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35 Years

Abbott-Fernbank Holdings Inc.
Fernbank Crossing – Phase 5

Servicing Design Brief

SERVICING DESIGN BRIEF
(PHASE 5)

ABBOTT-FERNBANK HOLDINGS INC.

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

December 7, 2018

Novatech File: 108180-19
Ref: R-2018-110

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Engineers, Planners & Landscape Architects

December 7, 2018

City of Ottawa
Infrastructure Services and Community Sustainability
110 Laurier Avenue West, 4th Floor
Ottawa, ON K1P 1J1

Attention: Mr. Eric Surprenant

Dear Mr. Surprenant:

Reference: Servicing Design Brief – Phase 5
Fernbank Crossing
Our File No.: 108180-19

Please find enclosed three (3) copies of the Servicing Design Brief for Phase 5 of the Fernbank Crossing Subdivision.

If you have any questions or comments, please do not hesitate to contact us.

Sincerely,

NOVATECH

Mark Bissett, P.Eng.
Senior Project Manager

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1.0 INTRODUCTION

1.1 Background

The Abbott-Fernbank Holdings Inc. (Abbott-Fernbank) Lands are located within the new Fernbank Community on the north side of Fernbank Road west of Terry Fox Drive. **Figure 1** shows the location of the Fernbank Community and the Abbott-Fernbank Lands. The lands will be developed as a low to medium density residential subdivision called Fernbank Crossing.

Figure 1: Key Plan

The proposed subdivision is approximately 67.30ha and will be bordered by future residential lands to the west (CRT Developments Inc.), a hydro corridor and the Trans-Canada Trail to the north, future residential lands to the east (Blackstone), and agricultural land to the south.

This Servicing Design Brief provides information on the considerations and approach by which Novatech has analyzed the existing site information for the Abbott-Fernbank Lands, and details how the development lands will be serviced while meeting the City requirements and other

relevant regulations. This brief builds upon completed works for the Fernbank Crossing Servicing Design Brief – Phase 1 & 2, Phase 3, and Phase 4 prepared by Novatech **[1]**, the Fernbank Community Design Plan **[2]** prepared by Walker, Nott, Dragicevic Associates Limited, the Fernbank Master Servicing Study **[3]** prepared by Novatech, and the Fernbank Environmental Management Plan prepared by Novatech **[4]**.

This report should be read in conjunction with the following:

- Geotechnical Investigation, Fernbank Crossing Residential Subdivision – Phase 5 Ottawa, Ontario prepared by Gemtec, dated November 19, 2018 (Project:64153.97). **[5]**
- Stormwater Management Report prepared by Novatech. (R-2018-112).

1.2 Land Use

The entire Fernbank Crossing Subdivision will be comprised primarily of low and medium density residential dwellings. Medium density residential (6.81ha) and a Community Core Area (7.11ha) are proposed adjacent Robert Grant Way and the hydro corridor. The Community Core is comprised of Mixed-Use land and a Village Green which is a public green space. Two schools (4.95ha) will front onto Cope Drive which divides the site (North/South). A Park n' Ride facility (1.79ha) is proposed along Fernbank Road. A Transit Station (1.02ha), Hydro Corridor (3.37ha), a SWM facility (0.93ha) and a Park (1.00ha) make up the remainder of the site. The proposed Land Use Plan is shown in **Figure 2**.

1.3 Phase 5

Fernbank Crossing Subdivision will be developed in phases as shown in **Figure 3**. This report includes details for the servicing design and construction of the Phase 5 lands that includes 47 townhouse units.

1.4 Changes from Fernbank Community Design Plan

A paramedic post was proposed in the Fernbank Community Design Plan for the lands comprising Phase 5. Coordination with the City of Ottawa concluded that a paramedic post is no longer required at this location. The proposed boundary of Phase 5 lands and the adjacent Park N' Ride have been circulated and approved by the City.

Figure 2: Land Use Plan

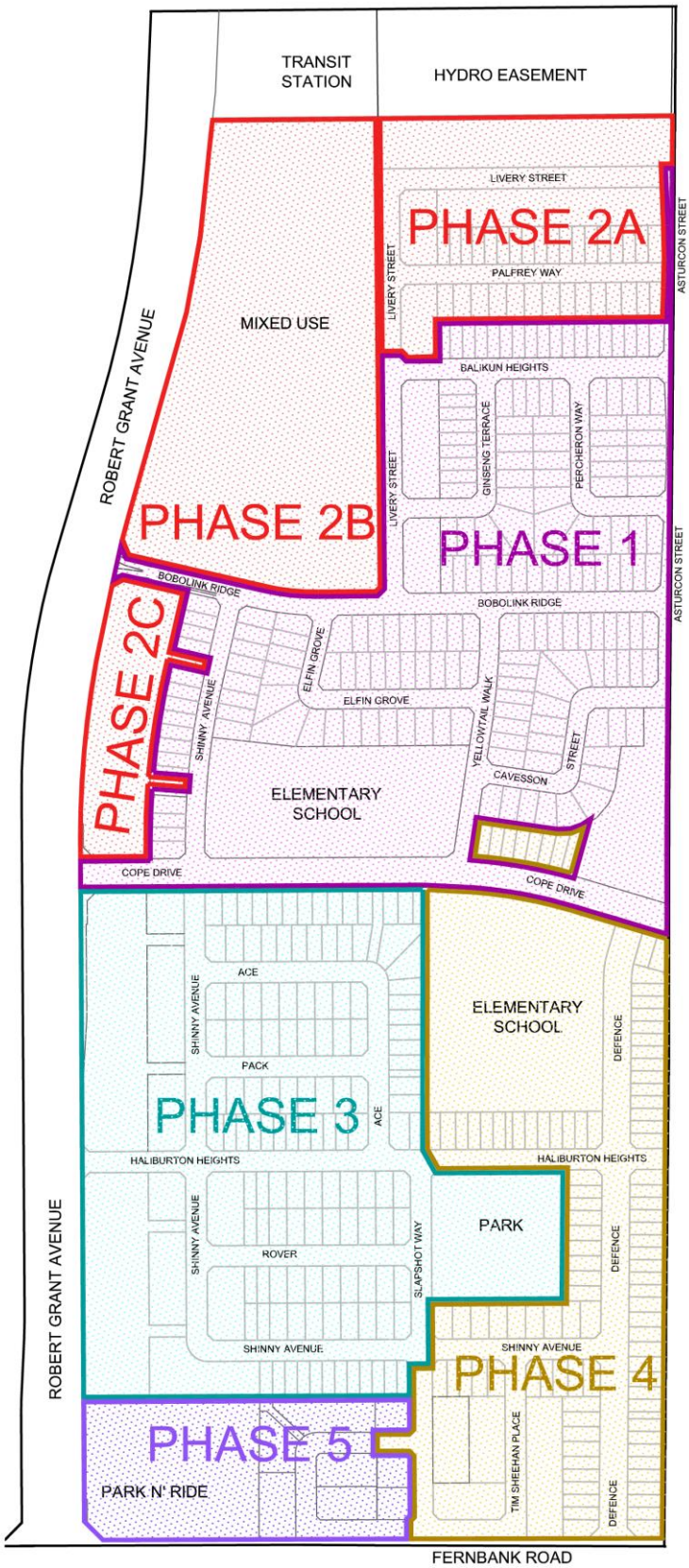

Figure 3: Phasing Plan

2.0 ROADWAYS

2.1 Existing Conditions

Currently there is access to Fernbank Crossing via Robert Grant Avenue and Fernbank Road. All roadways above are classified as a 2-lane Arterial Road in the 2013 City of Ottawa Transportation Master Plan **[6]**.

2.2 Proposed Conditions

The Fernbank Transportation Master Plan **[7]** prepared by Delcan, specifies that a North-South Arterial Road (Robert Grant Avenue) is required to serve the Fernbank Community. This Arterial Road is to be located along the west boundary of the Abbott-Fernbank Lands, and will extend from Fernbank Road to the Abbott Street Extension (which is to be constructed concurrently with other developments in the Fernbank area) and eventually to Hazeldean Road.

Robert Grant Avenue has been constructed as a 2-lane arterial road between Fernbank Road and Abbott Street. In the future, Robert Grant Avenue will be upgraded to include two vehicle-lanes in both directions and transit lanes in the median.

A single local road with a 16.5m and 18.5m ROW will connect to Tim Sheehan Place at two locations. Typical cross-sections are contained within the Fernbank Community Design Plan **[1],** the City of Ottawa Standard Detail Drawings, and the engineering design drawings.

2.3 Roadway Design

The road cross-sections are taken from the Fernbank Community Design Plan and City of Ottawa Standard Drawings. Refer to the Plan and Profile drawings for roadway details, and **Table 2-2** outlines specific roadway design criteria.

Table 2-1: Phase 5 Roadways and ROWs

Street	Class	ROW	Sidewalk	Profile
Street 1	Local	16.5/18.0	None	PR1

Table 2-2: Roadway Design Specifications

Minimum Road Grade	0.5%
Maximum Road Grade	7.0%
Roadway cross fall	3.0%
Vertical curves required	Δ >1.5%
K Value for Vertical curves on Crest	7
K Value for Vertical curve at Sag	12

Gemtec has prepared a Geotechnical Investigation report for the development (November 19, 2018), with recommendations for pavement structure, servicing and foundations. Phase 5 of the subdivision consists of a local road; the recommended pavement structure follows:

Table 2-3: Pavement Structure

Pavement Material Description	Layer Thickness (mm)
	Street 1
Asphalt Top: SP-12.5 (Level B)	40
Asphalt Base: SP-19.0 (Level B)	60
Granular Base: Granular A	150
Granular Sub-Base: Granular B, Type II	375
Total	**625**

3.0 GRADING

3.1 Existing Conditions

There is a high point running north-south along the center of the site, sloping approximately 1-2% to the west and 2-6% to the east. The maximum grade of approximately 106.00 metres in the center of the site and a minimum elevation of approximately 102.25 metres near the southeast corner results in a total elevation differential of approximately 3.75 metres across the site.

Geotechnical investigations were carried out by Gemtec **[**5**]**, and bedrock was encountered between 2.5 and 3.8 metres below the existing ground surface. The subsurface conditions consist of silty sand/sandy silt underlain by glacial till and bedrock. Based on this information, there are no grade raise restrictions within Phase 5 lands.

3.2 Proposed Conditions

The proposed grading for the Abbott-Fernbank Lands will closely follow the Grading Plan contained in the Fernbank Master Servicing Study **[3]**.

Existing elevations will be met along Fernbank Road, the north property boundary adjacent Phase 3, and the east property boundary adjacent to Phase 4. Grades along the west property line will tie into the existing ground within the Park N' Ride. For detailed grading refer to drawing 108180-19-GR1.

3.3 Lot Grading

Detailed lot grading is presented on the Grading Plans. For townhome units, the lot grading shall comply with the following criteria:

- Driveway: Minimum 2% - Maximum 6%
- Landscaped Area: Minimum 2% - Maximum 7%
- Rearyard Swales: Minimum 1.5% (1.0% With Subdrain)
- Maximum Terracing Grade – 3H:1V

4.0 SANITARY SEWERS

4.1 Existing Conditions

The existing sanitary drainage system flows through Phase 4 and into the Blackstone Subdivision to the Fernbank Trunk, that outlets to the Hazeldean Pump Station. A 450mm sub-trunk is installed in Rouncey Road, that crosses the Monahan Drain; progressively smaller pipes convey flow easterly within the Cope Drive ROW to the Fernbank Crossing property limit.

4.2 Proposed Conditions

The peak design flow parameters in **Table 4-1** have been used in the sewer capacity analysis.

Unit and population densities and all other design parameters are specified in the City of Ottawa Sewer Design Guidelines **[8]**.

Sanitary flow from Phase 5 of the Fernbank Crossing Subdivision will connect into the 200mm diameter sewer located within Tim Sheehan Place. The sanitary sewer layout is shown on the Sanitary Drainage Area Plan, and the design sheets are attached in **Appendix A**. The site (approx. 2.07ha) will outlet to the adjacent sanitary system with a peak design flow of 3.1 L/s at MH926.

Flows from the Park N' Ride will be directed to the Phase 3 sanitary sewer system as previously proposed in the Phase 3 Servicing Design Brief. The total area directed to Phase 3 has decreased resulting in a reduced flow of 1.5 L/s, instead of the previously calculation flow of 2.9 L/s.

Technical bulletin ISTB-2018-01 outlines recent changes to the sanitary sewer design criteria in the City of Ottawa. Phase 5 is the last development phase in this project, and for reasons of consistency we elected to maintain the same sanitary sewer design parameters used in the downstream sewers.

