Assessment of Adequacy of Public Services
232 Donald B. Munro Drive
Village of Carp
City of Ottawa

Report Project: 131947-6.04.03

January 2025

Assessment of Adequacy of Public Services 232 Donald B. Munro Drive – Village of Carp, City of Ottawa

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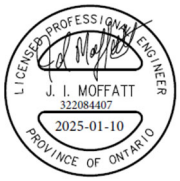

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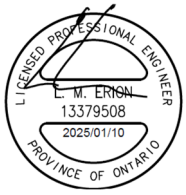

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1 INTRODUCTION

1.1 Purpose

The purpose of this report is to investigate and confirm the adequacy of public services for the proposed site. This report will review major municipal infrastructure including water supply, wastewater collection and disposal and management of stormwater. This report will also include a Sedimentation and Erosion Control Plan.

This report is being prepared as a technical document in support of a re-zoning application for the subdivision and was prepared in accordance with the November 2009 “Servicing Study Guidelines for Development Applications” in the City of Ottawa. **Appendix A** contains a customized copy of those guidelines which can be used as a quick reference for the location of each of the guideline items within the study report.

1.2 Background

The City of Ottawa completed a Community Design Plan (CDP) for the Village of Carp in June 2004. Among other things the CDP recommended a preferred Land Use plan for the Village of Carp. In support of the CDP, A.J. Robinson assisted the City of Ottawa in March 2005 with the preparation of an Environmental Management Plan (EMP). Attached for reference in **Appendix A**, is a copy of the Village of Carp – Community Design Plan – Schedule A – Land Use Plan which was extracted from the EMP report. Area I on that plan, which includes 232 Donald B. Munro Drive, is designated as low-density residential land use.

In 2011, D & H Rivington Enterprises started the Green Meadows subdivision which is located south of Donald B. Munro Drive also in Area I. They retained the services of exp Services Inc. to complete a Site Servicing and Stormwater Management Report for the Green Meadows Subdivision. That report provided a detailed description and design for water supply, wastewater collection and stormwater management for the Green Meadow development. That design also included a storm sewer outlet for the subject site and extension of both a sanitary sewer and watermain along the section of Donald B. Munro Drive in front of the subject site. The original watermain and sanitary sewer were constructed in the mid-1990’s in that street up to the limits of the Green Meadows development and subject site.

1.3 Subject Site

The current concept plan for the subject site is shown in **Figure 1.1**. The site covers about 24.3 ha but only about 6.5 ha are zoned for urbanization, the balance will remain as a Natural Environmental Area (NEA). The site is located at 232 Donald B. Munro Drive in the Village of Carp. It is located between two existing residential developments with an unopened road allowance to the north and Donald B. Munro Drive to the south. The proposed development includes a mix of single-family units and semi-detached units 105 units. The existing topography is from north to south so municipal services will connect and outlet to Donald B. Munro Drive.

1.4 Scope

Carp Development Inc. is planning to develop the subject site. This report is being prepared in support of a re-zoning application for the subject lands. This report will provide a recommended preliminary servicing plan for the major municipal infrastructure needed to support development of the site. The review will be a macro level study with further details to be confirmed and provided during the detailed design process in the form of detail drawings and design briefs. This report will demonstrate how proposed municipal servicing is in conformance with previous servicing studies. Any deviation from those documents will also be identified with rationalization for the change.

1.5 Phasing

The project is expected to be developed as one phase.

1.6 Previous Studies

Some of the previous studies, reports and designs that provided background, context and development recommendations for the subject sire include the following:

1. **Village of Carp, Communal Water Supply and Sewage Systems**, August 1993, by Kostuch Engineering Limited for the Regional Municipality of Ottawa-Carleton. This design included construction of a 200 mm dia watermain and 250 mm dia sanitary sewer in Donald B. Munro Drive up to the western limit of the subject site.
2. **Community Design Plan (CDP) for the Village of Carp**, City of Ottawa June 2004. The CDP identified areas for urbanization including Area I which includes a portion of the subject land.
3. **Carp River Watershed/Subwatershed Study (CRWSS)**, City of Ottawa by Robinson Consultants Inc., March 2005. The CRWSS provides a framework for development in the sub/watershed context.
4. **Village of Carp Environmental Management Plan (EMP)**, City of Ottawa by Robinson Consultants Inc., March 2005. The EMP was prepared in support of the CDP and provided recommendations for treatment of stormwater runoff including that from the subject site.
5. **Site Servicing and Stormwater Management Report**, August 2011, prepared by exp Services Inc., for D & H Rivington Enterprises. The report provided the detail design of the Green Meadows Subdivision. The design of that subdivision included runoff allowances for the subject site for both minor and major flows.

The subject property will follow the servicing recommendations of these reports.

1.7 Environmental Issues

The subject property covers about 24.3 ha of which only 8.0 ha is proposed for urbanization. The balance is proposed to remain undeveloped as an environmental area. Some of the area which is proposed for urbanization has been stripped of vegetation including topsoil. About 60% of the property is still vegetated with trees and shrubs. A tree cutting permit will be required prior to development.

There is an existing ditch which bisects the site in a north-south direction and carries runoff from the property to a catchbasin which is connected to the minor storm sewer system constructed as part of the Green Meadows subdivision south of Donald B. Munro Drive.

In the spring of 2021, the City Natural Systems and Rural Affairs staff, the applicant and environmental consultants field-proofed and confirmed the boundary between development and environmental protection lands, and this boundary will be reflected in a future zoning by-law application.

1.8 Pre-Consultation

There was a pre-consultation meeting with the City of Ottawa on December 16, 2020 and a copy of the meeting notes are attached in **Appendix A**. Some of the topics covered during the meeting included the following:

- Traffic Impact Assessment Screening Form
- Affordability

- Townhouses
- Noise wall potential
- Capacity of existing water supply and wastewater collection systems
- Environmental Protection Zone
- Soil Conditions
- Hydrogeotechnical Report
- Stormwater Management
- Speed Limits
- Environmental Impact Statement and IER
- Zoning Limits
- Headwater Assessment
- Parkland Dedication
- Village Entrance
- Tree Conservation Report

1.9 Geotechnical Consideration

Paterson Group Inc. completed a geotechnical investigation report on May 13, 2022 titled, “Geotechnical Investigation Proposed Residential Development 232 Donald B. Munro Drive Village of Carp, Ontario – Revision 2”. The report provides recommendations for both house and servicing construction. Parts of the site consist of clay to the extent that grade raise restrictions in some areas are limited to between 1.8 m and 2.5 m. The report also recommended obtaining a Permit To Take Water. Other topics included in the preliminary report include Site Grading and Preparation; Pavement Design and Groundwater Control.

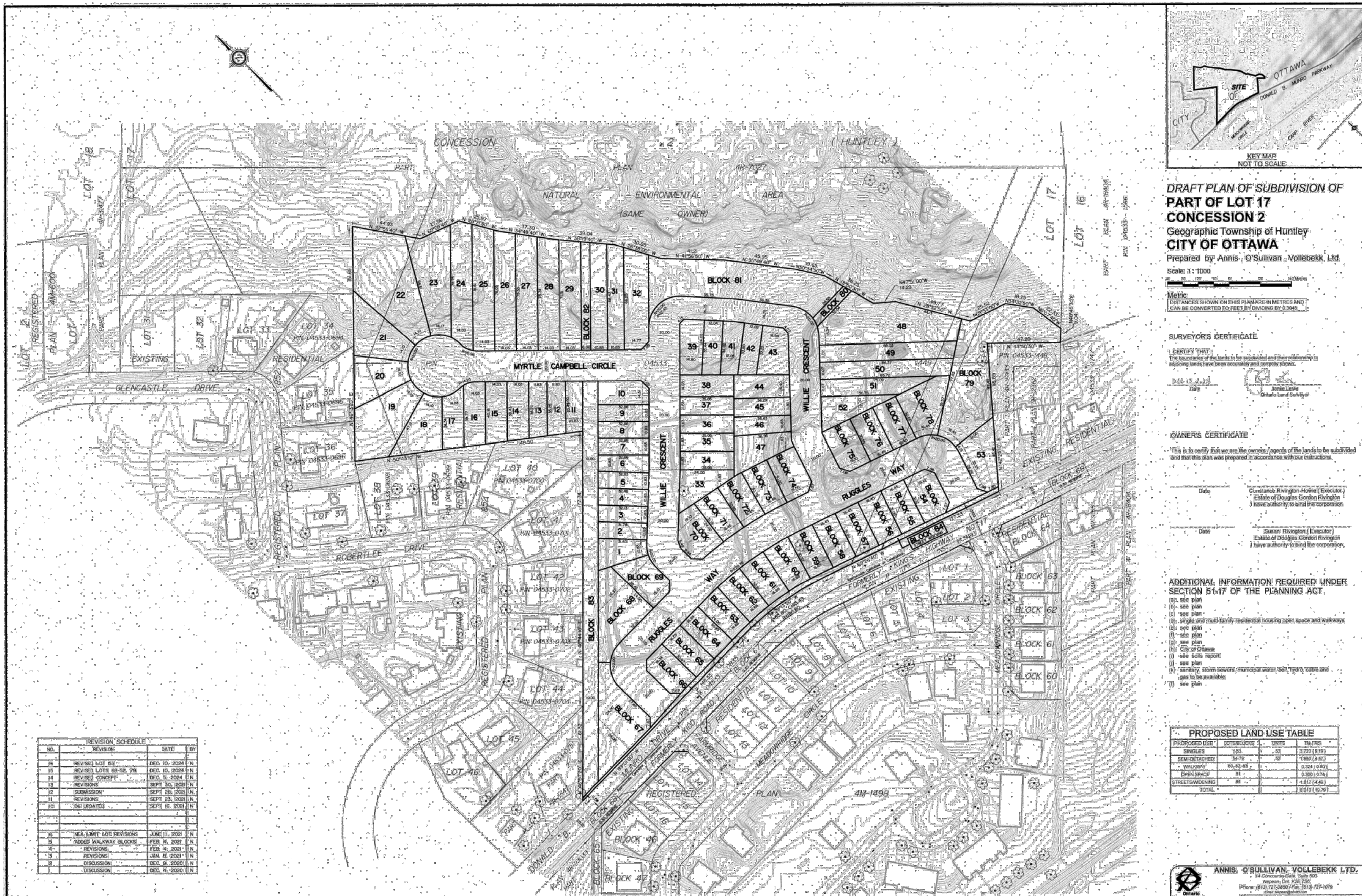
1.10 Watercourses and Setbacks

There is an existing watercourse that bisects the site in a north to south direction. The watercourse carries surface runoff from the natural environment area of the property and outlets to an existing storm sewer system. The lower reaches of that watercourse are proposed to be filled in the urbanized portion of the property. Consultation with the Mississippi Valley Conservation will confirm any permit requirements. Because the watercourse is proposed to be filled there will be no setback requirements related to the watercourse.

