Site Servicing & Stormwater Management Brief

Canadian Tire Store No. 442

2501 Greenbank Rd.

Ottawa, Ontario

Table of Contents

List of Tables

List of Figures

List of Appendices

Drawings

1.0 INTRODUCTION

Parsons Inc. was retained by Canadian Tire Real Estate Limited to provide engineering services for a proposed expansion to their existing store #442 located at 2501 Greenbank Road in Ottawa, Ontario.

The proposed expansion involves an additional retail and warehouse area on the south-east side of the existing store, relocation of the garden centre, new seasonal soil compound and new e-commerce parking spaces. The expansion will impact only a certain part of the total site. The impacted site area is estimated at 0.20 ha.

The proposed work will require modifications to the existing storm sewer and the removal of the garden centre on the south-east side of the existing store. The new garden centre, e-commerce parking spaces and the new seasonal soil compound will be integrated within the existing parking lot area.

2.0 PURPOSE

This brief summarizes the impact of the proposed expansion on the existing site servicing, grading and drainage design. The erosion and sediment control measures to be undertaken during construction are also described.

Stormwater management items addressed include the following:

- Comparison between the existing and proposed runoff from the site.

3.0 EXISTING CONDITIONS

Design of the initial site was made by Bronte Engineering Limited in 2000. An expansion to the south-east of the original store was previously designed in 2006 by Delcan (now Parsons Inc.). Improvements to stormwater management of the site was also made in 2014 by Novatech Engineering Consultants Ltd. to mitigate flooding onsite and to provide additional stormwater storage. New storm chambers were installed under the existing parking lot on the south-west side of the property along Greenbank Rd.

The runoff from all drainage areas is captured through the existing storm structures. The site stormwater discharge point is located on the south corner of the property. Site stormwater is exiting the site through a 180mm x 180mm diamond shape orifice ICD plate. As per Novatech report & plan in 2014, a check valve (flap gate) was proposed on the 300mm inlet pipe to prevent municipal storm sewer back flow on site.

4.0 PROPOSED DEVELOPMENT

As shown on the Architectural Site Plan, the proposed development will consist of the addition of a retail and warehouse area on the south-east side of the existing store, relocation of the garden centre, new seasonal soil compound and new e-commerce parking spaces.

The existing garden centre will be relocated to accommodate the building expansion. Existing catch basins and storm sewers, including a connection to the roof drains, located under the existing garden centre will be removed. The new roof drain connection will be accommodated by a new connection to the existing storm maintenance hole near the new building expansion. No grading modification are anticipated within the existing parking lot area to accommodate the new garden centre, soil compound and e-commerce parking spaces. However, a new grass swale is proposed south of the building expansion to capture any water runoff coming from the back of sidewalk along Strandherd Dr.

All of the remaining site will remain in its existing condition.

5.0 STORMWATER MANAGEMENT PLAN

As mentioned earlier, only a small portion of the existing site is impacted by the new building expansion. The estimated area impacted by the proposed works is 0.20 ha. The following table illustrates the comparison between the existing and proposed runoff coefficient of the impacted area using the following runoff coefficients:

- Landscaped surfaces (grass, trees, shrubs, etc.) C = 0.20
- Impervious surfaces (asphalt, concrete, pavers, rooftops, etc.) C = 0.90

Table 1 : Comparison Between Existing and Proposed Runoff Coefficient

	Existing Condition		Proposed Expansion	
	Area (ha)	Runoff Coefficient	Area (ha)	Runoff Coefficient
Landscape Areas	0.02	0.20	0.02	0.20
Impervious Areas (asphalt, concrete)	0.18	0.90	0.06	0.90
Building Area (roof)	-	0.90	0.12	0.90
Total	0.20	0.83	0.20	0.83

As shown in the previous table, the proposed building expansion is replacing impervious areas. Thus, the post-development runoff coefficient is the same as existing condition. No additional runoff is generated by the store expansion. Additionally, the existing StormTech Chambers located at the south-west end of the parking lot will provide storage for excessive runoff which is also controlled by an ICD diamond shape orifice 180mm x 180mm before exiting the site. A flap gate was also installed on the 300mm storm sewer pipe that outlet the site to prevent overflow from municipal storm sewer on site, see **Drawing C102** for more details. Stormwater quality control for this site is achieved via the existing Kennedy Burnett storm sewer management pond, therefore no additional treatment is required.

6.0 STORM SEWERS AND SWM SYSTEM

An existing storm sewer at the south side of the building needs to be removed due to the new building footprint. A new swale with a perforated subdrain on the south side of the new building addition will be added as well as a new rear yard catch basin to receive the subdrain and the swale. New storm sewer pipe and a storm sewer maintenance hole will also be added before re-connecting to an existing storm maintenance hole in the parking lot.

As previously mentioned, and existing roof drain will need to be removed to accommodate the proposed building extension. A new roof drain will therefore be located at the existing south-west side of the building and connected to an existing storm sewer maintenance hole in the parking lot.

Details including pipe lengths, sizes, materials, inverts elevations and structure types are shown on **Drawing C102**.

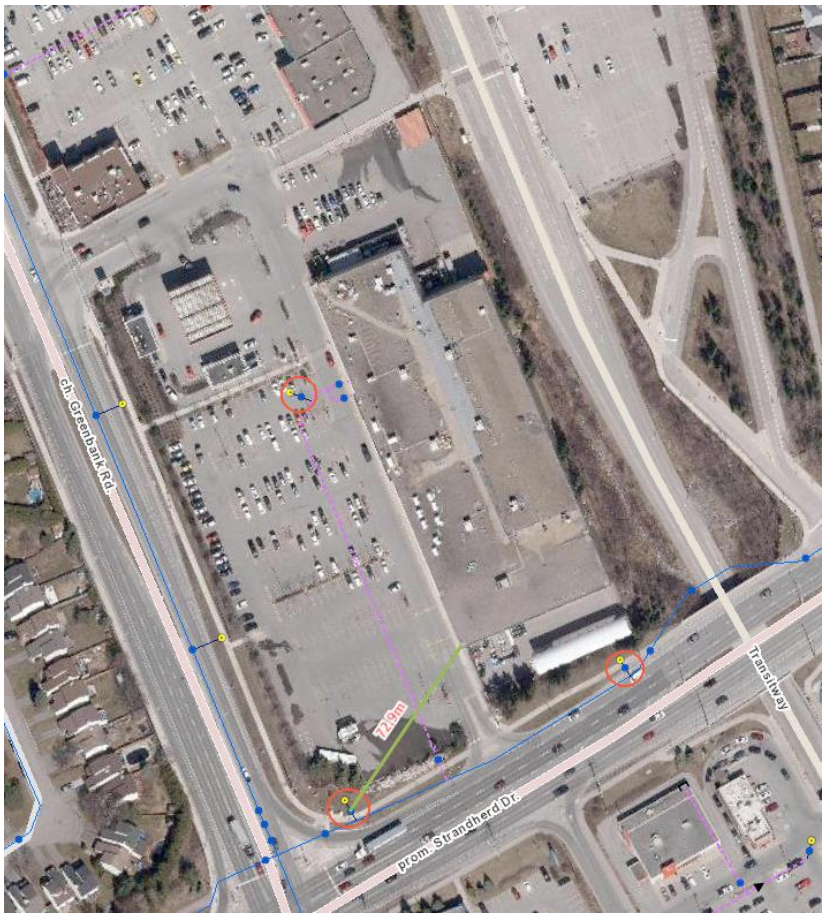
7.0 SANITARY SEWER

The building addition will be serviced internally from the existing building sanitary system. The peak sanitary flow for the building with the addition of the new expansion is calculated to be **1.98 L/s**, including infiltration. The increased sanitary load calculations can be found in Appendix B. The assessment of the existing sanitary service connection shows that the capacity is adequate for the expanded building. The Sanitary Sewer Computation Sheet is included in **Appendix A**. Details concerning the existing pipe lengths and locations are shown on the site servicing plan.

8.0 WATER SERVICING

Water servicing and fire protection for the proposed building addition will be provided by the existing building service. The existing 200mm service connection, off the existing 400mm watermain on Standherd Dr. will provide both the domestic and sprinkler demands. The exterior fire protection will be provided by a combination of three existing fire hydrants around the site, all located withing 75m of the buidling as shown on the figure below.

Figure 1 : Fire Hydrant Locations



The water demands for the existing and proposed building are listed in **Table 2**. The fire flow was calculated using the Fire Underwriters Survey (FUS, 2020) method. As the table below indicates, the fire flow demand will remain the same after the proposed store addition and the average daily demand will also remain under 50m^3/day (0.59L/s). Therefore, no modification to the existing on-site water service and exterior fire protection is required. Calculation details can be found in **Appendix B** and the boundary conditions received from the City are shown in **Appendix C**. Details regarding the existing watermain service connection pipe size and location are shown on **Drawing C102.**

Table 2 : Building Water Demands and Fire Flow

	Average Daily Demand (L/s)	Max Daily Demand (L/s)	Peak Hourly Demand (L/s)	Fire Flow Demand (L/s)	Max Daily + Fire Flow Demand (L/s)
Existing Store	0.28	0.42	0.75	150	150.42
Proposed Store	0.31	0.47	0.84	150	150.47

9.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

To mitigate the impacts due to erosion and sedimentation during construction, erosion and sediment control measures shall be installed and maintained throughout the duration of construction.

Measures shall only be removed once the construction activities are complete, and the site has stabilized.

The measures will include:

- Siltsack® shall be installed between the frame and cover of existing and new catchbasins and maintenance holes, to minimize sediments entering the storm drainage system.
- Light Duty Silt Fence Barriers placed around the perimeter of the site where necessary, installed and maintained according to OPSS 577 and OPSD 219.110.

10.0 CONCLUSIONS

No additional stormwater management is required for this site as the building expansion does not generate additional runoff. Minimal modifications to the existing storm sewer are required due to the new building footprint. The existing StormTech chambers located at the south-west end of the parking will provide storage for large storm events. No on-site stormwater treatment is required as the required treatment is achieved via the existing Kennedy Burnett Pond located downstream from our site.

The water servicing of the building addition will be provided from the existing building plumbing system and the existing 200mm service. The proposed building fire flow was estimated at **150 L/s** which is the same as the existing building fire flow and the average daily demand is under 50m^3/day. Thus, no modification to the existing water servicing and exterior fire protection is required.

The sanitary servicing of the building addition will be provided from the existing building plumbing system. The peak sanitary flow for the proposed building, including infiltration, is calculated to be **1.98 L/s**. The existing building sanitary service connection is adequate to carry the additional sanitary load.

Erosion and sediment control measures will minimize downstream impacts due to construction activities.

We look forward to receiving approval of this brief and the appended plans from the City of Ottawa in order to proceed with construction of the site.

Prepared by:

Patrick Charlebois, EIT

Reviewed by:

LICENCED PROFESSIONAL ENGINEER
M.J. THEINER
100130636
05/04/2023
PROVINCE OF ONTARIO

Mathew Theiner, P.Eng., ing.

Appendix A : Sanitary Sewer Computation Forms

SANITARY SEWER DESIGN SHEET

Drainage Area	From	To	Peak Flow Q (L/sec)	Sewer Data										REMARKS
				Type of Pipe	Pipe Dia. nom. (mm)	Pipe Dia. actual (mm)	Slope (%)	Length (m)	Capacity full (L/sec)	Velocity full (m/sec)	Velocity actual (m/sec)	Time of Flow (min)	Q(d) / Q(f)	
	CTC Site	*Public San Sewer*	1.98	PVC	200	203.2	0.5	150.0	24.2	0.75	0.40	6.21	0.08	

Manning's n = **0.013**

Design:	B. Villeneuve
Check:	M. Theiner
Date:	March, 2023

Project Name:	Barrhaven Canadian Tire
Parsons Project #:	478461
Client:	Canadian Tire Realty
Client Project #:	

Appendix B : Sanitary Load and Fire Flow

SANITARY DESIGN FLOWS

Area	WAREHOUSE					OFFICE					AUTOMOTIVE SERVICE CENTRE				COMMERCIAL/RETAIL			TOTAL	INFILTRATION			Total
	Site Area (ha)	Warehouse Area (m^2)	Capita (1/90m^2)	Peak Factor	Peak Flow (L/s)	Site Area (ha)	Office Area (m^2)	Capita (1/25m^2)	Peak Factor	Peak Flow (L/s)	Number of Bays	Capita	Peak Factor	Peak Flow (L/s)	Retail Area (m^2)	Peak Factor	Peak Flow (L/s)	Peak Flow (L/s)	Site Areas (ha)	Infiltration Allowance (L/s/ha)	Infilt. Flow (L/s)	Total Peak Flow (L/s)
Existing Store (C.T. Store # 442)																			3.03	0.33	1.00	1.00
Retail															5,181	1.5	0.22	0.22				0.22
Office							460	18	1.5	0.02								0.02				0.02
Warehouse		3,116	35	1.5	0.05													0.05				0.05
Automotive Service Centre											15	18	1.5	0.02				0.02				0.02
Corner Store															107	1.5	0.005	0.00				0.00
Car Wash																		0.63				0.63
																					Total	**1.94**
Proposed Expansion (C.T. Store # 442)																			3.03	0.33	1.00	1.00
Retail															5,832	1.5	0.25	0.25				0.25
Office							411	16	1.5	0.02								0.02				0.02
Warehouse		3,675	41	1.5	0.05													0.05				0.05
Automotive Service Centre											15	18	1.5	0.02				0.02				0.02
Corner Store															107	1.5	0.005	0.00				0.00
Car Wash																		0.63				0.63
																					Total	**1.98**

Design:	BV	**Project:**	Barrhaven Canadian Tire Ottawa, Ontario
Check :	MT	**Location:**	2501 Greenbank Rd Ottawa, Ontario
Dwg reference:		**Project # :**	478461
		Date:	March, 2023
		Sheet:	1 of 1

Average Daily Demands

(Based on City of Ottawa *Sewer Design Guidelines 2012* and *MOE Water Design Guidelines*)

Average Residential Daily Flow =	280	L/p/d
Institutional Flow =	28,000	L/ha/d
Commercial Flow =	28,000	L/ha/d
Light Industrial Flow =	35,000	L/ha/d
Heavy Industrial Flow =	55,000	L/ha/d
Hotel Daily Flow =	225	L/bed/d
Office/Warehouse Daily Flow =	75	L/empl/d
Shopping Centres =	2,500	L/(1000m^2/d)

Peak Factors

Commercial =	1.5	if commercial contribution > 20%, otherwise		1.0
Institutional =	1.5	if institutional contribution > 20%, otherwise		1.0
Industrial =		per Appendix 4-B.0 Graph		
Residential :		Harmon Equatio	1 + (14/(4+(Capita/1000) ^ 0.5))*8	
		min = 2	max = 4	

Infiltration allowance (dry weather)	0.05	L/s/ha
Infiltration allowance (wet weather)	0.28	L/s/ha
I/I (total)	0.33	L/s/ha

Population Densities

Average suburban residential dev.	60	p/ha
Single family	3.4	p./unit
Semi-detached	2.7	p./unit
Duplex	2.3	p./unit
Townhouse	2.7	p./unit
Appartment average	1.8	p./unit
Bachelor	1.4	p./unit
1 Bedroom	1.4	p./unit
2 Bedrooms	2.1	p./unit
3 Bedrooms	3.1	p./unit
Hotel room, 18 m2	1	p./unit
Restaurant, 1 m2	1	p./unit
Office	1	p/25m^2
Warehouse	1	p/90m^2
Automotive Service Centre, per bay	1	p/bay (plus management)
Car wash	40gallons per wash, 4mins wash, 10GPM, .0.63L/s	