Table 4-1: Sanitary Sewer Design Parameters (Phase 5)

Parameter	Design Parameter
Unit Population: Town	2.7 people/unit
Residential Flow Rate, Average Daily	350 L/cap/day
Residential Peaking Factor	Harmon Equation (min=2.0, max=4.0)
Infiltration Rate	0.28 L/s/ha
Minimum Pipe Size	200mm (Res)
Minimum Velocity	0.6 m/s
Maximum Velocity	3.0 m/s

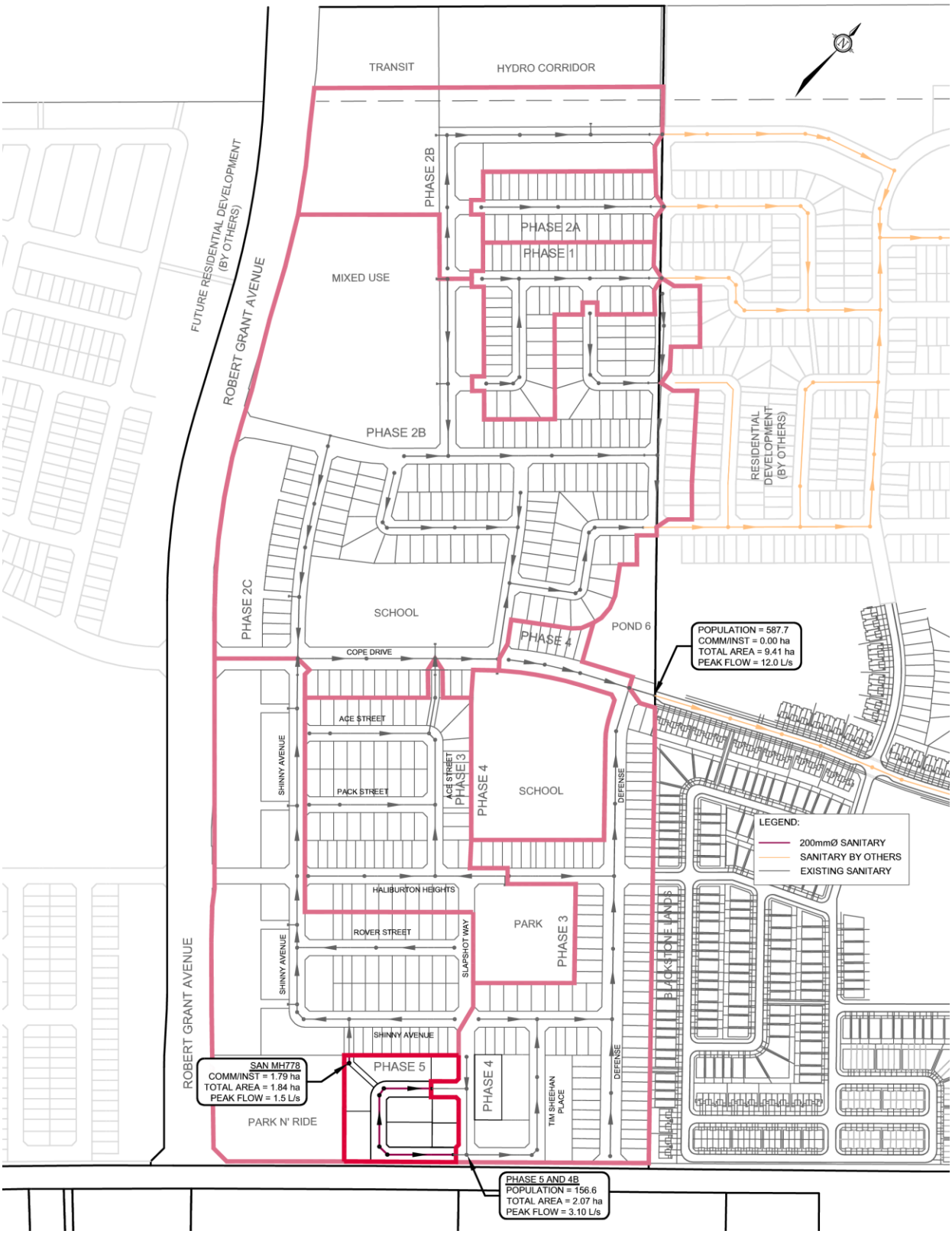

Figure 4: Sanitary Sewer Network

4.3 Offsite Requirements

The peak design flow from the combined Phase 4 and Phase 5 lands outletting to the sanitary sewer system in Cope Drive within Mattamy Lands is 12.0 L/s. The Phase 4 Servicing Design Brief had a peak design flow of 10.4 L/s directed to the downstream sanitary sewer system within Mattamy Lands. The Blackstone Community sanitary sewer design sheet (**Appendix A**) was reviewed to determine the available capacity within the downstream sewer system. The review concluded that the downstream sanitary sewers have sufficient capacity to convey the additional flow of 1.6 L/s.

5.0 STORMWATER MANAGEMENT

5.1 Existing Conditions

Fernbank Crossing is located at the headwaters of the Monahan Drain Subwatershed (part of the Jock River Watershed). **Figure 5** shows the location of the Fernbank Crossing Subdivision and the watershed boundaries circa 2012, prior to land development.

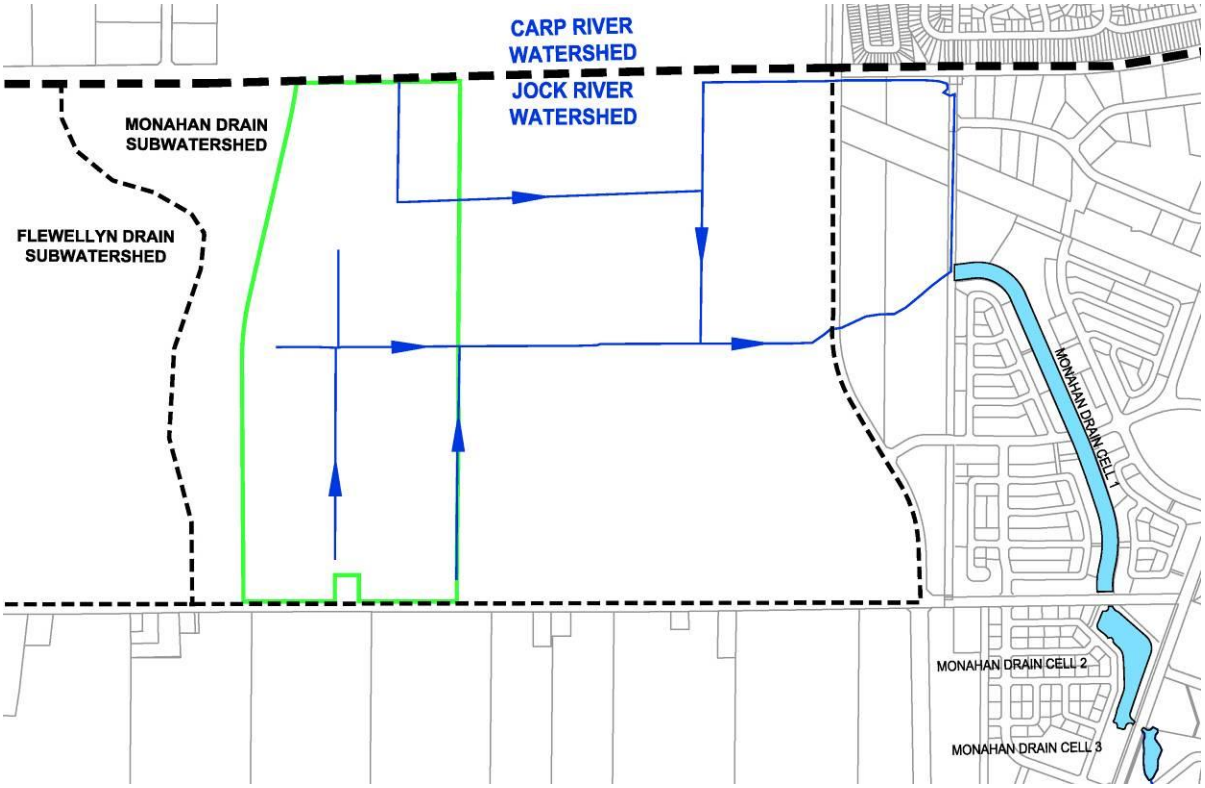

Figure 5: Existing Watershed Boundaries

The Monahan Drain is a municipal drain flowing eastward towards Terry Fox Drive, with several lateral branches on the north and south sides that connect with the main branch. The branches of the Monahan Drain were historically built to follow land ownership boundaries. Drainage works have been completed by others that include the lowering and re-alignment of the outlet channel, and construction of Pond 6 (not shown). These works have permitted the abandonment of most sections of the Drain.

As specified in the Fernbank Environmental Management Plan, the Monahan Drain has been classified as an intermittent watercourse that provides indirect habitat supporting tolerant warm/cool water fish communities.

Additional information on the existing conditions can be found in the Fernbank Environmental Management Plan **[4]**.

There is currently a storm sewer system servicing Phase 1, 2, 3 and 4 of Fernbank Crossing Subdivision. An existing 900mm diameter stub is located within the easement at the north west corner of the site that drains to the Phase 3 storm sewer system. An existing 300mm and 375mm diameter stubs are located at both intersections of Tim Sheehan Place and Street 1 that drains to the Phase 4 storm sewer system. Flows from both Phase 3 and Phase 4 ultimately drains to Pond 6.

5.2 Proposed Conditions

Runoff from Phase 5 of the Abbott-Fernbank development lands will be directed to the existing storm sewer systems within Phase 3 and Phase 4, where it will be directed to a stormwater facility (Pond 6) designed to provide both quantity and quality control. The stormwater management facility outlets to the realigned Monahan Drain, upstream of the existing inline Monahan Constructed Wetlands.

The stormwater management criteria is outlined in the Fernbank Environmental Management Plan **[4]** that is based on recommendations from the Jock River Reach 2 Subwatershed Study, with input from Rideau Valley Conservation Authority.

The proposed stormwater management strategy will adhere to applicable policies and guidelines of the Rideau Valley Conservation Authority, the City of Ottawa, the Ministry of the Environment, and other relevant approval agencies. Refer to the Stormwater Management Report prepared by Novatech (R-2018-112) for more detailed information.

Technical Bulletin PIEDTB-2016-01 outlines recent changes to sewer design criteria in the City of Ottawa. We have incorporated these criteria, except for the minimum storm sewer sizing. This is the last development phase in this project, and for reasons of consistency we elected to maintain the minimum 5-year storm sewer sizing criteria. Our approach is conservative, and will offer a slightly improved margin of safety against storm sewer back-up.

5.2.1 Minor System Design

The trunk storm sewers comprising the minor system have been designed based on the criteria outlined in the Ottawa Sewer Design Guidelines **[8]** using the principles of dual drainage. The design criteria used in sizing the storm sewers are summarized in **Table 5-1** and **Table 5-3** below.

The minor system servicing the Abbott-Fernbank Lands is divided into two main trunks with a north and a south inlet. Figure 6 shows the areas that are tributary to each inlet and highlights the storm sewers to be constructed as part of Phase 5.

Inlet control devices are proposed within the roadways to ensure inflows to the storm sewer system are controlled to the 5-year peak design flow. Inlet control devices shall be CB lead plate-type and are to be selected from the sizes listed in Section 13.1.19 of the Ottawa Sewer

Materials Specifications **[9]**. Refer to the Stormwater Management Report prepared by Novatech (R-2018-112) for detailed information.

Sewer design sheets are in **Appendix A**. Refer to the Storm Drainage Area Plan for additional details.

Table 5-1: Storm Sewer Design Parameters

Parameter	Design Criteria
Local and Collector Roads	5 Year Return Period
Storm Sewer Design	Rational Method/AutoDesk Storm Analysis
IDF Rainfall Data	Ottawa Sewer Design Guidelines
Initial Time of Concentration (T_c)	10 min
Minimum Velocity	0.8 m/s
Maximum Velocity	3.0 m/s
Minimum Diameter	250 mm

Table 5-2: Inlet Control Device Sizes

Structure	ICD Diameter (mm)
CB187	83
CB188	83
CB189	94
CB190	94
CB191	83
CB192	83
CB193	102
CB194	102
CB195	83
RYCB9	83
RYCB11	108
CBMH16	83

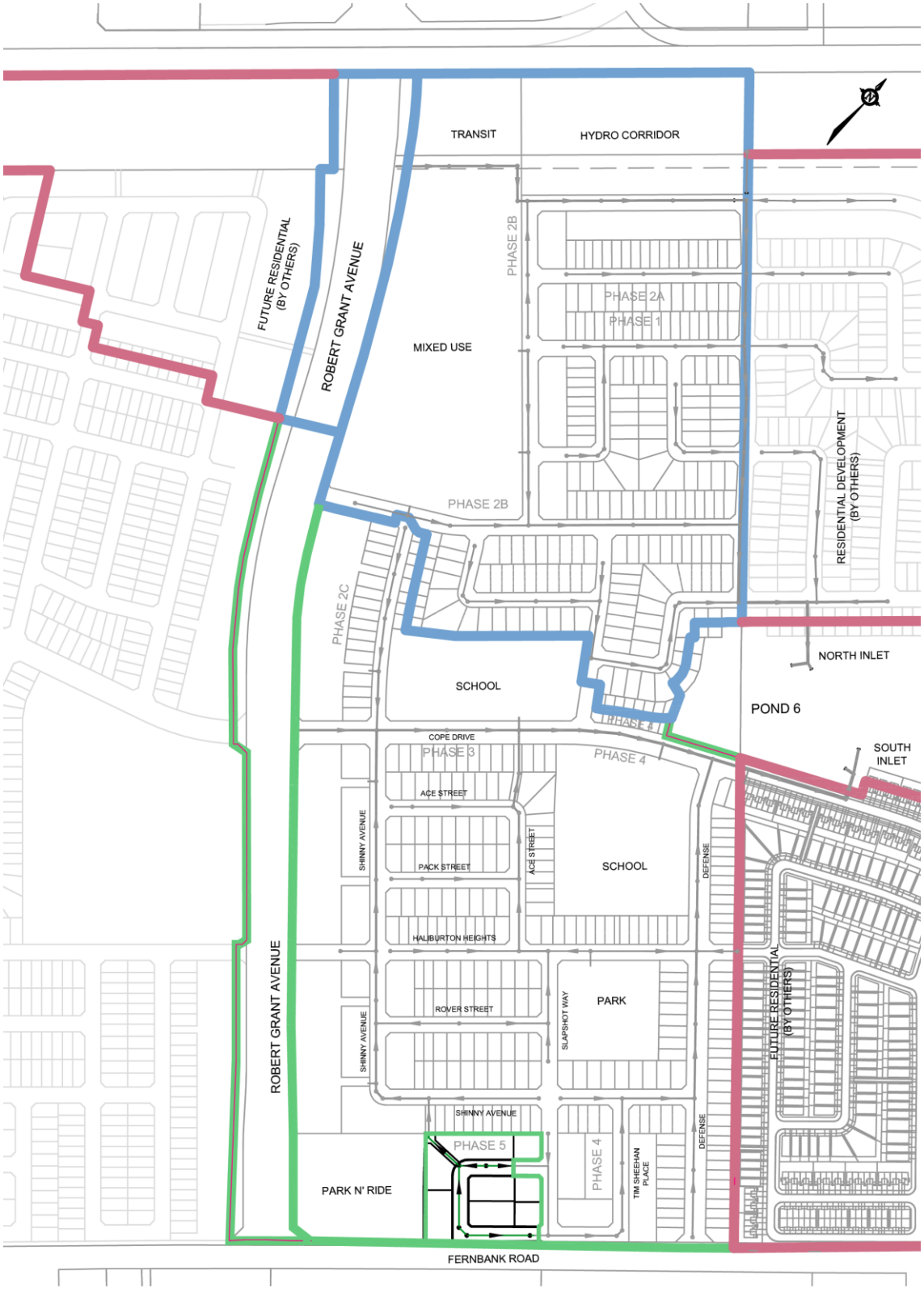

Figure 6: Storm Sewer Network

Table 5-3: Runoff Coefficients

Land Use	Runoff Coefficient
Park N' Ride	0.80
Towns Front Yards	0.70
Towns Rear Yards	0.60

5.2.2 Major System Design

Design of the major system will adhere to the design standards outlined in Section 5.5 of the Sewer Design Guidelines **[8]**.