As noted earlier, the northern portion of the property is a Natural Environmental Area (NEA) which will not be urbanized. We understand that there will be a requirement to respect a 15 m setback distance from the NEA.

1.11 Private Services

A hydrogeological report will be required to support any development application for the property. The report will confirm the existence of any private services including wells within a radius of influence of the development. If so identified, the development program will deal with such situations as needed.



REVISION SCHEDULE			
NO.	REVISION	DATE	BY
16	REVISED LOT 53	DEC. 10, 2024	N
15	REVISED LOTS 48-52, 79	DEC. 10, 2024	N
14	REVISED CONCEPT	DEC. 5, 2024	N
13	REVISIONS	SEPT 30, 2021	N
12	SUBMISSION	SEPT 28, 2021	N
11	REVISIONS	SEPT 23, 2021	N
10	D6 UPDATED	SEPT 16, 2021	N
6	NEA LIMIT LOT REVISIONS	JUNE 11, 2021	N
5	ADDED WALKWAY BLOCKS	FEB. 4, 2021	N
4	REVISIONS	FEB. 4, 2021	N
3	REVISIONS	JAN. 8, 2021	N
2	DISCUSSION	DEC. 9, 2020	N
1	DISCUSSION	DEC. 4, 2020	N

PROPOSED LAND USE TABLE			
PROPOSED USE	LOTS/BLOCKS	UNITS	Ha (Ac)
SINGLES	1-53	53	3.720 (9.19)
SEMI-DETACHED	54-79	52	1.850 (4.57)
WALKWAY	80, 82, 83		0.324 (0.80)
OPEN SPACE	81		0.300 (0.74)
STREETS/WIDENING	84		1.817 (4.49)
TOTAL			8.010 (19.79)

ARCADIS

Scale
N.T.S.

Project Title
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title
CONCEPT PLAN

Sheet No.
FIGURE 1.1
2025/01/10

2 WATER SUPPLY

2.1 Existing Conditions

There is an existing 200 mm watermain in Donald B. Munro Drive along the south boundary of the site. **Figure 2.1,** located in **Appendix B,** shows the location of the existing watermains in the vicinity of the subject site. A 200 mm watermain stub has been provided for a connection to Ruggles Way. Although there is a looped water distribution network adjacent to the site in Donald B. Munro Drive, the City has advised that the Carp water distribution network is currently operating at capacity and cannot presently provide a reliable water supply to new suburban expansions such as the subject site. The City also advised that it is reviewing the situation with an aim of increasing the Carp water supply system in order to accommodate further urban expansion in Carp.

2.2 Design Criteria

2.2.1 Water Demands

Water demands have been calculated for the site based on per unit population density and consumption rates taken from Tables 4.1 and 4.2 of the City of Ottawa Design Guidelines – Water Distribution and are summarized as follows:

- Single Family 3.4 person per unit
- Townhouse and Semi-Detached 2.7 person per unit
- Average Apartment 1.8 person per unit
- Residential Average Day Demand 280 l/cap/day
- Residential Peak Daily Demand 700 l/cap/day
- Residential Peak Hour Demand 1,540 l/cap/day

Residential units in the subject site consists of single family lots and semi-detached units. A watermain demand calculation sheet is included in **Appendix B** and the total water demands are summarized as follows:

- Average Day 1.04 l/s
- Maximum Day 2.60 l/s
- Peak Hour 5.71 l/s

2.2.2 System Pressure

The Ottawa Design Guidelines – Water Distribution (WDG001), July 2010, City of Ottawa, Clause 4.2.2 states that the preferred practice for design of a new distribution system is to have normal operating pressures range between 345 kPa (50 psi) and 552 kPa (80 psi) under maximum daily flow conditions. Other pressure criteria identified in Clause 4.2.2 of the guidelines are as follows:

Maximum Pressure — Maximum pressure at any point in the distribution system shall not exceed 689 kPa (100 psi). In accordance with the Ontario Building/Plumbing Code, the maximum pressure should not exceed 552 kPa (80 psi). Pressure reduction controls will be required for buildings where it is not possible/feasible to maintain the system pressure below 552 kPa.

Minimum Pressure	Minimum system pressure under peak hour demand conditions shall not be less than 276 kPa (40 psi)
Fire Flow	During the period of maximum day demand, the system pressure shall not be less than 140 kPa (20 psi) during a fire flow event.
Water Age	A total travel time of 5 days or less during basic day demand is reasonable. A resident time of 8 days should not be exceeded.

2.2.3 Fire Flow Rates

In the recent Technical Bulletin 'ISDTB-2014-02, Revisions to Ottawa Design Guidelines – Water', the fire flow requirements for single detached dwellings and traditional town and row houses can be capped at 10,000 l/min provided that there is a minimum separation of 10 meters between the backs of adjacent units and that the town and row house blocks are limited to 600 square meters of building areas and seven dwelling units. The townhouses and lots in the majority of this development meet the requirements of ISDTB-2014-02, the fire flow rate of 10,000 l/min (166.7 l/s) will be used in the fire flow analysis.

There are several locations where the rear of the single-family home faces the side of an adjacent unit. At these locations the distance between the rear and side of the adjacent building may be less than 10 meters depending on the size of the houses which appears to violate item 4.1 of Technical Bulletin ISDTB-2014-02 which requires a 10 meter separation between the backs of the adjacent units. Without the 10,000 l/min cap the fire flow is calculated per the Water Supply for Public Fire Protection, A Guide to Recommended Practice in Canada 2020 by the Fire Underwriters Survey (FUS) method of determining fire flow rates. A sample calculation, using estimated building sizes and separations is included in **Appendix B** for Lot 38 which is flanked by lots 39 and 40, results of the calculation show a fire demand of 10,000 l/min.

2.3 Proposed Water Plan

The proposed water plan for this development is shown on **Figure 2.2,** located in **Appendix B,** shows 200 mm watermains extending throughout the development. At this time the City of Ottawa is not providing watermain boundary conditions for the existing watermain on Donald B. Munro Drive pending further study. A watermain analysis was conducted for the adjacent Green Meadows Subdivision in a Site Servicing Report by exp Services Inc., March 2011 that is referenced in Section 1.6. The City provided a hydraulic boundary condition at the same location where Street No. 2 will connect to the existing watermain. The boundary condition was provided in 2007 and had a fire flow demand of 125 l/s which is less than the 167 l/s (10,000 l/mm) fire flow requirement per Section 2.2.3. No hydraulic analysis will be done on this site until the City of Ottawa can provide updated boundary conditions for the existing watermain on Donald B. Munro Drive.

A discussion on the system pressure requirements is outlined in Section 2.2.2 above, some comments and observations of the proposed water plan follow.

Maximum Pressure	In the 2007 boundary condition a high-pressure check elevation of 163.0 m was provided which corresponds approximately to a surface elevation of 106.7m at which the pressure is 552 kPa.
Minimum Pressure	Based on the peak hour boundary condition of 159.0 m provided in 2007 it is expected that all units in the proposed development will exceed the minimum pressure requirements of 276 kPa.
Fire Flow	Without a current boundary condition based on a 167 l/s fire flow demand it is difficult to speculate on the fire flows. As shown on

Figure 2.2, Conceptual Watermain Plan, there are 22 lots on a dead end cul-de-sac on Myrtle Campbell Circle. While the 22 unlooped lots meet the requirements of Section 4.3.1 of the Ottawa Design Guidelines Water Distribution it may be possible that adequate fire flows cannot be achieved on the unlooped watermain. Fire flows can be achieved by increasing the size of the watermain on Ruggles Way and Willie Crescent from Donald B. Munro Drive to Myrtle Campbell Circle, however, the increase in pipe size increases the volume of water in the system which can affect water quality.

Fire flows can also be calculated using the method from Appendix I of Technical Bulletin ISTB-2018-02. In this method an AA rated hydrant within 75 m of a building can contribute 5,700 l/min fire flow and 3,800 l/min for hydrants within 75 and 150 m from the building. Therefore, a building with two Class AA rated hydrants within 75 m will have a fire flow of 5,700 + 5,700 l/min for a total of 11,400 l/min which exceeds the 10,000 l/min requirement outlined in Section 2.2.3. A hydraulic analysis is required to determine if the hydrants in the model can be classified as AA rating and meet the residual pressure requirements when flowing at the same time.

