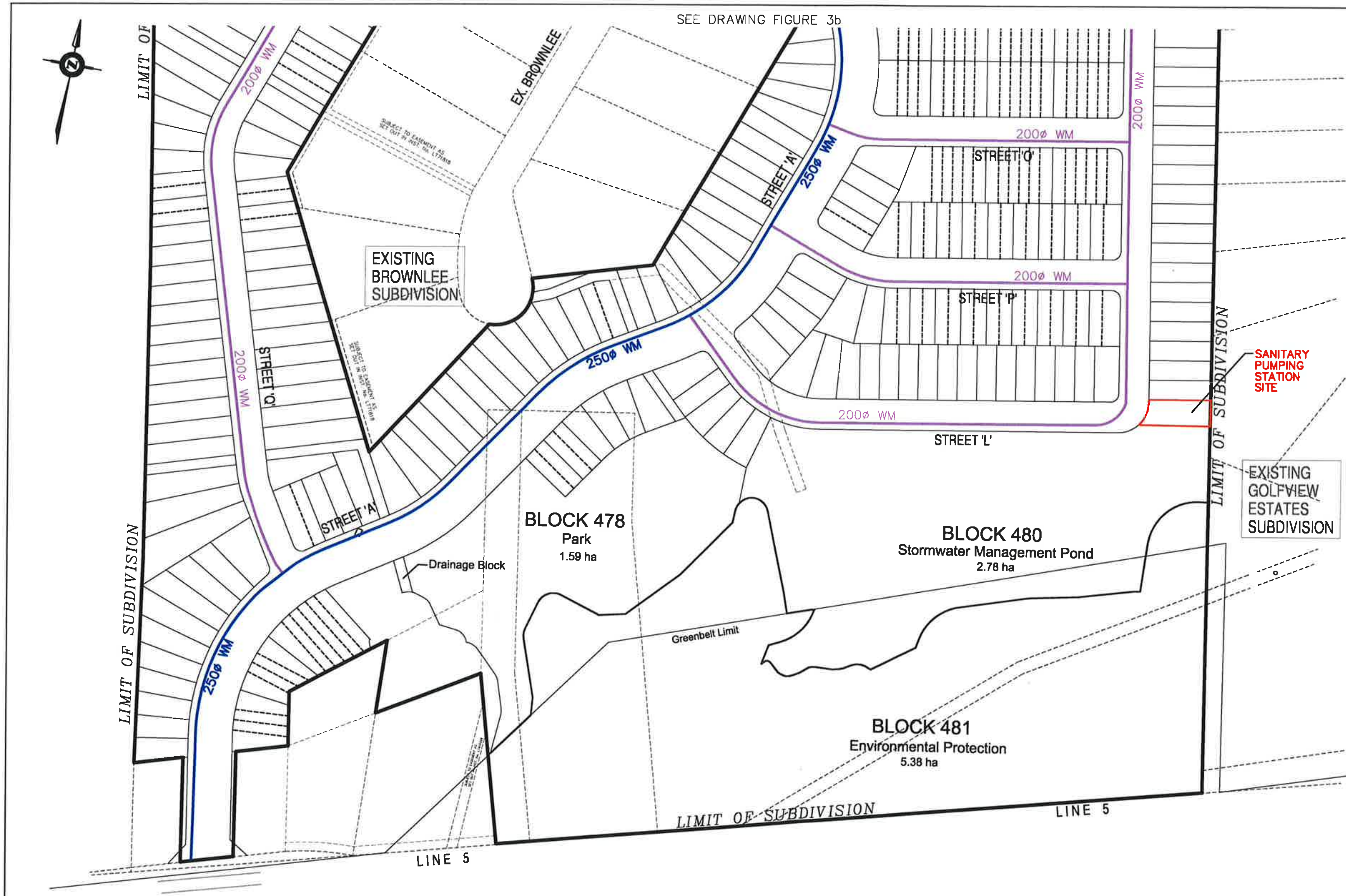
UEL
WATER SERVICING PLAN
SCALE 1:2500
DATE JUNE 2023
PROJECT No. 15011
FIGURE FIGURE 3b



LEGEND

150ø WATERMAIN	EX. 150ø WATERMAIN
200ø WATERMAIN	EX. 200ø WATERMAIN
250ø WATERMAIN	EX. 300ø WATERMAIN

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WATER SERVICING PLAN

SCALE	DATE	PROJECT No.	FIGURE
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6.0 SANITARY SEWAGE SYSTEM

The Master Environmental Servicing Report (MESP) prepared by R.J. Burnside & Associates in June 2008 outlined the sanitary servicing strategy for the Green Valley Community Plan (GVCP) study area.

The sanitary servicing works required in support of (GVCP) development area have been completed and consist of the following:

- Construction of a permanent sanitary pumping station on the south side of Line 6 and Parkwood Avenue and forcemain installation from 6th Line to the existing gravity sanitary sewer located at the intersection of Holland Street and Barrie Street has been completed.
- Construction of a 375 mm diameter gravity sanitary sewer from the permanent pumping station, traversing through Bradford East Residential Subdivision, extending to Simcoe Road and into the Bradford Capital Residential Subdivision has been completed.
- Expansion of the Bradford Water Pollution Control Plant (WPCP) facility located on the east side of Dissette Street discharging effluent to the Holland River and ultimately to Lake Simcoe

Subsequently, additional works have been completed to support expansion of the Green Valley Community Plan (GVCP) study area to accommodate further development within the Town of Bradford-West Gwillimbury, in particular,

- As part of the sanitary servicing design for the Bradford Capital Residential Subdivision, an internal 300 mm sanitary sewer has been extended westerly for the future servicing of the Bradford Highland development lands.

Based on the existing sanitary infrastructure system, the proposed sanitary servicing strategy for the subject lands is as follows:

- Installation of a 300 mm diameter gravity sanitary sewer from Inverness Way westerly to service the subject lands
- Installation of internal gravity sanitary sewers, varying in size from 200 mm diameter and 250 mm diameter at a minimum 0.50% gradient, as illustrated in **Figure 4a, 4b and 4c – Internal Sanitary Servicing Plan and Figure 5a and 5b – Sanitary Drainage Area Plan.**
- Complete modifications and/or upgrades to the line 6 Sanitary Pumping Station to accommodate increase sanitary flows from the proposed development.

6.0 SANITARY SEWAGE SYSTEM Cont'd

Sanitary sewage flows are proposed to be conveyed to outlet to the existing sanitary sewer system within the Bradford Capital Residential Subdivision

The northerly half of the subject development lands are proposed to be serviced by internal gravity sanitary sewers and discharging directly to the Inverness Way sanitary sewer connection.

The southerly half of the subject development lands are proposed to be serviced by internal gravity sanitary sewers discharging to a local pumping station, proposed to be located at the south east limit of the subject lands which will pump sewage flows to an upstream sanitary manhole which will also discharge to the Inverness Way sanitary sewer connection.

Sanitary sewage flows from this development can be conveyed and accommodated by the existing sanitary sewer system to the line 6 Sanitary Pumping Station.

The Line 6 Sanitary Pumping Station may require some modification and/or upgrade to accommodate the increased sanitary flow to outlet to the Town's Waste water treatment plant.

In addition to the above, the County of Simcoe recently released a Simcoe Water and Wastewater Service Delivery Review Report, prepared by R.V. Anderson Associates Limited (RVA), Project No. RVA 215657 dated January 31, 2022, which reviewed and summarized the wastewater systems capacities for all municipalities within the County.

Based on the above Report the County has concluded, that based on approximated current operating conditions and populations, spare capacity exists to accommodate the wastewater requirements anticipated for future growth within the municipalities.

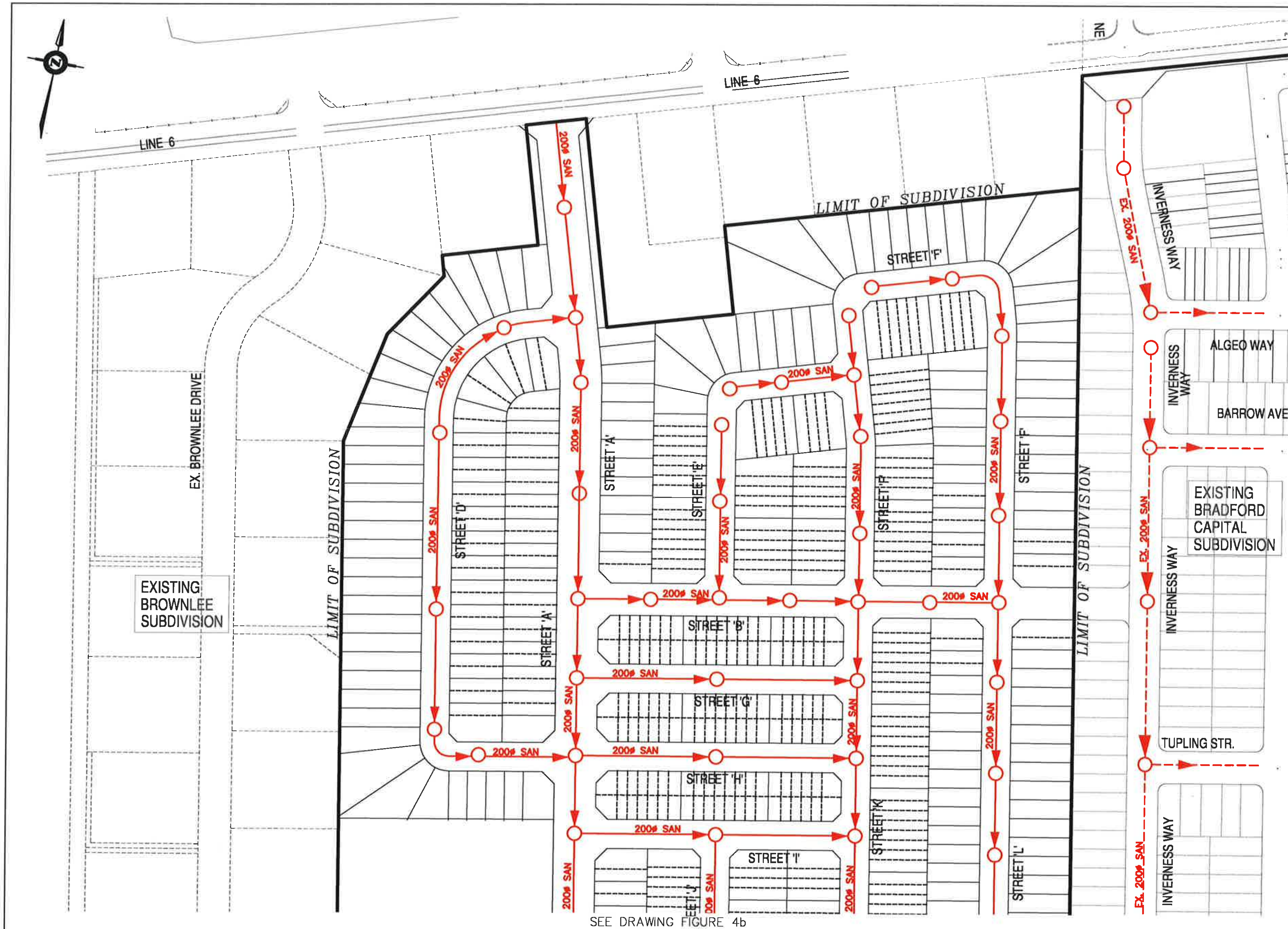
An excerpt from the Simcoe Water and Wastewater Service Delivery Review Report, prepared by R.V. Anderson Associates Limited (RVA), Project No. RVA 215657 dated January 31, 2022 is provided in **Appendix 2** of this Report.

Table 3.6 Wastewater Spare Capacity Analysis Results Table, included in the RVA Report, indicates that for the Bradford West Gwillimbury municipality, the total wastewater spare capacity is currently approx. 6687 cu.m/day representing a spare (equivalent population) capacity ranging from approx. 14,900 to 20,600 population.

6.0 SANITARY SEWAGE SYSTEM Cont'd

Although the above Table 3.6 identifies an opportunity for capacity for the subject lands, allocation of capacity would be subject to the Town of Bradford-West Gwillimbury Servicing Allocation Policy and Council Approval.

A preliminary sanitary design sheet for this development is included in **Appendix 3** of this FSR.



LEGEND

- 200ø SANITARY SEWER
- 250ø SANITARY SEWER
- 300ø SANITARY SEWER
- EX. 200ø SANITARY SEWER

BRADFORD HIGHLANDS
RESIDENTIAL SUBDIVISION
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SANITARY SERVICING PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 4a

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SEE DRAWING FIGURE 4a
BLOCK 477
Park
1.46 ha
EXISTING BROWNLEE SUBDIVISION
EX. BROWNLEE DRIVE
LIMIT OF SUBDIVISION
STREET 'I'
STREET 'J'
STREET 'L'
STREET 'C'
STREET 'S'
STREET 'G'
STREET 'A'
STREET 'M'
STREET 'N'
STREET 'O'
STREET 'R'
STREET 'Q'
BROWNLEE DRIVE
INVERNESS WAY
EXISTING BRADFORD CAPITAL SUBDIVISION
EXISTING GOLFVIEW ESTATES SUBDIVISION
BLOCK 479
Stormwater Management Pond
2.00 ha
EXISTING RESIDENTIAL
EX. BROWNLEE DRIVE
200ø SAN
250ø SAN
300ø SAN
EX. 200ø SAN
EX. 300ø SAN
SEE DRAWING FIGURE 4c
LEGEND
200ø SANITARY SEWER
250ø SANITARY SEWER
300ø SANITARY SEWER
EX. 200ø SANITARY SEWER
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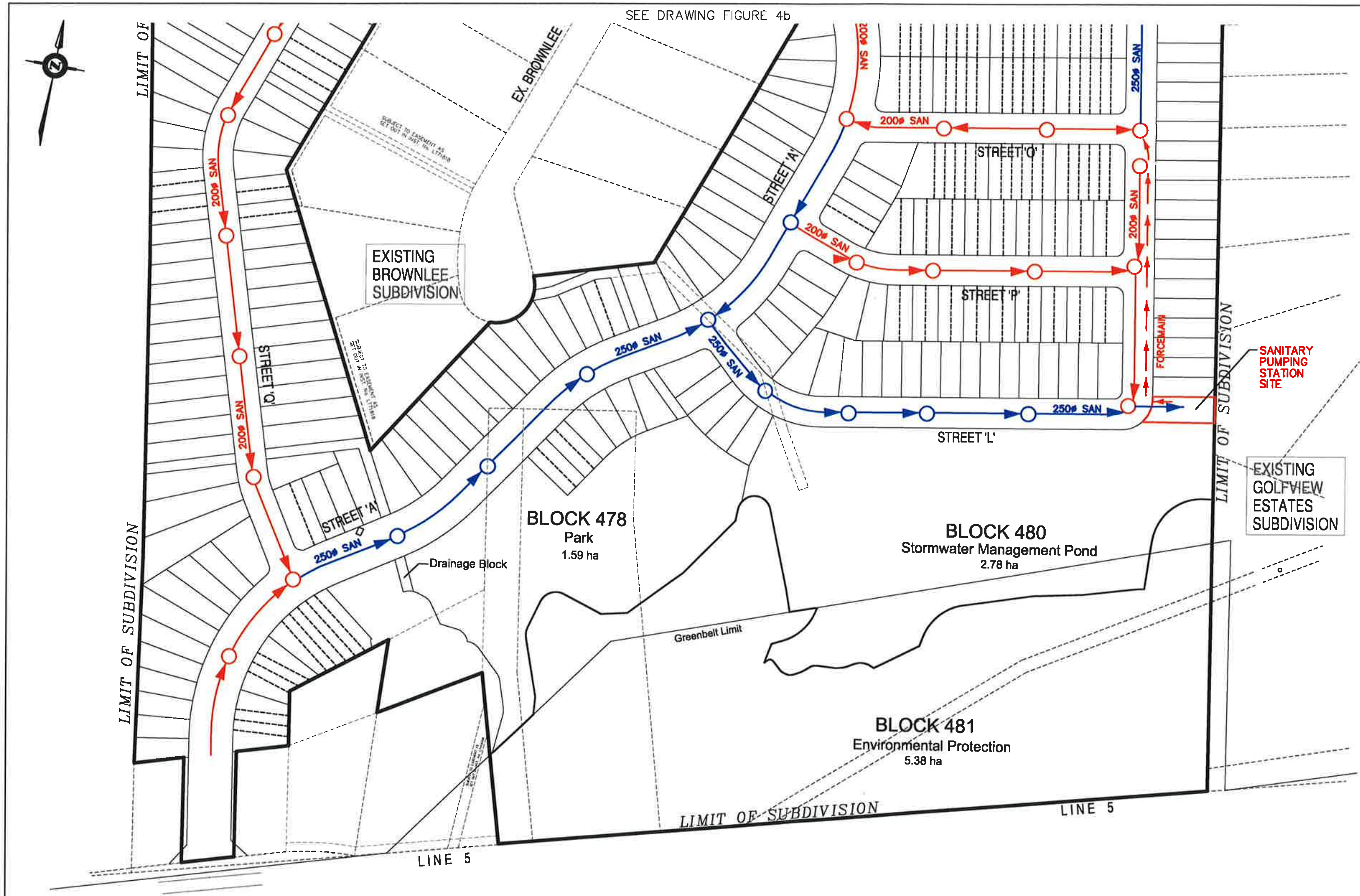
SANITARY SERVICING PLAN
SCALE 1:2500
DATE JUNE 2023
PROJECT No. 15011
FIGURE FIGURE 4b



LEGEND

(solid red line)	200ø SANITARY SEWER
(solid blue line)	250ø SANITARY SEWER
(solid green line)	300ø SANITARY SEWER
(dashed red line)	EX. 200ø SANITARY SEWER

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SANITARY SERVICING PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 4c

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LEGEND

1.27 Ha — AREA

BRADFORD HIGHLANDS
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SANITARY DRAINAGE
AREA PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 5a

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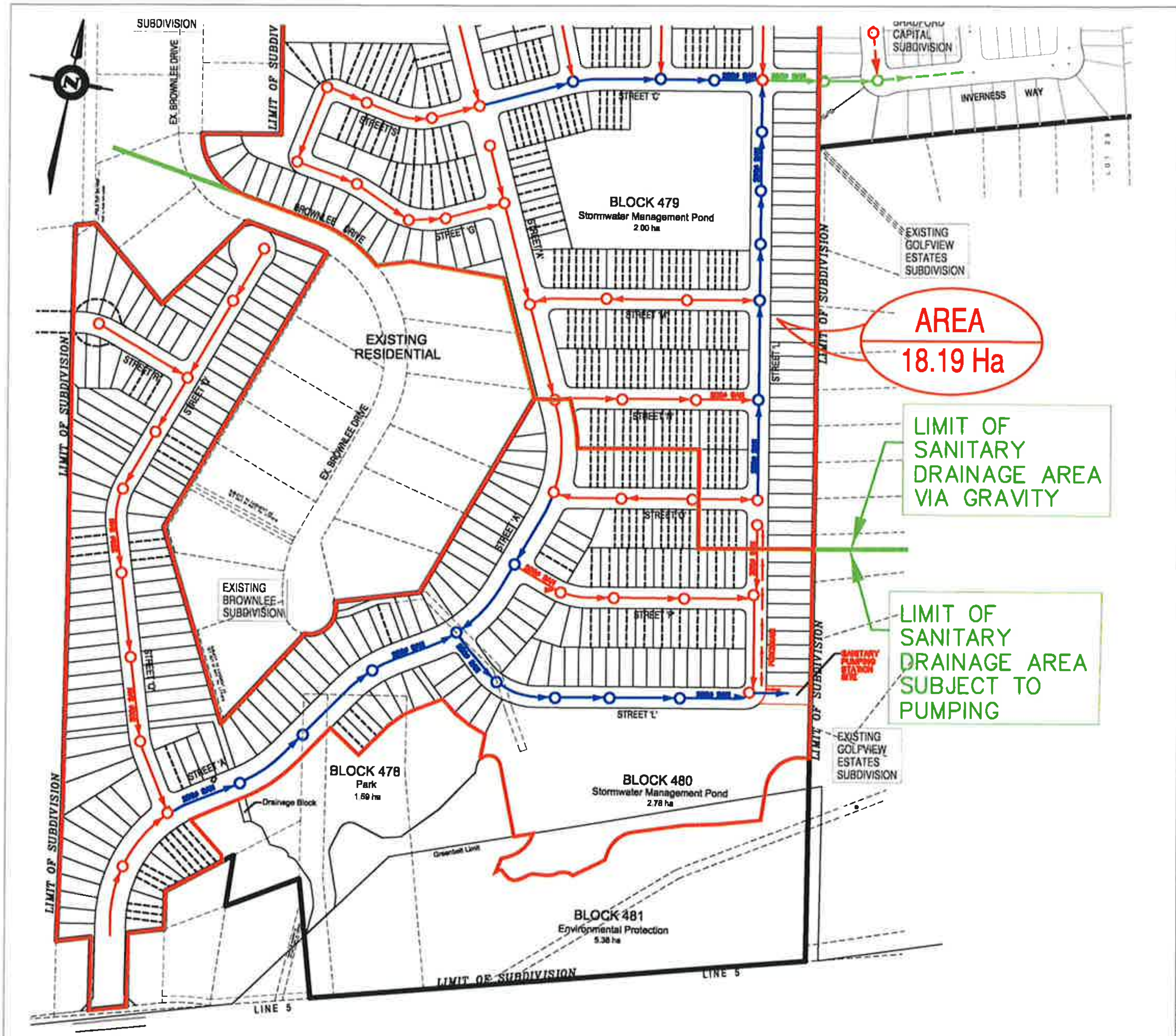

LEGEND

1.27 Ha — AREA

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SANITARY DRAINAGE AREA PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 5b

ID - P:\2015\15011-BRADFORD HIGHLANDS\FSR\15011-FSR-SANITARY DRAINAGE PLAN.dwg

7.0 STORM SEWER SYSTEM

The storm sewer system will be designed to convey the 10 year minor design storm in an underground piped network system, as illustrated in **Figure 6a, 6b and 6c– Storm Servicing Plan**

Surface runoff along the street will be conveyed via a roadside curb and gutter system and captured by a series of street catchbasins that are directed into an underground piped sewer system. External surface runoff along the west limit of the subject lands will be conveyed via drainage side yard swales and captured by a series of rear yard catchbasins that are directed into an underground piped system.

The proposed road layout and grading design preserves the existing drainage patterns and minimizes the amount of earthworks and disturbances to the adjacent properties.

It is anticipated that the storm sewer system will be divided into north and south drainage catchment areas with inlets into two SWM ponds, as illustrated in **Figure 7a and 7b– Storm Drainage Area Plan.**

The inlet of the North SWM Pond will accommodate approximately 28.4 ha of the northern part of the proposed subdivision and approximately 8.0 ha of the northern part of the external area to the west.

The inlet of the South SWM Pond will accommodate approximately 24.1 ha of the southern part of the proposed subdivision and approximately 4.8 ha of the southern part of the external area to the west.

The external storm drainage areas are illustrated in **Figure 8a and 8b– External Storm Drainage Plan .**

The proposed South Park block (1.6 ha) and the existing drainage flow from Drainage Feature 'D' and Drainage Feature 'E' (approx. 31 ha) will continue to drain in a south easterly direction, by-passing the South SWM Pond, and outletting to the existing North Canal watercourse.

7.0 STORM SEWER SYSTEM Cont'd

Flows exceeding the capacity of the minor drainage piped underground system, up to the 100 year storm event, will be conveyed overland. These flows will be contained within side yard swale easements and road allowances and will generally follow the minor storm sewer system to the SWM ponds.

The minor drainage and major drainage system flows will ultimately outlet into the SWM pond where they will be controlled to pre-development levels.

The controlled North SWM pond flows will then discharge into a proposed 1200mm diameter storm sewer outletting to the existing storm sewers within the Bradford Capital Residential Subdivision.

The controlled South SWM pond flows will then discharge into a proposed drainage swale outletting to the North Canal watercourse.

SEE DRAWING FIGURE 6b

LEGEND

STORM SEWER

BRADFORD HIGHLANDS
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UEL

STORM SERVICING PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 6a

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STORM SERVICING PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 6b

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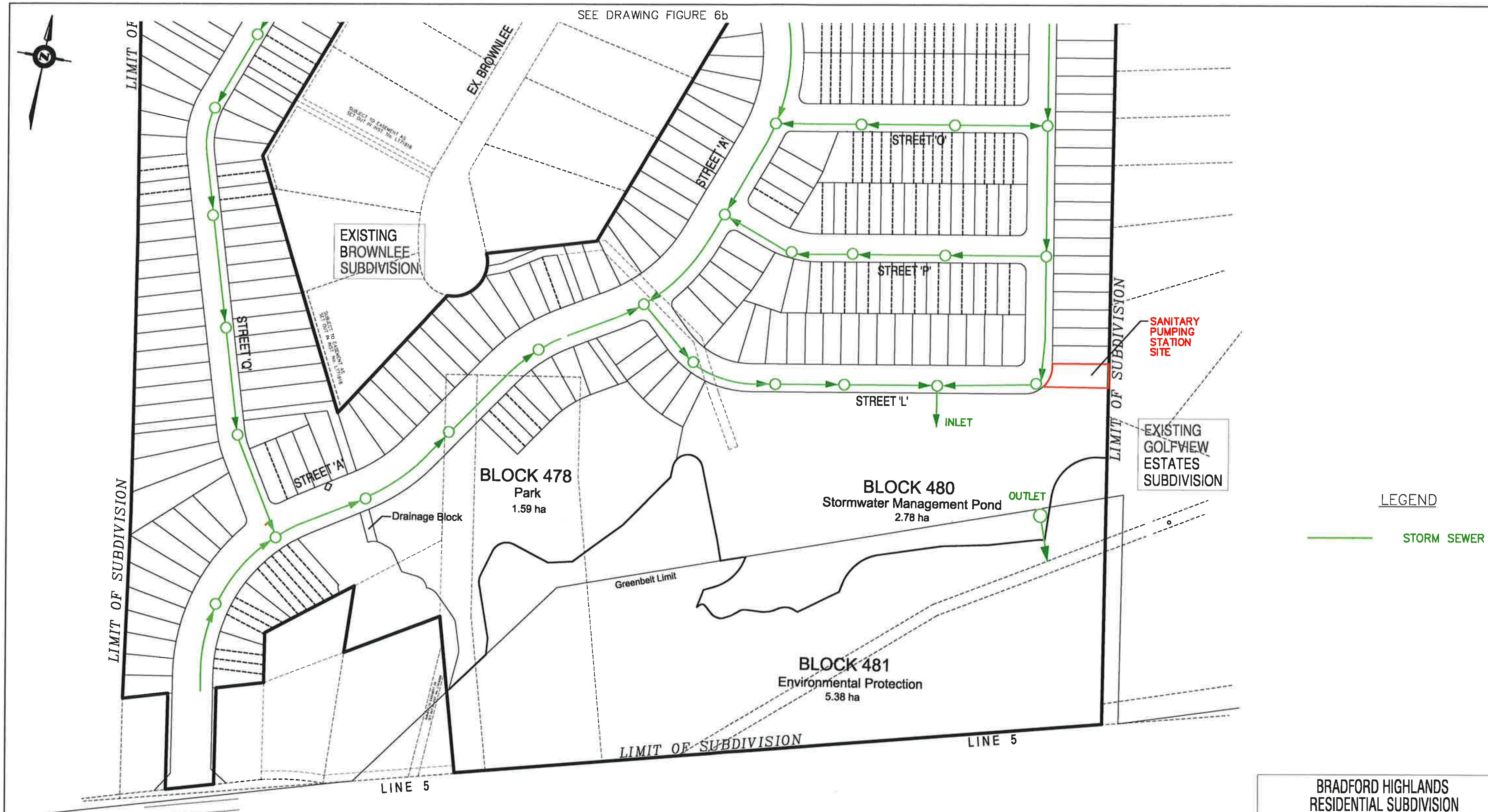

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STORM SERVICING PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 6c

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STORM DRAINAGE AREA PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 7a

ID - P:\2015\15011-BRADFORD HIGHLANDS\FSR\15011-FSR-SANITARY DRAINAGE PLAN.dwg

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STORM DRAINAGE AREA PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 7b

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EXTERNAL STORM DRAINAGE AREA PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 8a

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EXTERNAL STORM DRAINAGE AREA PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 8b

ID - P:\2015\15011-BRADFORD HIGHLANDS\FSR\15011-FSR-STORM DRAINAGE PLAN.dwg

8.0 ROOF / FOUNDATION DRAIN COLLECTOR SEWER

Town of Bradford-West Gwillimbury requires storm service connections be included in the storm sewer system design to convey water collected by the individual foundation drains constructed for the homes.

Lake Simcoe Conservation Authority (LSRCA) promotes the use of Low Impact Development Features to preserve natural areas, reduce impervious cover, use pervious areas to improve quality of stormwater runoff and reduce storm runoff volumes to mimic natural hydrology features of the pre-development lands (ie. post development infiltration matches pre-development infiltration levels).

A 200 mm diameter Roof / Foundation Drain Collector (RFDC) Sewer Installation is therefore proposed for this development to address Town individual dwelling storm connection requirement and also address LSRCA water balance requirement of matching post to pre-development conditions, as illustrated in **Figure 9a, 9b and 9c – Roof / Foundation Drain Collector Servicing Plan.**

The RFDC sewer/gallery installation is proposed to be located within the road allowance and is intended to collect foundation drainage flows and roof drainage flows from the proposed homes in this development and promote exfiltration of the collected foundation drain flows and roof drainage flows back into the soils.