The product of the overland flow Velocity (m/s) x Depth (m) will not be greater than 0.6. No cross-street flow is permitted for the minor (5-year) storm event, and there is no appreciable ponding within the roadways at the end of the 5-year event. Major system flow from local streets can be conveyed to other local or collector roads, or to a Stormwater Management Facility or watercourse.

For events exceeding the minor system design storm and up to the 100-year design storm, flow depth is permitted in the right of way up to the following maximum water depths:

Table 5-4: Major System Flow Depths

Road Classification	**Maximum Water Depth**
Local	350mm at edge of pavement

The 100-yr and 100-yr + 20% ponding limits in both roadways and rearyards are found in the Storm Drainage Area Plan attached (**Appendix B**).

5.3 Offsite Requirements

The Rational Method 5-year peak design flow from the Park N' Ride and Phase 5 lands outletting to the Phase 3 storm sewer system at existing MH387 is 541.1 L/s. The Phase 3 Servicing Design Brief had a 5-year peak design flow of 725.9 L/s outletting to MH387 from the proposed Park N' Ride and Paramedic Post. Due to the decrease in area of the proposed Park N' Ride and the replacement of the Paramedic Post with the Phase 5 lands, the flows draining to Phase 3 have decreased by 184.8 L/s.

The 5-year peak design flow from the Phase 5 lands outletting to the Phase 4 storm sewer system at existing MH327 is 260.3 L/s. The Phase 4 Servicing Design Brief had a 5-year peak design flow of 181.9 L/s at MH327. The increase of 78.4 L/s to MH327 is due to the replacement of the Paramedic Post with the proposed Phase 5 lands. The design sheets provided in **Appendix A** and the Detailed Stormwater Management Report demonstrates there is sufficient capacity in the Phase 4 storm sewers and Pond 6 infrastructure to service the additional flow from Phase 5.

6.0 EROSION AND SEDIMENT CONTROL

The following erosion and sediment control measures will be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987). Details are provided on the Erosion and Sediment Control Plan.

- A qualified inspector should conduct regular visits to ensure the contractor is working in accord with the drawings and that mitigation measures are implemented as specified.
- Filter fabric is to be placed under all catchbasins and storm manhole covers.
- Rock flow check dams are to be installed at the outlets to roadside ditches.
- Pond 6 is now functional and will provide quality control of any sediment runoff that gets into the storm sewers.
- After complete build-out, all sewers are to be inspected and cleaned and all sediment and construction fencing is to be removed.

7.0 WATER

7.1 Existing Conditions

The proposed development is located inside the 3W Pressure Zone. Existing 200mm watermain stubs are located at both intersections of Tim Sheehan Place and Street 1.

7.2 Proposed Conditions

A planning-level assessment of the water distribution system was completed in Section 8 of the Fernbank Master Servicing Study **[3]**.

Phase 5 of Fernbank Crossing will connect to the existing watermain network by way of two separate feed points. Both connections are proposed to the existing 200mm diameter watermain located within Tim Sheehan Place.

The Phase 5 lands will be serviced by 200mm diameter watermains. **Figure 7** shows the build-out watermain network as analyzed in the Fernbank Master Servicing Study **[3]**. **Figure 8** provides a high-level schematic of the proposed water distribution system.

The watermain boundary condition below was obtained from the City of Ottawa and has been included in **Appendix A**:

Boundary Condition
Max Day + FF of 167 L/s = 152.9m
Max Day + FF of 217 L/s = 151.2m
Minimum Pressure during Peak Hour = 155.5m
Max Pressure Check = 162.4m

The watermain network within Phase 5 has been designed to minimize pipe diameter, while still achieving city design criteria. This means the smallest commercially available pipe size will be

used that adequately conveys the required fire suppression flows under max day + fire flow conditions, with a minimum system pressure of 20psi. Smaller pipe sizes are generally desirable to maintain chlorine residual concentrations, and reduce life-cycle replacement costs.

City of Ottawa watermain design criteria and Fernbank Community Design Parameters are outlined in **Table 7-1**.

Figure 7: Build-out watermain alignment and sizing (Figure A-5 from MSS [2])

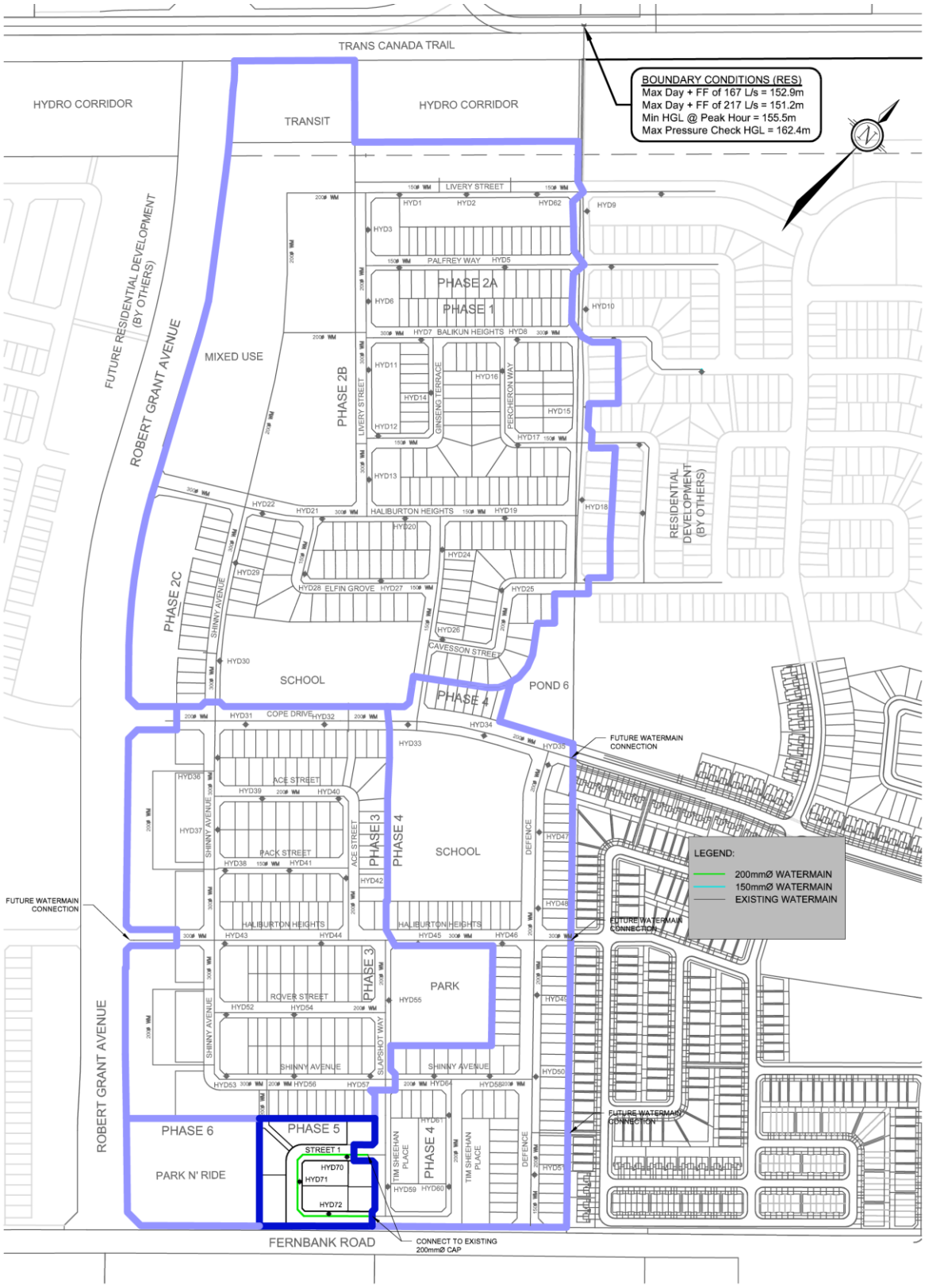

Figure 8: Watermain Layout

Table 7-1: Watermain Design Criteria

Design Parameter	Design Criteria
Population: Townhome	2.7 people/unit
Residential Demand	350 L/c/d
Maximum Day Demand	2.5 x Average Day
Peak Hour Demand	2.2 x Maximum Day
Fire Demand (Residential Areas)	167 L/s
Maximum Pressure	690 kPa (100psi) unoccupied areas
Maximum Pressure	552 kPa (80psi) occupied areas outside of ROW
Minimum Pressure	275 kPa (40 psi) except during fire flow
Minimum Pressure (Fire)	140 kPa (20 psi)

Table 7-2: Water Flow Summary (Phase 5)

	Units	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Towns	47	127	0.514	1.285	2.827
Total	**47**	**127**	**0.438**	**1.285**	**2.827**

Based on the fire underwriters survey, fire flows were calculated as 170 L/s for a 3-unit townhome block, 201 L/s for a 4-unit townhome block and 222 L/s for a 5-unit townhome block (**Appendix A**). As per the City of Ottawa's Technical Bulletin ISDTB-2014-02, fire flows may be capped at 167 L/s (10,000 L/min) for townhomes if certain criteria are met. All residential units within Phase 5 meet the criteria outlined in the above mentioned Technical Bulletin allowing the capped fire flow of 167 L/s to be used for all residential units.

The proposed watermain was modeled using EPANET 2. The EPANET model layout is shown in drawing 108180-19-WTR (refer to 108180-19-GP, and the Plan and Profile drawings for detailed watermain layout).

A summary of the model results is shown below in **Table 7-3**, **Table 7-4** and **Table 7-5**. Full model results are included in **Appendix A**.

Table 7-3: Summary of Hydraulic Model Results - Maximum Day + Fire Flow

Operating Condition	Minimum Pressure
167.35 L/s at HYD71	188.74 kPa (HYD71)

Table 7-4: Summary of Hydraulic Model Results - Peak Hour Demand

Operating Condition	Maximum Pressure	Minimum Pressure
2.827 L/s through system	488.73 kPa (T29)	471.17 kPa (HYD71)

The hydraulic modeling summarized above highlights the maximum and minimum system pressures during Peak Hour conditions, and the minimum system pressures during the Maximum Day + Fire condition. Since the Maximum Day + Fire Flow pressures are above the minimum 140 kPa, and the Peak Hour Pressures onsite fall within the normal operating pressure range (345 kPa to 552 kPa) the proposed development can be adequately serviced.

Table 7-5: Summary of Hydraulic Model Results – Maximum Pressure Check

Operating Condition	Maximum Pressure	Minimum Pressure
0.514 L/s through system	568.98 kPa (HYD59)	555.54 kPa (HYD71)

The average day pressures throughout the system are above 552 kPa, therefore pressure reducing valves shall be installed on all residential services.

7.3 Offsite Requirements

As specified in the Fernbank Master Servicing Study **[3]**, additional firm pumping capacity at the Glen Cairn Pumping Station and one of the Zone 2W pumping stations is required to meet additional demands associated with the Fernbank Community. The timing of these upgrades is related to the overall rate of growth in the entire Zone 3W (Kanata and Stittsville area). Growth within the Abbott-Fernbank Lands plays only a small part in determining when these upgrades are required; the City of Ottawa will determine when these water supply upgrades occur. No direct costs associated with the offsite upgrades are attributable to the developer.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding, the report conclusions are summarized below:

1) The servicing design generally conforms to the conclusions and recommendations outlined in the Fernbank Master Servicing Study and the Fernbank Environmental Management Plan both of which were approved by Council on June 24, 2009.
2) There is adequate capacity in the off-site infrastructure (sanitary, storm and water) to service Fernbank Crossing – Phase 5, with note to the following:
    a. Pond 6 is operational, and provides both quality and quantity control of stormwater runoff;
    b. The water distribution network can adequately provide both domestic and fire suppression needs.
    c. The Glen Cairn Pumping Station (water distribution) will be upgraded by the City of Ottawa as-and-when required based on overall growth rates within in the entire Zone 3W Area.
    d. Wastewater is routed via the Fernbank Trunk to the Hazeldean Pump Station.
3) The proposed infrastructure (sanitary, storm and water) will adequately service Fernbank Crossing – Phase 5 in accordance with City of Ottawa design standards.