Canadian Tire Barrhaven - Estimated Water Demands

Area	Units	Population	Gross Floor Area (m2)	Average Daily Demand (ADD) (L/s)	Maximum Daily Demand (MDD) (L/s)	Peak Hourly Demand (PHD) (L/s)	Fire Flow (FF) (L/s)	MDD + FF (L/s)
Existing Canadian Tire Store								
Shopping Centre			9,565	0.28	0.42	0.75	150	150.42
Proposed Canadian Tire Store								
Shopping Centre			10,726	0.31	0.47	0.84	150	150.47

Average Daily Demand

Based on Ottawa Design Guidelines - Water Distribution, 2010 and MOE Design Guidelines for Drinking-Water Systems, 2008

Average Residential Daily Flow =	350	L/p/d
Institutional Flow =	28,000	L/gross ha/d
Commercial Flow =	28,000	L/gross ha/d
Light Industrial Flow =	35,000	L/gross ha/d
Heavy Industrial Flow =	55,000	L/gross ha/d
Hotel Daily Flow =	225	L/bed/d
Office/Warehouse Daily Flow =	75	L/person/d
Office/Warehouse Daily Flow =	8.06	L/m2/day
Restaurant (Ordinary not 24 Hours) =	125	L/seat/d
Restaurant (24 Hours) =	200	L/seat/d
Shopping Centres =	2,500	L/(1000m^2/d)
Amenity Area =	5	L/m2/d

Maximum Daily Demand

Residential =	2.5 x Average Daily Demand
	4.9 x Average Daily Demand **
Industrial =	1.5 x Average Daily Demand
Commercial =	1.5 x Average Daily Demand
Institutional =	1.5 x Average Daily Demand

Peak Hourly Demand

Residential =	2.2 x Maximum Daily Demand
	7.4 x Maximum Daily Demand **
Industrial =	1.8 x Maximum Daily Demand
Commercial =	1.8 x Maximum Daily Demand
Institutional =	1.8 x Maximum Daily Demand

Canadian Tire Barrhaven - Fire Demand Calculations

Building	Type of Construction C	Total Floor Area (m2) A	Fire Flow (min. 2,000) (L/min) F	Adjusted (nearest 1,000) (L/min)	Occupancy Factor O	Reduction / Increase due to Occupancy	Fire Flow with Occupancy (min. 2,000) (L/min)	Sprinklers Factor S	Reduction due to Sprinklers (L/min)	Exposure Factor % E	Increase due to Exposure (L/min)	Fire Flow (L/min)	Roof Contribution (L/min) R	Required Fire Demand: Adjusted to the nearest 1000 (min. 2,000, max. 45,000) (L/min) F	Required Fire Demand: Minimum 33 (L/s)
Existing CT	0.8	9,565	17,213	17,000	0%	0	17,000	50%	8,500	0%	0	9,000	0	9,000	150
Proposed CT	0.8	10,726	18,228	18,000	0%	0	18,000	50%	9,000	0%	0	9,000	0	9,000	150

References

Reference: *Water Supply for Public Fire Protection , 2020 by Fire Underwriters Survey (FUS) and Ottawa Design Guidelines - Water Distribution, July 2010* and subsequent Technical Bulletins

C Type of Construction

Wood Frame (Type V)	1.5
Mass Timber (Type IV-A) - Encapsulated Mass Timber	0.8
Mass Timber (Type IV-B) - Rated Mass Timber	0.9
Mass Timber (Type IV-C) - Ordinary Mass Timber	1.0
Mass Timber (Type IV-D) - Unrated Mass Timber	1.5
Ordinary Construction (Type III also known as joisted masonry)	1.0
Non-Combustible Construction (Type II - minimum 1 hour fire resistance rating)	0.8
Fire resistive Construction (Type I - minimum 2 hour fire resistance rating)	0.6

A Total Effective Floor Area (m ^{2})

Buildings Classified with a Construction Coefficient from 1.0 to 1.5

100% of all Floor Areas

Buildings Classified with a Construction Coefficient below 1.0

Vertical Openings Unprotected
- Two (2) Largest Adjoining Floor Areas
- Additional Floors (up to eight (8)) at 50%

Vertical Openings Properly Protected
- Single Largest Floor
- Additional Two (2) Adjoining Floors at 25%

High One Storey Building

When a building has a large single storey space exceeding 3m in height, the number of storeys to be used in determining the total effective area depends upon the use being made of the building.

Subdividing Buildings (Vertical Firewalls)

Minimum two (2) hour fire resistance rating and meets National Building Code requirements.

- Up to 10% can be applied if there is severe risk of fire on the exposed side of the firewall due to hazard conditions.
- An exposure charge of up to 10% can be applied if there are unprotected openings in the firewall

Basement

Basement floor excluded when it is at least 50% below grade.

Open Parking Garages

Use the area of the largest floor.

O Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

- Table 3 provides recommended Occupancy and Contents Adjustment Factors for Example Major Occupancies from the National Building Code of Canada.
- Adjustment factors should be adjusted accordingly to the specific fore loading and situation that exists in the subject building.
- Values can be interpolated from the examples given considering fire loading and expected combustibility of contents if the subject building is not listed.
- Values can be modified by up to 10% (+/-) depending on the extent to which the fire loading is unusual for the building.
- Buildings with multiple major occupancies should use the most restrictive factor or interpolate based on the percentage of each occupancy and its associated fire loading.

Table 3 Values for Subject Building

Group:	F
Division:	3
Description of Occupancy:	Storage Garage including Open Air Parking Garage
Occupancy and Contents:	Combustible
Adjustment Factor:	0%

R Roof

Shake Roof	2,000 to 4,000 L/min	additional should be added to the fire flow
Wood Shingle	2,000 to 4,000 L/min	additional should be added to the fire flow

F Fire Flow (L/Min)

220*C*(A^0.5)

S Sprinklers

	Complete Coverage	Partial Coverage
Automatic Sprinklers NFPA Standards	30%	30% * x%
Standard Water Supply	10%	10% * x%
Full Supervision	10%	10% * x%

(x%: percentage of total protected floor area)

Additional Reductions for Community Level Automatic Sprinkler Protection of Area

Buildings located within communities or subdivisions that are completely sprinkler protected may apply up to a maximum additional 25% reduction in required fire flows beyond the normal maximum of 50% reduction for sprinkler protection of an individual building.

Adjustment of Sprinkler Reductions for Community Level Oversight of Sprinkler Maintenance, Testing, and Water Supply Requirements

The reduction in required fire flow for sprinkler protection may be reduced of eliminated if:

- The community does not have a Fire Prevention Program that provides a system of ensuring that the fire sprinkler systems are inspected, tested, and maintained in accordance with NFPA 25
- The community does not maintain the pressure and flow rate requirements for fire sprinkler installations, or otherwise allows the flow rates and pressure levels that were available during sprinkler system design to significantly degrade, increasing the probability of inadequate water supply for effective sprinkler operation.

E Exposure

The maximum exposure adjustment that can be applied to a building is 75% when summing the percentages of all sides of the building.

Separation Distance (m)	Maximum Exposure Adjustment	N	E	S	W
0 to 3	25%				
3.1 to 10	20%				
10.1 to 20	15%				
20.1 to 30	10%				
Greater than 30	0%				

Table 6: Exposure Adjustment Charges for Subject Building Considering Construction Type of Exposed Building Face

Distance to the Exposure (m)	Length-Height Factor of Exposing Building Face	Type V	Type III-IV[2]	Type III-IV[3]	Type I-II[2]	Type I-II[3]
0 to 3	0-20	20%	15%	5%	10%	0%
	21-40	21%	16%	6%	11%	1%
	41-60	22%	17%	7%	12%	2%
	61-80	23%	18%	8%	13%	3%
	81-100	24%	19%	9%	14%	4%
	Over 100	25%	20%	10%	15%	5%
3.1 to 10	0-20	15%	10%	3%	6%	0%
	21-40	16%	11%	4%	7%	0%
	41-60	17%	12%	5%	8%	1%
	61-80	18%	13%	6%	9%	2%
	81-100	19%	14%	7%	10%	3%
	Over 100	20%	15%	8%	11%	4%
10.1 to 20	0-20	10%	5%	0%	3%	0%
	21-40	11%	6%	1%	4%	0%
	41-60	12%	7%	2%	5%	0%
	61-80	13%	8%	3%	6%	1%
	81-100	14%	9%	4%	7%	2%
	Over 100	15%	10%	5%	8%	3%
20.1 to 30	0-20	0%	0%	0%	0%	0%
	21-40	2%	1%	0%	0%	0%
	41-60	4%	2%	0%	1%	0%
	61-80	6%	3%	1%	2%	0%
	81-100	8%	4%	2%	3%	0%
	Over 100	10%	5%	3%	4%	0%
Over 30m	All Sizes	0%	0%	0%	0%	0%

[2] with unprotected openings

[3] without unprotected openings

Automatic Sprinkler Protection in Exposed Buildings

- If the exposed building is fully protected with an automatic sprinkler system (see note Recognition of Automatic Sprinkler), the exposure adjustment charge determined from Table 6 may be reduced by up to 50% of the value determined.

Automatic Sprinkler Protection in both Subject and Exposed Buildings

- If both the subject building and the exposed building are fully protected with automatic sprinkler systems (see note Recognition of Automatic Sprinkler), no exposure adjustment charge should be applied.

Exposure Protection of Area Between Subject and Exposed Buildings

- If the exposed building is fully protected with an automatic sprinkler system (see note Recognition of Automatic Sprinkler), and the area between the buildings is protected with an exterior automatic sprinkler system, no exposure adjustment charge should be applied.

Reduction of Exposure Charge for Type V Buildings

- If the exposed building face of a Type V building has an exterior cladding assembly with a minimum 1 hour fire resistive rating, then the exposure charge may be treated as a Type III/IV building for the purposes of looking up the appropriate exposure charge in Table 6.

Appendix C : Site Boundary Condition

Boundary Conditions
2501 Greenbank Road

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	19	0.31
Maximum Daily Demand	28	0.47
Peak Hour	50	0.84
Fire Flow Demand #1	9,000	150.00

Location

Results

Existing Conditions (Pressure Zone 3SW)

Connection 1 – Strandherd Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.8	80.0
Peak Hour	143.7	61.4
Max Day plus Fire Flow	133.8	47.3

[1] Ground Elevation = 100.5 m

Future Conditions (Pressure Zone SUC)

Connection 1 – Strandherd Dr.

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	146.9	65.9
Peak Hour	144.4	62.4
Max Day plus Fire Flow	145.1	63.3
[1] Ground Elevation =	101.2	m

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.

Appendix D : Stormwater Management Improvements Report Novatech Engineering Consultants Ltd.

CANADIAN TIRE – BARRHAVEN

STORMWATER MANAGEMENT IMPROVEMENTS REPORT

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.
240 Michael Cowpland Dr. - Suite 200
Ottawa, Ontario
K2M 1P6

File No.: 113199
Report Reference No.: R-2014-072

May 28, 2014

NOVATECH
ENGINEERING
CONSULTANTS LTD.

May 28, 2014

Keller Engineering Associates Inc.
1390 Prince of Wales Drive, Suite 107
Ottawa, ON, K2C 3N6

Attention: Mr. Adam Archambault

Dear Sir:

Reference: Canadian Tire – Barrhaven Ontario
Stormwater Management Improvements Report
Our File No.: 113199

Enclosed herein is the Stormwater Management Improvements Report for improving the stormwater management strategy for the existing Canadian Tire in Barrhaven Ontario. This report is submitted to review the existing conditions and presents a stormwater management strategy for mitigating the existing flooding issues for the site.

Trusting this report is adequate for your purposes. Should you have any questions, or require additional information, please contact us.

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

Michael Petepiece, P.Eng.
Project Manager

Suite 200, 240 Michael Cowpland Dr., Ottawa ON K2M 1P6 Tel: (613) 254-9643 Fax: (613) 254-5867 www.novatech-eng.com

Consulting Engineers & Planners

TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

List of Attached Drawings

External Drawings:

1) Detailed Topographic Survey
   (Fairhall Moffatt & Woodland Ltd. October 17, 2013)
2) Servicing and Grading Plan for Proposed Canadian Tire
   (Bronte Engineering Limited, February, 2000)
3) Servicing Plan for Canadian Tire Gas Bar
   (Trow Associates Inc., February, 2003)
4) Site Servicing and Grading Plan for South Expansion to Canadian Tire
   (Delcan, March, 2006)
5) General Plan of Services for Village Square Plaza
   (Cumming Cockburn Limited, December 2000)
6) Site Servicing Plan for Village Square Plaza Expansion
   (Novatech Engineering Consultants Ltd., December 2010)
7) Plan and Profiles for Greenbank Road
   (Regional Municipality of Ottawa-Carleton, July 1990)
8) Strandherd Drive Road Reconstruction
   (McCormick Rankin Consulting Engineers, May 1992)

Internal Drawings:

1) 113199-SWM (storm drainage area plan)
2) 113199-STM-Existing (existing storm sewer network)
3) 113199-GP (proposed general plan of services)
4) 113199-DET (notes and details)
5) 113199-TCP (tree conservation plan)
6) 113199-L (landscape plan)

1.0 INTRODUCTION

This report outlines proposed improvements to the existing storm drainage infrastructure at the Canadian Tire retail centre and gas bar in Barrhaven, Ontario to reduce the frequency and extent of surface flooding during moderate to large storm events. This report identifies the primary causes of flooding, and illustrates the extent of flooding under existing conditions (based on model results) for various design rainfall events.

1.1 Location

The Canadian Tire site is located in Barrhaven (Ottawa), Ontario northwest of the intersection of Strandherd Drive and Greenbank Road, as shown in **Figure 1** below. The site shares an entrance off of Greenbank Road with Village Square Plaza, an existing retail plaza to the north of the Canadian Tire. An OC Transpo Transitway bounds the site to the east.

Figure 1: Aerial Photo of the Canadian Tire Site (Google, 2013)

1.2 Phasing

The current Canadian Tire site was developed in three phases, as outlined in the design reports prepared for each phase:

- Canadian Tire Building and Parking Lot *(Bronte Engineering Limited, February 2000)*
- Canadian Tire Gas Bar *(Trow Associates Inc., February 2003)*
- South Extension of the Existing Canadian Tire Building *(Delcan, March 2006)*

The initial site was designed in 2000 by Bronte Engineering Limited and has been modified twice to account for the development of the Gas Bar and expansion of the existing Canadian Tire building to the south. The original storm sewer design was modified to accommodate construction of the Canadian Tire Gas Bar (2003) and south extension (2006), but pipe sizes and slopes for both phases are similar to those specified in the original design by Bronte Engineering Limited.

The construction of the Gas Bar included removing storm sewers underneath the footprint of the Gas Bar to make room for the gas pumps, the underground fuel tanks, the car wash and the kiosk. The catchbasin manholes were relocated and a new sewer system was installed.

The construction of Strandherd Drive east of Greenbank Road provided the opportunity to expand the Canadian Tire building footprint to the south. The building expansion included extending the outlet pipe for the roof drains and relocating the existing catchbasins and catchbasins manholes within the footprint of the expansion.