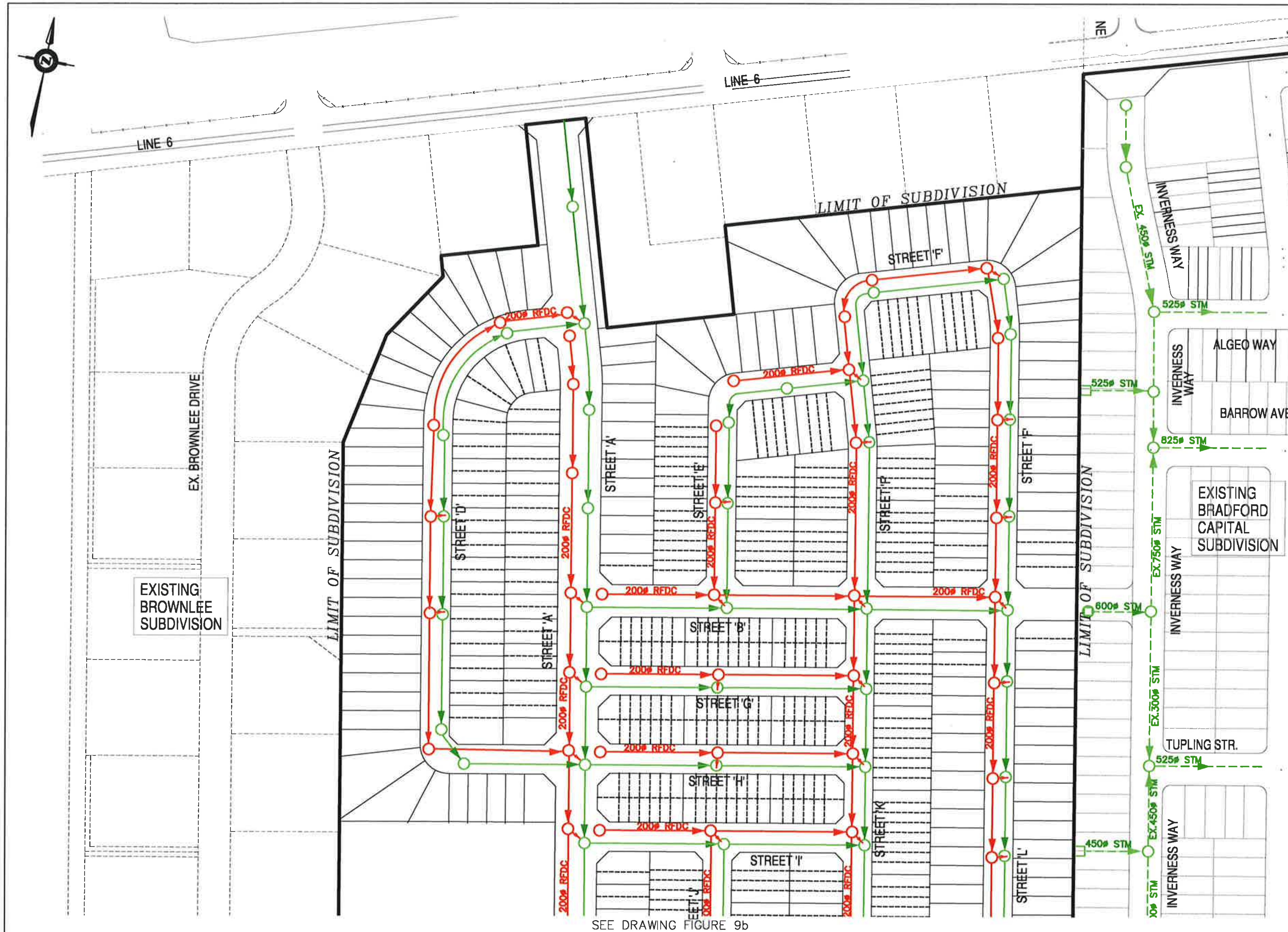
The RFDC sewer/gallery installation will consist of a perforated pvc pipe, located in a gravel jacket lined with a pervious geosynthetic non-woven geotextile fabric. The individual lot RFDC service connection, from the RFDC Sewer to property line, will consist of a non-perforated pvc pipe in accordance with Town service connection standard drawings.

The RFDC service connection pipe will terminate at the front of the house with a vertical riser pipe designed to accept foundation drainage flows from the house sump pump installation in accordance with UEL modified Town standard drawing C103 Revised (Refer to **Figure No. 10 – Sump Pump Discharge to RFDC Connection Detail**).

The RFDC service connection pipe will also include a pre-manufactured "y" connection, located prior to the foundation drain vertical riser pipe, with the drain pipes being extended to the front corner of the house and terminated with vertical riser pipes designed to accept roof drainage flows from the house eaves trough downspout installations (Refer to **Figure 11 – Typical Detached Lot Service Arrangement Detail**).

The RFDC sewer/ gallery installation will also include overflow riser pipe connections to the proposed storm sewers in the road, at selected locations, to provide overflow relief in cases of blockages and/or increased drainage flows in order to prevent drain flows from backing up into the houses. Refer to **Figure No. 12 – RFDC Sewer Connection to Storm Sewer Detail.**

Details of the storm service connection and sump pump installation shall be per Town of Bradford standard C 103.



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ROOF / FOUNDATION DRAIN COLLECTOR PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 9a

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LEGEND

200ø ROOF / FOUNDATION DRAIN COLLECTOR

STORM SEWER

BRADFORD HIGHLANDS
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ROOF / FOUNDATION DRAIN COLLECTOR PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 9b

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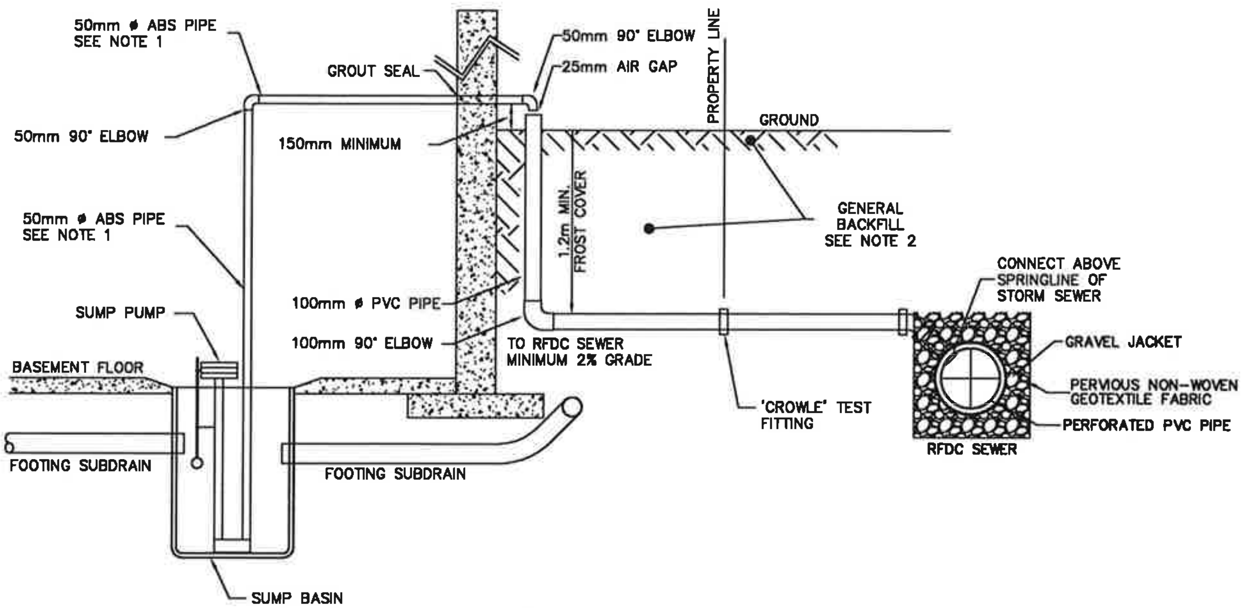
ROOF / FOUNDATION DRAIN COLLECTOR PLAN

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 9c



NOTES:

1. ACRYLONITRILE-BUTADIENE-STYRENE (ABS) PIPE, CSA B181-1.
2. BACKFILL TO BE SELECT NATIVE BACKFILL MATERIAL, COMPACTED TO 95% SPD.

ALL DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.

UEL MODIFIED

TOWN OF BRADFORD WEST GWILLIMBURY

SUMP PUMP DISCHARGE TO RFDC SEWER	SCALE: N.T.S. LAST REVISED: JUNE 2023 STD.DWG. C103-REV

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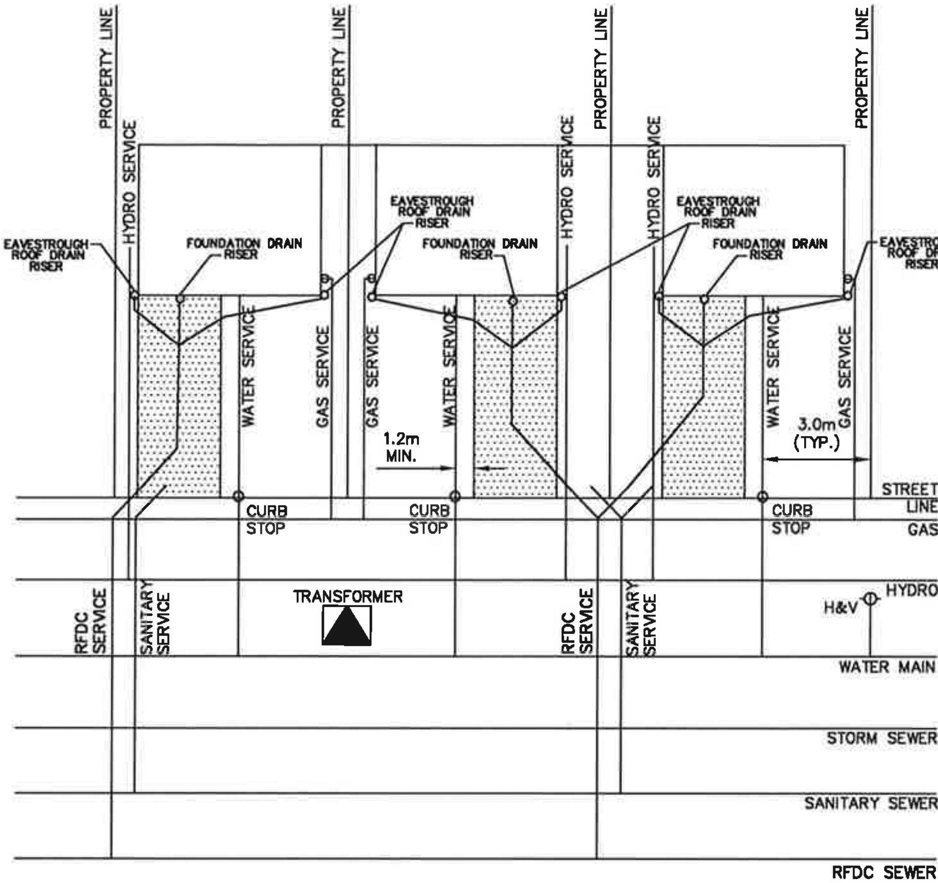
SUMP PUMP DISCHARGE TO RFDC CONNECTION DETAIL

DATE	PROJECT No.	FIGURE
JUNE 2023	15011	FIGURE 10



NOTES

1. PROPOSED DRIVEWAY APRONS TO BE SHOWN ON DRAWINGS.
2. WATER SERVICES WILL NOT BE PERMITTED WITHIN DRIVEWAYS UNLESS OTHERWISE APPROVED BY THE TOWN.
3. REFER TO BWG DESIGN STANDARDS E101, E102 AND E103 FOR DETAILS FOR CONSTRUCTION OF STORM AND SANITARY SERVICES.

ALL DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.

UEL MODIFIED

TOWN OF BRADFORD WEST GWILLIMBURY	
TYPICAL DETACHED LOT SERVICE ARRANGEMENT	SCALE: N.T.S.
	LAST REVISED: JUNE 2023
	STD.DWG. C101–REV

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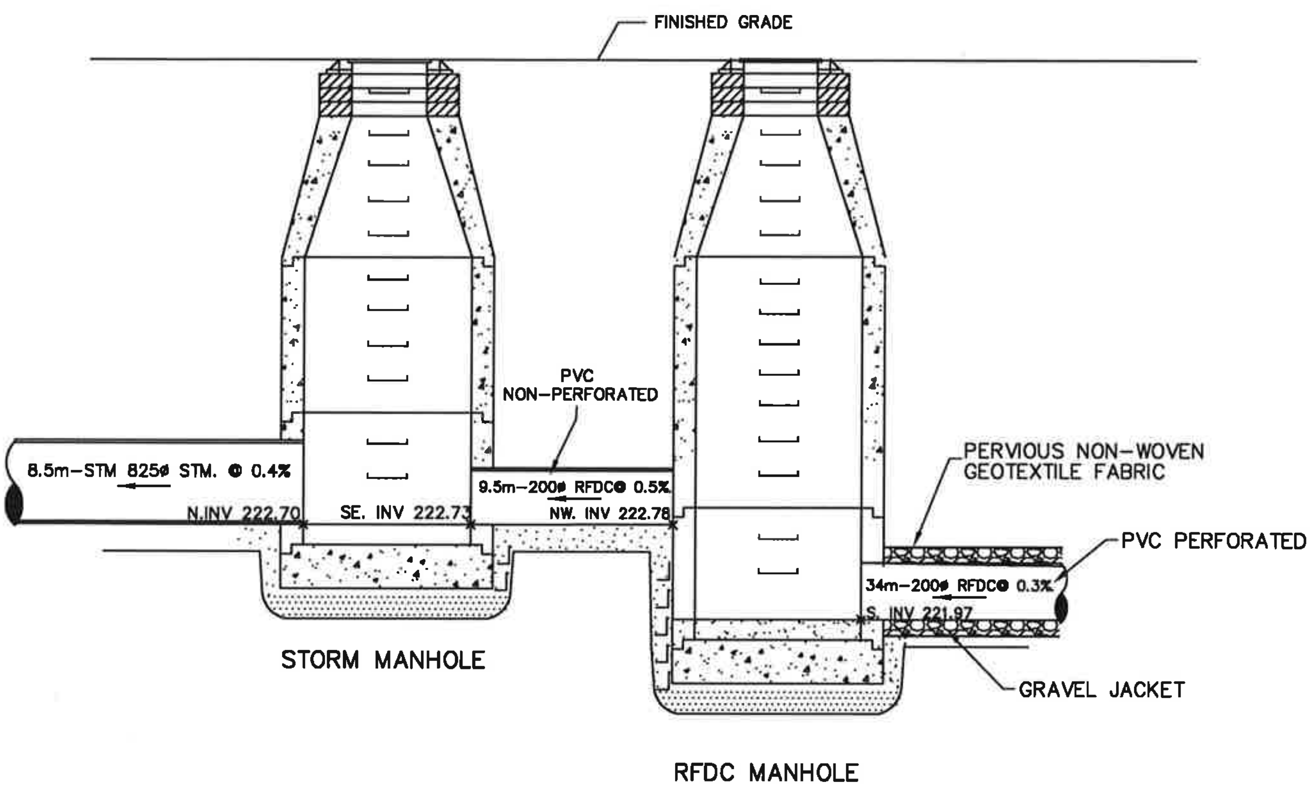
TYPICAL DETACHED LOT SERVICE ARRANGEMENT DETAIL

DATE	PROJECT No.	FIGURE
JUNE 2023	15011	FIGURE 11



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RFDC SEWER CONNECTION TO STORM SEWER DETAIL

DATE	PROJECT No.	FIGURE
JUNE 2023	15011	FIGURE 12

9.0 STORMWATER MANGEMENT SYSTEM

Stormwater management facility blocks are proposed to address stormwater runoff, outlet treatment and conveyance for this development site. The primary objective of the best management plan is to provide post-development control to pre-development levels and to ensure that quality of the runoff discharging from the site and the flood hazards (upstream, downstream or within the subject property) are not adversely impacted as a result of the proposed development.

It is anticipated that the storm sewer system will be divided into north and south drainage catchment areas with inlets into two Stormwater management facility blocks.

The North SWM Pond will accommodate approximately 49 ha drainage area, consisting of the northerly part of the proposed subdivision and external land areas.

The South SWM Pond will accommodate approximately 79 ha drainage area, consisting of the southerly part of the proposed subdivision and external land areas.

Flows exceeding the capacity of the minor drainage piped underground system, up to the 100-year storm event, will be conveyed overland. These flows will be contained within the side-yard swale easements and road allowances and will generally follow the minor storm sewers system to the SWM pond. The minor drainage and major drainage system flows will ultimately outlet into the SWM pond where they will be controlled to pre-development levels.

The controlled northerly SWM pond flows will then discharge into the existing storm sewer within Inverness Way of the Bradford Capital Residential Subdivision and ultimately out-letting via Simcoe Road culvert crossing to existing Tributary No. 1 watercourse located on the east side of Simcoe Road.

The controlled southerly SWM pond flows will discharge into the existing drainage channel located in the south east quadrant of this development and ultimately out-letting to the North Canal watercourse.

The Stormwater Management Ponds are proposed to provide water quality level 1 treatment and erosion control of the stormwater run-off from the subject lands. In addition to quality control, the stormwater management facilities will also control post-development drainage flows to pre-development levels.

Existing external drainage E, located in the south westerly quadrant of the lands, will be allowed to continue to drain, by-passing the South SWM pond by internal drainage channels and road crossings, to outlet to the existing wetland area at the south limit of the lands.

Figure 13 – North SWM Pond illustrates the stormwater management facility proposed to accommodate the northerly part of the proposed subdivision.

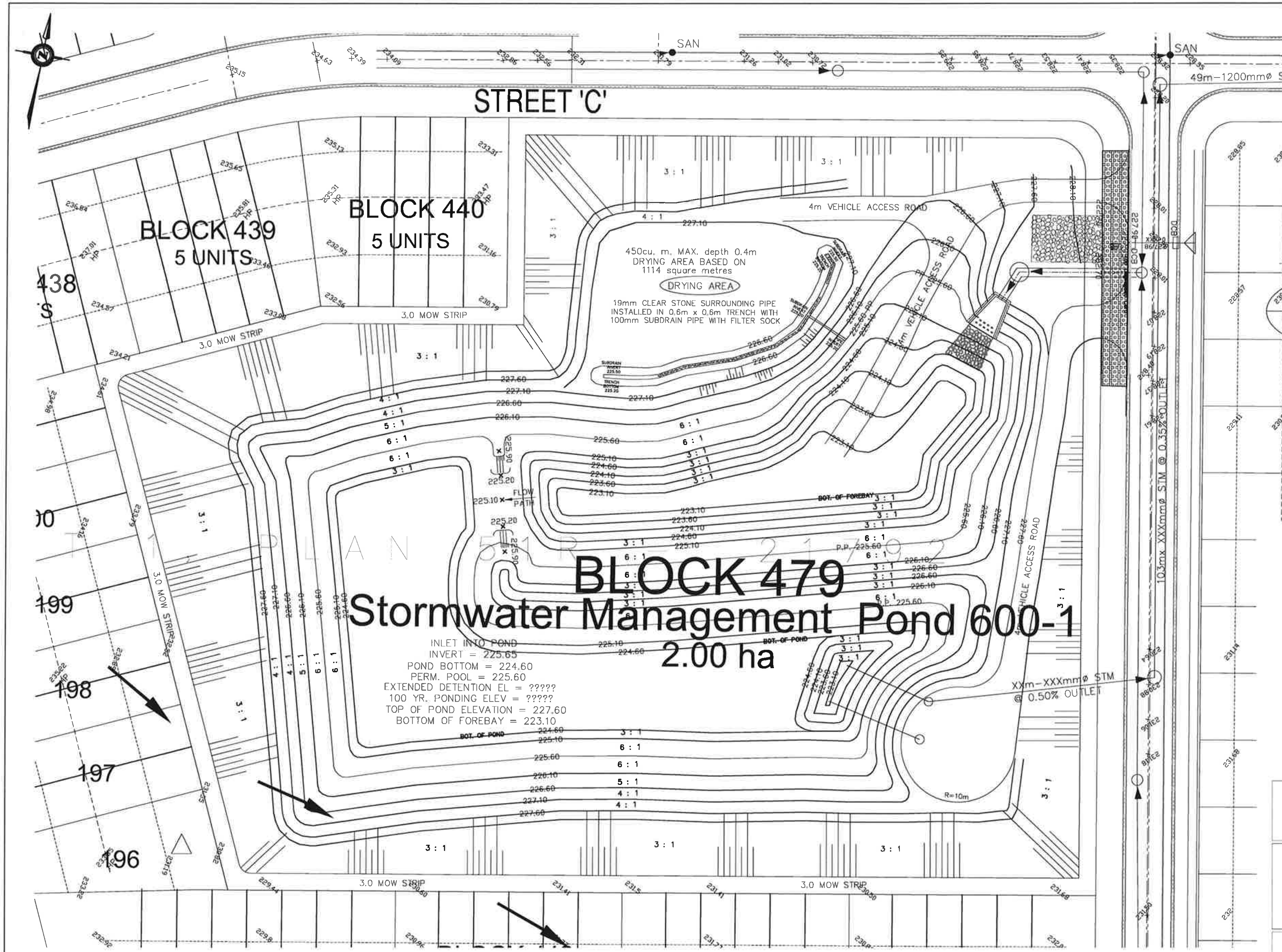
Figure 14 – South SWM Pond illustrates the stormwater management facility proposed to accommodate the southerly part of the proposed subdivision.

9.0 STORMWATER MANGEMENT SYSTEM Cont'd

The stormwater management strategy for the proposed Bradford Highlands residential subdivision has been developed by KSGS Engineering Corp.

Consultation between Urban Ecosystems Limited and KSGS have taken place to ensure that the municipal servicing aspects of the subdivision design, as described in this Report, integrate efficiently with all stormwater management requirements to produce the best suited overall servicing strategy.

The details of the Stormwater Management Ponds are provided in the Stormwater Management Report prepared by KSGS Engineering Corp dated July 2023



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NORTH STORMWATER
MANAGEMENT POND

SCALE	DATE	PROJECT No.	FIGURE
NTS	JUNE 2023	15011	FIGURE 13

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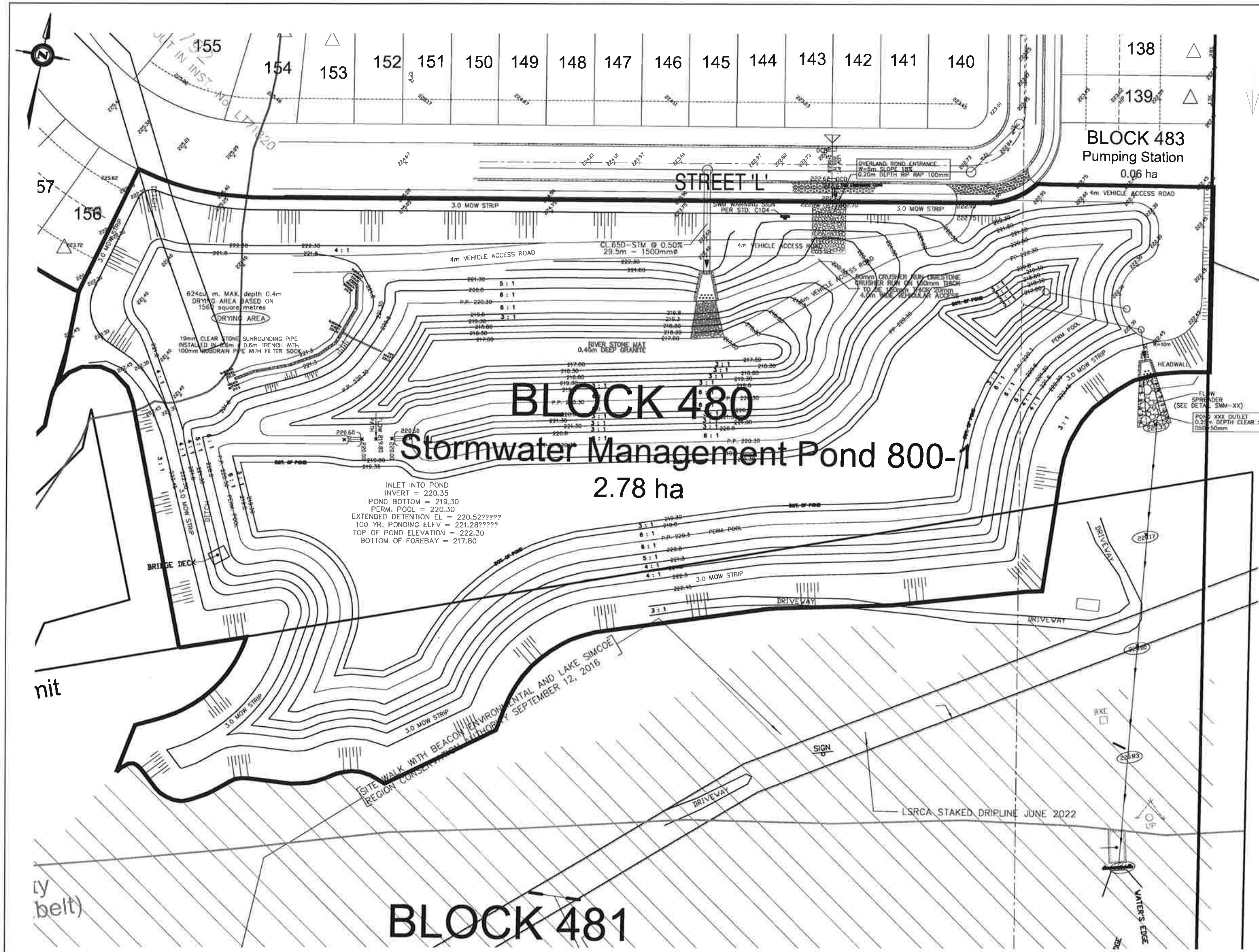

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SOUTH STORMWATER MANAGEMENT POND

SCALE	DATE	PROJECT No.	FIGURE
NTS	JUNE 2023	15011	FIGURE 14

10.0 STREETSCAPING AND ROAD GRADING

All internal roadways will be fully urbanized with sodded boulevards and concrete curb and pavement. A preliminary investigation of the road profile design confirms that the streets in the plan can be designed to match closely with the existing topography and in conformity with the existing drainage pattern while providing sufficient cover for the storm and sanitary sewer systems compatible with the available outlet sewer depths.

A preliminary road design and overland flow strategy proposed for this development is illustrated on **Figure 15a, 15b and 15c – Road Design and Overland Flow Routing.**

All proposed roadway gradients comply with the Town of Bradford-West Gwillimbury geometric road design criteria and offer sufficient sight and stopping distances. The cross-section of the typical roadway is in accordance with Town standards.

Major system overland flow routes along the roadway is achieved while minimizing extensive earthworks. Roadway fill material is to be approved, non-frost susceptible, well-drained and compacted on a firm stable ground. Slopes in areas of deep cut are to be benched to control erosion with intercepting ditches constructed to direct run-off to suitable outlets.

11.0 ROADS

All internal roadways will be fully urbanized with sodded boulevards, concrete curb and asphalt pavement. It is anticipated that the roadways proposed for this development can be designed to match closely with the existing topography and in conformity with the existing drainage pattern while providing sufficient cover for the storm and sanitary sewer systems compatible with the available outlet sewer depths. Major system overland flow routes along the roadway can be achieved while minimizing extensive earthworks.

Construction of roadway network to include pedestrian sidewalks and/or a walking/trail system.

Road access to the proposed development will occur at several points, including one proposed road connection to Line 6, a proposed road connection to Line 5, and two proposed road connections to Inverness Way located within the Bradford Capital Residential Subdivision.