Water Age

There are 22 single family lots on Myrtle Campbell Circle which are not on a looped watermain. An analysis is included in **Appendix B** which uses a consumption rate of 200 l/capital/day. Results of the analysis shows a turnover time for water consumption of less than 8 hours in the unlooped section. Before buildout the water quality on the cul-de-sac may be a concern based on the house building and occupancy schedule. An automatic flushing unit could be installed on the cul-de-sac to improve water turnover until a sufficient population is in place to provide the water demand.

3 WASTEWATER DISPOSAL

3.1 Existing Conditions

The Carp Sanitary Pump Station is the wastewater outlet for all urban lands in the Village of Carp. Flows from that pump station are carried in a 300 mm dia forcemain to sanitary sewer systems in Kanata where flows are ultimately directed to the Robert O. Pickard Wastewater Treatment Facility.

In the mid-1990's, the former Regional Municipality of Ottawa-Carleton, constructed central municipal infrastructure in the Village of Carp including the Pump Station and sanitary sewers. The sewer system at that time extended eastward along Donald B. Munro Drive and terminated at the western limit of the subject property.

In about 2011 that sanitary sewer was extended a little further eastward as part of the Green Meadows subdivision development. At present there is a 250 mm dia sanitary sewer terminated at the doorstep of the subject site near Street No. 2. **Figure 3.1**, Existing Sanitary Sewers, shows the location of the existing wastewater infrastructure in the vicinity of the subject site. Besides the 250 mm dia sanitary sewer, a 200 mm dia watermain and a 300 mm dia pump station forcemain are also located in Donald B. Munro Drive in front of 232 Donald B. Munro Drive.

Although there is a sanitary sewer collection and disposal system in the Village of Carp, the City of Ottawa has advised that the station is presently at capacity and cannot accept flows from new suburban expansion including the subject site. The City also advised it is in the process of reviewing the situation with an aim of increasing wastewater capacity in order to accommodate further urban expansion in Carp.

3.2 Master Servicing Studies

The City of Ottawa completed the Community Design Plan (CDP) for the Village of Carp in June 2004. The CDP provided a master plan for developments within the Village. Among other things it identified areas for urbanization which included the subject site. That property is identified as Area I on the Land Use plan from the CDP. A copy of same is included in **Appendix A**.

3.3 Design Criteria

The sanitary sewers for the subject site will be based on the standards of both the City of Ottawa and the provincial Ministry of the Environment Conservation and Parks. Some of the key criteria will include the following:

Average Day Residential Flow	280 l/cap/day
Residential Peaking Factor	Modified Harmon Formula (min – 2.0, max – 4.0)
Infiltration Rate	0.33 l/s/ha
Single Unit Population Density	3.4 ppu
Townhouse/Semi Unit Population Density	2.7 ppu
Velocities:	min – 0.6 m/s
	max – 3.0 m/s

3.4 Recommended Wastewater Plan

A Conceptual Sanitary Sewer Plan for 232 Donald B. Munro Drive is shown in **Figure 3.2,** which is located in **Appendix C.** Based on the preliminary concept plan, which includes 53 single units and 52 semi-detached units over an area of about 6.53 ha, the peak wastewater flow from the property will be 6.06 l/s. A copy of this calculation is included in **Appendix C**. The minimum size sanitary sewers permitted by the City of Ottawa is 200 mm dia which at a minimum slope has a capacity of 19.66 l/s. Therefore all proposed sanitary sewers will be 200 mm dia in size.

There will be one proposed connection to the existing 250 mm dia sewer (in Donald B. Munro Drive) from the western leg of Ruggles Way which will service the western potion of the subdivision. A second outlet sanitary sewer is recommended to outlet to Donald B. Munro Drive from the eastern leg of Ruggles Way. A new 200 mm dia sewer running westward along Donald B. Munro Drive will be needed to direct flows from the east portion of the proposed development to the existing outlet sewer.

3.5 Local Extraneous Flows

All sanitary sewers will be constructed to City of Ottawa standards, including testing prior to being put into service. There are no unusual local conditions within the subject site that are expected to contribute extraneous flows higher than those noted in the City's guidelines. Also, in accordance with the requirement of the December 2004 Carp River Watershed/Subwatershed Study infiltration controls will be investigated at the time of detail design and if put into service, should reduce some sources of extraneous flows to future site sewers. Such controls will be in accordance with applicable guidelines in effect at the time of detail design.

3.6 Sewer Calculations

Detailed sanitary sewer designs and drainage area plans, using criteria of the City of Ottawa and the provincial Ministry of Environment Conservation and Parks, will be provided during the detailed design of the subject site.

3.7 Environmental Constraints

The subject site covers an area of about 24.3 ha. Only about 8.0 ha of that area is zoned for urbanization while the balance is to remain as a naturalized environmental area. Accordingly, the southern limits of that environmental area will dictate the northern limit of the proposed subdivision. We understand that the urbanization of the site must respect a 15 m setback from the NEA.

4 STORMWATER MANAGEMENT

4.1 Existing Conditions

The subject property covers about 24.3 ha. The northern portion of the site is covered in vegetation while the southern portion has been cleared and grubbed. The site generally slopes from north to south with an average gradient in excess of 6%. There is an existing drainage ditch which bisects the site in a north south direction and directs surface runoff to an existing ditch inlet located adjacent to Donald B. Munro Drive. **Figure 4.1,** located in **Appendix D,** shows the existing site topography.

The adjacent Green Meadows development was constructed in about 2011 and, among other things, included a minor storm sewer system which provided capacity for the subject site. **Figure 4.2,** located in **Appendix D,** shows the location of the existing minor storm sewer system adjacent to the subject property. There is a 1050 mm dia storm sewer located in Donald B. Munro Drive adjacent to Street No. 2. That sewer system has been extended through the Green Meadows development where it passes frequent storm events through an oil and grit separator prior to release to the Carp River. The separator is designed to provide water quality treatment for both the Green Meadows development and the subject site.

Runoff from the Green Meadows site is conveyed via a channel to a 1980 mm diameter culvert crossing of the Ottawa Central Railway, downstream of which runoff is conveyed overland to the Carp River.

4.2 Design Constraints and Regulatory Requirements

4.2.1 Water Quantity Control

The subject site is located within the Carp River subwatershed. Section 4.1 of the EMP notes that areas draining to the Carp River do not require peak flow reduction to pre-development levels. As noted in above **Section 4.1**, the Green Meadows storm sewer was designed with an allocation for the subject site. The Green Meadows site accounts for runoff from 28.58 ha of future development area north of Donald B. Munro Drive. The rational method spreadsheet accounts for the 5 year flow calculated based on a runoff coefficient of 0.5. This results in a 5 year flow of 2.4 cms (refer to Green Meadows rational sheet and corresponding drainage area plan enclosed in **Appendix D**).

The flowing full capacity of the receiving downstream Ottawa Central Railway culvert was documented in Section 4.1.8 of the EMP, in which it is noted that "[t]he existing railway culvert consists of a 1.98 m diameter concrete pipe. Without surcharging, the capacity of this culvert is approximately 8 m^3/s." Refer to excerpt in **Appendix D**. The Green Meadows report indicates that the post-development runoff from the lands contributing to the culvert is just under 8 cms.

4.2.2 Water Quality Control

CRWSS Section 8.3.1.3 Urban Water Quality Control Plan states that for facilities discharging to the Carp River, Level 2 control is required, corresponding to 70% total suspended solids removal.

As noted in above **Section 4.1**, the Green Meadows subdivision is provided with an oil-grit separator (City SWMF ID 1239) that was sized to provide water quality treatment of the subject development. Refer to the Green Meadows Site Servicing and Stormwater Management Report Appendix 5 for OGS manufacturer sizing. The MOE Environmental Compliance Approval (Number 5689-8UCR8W) for the OGS is enclosed in **Appendix D**.

4.2.3 Infiltration

CRWSS Section 10.3 outlines groundwater targets for low, moderate and high recharge areas. The targets are: 73 mm/year for areas identified as low recharge potential, 104 mm/year for areas identified as medium recharge potential and 262 mm/year for areas identified as high recharge potential. Based on previous experience, areas comprised of clay soils have not been considered as areas with high recharge potential. However, a best effort will be made at the detailed design stage to maximize infiltration potential. For example, Arcadis suggests considering a modified rear yard trench system to promote infiltration. The design will account for site specific geotechnical and hydrogeological data and will also consider the topography of the site.

4.3 Storm Sewer Design Criteria

In accordance with the October 2012 City of *Ottawa Sewer Design Guidelines*, the following design criteria was used to size storm sewers using the rational method:

- Design return period: 1:2 year (subdivision)
  1:100 year (NEA area)
- Time of Concentration: 10 minutes
- Minimum velocity: 0.8 m/s
- Maximum velocity: 3.0 m/s
- Manning's roughness coefficient: 0.013
- Minimum allowable slopes: refer to below **Table 4-1**.

Table 4-1 City of Ottawa Minimum Allowable Slopes for Storm Sewer Pipes

SLOPE (%)	DIAMETER (MM)
0.432	250
0.340	300
0.250	375
0.195	450
0.160	525
0.132	600
0.113	675
0.100	750 and larger

Based on the preliminary concept plan for the property, a reasonable average runoff coefficient for the site is 0.40 to 0.55 for rear yards and 0.65 for roadways including Donald B. Munro Drive. We have also investigated a reasonable runoff coefficient for the NEA area. Based on information contained in the Minnesota Stormwater Manual, we have selected a runoff coefficient of 0.16. Refer to a table in **Appendix D**.