2.0 SWM CRITERIA

The proposed storm drainage improvements to alleviate the existing surface flooding will adhere to the stormwater management criteria previously established in the following documents:

- Canadian Tire – Stormwater Management Report
  (Bronte Engineering Limited, February 18, 2000)
- Village Square Plaza – Stormwater Management Report
  (Cumming Cockburn Limited, March 5, 2001)
- Village Square Plaza Expansion – Stormwater Management Report
  (Novatech Engineering Consultants Limited (February 18, 2010)
- City of Ottawa Sewer Design Guidelines (October 2012)

2.1 Allowable Release Rate

Based on the storm sewer design sheets provided in the Stormwater Management Report for Village Square Plaza (**Appendix B**), the Canadian Tire site was allocated a release rate of 160L/s. The outlet manhole from the Canadian Tire Site (MH 16) includes a diamond shaped 180mm x 180mm orifice plate installed in a slide gate as shown in **Figure 2a**. The 375mm outlet pipe downstream of the orifice plate is sloped at 0.5% and connects to a catchbasin manhole installed on Greenbank Road. The rating curve for this orifice (**Figure 2b)**, indicates that the depth of water in the manhole with the orifice plate (MH16) will need to be at the ground surface to achieve a release rate of 160L/s.

Figure 2a: Gate/Orifice in MH16

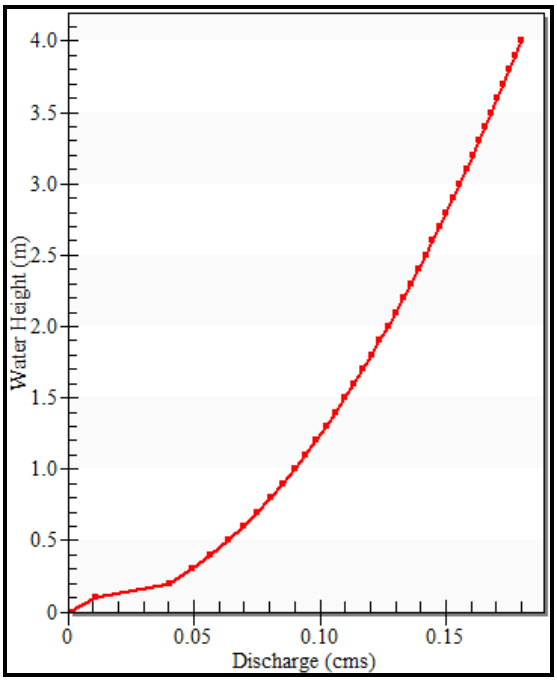


Figure 2b: Rating Curve for orifice in MH16

3.0 EXISTING CONDITIONS

The existing storm sewer network for the Canadian Tire site is shown on the Drawing 113199-STM-Existing.

3.1 Video Inspection Report

The video inspection completed by Multi-Drain Inspection Services (Multi-Drain) on October 23, 2013 did not reveal any significant problems with the storm sewers. In one instance there was a crack in the sewer, but this would only cause minor inflows/infiltration to or from the system.

Multi-Drain did notice the presence of oil sheen in the catchbasins and storm sewers near the Gas Bar. Further investigation by Terrapex Environmental Ltd. did not find any evidence of oil or sheen in the catchbasins and there were no obvious concerns with the stormceptor. At this time Terrapex Environmental Ltd. is not recommending any additional work since there does not appear to be any ongoing concern.

Pipe sizes and lengths were confirmed by Multi-Drain in the field and were consistent with the design drawings and survey completed by Fairhall Moffatt & Woodland Ltd. (October 17, 2013). Invert elevations of the storm sewers were provided by Multi-Drain Inspection Services to Fairhall Moffatt & Woodland Ltd. to develop an as-built drawing, which has been attached to this report.

3.2 Bronte Engineering Limited SWM Report

The stormwater management report for the original Canadian Tire (Bronte Engineering Limited, February 18, 2000) provided only a hydrologic analysis and did not include a hydraulic analysis of the sewer system. The hydrologic analysis from this report is summarized below:

- Allowable peak flow rate from the site (Rational Method):
  - 5-year = 151.8 L/s
  - 100-year = 248.7 L/s
- Controlled flow rate from the site (OTTHYMO model results):
  - 5-year = 144.6 L/s
  - 100-year = 147.2 L/s
- Depth of ponding in the parking lot:
  - 5-year = 0.19m (99.70m (elevation)
  - 100-year = 0.29m (99.80m elevation)

The building roof was designed to provide 836m^3 of storage with outflows controlled using eleven (11) ZURN type roof drains, which restrict flows to 21L/s at a head of 0.125m.

The parking lot was designed to provide 600m^3 of storage at a maximum ponding elevation of 99.80m, with outflows controlled using a 180mm x 180mm orifice plate located on the upstream side of the manhole at the southwest corner of the site (MH16).

3.3 Village Square Plaza

The Village Square Plaza was developed subsequent to the Canadian Tire site. The 1:1000 mapping provided by the City of Ottawa (2009) indicates that the parking lot of the Village Square Plaza is at least 1.0m higher than the Canadian Tire site.

The storm drainage area plan for Village Square Plaza allocated an area of approximately 0.30 ha to the Canadian Tire storm sewers (shown in blue on **Figure 3**). Based on a field review of existing conditions, several of the catchbasins in the Village Square parking lot are on a continuous grade, which significantly limits their effectiveness in capturing storm runoff. This results in a larger contributing area from the Village Square Plaza parking lot to the Canadian Tire site at the south entrance from Greenbank Road (i.e. CBMH6). Based on site visits and a review of the 1:1000 topographic mapping, the extra contributing drainage area from the Village Square Plaza is approximately 0.26 ha (shown in red on **Figure 3**), which is almost double what was previously allocated.

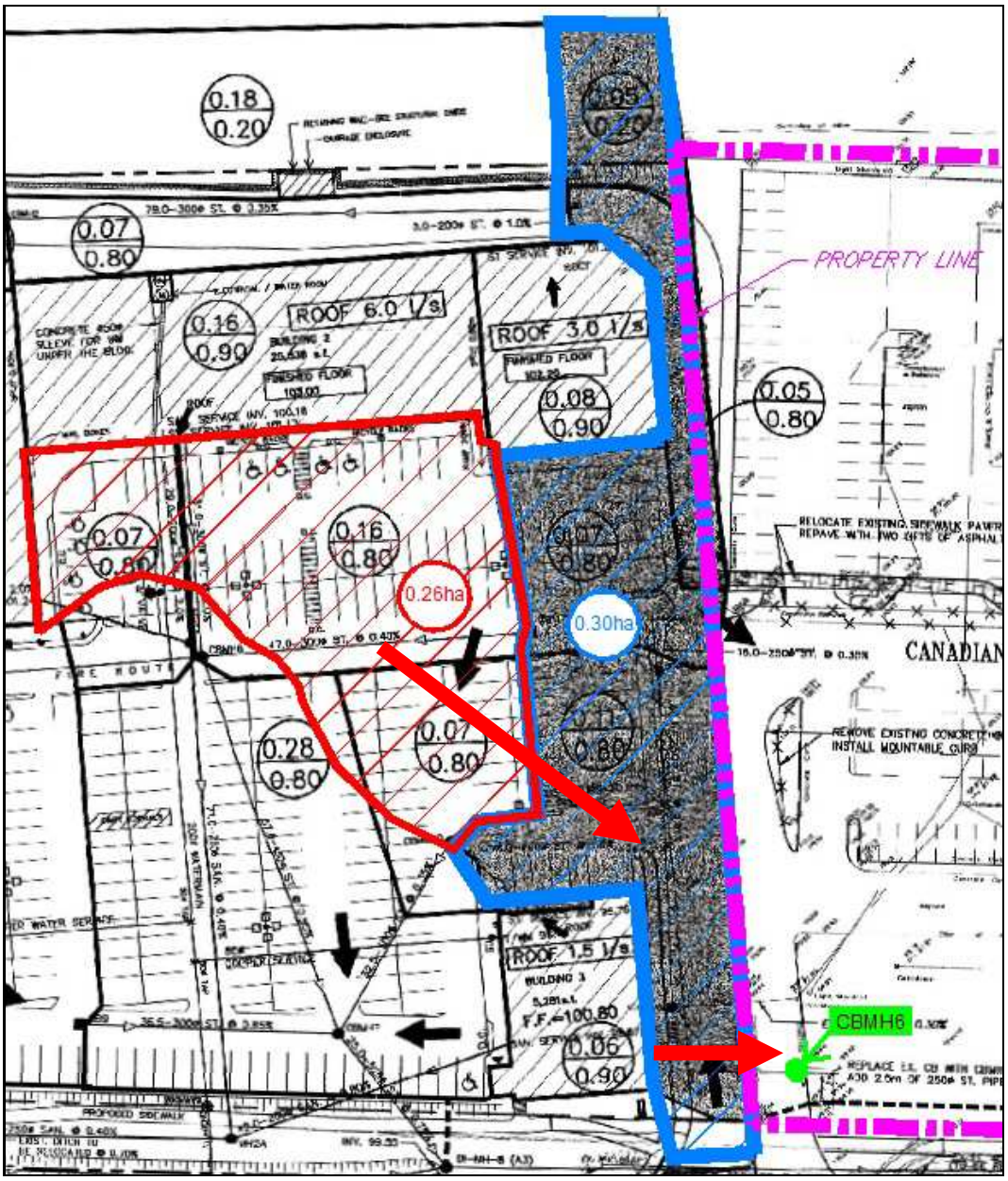


Figure 3: Drainage Area from Village Square Plaza to CBMH6

The storm sewer system on the Canadian Tire site is undersized (based on current City standards) and the additional runoff from the Village Square Plaza further reduces the level of service provided by the existing storm sewers.

3.4 Greenbank Road

The east portion of Greenbank Road drains into a roadside ditch, which flows into a ditch inlet catchbasin (DICB) north of the south entrance from Greenbank Road to the Canadian Tire site. As shown in **Figure 4**, there is a portion of Greenbank Road (approximately 0.07 ha) that drains into the Canadian Tire storm sewer system as the elevation of Greenbank Road is higher than the private entrance and a portion of Greenbank Road has roadside curbs.

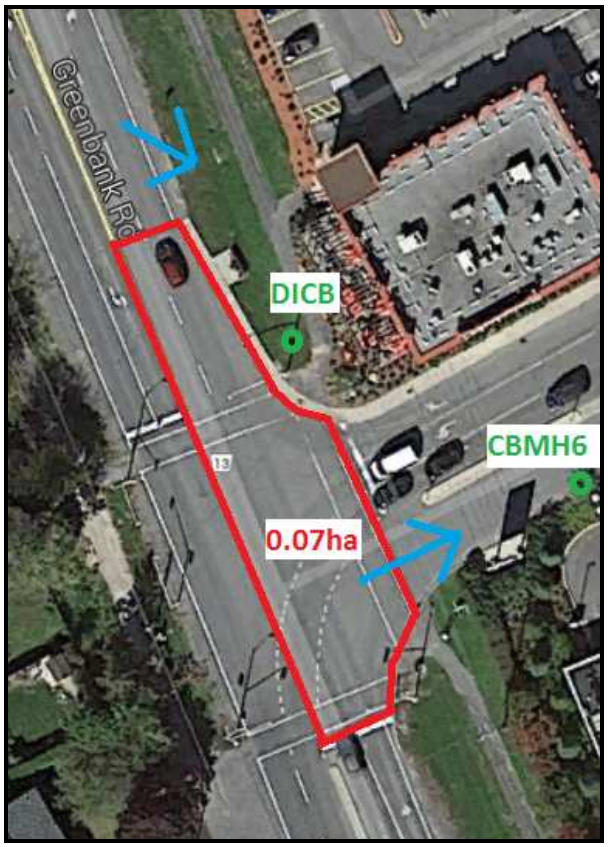


Figure 4: Drainage Area from Greenbank Road to CBMH6 (Google, 2014)

4.0 HYDROLOGIC AND HYDRAULIC MODELING

The City of Ottawa Sewer Design Guidelines (October 2012) require the use of a dynamic hydrologic/hydraulic model to evaluate stormwater management retrofits of existing infrastructure.

The existing Canadian Tire storm drainage system and the proposed modifications were modeled using Autodesk Storm and Sanitary Analysis (Autodesk SSA). The capabilities of the software are summarized in the *Autodesk Storm and Sanitary Analysis 2013 – Technical Capabilities and Functionalities* bulletin provided in **Appendix D.**

4.1 Model Development

The Autodesk SSA models account for both minor and major system flows, including the routing of flows through the storm sewer network (minor system), and overland between catchbasins (major system).

4.1.1 Subcatchments / Storm Sewers

Model parameters for the subcatchments and storm sewers were developed using the following sources:

- Detailed topographic survey by Fairhall Moffatt & Woodland Ltd. (October 17, 2013);
- 1:1000 mapping from the City of Ottawa (2009);
- Aerial photos from GeoOttawa (2011) and Google Maps (2013);
- Inverts and pipe sizes provided by Multi-Drain Inspection Services (October 23, 2013);
- Storm sewer design sheets and plan and profile drawings for Greenbank Road and Strandherd Drive (2001);

4.1.2 Infiltration

Infiltration losses were modeled using Horton's equation, which defines the infiltration capacity of the soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values from the City of Ottawa Sewer Design Guidelines (October 2012) were used for all catchments.

Horton's Equation:
$f(t) = fc + (fo - fc)e^{-k(t)}$

Initial infiltration rate: fo = 76.2 mm/hr
Final infiltration rate: fc = 13.2 mm/hr
Decay Coefficient: k = 4.14/hr

4.1.3 Depression Storage

Building rooftops are assumed to provide no depression storage (all rainfall converted to runoff). The default values for depression storage from the City of Ottawa Sewer Design Guidelines (October 2012) were used for all other catchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

4.1.4 Equivalent Width

The 'equivalent width' parameter is calculated by dividing the flow length by the catchment area, as described in the City of Ottawa Sewer Design Guidelines (October 2012).

4.1.5 Major & Minor System Networks

Inlets to the storm sewer network were modeled as storage nodes. The stage-storage curves include the storage volume within the structure (pipe invert to top of grate), as well as the storage above the structure (surface ponding).

Storm sewer (pipe) data includes length, diameter, slope, inlet and outlet elevations, Manning's Roughness, and inlet/outlet losses through manholes.

Overland flow paths between storm inlets are represented as open channels. Cross-sections and elevations for the overland flow network are based on the topographic data.

4.1.6 Modeling Files / Schematic

The Autodesk Storm and Sanitary Analysis modeling files and schematics are provided in **Appendix D**. Digital copies of the modeling files and model output for all storm events are provided on the enclosed CD.

4.2 Design Storms

The hydrologic analysis was completed using a wide range and variety of synthetic design storms and historical storms. The IDF parameters used to generate the design storms were taken from the City of Ottawa Sewer Design Guidelines (October 2012).

3 Hour Storm Distributions:	24 Hour Storm Distributions:
2-year 3hr Chicago	2-year 24hr Chicago
5-year 3hr Chicago	5-year 24hr Chicago
10-year 3hr Chicago	10-year 24hr Chicago
25-year 3hr Chicago	25-year 24hr Chicago
50-year 3hr Chicago	50-year 24hr Chicago
100-year 3hr Chicago	100-year 24hr Chicago
100-year 3hr Chicago (+20%)	100-year 24hr Chicago (+20%)

Historical Storms:
July 1, 1979
August 4, 1988
August 8, 1996
July 19, 2013 (used for calibration purposes)

5.0 EXISTING CONDITIONS MODEL

An existing conditions model of the Canadian Tire site was developed to simulate the minor and major drainage systems. In order to accurately evaluate hydraulic conditions in the on-site storm sewers, the following external drainage areas were also included in the model:

- Village Square Plaza / Plaza Expansion: Buildings and parking lots (including storage and controlled release rates), drainage areas tributary to the Canadian Tire site;
- Greenbank Road / Strandherd Drive: Upstream/downstream drainage areas, storm sewer network and major system overland flow routes.