SEE DRAWING FIGURE 15b

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ROAD DESIGN AND OVERLAND FLOW ROUTING

SCALE	DATE	PROJECT No.	FIGURE
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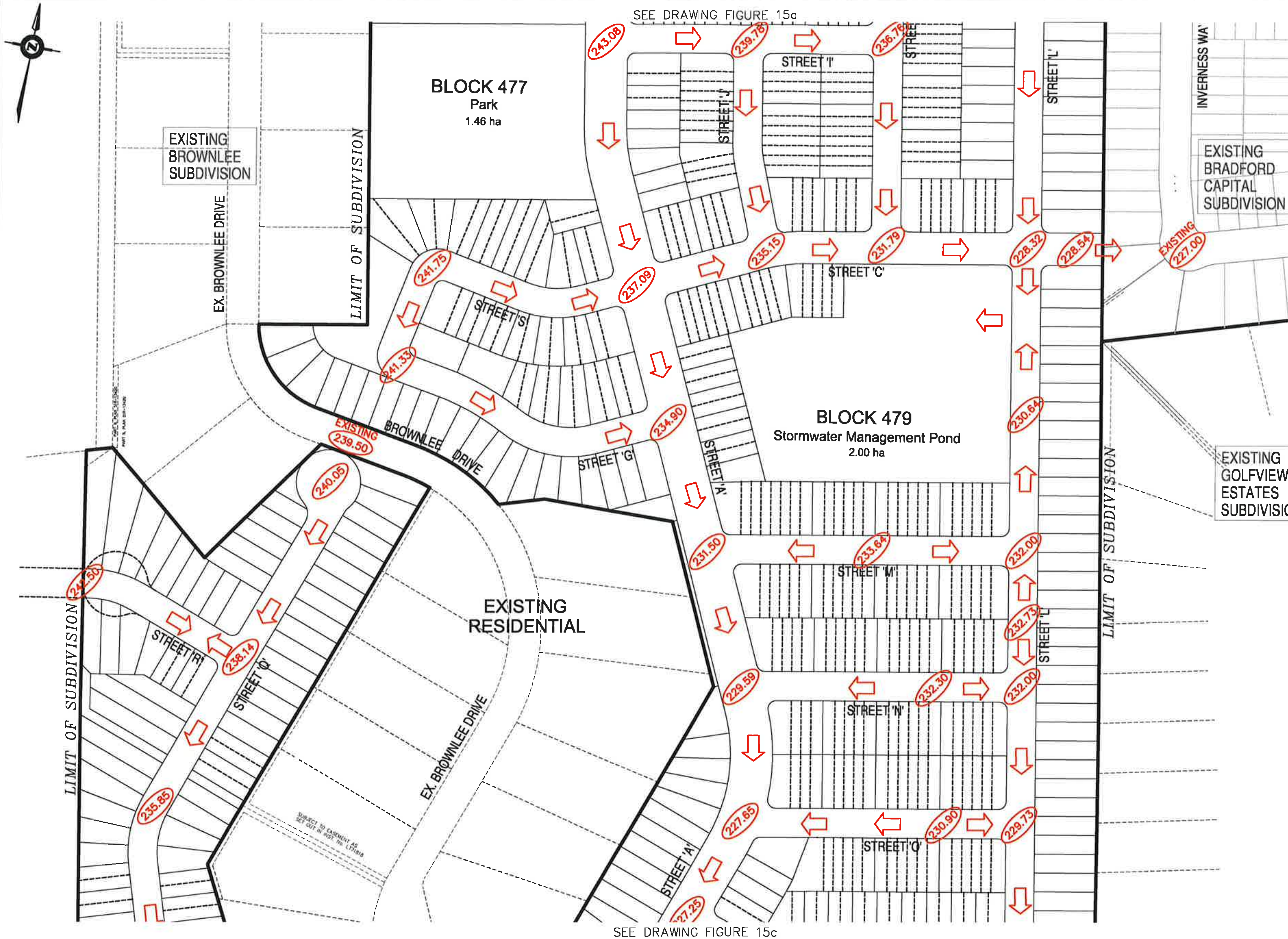

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ROAD DESIGN AND
OVERLAND FLOW ROUTING

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 15b

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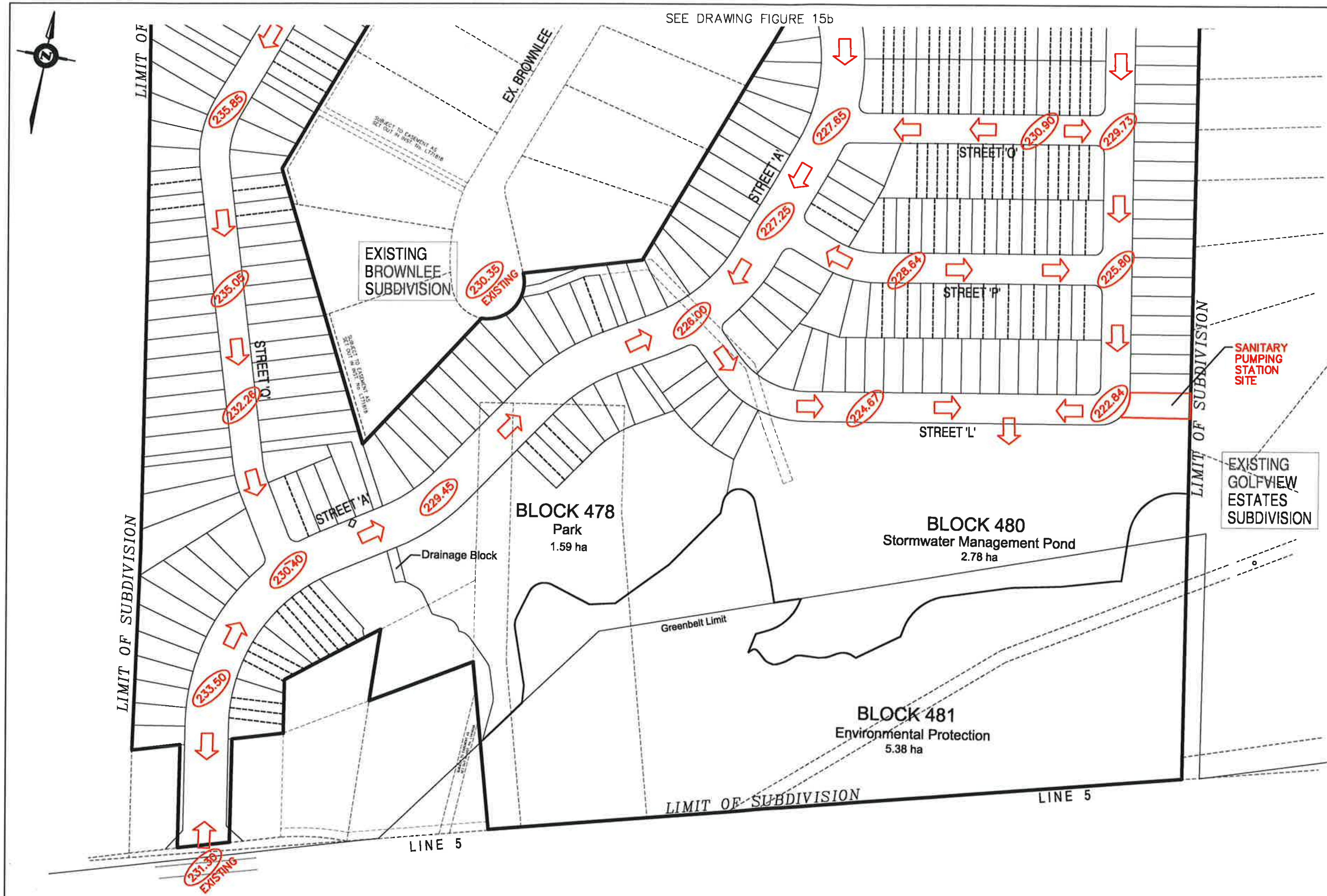

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ROAD DESIGN AND
OVERLAND FLOW ROUTING

SCALE	DATE	PROJECT No.	FIGURE
1:2500	JUNE 2023	15011	FIGURE 15c

12.0 LOT GRADING

A detailed topographic survey of the subject lands, prepared by Rady-Pentek & Edwards Surveying Ltd. Job No. 16-051 dated June 8, 2022, was used in the preparation of a preliminary grading design for this plan of subdivision which is provided in **Appendix 4**.

The road layout and grading design preserves the existing natural features of the adjacent lands, the internal surface drainage pattern and preserves the existing grades along the rear of the adjacent houses on the perimeter boundary.

Outlet provision for the existing surface drainage from the adjacent neighbouring lands has been made by using ditch inlet catchbasins connected into the underground storm sewer system for discharge into the stormwater management pond.

Lot grading will conform to the Town of Bradford-West Gwillimbury lot grading criteria.

Proposed lot grading along the external boundary will match to the existing ground elevations.

The house types will be typically conventional split types and front yard drainage for the residential units. Split drainage with rear yard drainage swales direct rainwater into rear lot catchbasins that are connected to the proposed storm sewer system. Determination of the final house types will be subject to a detailed lot grading design and actual house sittings.

Excessive cutting and filling is to be minimized, driveway slopes range from between 2.0% to 6.0% and proposed swale grades at a minimum 2.0%.

All rooftop rainwater leaders are proposed to be directed to roof / foundation drain connections (RFDC) to address runoff water balance requirements with overflow provisions to allow surplus flows to drain onto concrete splash pads where the flows will be directed into the side yard and/or rear yard swales.

In addition to RFDC runoff infiltration, grassed swales and sheet drainage flow will also be utilized to promote surface runoff infiltration to address water balance requirements for this development site.

13.0 CONSTRUCTION EROSION AND SEDIMENT CONTROL

It is imperative that the extent of the disturbed areas be minimized since soil erosion is a direct function of the area and the length of time ground cover within a construction site has been removed.

Areas disturbed during construction will be restored using topsoil and hydroseed.

Existing drainage paths will be protected from all construction activities, ranging from road and sewer construction, grading of lots and driveway construction, using strategically located silt fencing. Refer to **Figure 16a and 16b – Erosion Control Plan**

Regular inspection of the silt fence would be undertaken with maintenance including clean out on an as required basis.

Catchbasin inlets will be covered during construction with a siltation control device and have sumps to trap the heavier sediment. The last manhole installed immediately upstream of the storm outlet will be constructed with a temporary half-bulkhead to trap further sediment in the storm sewer system during the construction activities. The sewer system will be subsequently cleaned out and the bulkhead removed when all construction activities have been completed.

LEGEND

SILTATION CONTROL FENCE (REFER TO BWG F-109)

CONSTRUCTION ENTRANCE MAT (REFER TO BWG F-110)

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EROSION CONTROL PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 16a

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LEGEND

SILTATION CONTROL FENCE
(REFER TO BWG F-109)

CONSTRUCTION ENTRANCE MAT
(REFER TO BWG F-110)

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EROSION CONTROL PLAN

SCALE	DATE	PROJECT No.	FIGURE
N.T.S.	JUNE 2023	15011	FIGURE 16b

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14.0 GROUNDWATER

The WSP Geotechnical Report identifies the soils in the proposed development area as compact to very dense silty sands with traces of clay and low permeability.

The proposed development will result in a decrease in the groundwater recharge due to the impact of the increased areas associated with roadways, rooftops and driveways.

Therefore, rainwater leaders and sump pump outlet pipes will discharge to the proposed RFDC sewer installation, consisting of a perforated pvc pipe, located in a gravel jacket lined with a pervious geosynthetics non-woven geotextile fabric, designed to promote infiltration of the collected foundation drain flows and roof drainage flows back into the soils.

In addition to the RFDC infiltration system, infiltration galleries are proposed throughout the site to address water balance requirements for this development.

Details of the measures to address water balance are provided in the Hydrogeological Report and the Stormwater Management Report.

15.0 TREE PRESERVATION

No existing trees within the development limit of the plan of subdivision are anticipated to be preserved due to proximity to house excavations and the driveways.

A landscape plan, for both streetscape and the storm water management pond plantings, shall be prepared at the detailed design stage to address Town of Bradford-West Gwillimbury requirements.

Locations where existing trees can be preserved (if any) will be protected by temporary snow and siltation fencing. These protective measures will remain and be maintained throughout all phases of construction, including house construction, until completion of finished grading and seeding.

16.0 LIGHTING AND UTILITIES

No deficiencies in the existing infrastructure network of hydro, Bell, cable and gas utilities are anticipated.

Capacity of existing utility are to be confirmed with each Service Provider.

New hydro, Bell, cable and gas utility service connections are to be constructed within the municipal road allowances as per Town of Bradford-West Gwillimbury standards.

17.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing evaluation and subject to some improvements to the existing sanitary municipal infrastructure system, it is the opinion of this firm that the proposed development site comprising of the road pattern, lot configuration, proposed grading, storm water management and proposed construction techniques, can be effectively serviced from the existing municipal infrastructure in compliance with the latest Town of Bradford-West Gwillimbury design criteria and standards.

The proposed grading, servicing and storm water management concepts are compatible with the existing site conditions and all available current Town of Bradford-West Gwillimbury municipal servicing information criteria.

No adverse environmental impacts are anticipated as result of this development.

Respectfully submitted by

LICENSED PROFESSIONAL ENGINEER
R. SACCO
40295305
Sept 20, 2023
PROVINCE OF ONTARIO

Rosario Sacco, P.Eng.

APPENDIX 1

Watermain Network Analysis

BRADFORD HIGHLANDS
WATERMAIN ANALYSIS

PREPARED BY:

MUNICIPAL ENGINEERING SOLUTIONS

FOR:

URBAN ECOSYSTEMS LIMITED
July 2023

Project Number: 17021-01

TABLE OF CONTENTS

APPENDICES

Section 1 – INTRODUCTION

Municipal Engineering Solutions ("MES") was retained by Urban Ecosystems Limited to conduct a hydraulic water analysis for the proposed Bradford Highlands Development located in the Town of Bradford West Gwillimbury. As part of this hydraulic assessment MES was requested to undertake the following:

1. Calculate/verify water demands for the proposed development using Town of Bradford West Gwillimbury, provincial and industry design standards;
2. Add the subject watermains/development/boundary information to development water model;
3. Run the model to size the subject mains to achieve service criteria during Minimum Hour, Peak Hour and fire flow during Maximum Day demand; and
4. Prepare a Report summarizing the modeling results for agency review and design purposes.

1.1 Development Background

The Bradford Highlands site is located between Line 6 and 5th Line, west of Simcoe Road in the Town of Bradford. The residential development consists of 330 single family homes, 154 semi-detached homes, 467 townhomes and a school block. The demands for the site are shown in **Appendix A**. The proposed development is shown below on **Figure 1**.

Figure 1 - Proposed Bradford Highlands Development

Section 2 – WATERMAIN DESIGN CRITERIA

The design criteria utilized to estimate the water demands for the hydraulic water model follows general industry standards and is calculated using the design criteria and guidelines outlined in the Town of Bradford West Gwillimbury's Engineering Design Criteria Manual, the Ministry of the Environment Conservation and Parks (MECP) Watermain Design Criteria, and the Fire Underwriters Survey.

The following sections summarize the specific design criteria used to carry out the hydraulic watermain assessment for this development.

2.1 Equivalent Population Densities & Water Design Factors

To calculate the equivalent population and water design factors for this development MES used Town of Bradford West Gwillimbury standard population densities as noted in the *"Engineering Design Criteria Manual"*. **Table 1** summarizes the population densities and **Table 2** summarizes the average daily demand and peaking factors used for this analysis.

Table 1 – Equivalent Population Density

Type of Development	Equivalent Population (Persons/Unit)
Single Family	3.36

Source: Town of Bradford West Gwillimbury Engineering Design Criteria Manual

Table 2 - Water Design Factors

Type of Development	Average Daily Demand	Maximum Day Demand Peaking Factor	Minimum Hour Demand Peaking Factor	Peak Hour Demand Peaking Factor
Residential	0.300 m^3 per capita	2.0*	0.5*	3.0*
ICI	0.5 m^3/ha	2.0*	0.5*	3.0*

Source: Town of Bradford West Gwillimbury Engineering Design Criteria Manual, *MECP 3,001-10,000 persons

Section 3 –FLOW DEMANDS

Utilizing the equivalent population data from **Table 1** and the corresponding Average Day, Peak Hour and Maximum Day data from **Table 2** the water demands for this development were calculated.

3.1 Equivalent Population Flow Demands

The calculated demands for the development are summarized in **Table 3**. For additional details on the development water demands and assigned demand nodes used in the water model see **Appendix A**.

Table 3 – Water Demand for Bradford Highlands Development

	Average Day Demand (L/S)	Maximum Day Demand (L/S)	Peak Hour Demand (L/S)
Total	11.24	22.48	33.73

3.2 Fire Flow Demands

The Town criteria requests that fire demands be calculated using the Fire Underwriter's Survey where possible with a minimum requirement of 7,000 L/min (117 L/s). As the specifics of the proposed homes within the development are unknown, the fire flows suggested in **Table 4** have been used for this assessment. Once building designs/configurations are known, the fire flows must be confirmed using the FUS formula. Building construction may need to be designed to suit the available flow and pressure. For details on the fire flow demands for each node used to model see **Appendix A**.

Table 4 - Fire Flow Requirements

Type of Development	Fire Flow (L/S)
Single Family/Semidetached Homes	117
Townhomes	133
Schools	250

Source: Town of Bradford West Gwillimbury Engineering Design Criteria Manual

3.3 External Demands

The Watercad model provided contains external demands.

Section 4 – OTHER SYSTEM REQUIREMENTS

4.1 System Pressure Requirements

In addition to meeting the various flow requirements, the system must also satisfy minimum and maximum pressure requirements as outlined by the Town of Bradford West Gwillimbury. The Town's pressure requirements are outlined in the Engineering Design Criteria Manual and stipulate the following:

1. The minimum system pressure shall not be less than 140 kPa (20 psi) at any point in the water system under fire flow conditions.
2. The minimum Peak Hour pressure shall be 275 kPa (40 psi).
3. The water system shall be designed to maintain as close as possible to a maximum working pressure of 550 kPa (80 psi) as a best management practice.
4. If the pressure in a localized area is above 550 kPa (80 psi) pressure reducing valves shall be installed on individual services.

4.2 Watermain Sizing

The Town of Bradford West Gwillimbury also stipulates minimum pipe sizes and requires that all watermains are adequately sized to maintain demand flows at the required pressures without causing excessive energy loss or result in water quality decay. The watermain system must therefore be designed to accommodate the greater of the following:

- Maximum day plus fire demand
- Peak hour demand

The minimum pipe size for commercial and industrial areas shall be 250 mm diameter and for residential areas the minimum pipe size shall be 150 mm diameter; 200 mm for single feeds. For distribution systems providing fire protection the minimum pipe size shall be 150 mm diameter in accordance with Ministry of the Environment Conservation and Parks (MECP) and NFPA requirements.

To provide appropriate fire protection, reliable supply and pressures the water distribution system should be looped wherever possible to improve supply security and water quality.

4.3 Watermain C-Factor

In designing and modeling of the pipes the Coefficient of Roughness (C-Factor) factors from the Town's design criteria and as suggested by the MECP were utilized. The Coefficient of Roughness assigned to each pipe size in summarized in **Table 5** below.

Table 5 - Hazen-Williams Coefficient of Roughness (C-Factors)

Size of Pipe (Diameter in mm)	Coefficient of Roughness (C)
150 mm	100
200 mm to 250 mm	110
Greater Than 300 mm	120

Source: Town of Bradford West Gwillimbury Engineering Design Criteria Manual

Section 5 – ANALYSIS & MODELING RESULTS

To conduct the hydraulic water analysis for the proposed development the water demands were estimated by MES using the design criteria previously discussed and incorporated the demands into the WaterCAD model. The following sections discusses the model setup and results.

5.1 Model Setup

A copy of the Town's WaterCAD was provided to MES in July 2022. The development is located on the south side of Pressure Zone 1.

The development will be supplied by the existing 300 mm watermain on Line 6 and two connections to the 250 mm watermain on Inverness Way. Inverness Way is supplied through a pressure reducing valve (PRV) so the Highlands supply would need to take that into account.

Elevations in the development vary from approximately 223 m to 251 m. Friction factors were assigned to all new pipes in the model according to **Table 5**.

5.2 Watermain Sizing and System Pressures

The analysis was conducted under Minimum Hour, Maximum Day, and Maximum day plus Fire demands to confirm the watermain sizing and meet the pressure requirements. The pipe size and layout are shown in **Appendix B**.

The site was first modeled under average day conditions with only the connection to the Line 6 watermain to assess whether pressure reduction was required (connections to the east were closed). Much of the development would experience pressures above the OBC limit of 80 psi (550 kPa); areas to the southeast would have pressures above 100 psi (690 kPa) see **Figure 2** below, also in the Appendix. Pressure reduction is required on the Line 6 connection.

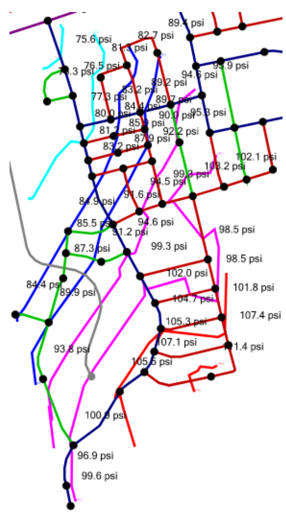


Figure 2 - Proposed Bradford Highlands Development

The model shows a reduced zone to the east of Bradford Highlands with four (4) pressure reducing valves along the pressure district boundary south of Line 6 at Inverness Way, Barrow Avenue, Simcoe Road and Zina Parkway, but only the one located at Inverness Way and Line 6 was active and flowing. All valves were set at 80 psi (550 kPa) which would cause some valves to close due the downstream pressure. The Town should confirm the status and setting of the existing pressure reducing valves.

The sizing and setting of the proposed PRV on Street A were based on the Street A and Inverness Way PRVs in operation.

With the original model setting for the Inverness PRV, the Bradford Highlands site would still have pressures above 100 psi (690 kPa) and the proposed PRV would not provide any flow. Based on the initial results, the proposed PRV was moved to the intersection of Street A and Street B so that the PRV could be setting would better suit the lower elevations and supply the school from full Zone 1 pressures. The proposed PRV was set at 50.2 psi (346 kPa) and the Inverness Way PRV setting changed to 71.3 psi (491 kPa) to have flow come through both PRVs and supplemented by the other active model PRVs if needed in the demand scenario. The settings were also based on maintaining pressures above the preferred lower pressure criteria of 50 psi (345 kPa).

The final location and setting of the proposed Street A PRV must be discussed and confirmed by the Town to ensure that existing areas are not adversely affected by changes to the reduced zone. The lower elevation areas may still have pressures above 80 psi (550 kPa), individual pressure reduction will be required in those units. The units requiring individual pressure reduction will be reviewed at the detailed design stage when further information is known about the reduced zone pressure settings. System pressures must be confirmed in the field.

Pipes were sized between 150 mm to 300 mm to meet the pressure and flow requirements. Modeled service pressures are summarized in **Table 6**. It should be noted that the Town model does not consider minimum hour conditions so pressure in the homes supplied by Zone 1 may be higher under low demand periods.

Fire flow demand can be met based on the assumptions outlined in this report.

Detailed pipe and node tables for the various scenarios modelled are attached to this report in **Appendix B**.

Table 6 - Modeled Service Pressures

Scenario	Average Day	Maximum Day	Peak Hour	Max. Day + Fire
Current Zone 1	73.5 to 77.5 psi (507 to 534 kPa)	73.1 to 77.1 psi (504 to 532 kPa)	72.7 to 76.5 psi (501 to 527 kPa)	140 to 401 L/s @ 20 psi (140 kPa)
Reduced Zone	55.1 to 89.8 psi (380 to 619 kPa)	55.1 to 89.7 psi (380 to 618 kPa)	55.1 to 89.5 psi (380 to 617 kPa)	

Section 6 – CONCLUSIONS/RECOMMENDATIONS

The results are summarized below.

- The service pressures are expected to range from 72.7 to 77.5 psi (501 to 534 kPa) in Zone 1 and from 55.1 to 89.8 psi (380 to 619 kPa) in the reduced zone.
- The existing PRV status and settings must be confirmed by the Town. The proposed PRV location and setting must be discussed and confirmed by the Town to ensure that existing areas are not adversely affected by changes to the reduced zone.
- Pressures may exceed the OBC requirements with the proposed PRV settings. Individual pressure reduction will be required in the homes located on the lower elevations. The units requiring pressure reduction will be reviewed at the detail design stage when further information is known about the reduced zone pressure settings.

- The available fire flow within the site meets or exceeds the fire flow demands as noted in Table 4 at the minimum pressure of 20 psi (140 kPa) based on the proposed watermain configuration.
- A hydrant test must be conducted to confirm the existing system pressures.
- Once the building designs/configurations are known for the proposed development the FUS fire flows summarized in Table 4 must be reviewed and confirmed by the designer(s), architect, and mechanical consultant as appropriate to ensure the fire flows used within this report are still valid prior to implementation and construction. It may also be necessary for the building construction or fire protection system to be designed to suit the available flows.
- Required fire flows for all proposed buildings must be confirmed with the appropriate designer (architect or mechanical designer) as well as the Town to determine the appropriate level of fire protection required.
- Confirmation and/or changes to the criteria should also be provided to and reviewed with MES prior to the finalization of the detailed design drawings and construction of the watermain system. Final design parameters are to be provided to MES prior to construction for further review to confirm that the actual (final) site conditions and building design(s) reflect those modeled by MES within this report.
- This report, including all modeling assumptions used, is to be submitted to and reviewed by the water operating authority (municipality) to confirm that the modeling parameters used are acceptable to the operating authority and/or confirm if modified domestic or fire flow requirements are required or should be implemented for this particular development.

Appendix A

Demands

Town of Bradford West Gwillimbury Design Criteria

Engineering Design Criteria Manual, 2023 (unless otherwise stated)

Equivalent Population by Unit

Type of Development	Equivalent Population Density
	(Person/Unit)
Single Family or Semi-Detached	3.36
Townhouse	3.36
Apartment	3.36

Water Design Factors

Average Daily Demand (m3/capita)	0.3	
Institutional Average (m3/ha)	5	
Minimum Hour Demand P.F.	0.5	MOECC (3,001 - 10,000 Persons)
Maximum Daily Demand P.F.		
Residential	2	MOECC (3,001 - 10,000 Persons)
I/C/I	2	
Maximum Hourly Demand P.F.		
Residential	*3*	MOECC (3,001 - 10,000 Persons)

Cofficient of Roughness

Size of Pipe (mm Dia.)	Coefficient of Roughness (C)
150	100
200-250	110
300-600	120
Over 600	120

Minimum Pipe Size

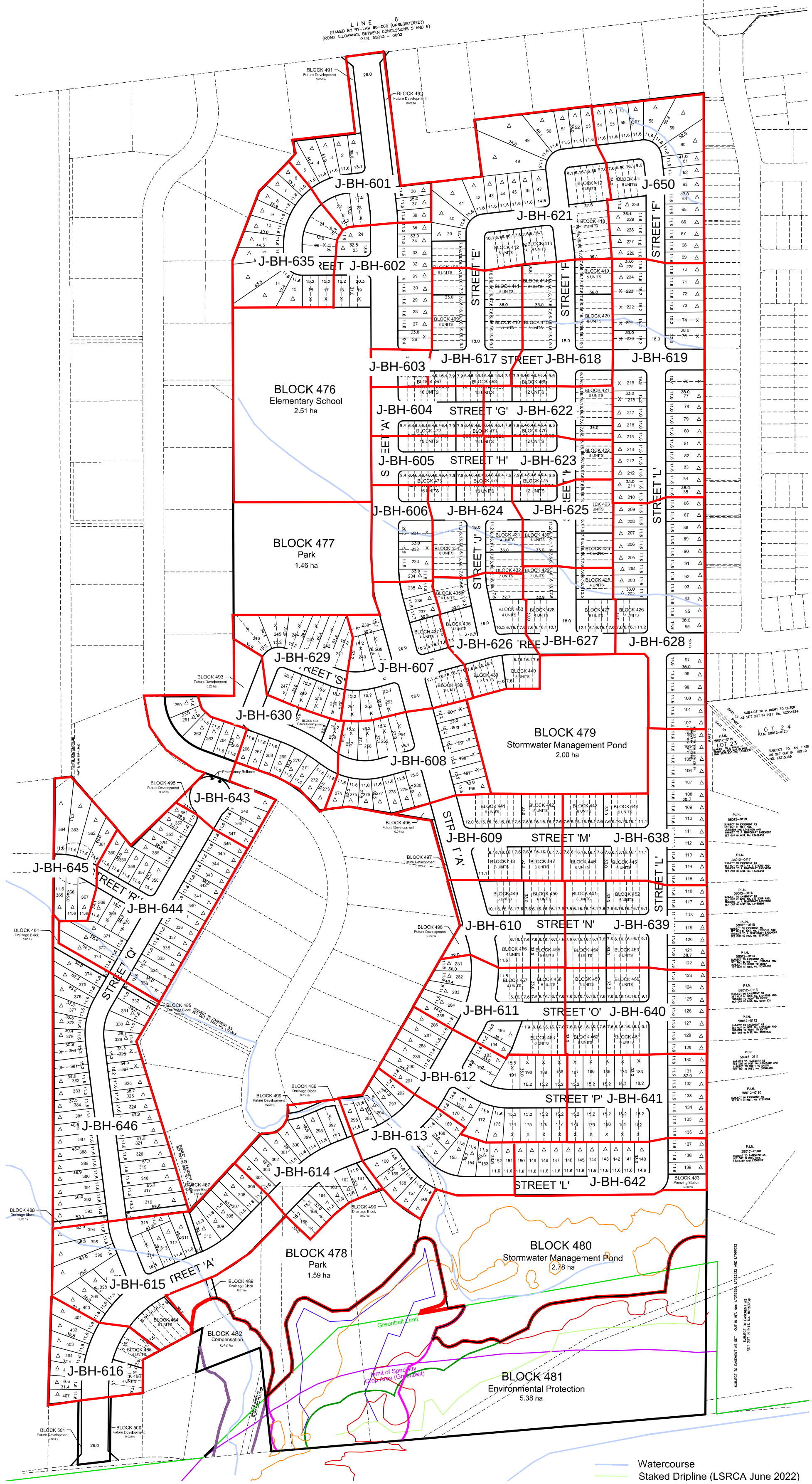
Type of Development	Size of Pipe (mm Dia.)
Residential	150
Commercial/Industrial/Community	250

Working Pressures

Parameter	Pressure
Normal Condition	
Minimum Max Hour Pressure	275 kPa (40 psi)
Maximum (Building Code)	550 kPa (80 psi)
Maximum Min Hour Pressure	550 kPa (80 psi)
Fire Flow Conditions	
Minimum Pressure	140 kPa (20 psi)