4.4 Proposed Minor Storm Plan

Based on the design criteria noted above, a preliminary storm sewer design sheet and **Figure 4.3**, Conceptual Storm Drainage Plan were developed and are included in **Appendix D**. Because the NEA area is upstream of the areas intended for municipal development, runoff from that external area needs to be included in the stormwater management strategy for the development. The location of the NEA tributary area is also shown on **Figure 4.3**. The total tributary NEA area is 16.0 ha. Based on our analysis, the NEA drainage is sub-divided into at least seven separate drainage areas. To collect the NEA runoff it is proposed to construct a swale below the proposed terracing from the NEA area. That swale (identified as NEA Swale on **Figure 4.3**) will also double as the rear yard swale on impacted lots. It is suggested that the 1:100 yr NEA runoff be captured in the NEA Swale and route same towards a series of ditch inlets. The inlets will release flows to nearby storm sewers in both Mrytle Campbell Circle and Willie Crescent.

The expected flow from the NEA area was calculated using the Rational Method. The Time of Concentration (TC) was calculated using the Airport Formula. Calculations of the TC's and runoff amounts are included in **Appendix D**.

The proposed minor storm plan is shown on **Figure 4.4**. The minor storm sewers could range in size from 250 mm dia to 1050 mm dia. All minor storm sewers will connect to the existing manhole in Donald B. Munro Drive at Ruggles Way. From there the minor storm flows from the subject site will enter the existing storm sewer in the Green Meadows development. The predicted site flows are about 2,309 l/s which is less than the available capacity of 2,688 l/s. Please refer to the design sheet in **Appendix D**.

4.5 Dual Drainage

The urbanized portion of the subject site will be designed with a dual drainage system that accommodates both minor and major stormwater runoff. During frequent storm events, the effective runoff of a catchment area is directly released via catchbasin inlets to the network of storm sewers, called the minor system. During less frequent storm events, the balance of the flow (in excess of the minor flow) is accommodated by a system of rear yard swales and street segments, called the major system. Opportunities for on-site storage in road sags across the subject site are limited. Inlet control devices (ICDs) will be utilized across the site to control the surcharge in the minor system during infrequent storm events and maximize use of available on-site storage. ICDs will be sized at the detailed design stage.

As noted above, the design of the downstream Green Meadows site accounts for minor system runoff from future development north of Donald B. Munro Drive. In terms of major flow from the subject site, the Green Meadows report contains 100 year runoff calculations for all contributing lands to the downstream culvert crossing of the railway, including the subject site. However, there are no details in the Green Meadows report to support how major flow from the subject site would be conveyed to the railway culvert. The Green Meadows design brief does not include a dual drainage model or depth and velocity calculations of surface flow, nor does it include a hydraulic grade line analysis. Following review of the Green Meadows grading plans, there does not appear to be adequate capacity on the Green Meadows streets to convey major flow from the subject site. For this reason, at this stage of the project Arcadis has developed a dual drainage model of the Green Meadows subdivision to simulate the existing storm sewer in an effort to optimize the amount of minor system runoff to the Green Meadows sewer while maintaining freeboard targets. The modeling effort is outlined in the following sections.

4.6 Hydraulic Evaluation

A hydrologic and hydraulic model was developed using PCSWMM to assess the feasibility of the proposed stormwater management concept and potential impacts to downstream stormwater infrastructure.

The dual drainage SWM model is presented in **Figure 4.5** and includes all areas upstream of the 1980mm diameter CN Rail culvert. The subject site was simulated at a conceptual level, while the receiving Green Meadows site was simulated at a detailed level. It should be noted that subsequent to the development of the model, there were refinements to the proposed draft plan of the subject site; such refinements do not change the proposed stormwater servicing concept of 100 year flow capture on the subject site. The subject site will be modeled in detail at the detailed design stage.

North of Green Meadows Drive, flow from the NEA area and subcatchment R4 is captured directly into the minor storm system. Subcatchments R1, R2, and R3 are routed via a swale which is also captured directly into the minor storm system at the southwest corner of the site. All other drainage is directed to streets draining towards Donald B. Munro Drive. The streets have all been modeled as continuous grade with approximately 50m spacing between catch basins. Major flow is fully captured into the storm sewer at low points indicated as LP1 and LP2 in **Figure 4.5**.

Detailed dual drainage modeling of the Green Meadows Subdivision located south of the subject site has been included to properly assess the capacity of the receiving storm sewer in addition to lumped drainage areas to the east which drain towards the CN rail culvert. Delineation of drainage areas, grades and storm inverts are based on the grading plan and profiles included in **Appendix D**. Catchbasins within the subdivision have been restricted to 20 l/s accounting for inlet control devices noted in the Green Meadows Site Servicing and Stormwater Management Report.

4.6.1 Design Storms

The stormwater management concept has been assessed using the following design storms:

- 2 year 3 hour Chicago (3H2CHI)
- 2 year 12 hour SCS Type II (12H2SCS)
- 2 year 24 hour SCS Type II (24H2SCS)
- 100 year 3 hour Chicago (3H100CHI)
- 100 year 12 hour SCS Type II (12H100SCS)
- 100 year 24 hour SCS Type II (24H100SCS)
- 100 year 3 hour Chicago stress test (3H120CHI)
- 100 year 12 hour SCS Type II stress test (12H120SCS)
- 100 year 24 hour SCS Type II stress test (24H120SCS)

4.6.2 Model Input Parameters

Subcatchments have been modeled in PCSWMM using both standard SWMM and Nash IUH runoff methods. Subcatchment input parameters used are consistent with OSDG guidelines and detailed in **Section 4.6.2.1** and **Section 4.6.2.2**. Due to the major system constraints on the receiving Green Meadows site, total flow generated on the subject site, up to and including the stress test, has been captured in the minor system. The downstream boundary condition was fixed to an HGL of 92.6 m based on the 100 year flood elevation in the Carp River PCSWMM model.

4.6.2.1 NEA Subcatchment Input Parameters

The NEA subcatchment located to the northeast of the subject site has been modeled using the Nash IUH runoff method with the SCS CN method used for losses. The hydrologic soil group B was selected for the NEA area based on available soils mapping for the area included in **Appendix D.** The mapping indicates that the soils in the NEA area consist of exposed bedrock and loamy sand or sandy loam with excessive to good drainage.

SCS CN Number – Considered the average CN value within the drainage area. A CN value of 55 has been used for the NEA subcatchment consistent with wooded areas in good hydrologic condition as outlined in the Table 9-1 of the NRCS National Engineering Handbook – Part 4 – Hydrology included in **Appendix D**.

Flow Length – Length of the longest flow path within the drainage are. A flow length of 540m was estimated using available LiDAR derived topography.

Subcatchment Slope – The average land slope of the drainage area determined using available LiDAR derived topography.

Initial Abstraction (Detention Storage) – The maximum potential retention of the drainage area. The initial abstraction in the SCS CN method is defined using the following equations:

$$i_a = 0.2S$$

$$S\ (mm) = \frac{25400}{CN} - 254$$

In accordance with the OSDG, the initial abstraction was reduced and set to 18.9 mm for the NEA subcatchment.

Time of Concentration – The time taken for flow to reach the outlet of the catchment. The time of concentration for NEA subcatchment has been estimated using the SCS method for watershed lag. The watershed lag method is defined by the following equation from chapter 15 of the NRCS National Engineering Handbook – Part 4 – Hydrology included in **Appendix D**:

$$t_c = \frac{L^{0.8}(S+1)^{0.7}}{1140Y^{0.5}}$$

Where:

t_c =Time of concentration (hours)
L = flow length (ft), defined as the longest flow path from the watershed divide to the outlet
S = maximum potential retention (in)
Y = Average watershed land slope

4.6.2.2 SWMM Subcatchment Input Parameters

Area and Imperviousness – Catchment areas used in the modeling are shown in **Figure 4.5**. Impervious ratios used within the subdivision are consistent with the C values used in the rational storm design.

Infiltration – Infiltration parameters consistent with the OSDG have been used in the modeling. The following Horton infiltration values have been used: f_o = 76.2 mm/h, f_c = 13.2 mm/h, k = 0.00115 s^{-1}.

Subcatchment Width –The catchment widths used within the subject site and in the Green Meadows development are based on the approximate length of sheet flow within the subcatchment. For external areas EX6, EX7, EX9 and EX10, the width has been set using the following equation:

$$w = 1.7\sqrt{Area}.$$

Slope – A slope of 3% has been used for all SWMM subcatchments.

Initial Abstraction (Detention Storage) – Detention storage depths of 1.5 mm and 4.67 mm were used for impervious and pervious areas, respectively. These values are consistent with the OSDG.

Manning's roughness – Manning's roughness coefficients of 0.013 and 0.25 were used for impervious and pervious areas, respectively.

4.6.3 Modeling Results

The conceptual design of the subject site accounts for total flow capture in the pipe. The resulting 100 year flows in the first pipe segment of the Green Meadows subdivision are approximately 3.2 cms for the 3 hour Chicago storm and 3.5 cms for the 12 hour SCS Type II, the most conservative of the 100 year storms that have been simulated. The hydraulic impact of this flow capture on the existing receiving infrastructure is summarized in the following sections.

4.6.3.1 Green Meadows Hydraulic Grade Line Assessment

The existing storm sewer network located south of the subject site which services a portion of Donald B. Munro Drive and the Green Meadows subdivision has been included in the model to verify that it can accommodate the total flow capture from the subject site. Storm sewer inverts used for modeling and USF elevations used in the HGL assessment are consistent with the existing plans and profiles included in **Appendix D**. Results of the hydraulic grade line assessment are presented in the following table for the 100 year 3 hour Chicago and 100 year 12 hour SCS Type II storms. Freeboard exceeds 0.3 m during the 100 year event and positive freeboard during the stress test events is maintained.