For areas where as-built information was not available, design elevations from the original SWM reports and drawings were used. The model subdivides the site into subcatchments which represent the area tributary to each inlet to the storm sewer system as shown on the Drawing 113199-SWM. An overview of the modeling parameters for each subcatchment is provided in **Table 1**. Supporting calculations are provided in **Appendix C**.

Table 1: Hydrologic Modeling Parameters

Catchment ID	Area (ha)	Runoff Coefficient C	Percent Impervious (%)	Equivalent Width (m)	Avg. Slope (%)
External Drainage Areas					
Greenbank Road (A3)	0.440	0.70	71%	34	1.00%
Greenbank Road (A3 - A2)	0.275	0.70	71%	31	1.00%
Greenbank Road (A2 - A1)	0.450	0.70	71%	35	1.00%
Greenbank Road (A1 – A)	0.770	0.70	71%	39	1.00%
Greenbank Road (A – B)	0.424	0.71	73%	53	1.00%
Strandherd Drive (B – C)	1.150	0.70	71%	58	1.00%

Catchment ID	Area (ha)	Runoff Coefficient C	Percent Impervious (%)	Equivalent Width (m)	Avg. Slope (%)
Greenbank Road (C – D)	1.174	0.54	48%	117	1.00%
Greenbank Road (D – E)	0.498	0.65	64%	62	1.00%
Village Square (Buildings)	0.660	0.90	100%	138	2.45%
Village Square (Parking)	1.209	0.90	100%	139	1.50%
Village Square Expansion (Buildings)	0.221	0.90	100%	82	1.50%
Village Square Expansion (Parking)	0.521	0.90	100%	163	0.91%
Canadian Tire Site					
EX-1 (Village Square)	0.178	0.90	100%	27	2.77%
Greenbank Road	0.070	0.90	100%	16	1.33%
CBMH6	0.440	0.88	97%	70	1.84%
CB1	0.123	0.78	83%	47	1.38%
CBMH2	0.131	0.80	86%	33	4.26%
CB3	0.160	0.90	100%	40	3.76%
PUMPS	0.037	0.90	100%	22	1.50%
GAS BAR	0.013	0.90	100%	19	1.50%
CAR WASH	0.011	0.90	100%	18	1.50%
CBMH102	0.059	0.90	100%	20	1.52%
CBMH101	0.106	0.90	100%	31	1.45%
GB-CB3	0.068	0.90	100%	13	1.36%
CBMH104	0.010	0.90	100%	11	0.64%
CBMH103	0.022	0.90	100%	24	2.96%
GB-CB1	0.010	0.90	100%	9	1.52%
GB-CB4	0.008	0.90	100%	7	0.40%
GB-CB2	0.012	0.90	100%	6	0.37%
CBMH105	0.028	0.20	0%	16	0.40%
CBMH106	0.011	0.20	0%	6	0.78%
CBMH10	0.331	0.87	96%	60	1.02%
CBMH11	0.247	0.89	99%	44	1.17%
CBMH12	0.323	0.87	96%	60	1.33%
CBMH13	0.229	0.78	83%	55	1.54%
CB14	0.133	0.90	100%	78	1.05%
CBMH15	0.079	0.90	100%	29	0.65%
BLDG	0.786	0.90	100%	138	1.50%

5.1 Model Calibration (July 19th, 2013 Storm Event)

The existing conditions model was calibrated using rainfall data from the July 19th, 2013 storm event collected by the Walter Baker City of Ottawa Rain Gauge. Rainfall intensities for this storm event are shown in **Figure 5**.

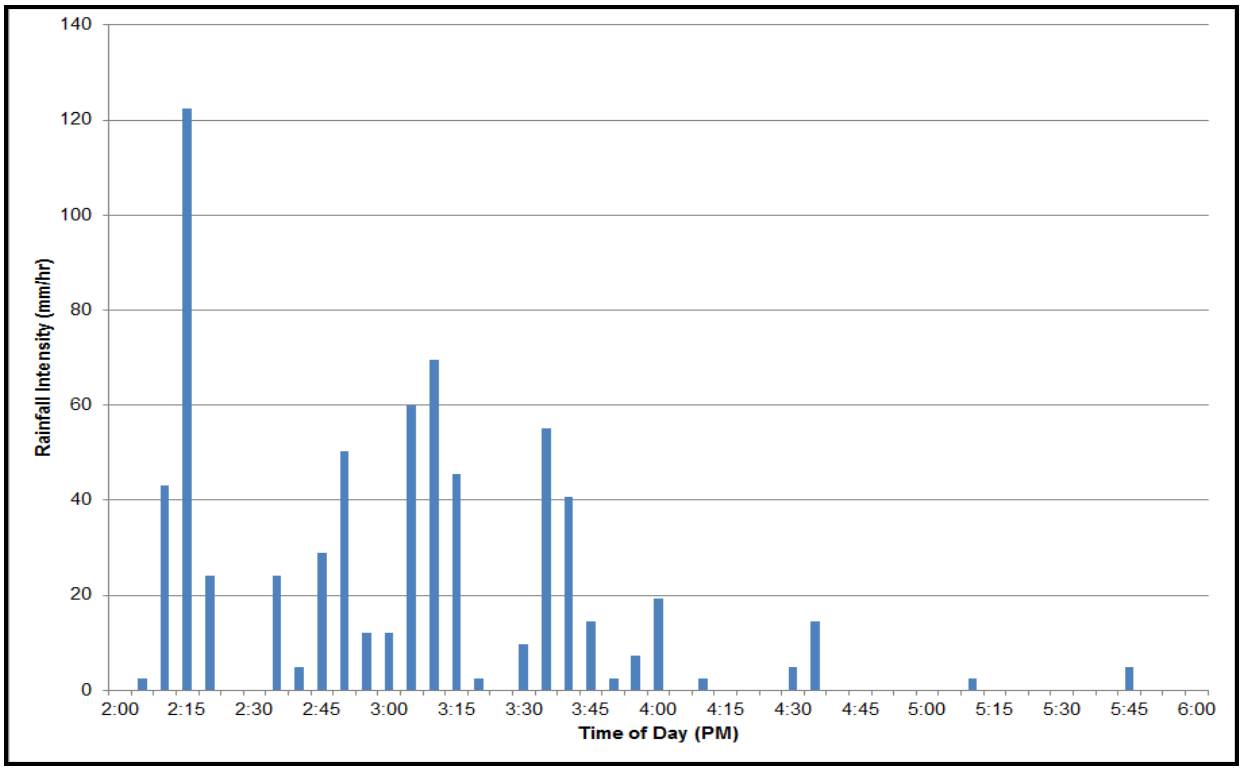


Figure 5: Rainfall Intensity (mm/hr) - July 19th, 2013 Event (Walter Baker Rain Gauge)

The July 19th, 2013 storm event had a peak intensity of 122 mm/hr and produced 56.6mm of rainfall at the Walter Baker rain gauge over approximately four (4) hours. This storm event can be categorized between a 1:5 year and 1:10 year return period.

Calibration of the existing conditions model was based on the observed extent of surface ponding following this event. The following photo (**Figure 6**) was taken at approximately 4:00pm on July 19th, 2013 from the car wash at the Canadian Tire Gas Bar. Through discussions with Canadian Tire Staff, this event resulted in approximately 15 - 20mm of water ponding in the parking lot for roughly 6 - 8 hours.

Figure 6: Extent of Flooding on July 19th, 2013

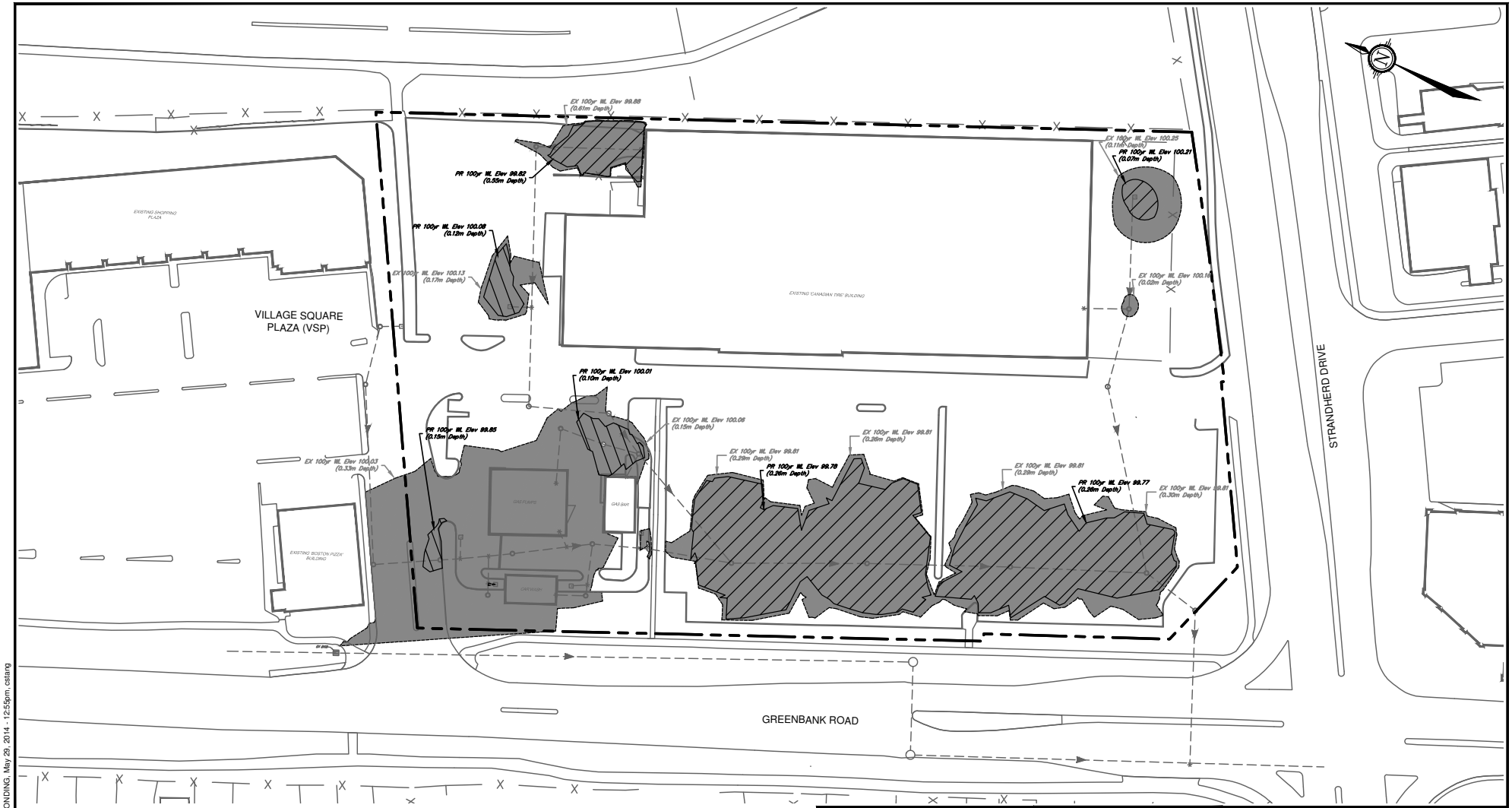
Using the July 19th, 2013 rainfall data, the model parameters were adjusted to produce ponding depths generally consistent with what is shown in **Figure 6**. It should be noted that the model reports a significantly shorter duration of ponding, which may be a result of an obstruction in one or more of the storm sewer inlets or outlets, or due to elevated water levels in the outlet storm sewers on Greenbank Road.

5.2 Model Results (Existing Conditions)

Following calibration of the existing conditions model, the performance of the existing Canadian Tire storm drainage system was evaluated using a range of synthetic design storms and historical storm events. The model results confirm that the storm sewer system is undersized and that portions of the site will experience surface flooding during relatively minor sstorm events. Ponding depths over each catchbasin (existing conditions) for the various storm events and distributions are summarized in Tables D1 – D3 in **Appendix D**. The extent of ponding under existing and proposed conditions for the 100-year storm event is shown on **Figure 7**.

The main Canadian Tire parking lot (CBMHs 10-13) is expected to experience approximately 0.14m of ponding overtop of the catchbasins during a 2-year storm event. The depth of ponding increases to 0.30m during a 100-year storm event, which is the maximum amount of ponding allowed for safe passage, as per the City of Ottawa Sewer Design Guidelines (October, 2012). When the system was stress tested by increasing 100-year peak flows and rainfall volumes by 20% there is 0.34m of ponding in the parking lot.

The catchbasin at the Gas Bar entrance from Greenbank Road (CBMH 6) experiences frequent flooding and greater ponding depths for a given storm event when compared with the main parking lot.



LEGEND

- EXISTING STORM SEWER WITH FLOW DIRECTION
- EXISTING CATCH BASIN MANHOLE
- EXISTING MANHOLE
- EXISTING CATCH BASIN
- EXISTING CURB
- PROPERTY LINE
- 100-YEAR PONDING LIMITS (EXISTING)
- 100-YEAR PONDING LIMITS (PROPOSED)

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

SCALE

1:1000

1:1000
0 10 20 30 40

CANADIAN TIRE BARRHAVEN

EXISTING AND PROPOSED 100-YEAR PONDING LIMITS

MAY 2014 113199 FIGURE 7

M:\2013\113199\CAD\Design\113199-SWM.dwg, PONDING, May 29, 2014 - 12:55pm, cstang

SHT11X17.DWG - 279mmX432mm

5.3 Identification of the Primary Causes of Flooding

The frequent surface flooding in the vicinity of the Gas Bar (CBMH 6) is due to several factors: The storm sewers in the vicinity of the gas bar were intended to surcharge to the ground surface. Storm runoff would be routed through the on-site sewers and back out onto the parking lot surface through the grates of the catchbasin manholes in the main parking lot (CBMH10-13). However, the original design report did not evaluate the hydraulics of the system. A review of the existing storm sewer system revealed significant deficiencies in both the size and configuration of the storm sewers connecting the gas bar to the main parking lot, which prevents the system from operating as intended.

Storm sewers are typically designed to convey the 5-year post-development peak flows. Based on current City of Ottawa Standards, almost all of the on-site storm sewers are significantly undersized (refer to the storm sewer design sheets provided in **Appendix B)**. While this may have been intentional (the storm system was intended to be restricted by the orifice in MH16 and to back up onto the surface through the grates of the catchbasins in the main parking lot), the ability of the sewers to internally convey runoff between the gas bar and the main parking lot was overlooked.

This issue is compounded by the additional runoff from the Village Square Plaza parking lot and Greenbank Road that was not accounted for in the original design, resulting in a larger volume of runoff entering the Canadian Tire site than was originally intended. There is also no defined major system (overland flow) outlet for the site, so the depth of water in the parking lots can exceed 0.30m during larger storm events.

6.0 PROPOSED SWM IMPROVEMENTS

The proposed improvements to the existing storm drainage system include:

1) The installation of a new 600mm storm sewer along the western boundary of the site to supplement the conveyance capacity of the existing storm sewer network connecting the gas bar and the main parking lot.
2) The installation of an underground storage system beneath the main parking lot consisting of two (2) rows of StormTech MC-3500 (or approved equivalent) infiltration chambers.
3) The installation of a check valve at the storm outlet to prevent inflows from the off-site storm sewers into the proposed underground storage system.