Water Demand
Bradford Highlands Development
June 20, 2023

Node	Elevation	Type of Development				Population	Demands				Fire Flow Demands
		Single Family	Semi-Detached	Townhouse	Institutional	Total Population	ADD	MHD	MDD	PHD	
	(m)	(units)	(units)	(units)	(ha)	(Residential)	(L/s)	(L/s)	(L/s)	(L/s)	(L/s)
J-BH-600	251.13					0	0.00	0.00	0.00	0.00	133
J-BH-601	249.01	8	4			40	0.14	0.07	0.28	0.42	117
J-BH-602	248.19	11	6		2.54	57	0.35	0.17	0.69	1.04	250
J-BH-603	247.37			4		13	0.05	0.02	0.09	0.14	133
J-BH-604	245.40			24		81	0.28	0.14	0.56	0.84	133
J-BH-605	244.53			24		81	0.28	0.14	0.56	0.84	133
J-BH-606	243.08	2	4	4		34	0.12	0.06	0.23	0.35	133
J-BH-607	237.09	3	12	10		84	0.29	0.15	0.58	0.88	133
J-BH-608	234.90	8	18			87	0.30	0.15	0.61	0.91	133
J-BH-609	231.50			26		87	0.30	0.15	0.61	0.91	133
J-BH-610	229.59			20		67	0.23	0.12	0.47	0.70	133
J-BH-611	227.70	7		15		74	0.26	0.13	0.51	0.77	133
J-BH-612	227.25	11	18			97	0.34	0.17	0.68	1.02	117
J-BH-613	226.00	18				60	0.21	0.11	0.42	0.63	117
J-BH-614	227.17	11	6			57	0.20	0.10	0.40	0.60	117
J-BH-615	230.40	17	2	6		84	0.29	0.15	0.58	0.88	133
J-BH-616	233.20	7		8		50	0.18	0.09	0.35	0.53	133
J-BH-617	243.16			35		118	0.41	0.20	0.82	1.23	133
J-BH-618	238.96			33		111	0.39	0.19	0.77	1.16	133
J-BH-619	234.91	23	18			138	0.48	0.24	0.96	1.44	133
J-BH-620	232.28					0	0.00	0.00	0.00	0.00	133
J-BH-621	243.46	15		27		141	0.49	0.25	0.98	1.47	133
J-BH-622	238.60			28		94	0.33	0.16	0.65	0.98	133
J-BH-623	238.36			26		87	0.30	0.15	0.61	0.91	133
J-BH-624	239.78			27		91	0.32	0.16	0.63	0.95	133
J-BH-625	236.76			25		84	0.29	0.15	0.58	0.88	133
J-BH-626	235.15			26		87	0.30	0.15	0.61	0.91	133
J-BH-627	231.79			18		60	0.21	0.11	0.42	0.63	133
J-BH-628	228.32	25		4		97	0.34	0.17	0.68	1.02	133
J-BH-629	241.75		20			67	0.23	0.12	0.47	0.70	117
J-BH-630	241.33	9	2			37	0.13	0.06	0.26	0.39	117
J-BH-631	237.30					0	0.00	0.00	0.00	0.00	117
J-BH-632	234.21					0	0.00	0.00	0.00	0.00	117
J-BH-633	238.64	21		5		87	0.30	0.15	0.61	0.91	133
J-BH-634	244.47					0	0.00	0.00	0.00	0.00	133
J-BH-635	248.38	10	8			60	0.21	0.11	0.42	0.63	117
J-BH-636	242.35					0	0.00	0.00	0.00	0.00	133
J-BH-637	241.22					0	0.00	0.00	0.00	0.00	133
J-BH-638	232.00	13		24		124	0.43	0.22	0.86	1.30	133
J-BH-639	232.00	7		24		104	0.36	0.18	0.72	1.09	133
J-BH-640	229.73	7		24		104	0.36	0.18	0.72	1.09	133
J-BH-641	225.80	7	20			91	0.32	0.16	0.63	0.95	117
J-BH-642	222.97	14				47	0.16	0.08	0.33	0.49	117
J-BH-643	240.00	10				34	0.12	0.06	0.23	0.35	117
J-BH-644	238.14	26	8			114	0.40	0.20	0.79	1.19	117
J-BH-645	242.00	7				24	0.08	0.04	0.16	0.25	117
J-BH-646	235.39	33	8			138	0.48	0.24	0.96	1.44	117
J-BH-647	231.30					0	0.00	0.00	0.00	0.00	133
Total		**330**	**154**	**467**	**2.54**	**3195**	**11.24**	**5.62**	**22.48**	**33.73**	



LINE 6
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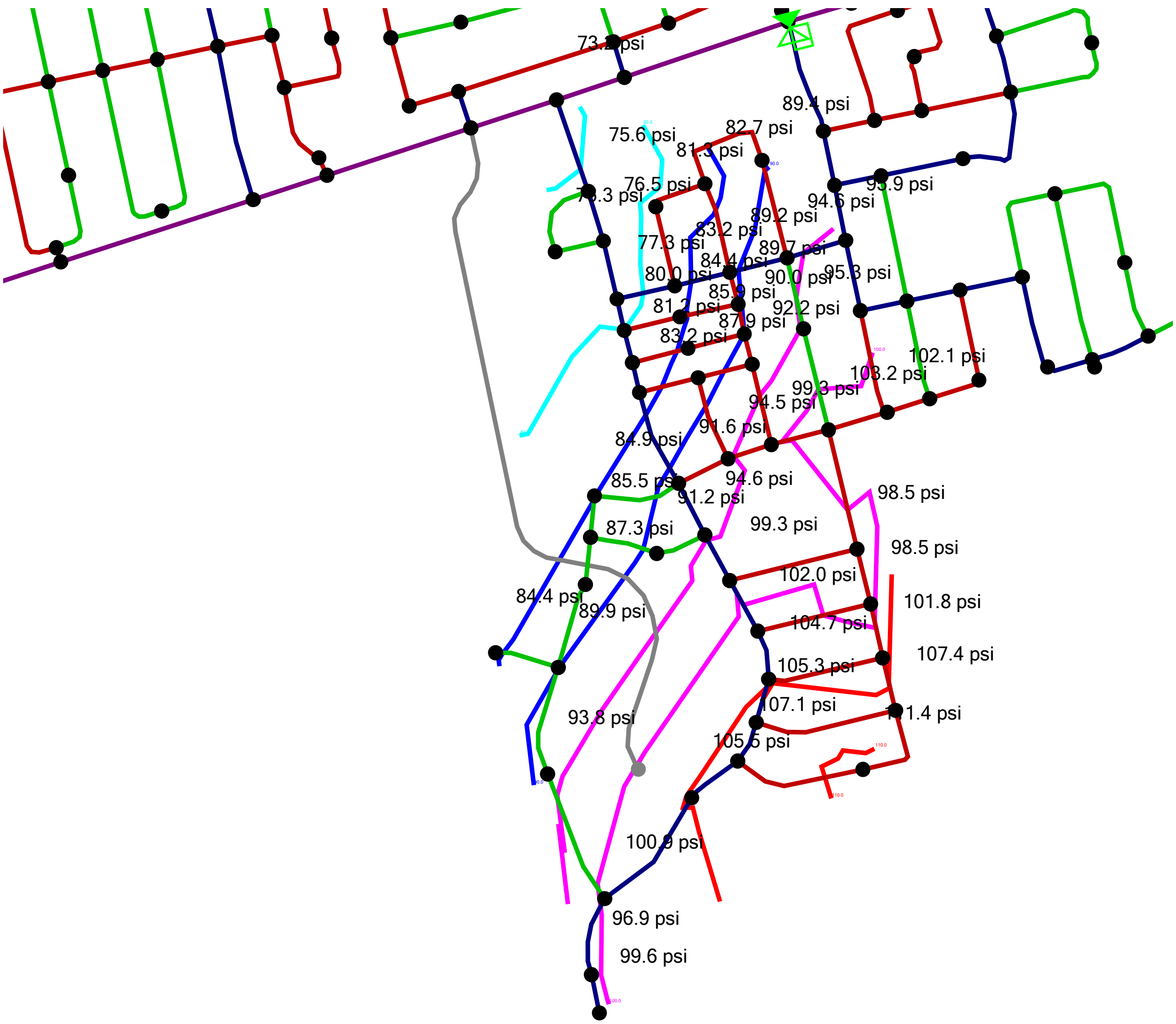
STREET 'F'
STREET 'G'
STREET 'H'
STREET 'J'
STREET 'L'
STREET 'M'
STREET 'N'
STREET 'O'
STREET 'P'
STREET 'Q'
STREET 'A'
BLOCK 476
Elementary School
2.51 ha
BLOCK 477
Park
1.46 ha
BLOCK 479
Stormwater Management Pond
2.00 ha
BLOCK 478
Park
1.59 ha
BLOCK 480
Stormwater Management Pond
2.78 ha
BLOCK 481
Environmental Protection
5.38 ha
Watercourse
Staked Dripline (LSRCA June 2022)

Appendix B

Model Results

Scenario: Short Range Future (<3 yrs)



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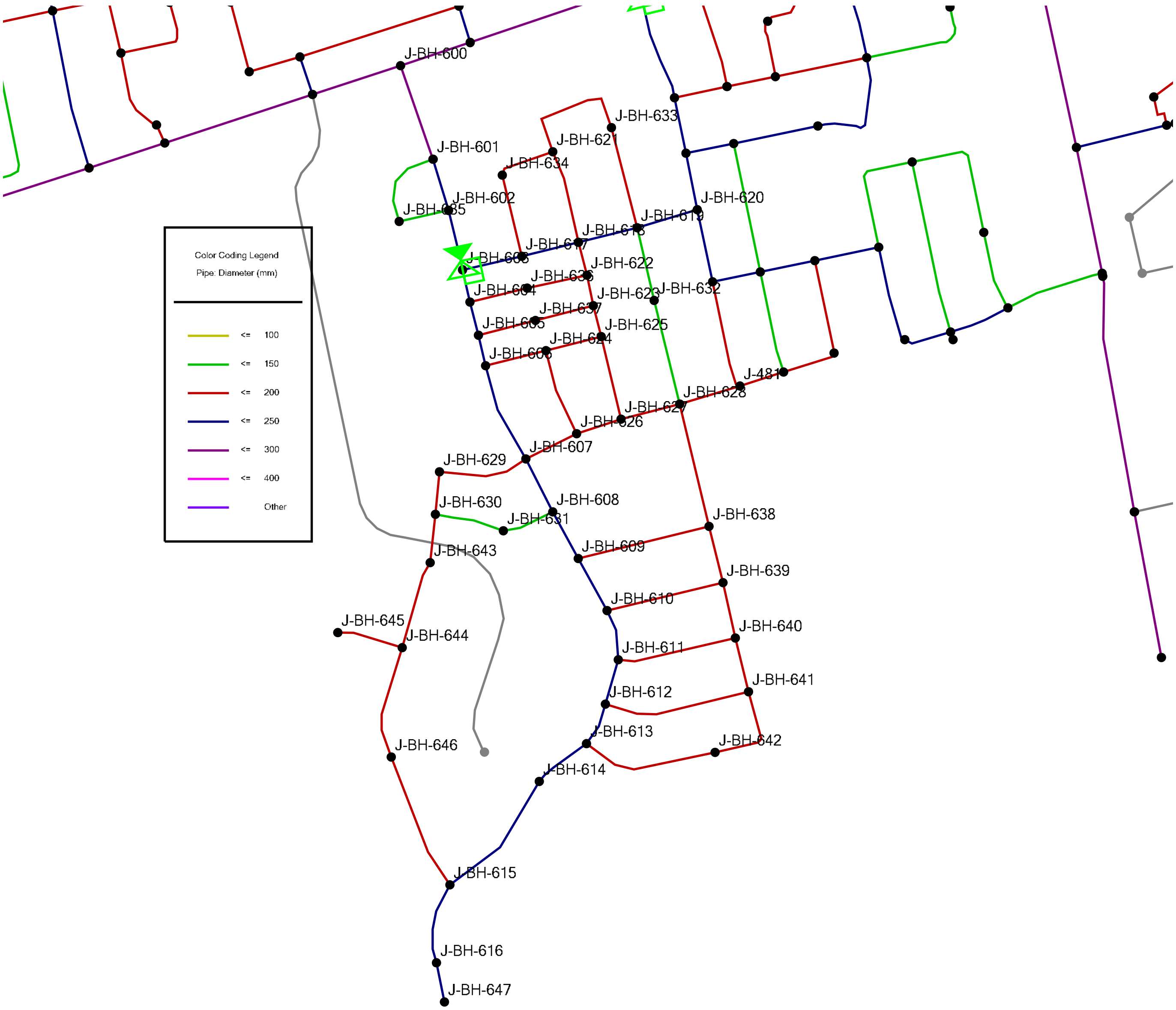

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J-BH-645
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J-481
Color Coding Legend
Pipe: Diameter (mm)
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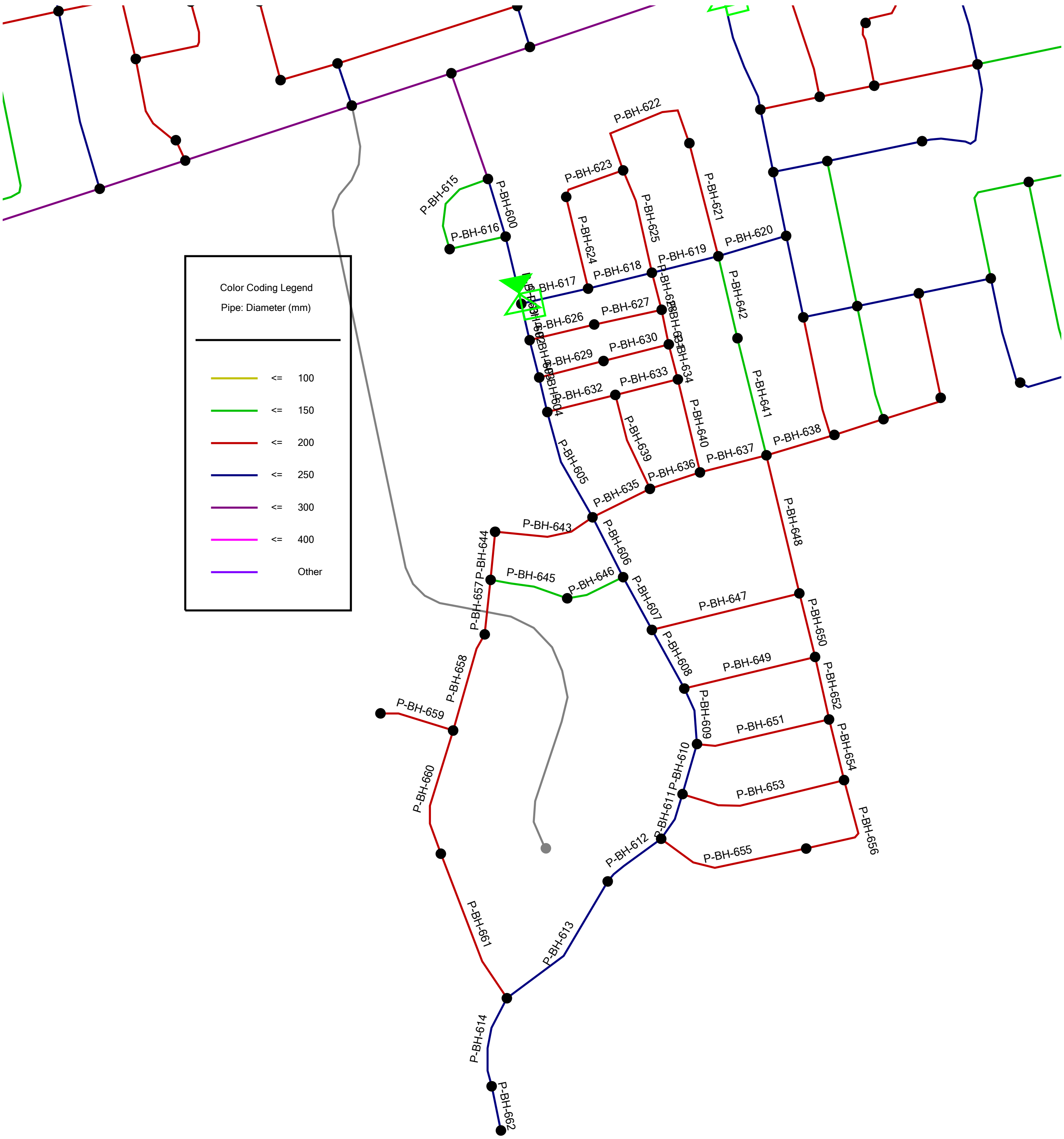
<= 150
<= 200
<= 250
<= 300
<= 400
Other

Pipe IDs



Color Coding Legend
Pipe: Diameter (mm)
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<= 200
<= 250
<= 300
<= 400
Other
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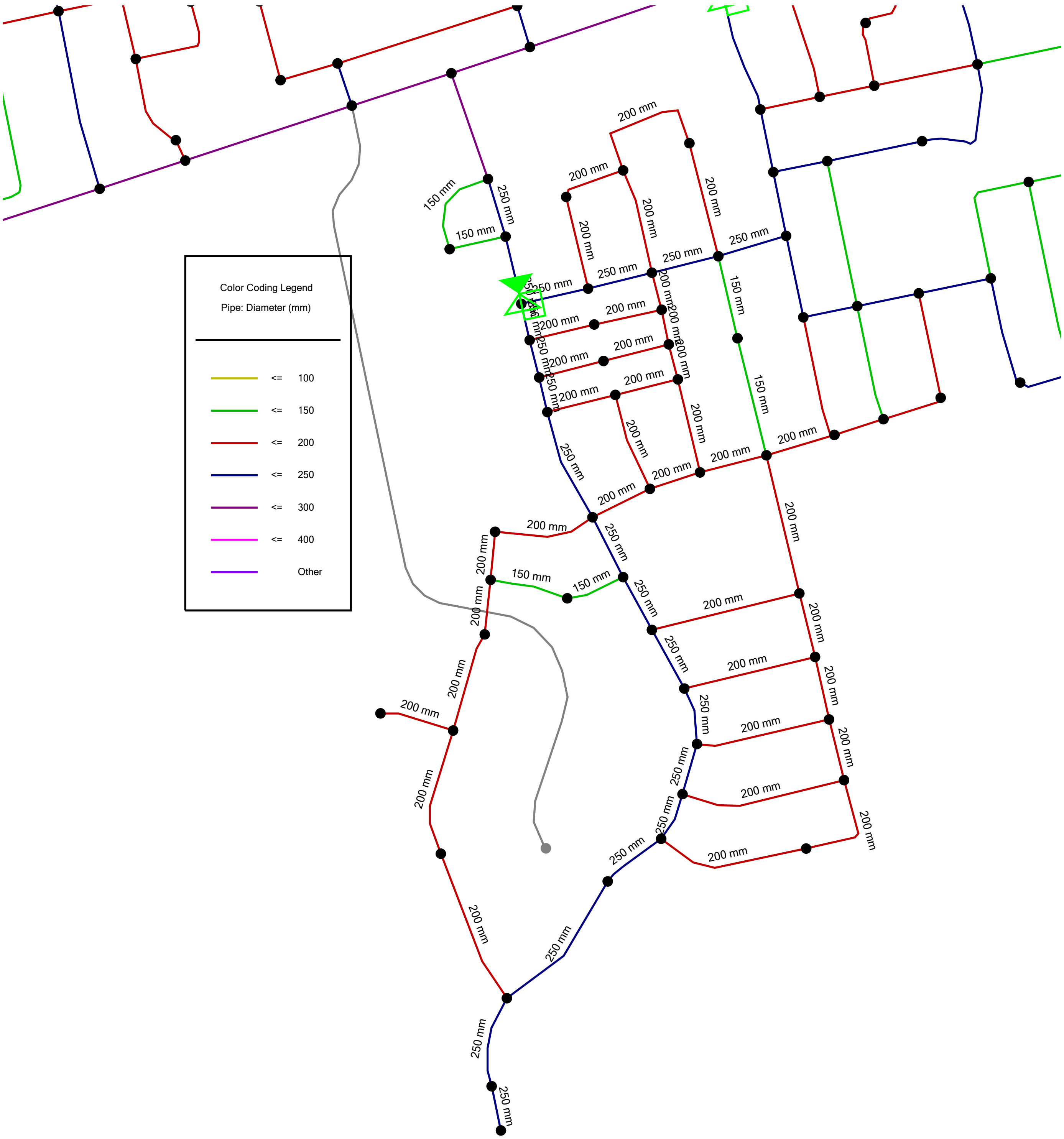
P-BH-662

Diameters



Color Coding Legend
Pipe: Diameter (mm)
<= 100
<= 150
<= 200
<= 250
<= 300
<= 400
Other
200 mm
250 mm
150 mm

Existing Conditions (<3 yrs)
Bradford Highlands Development
June 20, 2023

Municipal Engineering Solutions

Average Day - Existing

Node Table

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-481	1.14	228.00	286.06	82.60
J-BH-600	0.00	251.13	302.78	73.50
J-BH-601	0.14	249.01	302.75	76.40
J-BH-602	0.15	248.19	302.71	77.50
J-BH-603	0.24	247.37	286.13	55.10
J-BH-604	0.24	245.40	286.12	57.90
J-BH-605	0.28	244.53	286.11	59.10
J-BH-606	0.12	243.08	286.10	61.20
J-BH-607	0.29	237.09	286.09	69.70
J-BH-608	0.30	234.90	286.08	72.80
J-BH-609	0.30	231.50	286.08	77.60
J-BH-610	0.23	229.59	286.08	80.30
J-BH-611	0.26	227.70	286.07	83.00
J-BH-612	0.34	227.25	286.07	83.70
J-BH-613	0.21	226.00	286.07	85.40
J-BH-614	0.20	227.17	286.07	83.80
J-BH-615	0.29	230.40	286.07	79.20
J-BH-616	0.18	233.20	286.07	75.20
J-BH-617	0.41	243.16	286.12	61.10
J-BH-618	0.39	238.96	286.11	67.10
J-BH-619	0.48	234.91	286.08	72.80
J-BH-620	0.00	232.28	286.08	76.50
J-BH-621	0.49	243.46	286.11	60.70
J-BH-622	0.33	238.60	286.11	67.60
J-BH-623	0.30	238.36	286.11	67.90
J-BH-624	0.32	239.78	286.10	65.90
J-BH-625	0.29	236.76	286.10	70.20
J-BH-626	0.30	235.15	286.10	72.50
J-BH-627	0.21	231.79	286.10	77.20
J-BH-628	0.34	228.32	286.07	82.10
J-BH-629	0.23	241.75	286.09	63.10
J-BH-630	0.13	241.33	286.08	63.70
J-BH-631	0.00	237.30	286.08	69.40
J-BH-632	0.00	234.21	286.07	73.80
J-BH-633	0.30	238.64	286.09	67.50
J-BH-634	0.00	244.47	286.11	59.20
J-BH-635	0.21	248.38	302.72	77.30
J-BH-636	0.00	242.35	286.11	62.20
J-BH-637	0.00	241.22	286.11	63.80
J-BH-638	0.43	232.00	286.07	76.90
J-BH-639	0.36	232.00	286.07	76.90
J-BH-640	0.36	229.73	286.07	80.10
J-BH-641	0.32	225.80	286.07	85.70
J-BH-642	0.16	222.97	286.07	89.80
J-BH-643	0.12	240.00	286.08	65.50
J-BH-644	0.40	238.14	286.08	68.20
J-BH-645	0.08	242.00	286.08	62.70
J-BH-646	0.48	235.39	286.08	72.10
J-BH-647	0.00	231.30	286.07	77.90

		Elevation		Pressure
MIN		**248.19**		**73.50**
MAX		**251.13**		**77.50**
Within Reduced Area				
MIN		**222.97**		**55.10**
MAX		**247.37**		**89.80**

Pipe Table

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughnes (C)	Flow (L/s)	Velocity (m/s)
P-BH-600	J-BH-601	J-BH-602	79.78	250	110	12.62	0.26
P-BH-601	PRV-84	J-BH-603	13.44	250	110	14.14	0.29
P-BH-602	J-BH-603	J-BH-604	49.41	250	110	8.21	0.17
P-BH-603	J-BH-604	J-BH-605	51.14	250	110	6.54	0.13
P-BH-604	J-BH-605	J-BH-606	46.91	250	110	5.71	0.12
P-BH-605	J-BH-606	J-BH-607	152.96	250	110	4.68	0.10
P-BH-606	J-BH-607	J-BH-608	89.08	250	110	5.09	0.10
P-BH-607	J-BH-608	J-BH-609	79.51	250	110	4.67	0.10
P-BH-608	J-BH-609	J-BH-610	88.79	250	110	2.94	0.06
P-BH-609	J-BH-610	J-BH-611	76.61	250	110	1.86	0.04
P-BH-610	J-BH-611	J-BH-612	69.10	250	110	1.11	0.02
P-BH-611	J-BH-612	J-BH-613	66.45	250	110	0.50	0.01
P-BH-612	J-BH-613	J-BH-614	90.64	250	110	0.06	0.00
P-BH-613	J-BH-614	J-BH-615	208.41	250	110	-0.14	0.00
P-BH-614	J-BH-615	J-BH-616	122.82	250	110	0.18	0.00
P-BH-615	J-BH-601	J-BH-635	128.19	150	100	1.88	0.11
P-BH-616	J-BH-635	J-BH-602	75.82	150	100	1.67	0.09
P-BH-617	J-BH-603	J-BH-617	90.82	250	110	5.69	0.12
P-BH-618	J-BH-617	J-BH-618	87.07	250	110	3.48	0.07
P-BH-619	J-BH-618	J-BH-619	90.59	250	110	0.00	0.00
P-BH-620	J-BH-619	J-BH-620	93.82	250	110	1.31	0.03
P-BH-621	J-BH-619	J-BH-633	154.52	200	110	-2.61	0.08
P-BH-622	J-BH-633	J-BH-621	193.11	200	110	-2.91	0.09
P-BH-623	J-BH-621	J-BH-634	86.73	200	110	-1.81	0.06
P-BH-624	J-BH-634	J-BH-617	124.91	200	110	-1.81	0.06
P-BH-625	J-BH-621	J-BH-618	141.46	200	110	-1.60	0.05
P-BH-626	J-BH-604	J-BH-636	87.97	200	110	1.43	0.05
P-BH-627	J-BH-636	J-BH-622	91.41	200	110	1.43	0.05
P-BH-628	J-BH-622	J-BH-618	50.70	200	110	-1.49	0.05
P-BH-629	J-BH-605	J-BH-637	88.00	200	110	0.55	0.02
P-BH-630	J-BH-637	J-BH-623	89.10	200	110	0.55	0.02
P-BH-631	J-BH-623	J-BH-622	46.67	200	110	-2.59	0.08
P-BH-632	J-BH-606	J-BH-624	92.93	200	110	0.91	0.03
P-BH-633	J-BH-624	J-BH-625	85.32	200	110	-1.01	0.03
P-BH-634	J-BH-625	J-BH-623	47.88	200	110	-2.84	0.09
P-BH-635	J-BH-607	J-BH-626	84.87	200	110	-2.63	0.08
P-BH-636	J-BH-626	J-BH-627	69.81	200	110	-1.33	0.04
P-BH-637	J-BH-627	J-BH-628	90.69	200	110	0.00	0.00
P-BH-638	J-BH-628	J-481	93.93	200	110	2.12	0.07
P-BH-639	J-BH-626	J-BH-624	133.04	200	110	-1.59	0.05
P-BH-640	J-BH-627	J-BH-625	126.71	200	110	-1.54	0.05
P-BH-641	J-BH-628	J-BH-632	159.64	150	100	-0.82	0.05
P-BH-642	J-BH-632	J-BH-619	111.71	150	100	-0.82	0.05
P-BH-643	J-BH-607	J-BH-629	135.86	200	110	1.93	0.06
P-BH-644	J-BH-629	J-BH-630	63.92	200	110	1.70	0.05
P-BH-645	J-BH-630	J-BH-631	104.93	150	100	-0.12	0.01
P-BH-646	J-BH-631	J-BH-608	79.83	150	100	-0.12	0.01
P-BH-647	J-BH-609	J-BH-638	201.19	200	110	1.43	0.05
P-BH-648	J-BH-638	J-BH-628	188.11	200	110	1.64	0.05
P-BH-649	J-BH-610	J-BH-639	178.20	200	110	0.85	0.03
P-BH-650	J-BH-639	J-BH-638	86.75	200	110	0.64	0.02
P-BH-651	J-BH-611	J-BH-640	179.12	200	110	0.49	0.02
P-BH-652	J-BH-640	J-BH-639	84.75	200	110	0.15	0.00
P-BH-653	J-BH-612	J-BH-641	220.26	200	110	0.27	0.01
P-BH-654	J-BH-641	J-BH-640	82.90	200	110	0.02	0.00
P-BH-655	J-BH-613	J-BH-642	205.88	200	110	0.22	0.01
P-BH-656	J-BH-642	J-BH-641	146.36	200	110	0.06	0.00
P-BH-657	J-BH-630	J-BH-643	72.78	200	110	1.69	0.05
P-BH-658	J-BH-643	J-BH-644	134.48	200	110	1.57	0.05
P-BH-659	J-BH-644	J-BH-645	99.54	200	110	0.08	0.00
P-BH-660	J-BH-644	J-BH-646	170.56	200	110	1.09	0.03
P-BH-661	J-BH-646	J-BH-615	211.42	200	110	0.61	0.02
P-BH-662	J-BH-616	J-BH-647	59.85	250	110	0.00	0.00

ID	Diameter (mm)	Elevation (m)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (L/s)	Velocity (m/s)	Headloss (m)
PRV-70	150	236	302.59	286.15	13.58	0.74	16.44
PRV-84	200	250.83	302.67	286.13	14.14	0.45	16.53

Existing Conditions (<3 yrs)
Bradford Highlands Development
June 20, 2023

Maximum Day - Existing

Node Table

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-481	1.14	228.00	286.02	82.50
J-BH-600	0.00	251.13	302.55	73.10
J-BH-601	0.28	249.01	302.48	76.00
J-BH-602	0.40	248.19	302.39	77.10
J-BH-603	0.09	247.37	286.12	55.10
J-BH-604	0.56	245.40	286.09	57.90
J-BH-605	0.56	244.53	286.08	59.10
J-BH-606	0.23	243.08	286.07	61.10
J-BH-607	0.58	237.09	286.04	69.60
J-BH-608	0.61	234.90	286.03	72.70
J-BH-609	0.61	231.50	286.02	77.50
J-BH-610	0.47	229.59	286.02	80.30
J-BH-611	0.51	227.70	286.01	82.90
J-BH-612	0.68	227.25	286.01	83.60
J-BH-613	0.42	226.00	286.01	85.40
J-BH-614	0.40	227.17	286.01	83.70
J-BH-615	0.58	230.40	286.01	79.10
J-BH-616	0.35	233.20	286.01	75.10
J-BH-617	0.82	243.16	286.10	61.10
J-BH-618	0.77	238.96	286.09	67.00
J-BH-619	0.96	234.91	286.04	72.70
J-BH-620	0.00	232.28	286.04	76.50
J-BH-621	0.98	243.46	286.08	60.60
J-BH-622	0.65	238.60	286.08	67.50
J-BH-623	0.61	238.36	286.08	67.90
J-BH-624	0.63	239.78	286.06	65.80
J-BH-625	0.58	236.76	286.07	70.10
J-BH-626	0.61	235.15	286.06	72.40
J-BH-627	0.42	231.79	286.06	77.20
J-BH-628	0.68	228.32	286.02	82.10
J-BH-629	0.47	241.75	286.03	63.00
J-BH-630	0.26	241.33	286.03	63.60
J-BH-631	0.00	237.30	286.03	69.30
J-BH-632	0.00	234.21	286.03	73.70
J-BH-633	0.61	238.64	286.06	67.40
J-BH-634	0.00	244.47	286.09	59.20
J-BH-635	0.42	248.38	302.42	76.90
J-BH-636	0.00	242.35	286.09	62.20
J-BH-637	0.00	241.22	286.08	63.80
J-BH-638	0.86	232.00	286.02	76.80
J-BH-639	0.72	232.00	286.01	76.80
J-BH-640	0.72	229.73	286.01	80.10
J-BH-641	0.63	225.80	286.01	85.60
J-BH-642	0.33	222.97	286.01	89.70
J-BH-643	0.23	240.00	286.02	65.50
J-BH-644	0.79	238.14	286.02	68.10
J-BH-645	0.16	242.00	286.02	62.60
J-BH-646	0.96	235.39	286.01	72.00
J-BH-647	0.00	231.30	286.01	77.80