Table 4-2 Green Meadows Hydraulic Grade Line Assessment Results

Node (refer to Figure 4.5)	USF (m)	100 year 3 hour Chicago		100 year 12 hour SCS Type II		100 year 3 hour Chicago Stress Test		100 year 12 hour SCS Type II Stress Test	
		HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)
J-067	95.48	94.70	0.78	94.70	0.78	94.98	0.50	95.20	0.28
J-068	95.55	95.08	0.47	95.08	0.47	95.24	0.31	95.47	0.08
J-069	96.17	95.43	0.74	95.43	0.74	95.46	0.71	95.76	0.41
J-070	96.27	95.55	0.72	95.55	0.72	95.55	0.72	95.77	0.50
J-071	96.44	95.64	0.80	95.64	0.80	95.64	0.80	95.77	0.67
J-072	97.30	96.16	1.14	96.16	1.14	96.16	1.14	96.16	1.14
J-073	97.60	96.40	1.20	96.40	1.20	96.40	1.20	96.40	1.20
J-075	96.75	96.26	0.49	96.26	0.49	96.31	0.44	96.36	0.39
J-074	97.43	96.87	0.56	96.90	0.53	97.12	0.31	97.12	0.31
J-076	99.50	98.00	1.50	98.00	1.50	98.02	1.48	98.02	1.48
J-077	99.80	98.49	1.31	98.49	1.31	98.50	1.30	98.50	1.30
J-078	102.45	101.25	1.20	101.25	1.20	101.26	1.19	101.26	1.19
J-079	104.60	103.70	0.90	103.70	0.90	103.70	0.90	103.70	0.90
J-086	96.72	96.14	0.58	96.30	0.42	96.63	0.09	96.70	0.02
J-085	98.55	97.36	1.19	97.43	1.12	97.82	0.73	98.03	0.52

Node (refer to Figure 4.5)	USF (m)	100 year 3 hour Chicago		100 year 12 hour SCS Type II		100 year 3 hour Chicago Stress Test		100 year 12 hour SCS Type II Stress Test	
		HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)	HGL (m)	Freeboard (m)
J-084	99.05	97.97	1.08	98.04	1.01	98.15	0.90	98.40	0.65
J-100	101.24	99.49	1.75	99.75	1.49	100.06	1.18	100.39	0.85
J-083	101.44	100.20	1.24	100.20	1.24	100.25	1.19	100.69	0.75
J-082	101.46	100.62	0.84	100.62	0.84	100.62	0.84	100.71	0.75
J-081	101.83	101.17	0.66	101.17	0.66	101.17	0.66	101.17	0.66
J-080	102.06	101.41	0.65	101.41	0.65	101.41	0.65	101.41	0.65

4.6.3.2 CN Rail Culvert Capacity

Flows from the subject site pass through the Green Meadows Subdivision which outlets to a culvert crossing the CN Rail line before ultimately discharging to the Carp River. The flowing full capacity of the CN rail culvert was previously documented in the EMP as 8 m^3/s. The CN rail culvert and areas draining towards the culvert have been included in the SWM model to confirm sufficient culvert capacity during the 100 year event. Modeling results are shown in the following table and indicate 100 year flows less than the culvert's flowing full capacity. In other words, the culvert operates under free flow conditions during the 100 year event.

Table 4-3 CN Rail Culvert Modeling Results

Design Storm	Flow Condition	Upstream HGL (m)	Flow (cms)
100 year 3 hour Chicago	Free Flow	93.27	6.42
100 year 12 hour SCS Type II	Free Flow	93.32	6.62
100 year 24 hour SCS Type II	Free Flow	93.10	5.42
100 year 3 hour Chicago stress test	Surcharged	93.53	7.93
100 year 12 hour SCS Type II stress test	Surcharged	93.57	8.17
100 year 24 hour SCS Type II stress test	Free Flow	93.35	6.94

4.6.4 Conclusion

Based on the results of the hydraulic analysis presented in **Section 4.6.3**, it is concluded that total flow (up to and including the stress test) on the subject site can be captured in the minor system while maintaining City of Ottawa guidelines with respect to HGL freeboard through the existing receiving Green Meadows subdivision. Further, the resulting 100 year flow to the railway culvert is less than the flowing full capacity.

4.6.5 Summary of Model Files

PCSWMM Model included in the digital submission are indicated in **Table 4-4**.

Table 4-4 PCSWMM Model Files

Design Storm	PCSWMM File
2 year 3 hour Chicago	131947-Carp_3H2CHI_V02.pcz
2 year 12 hour SCS Type II	131947-Carp_12H2SCS_V02.pcz
2 year 24 hour SCS Type II,	131947-Carp_24H2SCS_V02.pcz
100 year 3 hour Chicago	131947-Carp_3H100CHI_V02.pcz
100 year 12 hour SCS Type II	131947-Carp_12H100SCS_V02.pcz
100 year 24 hour SCS Type II	131947-Carp_24H100SCS_V02.pcz
100 year 3 hour Chicago stress test	131947-Carp_3H120CHI_V02.pcz
100 year 12 hour SCS Type II stress test	131947-Carp_12H120SCS_V02.pcz
100 year 24 hour SCS Type II stress test	131947-Carp_24H120SCS_V02.pcz

4.7 Water Quality Control

The Green Meadows OGS (City SWMF ID 1239) was sized for a total area of 29.5 ha, with a corresponding c value of 0.61 (corresponding to an A x c of 18.0). Considering Green Meadows and the subject site, the area and c value are 30.2 ha and 0.4 (corresponding to an A x c of 12.4), less than those assumed at the time of the OGS sizing. It is therefore concluded that the OGS can provide water quality treatment for the subject site, as intended. See **Table D.1** in **Appendix D** for supporting calculations.

4.8 Macro Grading Plan

A macro level grading plan for the subject site is shown on **Figure 4.6** and located in **Appendix D**. The site topography which generally slopes from the north to south, is fairly steep with existing average slopes in the 6.5% range. Existing grades along the NEA limit are near the 123 m elevation and near the 104 elevation at Donald B. Munro Drive. The information on **Figure 4.6** attempts to highlight some of the grading challenges for this site.

There are existing residential properties both to the west and east, Donald B. Munro Drive to the south and the NEA buffer to the north. The preliminary street grades, which sometimes reach a maximum of 5.0% to comply with City guidelines, attempt to best “fit” the plan to the existing surrounding properties.

Based on the macro grading, it is evident that the site development will require grading techniques for grade “take-up”. The two usual methods to mitigate such conditions are terracing and retaining walls. The macro grading plan

proposes a combination of both. Terracing is the preferred method, but retaining walls are also proposed where space is at a premium. At this time, retaining walls seem appropriate in four locations:

- Along the rear of lots 11 to 21 on Myrtle Campbell Circle
- Adjacent to the single loaded road section of Willie Crescent
- Adjacent to Donald B. Munro Drive, and
- Potentially along the west side of Block 83

Some preliminary retaining wall heights are also indicated on **Figure 4.6**.

Terracing is presently proposed adjacent to the NEA setback limit. Minor site terracing is also indicated in other areas of the site. The final design will eventually provide the best “grade take-up” techniques.

Unique to this development is the presence of an upstream Natural Environment Area (NEA). **Figure 4.3** provides a fairly detailed storm drainage area plan which also includes the existing drainage patterns from the NEA area. Based on this plan, it is likely that drainage from the NEA towards the development will be in several distinct locations. To accept the NEA drainage, a NEA Drainage Swale is proposed to be constructed along adjacent lots, immediately below the NEA terracing. The swale should be designed to collect rear yard drainage and the 100 yr NEA surface flow and route towards one of three drainage inlet features. The inlets are proposed to be located in three blocks (presently blocks 48, 80 and 82) in which storm sewers will be placed to convey the NEA drainage to the local storm sewers.

The figure also shows proposed typical local rear yard drainage swales complete with possible outlet locations. Major flow routing is also shown on the figure. Most major flow will route towards Rugglers Way where flows will be captured in the minor system in one of two low points. Major flow from the rear of lots 11 to 21 is proposed to be routed to Block 83.

The macro grading plan indicates that a retaining wall will be needed along most of the west side of Block 83. That wall will be required if a walk is proposed to be located in the Block. Based on the macro grading plan, the proposed walk will need to be constructed up to 2 m above original grade if it is to be compliant with mobility guidelines. A multi-use pathway (MUP) located in Block 83 will have a negative impact on existing vegetation. Consideration should be given to “shifting” the intent of the MUP onto local sidewalks on Ruggles Way and Willie Crescent.

The nature of the site grading lends itself to several housing designs. Besides typical units both walk-out and walk-in unit types should be considered. The figure indicates potential locations for the walk-out (WO) and walk-in (WI) unit types.

The macro grading plan also provides sporadic potential house grading. The plans include front and rear yard grades together with potential underside of footing elevations based on a eight-foot deep basement.

The current geotechnical report, which is referenced in Section 1.9, provides some grade raise limitations for the property. **Figure 4.6** indicates the most restrictive area where a Permissible Grade Raise (PGR) of 1.8 m is recommended. Based on the preliminary grading from **Figure 4.6**, the 1.8 m PGR will likely be exceeded in the location indicated on the Figure. It is recommended that prior to construction, that mitigative measures, such as light weight fill or pre-loading be confirmed with a professional geotechnical engineer.