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

Prepared By:
NOVATECH

Lucas Wilson, P.Eng.
Project Engineer

Reviewed By:

Mark Bissett, P.Eng.
Senior Project Manager

References

1 "Fernbank Crossing Servicing Design Brief – Phase 1 & 2, Novatech [August 17, 2012]
"Fernbank Crossing Servicing Design Brief – Phase 3, Novatech [July 13, 2015]
"Fernbank Crossing Servicing Design Brief – Phase 4, Novatech [February 8, 2018]

2 "Fernbank Community Design Plan, Walker, Nott, Dragicevic Associates Ltd. [June 24, 2009]

3 "Fernbank Master Servicing Study", Novatech Engineering Consultants Ltd. [June 24, 2009]

4 "Fernbank Environmental Management Plan", Novatech Engineering Consultants Ltd. [June 24, 2009]

5 "Geotechnical Investigation, Fernbank Crossing Residential Subdivision, Phase 5, Ottawa, Ontario" Gemtec [Project No. 64153.97, August 30, 2018]

6 "Transportation Master Plan", City of Ottawa [November 2013]

7 "Fernbank Transportation Master Plan", Delcan [June 24, 2009]

8 "Sewer Design Guidelines", Department of Public Works and Services, City of Ottawa [October 2012]

9 "Standard Tender Documents, Material Specifications and Standard Detail Drawings" City of Ottawa, Department of Infrastructure Services and Community Sustainability [March, 2014]

Appendix A: Design Sheets

Storm Sewer Design Sheet (Rational Method)
Sanitary Sewer Design Sheets
Blackstone Community Sanitary Sewer Design Sheet (Stantec)
Watermain Boundary Conditions
Watermain Modelling
Sample Fire Flow Calculations

Fernbank Crossing (Phase 5) - Storm Sewer Design Sheet (Flows Outletting to Phase 3) (Rational Method)

LOCATION			AREA								FLOW							PROPOSED SEWER							
Location	From node	To node	Park N' Ride	Parks	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area	Weighted Runoff Coefficient	Indivi 2.78 AR	Accum 2.78 AR	Time of Concentration	Rain Intensity (mm/hr) 5yr	Rain Intensity (mm/hr) 10yr	Peak Flow	Total Peak Flow (Q) (L/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
			0.80	0.40	0.65	0.55	0.70	0.60	(ha)							(L/s)									
Phase 5 (Outletting to Phase 3)																									
645	505	509					0.24		0.24	0.70	0.47	0.47	10.00	104.2		48.7	**48.7**	PVC	375	0.30	69.5	100.2	0.88	1.32	48.6%
									0.00		0.00	0.00	10.00			0.0									
644	507	509					0.17		0.17	0.70	0.33	0.33	10.00	104.2		34.5	**34.5**	PVC	300	0.40	30.5	63.8	0.87	0.58	54.0%
									0.00		0.00	0.00	10.00			0.0									
	509	CBMH15							0.00	0.00	0.00	0.80	11.32	97.7		78.0	**78.0**	PVC	450	0.20	46.1	133.0	0.81	0.95	58.6%
									0.00		0.00	0.00	11.32			0.0									
633	CAP	CBMH15	1.78						1.78	0.80	3.96	3.96	10.00	104.2		412.5	**412.5**	CONC	750	0.30	5.5	636.1	1.39	0.07	64.8%
									0.00		0.00	0.00	10.00			0.0									
658, 659, 730, 739	CBMH15	EX387				0.18		0.45	0.63	0.59	1.03	5.78	12.27	93.6		541.1	**541.1**	CONC	900	0.20	44.3	844.6	1.29	0.57	64.1%
									0.00		0.00	0.00	12.27			0.0									

Q = 2.78 AIR WHERE : Q = (1/n) A R^(2/3)So^(1/2) WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m2)

Project: Fernbank Crossing, Phase 5 (108180-19)
Designed: LRW
Checked: MAB
Date: December 7 2018

NOVATECH
Engineers, Planners & Landscape Architects

Fernbank Crossing (Phase 5 and Phase 4) - Storm Sewer Design Sheet (Rational Method)

LOCATION			AREA							FLOW							PROPOSED SEWER							
Location	From node	To node	Parks	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area	Weighted Runoff Coefficient	Indivi 2.78 AR	Accum 2.78 AR	Time of Concentration	Rain Intensity (mm/hr) 5yr	Rain Intensity (mm/hr) 10yr	Peak Flow	Total Peak Flow (Q) (L/s)	Pipe Type	Size (mm)	Grade (%)	Length (m)	Capacity (l/s)	Full Flow Velocity (m/s)	Time of Flow (min.)	Q/Qfull (%)
			0.40	0.65	0.55	0.70	0.60	(ha)							(L/s)									
Phase 5 (Outletting through Phase 4)																								
647	333	331				0.16		0.16	0.70	0.31	0.31	10.00	104.2		32.4	**32.4**	PVC	375	1.00	36.4	182.9	1.60	0.38	17.7%
								0.00		0.00	0.00	10.00			0.0									
648, 657	507	331				0.27	0.05	0.32	0.68	0.61	0.61	10.00	104.2		63.4	**63.4**	PVC	300	1.00	69.6	100.9	1.38	0.84	62.9%
								0.00		0.00	0.00	10.00			0.0									
649, 650, 660	331	329				0.31	0.22	0.53	0.66	0.97	1.89	10.84	100.0		189.0	**189.0**	PVC	450	0.75	78.0	257.6	1.57	0.83	73.4%
								0.00		0.00	0.00	10.84			0.0									
	505	503						0.00	0.00	0.00	0.00	10.00			0.0	**0.0**	PVC	250	2.00	12.4	87.7	1.73	0.12	0.0%
								0.00		0.00	0.00	10.00			0.0									
646	503	501				0.17		0.17	0.70	0.33	0.33	10.12	103.6		34.3	**34.3**	PVC	300	2.00	70.8	142.7	1.96	0.60	24.0%
								0.00		0.00	0.00	10.12			0.0									
	501	329						0.00	0.00	0.00	0.33	10.72	100.5		33.3	**33.3**	PVC	375	1.00	20.5	182.9	1.60	0.21	18.2%
								0.00		0.00	0.00	10.72			0.0									
653, 661	329	327				0.25		0.25	0.70	0.49	2.71	11.67	96.1		260.3	**260.3**	CONC	525	0.80	76.9	401.3	1.80	0.71	64.9%
								0.00		0.00	0.00	11.67			0.0									
	327	325						0.00	0.00	0.00	2.71	12.38	93.1		252.1	**252.1**	CONC	600	0.35	8.6	379.0	1.30	0.11	66.5%
								0.00		0.00	0.00	12.38			0.0									
651, 654	325	323				0.33	0.21	0.54	0.66	0.99	3.70	12.49	92.6		342.8	**342.8**	CONC	675	0.35	75.6	518.8	1.40	0.90	66.1%
								0.00		0.00	0.00	12.49			0.0									
652, 677	323	319				0.35	0.22	0.57	0.66	1.05	4.75	13.39	89.2		423.3	**423.3**	CONC	750	0.35	72.6	687.1	1.51	0.80	61.6%
								0.00		0.00	0.00	13.39			0.0									
693	321	319		0.16				0.16	0.65	0.29	0.29	10.00	104.2		30.1	**30.1**	PVC	300	4.00	69.1	201.8	2.77	0.42	14.9%
								0.00		0.00	0.00	10.00			0.0									
655, 692	319	313		0.47				0.47	0.65	0.85	5.89	14.19	86.3		507.8	**507.8**	CONC	750	0.35	81.2	687.1	1.51	0.90	73.9%
								0.00		0.00	0.00	14.19			0.0									
656	317	315		0.10				0.10	0.65	0.18	0.18	10.00	104.2		18.8	**18.8**	PVC	375	0.30	75.4	100.2	0.88	1.43	18.8%
								0.00		0.00	0.00	10.00			0.0									
681, 687, 682, 688	315	313		0.61	1.07			1.68	0.59	2.74	2.92	11.43	97.2		283.7	**283.7**	CONC	600	0.30	80.5	350.8	1.20	1.12	80.9%
								0.00		0.00	0.00	11.43			0.0									
694, 696	313	311		0.46	0.27			0.73	0.61	1.24	10.05	15.09	83.3		836.8	**836.8**	CONC	975	0.25	83.5	1169.0	1.52	0.92	71.6%
								0.00		0.00	0.00	15.09			0.0									
703	311	307		0.39				0.39	0.65	0.70	10.75	16.01	80.4		865.1	**865.1**	CONC	1050	0.25	81.9	1424.4	1.59	0.86	60.7%
								0.00		0.00	0.00	16.01			0.0									
695, 699, 707, 709, 714	309	307	1.28	0.40	0.27			1.95	0.47	2.56	2.56	10.00	104.2		266.6	**266.6**	PVC	450	1.64	119.0	380.9	2.32	0.85	70.0%
								0.00		0.00	0.00	10.00			0.0									
698, 702, 724	433	307		0.12	0.58			0.70	0.57	1.10	1.10	10.00	104.2		115.0	**115.0**	PVC	375	0.50	45.8	129.3	1.13	0.67	88.9%
								0.00		0.00	0.00	10.00			0.0									
701	307	305			0.14			0.14	0.55	0.21	14.63	16.86	78.0		1141.0	**1141.0**	CONC	1050	0.25	78.8	1424.4	1.59	0.82	80.1%
								0.00		0.00	0.00	16.86			0.0									
715	305	303		0.44				0.44	0.65	0.80	15.43	17.69	75.8		1168.9	**1168.9**	CONC	1050	0.25	84.8	1424.4	1.59	0.89	82.1%
								0.00		0.00	0.00	17.69			0.0									
725, 726	303	301		0.32	0.32			0.64	0.60	1.07	16.49	18.58	73.5		1213.0	**1213.0**	CONC	1200	0.25	54.7	2033.7	1.74	0.52	59.6%
								0.00		0.00	0.00	18.58			0.0									

Q = 2.78 AIR WHERE :

Q = (1/n) A R^(2/3)So^(1/2) WHERE :

Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m2)

Project: Fernbank Crossing, Phase 5 (108180-19)
Designed: LRW
Checked: MAB
Date: December 7, 2018

M:\2008\108180\Subdivision - Phase 5\DATA\Calculations\Sewer Calcs\STM\20181207-Storm Design Sheet Phase 5 (Rational Method).xlsx

NOVATECH
Engineers, Planners & Landscape Architects

Fernbank Crossing (Phase 5) - Sanitary Sewer Design Sheet

AREA			RESIDENTIAL								ICI			INFILTRATION				PIPE					
			SINGLES		TOWNS		TOTAL																
ID	From	To	Units	Pop.	Units	Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Institutional Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	**Total Flow (l/s)**	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
Phase 5/4B																							
9-4	930	928		0.0	9	24.3	24.3	24.3	4.0	0.4				0.32	0.32	0.1	0.5	200	1.00	36.3	34.2	1.06	1.4%
9-24	954	956		0.0	8	21.6	21.6	21.6	4.0	0.4				0.27	0.27	0.1	0.4	200	1.00	58.4	34.2	1.06	1.2%
9-23	956	958		0.0	2	5.4	5.4	27.0	4.0	0.4				0.18	0.45	0.1	0.6	200	1.00	9.3	34.2	1.06	1.6%
9-22	958	928		0.0	16	43.2	43.2	70.2	4.0	1.1				0.50	0.95	0.3	1.4	200	1.00	94.0	34.2	1.06	4.1%
9-5	928	926		0.0	10	27.0	27.0	121.5	4.0	2.0				0.34	1.61	0.5	2.4	200	1.00	75.0	34.2	1.06	7.1%
9-25	954	952		0.0	2	5.4	5.4	5.4	4.0	0.1				0.08	0.08	0.0	0.1	200	2.00	12.8	48.4	1.49	0.2%
9-26	952	926		0.0	11	29.7	29.7	35.1	4.0	0.6				0.38	0.46	0.1	0.7	200	2.00	90.1	48.4	1.49	1.4%
Phase 4																							
9-6	926	**924**		0.0	8	21.6	21.6	178.2	4.0	2.9				0.31	2.38	0.7	3.6	200	0.80	74.1	30.6	0.94	11.6%
9-7	924	**922**		0.0	1	2.7	2.7	180.9	4.0	2.9				0.07	2.45	0.7	3.6	200	0.50	8.4	24.2	0.75	15.0%
9-8	922	**920**		0.0	18	48.6	48.6	229.5	4.0	3.7				0.55	3.00	0.8	4.6	200	0.35	82.7	20.2	0.62	22.5%
9-9	920	**916**		0.0	8	21.6	21.6	251.1	4.0	4.1				0.28	3.28	0.9	5.0	200	0.35	65.7	20.2	0.62	24.6%
9-10	918	**916**	9	30.6		0.0	30.6	30.6	4.0	0.5				0.54	0.54	0.2	0.6	200	4.00	66.5	68.4	2.11	0.9%
9-11	916	**910**	10	34.0		0.0	34.0	315.7	4.0	5.1				0.61	4.43	1.2	6.4	200	0.41	85.2	21.9	0.68	29.0%
9-12	914	**912**	14	47.6		0.0	47.6	47.6	4.0	0.8				0.72	0.72	0.2	1.0	200	0.65	71.6	27.6	0.85	3.5%
9-13	912	**910**	9	30.6		0.0	30.6	78.2	4.0	1.3				0.55	1.27	0.4	1.6	200	0.65	83.8	27.6	0.85	5.9%
9-14	910	**908**	10	34.0		0.0	34.0	427.9	4.0	6.9				0.58	6.28	1.8	8.7	200	0.35	79.9	20.2	0.62	42.9%
9-15	908	**906**	13	44.2		0.0	44.2	472.1	4.0	7.6				0.67	6.95	1.9	9.6	200	0.35	82.6	20.2	0.62	47.3%
9-16	740	**906**	10	34.0		0.0	34.0	34.0	4.0	0.6				0.58	0.58	0.2	0.7	200	2.16	120.0	50.3	1.55	1.4%
9-17	906	**904**	7	23.8		0.0	23.8	529.9	4.0	8.5				0.51	8.04	2.3	10.8	250	0.30	82.3	34.0	0.67	31.6%
9-18	904	**902**	7	23.8		0.0	23.8	553.7	4.0	8.9				0.44	8.48	2.4	11.2	250	0.30	82.3	34.0	0.67	33.1%
9-19	902	**900**	0	0.0		0.0	0.0	553.7	4.0	8.9				0.11	8.59	2.4	11.3	250	0.25	51.3	31.0	0.61	36.3%
9-1	936	**934**	4	13.6		0.0	13.6	13.6	4.0	0.2				0.26	0.26	0.1	0.3	200	1.00	41.4	34.2	1.06	0.9%
9-2	934	**932**	4	13.6		0.0	13.6	27.2	4.0	0.4				0.26	0.52	0.1	0.6	200	4.25	41.4	70.5	2.18	0.8%
9-3	932	**900**		0.0		0.0	0.0	27.2	4.0	0.4				0.14	0.66	0.2	0.6	250	0.25	58.2	31.0	0.61	2.0%
9-20	900	**CAP**	2	6.8		0.0	6.8	587.7	3.9	9.4				0.16	9.41	2.6	12.0	250	0.25	29.8	31.0	0.61	38.7%
Park N' Ride																							
7-19	778A	**778**		0.0		0.0	0.0	0.0	4.0	0.0	1.78	1.78	0.9	1.78	1.78	0.6	1.5	200	0.35	7.5	20.2	0.62	7.2%
7-15	778	**774**		0.0		0.0	0.0	0.0	4.0	0.0		1.78	0.9	0.05	1.83	0.6	1.5	200	0.32	46.9	19.4	0.60	7.6%