The proposed underground storage system (Drawing 113199-STM) represents a balance between cost and level of service. This configuration provides sufficient underground storage for runoff from a 5-year event (approx. 500 m^3). Runoff from larger storms will exceed the available underground storage and begin to accumulate on the parking lot surface as per the original design intent.

6.1 Model Results (Proposed Improvements)

The model results indicate that the proposed works will significantly improve the capacity of the internal storm drainage network and reduce the frequency of surface flooding on the site. There will be no ponding in the main parking area during the 5-year storm event. The extent of ponding during the 100-year storm event (maximum depth of approximately 0.26 m) is shown on **Figure 7**.

6.2 Design Details

Infiltration Chambers

The proposed infiltration chambers (StormTech MC-3500) have been designed to provide the as much storage as possible while maintaining adequate clearance from the granular material in the parking lot. Details and design specifications are shown on Drawings 113199-STM and 113199-ND:

1. Provide a 300mm (minimum) clearstone base (50mm dia. D_{50}) and 150mm perforated subdrain pipe beneath the infiltration chambers.
2. Backfill the space surrounding the infiltration chambers with clean, crushed angular stone (19mm – 51mm) to a minimum depth of 305mm above the infiltration chambers
3. A non-woven geotextile (ADS 601 or approved equivalent) is to be wrapped around the perimeter of the stone fill to prevent soil movement into the storage area.
4. Provide a minimum 610mm of clearance from the top of the infiltration chambers to the base of asphalt.
5. The bottom of the first row of the storage chambers is to be underlain with a geotextile liner or flooring to allow for flushing of accumulated sediment.

Supporting calculations for the StormTech MC-3500 infiltration chambers are provided in **Appendix E**. Approved equivalent infiltration chambers can be specified, provided they meet the following standards:

1. The chambers must meet the requirements of CSA B184.0-11, “General Requirements and Methods of Testing for Polymeric Subsurface Stormwater Management Structures”
2. The chambers must meet the requirements of CBSA B184.2-11 for “Polypropylene (PP) Chambers”

600mm Storm Sewer

The proposed 600mm storm sewer from the south entrance from Greenbank Road to the infiltration chambers will alleviate the flooding at the south entrance, which will prevent the car wash from flooding during frequent events. The installation of this storm sewer will be within the property limits for the existing Canadian Tire, but will require the removal and installation of vegetation such as trees and bushes as shown on the Drawing 113199-TCP.

Check Valve

A check valve (flap gate) is to be installed on the 300mm pipe entering MH16 to prevent flows from the off-site storm sewers from entering the underground storage chambers.

Utilities

The location of existing utilities shown on the Drawing 113199-STM is based on the available design drawings. While there are no apparent conflicts based on the current layout, utility locates are to be performed in advance of construction. If any conflicts with existing utilities are identified, the layout of the proposed storm sewers and infiltration chambers will be adjusted accordingly.

Landscaping

The proposed 600mm storm sewer will be routed along the western property limit parallel to Greenbank Road in order to minimize disruption to the Gas Bar and carwash. The proposed sewer will require the removal of existing trees and shrubs along the property line.

The proposed landscaping plan (Drawing 113199-L) replaces the vegetation that will be removed during construction with vegetation of equivalent size. All large trees will be placed at least 1.5m from the proposed storm sewer.

Construction

A pre-construction meeting will be held with representatives from Keller Engineering, Novatech Engineering, and the contractor to go over the installation procedure. It is anticipated that construction will take approximately two (2) to three (3) weeks to complete.

7.0 WATER QUALITY

The Canadian Tire storm sewers are tributary to the Kennedy-Burnett Stormwater Management Facility, which provides water quality treatment before outletting into the Jock River. For the Gas Bar, two (2) existing stormceptors (STC-750) have been installed to capture any spillage from the gas pumps before outletting into the storm sewer system.

8.0 EMERGENCY OVERLAND DRAINAGE

The main Canadian Tire parking lot does not have a defined overland drainage route. The lowest spill elevation is along the west side of the site and is approximately 0.50m higher than the elevations of the catchbasins within the parking lot. The lowest point of the Canadian Tire building is the entrance to the garage, which is 0.80m higher than the elevations of the catchbasin within the parking lot.

The overland flow route for the Gas Bar is via Greenbank Road, which is sloped south to Strandherd Drive and eventually the Kennedy Burnett Stormwater Management Facility.

9.0 GEOTECHNICAL INVESTIGATION

The following geotechnical reports, provided in **Appendix A,** were reviewed to determine the soil type, depth of bedrock and groundwater elevations.

1. Geotechnical Investigation, Proposed Commercial Development, 1581 Greenbank Road (i.e. Village Square Plaza Expansion), Ottawa, Ontario

   Golder and Associates, December 2009 – Report Number 09-1121-1036

2. Geotechnical Investigation – Canadian Tire Real Estate Limited, Proposed Store #442 Barrhaven, Ontario

   Jacques, Whitford & Associates Limited, January 31, 2000

Based on the geotechnical report (Golder and Associates) for the expansion to Village Square Plaza, the soil type between 0.5 and 3.5m below grade is on average sandy silt (glacial till), which has a low hydraulic conductivity (10^{-7} m/s) and percolation rate (25mm/hr). Bedrock elevations were observed to be below 3.5m.

The geotechnical report (Jaques Whitford & Associates) for the Canadian Tire was completed before the building and parking lot were built. In general, the underlying soil was predominantly glacial till (consisting of a heterogeneous mixture of silt, sand and gravel) with layers of silty clay. Bedrock in the location of the proposed works is on average 3m from the ground surface with no groundwater levels observed in the boreholes.

10.0 EROSION & SEDIMENT CONTROL REQUIREMENTS

The erosion and sediment control requirements that will be implemented during construction are as follows.

Temporary and permanent erosion and sediment control measures are to be implemented prior to, during and after construction; and should be inspected regularly.

To prevent surface erosion, sediment and debris from entering the storm system during construction, the following erosion and sediment control measures should be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987):

- Filter socks (i.e. Filtrexx or approved equivalent) should be placed around the grates of all area drains and remain in place until the asphalt has been reestablished and construction is complete;
- Street sweeping and cleaning should be performed on all roads adjacent to active construction on a regular basis; and,
- Stockpiles should not be located overtop of maintenance holes, storm inlets or utility accesses. Stockpile locations should not block any overland drainage paths.

Permanent erosion and sediment control measures will consist of re-establishing the asphalt and re-planting all disturbed vegetation areas.

11.0 CONCLUSIONS AND RECOMMENDATIONS

This report provides an overview of the existing storm drainage system and identifies the probable causes for the existing flooding issues at the Canadian Tire in Barrhaven (Ottawa), Ontario. The proposed modifications to the existing system will improve the capacity of the on-site sewers and provide additional underground storage.

Existing Conditions

- The existing design did not account for the conveyance of stormwater (i.e. hydraulics) within the site, as such the storm sewers are undersized to convey peak flows to the main parking lot for storage.
- The main parking lot has been sized to provide sufficient surface storage.
- Ponding in the parking lot experienced during storm events equal to or greater than the 2-year storm event prevents stormwater from being conveyed from the south entrance from Greenbank Road; therefore, significant ponding occurs at the south entrance from Greenbank Road.

- The Hydraulic Grade Line in the 600mm storm sewer along Greenbank Road prevents the site from draining during storm events greater than the 2-year storm event, which causes backflows into the Canadian Tire storm sewer system.

Proposed Modifications

- Improve the conveyance capacity of the on-site storm sewers by installing a new 600mm pipe from the Gas Bar entrance to the underground storage system.
- Provide underground storage chambers (i.e. StormTech MC-3500 or approved equivalent) beneath the parking lot to store the 5-year storm event underground.

NOVATECH ENGINEERING CONSULTANTS LTD.

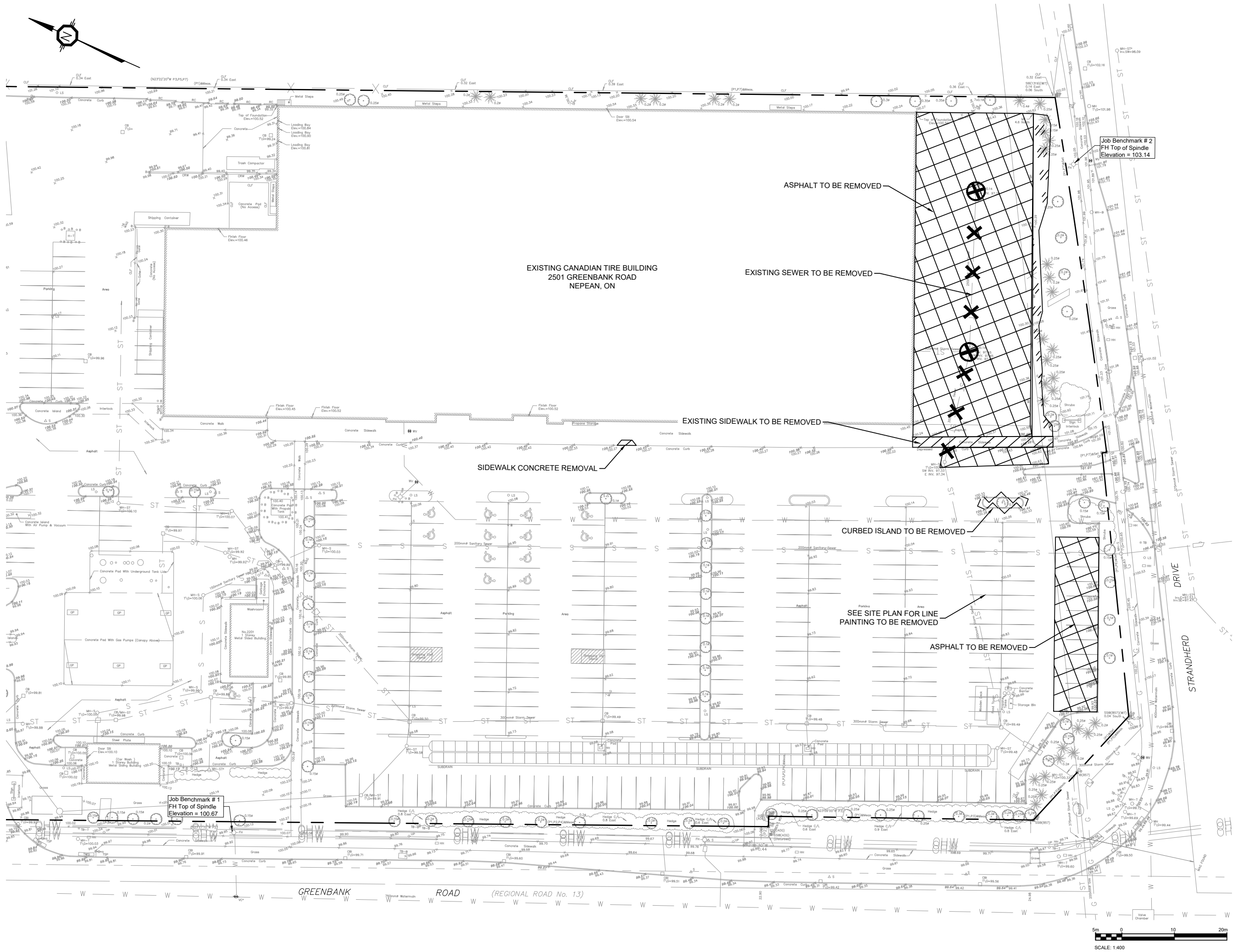
Prepared by:

Conrad Stang, M.A.Sc., P.Eng.
Water Resources Engineer

Reviewed by:

Michael Petepiece, P.Eng.
Project Manager

DRAWINGS



LEGEND:

- EXISTING PROPERTY LINE
- STRUCTURE TO BE REMOVED
- SEWER TO BE REMOVED
- ASPHALT REMOVAL
- LANDSCAPE REMOVAL
- CONCRETE REMOVAL
- EXISTING CURB REMOVAL

NOTES: REMOVALS AND DEMOLITION

1. PRE-REMOVAL, THE CONTRACTOR MUST VISIT THE PREMISES IN ORDER TO BE FULLY AWARE OF EXISTING CONDITIONS ON SITE, INCLUDING ALL ELEMENTS TO BE REMOVED AND DEMOLISHED. NO CLAIM WILL BE ACCEPTED DUE TO A POOR EVALUATION OF THE WORK TO BE COMPLETED.
2. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND THE REQUEST FOR INTERRUPTION OF PUBLIC UTILITY SERVICES, SUCH AS GAS, TELEPHONE, POWER, CABLE, SEWERS, WATERMAIN, ETC. BEFORE PROCEEDING WITH WORK, COORDINATE WITH ALL APPLICABLE UTILITY COMPANIES.
3. FIRE HYDRANTS TO BE TAGGED AND BAGGED AND/OR PROTECTED AS INDICATED ON DRAWING.
4. CURB, ASPHALT, SIDEWALK, AND GRANULAR BASE TO BE EXCAVATED WITHIN LIMITS OF DEMOLITION REMOVAL. THE CONTRACTOR MUST CARRY OUT NECESSARY SAW CUTS.
5. SEWER / WATERMAIN PIPES TO BE ABANDONED MUST BE CUT, FILL WITH UNSHRINKABLE CONCRETE CONFORMING TO OPSS 1359, AND CAPPED.
6. REMOVE AND DISPOSE SEWERS AS INDICATED. PLUG ANY SERVICE LATERALS TO BE ABANDONED.
7. THE CONTRACTOR MUST ENTIRELY REMOVE THE DEMOLITION WRECKAGE FROM THE CONSTRUCTION SITE OFFSITE IN ACCORDANCE WITH THE REQUIREMENTS OF THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE (MOECC).
   a. THE CONTRACTOR MUST DISCARD RECYCLABLE DEMOLITION MATERIALS IN COLLABORATION WITH A REGIONAL RECYCLING COMPANY.
   b. ALL OTHER DEMOLITION MATERIALS MUST BE DISPOSED OFF-SITE AT AUTHORIZED LICENSED LANDFILLS AND IN CONFORMITY WITH THE APPLICABLE LAWS AND REGULATIONS. THE CONTRACTOR MUST BE ABLE TO PROVIDE, UPON REQUEST, COPIES OF THE DISPOSAL TICKETS TO THE OWNER'S REPRESENTATIVE.
8. SURFACES AND WORKS LOCATED OUTSIDE OF THE CONSTRUCTION WORK LIMIT MUST BE REINSTATED AS THEY WERE BEFORE BEGINNING OF WORK. CONTRACTOR IS RESPONSIBLE TO MAKE GOOD ON ANY DAMAGES TO EXISTING CURB AND ASPHALT NOT SCHEDULED FOR REMOVAL.
9. ALL MATERIALS, PRODUCTS AND OTHERS COMING FROM THE DEMOLITION BELONG TO THE CONTRACTOR, UNLESS SPECIFIED OTHERWISE.
10. THE CONTRACTOR MUST COMPLETE ALL REMOVALS AS SHOWN ON THE DRAWINGS AND AS REQUIRED TO MAKE THE WORK COMPLETE.
11. THE CONTRACTOR MUST PROTECT AND MAINTAIN IN SERVICE THE EXISTING WORKS WHICH MUST REMAIN IN PLACE. IF THEY ARE DAMAGED, THE CONTRACTOR MUST IMMEDIATELY MAKE THE REPLACEMENTS AND NECESSARY REPAIRS TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE AND WITHOUT ADDITIONAL EXPENSE TO THE OWNER.
12. THE CONTRACTOR MUST NOT PERFORM ANY TREE CUTTING DURING THE CORE MIGRATORY BIRDS NESTING PERIOD, WHICH IS APRIL 15 TO AUGUST 15.