		Elevation		Pressure
MIN		**248.19**		**73.10**
MAX		**251.13**		**77.10**

Within Reduced Area

		Elevation		Pressure
MIN		**222.97**		**55.10**
MAX		**247.37**		**89.70**

Pipe Table

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness (C)	Flow (L/s)	Velocity (m/s)
P-BH-600	J-BH-601	J-BH-602	79.78	250	110	19.41	0.40
P-BH-601	PRV-84	J-BH-603	13.44	250	110	21.52	0.44
P-BH-602	J-BH-603	J-BH-604	49.41	250	110	12.79	0.26
P-BH-603	J-BH-604	J-BH-605	51.14	250	110	10.08	0.21
P-BH-604	J-BH-605	J-BH-606	46.91	250	110	8.63	0.18
P-BH-605	J-BH-606	J-BH-607	152.96	250	110	6.86	0.14
P-BH-606	J-BH-607	J-BH-608	89.08	250	110	7.09	0.14
P-BH-607	J-BH-608	J-BH-609	79.51	250	110	6.09	0.12
P-BH-608	J-BH-609	J-BH-610	88.79	250	110	4.11	0.08
P-BH-609	J-BH-610	J-BH-611	76.61	250	110	2.96	0.06
P-BH-610	J-BH-611	J-BH-612	69.10	250	110	2.09	0.04
P-BH-611	J-BH-612	J-BH-613	66.45	250	110	1.27	0.03
P-BH-612	J-BH-613	J-BH-614	90.64	250	110	0.93	0.02
P-BH-613	J-BH-614	J-BH-615	208.41	250	110	0.53	0.01
P-BH-614	J-BH-615	J-BH-616	122.82	250	110	0.35	0.01
P-BH-615	J-BH-601	J-BH-635	128.19	150	100	2.92	0.17
P-BH-616	J-BH-635	J-BH-602	75.82	150	100	2.50	0.14
P-BH-617	J-BH-603	J-BH-617	90.82	250	110	8.64	0.18
P-BH-618	J-BH-617	J-BH-618	87.07	250	110	5.33	0.11
P-BH-619	J-BH-618	J-BH-619	90.59	250	110	0.00	0.00
P-BH-620	J-BH-619	J-BH-620	93.82	250	110	0.59	0.01
P-BH-621	J-BH-619	J-BH-633	154.52	200	110	-2.85	0.09
P-BH-622	J-BH-633	J-BH-621	193.11	200	110	-3.46	0.11
P-BH-623	J-BH-621	J-BH-634	86.73	200	110	-2.48	0.08
P-BH-624	J-BH-634	J-BH-617	124.91	200	110	-2.48	0.08
P-BH-625	J-BH-621	J-BH-618	141.46	200	110	-1.95	0.06
P-BH-626	J-BH-604	J-BH-636	87.97	200	110	2.15	0.07
P-BH-627	J-BH-636	J-BH-622	91.41	200	110	2.15	0.07
P-BH-628	J-BH-622	J-BH-618	50.70	200	110	-2.61	0.08
P-BH-629	J-BH-605	J-BH-637	88.00	200	110	0.89	0.03
P-BH-630	J-BH-637	J-BH-623	89.10	200	110	0.89	0.03
P-BH-631	J-BH-623	J-BH-622	46.67	200	110	-4.12	0.13
P-BH-632	J-BH-606	J-BH-624	92.93	200	110	1.54	0.05
P-BH-633	J-BH-624	J-BH-625	85.32	200	110	-1.48	0.05
P-BH-634	J-BH-625	J-BH-623	47.88	200	110	-4.40	0.14
P-BH-635	J-BH-607	J-BH-626	84.87	200	110	-3.69	0.12
P-BH-636	J-BH-626	J-BH-627	69.81	200	110	-1.92	0.06
P-BH-637	J-BH-627	J-BH-628	90.69	200	110	0.00	0.00
P-BH-638	J-BH-628	J-481	93.93	200	110	-0.17	0.01
P-BH-639	J-BH-626	J-BH-624	133.04	200	110	-2.39	0.08
P-BH-640	J-BH-627	J-BH-625	126.71	200	110	-2.34	0.07
P-BH-641	J-BH-628	J-BH-632	159.64	150	100	-1.30	0.07
P-BH-642	J-BH-632	J-BH-619	111.71	150	100	-1.30	0.07
P-BH-643	J-BH-607	J-BH-629	135.86	200	110	2.88	0.09
P-BH-644	J-BH-629	J-BH-630	63.92	200	110	2.41	0.08
P-BH-645	J-BH-630	J-BH-631	104.93	150	100	-0.39	0.02
P-BH-646	J-BH-631	J-BH-608	79.83	150	100	-0.39	0.02
P-BH-647	J-BH-609	J-BH-638	201.19	200	110	1.37	0.04
P-BH-648	J-BH-638	J-BH-628	188.11	200	110	-0.79	0.03
P-BH-649	J-BH-610	J-BH-639	178.20	200	110	0.69	0.02
P-BH-650	J-BH-639	J-BH-638	86.75	200	110	-1.30	0.04
P-BH-651	J-BH-611	J-BH-640	179.12	200	110	0.36	0.01
P-BH-652	J-BH-640	J-BH-639	84.75	200	110	-1.26	0.04
P-BH-653	J-BH-612	J-BH-641	220.26	200	110	0.13	0.00
P-BH-654	J-BH-641	J-BH-640	82.90	200	110	-0.91	0.03
P-BH-655	J-BH-613	J-BH-642	205.88	200	110	-0.08	0.00
P-BH-656	J-BH-642	J-BH-641	146.36	200	110	-0.41	0.01
P-BH-657	J-BH-630	J-BH-643	72.78	200	110	2.54	0.08
P-BH-658	J-BH-643	J-BH-644	134.48	200	110	2.31	0.07
P-BH-659	J-BH-644	J-BH-645	99.54	200	110	0.16	0.01
P-BH-660	J-BH-644	J-BH-646	170.56	200	110	1.36	0.04
P-BH-661	J-BH-646	J-BH-615	211.42	200	110	0.40	0.01
P-BH-662	J-BH-616	J-BH-647	59.85	250	110	0.00	0.00

ID	Diameter (mm)	Elevation (m)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (L/s)	Velocity (m/s)	Headloss (m)
PRV-70	150	236	302.44	286.15	16.59	0.94	16.30
PRV-84	200	250.83	302.30	286.13	21.52	0.68	16.16

Existing Conditions (<3 yrs)
Bradford Highlands Development
June 20, 2023

Municipal Engineering Solutions

Peak Hour - Existing

Node Table

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (psi)
J-481	1.14	228.00	285.96	82.40
J-BH-600	0.00	251.13	302.28	72.70
J-BH-601	0.42	249.01	302.15	75.60
J-BH-602	0.60	248.19	302.01	76.50
J-BH-603	0.14	247.37	286.10	55.10
J-BH-604	0.84	245.40	286.06	57.80
J-BH-605	0.84	244.53	286.04	59.00
J-BH-606	0.35	243.08	286.02	61.10
J-BH-607	0.88	237.09	285.98	69.50
J-BH-608	0.91	234.90	285.96	72.60
J-BH-609	0.91	231.50	285.94	77.40
J-BH-610	0.70	229.59	285.93	80.10
J-BH-611	0.77	227.70	285.93	82.80
J-BH-612	1.02	227.25	285.92	83.50
J-BH-613	0.63	226.00	285.92	85.20
J-BH-614	0.60	227.17	285.92	83.60
J-BH-615	0.88	230.40	285.92	79.00
J-BH-616	0.53	233.20	285.92	75.00
J-BH-617	1.23	243.16	286.07	61.00
J-BH-618	1.16	238.96	286.05	67.00
J-BH-619	1.44	234.91	286.00	72.70
J-BH-620	0.00	232.28	286.00	76.40
J-BH-621	1.47	243.46	286.05	60.60
J-BH-622	0.98	238.60	286.05	67.50
J-BH-623	0.91	238.36	286.03	67.80
J-BH-624	0.95	239.78	286.01	65.80
J-BH-625	0.88	236.76	286.02	70.10
J-BH-626	0.91	235.15	286.00	72.30
J-BH-627	0.63	231.79	286.00	77.10
J-BH-628	1.02	228.32	285.96	82.00
J-BH-629	0.70	241.75	285.96	62.90
J-BH-630	0.39	241.33	285.95	63.50
J-BH-631	0.00	237.30	285.95	69.20
J-BH-632	0.00	234.21	285.98	73.60
J-BH-633	0.91	238.64	286.02	67.40
J-BH-634	0.00	244.47	286.06	59.10
J-BH-635	0.63	248.38	302.05	76.30
J-BH-636	0.00	242.35	286.06	62.20
J-BH-637	0.00	241.22	286.03	63.70
J-BH-638	1.30	232.00	285.94	76.70
J-BH-639	1.09	232.00	285.93	76.70
J-BH-640	1.09	229.73	285.93	79.90
J-BH-641	0.95	225.80	285.92	85.50
J-BH-642	0.49	222.97	285.92	89.50
J-BH-643	0.35	240.00	285.94	65.30
J-BH-644	1.19	238.14	285.93	68.00
J-BH-645	0.25	242.00	285.93	62.50
J-BH-646	1.44	235.39	285.92	71.90
J-BH-647	0.00	231.30	285.92	77.70

		Elevation		Pressure
MIN		**248.19**		**72.70**
MAX		**251.13**		**76.50**
Within Reduced Area				
MIN		**222.97**		**55.10**
MAX		**247.37**		**89.50**

Pipe Table

ID	From Node	To Node	Length (m)	Diameter (mm)	Roughness (C)	Flow (L/s)	Velocity (m/s)
P-BH-600	J-BH-601	J-BH-602	79.78	250	110	26.35	0.54
P-BH-601	PRV-84	J-BH-603	13.44	250	110	29.11	0.59
P-BH-602	J-BH-603	J-BH-604	49.41	250	110	17.42	0.35
P-BH-603	J-BH-604	J-BH-605	51.14	250	110	13.71	0.28
P-BH-604	J-BH-605	J-BH-606	46.91	250	110	11.66	0.24
P-BH-605	J-BH-606	J-BH-607	152.96	250	110	9.13	0.19
P-BH-606	J-BH-607	J-BH-608	89.08	250	110	9.16	0.19
P-BH-607	J-BH-608	J-BH-609	79.51	250	110	7.58	0.15
P-BH-608	J-BH-609	J-BH-610	88.79	250	110	5.66	0.12
P-BH-609	J-BH-610	J-BH-611	76.61	250	110	4.44	0.09
P-BH-610	J-BH-611	J-BH-612	69.10	250	110	3.29	0.07
P-BH-611	J-BH-612	J-BH-613	66.45	250	110	2.16	0.04
P-BH-612	J-BH-613	J-BH-614	90.64	250	110	1.74	0.04
P-BH-613	J-BH-614	J-BH-615	208.41	250	110	1.14	0.02
P-BH-614	J-BH-615	J-BH-616	122.82	250	110	0.53	0.01
P-BH-615	J-BH-601	J-BH-635	128.19	150	100	3.99	0.23
P-BH-616	J-BH-635	J-BH-602	75.82	150	100	3.36	0.19
P-BH-617	J-BH-603	J-BH-617	90.82	250	110	11.55	0.24
P-BH-618	J-BH-617	J-BH-618	87.07	250	110	7.19	0.15
P-BH-619	J-BH-618	J-BH-619	90.59	250	110	0.00	0.00
P-BH-620	J-BH-619	J-BH-620	93.82	250	110	-0.21	0.00
P-BH-621	J-BH-619	J-BH-633	154.52	200	110	-2.96	0.09
P-BH-622	J-BH-633	J-BH-621	193.11	200	110	-3.87	0.12
P-BH-623	J-BH-621	J-BH-634	86.73	200	110	-3.13	0.10
P-BH-624	J-BH-634	J-BH-617	124.91	200	110	-3.13	0.10
P-BH-625	J-BH-621	J-BH-618	141.46	200	110	-2.21	0.07
P-BH-626	J-BH-604	J-BH-636	87.97	200	110	2.88	0.09
P-BH-627	J-BH-636	J-BH-622	91.41	200	110	2.88	0.09
P-BH-628	J-BH-622	J-BH-618	50.70	200	110	-3.82	0.12
P-BH-629	J-BH-605	J-BH-637	88.00	200	110	1.21	0.04
P-BH-630	J-BH-637	J-BH-623	89.10	200	110	1.21	0.04
P-BH-631	J-BH-623	J-BH-622	46.67	200	110	-5.72	0.18
P-BH-632	J-BH-606	J-BH-624	92.93	200	110	2.17	0.07
P-BH-633	J-BH-624	J-BH-625	85.32	200	110	-1.98	0.06
P-BH-634	J-BH-625	J-BH-623	47.88	200	110	-6.02	0.19
P-BH-635	J-BH-607	J-BH-626	84.87	200	110	-4.82	0.15
P-BH-636	J-BH-626	J-BH-627	69.81	200	110	-2.53	0.08
P-BH-637	J-BH-627	J-BH-628	90.69	200	110	0.00	0.00
P-BH-638	J-BH-628	J-481	93.93	200	110	-2.41	0.08
P-BH-639	J-BH-626	J-BH-624	133.04	200	110	-3.20	0.10
P-BH-640	J-BH-627	J-BH-625	126.71	200	110	-3.16	0.10
P-BH-641	J-BH-628	J-BH-632	159.64	150	100	-1.73	0.10
P-BH-642	J-BH-632	J-BH-619	111.71	150	100	-1.73	0.10
P-BH-643	J-BH-607	J-BH-629	135.86	200	110	3.91	0.12
P-BH-644	J-BH-629	J-BH-630	63.92	200	110	3.21	0.10
P-BH-645	J-BH-630	J-BH-631	104.93	150	100	-0.68	0.04
P-BH-646	J-BH-631	J-BH-608	79.83	150	100	-0.68	0.04
P-BH-647	J-BH-609	J-BH-638	201.19	200	110	1.01	0.03
P-BH-648	J-BH-638	J-BH-628	188.11	200	110	-3.12	0.10
P-BH-649	J-BH-610	J-BH-639	178.20	200	110	0.52	0.02
P-BH-650	J-BH-639	J-BH-638	86.75	200	110	-2.82	0.09
P-BH-651	J-BH-611	J-BH-640	179.12	200	110	0.38	0.01
P-BH-652	J-BH-640	J-BH-639	84.75	200	110	-2.26	0.07
P-BH-653	J-BH-612	J-BH-641	220.26	200	110	0.11	0.00
P-BH-654	J-BH-641	J-BH-640	82.90	200	110	-1.55	0.05
P-BH-655	J-BH-613	J-BH-642	205.88	200	110	-0.22	0.01
P-BH-656	J-BH-642	J-BH-641	146.36	200	110	-0.71	0.02
P-BH-657	J-BH-630	J-BH-643	72.78	200	110	3.50	0.11
P-BH-658	J-BH-643	J-BH-644	134.48	200	110	3.15	0.10
P-BH-659	J-BH-644	J-BH-645	99.54	200	110	0.25	0.01
P-BH-660	J-BH-644	J-BH-646	170.56	200	110	1.71	0.05
P-BH-661	J-BH-646	J-BH-615	211.42	200	110	0.27	0.01
P-BH-662	J-BH-616	J-BH-647	59.85	250	110	0.00	0.00

ID	Diameter (mm)	Elevation (m)	Upstream Pressure (psi)	Downstream Pressure (psi)	Flow (L/s)	Velocity (m/s)	Headloss (m)
PRV-70	150	236	302.24	286.15	19.63	1.11	16.10
PRV-84	200	250.83	301.84	286.13	29.11	0.93	15.71

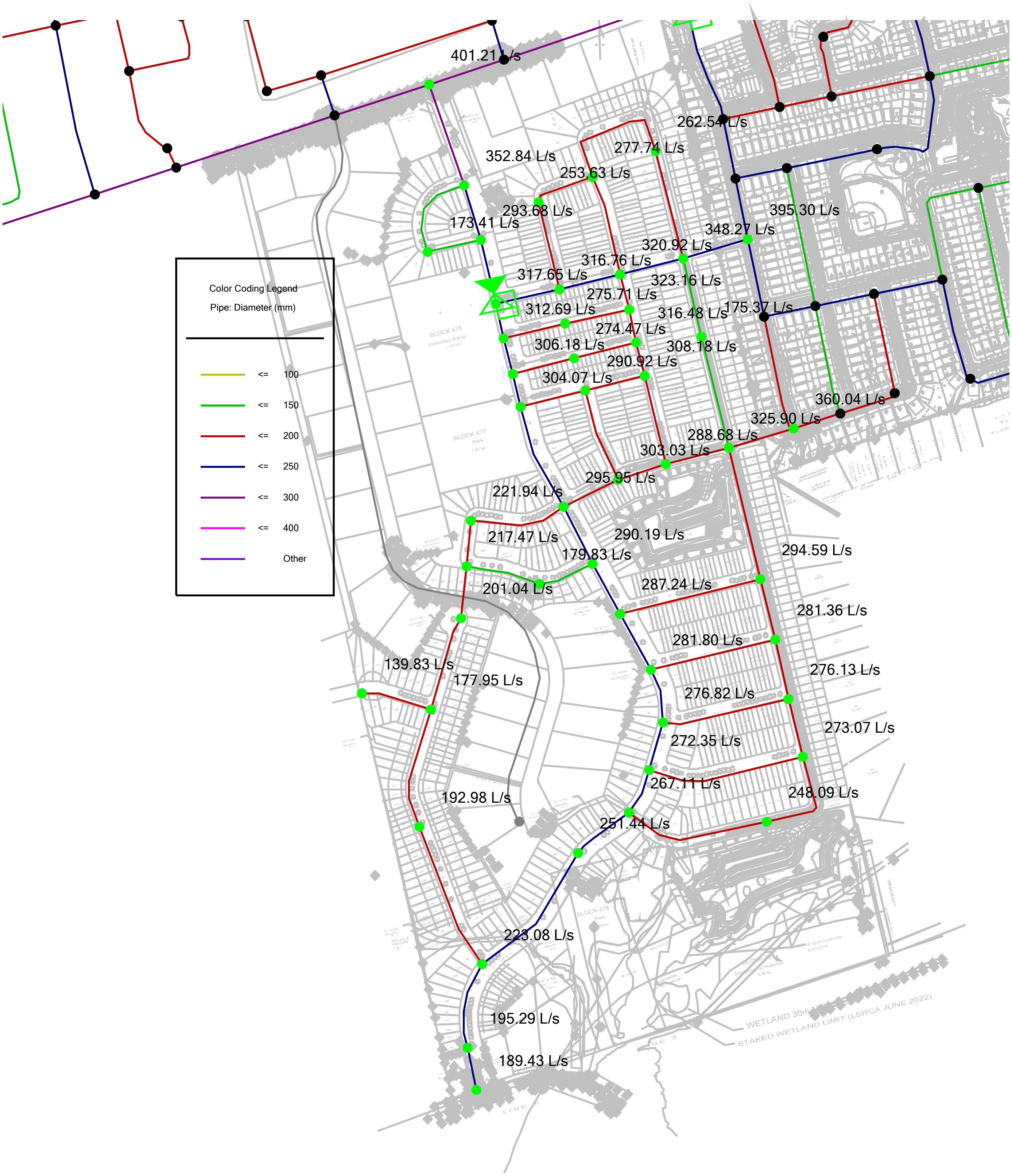
Existing Conditions (<3 yrs)
Bradford Highlands Development
June 20, 2023

Municipal Engineering Solutions

Fire Flow Table			
ID	Total Demand *(L/s)*	Available Flow *(L/s)*	**Fire Flow Met?**
J-BH-600	133.00	401.21	TRUE
J-BH-601	117.28	353.12	TRUE
J-BH-602	250.30	293.98	TRUE
J-BH-603	133.48	318.13	TRUE
J-BH-604	133.48	313.17	TRUE
J-BH-605	133.56	306.74	TRUE
J-BH-606	133.24	304.31	TRUE
J-BH-607	133.58	296.53	TRUE
J-BH-608	133.60	290.79	TRUE
J-BH-609	133.60	287.84	TRUE
J-BH-610	133.46	282.26	TRUE
J-BH-611	133.52	277.34	TRUE
J-BH-612	117.68	273.03	TRUE
J-BH-613	117.42	267.53	TRUE
J-BH-614	117.40	251.84	TRUE
J-BH-615	133.58	223.66	TRUE
J-BH-616	133.36	195.65	TRUE
J-BH-617	133.82	317.58	TRUE
J-BH-618	133.78	321.70	TRUE
J-BH-619	133.96	349.23	TRUE
J-BH-620	133.00	395.30	TRUE
J-BH-621	133.98	278.72	TRUE
J-BH-622	133.66	323.82	TRUE
J-BH-623	133.60	317.08	TRUE
J-BH-624	133.64	291.56	TRUE
J-BH-625	133.58	308.76	TRUE
J-BH-626	133.60	303.63	TRUE
J-BH-627	133.42	289.10	TRUE
J-BH-628	133.68	326.58	TRUE
J-BH-629	117.46	222.40	TRUE
J-BH-630	117.26	217.73	TRUE
J-BH-631	117.00	179.83	TRUE
J-BH-632	117.00	175.37	TRUE
J-BH-633	133.60	263.14	TRUE
J-BH-634	133.00	253.63	TRUE
J-BH-635	117.42	173.83	TRUE
J-BH-636	133.00	275.71	TRUE
J-BH-637	133.00	274.47	TRUE
J-BH-638	133.86	295.45	TRUE
J-BH-639	133.72	282.08	TRUE
J-BH-640	133.72	276.85	TRUE
J-BH-641	117.64	273.71	TRUE
J-BH-642	117.32	248.41	TRUE
J-BH-643	117.24	201.28	TRUE
J-BH-644	117.80	178.75	TRUE
J-BH-645	117.16	139.99	TRUE
J-BH-646	117.96	193.94	TRUE
J-BH-647	133.00	189.43	TRUE

MIN	**139.99**
MAX	**401.21**

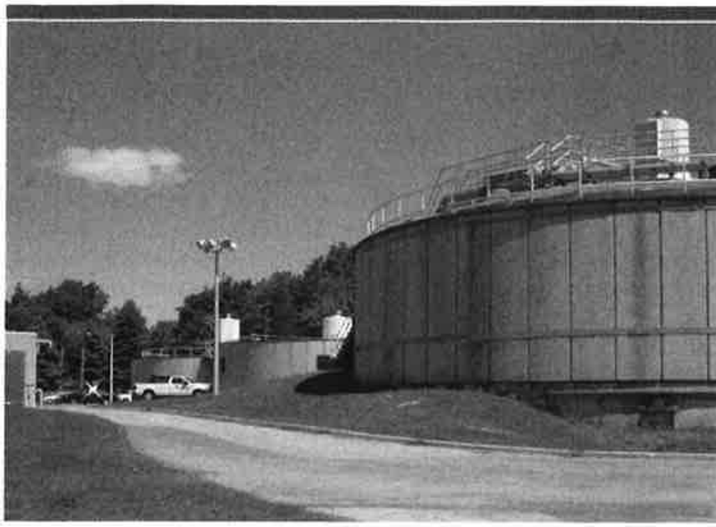
Fire Flows

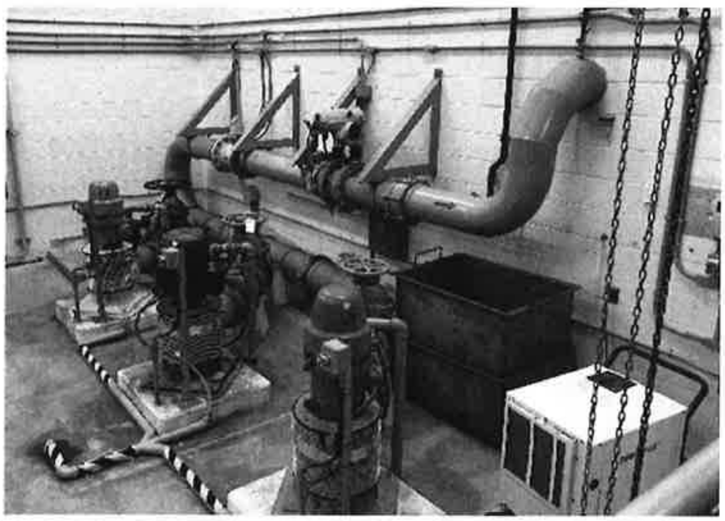
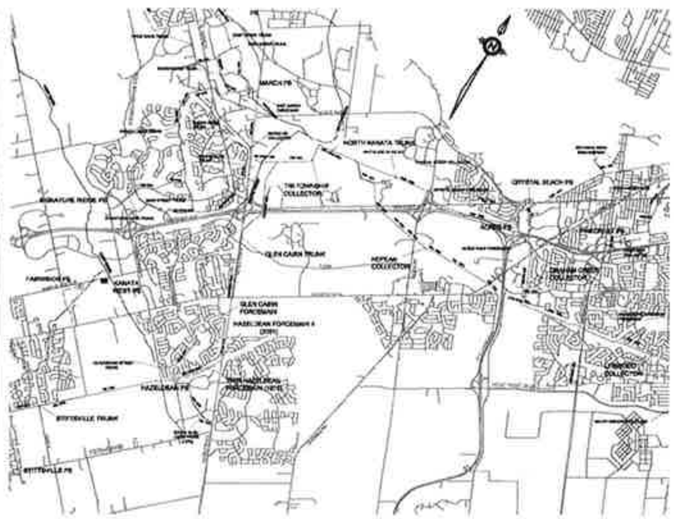


401.21 L/s
262.54 L/s
277.74 L/s
352.84 L/s
253.63 L/s
293.68 L/s
395.30 L/s
173.41 L/s
348.27 L/s
320.92 L/s
316.76 L/s
317.65 L/s
323.16 L/s
275.71 L/s
312.69 L/s
316.48 L/s
175.37 L/s
274.47 L/s
306.18 L/s
308.18 L/s
290.92 L/s
304.07 L/s
360.04 L/s
325.90 L/s
288.68 L/s
303.03 L/s
295.95 L/s
221.94 L/s
217.47 L/s
290.19 L/s
179.83 L/s
294.59 L/s
201.04 L/s
287.24 L/s
281.36 L/s
281.80 L/s
139.83 L/s
177.95 L/s
276.13 L/s
276.82 L/s
272.35 L/s
273.07 L/s
267.11 L/s
192.98 L/s
248.09 L/s
251.44 L/s
223.08 L/s
195.29 L/s
189.43 L/s
Color Coding Legend
Pipe: Diameter (mm)
<= 100
<= 150
<= 200
<= 250
<= 300
<= 400
Other
WETLAND 30m
STAKED WETLAND LIMIT (LSRCA JUNE 2022)

APPENDIX 2

Excerpt-Simcoe Water and Wastewater Service Delivery Review



Simcoe Water and Wastewater Service Delivery Review

Final Report

January 31, 2022

Prepared for:

COUNTY OF SIMCOE

arva

CANADA'S BEST MANAGED COMPANIES Platinum member

R.V. Anderson Associates Limited
2001 Sheppard Avenue East Suite 300
Toronto Ontario M2J 4Z8 Canada
Tel 416 497 8600 Fax 855 833 4022
www.rvanderson.com

January 31, 2022

RVA 215657

County of Simcoe
1110 Highway 26,
Midhurst, ON
L9X 1N6

Attention: Rob Elliot, MCIP RPP, MBA - General Manager

Dear Mr. Elliot:

Re: County of Simcoe Water and Wastewater Service Delivery Review
Final Report

R.V. Anderson Associated Limited (RVA) is please to submit our final report for the County of Simcoe's Water and Wastewater Service Delivery Review. This report summarizes our engagement with local municipalities to seek input on the current service challenges and capacities, identifies potential opportunities on coordination, and solicits any opinions on the potential roles of the County of Simcoe in this regard.

Thank you for this opportunity to work with the County and its sixteen member municipalities. We trust the information contained in this report meets your expectations and are available to respond to any questions.

Yours very truly,

R.V. ANDERSON ASSOCIATES LIMITED

Digitally signed by Rika Law
Date: 2022.01.31 16:18:26 -05'00'

Prepared by:
Mike Benson, MScE, P.Eng.
Project Coordinator

Reviewed by:
Rika Law, P.Eng., PMP
Project Manager

3.3 Spare Capacity Analysis

3.3.1 Water

The "spare" capacity of each drinking water system under current operating conditions and populations has been approximated to assess the ability of each municipality to service future growth. Spare capacity has been estimated by comparing the Maximum Day Demands (MDD) recorded in 2020 to each system's total operational capacity. This assessment is for existing systems only and does not consider a Municipality's planned expansions or capital works to increase the capacity of their systems. Note this is a high-level assessment only and should be interpreted and used with caution. In order to refine the spare capacity of the existing systems, a more thorough analysis of the last 5 years of water demands, populations and industrial water demands should be completed.