Design Parameters:

ISTB-2018-01 Avg Flow/Person (Phase 5) = 280 l/day
Avg Flow/Person = 350 l/day
Comm./Inst. Flow = 28000 l/ha/day
ISTB-2018-01 Infiltration (Phase 5) = 0.33 l/s/ha
Infiltration = 0.28 l/s/ha
Pipe Friction n = 0.013
Residential Peaking Factor = Harmon Equation (max 4, min 2)
Peaking Factor Comm./Inst. 1.5

Population Density:

	ppl/unit	units/net ha
Mixed Use	1.80	90
Singles	3.40	
Towns	2.70	60

Project: Fernbank Crossing, Phase 5 (108180-19)
Designed: LRW
Checked: MAB
Date: December 7, 2018

NOVATECH
Engineers, Planners & Landscape Architects

Stantec

SUBDIVISION Blackstone Community Phase 4 - 8

DATE: 2018-02-07
REVISION: 2
DESIGNED BY: MJS
CHECKED BY: DT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401130

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	50,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	50,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 l/s/Ha		
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	UNITS SINGLE	UNITS TOWN	UNITS APT	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(l/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
R104A	104	103	0.23	0	6	0	16	0.23	16	4.00	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.23	0.23	0.1	0.3	39.6	250	PVC	SDR 35	0.80	54.2	**0.60%**	1.09	0.27
R103A	103	102	0.25	0	6	0	16	0.48	32	4.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.25	0.48	0.1	0.7	42.7	250	PVC	SDR 35	0.80	54.2	**1.22%**	1.09	0.31
R102A	102	101	0.26	0	6	0	16	0.74	49	4.00	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.26	0.74	0.2	1.0	42.7	250	PVC	SDR 35	0.80	54.2	**1.84%**	1.09	0.36
I101A, R101A	101	100	0.10	0	0	0	0	0.84	49	4.00	0.8	0.00	0.00	0.00	0.00	0.00	0.00	7.40	7.40	0.00	0.00	6.4	7.50	8.24	2.3	9.5	42.8	250	PVC	SDR 35	0.80	54.2	**17.55%**	1.09	0.68
R100B, R100A	100	4	7.81	107	35	0	458	8.65	507	3.97	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	6.4	7.81	16.05	4.5	19.1	48.8	300	PVC	SDR 35	0.20	42.9	**44.42%**	0.61	0.50
	6	5	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	120.1	250	PVC	SDR 35	0.25	30.3	**0.00%**	0.61	0.00
	5	4	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	39.3	250	PVC	SDR 35	0.25	30.3	**0.00%**	0.61	0.00
	4	3	0.00	0	0	0	0	8.65	507	3.97	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	6.4	0.00	16.05	4.5	19.1	62.5	300	PVC	SDR 35	0.20	42.9	**44.42%**	0.61	0.50
	3	2	0.00	0	0	0	0	8.65	507	3.97	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	6.4	0.00	16.05	4.5	19.1	70.7	300	PVC	SDR 35	0.20	42.9	**44.42%**	0.61	0.50
	2	1	0.00	0	0	0	0	8.65	507	3.97	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	6.4	0.00	16.05	4.5	19.1	70.5	300	PVC	SDR 35	0.20	42.9	**44.42%**	0.61	0.50
	1	145B	0.00	0	0	0	0	8.65	507	3.97	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	6.4	0.00	16.05	4.5	19.1	20.1	525	CONCRETE	SDR 35	0.25	226.7	**8.41%**	1.01	0.52
	145B	145A	0.00	0	0	0	0	8.65	507	3.97	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	6.4	0.00	16.05	4.5	19.1	34.4	525	CONCRETE	SDR 35	0.25	226.7	**8.41%**	1.01	0.52
	145A	145	0.00	0	0	0	0	8.65	507	3.97	8.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.40	0.00	0.00	6.4	0.00	16.05	4.5	19.1	46.4	525	CONCRETE	SDR 35	0.25	226.7	**8.41%**	1.01	0.52
																												525							
R207A	207	206	0.37	0	8	0	22	0.37	22	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.37	0.37	0.1	0.5	61.0	200	PVC	SDR 35	0.65	27.0	**1.68%**	0.85	0.26
R206A	206	205	0.40	6	0	0	20	0.77	42	4.00	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.40	0.77	0.2	0.9	65.0	200	PVC	SDR 35	0.40	21.1	**4.24%**	0.67	0.27
R205A, R205C, R205B	205	204	3.39	0	4	0	453	4.16	495	3.98	8.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	3.39	4.16	1.2	9.1	49.4	200	PVC	SDR 35	0.40	21.1	**43.20%**	0.67	0.55
R204A	204	203	0.76	6	11	0	50	4.92	545	3.95	8.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.76	4.92	1.4	10.1	91.8	200	PVC	SDR 35	0.40	21.1	**47.80%**	0.67	0.56
R203A	203	202	0.52	0	11	0	30	5.44	575	3.94	9.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.52	5.44	1.5	10.7	120.0	200	PVC	SDR 35	0.40	21.1	**50.60%**	0.67	0.57
R900A, External Fernbank	900	212	8.66	0	9	0	528	8.66	528	3.96	8.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	8.66	8.66	2.4	10.9	111.9	250	PVC	SDR 35	0.27	31.5	**34.61%**	0.63	0.49
R212A	212	211	0.88	0	23	0	62	9.55	590	3.94	9.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.88	9.55	2.7	12.1	118.1	250	PVC	SDR 35	0.40	38.3	**31.52%**	0.77	0.57
R211A	211	210	0.50	0	15	0	41	10.05	631	3.92	10.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.50	10.05	2.8	12.8	61.1	250	PVC	SDR 35	0.40	38.3	**33.46%**	0.77	0.59
	210B	210	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	18.0	200	PVC	SDR 35	0.40	21.1	**0.00%**	0.67	0.00
	210A	210	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	17.9	200	PVC	SDR 35	0.40	21.1	**0.00%**	0.67	0.00
R210A, G210A, R210B	210	209	14.15	167	161	0	1003	24.20	1633	3.65	24.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42	1.42	0.0	15.57	25.63	7.2	31.3	56.0	300	PVC	SDR 35	0.20	42.9	**72.99%**	0.61	0.58
	209	208	0.00	0	0	0	0	24.20	1633	3.65	24.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.0	0.00	25.63	7.2	31.3	56.0	300	PVC	SDR 35	0.20	42.9	**72.99%**	0.61	0.58
	208	202	0.00	0	0	0	0	24.20	1633	3.65	24.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42	0.0	0.00	25.63	7.2	31.3	120.0	300	PVC	SDR 35	0.20	42.9	**72.99%**	0.61	0.58
	215A	215	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	18.0	200	PVC	SDR 35	0.40	21.1	**0.00%**	0.67	0.00
R215B, R215A	215	214	4.49	45	11	0	183	4.49	183	4.00	3.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	4.49	4.49	1.3	4.2	39.4	250	PVC	SDR 35	0.25	30.3	**13.91%**	0.61	0.36
R214A	214	213	1.01	0	32	0	86	5.50	269	4.00	4.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.01	5.50	1.5	5.9	111.6	250	PVC	SDR 35	0.25	30.3	**19.46%**	0.61	0.40
R213A	213	202	0.60	0	15	0	41	6.10	310	4.00	5.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.60	6.10	1.7	6.7	81.7	250	PVC	SDR 35	0.25	30.3	**22.18%**	0.61	0.41
R219A	219	218	0.30	0	7	0	19	0.30	19	4.00	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.30	0.30	0.1	0.4	47.6	200	PVC	SDR 35	0.65	27.0	**1.45%**	0.85	0.26
R218A	218	217	0.28	0	7	0	19	0.58	38	4.00	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.28	0.58	0.2	0.8	47.6	200	PVC	SDR 35	0.40	21.1	**3.66%**	0.67	0.26
R2017A	217	216	0.64	0	15	0	41	1.22	78	4.00	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.64	1.22	0.3	1.6	120.0	250	PVC	SDR 35	0.40	38.3	**4.20%**	0.77	0.32
	216	202	0.00	0	0	0	0	1.22	78	4.00	1.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.22	0.3	1.6	5.2	250	PVC	SDR 35	0.40	38.3	**4.20%**	0.77	0.32
I202A	202	201	0.00	0	0	0	0	36.96	2596	3.50	36.8	0.00	0.00	0.00	0.00	0.00	0.00	2.84	2.84	0.00	1.42	2.5	2.84	41.22	11.5	50.8	86.1	375	PVC	SDR 35	0.20	72.6	**69.93%**	0.69	0.65
R201A	201	200	1.37	0	24	0	65	38.32	2661	3.49	37.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84	0.00	1.42	2.5	1.37	42.59	11.9	52.0	115.0	375	PVC	SDR 35	0.20	72.6	**71.59%**	0.69	0.66
	220a	220	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	15.5	200	PVC	SDR 35	0.50	23.6	**0.00%**	0.74	0.00
	201A	221	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	15.6	200	PVC	SDR 35	0.50	23.6	**0.00%**	0.74	0.00
R222A	222	221	0.29	0	2	0	5	0.29	5	4.00	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.29	0.29	0.1	0.2	58.6	200	PVC	SDR 35	0.65	27.0	**0.62%**	0.85	0.21
R221A	221	220	0.93	15	0	0	51	1.22	56	4.00	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.93	1.22	0.3	1.3	115.0	200	PVC	SDR 35	0.50	23.6	**5.31%**	0.74	0.33
R220A	220	200	1.65	23	0	0	78	2.86	135	4.00	2.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.65	2.86	0.8	3.0	2.5	200	PVC	SDR 35	0.50	23.6	**12.62%**	0.74	0.42
	200	303-1	0.00	0	0	0	0	41.19	2795	3.47	39.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84	0.00	1.42	2.5	0.00	45.46	12.7	54.5	15.3	375	PVC	SDR 35	0.20	72.7	**74.94%**	0.69	0.67
	303-2	303-1	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	10.9	450	CONCRETE	SDR 35	0.20	134.4	**0.00%**	0.82	0.00
R303-1A	303-1	303	0.12	0	0	0	0	41.31	2795	3.47	39.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84	0.00	1.42	2.5	0.12	45.57	12.8	54.5	85.5	450	CONCRETE	SDR 35	0.20	134.4	**40.54%**	0.82	0.66
	303	302	0.00	0	0	0	0	41.31	2795	3.47	39.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84	0.00	1.42	2.5	0.00	45.57	12.8	54.5	80.8	450	CONCRETE	SDR 35	0.20	134.4	**40.54%**	0.82	0.66
																												450							