NOTES: GENERAL

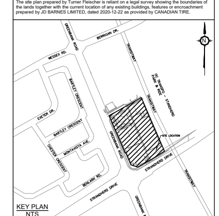
1. THE CONTRACTOR MUST CONFORM TO ALL LAWS, CODES, ORDINANCES, AND REGULATIONS ADOPTED BY FEDERAL, PROVINCIAL OR MUNICIPAL GOVERNMENT COUNCILS AND GOVERNMENT AGENCIES, APPLYING TO WORK TO BE CARRIED OUT. WHEREVER STANDARDS, LAWS AND/OR REGULATIONS ARE MENTIONED THEY REFER TO THEIR CURRENT VERSIONS, MODIFICATIONS INCLUDED.
2. ALL MATERIALS AND CONSTRUCTION METHODS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS (OPSS AND OPSD), THE ONTARIO MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE, THE ONTARIO MINISTRY OF NATURAL RESOURCES, APPLICABLE CONSERVATION AUTHORITIES, THE MUNICIPAL STANDARD SPECIFICATIONS AND DRAWINGS, AND ALL OTHER GOVERNING AUTHORITIES AS THEY APPLY, UNLESS OTHERWISE INDICATED.
3. ALL MATERIAL SUPPLIED AND PLACED FOR PARKING LOT AND ACCESS ROAD CONSTRUCTION SHALL BE TO OPSS STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE NOTED. CONSTRUCTION TO OPSS 206, 310 & 314. MATERIALS TO OPSS 1001, 1003 & 1010.
4. THE LOCATION OF EXISTING UNDERGROUND MUNICIPAL SERVICES AND PUBLIC UTILITIES AS SHOWN ON THE PLANS ARE APPROXIMATE. THE CONTRACTOR MUST DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES (ON-SITE AND OFF-SITE) PRIOR TO ANY EXCAVATION WORK. DAMAGE TO ANY EXISTING SERVICES AND/OR EXISTING UTILITIES DURING CONSTRUCTION, WHETHER OR NOT SHOWN ON THE DRAWINGS MUST BE REPAIRED BY THE CONTRACTOR AT HIS OWN EXPENSE.
5. THE CONTRACTOR SHALL DETERMINE THE EXACT INVERT (GEODETIC ELEVATION), DIAMETER AND CONSTRUCTION MATERIAL OF THE EXISTING CONDUITS AT THE PROPOSED CONNECTIONS. THEY SHALL ALSO CARRY OUT, IF NECESSARY, EXPLORATORY DIGS IN ORDER TO DETERMINE THE EXACT LOCATION AND INVERTS OF EXISTING DUCK BANKS. THIS INFORMATION SHALL IMMEDIATELY BE PROVIDED TO THE CONSULTANT PRIOR TO START UNDERTAKING ANY MUNICIPAL SERVICES WORK AND A 48 HOUR PERIOD MUST BE ALLOCATED TO THE CONSULTANT FOR DESIGN REVIEW.
6. AT PROPOSED UTILITY CONNECTION POINTS AND CROSSINGS (I.E. STORM SEWER, SANITARY SEWER, WATER, ETC.) THE CONTRACTOR SHALL DETERMINE THE PRECISE LOCATION AND DEPTH OF EXISTING UTILITIES AND REPORT ANY DISCREPANCIES OR CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK.
7. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
8. THE CONTRACTOR IS RESPONSIBLE FOR THE COORDINATION OF ALL WORK AND ACTIVITIES WITH OTHERS TRADES AND CONTRACTORS.
9. THE CONTRACTOR IS THE ONLY PERSON IN CHARGE OF SAFETY ON THE BUILDING SITE. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ADEQUATE PROTECTION OF THE WORKERS, OTHER PERSONNEL AND THE GENERAL PUBLIC, PROTECTION OF MATERIALS, AS WELL AS MAINTAINING IN GOOD CONDITION THE COMPLETED WORKS AND WORKS TO BE COMPLETED. THE CONTRACTOR MUST PROVIDE AT ANY TIME:
   a. A SUFFICIENT NUMBER OF FENCES, BARRIERS, POSTERS, GUARDS AND OTHERS TO ENSURE SAFETY;
   b. NECESSARY CONVENIENCES FOR THE COMPLETION OF WORK SUCH AS HEATING, LIGHTING, VENTILATION ETC.
10. CONTRACTOR IS RESPONSIBLE TO OBTAIN THE VARIOUS PERMITS/APPROVALS REQUIRED TO COMPLETE ALL THE WORKS AND ACTIVITIES AND BEAR COST OF THE SAME, SUCH AS BUT NOT LIMITED TO; ROAD CUT PERMITS, SEWER PERMITS, WATER PERMIT, ETC. AND THEIR ASSOCIATED COSTS.
11. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
12. JOB BENCH MARK - CONFIRM WITH PARSONS PRIOR TO UTILIZATION. THE CONTRACTOR MUST MAINTAIN BENCHMARKS AND LANDMARK REFERENCES AS IS. OTHERWISE THESE REFERENCES WILL BE REPOSITIONED BY A CERTIFIED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.
13. ALL GROUND SURFACES SHALL BE EVENLY GRADED WITHOUT PONDING AREAS AND LOW POINTS EXCEPT WHERE APPROVED SWALE OR CATCH BASIN OUTLETS ARE PROVIDED.
14. IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION, DEWATERING OF EXCAVATIONS COULD BE REQUIRED. IT IS ASSUMED THAT GROUNDWATER MAY BE CONTROLLED BY SUMP AND PUMPING METHODS. THE CONTRACTOR SHALL OBTAIN A PERMIT TO TAKE WATER IF SITE CONDITIONS REQUIRE TAKING MORE THAN A TOTAL OF 400 000 L/DAY.
15. STRIP AND REMOVE ALL TOPSOIL FROM IMPROVED AREAS. SITE PREPARATION INCLUDES CLEARING, GRUBBING, STRIPPING OF TOPSOIL, DEMOLITION, REMOVAL OF UNSUITABLE MATERIALS, CUT, FILL AND ROUGH GRADING OF ALL AREAS TO RECEIVE FINISHED SURFACES.
16. ABUTTING PROPERTY GRADE TO BE MATCHED.
17. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW PAVEMENT. PAVEMENT REINSTATEMENT SHALL BE WITH STEP JOINTS OF 300mm WIDTH MINIMUM.
18. CURBS TO BE BARRIER, CONSTRUCTED AS PER OPSD 600.110, EXCEPT WHERE INDICATED OTHERWISE. ELEVATION AT TOP OF CONCRETE CURBS TO BE 150 mm ABOVE THE ASPHALT, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
19. DEPRESSED CURBS TO BE MOUNTABLE, CONSTRUCTED AS PER OPSD 600.100.
20. LIGHT DUTY AND HEAVY DUTY ASPHALT PAVEMENTS TO BE CONSTRUCTED AS PER TABLE ON DRAWING C103.
21. TRANSITION BETWEEN EXISTING AND PROPOSED PAVEMENT SHALL BE CONSTRUCTED AS PER DETAIL D2 ON DRAWING C103 AND TRENCHES AS PER DETAIL R10 ON DRAWING C104.
22. RESTORE PAVEMENT STRUCTURE AND SURFACES ON EXISTING ROADS TO A CONDITION AT LEAST EQUAL TO ORIGINAL AND TO THE SATISFACTION OF THE MUNICIPAL AUTHORITIES.
23. CLEANLINESS ON THE SITE, INCLUDES THE CONTRACTOR SHALL CLEAN ROADWAYS AT HIS OWN COST AS DIRECTED BY THE OWNER'S REPRESENTATIVE, MATERIALS AND EQUIPMENT MUST BE LAID OUT IN AN ORGANIZED AND SAFE MANNER, AND ALL MATERIAL, EQUIPMENT AND TEMPORARY STRUCTURES WHICH ARE NO LONGER NECESSARY FOR THE EXECUTION OF THE CONTRACT MUST BE REMOVED FROM THE SITE.
24. CONTRACTOR TO ENSURE MITIGATION MEASURES ARE IMPLEMENTED TO REDUCED THE RISK OF GROUND CONTAMINATION FROM PETROLEUM PRODUCTS.
25. THE CONTRACTOR MUST ENSURE THE FOLLOWING MEASURES ARE IMPLEMENTED REGARDING THE HANDLING OF CONCRETE:
   a. CONCRETE SHOULD EITHER BE MIXED AWAY FROM THE SITE OR SHOULD BE PREPARED ON PAVED SURFACES IF ONLY SMALL QUANTITIES ARE REQUIRED (I.E. MINOR REPAIRS);
   b. EXCESS CONCRETE MUST BE DISPOSED OFF-SITE AT A LOCATION THAT MEETS ALL REGULATORY REQUIREMENTS;
   c. THE WASHING OF CONCRETE TRUCKS AND OTHER EQUIPMENT USED FOR MIXING CONCRETE SHOULD NOT BE CARRIED OUT WITHIN 30 METERS OF A WATERCOURSE OR WETLAND AND SHOULD TAKE PLACE OUTSIDE OF THE WORK SITE;
   d. ALL CONCRETE TRUCKS SHOULD COLLECT THEIR WASH WATER AND RECYCLE IT BACK INTO THEIR TRUCKS FOR DISPOSAL OFF-SITE AT A LOCATION MEETING ALL REGULATORY REQUIREMENTS.
26. THE CONTRACTOR SHALL ENSURE THAT ALL EXCAVATED SURPLUS MATERIALS THAT WILL BE REQUIRED TO BE DISPOSED OFFSITE BE STOCKPILED TEMPORALLY FOR SAMPLING PRIOR BEING LOADED OFFSITE.
27. MINIMIZE DISTURBANCE TO EXISTING VEGETATION DURING THE EXECUTION OF ALL WORKS.
28. TRENCHING, BACKFILLING AND COMPACTING MUST CONFORM TO OPSS 401.
29. DEWATERING OF PIPELINE, UTILITY AND ASSOCIATED STRUCTURE EXCAVATIONS TO BE COMPLETED AS PER OPSS 517.
30. THE CONTRACTOR MUST CONTROL SURFACE RUNOFF FROM PRECIPITATION DURING CONSTRUCTION.
31. FOR ALL GEOTECHNICAL WORK, CONTRACTOR TO REFER TO "GEOTECHNICAL INVESTIGATION, CANADIAN TIRE STORE #442, GREENBANK ROAD, NEPEAN, ONTARIO, BY JACQUES, WHITOFRD AND ASSOCIATES LIMITED. DATED JANUARY 31, 2000.
32. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE DIRECTED FROM THE ENGINEER. EXCAVATE AND REMOVE ALL ORGANIC MATERIAL AND DEBRIS LOCATED WITHIN THE PROPOSED BUILDING, PARKING AND ROADWAY LOCATIONS.
33. THE CONTRACTOR IS RESPONSIBLE FOR ALL EXCAVATION, BACKFILL AND REINSTATEMENT OFF ALL AREAS DISTURBED DURING CONSTRUCTION TO EXISTING CONDITIONS OR BETTER AND ALL ASSOCIATED WORKS TO THE SATISFACTION OF THE CONSULTANT AND MUNICIPAL AUTHORITIES. ASPHALT REINSTATEMENT MUST BE IN ACCORDANCE WITH OPSS 310. LANDSCAPE AREAS TO BE REINSTATED WITH 150 mm OF TOPSOIL AND SOD IN ACCORDANCE WITH OPSS 802 AND OPSS 803.
34. DURING THE CONSTRUCTION PERIOD THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING TEMPORARY TRAFFIC SIGNAGE, INCLUDING TRAFFIC SIGNS, TRAFFIC MARKINGS AND TEMPORARY TRAFFIC LIGHTS, AND FLAGMEN, AS REQUIRED BY THE OWNER, THE CONSULTANT, THE MUNICIPALITY, THE MTO, AND OTHER GOVERNING AUTHORITIES.
35. CONSTRUCT SIDEWALK EXPANSION JOINTS & CONTROL JOINTS AS PER OPSD 310.020.
36. CONSTRUCT CONCRETE SIDEWALK AS PER OPSD 310.020 AND OPSS 351. TACTILE WALKING SURFACE INDICATORS PER OPSS 351.
37. DISPOSE OF CONTAMINATED MATERIALS AT APPROPRIATE OFF-SITE FACILITY THAT MEETS ALL REGULATORY REQUIREMENTS.
38. BE PREPARED TO INTERCEPT, CLEAN UP, AND DISPOSE OF SPILLS OR RELEASES THAT MAY OCCUR WHETHER ON LAND OR WATER. MAINTAIN MATERIALS AND EQUIPMENT REQUIRED FOR CLEANUP OF SPILLS OR RELEASES READILY ACCESSIBLE ON SITE.
39. PROMPTLY REPORT SPILLS AND RELEASES POTENTIALLY CAUSING DAMAGE TO ENVIRONMENT TO: AUTHORITY HAVING JURISDICTION OR INTEREST IN SPILL OR RELEASE INCLUDING CONSERVATION AUTHORITY, WATER SUPPLY AUTHORITIES, DRAINAGE AUTHORITY, ROAD AUTHORITY, AND FIRE DEPARTMENT.
40. DECONTAMINATE EQUIPMENT AFTER WORKING IN POTENTIALLY CONTAMINATED WORK AREAS AND PRIOR TO SUBSEQUENT WORK OR TRAVEL ON CLEAN AREAS.
41. DO NOT DISCHARGE DECONTAMINATED WATER, OR SURFACE WATER RUNOFF, OR GROUNDWATER WHICH MAY HAVE COME IN CONTACT WITH POTENTIALLY CONTAMINATED MATERIAL, OFF SITE OR TO MUNICIPAL SEWERS.
42. CONTRACTOR NEEDS TO SUBMIT A TRAFFIC MANAGEMENT PLAN FOR APPROVAL ONE (1) WEEK PRIOR TO ANY WORK WITHIN THE ROW LIMITS TO MEET THE REQUIREMENTS OF MTO BOOK 7. THE CONTRACTOR WILL BE REQUIRED TO IMPLEMENT ALL REQUIREMENTS OF THE MTO BOOK 7.
43. TOWN PUBLIC WORKS DEPARTMENT TO BE CONTACTED MINIMUM 7 DAYS PRIOR TO PLANNED DATE FOR CONNECTION TO EXISTING STORM SEWERS, SANITARY SEWERS, AND WATERMAIN. CONNECTION TO EXISTING TO TAKE PLACE IN THE PRESENCE OF APPROPRIATE MUNICIPALITY OF CASSELMAN STAFF.

TURNER FLEISCHER

Turner Fleischer Architects Inc.

67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

The site plan prepared by Turner Fleischer is reliant on a legal survey showing the boundaries of the lands together with the current location of any existing buildings, features or encroachment prepared by JD BARNES LIMITED, dated 2020-12-22 as provided by CANADIAN TIRE.