5 EROSION AND SEDIMENTATION CONTROL PLAN

5.1 General

During construction, existing stream and conveyance systems can be exposed to significant sediment loadings. Although construction is only a temporary situation, it is proposed to introduce a number of potential mitigative construction techniques to reduce unnecessary construction sediment loadings. These could include:

- Until the local storm sewers are constructed, groundwater in trenches will be pumped into a filter mechanism prior to release to the environment or alternatively, dewatering will be routed to the nearest storm sewer;
- Bulkhead barriers will be installed at the nearest downstream manhole in each sewer which connects to an existing downstream sewer;
- Seepage barriers will be constructed in any temporary drainage ditches;
- Filter socks will remain on open surface structures such as maintenance holes and catchbasins until these structures are commissioned and put into use;
- Mud mats could be constructed to reduce the potential of contaminating existing streets in the vicinity of the property; and
- Silt fence on the site perimeter.

5.2 Trench Dewatering

The two likely options for disposal of taken water during construction are to discharge into the existing storm sewer in Donald B. Munro Drive which will outlet to an existing Oil and Grit Separator in the Green Meadow subdivision and which provides end-of-pipe treatment or to discharge into a filter trap made up of geotextile filters and straw bales similar in design to the OPSD 219.240 Dewatering Trap. (See **Appendix E**). These will be constructed in a bowl shape with the fabric forming the bottom and the straw bales forming the sides. Any pumped groundwater will be filtered prior to release to the existing surface runoff. The contractor will inspect and maintain the filters as needed, including sediment removal and disposal and material replacement as needed.

5.3 Bulkhead Barriers

Because the proposed site sewers discharge into sewers in downstream developments and in order to prevent sediments entering those sewers, ½ diameter bulkheads will be constructed over the lower half of the new outletting sewers to reduce sediment loadings during construction. These bulkheads will trap any sediment laden flows, thus preventing any construction-related contamination into existing sewers. The bulkheads will be inspected and maintained including periodic sediment removal as needed. These bulkheads can be marine grade plywood which can be temporarily affixed to the outlet manhole wall on a sand bag assembly if the designated manhole is circular in shape.

5.4 Seepage Barriers

In order to further reduce sediment loading to the environment or the Stormwater Management Facility, a seepage barrier will be installed on any surface water courses at appropriate locations that may become evident during construction. These barriers will be similar to either the Light Duty Straw Bale Barrier as per OPSD 219.100 or the Light Duty Silt Fence Barrier as per OPSD219.110 (copies of both are included in **Appendix E**). They are typically

made of layers of straw bales or geotextile fabric staked in place. All seepage barriers will be inspected and maintained as needed.

A potential Erosion and Sedimentation Control Plan (ESC) is shown on **Figure 4.7**. (See **Appendix E**). Among other items, light duty silt fence barriers should be erected and maintained around most of the perimeter of the property including along the 15 m NEA set back limits. Although the NEA area is upstream of the proposed development, and the likelihood of sediments migrating towards the NEA is small, it is still proposed to separate the upstream area via sediment controls. The effectiveness of such controls can be reviewed during construction. Straw bale barriers should also be installed along the existing Donald B. Monroe Drive ditch near Block 66. Existing catchbasins and manhole covers could also be equipped with filter socks. The final ESC plan will be completed in consultation with applicable experts to the approval of the City and CA.

6 APPROVALS AND PERMIT REQUIREMENTS

6.1 City of Ottawa

The City of Ottawa will review all and approve most development applications as they relate to provision of water supply, wastewater collection and disposal, and stormwater conveyance and treatment. Ultimately, the City will issue final approvals for construction, including:

- Sanitary Sewers through the Linear Infrastructure process
- MECP Section 53 Application for Storm Sewers
- Form 1 for Watermains
- Commence Work Notification

6.2 Province of Ontario

At the time of final design approvals, the Ministry of Environment, Conservation and Parks (MECP) will approve the local sewers under Section 53 of the Ontario Water Resources Act and issue the appropriate Environmental Compliance Approvals. If required, the MECP will also issue a Permit To Take Water (PTTW).

6.3 Conservation Authority

The Mississippi Valley Conservation will be consulted during the detailed design process to confirm the requirements for potential permits.

6.4 Federal Government

There are no anticipated permits, authorizations or approvals required from the federal government for the proposed development.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusion

It appears that the subject lands can proceed with development when a number of improvements and/or extensions of existing major municipal infrastructure are completed. These include:

1. Increasing capacity to the Village of Carp water supply system.
2. Increasing capacity to the Carp Sanitary Pump Station.
3. Extending the sanitary sewer along Donald B. Munro Drive.
4. Upgrading and replacing the existing storm sewer in Donald B. Munro Drive.

7.2 Recommendation

Once the major municipal infrastructures identified in Section 7.1 are implemented, the subject site can proceed to final development. This report therefore recommends that the City provide relevant draft conditions and that the planning and development review processes for the subject lands move forward.

Appendix A

General

GENERAL CONTENT

	ITEM DESCRIPTION	LOCATION
	Executive Summary (for larger reports only)	N/A
√	Date and revision number of the report	Front Cover
√	Location Map and plan showing municipal address, boundary, and layout of proposed development.	Figure 1.1
√	Plan showing the site and location of all existing services.	Figures 2.1, 3.1 and 4.2
√	Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	Section 2.2.1, 3.3 and 4.3
√	Summary of Pre-consultation Meeting with City and other approval agencies.	Appendix A
√	Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	Section 1.6
√	Statement of objectives and servicing criteria	Sections 2.2.1, 3.3 and 4.2
√	Identification of existing and proposed infrastructure available in the immediate area.	Figures 2.1, 3.1 and 4.3
√	Identification of Environmentally Significant Areas, Watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Section 1.10
√	Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Section 4.8 Figure 4.4
√	Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	Section 1.11
	Proposed phasing of the development, if applicable.	Section 1.5
√	Reference to geotechnical studies and recommendations concerning servicing.	Section 1.9

√	All preliminary and formal site plan submissions should have the following information: • Metric scale • North arrow (including construction North) • Key plan • Name and contact information of applicant and property owner • Property limits including bearings and dimensions • Existing and proposed structures and parking areas • Easements, road widening and rights-of-way • Adjacent street names	Done

DEVELOPMENT SERVICING REPORT: WATER

	ITEM DESCRIPTION	LOCATION
√	Confirm consistency with Master Servicing Study, if available	Sections 1.6, 3.2 and 4.2
√	Availability of public infrastructure to service proposed development	Figures 2.1, 3.1 and 4.2 Sections 2.1, 3.1 and 4.1
√	Identification of system constraints – external water needed	Section 2.3
√	Identify boundary conditions	Section 2.3
√	Confirmation of adequate domestic supply and pressure	Sections 2.2.2 and 2.3
√	Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Section 2.2.3 and 2.3
√	Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Section 2.3
	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defining phases of the project including the ultimate design.	N/A
	Address reliability requirements such as appropriate location of shut-off valves.	N/A
√	Check on the necessity of a pressure zone boundary modification.	N/A
√	Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Section 2.3
√	Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Figure 2.4
√	Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities and timing of implementation.	Section 2.1
√	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Section 2.2.1
√	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Section 2.3 Appendix B

DEVELOPMENT SERVICING REPORT: WASTEWATER

	ITEM DESCRIPTION	LOCATION
√	Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Section 3.3
√	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Section 3.2
√	Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age condition of sewers.	Section 3.5
√	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 3.1
√	Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Section 3.1
	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix "C") format.	Section 3.4 Appendix C
√	Description of proposed sewer network including sewers, pumping stations and forcemains.	Section 3.4 Figure 3.2
√	Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	Section 1.11 Section 6.3
√	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	Section 3.1
√	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
√	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A
√	Special considerations such as contamination, corrosive environment etc.	Section 1.9

DEVELOPMENT SERVICING REPORT: STORMWATER CHECKLIST

	ITEM DESCRIPTION	LOCATION
√	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 4.1 and 4.5
√	Analysis of available capacity in existing public infrastructure.	Section 4.4
√	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Figure 4.1
√	Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be	Section 4.5 and 4.7

	included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	
√	Water quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Section 4.5 and 4.7
√	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 4.4 and 4.5
√	Set-back from private sewage disposal systems.	N/A
√	Watercourse and hazard lands setbacks.	N/A
√	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N/A
√	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	Section 4.2
√	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 4.4 and 4.5 Appendix D, 5.4 and 5.5
√	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Sections 1.7 and 4.4
	Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Section 4.5
√	Any proposed diversion of drainage catchment areas from one outlet to another.	N/A
√	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Sections 4.4 and 4.5 Figure 4.3
	If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	Section 4.7
√	Identification of potential impacts to receiving watercourses	N/A
√	Identification of municipal drains and related approval requirements.	N/A
√	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Sections 4.4, 4.5 and 4.7
√ √	100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	N/A
	Inclusion of hydraulic analysis including hydraulic grade line elevations.	Section 4.6
√	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 5
√	Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A
√	Identification of fill constraints related to floodplain and geotechnical investigation.	N/A