LICENSED PROFESSIONAL ENGINEER
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07/02/2018
PROVINCE OF ONTARIO

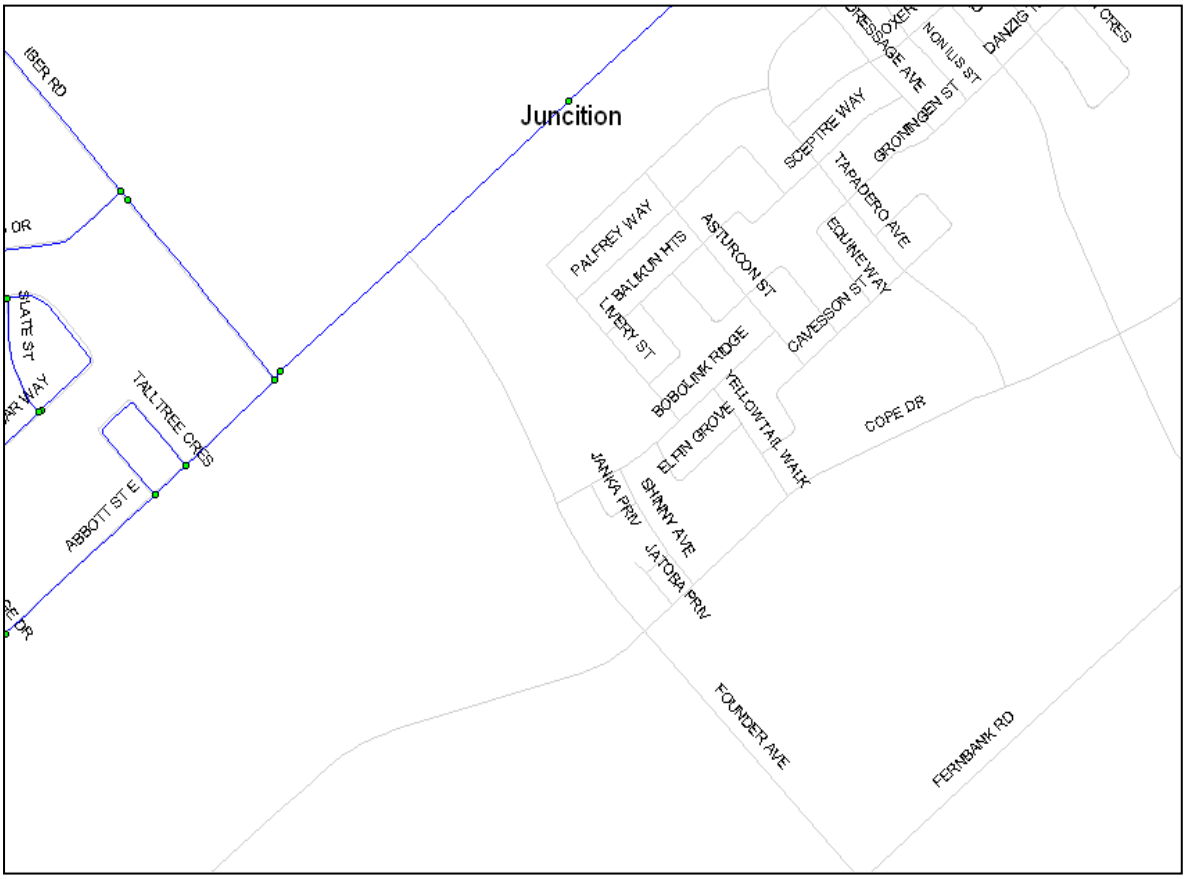
Boundary Conditions at Fernbank-Abott site

Junction

Max HGL = 162.4m
PKHR = 155.5m
MXDY+Fire (167 L/s) = 152.9m
MXDY+Fire (217 L/s)= 151.2m

Note:
The site exceeds standard Bench Mark of maximum pressure (80 psi). Therefore, according to the City's guidelines it requires Pressure Reducing Valve (PRV) to maintain a safe and continuous water supply.

Location of Connections:



Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Abbott-Fernbank Subdivision (Phase 5)
Water Demand

	Area (ha)	Units	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Towns	N/A	47	127	0.514	1.285	2.827
Total	**0.00**	**47**	**127**	**0.514**	**1.285**	**2.827**

Water Demand Parameters

Towns	2.7	ppl/unit
Residential Demand	350	L/c/day
Residential Max Day	2.5	x Avg Day
Residential Peak Hour	2.2	x Max Day
Residential Fire Flow	167	L/s

Fernbank Crossing (Phase 5) - Watermain Demand

Node	Towns	Total Population	Average Day Residential Demand (L/s)	Maximum Day Residential Demand (L/s)	Peak Hour Residential Demand (L/s)	Fire Flow (L/s)
HYD59		0	0.000	0.000	0.000	167
HYD65		0	0.000	0.000	0.000	167
HYD70	16	43	0.175	0.438	0.963	167
HYD71	12	32	0.131	0.328	0.722	167
HYD72	11	30	0.120	0.301	0.662	167
T29		0	0.000	0.000	0.000	N/A
T30	19	51	0.208	0.520	1.143	N/A
Total	**58**	**157**	**0.634**	**1.586**	**3.489**	

Water Demand Parameters

Singles	3.4	ppl/unit	Residential Max Day	2.5	x Avg Day
Towns	2.7	ppl/unit	Residential Peak Hour	2.2	x Max Day
Residential Demand	350	L/c/day	Residential Fire Flow	167	L/s

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes - (Peak Hour)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc HYD59	104.3	0	153.7	49.4	484.61	70.29
Junc HYD65	105.1	0	153.7	48.6	476.77	69.15
Junc HYD70	105.09	0.96	153.7	48.61	476.86	69.16
Junc HYD71	105.67	0.72	153.7	48.03	471.17	68.34
Junc HYD72	105.29	0.66	153.7	48.41	474.90	68.88
Junc T29	103.88	0	153.7	49.82	488.73	70.88
Junc T30	104.58	1.14	153.7	49.12	481.87	69.89
Resvr RES1	155.5	-85.25	155.5	0	0.00	0.00

Network Table - Links - (Peak Hour)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 142	33	204	110	-0.57	0.02	0.00	0.055
Pipe 166	36	204	110	-0.57	0.02	0.00	0.051
Pipe 167	31	204	110	-3.09	0.09	0.09	0.041
Pipe 168	40	204	110	-3.09	0.09	0.09	0.041
Pipe 169	64	204	110	0.98	0.03	0.01	0.049
Pipe 170	70	204	110	0.31	0.01	0.00	0.058
Pipe 171	83	204	110	-0.41	0.01	0.00	0.055
Pipe 172	43	204	110	-1.37	0.04	0.02	0.046

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes - (Max Pressure Check)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc HYD59	104.3	0	162.3	58	568.98	82.52
Junc HYD65	105.1	0	162.3	57.2	561.13	81.39
Junc HYD70	105.09	0.17	162.3	57.21	561.23	81.40
Junc HYD71	105.67	0.13	162.3	56.63	555.54	80.57
Junc HYD72	105.29	0.12	162.3	57.01	559.27	81.11
Junc T29	103.88	0	162.3	58.42	559.07	81.09
Junc T30	104.58	0.21	162.3	57.72	566.23	82.13
Resvr RES1	162.4	-17.58	162.4	0	0.00	0.00

Network Table - Links - (Max Pressure Check)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 142	33	204	110	-0.09	0.00	0.00	0.000
Pipe 166	36	204	110	-0.09	0.00	0.00	0.000
Pipe 167	31	204	110	-0.54	0.02	0.00	0.052
Pipe 168	40	204	110	-0.54	0.02	0.00	0.054
Pipe 169	64	204	110	0.18	0.01	0.00	0.077
Pipe 170	70	204	110	0.06	0.00	0.00	0.000
Pipe 171	83	204	110	-0.07	0.00	0.00	0.000
Pipe 172	43	204	110	-0.25	0.01	0.00	0.061

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes - (Fire Flow Summary)

Fire Flow		Minimum Pressure		
Node	Flow (L/s)	Pressure (kPa)	Pressure (PSI)	Node
HYD59	167	240.35	34.86	HYD59
HYD65	167	265.56	38.52	HYD65
HYD70	167	208.46	30.23	HYD70
HYD71	167	188.74	27.38	HYD71
HYD72	167	201.20	29.18	HYD72

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Hyd59')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc HYD59	104.3	167	128.8	24.5	240.35	34.86
Junc HYD65	105.11	0	133.24	28.13	275.96	40.02
Junc HYD70	105.65	0.44	130.37	24.72	242.50	35.17
Junc HYD71	105.66	0.35	130.23	24.57	241.03	34.96
Junc HYD72	105.35	0.3	130.11	24.76	242.90	35.23
Junc T29	103.88	0	130.01	26.13	256.34	37.18
Junc T30	104.57	0.52	130.45	25.88	253.88	36.82
Resvr RES1	152.9	-206.53	152.9	0	0.00	0.00

Network Table - Links (Max Day + FF 'Hyd59')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 142	33	204	110	78.21	2.39	36.35	0.025
Pipe 166	36	204	110	-88.79	2.72	45.97	0.025
Pipe 167	45	204	110	-104.84	3.21	62.54	0.024
Pipe 168	40	204	110	-104.84	3.21	62.54	0.024
Pipe 169	63	204	110	-14.44	0.44	1.59	0.033
Pipe 170	71	204	110	14.74	0.45	1.65	0.033
Pipe 171	83	204	110	-15.09	0.46	1.73	0.032
Pipe 172	43	204	110	-15.53	0.48	1.82	0.032

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Hyd65')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc HYD59	104.3	0	132.87	28.57	280.27	40.65
Junc HYD65	105.11	167	132.18	27.07	265.56	38.52
Junc HYD70	105.65	0.44	132.73	27.08	265.65	38.53
Junc HYD71	105.66	0.35	132.85	27.19	266.73	38.69
Junc HYD72	105.35	0.3	132.96	27.61	270.85	39.28
Junc T29	103.88	0	133.06	29.18	286.26	41.52
Junc T30	104.57	0.52	132.67	28.1	275.66	39.98
Resvr RES1	152.9	-206.53	152.9	0	0.00	0.00

Network Table - Links (Max Day + FF 'Hyd65')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 142	33	204	110	28.39	0.87	5.56	0.030
Pipe 166	36	204	110	28.39	0.87	5.56	0.030
Pipe 167	45	204	110	41.12	1.26	11.05	0.028
Pipe 168	40	204	110	-125.88	3.85	87.76	0.024
Pipe 169	63	204	110	14.34	0.44	1.57	0.033
Pipe 170	71	204	110	-14.04	0.43	1.51	0.033
Pipe 171	83	204	110	13.69	0.42	1.44	0.033
Pipe 172	43	204	110	13.25	0.41	1.36	0.033

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Hyd70')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc HYD59	104.3	0	130.3	26	255.06	36.99
Junc HYD65	105.11	0	133.15	28.04	275.07	39.90
Junc HYD70	105.65	167.44	126.9	21.25	208.46	30.23
Junc HYD71	105.66	0.35	128.2	22.54	221.12	32.07
Junc HYD72	105.35	0.3	129.33	23.98	235.24	34.12
Junc T29	103.88	0	130.33	26.45	259.47	37.63
Junc T30	104.57	0.52	130.26	25.69	252.02	36.55
Resvr RES1	152.9	-206.53	152.9	0	0.00	0.00

Network Table - Links (Max Day + FF 'Hyd70')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 142	33	204	110	11.55	0.35	1.05	0.034
Pipe 166	36	204	110	11.55	0.35	1.05	0.034
Pipe 167	45	204	110	-106.75	3.27	64.67	0.024
Pipe 168	40	204	110	-106.75	3.27	64.67	0.024
Pipe 169	63	204	110	50.31	1.54	16.06	0.027
Pipe 170	71	204	110	-50.01	1.53	15.88	0.027
Pipe 171	83	204	110	49.66	1.52	15.67	0.027
Pipe 172	43	204	110	-117.78	3.60	77.59	0.024

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Hyd71')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc HYD59	104.3	0	130.26	25.96	254.67	36.94
Junc HYD65	105.11	0	133.19	28.08	275.46	39.95
Junc HYD70	105.65	0.44	128.47	22.82	223.86	32.47
Junc HYD71	105.66	167.35	124.9	19.24	188.74	27.38
Junc HYD72	105.35	0.3	127.69	22.34	219.16	31.79
Junc T29	103.88	0	130.17	26.29	257.90	37.41
Junc T30	104.57	0.52	130.36	25.79	253.00	36.69
Resvr RES1	152.9	-206.53	152.9	0	0.00	0.00

Network Table - Links (Max Day + FF 'Hyd71')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 142	33	204	110	-19.09	0.58	2.67	0.031
Pipe 166	36	204	110	-19.09	0.58	2.67	0.031
Pipe 167	45	204	110	-105.79	3.24	63.59	0.024
Pipe 168	40	204	110	-105.79	3.24	63.59	0.024
Pipe 169	63	204	110	81.92	2.51	39.60	0.025
Pipe 170	71	204	110	-81.62	2.50	39.33	0.025
Pipe 171	83	204	110	-85.74	2.62	43.09	0.025
Pipe 172	43	204	110	-86.18	2.64	43.50	0.025

Fernbank Crossing (Phase 5) - Watermain Analysis

Network Table - Nodes (Max Day + FF 'Hyd72')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc HYD59	104.3	0	130.17	25.87	253.78	36.81
Junc HYD65	105.11	0	133.29	28.18	276.45	40.10
Junc HYD70	105.65	0.44	129.51	23.86	234.07	33.95
Junc HYD71	105.66	0.35	127.54	21.88	214.64	31.13
Junc HYD72	105.35	167.3	125.86	20.51	201.20	29.18
Junc T29	103.88	0	129.82	25.94	254.47	36.91
Junc T30	104.57	0.52	130.56	25.99	254.96	36.98
Resvr RES1	152.9	-206.53	152.9	0	0.00	0.00

Network Table - Links (Max Day + FF 'Hyd72')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe 142	33	204	110	-40.50	1.24	10.74	0.028
Pipe 166	36	204	110	-40.50	1.24	10.74	0.028
Pipe 167	45	204	110	-103.72	3.17	61.31	0.024
Pipe 168	40	204	110	-103.72	3.17	61.31	0.024
Pipe 169	63	204	110	105.39	3.22	63.15	0.024
Pipe 170	71	204	110	61.91	1.89	23.58	0.026
Pipe 171	83	204	110	-62.27	1.90	23.83	0.026
Pipe 172	43	204	110	-62.70	1.92	24.14	0.026

Fire Flow Calculations

As per Fire Underwriter's Survey Guidelines

PROJECT: Fernbank Crossing - Phase 5 **DATE:** August 22, 2018

JOB#: 108180-19

Townhome (3-Unit Block)