KEY PLAN
NTS

PARSONS

1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON NOVEMBER 9TH, 2022. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

#	DATE	DESCRIPTION	BY
1	2023-05-18	ISSUED FOR SITE PLAN APPLICATION	PC

BARRHAVEN
STORE No.
442

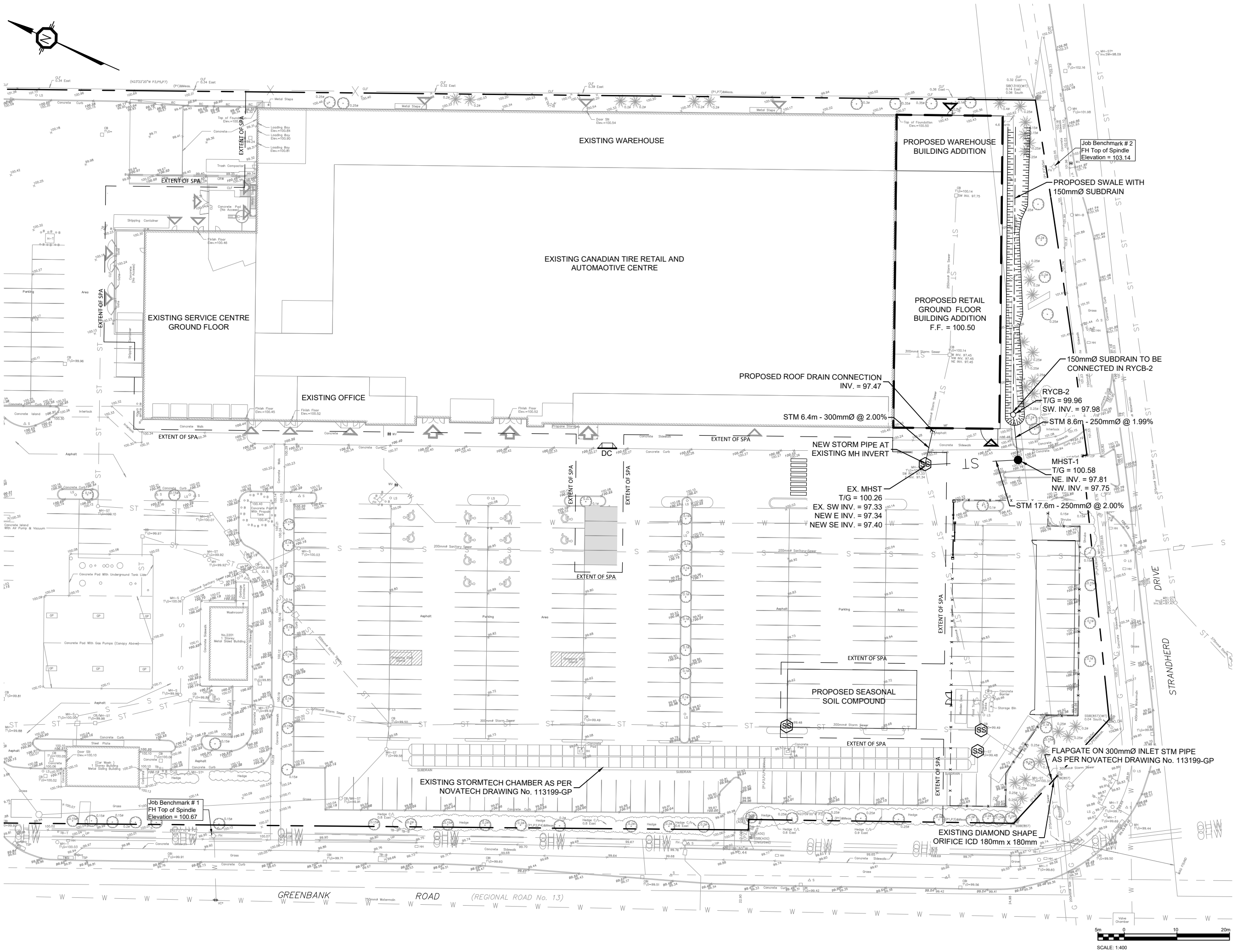
PROJECT
2501 GREENBANK RD
CANADIAN TIRE STORE EXPANSION
BARRHAVEN, ONTARIO

DRAWING
REMOVAL PLAN

PROJECT NO. 478461
PROJECT DATE 2022-09-23
DRAWN BY BV
CHECKED BY MT
SCALE As indicated

LICENSED PROFESSIONAL ENGINEER
M.J. THEINER
100130636
05/18/2023
PROVINCE OF ONTARIO

DRAWING NO. C101
REV. 1



LEGEND:

Symbol	Description
	EXISTING PROPERTY LINE
W W	EXISTING WATERMAIN
	EXISTING V&VB
FH	EXISTING FIRE HYDRANT
	EXISTING CATCH BASIN
S S	EXISTING SANITARY SEWER AND MAINTENANCE HOLE
ST ST	EXISTING STORM SEWER AND MAINTENANCE HOLE
ST	PROPOSED STORM SEWER AND MAINTENANCE HOLE
	PROPOSED REAR YARD CATCH BASIN
	PROPOSED CENTERLINE SWALE WITH SUBDRAIN 150mmØ
DC	PROPOSED DEPRESSED CONCRETE CURB
	PROPOSED BUILDING ADDITION OUTLINE
SS	SILT SACK PER DETAIL D1

NOTES: SEWER

1. CONTRACTOR TO CONFIRM ELEVATION OF EXISTING STORM AND SANITARY SEWERS AT PROPOSED CONNECTION POINTS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE COMMENCING ANY WORK.
2. ALL WORK SHALL BE PERFORMED, AS APPLICABLE IN ACCORDANCE WITH OPSS 407, AND 410.
3. PIPE MATERIAL TO BE PVC SDR-35 AND CONFORMING TO OPSS 1841, UNLESS INDICATED OTHERWISE. PVC SEWERS TO BE INSTALLED PER OPSD 802.010 (MODIFIED). BEDDING AND COVER MATERIALS TO BE OPSS 1010 GRANULAR 'A' CRUSHER-RUN LIMESTONE BEDDING COMPACTED TO 95% SPMDD.
4. ALL SEWERS WITH LESS THAN 1.5 METERS OF COVER ARE SUBJECTED TO INSULATION
5. PIPE BACKFILL MATERIAL TO BE APPROVED NATIVE MATERIAL OR SELECT SUBGRADE MATERIAL IN CONFORMANCE WITH OPSS 212.
6. ALL MAINTENANCE HOLES AND CATCH BASIN MAINTENANCE HOLES TO BE 1200mmØ AS PER OPSD 701.010, UNLESS INDICATED OTHERWISE. MAINTENANCE HOLES AND CATCH BASIN MAINTENANCE HOLES TO BE INSTALLED PER OPSS 407.
7. ALL CATCH BASINS TO BE 600x600mm AS PER OPSD 705.010, UNLESS INDICATED OTHERWISE. CATCH BASINS TO BE INSTALLED PER OPSS 407.
8. EXCAVATING, BACKFILLING, AND COMPACTING REQUIRED FOR MAINTENANCE HOLES, CATCH BASIN MAINTENANCE HOLES, AND CATCH BASINS TO BE COMPLETED AS PER OPSS 402. THEY ARE TO BE BACKFILLED WITH OPSS GRANULAR 'B' COMPACTED TO 98% SPMDD. JOINTS BETWEEN SECTIONS TO BE WRAPPED WITH NON-WOVEN GEOTEXTILE.
9. FOR STORM STRUCTURES: CAST IRON CATCH BASIN MAINTENANCE HOLE COVER AS PER OPSD 401.010 TYPE 'B' AND CAST IRON CATCH BASIN COVER AS PER OPSD 400.020.
10. THE CONTRACTOR IS RESPONSIBLE FOR MAKING OR ARRANGING ALL CONNECTIONS TO THE EXISTING SEWERS AS PER MUNICIPAL REQUIREMENTS. PRIOR TO CONNECTION, THE CONTRACTOR MUST PROVIDE, TO THE CONSULTANT / ENGINEER AND THE CITY FOR APPROVAL, ALL TEST RESULTS PERFORMED ON THE INTERNAL SERVICES.
11. ADVISE THE CITY PUBLIC WORKS AT LEAST 72 HOURS IN ADVANCE BEFORE ANY CONNECTION TO THE TOWN SERVICES. CO-ORDINATE WITH TOWN AS REQUIRED.
12. TERMINATE AND PLUG ALL SERVICE CONNECTIONS AT 1.0 m FROM EDGE OF THE BUILDING.
13. ALL SEWERS TO BE C.C.T.V. INSPECTED BY THE CONTRACTOR AS PER OPSS 409. TWO COPIES OF THE INSPECTION REPORT MUST BE PROVIDED TO THE CONSULTANT AND THE C.C.T.V. INSPECTION IN DVD FORMAT ONLY.
14. SUBDRAIN KNOCKOUT (KO) WILL BE PRE-MANUFACTURED WITH CATCH BASINS AND MAINTENANCE HOLES.
15. EXISTING STORMTECH CHAMBERS LOCATED ON THE SOUTH WEST END OF THE PARKING LOT, PARALLEL TO GREENBANK (SEE PLAN C102), TO BE KEPT AND PROTECT, FREE OF ANY CONSTRUCTION DEBRIS OR ANY OTHER DAMAGES DURING CONSTRUCTION.

EROSION AND SEDIMENT CONTROL MEASURES:

- CONTRACTOR IS RESPONSIBLE FOR ALL INSTALLATION, MONITORING, REPAIR AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL FEATURES. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURE MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
- SEDIMENT AND EROSION CONTROL PLAN OBJECTIVES:
- PREVENT SOIL EROSION. THIS CAN RESULT FROM STREAMING RAIN WATER OR WIND EROSION DURING CONSTRUCTION,
- PREVENT SEDIMENT DEPOSITS IN THE SEWER PIPES AND NEARBY COLLECTING STREAMS (AS APPLICABLE),
- PREVENT AIR POLLUTION FROM PARTICULATE MATTER AND DUST.

1. PRIOR TO START OF CONSTRUCTION:

PRIOR TO THE REMOVAL OF ANY VEGETATIVE COVER, MOVING OF SOIL AND CONSTRUCTION:
- INSTALL SILT FENCE (AS PER OPSD 219.110) ALONG DITCHES IMMEDIATELY DOWNSTREAM FROM AREAS TO BE DISTURBED.
- INSTALL FILTER CLOTH ON DOWNSTREAM MANHOLE COVERS.
- INSTALL SILTSACK FILTERS IN ALL CONCRETE CATCH BASINS STRUCTURES.
- INSPECT MEASURES IMMEDIATELY AFTER INSTALLATION.
- THE CONTRACTOR MUST SET UP THE MEASURES INDICATED ON THE PLAN, INSPECT THEM FREQUENTLY AND CLEAN AND REPAIR OR REPLACE THE DETERIORATED STRUCTURES. AT THE END OF THE CONSTRUCTION PERIOD, THE CONTRACTOR IS RESPONSIBLE FOR REMOVAL OF THE TEMPORARY STRUCTURES AND RECONDITIONING THE AFFECTED AREAS

2. DURING CONSTRUCTION:

- SEDIMENT AND EROSION CONTROL MEASURES TO BE CONSTRUCTED AS PER OPSS 805.
- WHEN SEDIMENT AND EROSION CONTROL MEASURES MUST BE REMOVED TO COMPLETE A PORTION OF THE WORK, THE SAME MEASURES MUST BE REINSTATED UPON THE WORK'S COMPLETION.
- WORK TO BE DONE IN THE VICINITY OF MAJOR WATERWAYS TO BE CARRIED OUT FROM JULY AND SEPTEMBER ONLY.
- MINIMIZE THE EXTENT OF DISTURBED AREAS AND THE DURATION OF EXPOSURE.
- PROTECT DISTURBED AREAS FROM RUNOFF.
- PROVIDE TEMPORARY COVER SUCH AS SEEDING OR MULCHING IF DISTURBED AREA WILL NOT BE REHABILITATED SHORTLY.
- INSPECT STRAW BALE FLOW CHECK DAMS, SILT FENCES, SILT SACKS, AND CATCH BASIN SUMPS REGULARLY AND AFTER EVERY MAJOR STORM EVENT. CLEAN AND REPAIR WHEN NECESSARY.
- PLAN TO BE REVIEWED AND REVISED AS REQUIRED DURING CONSTRUCTION.
- EROSION CONTROL FENCING TO BE ALSO INSTALLED AROUND THE BASE OF ALL STOCKPILES.
- DO NOT LOCATE TOPSOIL PILES AND EXCAVATION MATERIAL CLOSER THAN 2.5m FROM ANY PAVED SURFACE, OR ONE WHICH IS TO BE PAVED BEFORE THE PILE IS REMOVED. ALL TOPSOIL PILES ARE TO BE SEEDED IF THEY ARE TO REMAIN ON SITE LONG ENOUGH FOR SEEDS TO GROW (LONGER THAN 30 DAYS). WHEN STORING SOIL ON SITE IN PILES THE CONTRACTOR MUST COVER EACH PILE WITH TARPS, STRAW OR A GEOTEXTILE FABRIC TO AVOID FINE PARTICLE TRANSPORT BY WIND AND/OR STREAMING RAIN WATER.
- CONTROL WIND-BLOWN DUST OFF SITE TO ACCEPTABLE LEVELS BY SEEDING TOPSOIL PILES AND OTHER AREAS TEMPORARILY (PROVIDE WATERING AS REQUIRED). FOR DUST CONTROL, CONTRACTOR TO APPLY CALCIUM CHLORIDE (TYPE I – OPSS 2501 AND CAN/CGSB-15-1) AND WATER WITH EQUIPMENT APPROVED BY THE OWNER'S REPRESENTATIVE AT RATE IN ACCORDANCE TO OPSS 506 WHEN DIRECTED BY OWNER'S REPRESENTATIVE.
- ALL EROSION CONTROL STRUCTURE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER. SEDIMENT CAPTURE SILT SACKS MUST BE MAINTAINED AND CANNOT BE REMOVED UNTIL ALL LANDSCAPING AREAS ARE COMPLETED.
- NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVES BY THIS CONSULTING ENGINEER AND THE TOWN DEPARTMENT OF PUBLIC WORKS.
- CONTRACTOR RESPONSIBLE FOR MUNICIPAL ROADWAY AND SIDEWALK TO BE CLEANED OF ALL SEDIMENT FROM VEHICULAR TRACKING ETC. AT THE END OF EACH WORK DAY.
- DURING WET CONDITIONS, TIRES OF ALL VEHICLES/EQUIPMENT LEAVING THE SITE ARE TO BE SCRAPED.
- ANY MUD/MATERIAL TRACKED ONTO THE ROAD SHALL BE REMOVED IMMEDIATELY BY HAND OR RUBBER TIRE LOADER.
- TAKE ALL NECESSARY STEPS TO PREVENT BUILDING MATERIAL, CONSTRUCTION DEBRIS OR WASTE BEING SPILLED OR TRACKED ONTO ABUTTING PROPERTIES OR PUBLIC STREETS DURING CONSTRUCTION AND PROCEED IMMEDIATELY TO CLEAN UP ANY AREAS SO AFFECTED.
- PROVIDE GRAVEL ENTRANCE WHEREVER EQUIPMENT LEAVES THE SITE TO PROVIDE MUD TRACKING ONTO PAVED SURFACES. GRAVEL BED SHALL BE A MINIMUM OF 10m LONG, 4m WIDE, AND 0.15m DEEP AND SHALL CONSIST OF COARSE MATERIAL. MAINTAIN GRAVEL ENTRANCE IN CLEAN CONDITION.

3. AFTER CONSTRUCTION:

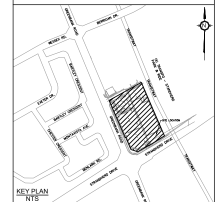
- PROVIDE PERMANENT COVER CONSISTING OF TOPSOIL AND SEED TO DISTURBED AREAS.
- ALL SEDIMENT AND EROSION CONTROL MEASURES TO BE REMOVED BY THE CONTRACTOR FOLLOWING THE COMPLETION OF WORK AND AFTER DISTURBED AREAS HAVE BEEN REHABILITATED AND STABILIZED, THIS INCLUDES REMOVE STRAW BALE FLOW CHECK DAMS, SILT FENCES AND FILTER CLOTHS ON CATCH BASINS AND MANHOLE COVERS.
- INSPECT AND CLEAN CATCH BASIN SUMPS AND STORM SEWERS.