APPROVAL AND PERMIT REQUIREMENTS: CHECKLIST

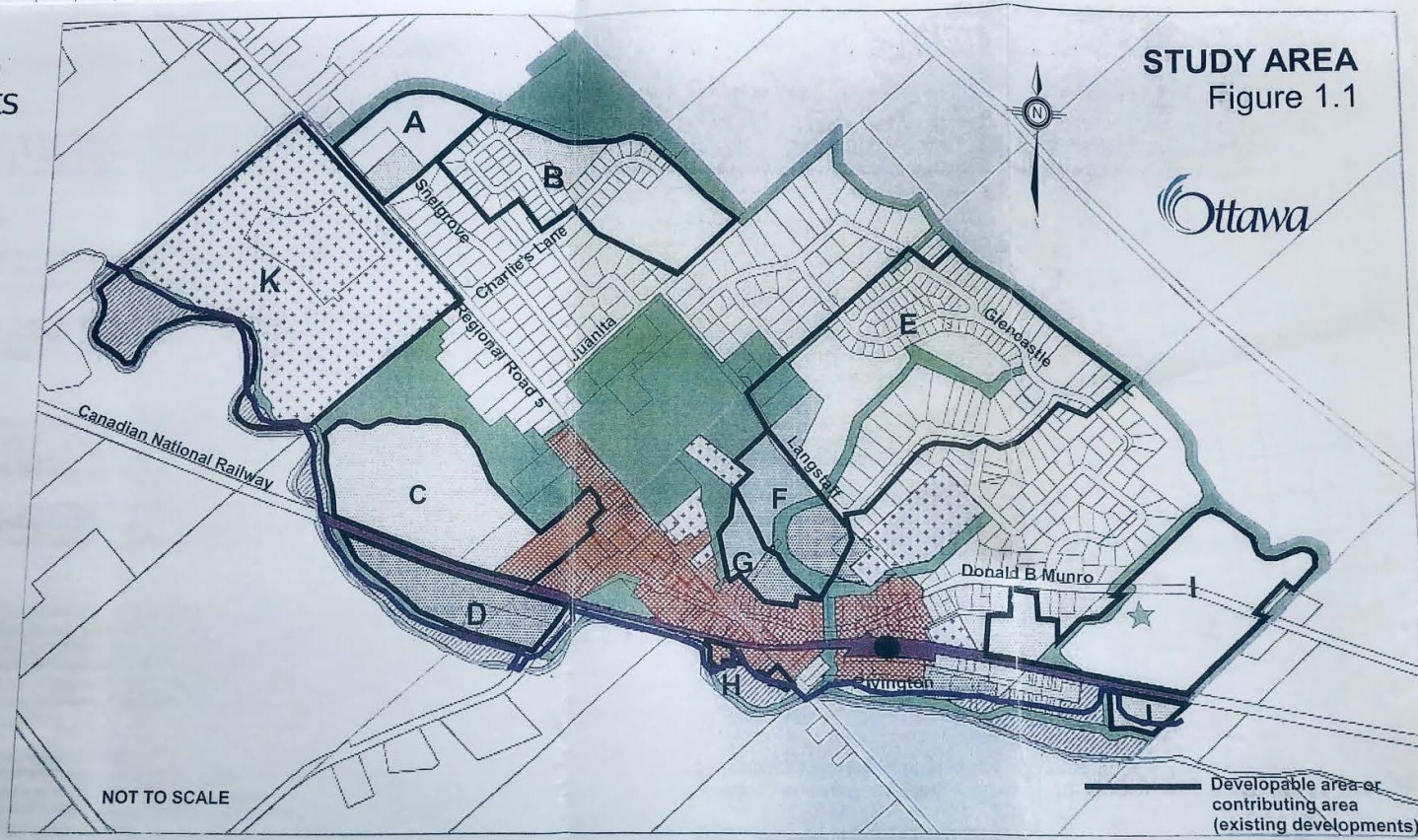
	ITEM DESCRIPTION	LOCATION
√	Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	Section 6.3
	Application for Certification of Approval (CofA) under the Ontario Water resources Act.	Section 6.2
√	Changes to Municipal Drains	N/A
√	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Sections 6.3 and 6.4

CONCLUSION CHECKLIST

	ITEM DESCRIPTION	LOCATION
√	Clearly stated conclusions and recommendations	Section 7
	Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	N/A
√	All draft and final reports shall be signed and stamped by professional Engineer registered in Ontario.	Done

Robinson
Consultants

STUDY AREA
Figure 1.1



Village of Carp - Community Design Plan
Schedule A - Land Use

Village de Carp - plan de conception de communautaire
Annexe A - Utilisation du sol

Official Plan Designations
Désignations du Plan officiel

- Flood Plain / plaine inondable
- Village Core / Centre du village
- Residential - One and Two Unit Dwellings / Résidentiel - Habitations à un ou à deux logements
- Residential - Ground Oriented Multi Unit / Résidentiel - Logements multiples de plain-pied
- Residential - Multi Unit / Résidentiel - Logements multiples
- Institutional / Zones institutionnelles
- Open Space / Espaces libres
- Potential Fairground Expansion / Expansion potentielle du champ de foire
- Future Neighbourhood Park / Parc du voisinage
- Transportation Corridor / Couloir de transp
- Future Train Station / Future gare

File Number PC2020-0332

1 February 2021

Tartan Land Consultants Inc.
Melissa Cote
237 Somerset St. W
Ottawa, ON
K2P 0J3

Dear Ms Cote

Re: 232 Donald B. Munro Drive, Village of Carp Pre-Consultation Results

Date of Meeting December 16, 2020

In attendance and/or provided comments:

Ostafichuk, Jeffrey Jeffrey.Ostafichuk@ottawa.ca
Brown, Adam Adam.Brown@ottawa.ca
Whittaker, Damien Damien.Whittaker@ottawa.ca
Melissa Cote mcote@tartanland.on.ca
Pierre Dufresne pdufresne@tartanland.on.ca
David Hook DHook@IBIGroup.com
Ben.Pascolo-Neveu@ibigroup.com
Stow, Nick Nick.Stow@ottawa.ca
Rehman, Sami Sami.Rehman@ottawa.ca
Shepherd, Reid reid.shepherd@ottawa.ca
Gervais, Josiane josiane.gervais@ottawa.ca
Young, Mark Mark.Young@ottawa.ca
Erica Ogden eogden@mvc.on.ca
Joseph Zagorski Joseph.Zagorski@ottawa.ca

Please find below the results of our meeting with respect to your proposal to develop a “multi residential” dwellings on a private street.

Comments

Jeff Ostafichuk Planning

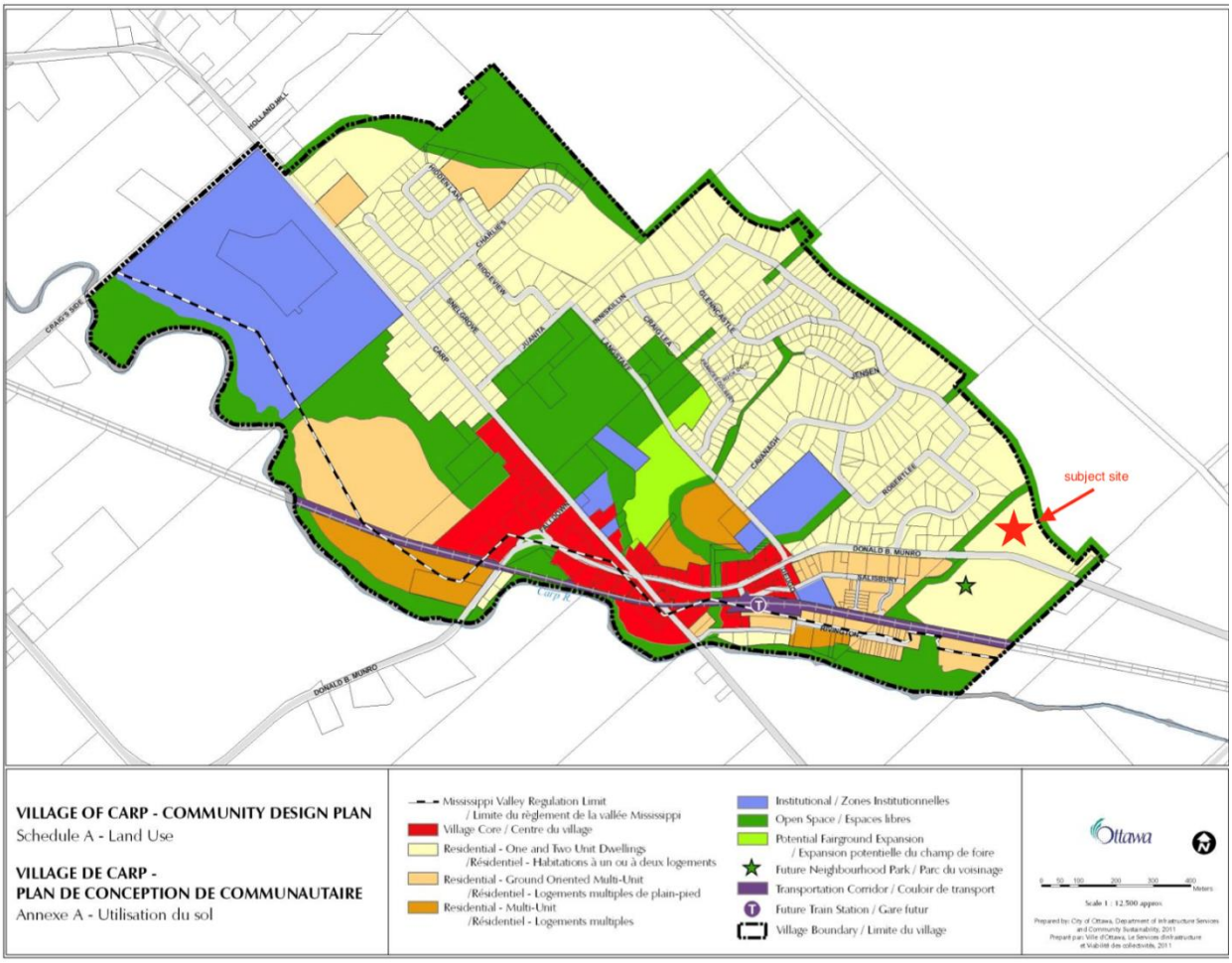
In our discussions you have suggested that you will be filing a plan of subdivision and zoning by-law amendment. Policies that need to be considered as per the Official

Plan and Village of Carp CDP (changing to Secondary Plan through the new Official Plan) are as follows.