		[yes/no]			
C	**Coefficient related to type of construction**				
	◆ Wood frame	yes	1.5		
	◆ Ordinary construction		1		
	◆ Non-combustible construction		0.8		
	◆ Fire resistive construction (< 2 hrs)		0.7		
	◆ Fire resistive construction (> 2 hrs)		0.6		
	◆ Interpolation (Using FUS Tables)				
A	**Area of structure considered (m^2)**	***552***	<==>	**5,942 ft^2**	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***7,753 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	◆ Non-combustible		-25%		
	◆ Limited combustible	yes	-15%		
	◆ Combustible		0%		
	◆ Free burning		15%		
	◆ Rapid burning		25%		
				6,590 L/min	**(1)**
	Sprinkler Reduction				
	◆ Non-combustible - Fire Resistive (3	**no**	50%	***0 L/min***	**(2)**
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m		25%		
	3.1 - 10 m	**yes**	20%	**1 side**	20%
	10.1 - 20 m	**yes**	15%	**1 side**	15%
	20.1 - 30 m	**yes**	10%	**2 side**	20%
	30.1- 45 m		5%		
			Cumulative Total		**55%**
				3,625 L/min	
	Fire Wall Separation				
	◆ Number of Party Walls * 1000 L/min				
	(As per City of Ottawa Standard)			***3,625 L/min***	**(3)**

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***10,215 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***170 L/s***
Technical Bulletin ISDTB-2014-02 fire flow cap		***167 L/s***

Fire Flow Calculations

As per Fire Underwriter's Survey Guidelines

PROJECT: Fernbank Crossing - Phase 5 **DATE:** August 22, 2018

JOB#: 108180-19

Townhome (4-Unit Block)

		[yes/no]			
C	**Coefficient related to type of construction**				
	◆ Wood frame	yes	1.5		
	◆ Ordinary construction		1		
	◆ Non-combustible construction		0.8		
	◆ Fire resistive construction (< 2 hrs)		0.7		
	◆ Fire resistive construction (> 2 hrs)		0.6		
	◆ Interpolation (Using FUS Tables)				
A	**Area of structure considered (m^2)**	***770***	<==>	**8,288 ft^2**	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***9,157 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	◆ Non-combustible		-25%		
	◆ Limited combustible	yes	-15%		
	◆ Combustible		0%		
	◆ Free burning		15%		
	◆ Rapid burning		25%		
				7,784 L/min	**(1)**
	Sprinkler Reduction				
	◆ Non-combustible - Fire Resistive (3	**no**	50%	***0 L/min***	**(2)**
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m		25%		
	3.1 - 10 m	**yes**	20%	**2 side**	40%
	10.1 - 20 m		15%		
	20.1 - 30 m	**yes**	10%	**1 side**	10%
	30.1- 45 m	**yes**	5%	**1 side**	5%
			Cumulative Total		**55%**
				4,281 L/min	
	Fire Wall Separation				
	◆ Number of Party Walls * 1000 L/min				
	(As per City of Ottawa Standard)			***4,281 L/min***	**(3)**

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***12,065 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***201 L/s***
Technical Bulletin ISDTB-2014-02 fire flow cap		***167 L/s***

Fire Flow Calculations

As per Fire Underwriter's Survey Guidelines

PROJECT: Fernbank Crossing - Phase 5 **DATE:** August 22, 2018

JOB#: 108180-19

Townhome (5-Unit Block)

C Coefficient related to type of construction

	[yes/no]	
◆ Wood frame	yes	1.5
◆ Ordinary construction		1
◆ Non-combustible construction		0.8
◆ Fire resistive construction (< 2 hrs)		0.7
◆ Fire resistive construction (> 2 hrs)		0.6
◆ Interpolation (Using FUS Tables)		

A Area of structure considered (m^2) *940* <==> **10,118 ft^2**

(All floors excluding Basement, under 2-Storeys)

F Required fire flow (L/min)

$F = 220\ C\ (A)^{0.5}$ ***10,118 L/min***

Occupancy hazard reduction of surcharge	[yes/no]		
◆ Non-combustible		-25%	
◆ Limited combustible	yes	-15%	
◆ Combustible		0%	
◆ Free burning		15%	
◆ Rapid burning		25%	
			8,600 L/min (1)

Sprinkler Reduction			
◆ Non-combustible - Fire Resistive (3	**no**	50%	***0 L/min*** (2)

Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
0 - 3 m		25%		
3.1 - 10 m	**yes**	20%	**1 side**	20%
10.1 - 20 m	**yes**	15%	**2 side**	30%
20.1 - 30 m		10%		
30.1- 45 m	**yes**	5%	**1 side**	5%
		Cumulative Total		**55%**
				4,730 L/min

Fire Wall Separation

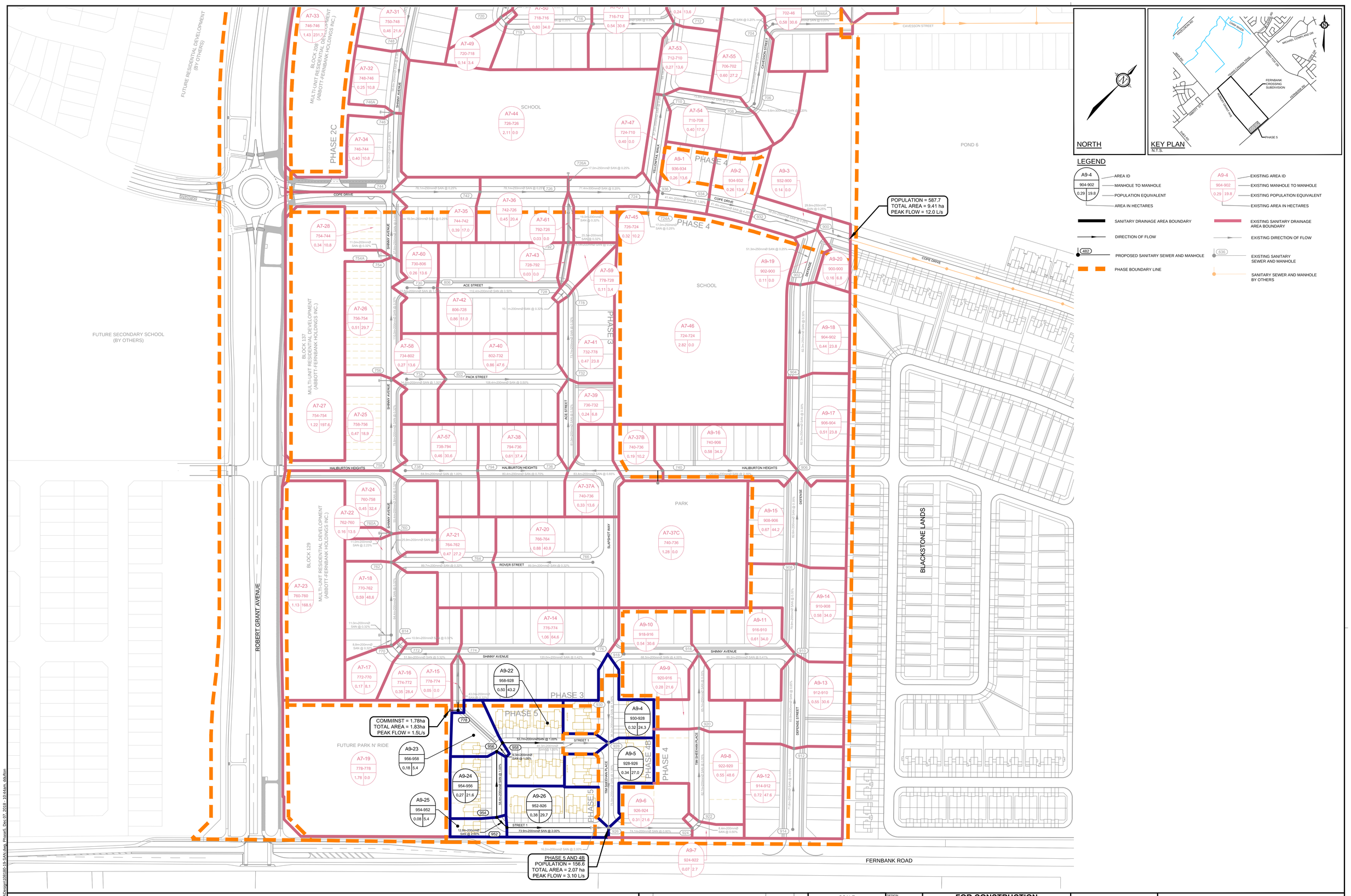
◆ Number of Party Walls * 1000 L/min

(As per City of Ottawa Standard) ***4,730 L/min*** (3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***13,330 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***222 L/s***
Technical Bulletin ISDTB-2014-02 fire flow cap		***167 L/s***

Appendix B: Drawings

108180-19-SAN
108180-19-STM
108180-19-WTR



NOTE:
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No.	REVISION	DATE	BY
1.	ISSUED FOR APPROVAL	DEC 7/18	MAB

SCALE 1:1250

1:1250
0 10 20 30 40 50

DESIGN LRW
CHECKED MAB
DRAWN DTD
CHECKED MAB
APPROVED JGR

FOR CONSTRUCTION

L.R. WILSON 100160065 LICENSED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

M.A. BISSETT LICENSED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

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Website www.novatech-eng.com

CITY OF OTTAWA
FERNBANK CROSSING - PHASE 5

SANITARY DRAINAGE AREA PLAN

PROJECT No. 108180-19
REV REV # 1
DRAWING No. 108180-19-SAN

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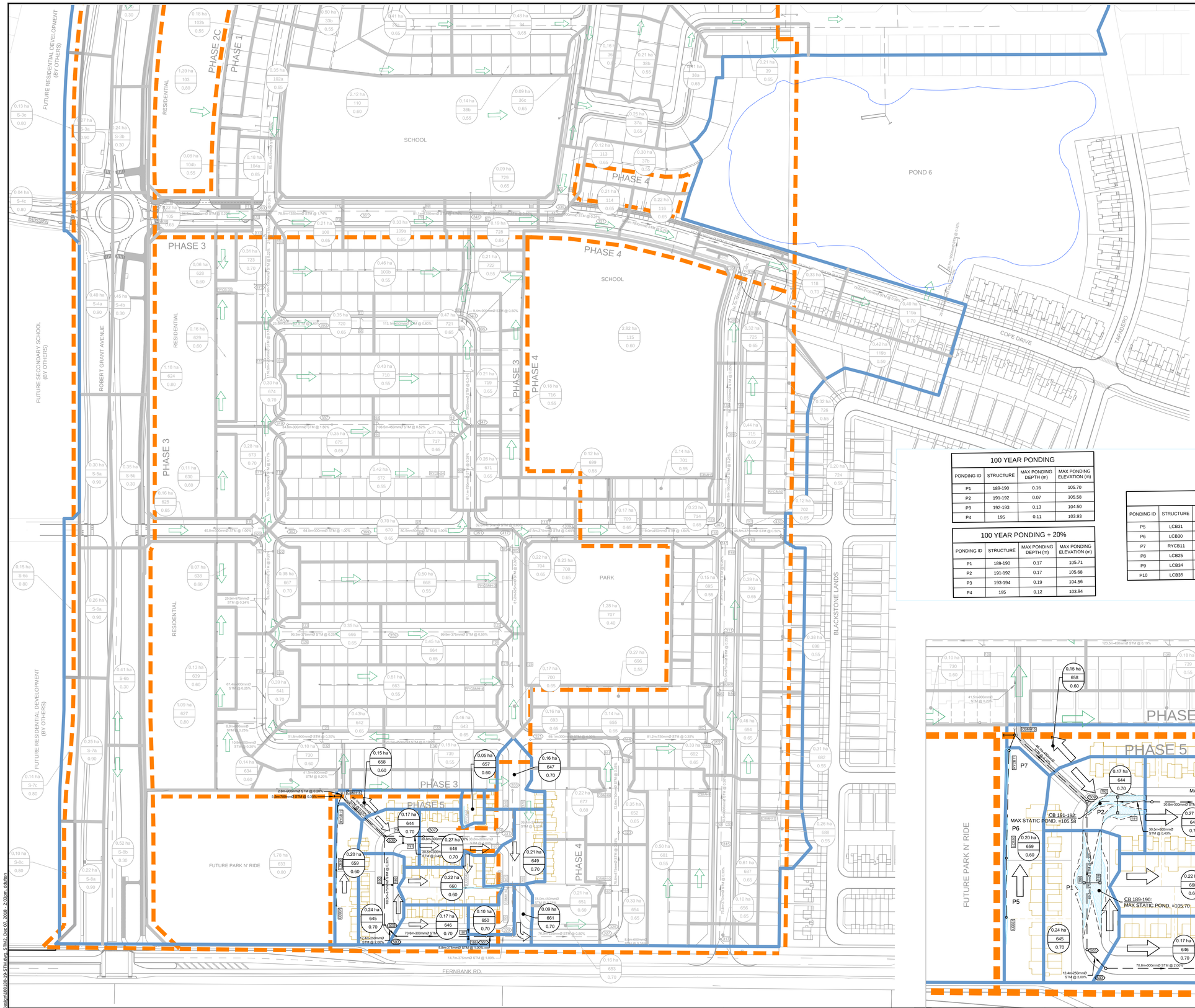
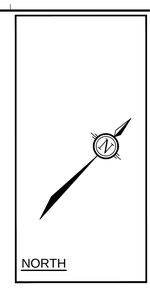
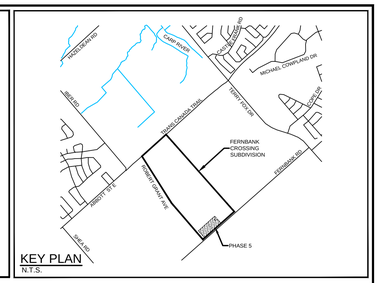