STORM SEWER STRUCTURE TABLE

STRUCTURE No.	STRUCTURE DETAILS	ELEVATIONS (m)	NORTHING	EASTING
MHST-1	CONCRETE MANHOLE 1200mm OPSD 701.010	T/G = 100.58 INV NE = 97.81 INV NW = 97.75	5014866.96	363999.18
RYCB-2	RYCB 375mm CITY OF OTTAWA S31	T/G = 99.96 INV SW = 97.98	5014871.28	364006.61
EX. MHST	EXISTING STRUCTURE	EX T/G = 100.26 EX INV SW = 97.33 NEW INV E = 97.34 NEW INV SE = 97.40	5014882.64	363991.18

TURNER FLEISCHER
Turner Fleischer Architects Inc.
67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

The site plan prepared by Turner Fleischer is reliant on a legal survey showing the boundaries of the lands together with the current location of any existing buildings, features or encroachment prepared by JD BARNES LIMITED, dated 2020-12-22 as provided by CANADIAN TIRE.



KEY PLAN
NTS

PARSONS
1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON NOVEMBER 9TH, 2022. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

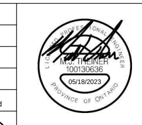
#	DATE	DESCRIPTION	BY
1	2023-05-18	ISSUED FOR SITE PLAN APPLICATION	PC

BARRHAVEN
STORE No.
442

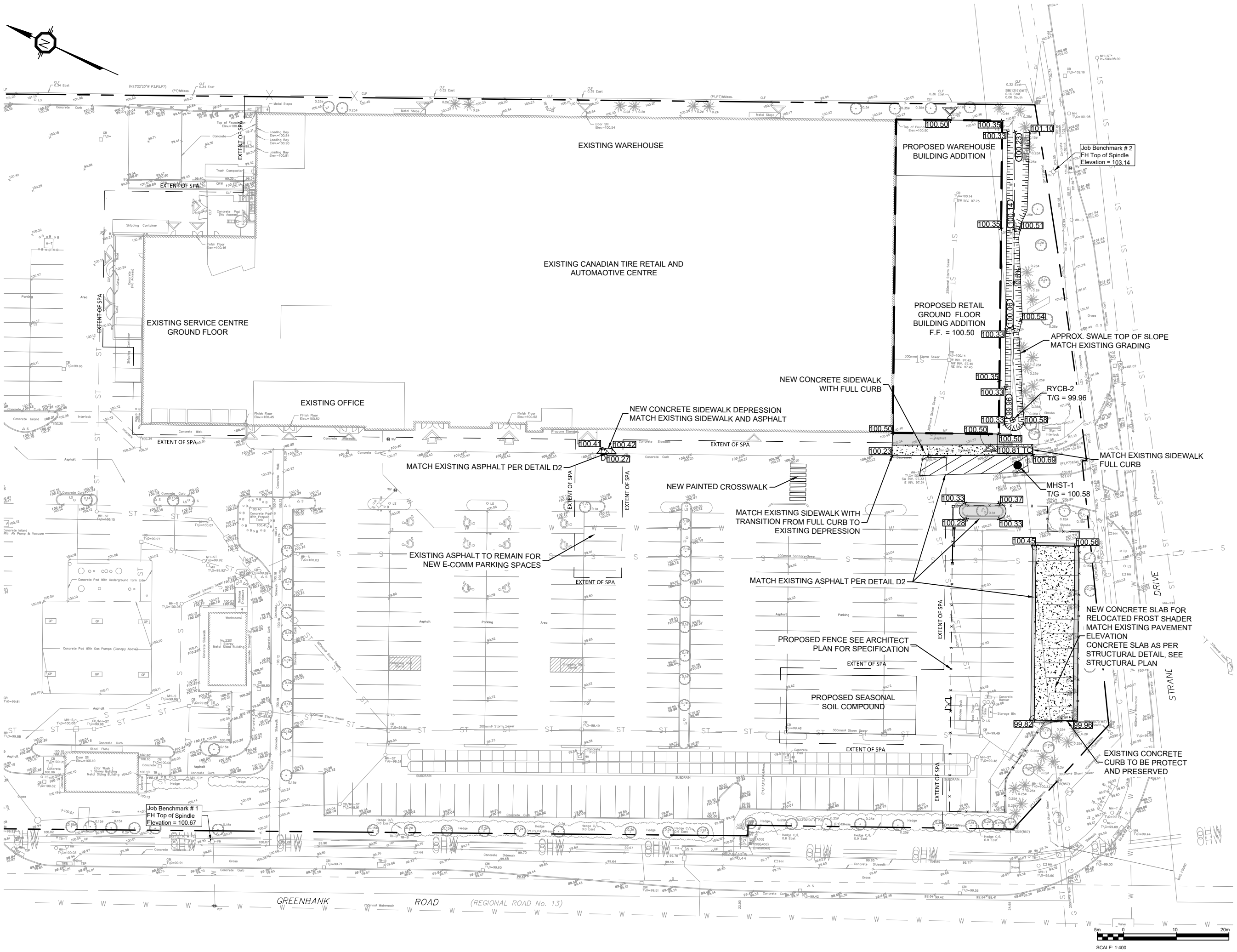
PROJECT
2501 GREENBANK RD
CANADIAN TIRE STORE EXPANSION
BARRHAVEN, ONTARIO

DRAWING
SITE SERVICING &
EROSION/SEDIMENT CONTROL PLAN

PROJECT NO. 478461
PROJECT DATE 2022-09-23
DRAWN BY BV
CHECKED BY MT
SCALE As indicated



DRAWING NO. C102
REV. 1

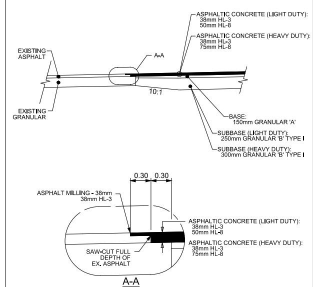


PAVEMENT STRUCTURES			
MATERIAL	LIGHT DUTY	HEAVY DUTY	COMPACTION
Asphaltic Concrete Surface Course: HL3	38 mm	38 mm	≥ 97%
Asphaltic Concrete Binder Course: HL8	50 mm	75 mm	≥ 97%
Granular Base: OPSS 1010 Granular A (crushed limestone)	150 mm	150 mm	100%
Granular Sub-base: OPSS 1010 Granular B, Type I	250 mm	300 mm	100%

FROM: GEOTECHNICAL INVESTIGATION, PROPOSED BUILDING STORE #442, GREENBANK ROAD, NEPEAN, ONTARIO, BY JACQUES, WHITFORD LIMITED. DATED JANUARY 31, 2000
*MINIMUM PAVEMENT COMPACTION BASED ON MARSHALL BULK DENSITY TEST
**BASED ON STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD)

LEGEND:

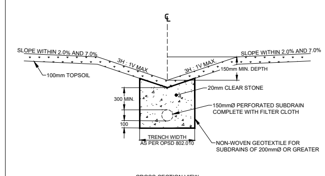
- EXISTING PROPERTY LINE
- TERRACE (3:1 MAX)
- PROPOSED CENTERLINE SWALE WITH SUBDRAIN 150mmØ
- 99.99 EXISTING GRADE
- 99.99 PROPOSED GRADE
- 99.99 TC PROPOSED GRADE TOP OF CURB
- 99.99 PROPOSED SWALE CENTERLINE GRADE
- 9.9% PROPOSED SLOPE DIRECTION AND PERCENTAGE
- PROPOSED LIGHT DUTY PAVEMENT
- PROPOSED HEAVY DUTY PAVEMENT
- PROPOSED CONCRETE SIDEWALK
- PROPOSED BUILDING ADDITION OUTLINE
- PROPOSED FENCE SEE ARCHITECT PLAN



NEW TO EXISTING PAVEMENT PERPENDICULAR TRANSITION TREATMENT
N.T.S.

PARSONS

D2



CROSS-SECTION VIEW

NOTE:
1. ALL DIMENSION ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. APPROVED NON-WOVEN CLASS 1 GEOTEXTILE SHALL BE USED.
3. LONGITUDINAL SLOPE OF SWALES/DITCHES 0.5% MINIMUM WITH 1% OR GREATER PREFERRED.
4. PERFORATED SUBDRAIN TO BE INSTALLED AT MINIMUM 0.5% SLOPE

SWALE WITH SUBDRAIN
N.T.S.

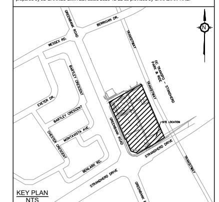
PARSONS

D3

TURNER FLEISCHER

Turner Fleischer Architects Inc.
67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

The site plan prepared by Turner Fleischer is reliant on a legal survey showing the boundaries of the lands together with the current location of any existing buildings, features or encroachment prepared by JD BARNES LIMITED, dated 2020-12-22 as provided by CANADIAN TIRE.



KEY PLAN
NTS

PARSONS

1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON NOVEMBER 9TH, 2022. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

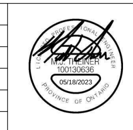
#	DATE	DESCRIPTION	BY
1	2023-05-18	ISSUED FOR SITE PLAN APPLICATION	PC

BARRHAVEN
STORE No. 442

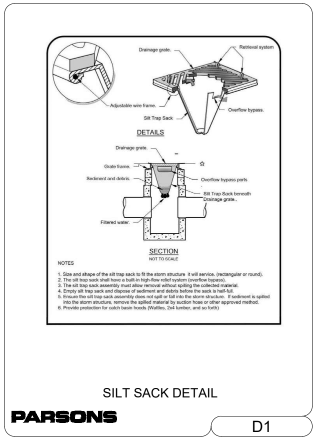
PROJECT
2501 GREENBANK RD
CANADIAN TIRE STORE EXPANSION
BARRHAVEN, ONTARIO

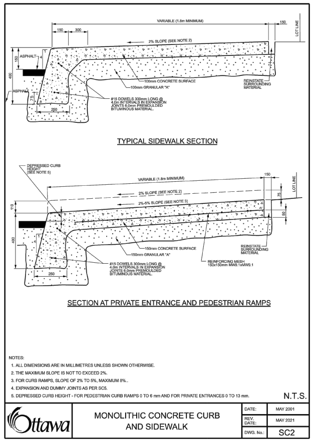
DRAWING
GRADING PLAN

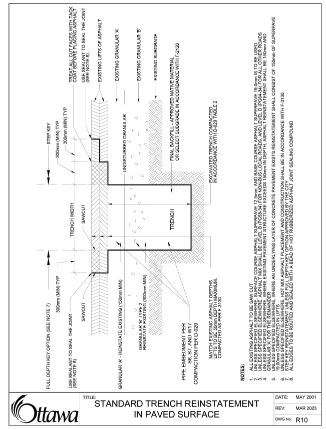
PROJECT NO.
478461
PROJECT DATE
2022-09-23
DRAWN BY
BV
CHECKED BY
MT
SCALE
As indicated

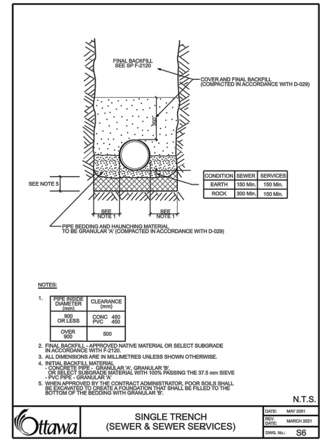


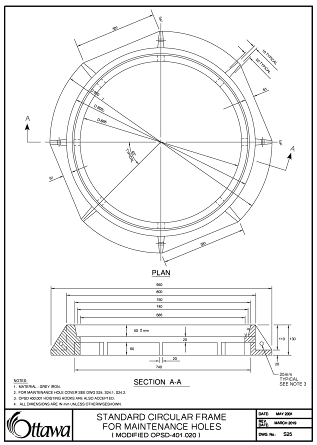
DRAWING NO.
C103
REV.
1

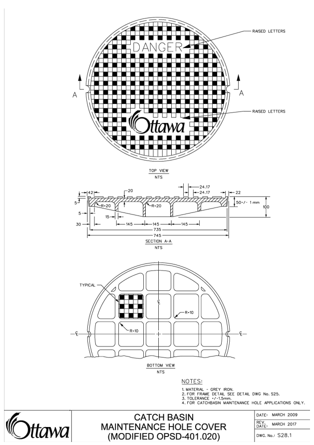


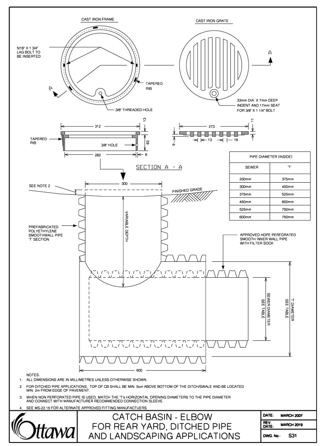


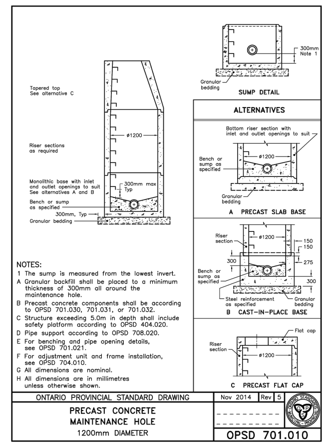










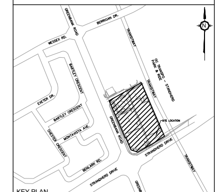


TURNER FLEISCHER

Turner Fleischer Architects Inc.

67 Lesmill Road
Toronto, ON, M3B 2T8
T 416 425 2222
turnerfleischer.com

The site plan prepared by Turner Fleischer is reliant on a legal survey showing the boundaries of the lands together with the current location of any existing buildings, features or encroachment prepared by JD BARNES LIMITED, dated 2020-12-22 as provided by CANADIAN TIRE.



KEY PLAN
NTS

PARSONS

1223 MICHAEL STREET, SUITE 100, OTTAWA, ONTARIO K1J 7T2
Tel: 613-738-4160 Fax: 613-739-7105

TOPOGRAPHIC INFORMATION & BENCHMARK

SURVEY COMPLETED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. ON NOVEMBER 9TH, 2022. ELEVATIONS SHOWN ARE GEODETIC AND ARE REFERRED TO THE CGVD28 GEODETIC DATUM, DERIVED FROM CONTROL MONUMENT NO. 019680071 HAVING AN ELEVATION OF 99.742m.

#	DATE	DESCRIPTION	BY
1	2023-05-18	ISSUED FOR SITE PLAN APPLICATION	PC

BARRHAVEN
STORE No. 442

PROJECT

2501 GREENBANK RD
CANADIAN TIRE STORE EXPANSION

BARRHAVEN, ONTARIO

DRAWING

DETAILS

PROJECT NO.	478461
PROJECT DATE	2022-09-23
DRAWN BY	BV
CHECKED BY	MT
SCALE	As indicated

LICENSED PROFESSIONAL ENGINEER
M.J. THEINER
100130636
05/18/2023
PROVINCE OF ONTARIO

N

DRAWING NO. C104
REV. 1