The spare capacity (m^3/day) of each water system has been converted into a range of residential-equivalent population using the equation below. Key assumptions of this analysis are:

- Average Domestic Water Demand ranges between 270 to 450 L/person/day.
- Maximum Day Factor for each system is estimated by taking the greater of two values: 1) actual 2020 Maximum Day Factors, or 2) recommended population-based Maximum Day Factors listed in the MECP Design Guidelines for Drinking-Water Systems.
- Drinking water systems can operate efficiently up to 100% of their operational capacity with no additional limitations other than what has been reported by the local municipality.
- 10% factor of safety and uncertainty has been applied to 2020 Maximum Day Demands to account for limited historical data availability.

$$SC_{eq.pop.} = \frac{(SOC - 1.10 * MDD_{2020})}{(MDF * ADWD)}$$

Where:

$SC_{eq.pop.}$ = Spare Capacity (residential equivalent population)
SOC = System Operational Capacity (m^3/day)
MDD_{2020} = Maximum Day Demand in 2020 (m^3/day)
MDF = Maximum Day Factor
ADWD = Average Domestic Water Demand (m^3/day) which ranges between 0.270 and 0.450 m^3/person/day.

The total spare capacity available for each municipality is summarized in Table 3-5. In summary, the total spare capacity of drinking water in the County is estimated to be between 121,000 and 229,500 residential-equivalent population.

Table 3-5. Drinking Water Spare Capacity Analysis Results

Municipality	Total Operational Capacity (m^3/day)	Demand[1] as % of Operational Capacity	Spare Capacity (m^3/day)	Spare Capacity (equivalent population)	
				Low	High
Adjala-Tosorontio	6,173	33%	4,140	2,800	4,800
Bradford West Gwillimbury	25,549	62%	9,726	12,000	23,000
Clearview	10,422	54%	4,787	4,600	8,400
Collingwood	31,140	87%	4,106	4,800	12,800
Essa	12,744	64%	4,559	5,100	9,700
Innisfil	44,873	58%	18,780	21,700	40,600
Midland	19,544	73%	5,256	4,500	9,400
New Tecumseth	29,482	69%	9,285	11,300	22,600
Oro-Medonte	18,171	23%	14,000	12,700	21,600
Penetanguishene	10,510	52%	5,054	5,500	10,100
Ramara	5,964	37%	3,780	4,000	7,200
Severn	6,781	38%	4,227	5,400	9,500
Springwater	18,636	52%	9,016	8,400	15,000
Tay	7,674	74%	2,012	2,100	4,400
Tiny	12,344	54%	5,686	4,600	8,200
Wasaga Beach	31,415	65%	11,088	10,100	19,700
Total	**291,422**	**61%**	**115,502**	**119,600**	**227,000**

1 - Representative historical demand is assumed equal to 110% of 2020 Max Day Demand.

3.3.2 Wastewater

The "spare" capacity of each wastewater system has been approximated under current operating conditions and populations to assess the ability of each municipality to service future growth. Spare capacity has been estimated by comparing the Average Daily Flows (ADF) recorded in 2020 to each system's total operational capacity. This assessment is for existing systems only and does not consider a Municipality's planned expansions or capital works to increase the capacity of their systems. Note this is a high-level assessment only and should be interpreted and used with caution. In order to refine the spare capacity of the existing systems, a more thorough analysis of the last 5 years of water demands, populations and industrial water demands should be completed.

The spare capacity (m^3/day) of each wastewater system has been converted into a range of residential-equivalent population using the equation below. Key assumptions of this analysis include:

- Average Domestic Wastewater Demand (ADWWD) ranges between 325 to 450 L/person/day.
- Peak Daily Flows, Peak Instantaneous Flows and Peak Loading Factors to the treatment facilities are not a limiting factor.
- The wastewater systems can operate efficiently and continue to meet ECA requirements up to 100% of their operational capacity with no additional limitations other than what has been reported by the local municipality.
- 10% factor of safety and uncertainty has been applied to 2020 Average Daily Flow to account for limited historical data availability and flow variation.

$$SC_{eq.pop.} = \frac{(SOC - 1.10 * ADF_{2020})}{(ADWWD)}$$

Where:

$SC_{eq\,pop}$ = Spare Capacity (residential equivalent population)
SOC = System Operational Capacity (m^3/day)
ADF_{2020} = Maximum Day Demand in 2020 (m^3/day)
ADWWD = Average Domestic Wastewater Demand which ranges between 0.325 and 0.450 m^3/person/day.

The total spare capacity available for each municipality is summarized in Table 3-6. In summary, the total spare capacity of wastewater systems in the County of Simcoe is estimated to be between 103,600 and 143,600 residential-equivalent population.

Table 3-6. Wastewater Spare Capacity Analysis Results

Municipality	Total Operational Capacity (m^3/day)	Demand[1] as % of Operational Capacity	Spare Capacity (m^3/day)	Spare Capacity Estimate (equivalent population)	
				Low	High
Adjala-Tosorontio	80	100%	0	0	0
Bradford West Gwillimbury	19,400	66%	6,687	14,900	20,600
Clearview	2,970	67%	970	2,200	3,000
Collingwood	24,548	84%	3,809	8,500	11,700
Essa	5,511	49%	2,831	6,300	8,700
Innisfil	17,825	69%	5,571	12,400	17,200
Midland	15,665	55%	7,048	15,700	21,700
New Tecumseth	17,358	73%	4,720	10,500	14,600
Oro-Medonte	147	100%	0	0	0
Penetanguishene	6,750	57%	2,909	6,400	9,000
Ramara	2,672	74%	741	1,600	2,300
Severn	2,539	64%	916	2,000	2,900
Springwater	3,164	52%	1,516	3,400	4,700
Tay	4,282	98%	485	1,100	1,500
Tiny	0	NA	0	0	0
Wasaga Beach	15,433	46%	8,357	18,600	25,700
Total	**138,344**	**67%**	**46,559**	**103,600**	**143,600**

1 - Representative historical demand is assumed equal to 110% of 2020 Average Daily Flow.

3.3.3 Integrated Spare Capacity

The Ontario Provincial Policy Statement (2020) and the GGH Growth Plan direct municipalities to allocate the "*vast majority*" of growth to settlement areas which are serviced by an existing or planned municipal water and wastewater system. As such, municipalities should consider the availability of water and wastewater servicing when considering future population and employment allocations.

A preliminary assessment of the residential equivalent-population which can be serviced by the existing water and wastewater systems within each municipality is summarized in Table 3-7 and Figure 3-5. This summary assumes the maximum number of residential equivalent-population which can be serviced is the lowest of the water or wastewater systems spare capacity.

Note this is a relatively high-level analysis and additional investigations are warranted to confirm the serviceable population estimates within each municipality and settlement areas. Results should be used with caution and are only intended for strategic-level planning discussions. Findings should not be used by the County or local municipalities to allocate population or employment.

Table 3-7. Summary of Integrated Spare Capacity

Municipality	Spare Capacity Estimate (equivalent population)				Integrated Spare Capacity	
	Water		Wastewater			
	Low	High	Low	High	Low	High
Adjala-Tosorontio	2,800	4,800	0	0	0	0
Bradford West Gwillimbury	12,000	23,000	14,900	20,600	12,000	20,600
Clearview	4,600	8,400	2,200	3,000	2,200	3,000
Collingwood	4,800	12,800	8,500	11,700	4,800	11,700
Essa	5,100	9,700	6,300	8,700	5,100	8,700
Innisfil	21,700	40,600	12,400	17,200	12,400	17,200
Midland	4,500	9,400	15,700	21,700	4,500	9,400
New Tecumseth	11,300	22,600	10,500	14,600	10,500	14,600
Oro-Medonte	12,700	21,600	0	0	0	0
Penetanguishene	5,500	10,100	6,400	9,000	5,500	9,000
Ramara	4,000	7,200	1,600	2,300	1,600	2,300
Severn	5,400	9,500	2,000	2,900	2,000	2,900
Springwater	8,400	15,000	3,400	4,700	3,400	4,700
Tay	2,100	4,400	1,100	1,500	1,100	1,500
Tiny	4,600	8,200	0	0	0	0
Wasaga Beach	10,100	19,700	18,600	25,700	10,100	19,700
Total	**119,600**	**227,000**	**103,600**	**143,600**	**75,200**	**125,300**

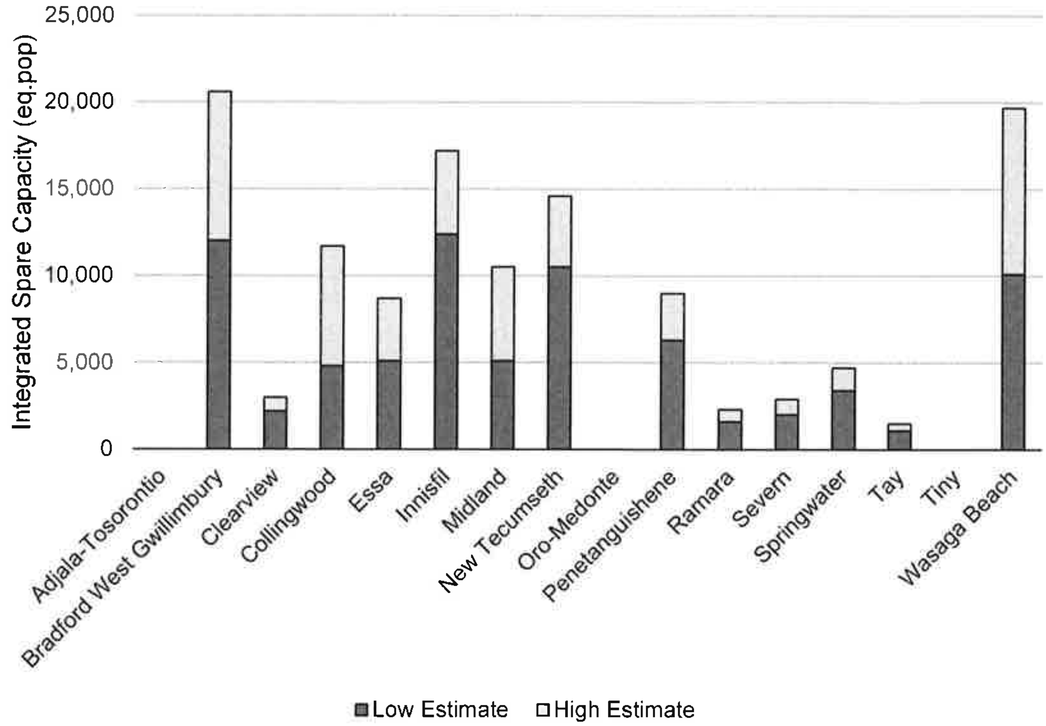


Figure 3-5. Integrated Spare Capacity Results

3.4 Planned Capacity Increases

In addition to the water and wastewater systems currently in operation, municipalities throughout the County are in various stages of planning, designing, or constructing additional capacity. A review of planning documents, studies, and correspondence from each local municipality was completed to estimate the total planned water and wastewater capacity for each municipality. Details of this review are provided in Appendix 2.

In summary, most municipalities have indicated they will likely require additional water and wastewater capacity to meet the growth requirements in their community. This planned increase could be at least 90,500 m^3/day and 70,900 m^3/day for water and wastewater, respectively. The time horizon for these planned increases varies depending on the municipality. Generally, the time horizon for planned increases is to service anticipated growth needs up to 2031, however some municipalities (such as Innisfil and Collingwood) are planning beyond this time horizon. Additionally, some municipalities have identified the need for additional capacity, but the documentation reviewed does not clearly indicate the magnitude of this need. The total planned water and wastewater capacity for each municipality, as available, is summarized in Table 3-8 and Table 3-9.

Table 3-8. Planned Water Capacity

Municipality	Current Capacity (m^3/day)	Planned Capacity Increase (m^3/day)	Total Planned Capacity (m^3/day)	% Increase
Adjala-Tosorontio	6,173	1,962	8,135	32%
BWG	25,549	6,351	31,900	25%
Clearview	10,422	5,645	16,067	54%
Collingwood	31,140	69,929	101,069	225%
Essa	12,744	TBD[1]	TBD[1]	TBD[1]
Innisfil	44,873	47,000	91,873	105%
Midland	19,544	0	19,544	0%
New Tecumseth	29,482	TBD[1]	TBD[1]	TBD[1]
Oro-Medonte	18,171	TBD[1]	TBD[1]	TBD[1]
Penetanguishene	10,510	TBD[1]	TBD[1]	TBD[1]
Ramara	5,964	TBD[1]	TBD[1]	TBD[1]
Severn	6,781	TBD[1]	TBD[1]	TBD[1]
Springwater	18,636	14,947	33,583	80%
Tay	7,674	3,480	11,154	45%
Tiny	12,344	0	12,344	0%
Wasaga Beach	31,415	TBD[1]	TBD	TBD[1]
Total	**291,422**	**149,314 +**	**325,669 +**	**51%**

1- Staff or documentation reviewed indicates a capacity increase is likely required but the magnitude of this increase is not well defined at this time.

Table 3-9. Planned Wastewater Capacity

Municipality	Current Capacity (m^3/day)	Planned Capacity Increase (m^3/day)	Planned Capacity (m^3/day)	% Increase
Adjala-Tosorontio	80	4,218	4,298	5273%
BWG	19,400	3,900	23,300	20%
Clearview	2,970	5,390	8,360	181%
Collingwood	24,548	11,637	36,185	47%
Essa	5,511	TBD[1]	TBD[1]	TBD[1]
Innisfil	17,825	24,933	42,758	140%
Midland	15,665	5,216	20,881	33%
New Tecumseth	17,358	TBD[1]	TBD[1]	TBD[1]
Oro-Medonte	147	3,386	3,533	2302%
Penetanguishene	6,750	TBD[1]	TBD[1]	TBD[1]
Ramara	2,672	TBD[1]	TBD[1]	TBD[1]
Severn	2,539	TBD[1]	TBD[1]	TBD[1]
Springwater	3,164	12,314	15,478	389%
Tay	4,282	TBD[1]	TBD[1]	TBD[1]
Tiny	0	0	0	0%
Wasaga Beach	15,433	TBD[1]	TBD[1]	TBD[1]
Total	**138,344**	**70,994 +**	**154,794 +**	**51%**

1- Staff or documentation reviewed indicates a capacity increase is likely required but the magnitude of this increase is not well defined at this time.

APPENDIX 3

Sanitary Design Sheet

TOWN OF BRADFORD WEST GWILLIMBURY
SANITARY SEWER DESIGN SHEET

Project / Subdivision **BRADFORD HIGHLANDS RESIDENTIAL SUBDIVISION**

Prepared by: Daniel Schembri

Consulting Engineer URBAN ECOSYSTEMS LIMITED

Project No.: 15011.100

Checked by: Rosario Sacco

Last Revised: June 10, 2023

Design Parameters

Residential Density =	3.14 cap/unit	Residential =	250 L/cap/day
Manning 'n' =	0.013	Industrial =	35 m^3/ha*day
Extran. Flow (pre 2000) =	0.5 L/s/ha	Institutional =	19.8 m^3/ha*day
Extran. Flow (post 2000) =	0.2 L/s/ha	Commercial =	28 m^3/ha*day

Design Equations

$M(r) = 1 + \frac{14}{4 + \sqrt{P}}$ $Q(i) = i \times \Sigma A$ $Q(d) = \Sigma(Q(x))$

$M(ind) = 6.6604 * A^{-0.1992}$ $Q(r) = \frac{P * q(r) * M}{86400}$

NOTE: Table 14 of the Engineering Standards is to be referenced for Maximum Capacity

Notes/Comments:

Location					Individual Values							Cumulative Values								Flow Data						Sewer Data							
Street	From		To		Industrial Area	Commercial Area	Institutional Area	Pre 2000 Residental Area	Post 2000 Residental Area	Residential Units	Residential Population	Industrial P.F.	Industrial Area	Commercial Area	Institutional Area	Residential P.F.	Pre 2000 Residental Area	Post 2000 Residental Area	Residential Population	Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual velocity at design flow	PERCENTAGE OF CAPACITY
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	cap.	M(ind)	A(ind)	A(c)	A(ins)	M(r)	A(r)	A(r)	P	Q(ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)	(%)
Inverness - West	626		624						0.17	2	6.3					4.43		0.17	6.3				0.08	0.03	0.11	41.5	200	PVC	1.50%	40.2	1.28	0.294	0.3%
Inverness - West	624		622						0.41	7	22.0					4.36		0.58	28.3				0.36	0.12	0.47	59.5	200	PVC	3.00%	56.8	1.81	0.416	0.8%
Inverness - West	622		620						0.25	4	12.6					4.33		0.83	40.8				0.51	0.17	0.68	31.5	200	PVC	3.50%	61.4	1.95	0.605	1.1%
Algeo - West	620		618						0.59	16	50.2					4.25		1.42	91.1				1.12	0.28	1.40	81.5	200	PVC	3.00%	56.8	1.81	0.669	2.5%
Fortis - Comm West	649		648			0.39								0.39							0.13			0.08	0.20	11.5	200	PVC	1.50%	40.2	1.28	0.294	0.5%
Fortis - West	648		646						0.43	19	59.7			0.39		4.30		0.43	59.7		0.13		0.74	0.16	1.03	73.5	200	PVC	2.50%	51.9	1.65	0.512	2.0%
Fortis - West	646		618						0.12	2	6.3			0.39		4.29		0.55	65.9		0.13		0.82	0.19	1.13	34.0	200	PVC	1.00%	32.8	1.04	0.438	3.5%
Algeo - West	618		616						0.41	11	34.5			0.39		4.15		2.38	191.5		0.13		2.30	0.55	2.98	84.0	200	PVC	3.40%	60.5	1.93	0.905	4.9%
Fortis - West	642		640						0.19	6	18.8					4.38		0.19	18.8				0.24	0.04	0.28	29.0	200	PVC	3.00%	56.8	1.81	0.416	0.5%
Fortis - West	640		638						0.42	12	37.7					4.30		0.61	56.5				0.70	0.12	0.83	88.5	200	PVC	2.40%	50.8	1.62	0.501	1.6%
Fortis - West	638		636						0.10	2	6.3					4.29		0.71	62.8				0.78	0.14	0.92	15.5	200	PVC	2.00%	46.4	1.48	0.458	2.0%
Fortis - West	636		634						0.44	14	44.0					4.24		1.15	106.8				1.31	0.23	1.54	61.0	200	PVC	1.75%	43.4	1.38	0.580	3.5%
Fortis - West	634		632						0.26	4	12.6					4.22		1.41	119.3				1.46	0.28	1.74	15.5	200	PVC	1.40%	38.8	1.24	0.581	4.5%
Fortis - West	632		630						0.06							4.22		1.47	119.3				1.46	0.29	1.75	34.0	200	PVC	1.75%	43.4	1.38	0.649	4.0%
Fortis - West	630		628						0.26	4	12.6					4.21		1.73	131.9				1.61	0.35	1.95	9.5	200	PVC	1.20%	35.9	1.14	0.583	5.4%
Fortis - West	628		616						0.50	12	37.7					4.17		2.23	169.6				2.05	0.45	2.49	67.5	200	PVC	1.20%	35.9	1.14	0.632	6.9%
Algeo - West	616		614						0.49	12	37.7			0.39		4.02		5.10	398.8		0.13		4.64	1.10	5.87	70.0	200	PVC	1.50%	40.2	1.28	0.921	14.6%
Algeo - West	614		606						0.26	4	12.6			0.39		4.02		5.36	411.3		0.13		4.78	1.15	6.06	70.5	200	PVC	0.50%	23.2	0.74	0.619	26.1%
Barrow - West	612		610						0.66	12	37.7					4.34		0.66	37.7				0.47	0.13	0.60	80.0	200	PVC	3.00%	56.8	1.81	0.561	1.1%
Cayton - West	666		665						0.28	5	15.7					4.39		0.28	15.7				0.20	0.06	0.26	38.5	200	PVC	1.50%	40.2	1.28	0.294	0.6%
Cayton - West	665		610						0.34	6	18.8					4.34		0.62	34.5				0.43	0.12	0.56	55.0	200	PVC	0.50%	23.2	0.74	0.273	2.4%
Barrow - West	610		608						0.26	6	18.8					4.25		1.54	91.1				1.12	0.31	1.43	32.0	200	PVC	1.50%	40.2	1.28	0.537	3.6%
Barrow - West	608		606						0.36	8	25.1					4.23		1.90	116.2				1.42	0.38	1.80	48.0	200	PVC	0.50%	23.2	0.74	0.430	7.8%
Cayton - West	660		659						0.23	3	9.4					4.42		0.23	9.4				0.12	0.05	0.17	20.5	200	PVC	1.50%	40.2	1.28	0.294	0.4%
Cayton - West	659		658						0.23	2	6.3					4.39		0.46	15.7				0.20	0.09	0.29	16.0	200	PVC	1.50%	40.2	1.28	0.294	0.7%
Cayton - West	658		656						0.66	12	37.7					4.31		1.12	53.4				0.67	0.22	0.89	75.0	200	PVC	0.50%	23.2	0.74	0.310	3.8%
Cayton - West	656		654						0.18	2	6.3					4.30		1.30	59.7				0.74	0.26	1.00	10.0	200	PVC	0.50%	23.2	0.74	0.347	4.3%
Cayton - West	654		652						0.36	6	18.8					4.27		1.66	78.5				0.97	0.33	1.30	59.0	200	PVC	0.50%	23.2	0.74	0.376	5.6%
Cayton - West	652		606						0.37	7	22.0					4.24		2.03	100.5				1.23	0.41	1.64	61.0	200	PVC	0.50%	23.2	0.74	0.430	7.1%

TOWN OF BRADFORD WEST GWILLIMBURY
SANITARY SEWER DESIGN SHEET

Project / Subdivision **BRADFORD HIGHLANDS RESIDENTIAL SUBDIVISION**

Prepared by: Daniel Schembri

Consulting Engineer URBAN ECOSYSTEMS LIMITED

Project No.: 15011.100

Checked by: Rosario Sacco

Last Revised: June 10, 2023

Design Parameters

Residential Density = 3.14 cap/unit
Manning 'n' = 0.013
Extran. Flow (pre 2000) = 0.5 L/s/ha
Extran. Flow (post 2000) = 0.2 L/s/ha

Residential = 250 L/cap/day
Industrial = 35 m^3/ha*day
Institutional = 19.8 m^3/ha*day
Commercial = 28 m^3/ha*day

Design Equations

$M(r) = 1 + \frac{14}{4 + \sqrt{P}}$ $Q(i) = i \times er \; A$ $Q(d) = er(Q(x))$

$M(ind) = 6.6604 \cdot A^{-0.1992}$ $Q(r) = \frac{P \cdot q(r) \cdot M}{86400}$

NOTE: Table 14 of the Engineering Standards is to be referenced for Maximum Capacity

Notes/Comments:

Location					Individual Values							Cumulative Values								Flow Data						Sewer Data							
Street	From		To		Industrial Area	Commercial Area	Institutional Area	Pre 2000 Residental Area	Post 2000 Residental Area	Residential Units	Residential Population	Industrial P.F.	Industrial Area	Commercial Area	Institutional Area	Residental P.F.	Pre 2000 Residental Area	Post 2000 Residental Area	Residental Population	Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual velocity at design flow	PERCENTAGE OF CAPACITY
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	cap.	M(ind)	A(ind)	A(c)	A(ins)	M(r)	A(r)	A(r)	P	Q(ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)	(%)
Barrow - West	606		605						0.16	2	6.3			0.39		3.92		9.45	634.3		0.13		7.19	1.97	9.29	38.5	200	PVC	0.50%	23.2	0.74	0.694	40.0%
Barrow - West	605		604						0.01					0.39		3.92		9.46	634.3		0.13		7.19	1.97	9.29	8.0	200	PVC	0.50%	23.2	0.74	0.694	40.1%
Barrow - West	604		600						0.31	4	12.6			0.39		3.91		9.77	646.8		0.13		7.33	2.03	9.48	76.0	200	PVC	0.50%	23.2	0.74	0.694	40.9%
Inverness - West	682		678						0.41	6	18.8					4.38		0.41	18.8				0.24	0.08	0.32	62.5	200	PVC	1.50%	40.2	1.28	0.294	0.8%
Inverness - West	679		678						0.51	5	15.7					4.39		0.51	15.7				0.20	0.10	0.30	52.0	200	PVC	1.50%	40.2	1.28	0.294	0.8%
Barrow - West	678		676						0.55	10	31.4					4.29		1.47	65.9				0.82	0.29	1.11	77.5	200	PVC	1.90%	45.2	1.44	0.532	2.5%
Barrow - West	676		674						0.51	10	31.4					4.25		1.98	97.3				1.20	0.40	1.59	69.0	200	PVC	3.75%	63.5	2.02	0.748	2.5%
Barrow - West	674		672						0.39	6	18.8					4.23		2.37	116.2				1.42	0.47	1.89	81.0	200	PVC	4.00%	65.6	2.09	0.773	2.9%
Barrow - West	672		670						0.17	2	6.3					4.22		2.54	122.5				1.49	0.51	2.00	36.5	200	PVC	1.20%	35.9	1.14	0.583	5.6%
Barrow - West	670		600						0.04							4.22		2.58	122.5				1.49	0.52	2.01	27.0	200	PVC	0.50%	23.2	0.74	0.447	8.7%
Bar/Gib SWM - West	600		749						0.04					0.39		3.87		12.39	769.3		0.13		8.62	2.56	11.30	49.0	250	PVC	0.50%	42.0	0.86	0.718	26.9%
Inverness - West	679		794						0.40	6	18.8					4.38		0.40	18.8				0.24	0.08	0.32	43.5	200	PVC	2.00%	46.4	1.48	0.340	0.7%
Inverness - West	794		792						0.83	16	50.2					4.28		1.23	69.1				0.86	0.25	1.10	100.0	200	PVC	1.75%	43.4	1.38	0.511	2.5%
Inverness - West	778		792						0.15	2	6.3					4.43		0.15	6.3				0.08	0.03	0.11	39.5	200	PVC	1.50%	40.2	1.28	0.294	0.3%
Tupling - West	792		786						0.36	5	15.7					4.25		1.74	91.1				1.12	0.35	1.47	84.0	200	PVC	3.50%	61.4	1.95	0.723	2.4%
Tay - West	691		690						0.45	9	28.3					4.36		0.45	28.3				0.36	0.09	0.45	55.5	200	PVC	2.50%	51.9	1.65	0.380	0.9%
Tay - West	690		786						0.66	12	37.7					4.29		1.11	65.9				0.82	0.22	1.04	98.0	200	PVC	2.50%	51.9	1.65	0.611	2.0%
Gibson - West	790		788						0.40	8	25.1					4.37		0.40	25.1				0.32	0.08	0.40	32.5	200	PVC	1.50%	40.2	1.28	0.294	1.0%
Gibson - West	788		786						0.33	5	15.7					4.33		0.73	40.8				0.51	0.15	0.66	81.0	200	PVC	0.50%	23.2	0.74	0.273	2.8%
Tupling - West	786		760						0.65	11	34.5					4.12		4.23	232.4				2.77	0.85	3.62	84.0	200	PVC	0.50%	23.2	0.74	0.539	15.6%
Inverness - West	778		776						0.80	15	47.1					4.32		0.80	47.1				0.59	0.16	0.75	94.5	200	PVC	3.00%	56.8	1.81	0.561	1.3%
Inverness - West	776		773						0.33	4	12.6					4.30		1.13	59.7				0.74	0.23	0.97	32.0	200	PVC	0.50%	23.2	0.74	0.347	4.2%
Inverness - West	773		772						0.20	1	3.1					4.29		1.33	62.8				0.78	0.27	1.05	11.0	200	PVC	0.50%	23.2	0.74	0.347	4.5%

TOWN OF BRADFORD WEST GWILLIMBURY
SANITARY SEWER DESIGN SHEET

Project / Subdivision **BRADFORD HIGHLANDS RESIDENTIAL SUBDIVISION**

Prepared by: Daniel Schembri

Consulting Engineer URBAN ECOSYSTEMS LIMITED

Project No.: 15011.100

Checked by: Rosario Sacco

Last Revised: June 10, 2023

Design Parameters

Residential Density =	3.14 cap/unit	Residential =	250 L/cap/day
Manning 'n' =	0.013	Industrial =	35 m^3/ha*day
Extran. Flow (pre 2000) =	0.5 L/s/ha	Institutional =	19.8 m^3/ha*day
Extran. Flow (post 2000) =	0.2 L/s/ha	Commercial =	28 m^3/ha*day

Design Equations

$M(r) = 1 + \frac{14}{4 + \sqrt{(P)}}$ Q(i) = i x A Q(d) = (Q(x))

$M(ind) = 6.6604 * A^{-0.1992}$ $Q(r) = \frac{P * q(r) * M}{86400}$

NOTE: Table 14 of the Engineering Standards is to be referenced for Maximum Capacity

Notes/Comments:

Location					Individual Values							Cumulative Values								Flow Data						Sewer Data							
Street	From		To		Industrial Area	Commercial Area	Institutional Area	Pre 2000 Residental Area	Post 2000 Residental Area	Residential Units	Residential Population	Industrial P.F.	Industrial Area	Commercial Area	Institutional Area	Residential P.F.	Pre 2000 Residental Area	Post 2000 Residental Area	Residential Population	Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual velocity at design flow	PERCENTAGE OF CAPACITY
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	cap.	M(ind)	A(ind)	A(c)	A(ins)	M(r)	A(r)	A(r)	P	Q(ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)	(%)
Bradford Highlands Residential Subdivision					**Based on MGP Concept Development Plan dated May 8, 2023**															Town of Bradford West Gwillimbury 2023 Design Criteria													
Single Detached Units		20.5	Note 1						17.69	330	1108.8					3.77		17.69	1108.8	**Single Detached Units**				3.36 cap/unit									
Semi Detached Units		Incl above							9.00	154	517.4					3.97		9.00	517.4	**Semi Detached Units**				3.36 cap/unit									
Street Townhouse Units		7.9	Note 1						10.31	335	948.1					3.81		10.31	948.1	**Street Townhouse Units**				2.83 cap/unit									
B2N Townhouse Units		1.4	Note 1						1.78	132	373.6					4.04		1.78	373.6	**B2N Townhouse Units**				2.83 cap/unit									
School Block		2.5	Note 1				2.76								2.76					**School Block**				19.8 m^3/ha*day									
Note 1 : Area adjusted to include 50% of Road Area																																	
							2.8		38.8	951.0	2947.9								2947.9														
Total Development									38.78	951	2947.9				2.76	3.45		38.78	2947.9			0.16	29.42	8.31	37.88	75.5	300	PVC	0.50%	68.4	0.97	0.987	55.4%
Inverness - West	772		770						0.69	10	31.4				2.76	3.44		40.80	3042.1			0.16	30.26	8.71	39.13	75.5	300	PVC	0.50%	68.4	0.97	0.996	57.2%
Inverness - West	770		768						0.75	9	28.3				2.76	3.43		41.55	3070.3			0.16	30.51	8.86	39.53	70.0	300	PVC	0.50%	68.4	0.97	0.996	57.8%
Inverness - West	768		766						0.22	2	6.3				2.76	3.43		41.77	3076.6			0.16	30.56	8.91	39.63	12.0	300	PVC	0.50%	68.4	0.97	0.996	58.0%
Inverness - West	766		764						0.39	6	18.8				2.76	3.43		42.16	3095.4			0.16	30.73	8.98	39.87	71.5	300	PVC	0.50%	68.4	0.97	0.996	58.3%
Inverness - West	764		760						0.47	8	25.1				2.76	3.43		42.63	3120.6			0.16	30.95	9.08	40.19	82.0	300	PVC	0.50%	68.4	0.97	0.996	58.8%
Tupling - West	760		754						0.63	11	34.5				2.76	3.40		47.49	3387.5			0.16	33.30	10.05	43.50	85.5	300	PVC	0.50%	68.4	0.97	1.030	63.6%
Gibson - West	738		756						0.26	5	15.7					4.39		0.26	15.7				0.20	0.05	0.25	36.0	200	PVC	1.50%	40.2	1.28	0.294	0.6%
Gibson - West	756		754						0.54	10	31.4					4.32		0.80	47.1				0.59	0.16	0.75	80.0	200	PVC	0.50%	23.2	0.74	0.310	3.2%
Gibson - West	754		753						0.25	4	12.6				2.76	3.39		48.54	3447.1			0.16	33.82	10.26	44.24	52.0	300	PVC	0.50%	68.4	0.97	1.035	64.7%
Gibson - West	753		752						0.22	2	6.3				2.76	3.39		48.76	3453.4			0.16	33.87	10.30	44.33	62.5	300	PVC	0.50%	68.4	0.97	1.035	64.8%
Gibson - West	752		749						0.15	2	6.3				2.76	3.39		48.91	3459.7			0.16	33.93	10.33	44.42	24.5	300	PVC	0.50%	68.4	0.97	1.035	65.0%
Gibson - West	749		704						0.24	3	9.4			0.39	2.76	3.31		61.54	4238.4		0.13	0.16	40.60	12.94	53.82	61.5	300	PVC	0.60%	74.9	1.06	1.155	71.9%
Lewis - West	722		721						0.40	8	25.1					4.37		0.40	25.1				0.32	0.08	0.40	42.5	200	PVC	1.50%	40.2	1.28	0.294	1.0%
Lewis - West	721		720						0.63	12	37.7					4.29		1.03	62.8				0.78	0.21	0.99	75.0	200	PVC	0.50%	23.2	0.74	0.347	4.3%
Lewis - West	720		704						0.50	8	25.1					4.26		1.53	87.9				1.08	0.31	1.39	91.0	200	PVC	0.50%	23.2	0.74	0.376	6.0%
Gibson - West	704		598						0.37	5	15.7			0.39	2.76	3.30		63.44	4342.0		0.13	0.16	41.48	13.32	55.08	89.5	300	PVC	0.60%	74.9	1.06	1.171	73.5%
Gibson - West	738		736						0.34	4	12.6					4.40		0.34	12.6				0.16	0.07	0.23	36.5	200	PVC	1.50%	40.2	1.28	0.294	0.6%
Gibson - West	736		724						0.72	11	34.5					4.32		1.06	47.1				0.59	0.21	0.80	83.5	200	PVC	0.50%	23.2	0.74	0.310	3.5%
Gibson - West	plug		724						1.20	13	40.8					4.33		1.20	40.8				0.51	0.24	0.75	11.5	200	PVC	0.50%	23.2	0.74	0.310	3.2%
Gibson - West	724		726						0.21	3	9.4					4.25		2.47	97.3				1.20	0.49	1.69	33.5	200	PVC	0.50%	23.2	0.74	0.430	7.3%
Gibson - West	726		728						0.50	8	25.1					4.22		2.97	122.5				1.49	0.59	2.09	58.5	200	PVC	0.50%	23.2	0.74	0.469	9.0%
Gibson - West	730		728						0.28	3	9.4					4.42		0.28	9.4				0.12	0.06	0.18	19.0	200	PVC	1.50%	40.2	1.28	0.294	0.4%
Gibson - West	728		712						0.11	1	3.1					4.21		3.36	135.0				1.64	0.67	2.32	37.0	200	PVC	0.50%	23.2	0.74	0.469	10.0%
Gibson - West	712		710						0.83	14	44.0					4.17		4.19	179.0				2.16	0.84	3.00	76.0	200	PVC	0.50%	23.2	0.74	0.508	12.9%

TOWN OF BRADFORD WEST GWILLIMBURY
SANITARY SEWER DESIGN SHEET

Project / Subdivision **BRADFORD HIGHLANDS RESIDENTIAL SUBDIVISION**

Prepared by: Daniel Schembri

Consulting Engineer URBAN ECOSYSTEMS LIMITED

Project No.: 15011.100

Checked by: Rosario Sacco

Last Revised: June 10, 2023

Design Parameters

Residential Density =	3.14 cap/unit	Residential =	250 L/cap/day
Manning 'n' =	0.013	Industrial =	35 m^3/ha*day
Extran. Flow (pre 2000) =	0.5 L/sha	Institutional =	19.8 m^3/ha*day
Extran. Flow (post 2000) =	0.2 L/sha	Commercial =	28 m^3/ha*day

Design Equations

$M(r) = 1 + \frac{14}{4 + \sqrt{(P)}}$ Q(i) = i x ɛr A Q(d) = ɛr(Q(x))

$M(ind) = 6.6604*A^{-0.1992}$ $Q(r) = \frac{P * q(r) * M}{86400}$

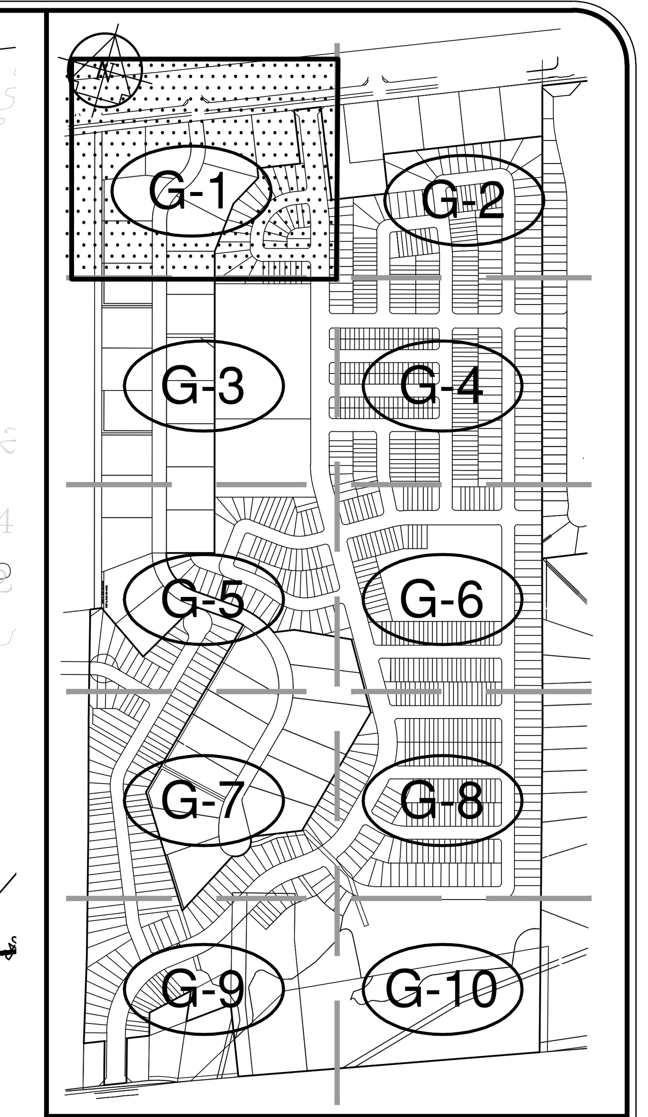
NOTE: Table 14 of the Engineering Standards is to be referenced for Maximum Capacity

Notes/Comments:

Location					Individual Values							Cumulative Values								Flow Data						Sewer Data							
Street	From		To		Industrial Area	Commercial Area	Institutional Area	Pre 2000 Residental Area	Post 2000 Residental Area	Residential Units	Residential Population	Industrial P.F.	Industrial Area	Commercial Area	Institutional Area	Residential P.F.	Pre 2000 Residental Area	Post 2000 Residental Area	Residential Population	Industrial Peak Flow (L/s)	Commercial Peak Flow (L/s)	Institutional Peak Flow (L/s)	Population Peak Flow (L/s)	Peak Extraneous Flow (L/s)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity	Full Flow Velocity	Actual velocity at design flow	PERCENTAGE OF CAPACITY
	MH #	Inv	MH #	Inv	(ha)	(ha)	(ha)	(ha)	(ha)	#	cap.	M(ind)	A(ind)	A(c)	A(ins)	M(r)	A(r)	A(r)	P	Q(ind)	Q(c)	Q(ins)	Q(r)	Q(i)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)	(%)
Gibson - West	710		709						0.55	9	28.3					4.14		4.74	207.2				2.48	0.95	3.43	66.0	200	PVC	0.50%	23.2	0.74	0.532	14.8%
Gibson - West	709		708						0.41	6	18.8					4.13		5.15	226.1				2.70	1.03	3.73	53.0	200	PVC	0.50%	23.2	0.74	0.548	16.1%
Gibson - West	708		598													4.13		5.15	226.1				2.70	1.03	3.73	11.5	200	PVC	0.50%	23.2	0.74	0.548	16.1%
Internal Easement	598		596						0.04					0.39	2.76	3.28		68.63	4568.1		0.13	0.16	43.37	14.36	58.01	46.0	300	PVC	0.75%	83.7	1.18	1.280	69.3%
Internal Easement	596		594						0.03					0.39	2.76	3.28		68.66	4568.1		0.13	0.16	43.37	14.36	58.02	24.0	300	PVC	0.75%	83.7	1.18	1.280	69.3%
Internal Easement	594		591						0.08					0.39	2.76	3.28		68.74	4568.1		0.13	0.16	43.37	14.38	58.03	86.0	375	PVC	0.35%	103.7	0.94	0.958	55.9%
Simcoe - West	FUT		593						5.69	27	84.8					4.26		5.69	84.8				1.05	1.14	2.18	10.0	200	PVC	0.50%	23.2	0.74	0.469	9.4%
Simcoe - West	593		591						0.46	5	15.7					4.24		6.15	100.5				1.23	1.23	2.46	92.0	200	PVC	0.50%	23.2	0.74	0.485	10.6%
Simcoe - West	591		590						0.27	1	3.1			0.39	2.76	3.27		75.16	4671.7		0.13	0.16	44.23	15.66	60.18	19.0	375	PVC	0.35%	103.7	0.94	0.967	58.0%
Simcoe - West	FUT		590				2.12		23.18	90	282.6				2.12	4.09		23.18	282.6			0.49	3.34	5.06	8.89	6.0	300	PVC	0.35%	57.2	0.81	0.591	15.5%
Jonkman Blvd	590		589						0.04					0.39	2.76	3.25		98.38	4954.3		0.13	0.49	46.57	20.31	67.49	51.5	375	PVC	0.35%	103.7	0.94	1.010	65.1%
Jonkman Blvd	589		588						0.25	2	6.3			0.39	2.76	3.25		98.63	4960.6		0.13	0.49	46.62	20.36	67.59	51.5	375	PVC	0.35%	103.7	0.94	1.010	65.2%
Jonkman Blvd	588		586						0.19	3	9.4			0.39	2.76	3.25		98.82	4970.0		0.13	0.49	46.70	20.39	67.71	46.0	375	PVC	0.35%	103.7	0.94	1.010	65.3%
Med Dens. - East	plug		586						0.94	60	188.4					4.16		0.94	188.4				2.27	0.19	2.45	9.5	200	PVC	2.00%	46.4	1.48	0.753	5.3%
Tiberini Way	plug		586				0.66		12.20	239	750.5				5.54	3.88		12.20	750.5			1.27	8.42	3.55	13.24	10.5	250	PVC	0.40%	37.6	0.77	0.693	35.2%
Jonkman Blvd	586		584						0.07					0.39	5.54	3.18		112.03	5908.9		0.13	1.27	54.32	23.59	79.31	41.0	375	PVC	0.35%	103.7	0.94	1.047	76.5%
Jonkman Blvd	584		582						0.42	12	37.7			0.39	5.54	3.17		112.45	5946.6		0.13	1.27	54.62	23.68	79.69	74.5	375	PVC	0.35%	103.7	0.94	1.047	76.8%
Jonkman Blvd	582		578						0.30	6	18.8			0.39	5.54	3.17		112.75	5965.4		0.13	1.27	54.77	23.74	79.90	90.5	375	PVC	0.35%	103.7	0.94	1.052	77.0%
Armson Court	plug		578						1.11	14	44.0					4.33		1.11	44.0				0.55	0.22	0.77	7.0	200	PVC	1.50%	40.2	1.28	0.396	1.9%
Ferragine Cres. West	plug		578						2.36	55	172.7					4.17		2.36	172.7				2.08	0.47	2.56	13.5	200	PVC	0.50%	23.2	0.74	0.497	11.0%
Jonkman Blvd	578		576						0.12	2	6.3			0.39	5.54	3.16		116.34	6188.3		0.13	1.27	56.55	24.45	82.40	33.0	375	PVC	0.35%	103.7	0.94	1.057	79.4%
Jonkman Blvd	576		574						0.27	5	15.7			0.39	5.54	3.16		116.61	6204.0		0.13	1.27	56.67	24.51	82.58	37.0	375	PVC	0.35%	103.7	0.94	1.057	79.6%
Jonkman Blvd	574		572						0.42	6	18.8			0.39	5.54	3.16		117.03	6222.9		0.13	1.27	56.82	24.59	82.81	36.0	375	PVC	0.35%	103.7	0.94	1.057	79.8%
Ferragine Cres. East	plug		572						2.89	45	141.3					4.20		2.89	141.3				1.72	0.58	2.29	11.5	200	PVC	0.50%	23.2	0.74	0.469	9.9%
Jonkman Blvd	572		571						0.12	1	3.1			0.39	5.54	3.15		120.04	6367.3		0.13	1.27	57.96	25.19	84.55	24.0	375	PVC	0.35%	103.7	0.94	1.057	81.5%
Jonkman Blvd	571		570						0.01					0.39	5.54	3.15		120.05	6367.3		0.13	1.27	57.96	25.20	84.56	13.0	375	PVC	0.35%	103.7	0.94	1.057	81.5%
Zima -Street 1 - East	plug		568						3.14	30	94.2					4.25		3.14	94.2				1.16	0.63	1.79	35.0	200	PVC	0.50%	23.2	0.74	0.430	7.7%
Jonkman Blvd	568		570						0.01							4.25		3.15	94.2				1.16	0.63	1.79	13.0	375	PVC	0.50%	124.0	1.12	0.348	1.4%
External Easement	570		566						0.04					0.39	5.54	3.14		123.24	6461.5		0.13	1.27	58.71	25.83	85.94	48.5	375	PVC	0.35%	103.7	0.94	1.061	82.9%
External Easement	566		564						0.08					0.39	5.54	3.14		123.32	6461.5		0.13	1.27	58.71	25.85	85.95	100.0	375	PVC	0.35%	103.7	0.94	1.061	82.9%
External Easement	564		561						0.08					0.39	5.54	3.14		123.40	6461.5		0.13	1.27	58.71	25.87	85.97	100.0	375	PVC	0.35%	103.7	0.94	1.061	82.9%
External Easement	561		560						0.04					0.39	5.54	3.14		123.44	6461.5		0.13	1.27	58.71	25.87	85.98	49.5	375	PVC	0.35%	103.7	0.94	1.061	82.9%
External Easement	560		Ex 16						0.01					0.39	5.54	3.14		123.45	6461.5		0.13	1.27	58.71	25.88	85.98	10.5	450	PVC	0.50%	201.6	1.27	1.192	42.6%

APPENDIX 4

Preliminary Grading Plans



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PRELIMINARY GRADING
PLAN

DATE	PROJECT No.	FIGURE
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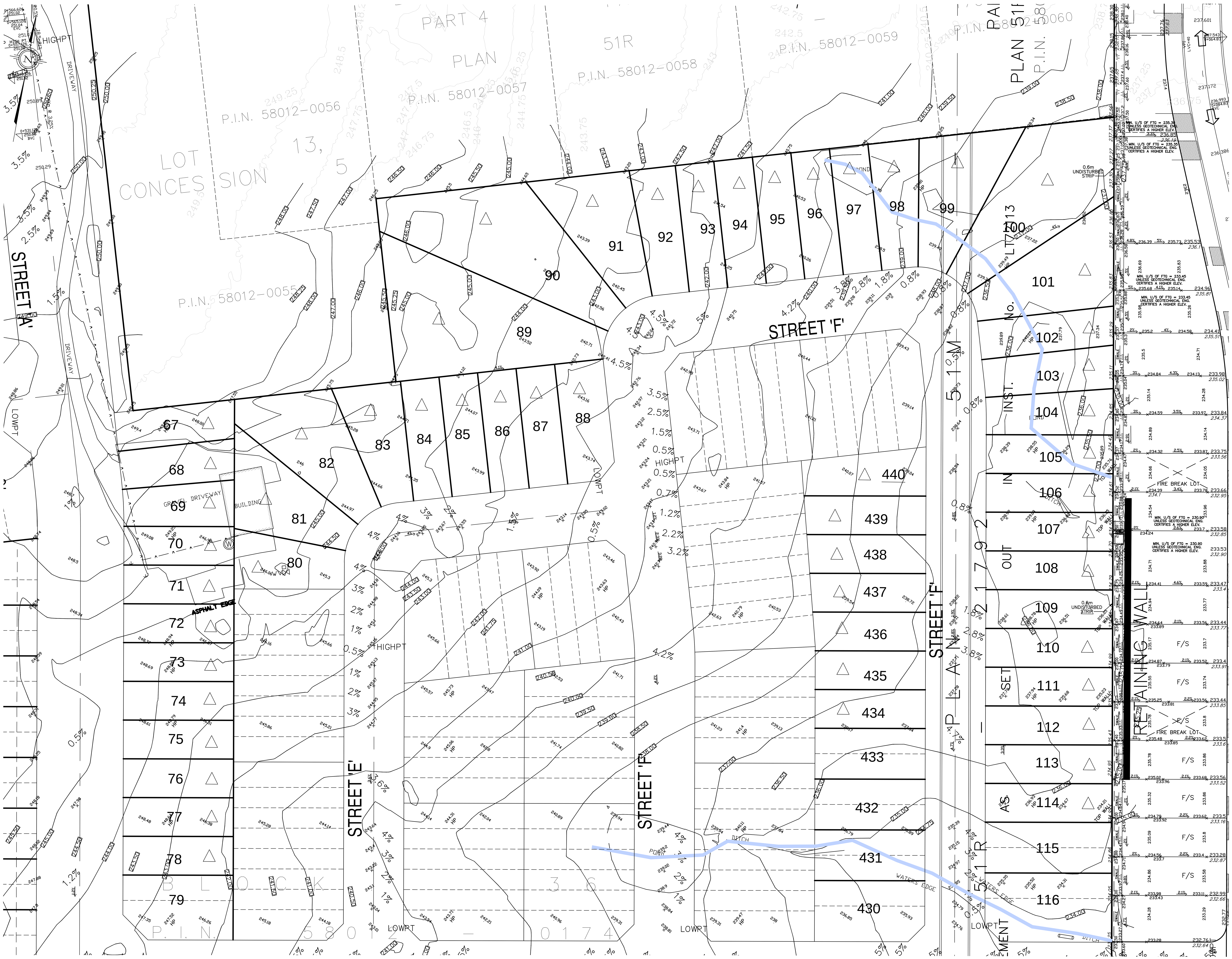

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PRELIMINARY GRADING PLAN

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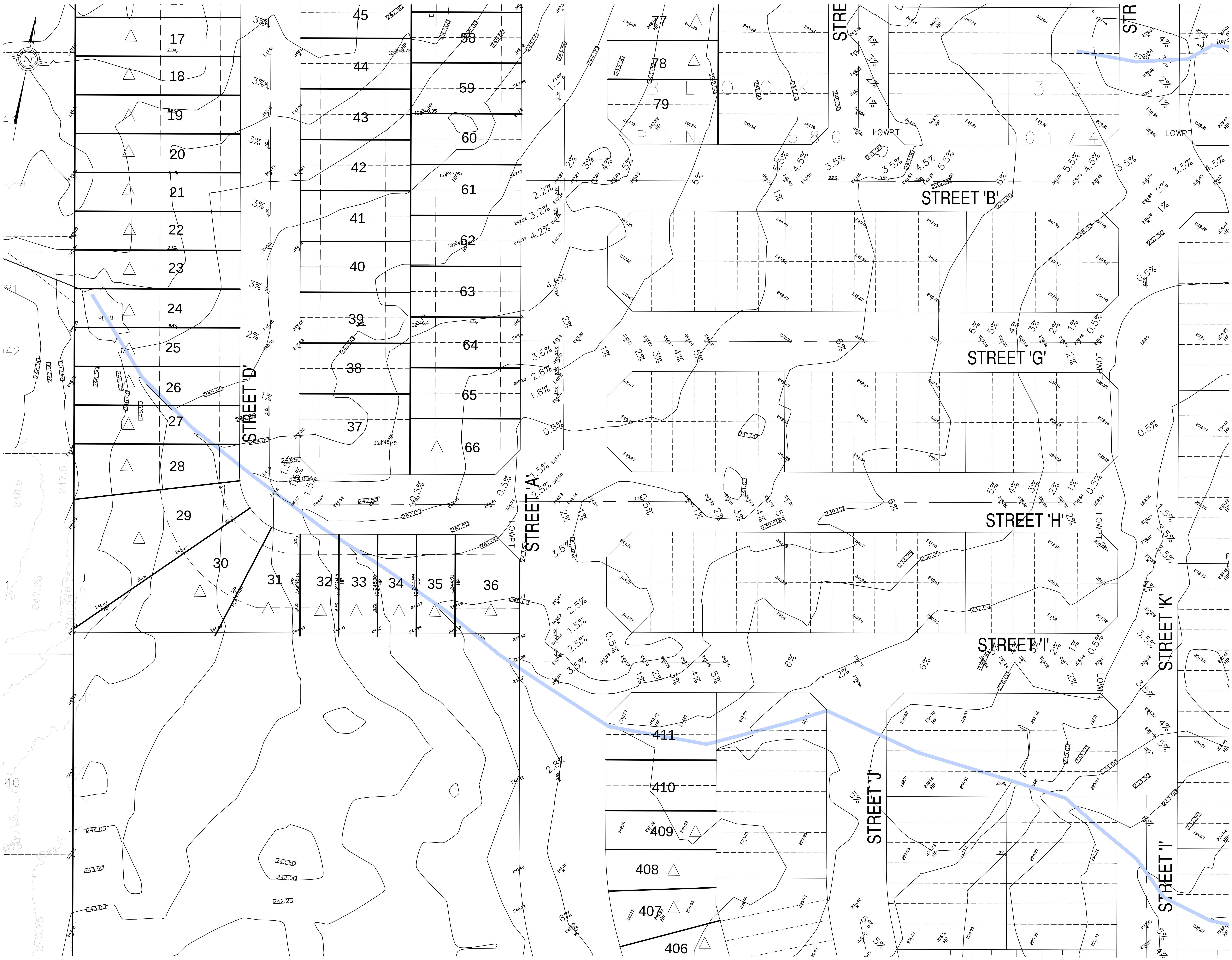

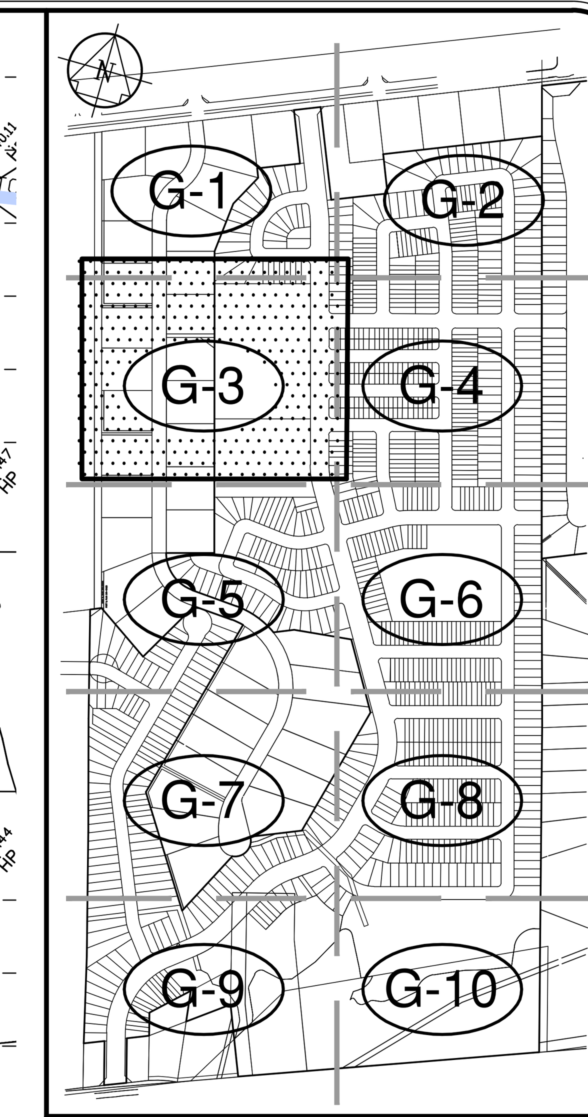

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PRELIMINARY GRADING PLAN

DATE	PROJECT No.	FIGURE
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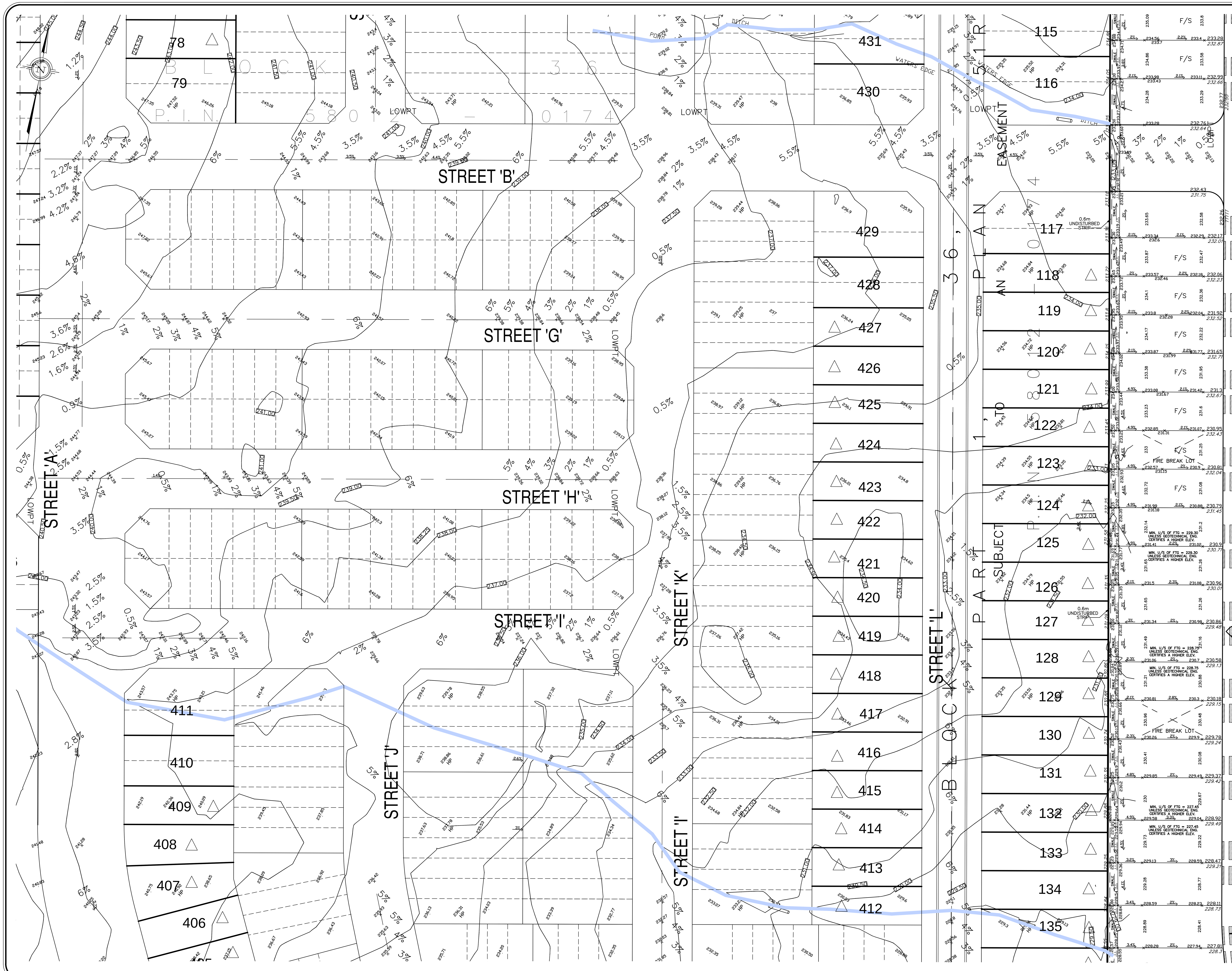