LEGEND

- 0.24 ha / 88a / 0.65 — PHASE 5 AREA (hectares) / PHASE 5 AREA ID / PHASE 5 RUN-OFF COEFFICIENT
- 0.24 ha / 88a / 0.65 — EXISTING DRAINAGE AREA (hectares) / EXISTING AREA ID / EXISTING RUN-OFF COEFFICIENT
- PROPOSED STORM DRAINAGE AREA BOUNDARY
- EXISTING STORM DRAINAGE AREA BOUNDARY
- 100 — PROPOSED STORM MANHOLE / SEWER AND FLOW DIRECTION
- 99 — PROPOSED ROAD CATCHBASIN
- MAJOR SYSTEM FLOW ROUTE
- 100 YEAR PONDING LIMIT
- 100 YEAR + 20% PONDING LIMIT

100 YEAR PONDING

PONDING ID	STRUCTURE	MAX PONDING DEPTH (m)	MAX PONDING ELEVATION (m)
P1	189-190	0.16	105.70
P2	191-192	0.07	105.58
P3	192-193	0.13	104.50
P4	195	0.11	103.93

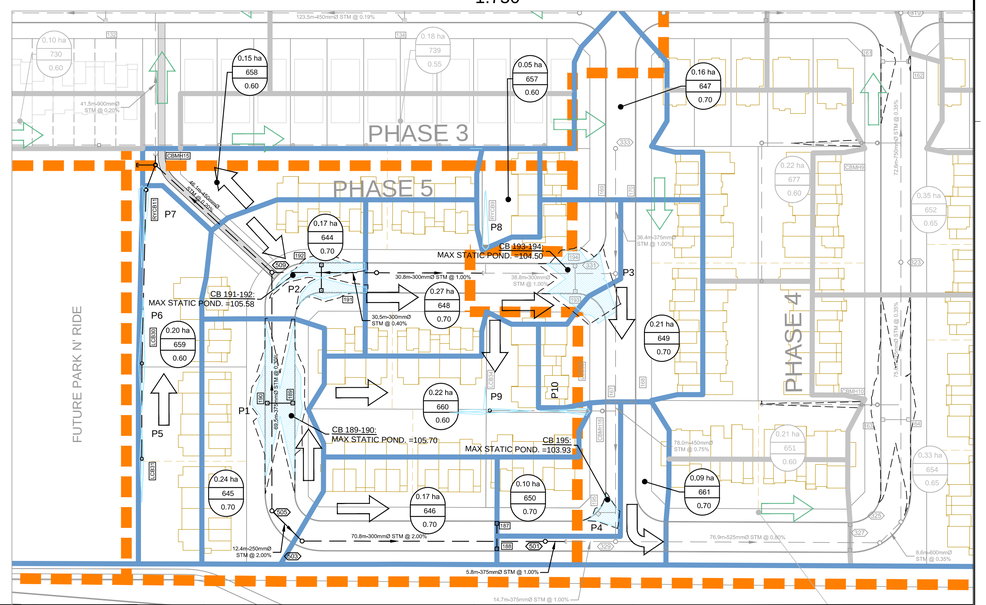
100 YEAR PONDING + 20%

PONDING ID	STRUCTURE	MAX PONDING DEPTH (m)	MAX PONDING ELEVATION (m)
P1	189-190	0.17	105.71
P2	191-192	0.17	105.68
P3	193-194	0.19	104.56
P4	195	0.12	103.94

REAR YARD PONDING

PONDING ID	STRUCTURE	MAX 100 YEAR PONDING DEPTH (m)	MAX 100 YEAR PONDING ELEVATION (m)	MAX 100 YEAR +20% PONDING DEPTH (m)	MAX 100 YEAR + 20% PONDING ELEVATION (m)
P5	LCB31	0.30	105.92	0.30	105.92
P6	LCB30	0.30	105.83	0.30	105.83
P7	RYCB11	0.30	105.47	0.30	105.47
P8	LCB25	0.30	105.12	0.30	105.12
P9	LCB34	0.20	104.47	0.20	104.47
P10	LCB35	0.20	104.36	0.20	104.36

PHASE 5
1:750



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SCALE 1:1250 (1:1250 0 10 20 30 40 50)

DESIGN LRW
CHECKED MAB
DRAWN DTD
CHECKED MAB
APPROVED JGR

FOR CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER — L. R. WILSON — 100160065 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — M.A. BISSETT — PROVINCE OF ONTARIO

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CITY OF OTTAWA
FERNBANK CROSSING - PHASE 5

STORM DRAINAGE AREA PLAN

PROJECT No. 108180-19
REV REV # 1
DRAWING No. 108180-19-STM

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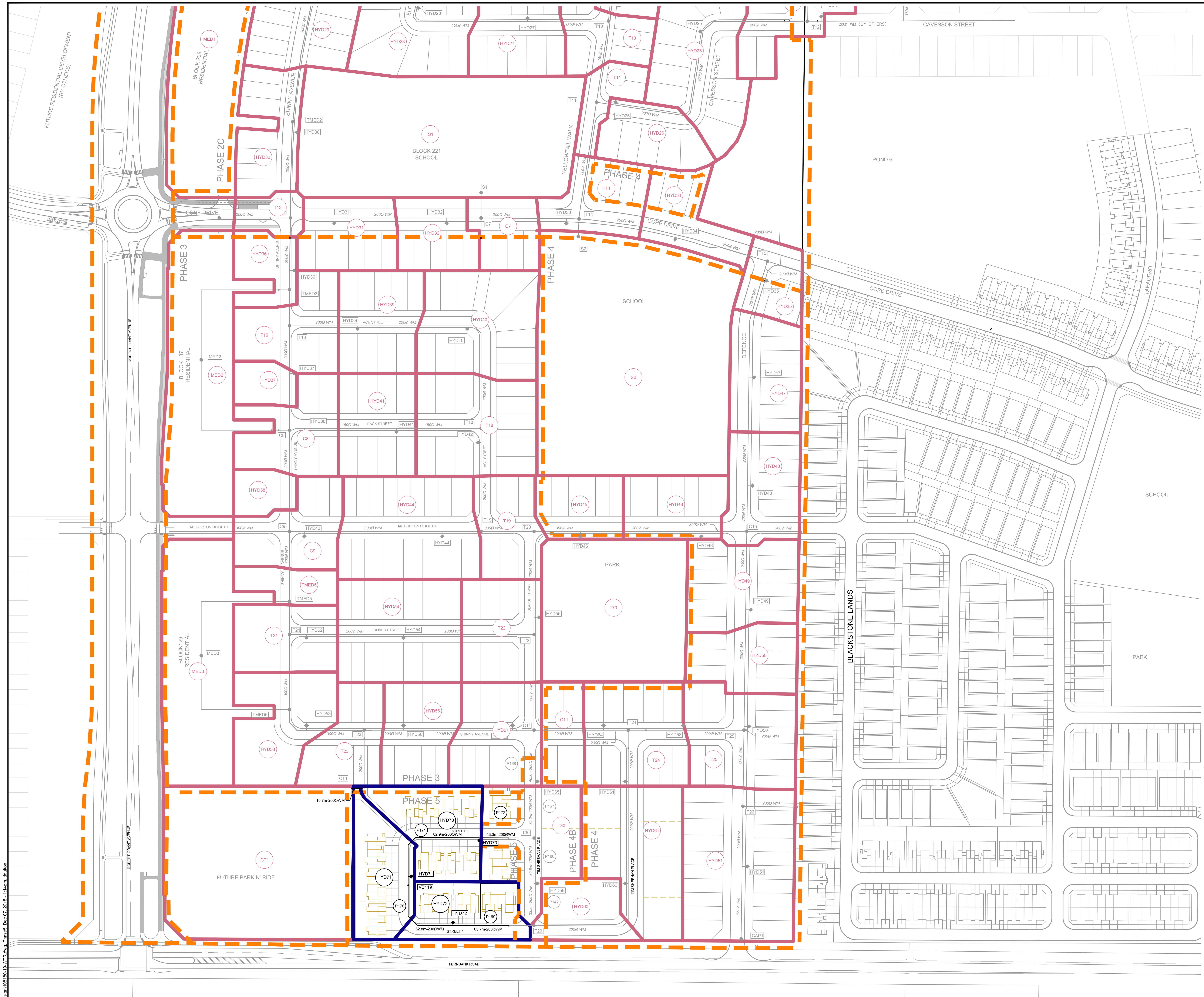

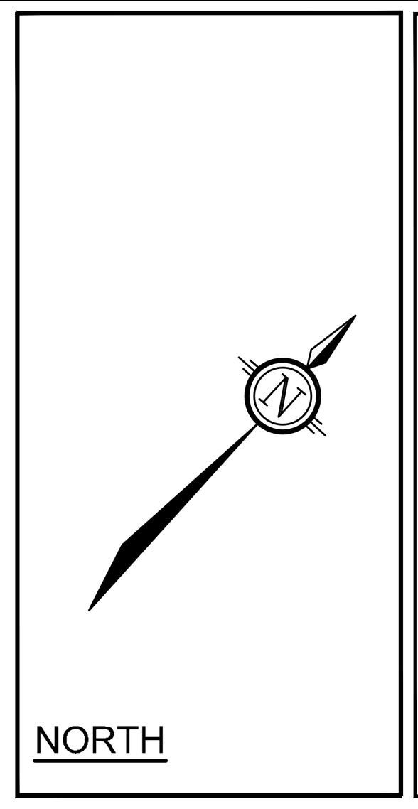

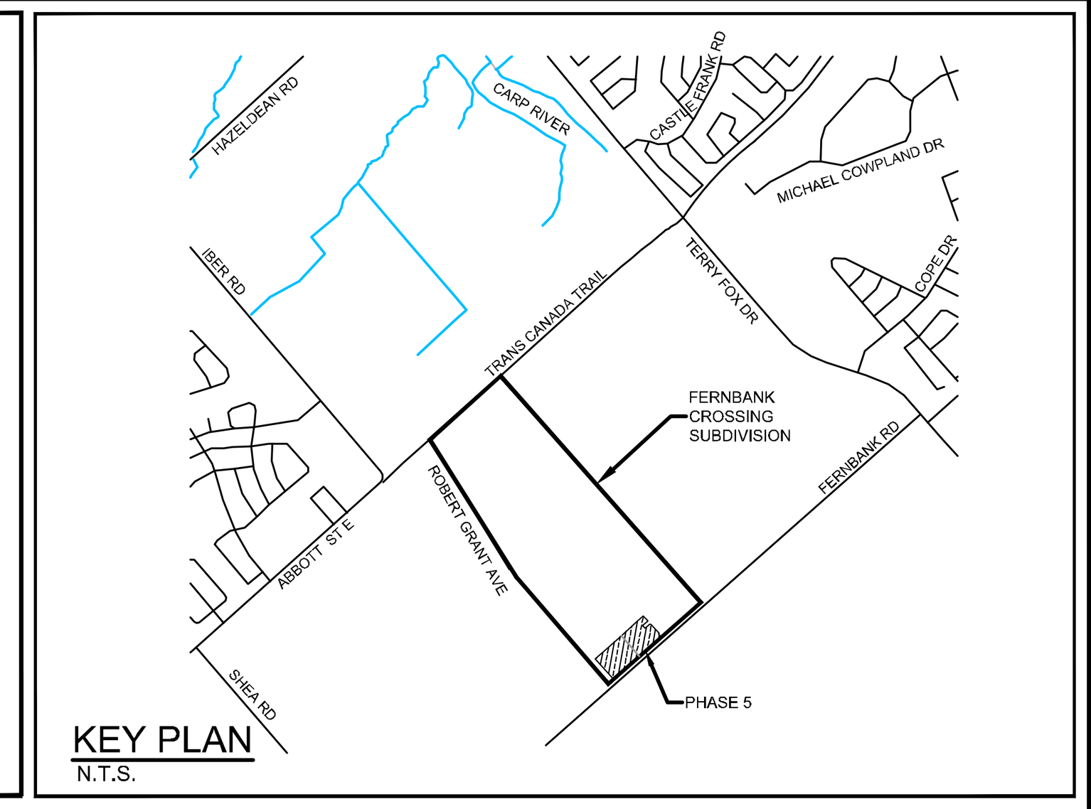

LEGEND

- C9 — PHASE 5 NODE ID
- C11 — EXISTING NODE ID
- 71.0-200Ø WM — PROPOSED WATERMAIN AND SIZE
- WATER SERVICE BOUNDARY
- WATERMAIN RESERVOIR (THEORETICAL)
- HYD2 — FIRE HYDRANT AND ID#
- T2 — PIPE NODE AND ID#
- PIPE REDUCER

WATERMAIN NODE TABLE

NODE ID	F/G ELEVATION	AVG. DAY DEMAND	MAX DAY	PEAK FLOW	FIRE FLOW
HYD59	104.30	0.000	0.000	0.000	167
HYD65	105.11	0.000	0.000	0.000	167
HYD70	105.09	0.175	0.438	0.963	167
HYD71	105.67	0.131	0.328	0.722	167
HYD72	105.33	0.120	0.301	0.662	167
T29	0.01	0.000	0.000	0.000	-
T30	104.57	0.208	0.520	1.143	-

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SCALE 1:1250

DESIGN LRW
CHECKED MAB
DRAWN DJD
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APPROVED JGR

FOR CONSTRUCTION

LICENSED PROFESSIONAL ENGINEER L. R. WILSON 100160065 PROVINCE OF ONTARIO

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CITY of OTTAWA
FERNBANK CROSSING - PHASE 5

WATERMAIN DISTRIBUTION PLAN

PROJECT No. 108180-19
REV REV # 1
DRAWING No. 108180-19-WTR