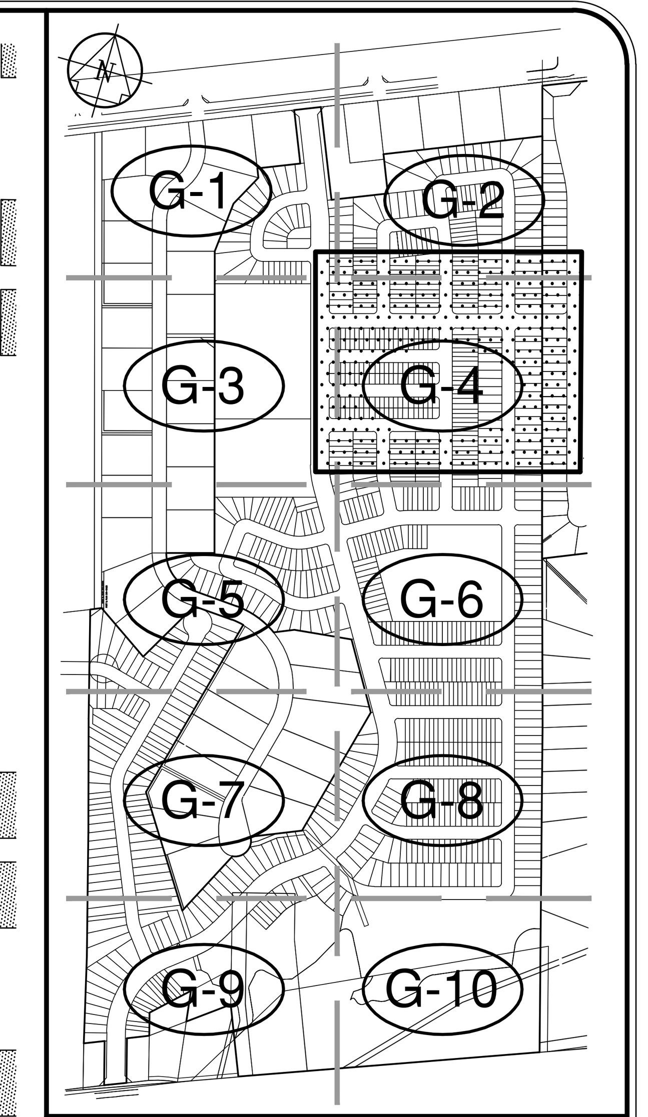

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PRELIMINARY GRADING PLAN

DATE	PROJECT No.	FIGURE
SEPT. 2023	15011	G-4

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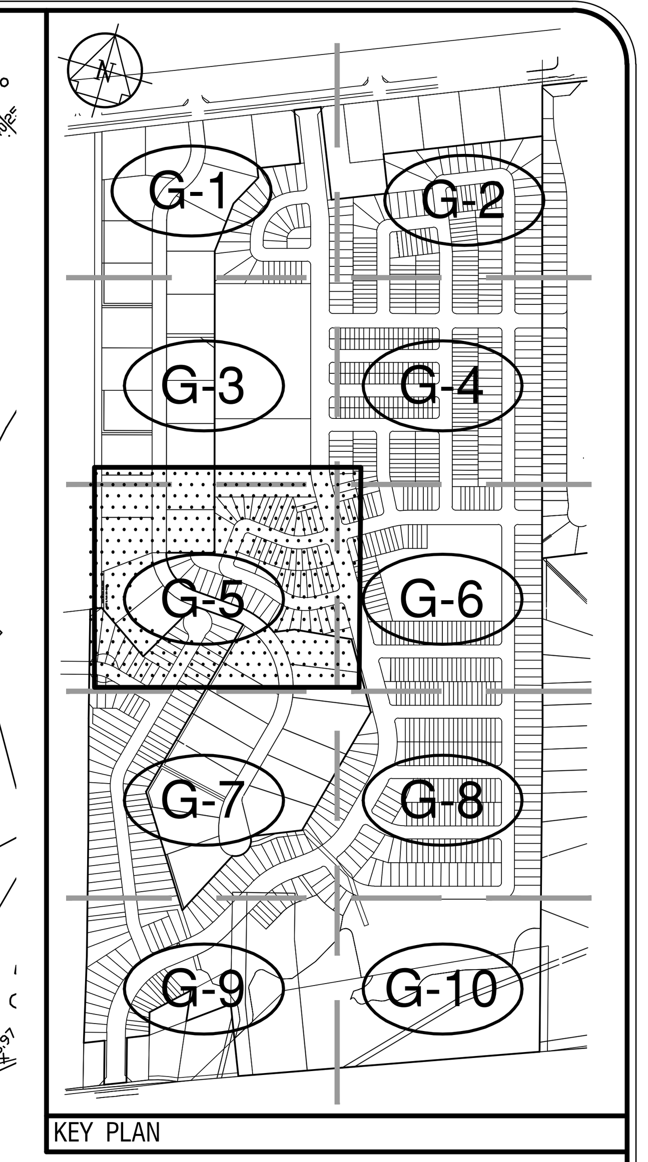

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PRELIMINARY GRADING
PLAN

DATE	PROJECT No.	FIGURE
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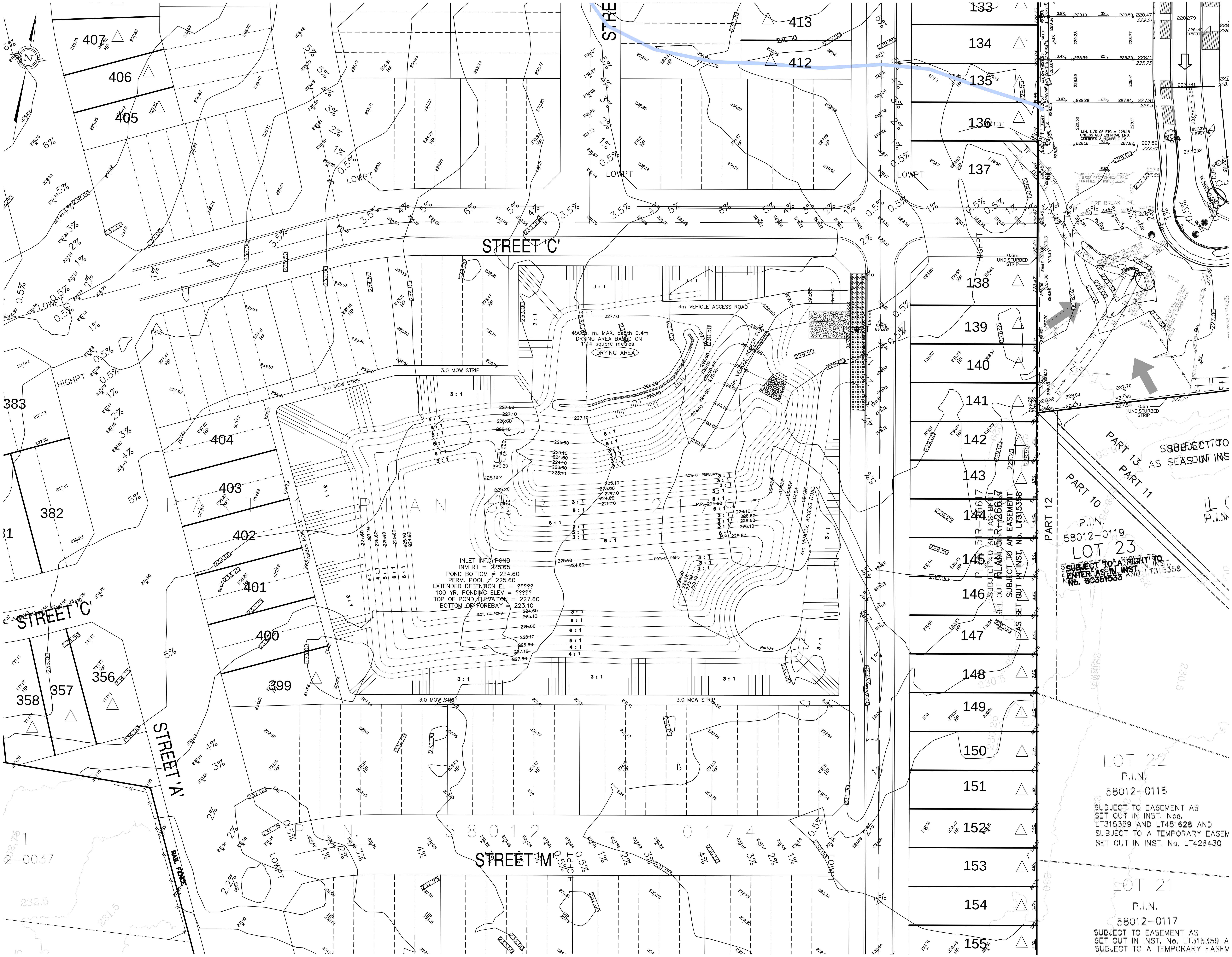

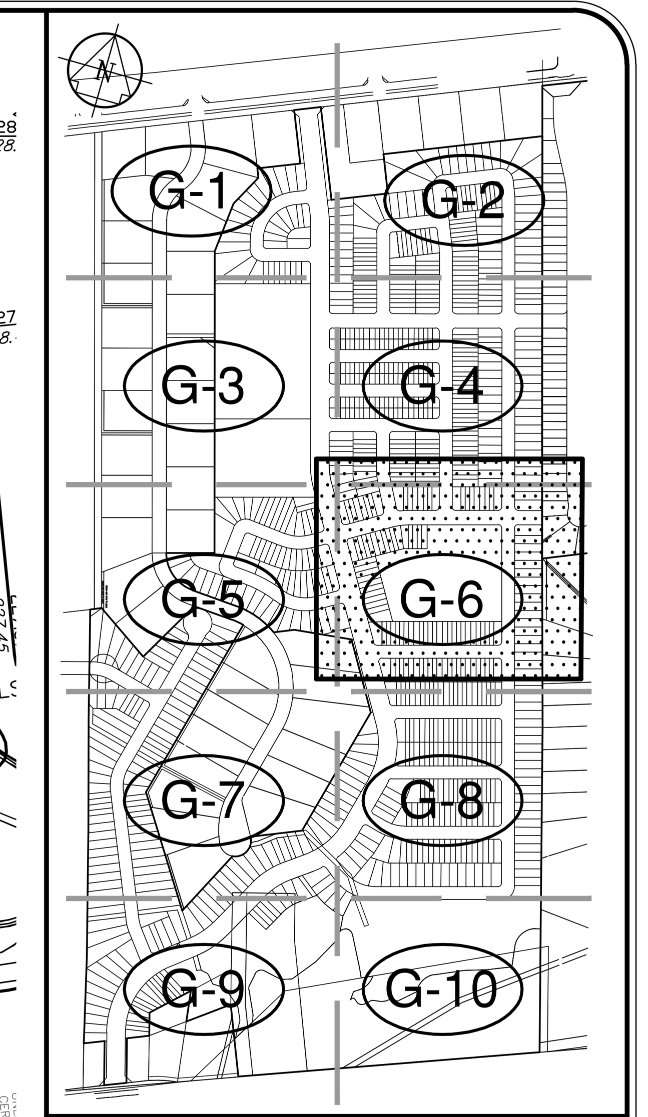

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PRELIMINARY GRADING PLAN

DATE	PROJECT No.	FIGURE
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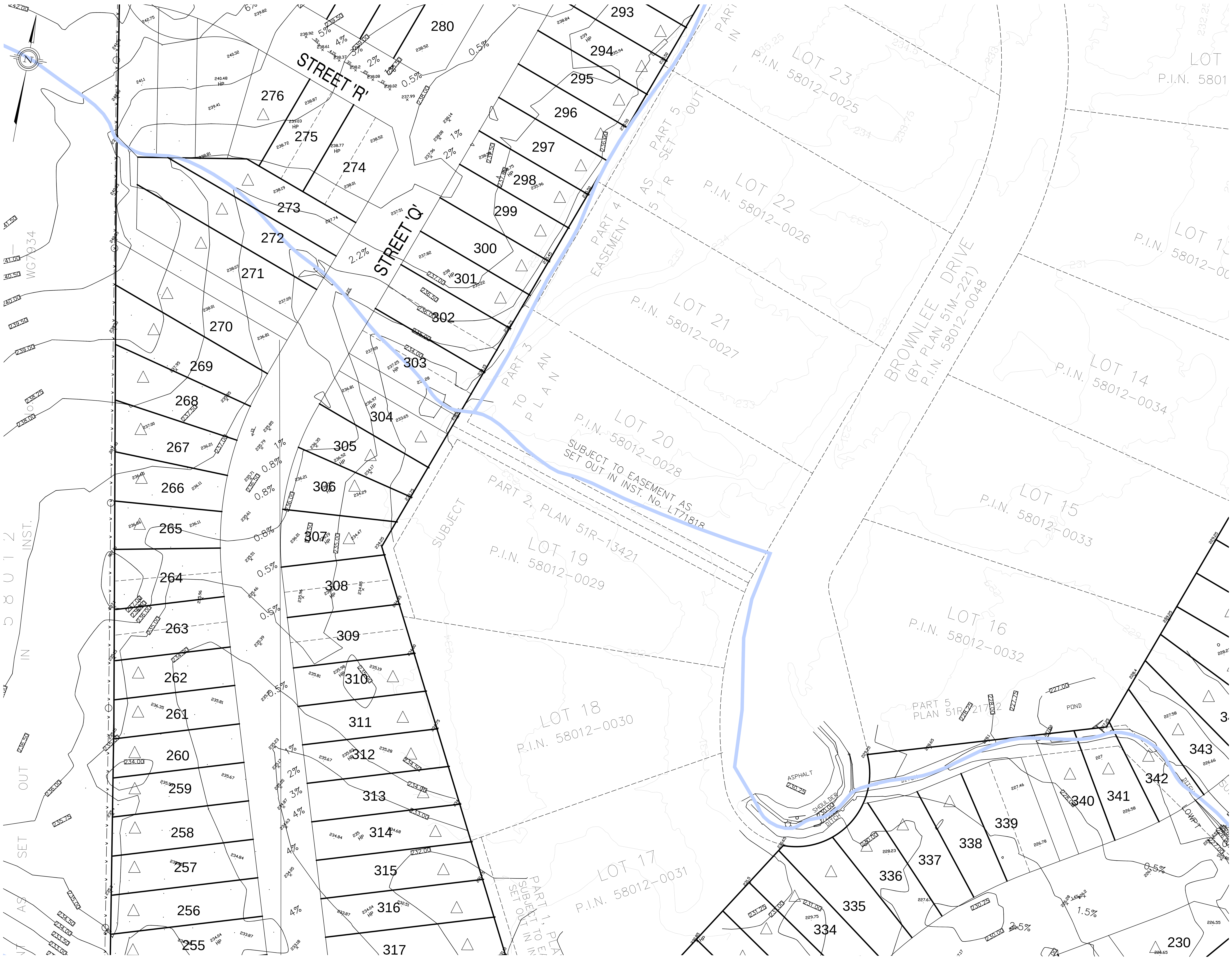

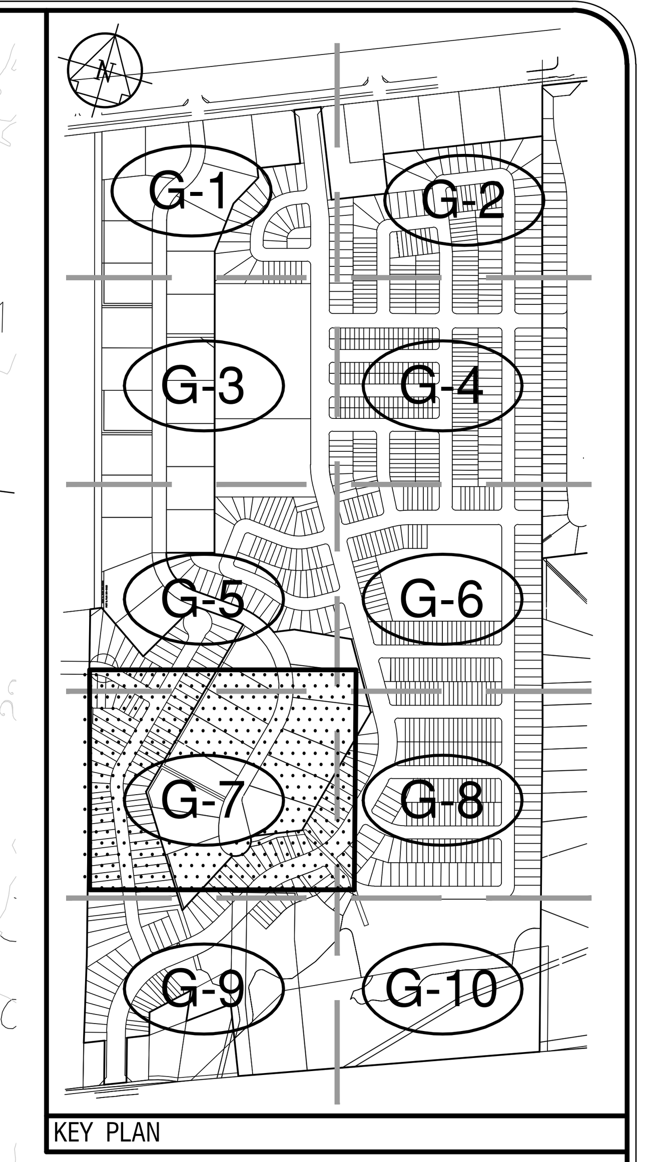

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PRELIMINARY GRADING
PLAN

DATE	PROJECT No.	FIGURE
SEPT. 2023	15011	G-7

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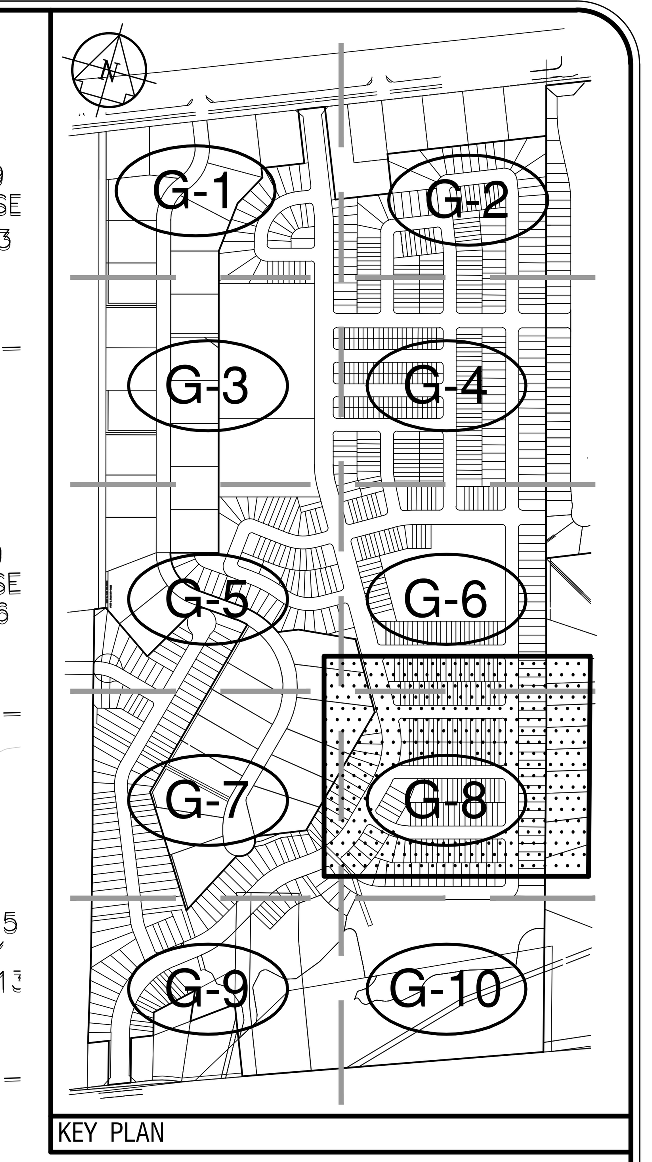

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PRELIMINARY GRADING PLAN

DATE	PROJECT No.	FIGURE
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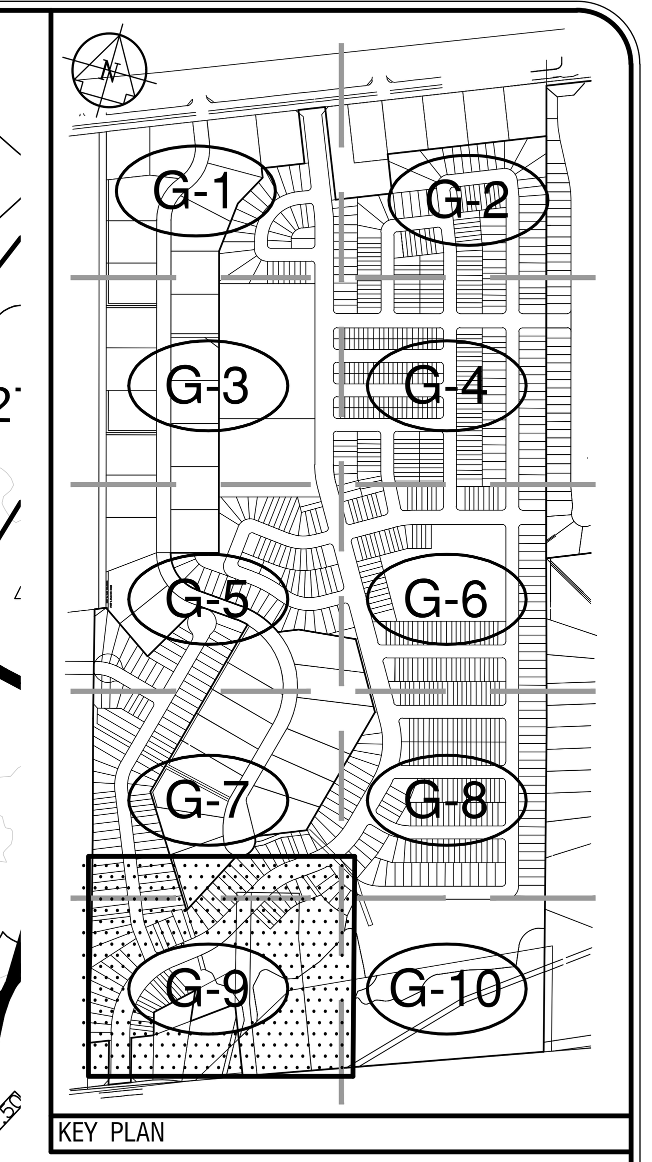

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RESIDENTIAL SUBDIVISION
GREEN VALLEY COMMUNITY PLAN AREA

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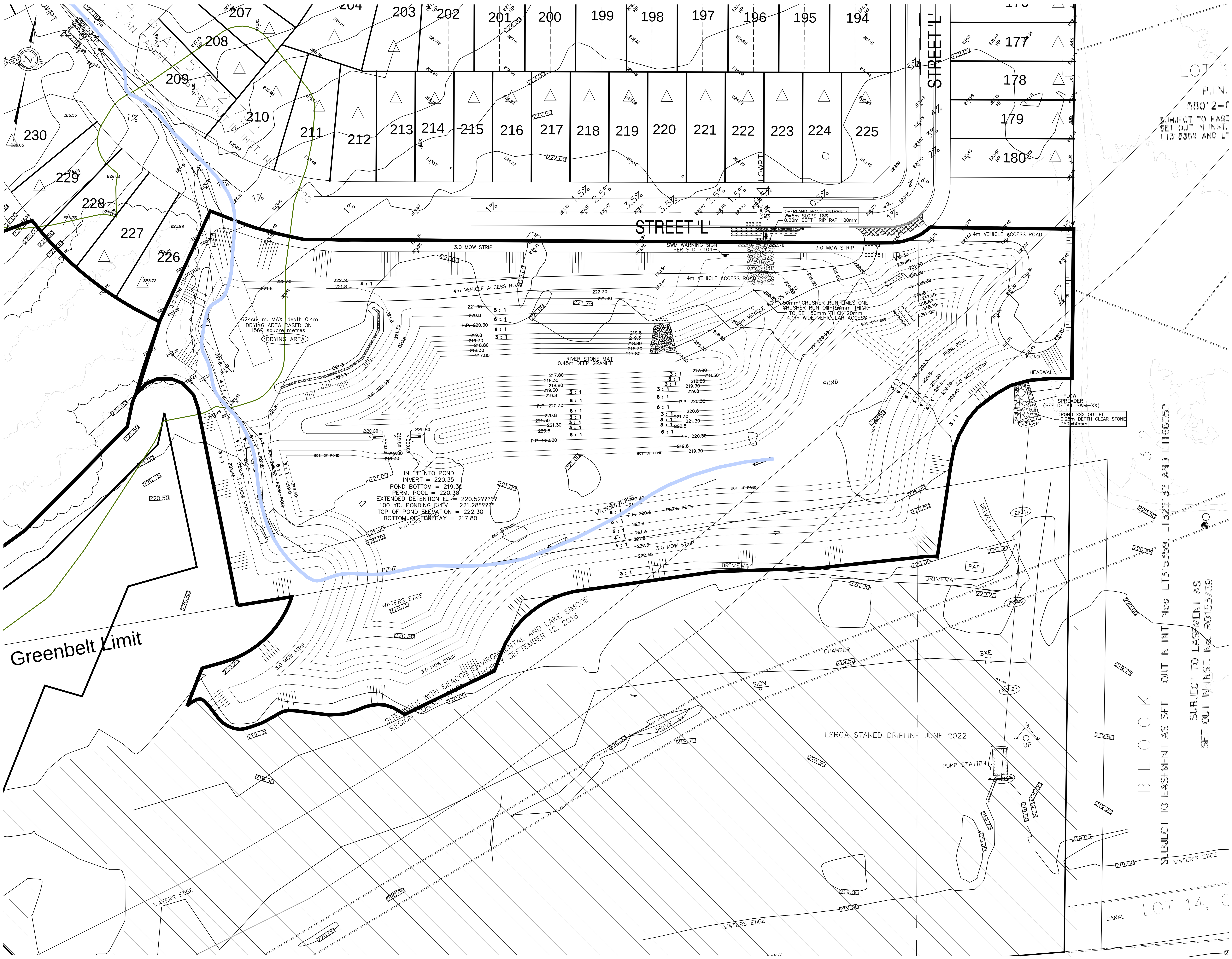
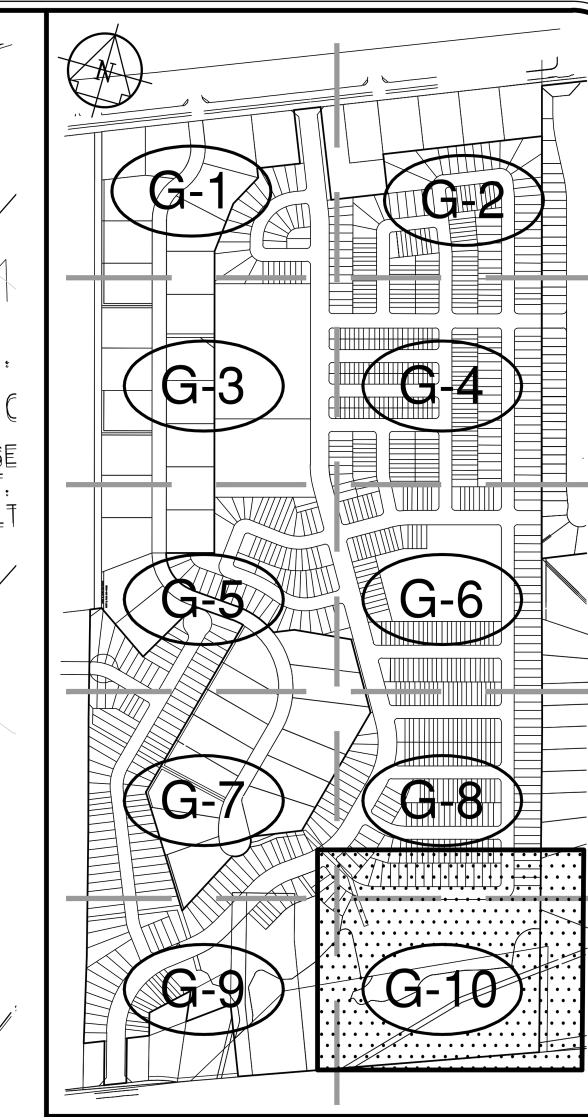
PRELIMINARY GRADING PLAN

DATE	PROJECT No.	FIGURE
SEPT. 2023	15011	G-9

SCALE 1:500





KEY PLAN

BRADFORD HIGHLANDS
RESIDENTIAL SUBDIVISION
GREEN VALLEY COMMUNITY PLAN AREA

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PRELIMINARY GRADING PLAN

DATE	PROJECT No.	FIGURE
SEPT. 2023	15011	G-10

SCALE 1:500