Land Use

The proposed plan of subdivision is located in the Village of Carp. The lands front onto the north side of Donald B. Munro, the main northwest/southwest entrance to the Village. The site, approximately 7.2 ha in size, proposes 64 single family lots and 65 townhouse/semi detached units. Access to the site is provided by two intersections to the north side of Donald B. Munro Drive which service the development via an internal loop road system (18 metre right-of -way). The applicant proposes municipal servicing via an extension to the existing local water and sanitary systems.

The subject lands are within the “Village” designation as identified on Schedule ‘A’, Rural Policy Plan of the City Official Plan. Further land uses within the Village of Carp are determined in the context of the Carp CDP (New OP Secondary Plan). The CDP provides guidelines for land use planning, such as subdivision, zoning applications. The CDP sets aside these lands for residential use.



2. Managing Growth

2.3 Environmental Protection

Policies are addressed by:

Sami Rehman, Environmental Planner, Planning
Damien Whittaker, Senior Engineer Infrastructure
Erica Ogden, Environmental Planner, MVCA Mississippi Valley Conservation Authority

2.3.1 The Natural Heritage System

Policies are addressed by:
Sami Rehman, Environmental Planner, Planning
Erica Ogden, Environmental Planner, MVCA Mississippi Valley Conservation Authority

2.3.2 Source Water Protection

Land uses that are determined to constitute a significant threat to municipal drinking water (as defined in the Source Water Protection Act and its regulations) may be restricted. The basis and policy mechanism for restrictions will be in accordance with the Mississippi Rideau Source Water Protection Plan and the Official Plan.

Statement in rationale required.

3. Land Use

3.3.2 Design Guidelines for new Residential Development

Policies

1. To maintain the character of traditional village streets, and ensure the buildings define the streetscape, the building face to building face distance should be in the range of 24 to 25 metres for smaller singles, semi, duplexes, town houses, and not greater that 30 meters for larger singles, or low rise apartments.

2. Zoning and subdivision plans will address the following aspects:

- Residential streets will be 18.0m wide
- The length of the driveway to accommodate cars can be measured from the curb, or back of sidewalk rather than from the ROW, provided pedestrian access is not blocked. The result will be parking within the public ROW
- Building setbacks may be reduced to as low as 3.0 meters from the ROW or 6.0 metres from the sidewalk if it is provided for.
- The front of garages should not extend beyond the front façade of the house, either as attached buildings or separate structures.
- The tree lined village streets will be created through the provision of one tree per lot and two on corner lots as part of subdivision development agreements.

3.3.4 Residential – One and Two Unit Dwellings

The uses permitted in the area designated Residential - One and Two Unit Dwellings on Schedule A will be detached, semi-detached and duplex dwelling units including secondary dwelling units.

The proposed draft plan of subdivision provides for a full range of ground oriented dwelling types including single family, semi detached and townhouse units. It is the introduction of townhouse units (ground oriented multi-unit) that goes beyond the site objectives. Some rationale needs to provided to support multiple units; perhaps a discussion is warranted with the Policy team (contact John Lunney) currently updating the OP team because Carp CDP will be amended to become a Secondary Plan.

3.7 Open Space

Policies are addressed by:
Mark Young, Urban Design Planner
Reid Shepherd, Parks

4.10 Create Prominent Approaches to the Village

Policies are addressed by:
Mark Young, Urban Design Planner

Key initiatives

1. At the four approaches to the Village identified on Figure 2:

    a) Erect a Carp Village sign using common and well-designed graphics and materials at the four main entrances to the village;

    b) Reconfigure the road from a rural cross-section to a village cross-section (by providing sidewalks, landscaping etc.); and

    c) Add specific design elements as visual accents that give the impression that travelers are entering a unique village with character.

2. When undertaking road works or as a special community improvement the following will be considered:

    - Plant an avenue of trees along Donald B. Munro Drive from the southern village limit to the Village Core as part of roadway improvements and development of any subdivisions.

5. Road Network and Right-of-Way Protection

Policies are addressed by:
Josiane Gervais, P.Eng. Project Manager

7. Recreation and Open Space

Policies are addressed by:
Mark Young, Urban Design Planner
Reid Shepherd, Parks

7.4 Pedestrian Pathways

Policies

1. The pedestrian pathway system is shown on Schedule C.

2. The City will ensure that new developments are linked to the existing or planned network of public sidewalks, recreational pathways and on-road cycle routes, which connect parks and other open spaces, and community services and facilities.

The proposed plan does not provide for pathways as identified on Schedule 'C'- Pedestrian Pathway System ,CDP.

Damien Whittaker, Senior Engineer Infrastructure

Surveying:

Survey monument to be shown and annotated, and sufficient information to enable a layperson to locate.

Water pipes:

There is a municipal water pipe near the application, though presently there is no capacity in the Carp water treatment plant for the application. When capacity is made available, a looped system may be needed. A 203 mm PVC stub exists in the property. A boundary codition request was submitted and the response to that request is as copied herein "It is to our understanding that there is limited/no more capacity in the Village of Carp Water facility to support further developments. With the understanding that any remaining residual capacity has already been allocated we can not provide the Water Boundary Condition for further site applications at this stage."

Sanitary Sewers:

There is a municipal sanitary sewer adjacent the proposed development, though, presently, there is no capacity in the Carp sanitary pump station for the development.a 200 mm dia sani pipe stub exists in the proposed development. Please check the capacity of the downstream pipes to accept the proposed flows.

The Carp sanitary pump station forcemain is in the ROW and needs to be cautioned against.

Geotechnical:

Please note that sensitive marine clays are anticipated in the area of the proposal and, if so, enhanced geotechnical investigation and analysis will be necessary. Investigation of clays should be undertaken with vane shear, Atterberg limits, shrinkage, size, grade raise restriction, consolidation, sensitivity, and liquefaction analysis- amongst others. Further, to maintain the desired result of the trees in clay soils policy all of the conditions of the policy need to be met. Please note that the 2.1 m of cover in the vicinity of the footings is sometimes a challenge as is the necessary comprehensive linkages between geotechnical, grading, parks, utilities, and trees.
Organic soils exist in the area and enhanced geotechnical investigation and analysis will be necessary. Thin soils, and possibly bedrock outcrops exist in the area and enhanced geotechnical investigation and analysis will be necessary.

Hydrogeological:

A hydrogeological report will be required if a SWM pond, or similar stormwater management infrastructure, is proposed.

Storm Sewers:

There is a municipal storm sewer adjacent the proposed development. And a 1050 mm stub in the lands. Please review the downstream system for capacity.

Groundwater:

Groundwater is anticipated to be high and the level is to be derived from long-term analysis (12 months, or more). With the high groundwater anticipated, the City advises against basements for the development. An (annual) groundwater elevation, from a long-term study will be required.

Noise and vibration:

A noise feasibility study is required showing a number of layouts to minimize noise barriers (if required). In due course a noise report will be required for the traffic from Donald B. Munro Drive, recorded on Official Plan Schedule G as an existing collector, and for the rail corridor located 210 m away (less than the threshold). Rail safety should be reviewed against the document Guidelines for New Development in Proximity to Rail Operations.

Integrated Environmental Review:

An integrated environmental review is required being adjacent to an EP3 zoned area.

Storm Water Management:

Stormwater management quality criteria shall follow the MVCA's requirements of 80% TSS removal. The quantity criteria for the development is that 100-year

post-development shall match 5-year pre-development. LID is required as per the memo from the former MOECC (now MECP). A water budget will need to be developed for the proposal and resulting in a 15% reduction in the change. Any existing stormwater runoff from adjacent site(s) that crosses the property must be accommodated by the proposed stormwater management design. All stormwater management determinations shall have supporting rationale. The stormwater management shall itemize concurrence with the content of the update Carp River wateshed/subwatershed study.
In the pre-consultation it was suggested that that quantity control for the lands being applied for currently was provided by the lands already developed to the south of Donald B Munro known as the Rivington lands. Based on a review of the Rivington report, and existing development, quantity control does not appear to be provided.

Roads:

Please refer to the City of Ottawa Private Approach By-Law 2003-447 for the entrance design. Some of the driveways might be a challenge at curves.
As per the Safer Roads initiative (adopted by Coucil, late 2019), roads must be designed to limit vehicle speeds to 30 km/h (by design; not merely by signage). Additional ROW will be required if sidewalks and/or sensitive marine clay is found. Please note that additional width is required for SMC and additional width for sidewalks (if required)

Energy conservation is required to be demonstrated throughout design as per section 4.9 of the Official Plan.

Permits and Approvals:

Please contact the Mississippi Valley Conservation Authority (MVCA), amongst other federal and provincial departments/agencies, to identify all the necessary permits and approvals required to facilitate the development: responsibility rests with the developer and their consultant for determining which approvals are needed and for obtaining all external agency approvals. The address shall be in good standing with all approval agencies, for example MVCA, prior to approval. Copies of confirmation of correspondence will be required by the City of Ottawa from all approval agencies that a form of assent is given. Please note that a stormwater program for multiple lots is understood to be the expanded type of Environmental Compliance Approval (ECA) application with the MECP; please speak with your engineering consultant to understand the impact this has on the application. An MECP ECA application is not submitted until after City of Ottawa engineering is satisfied that components directly or indirectly aligned with the ECA process concur with standards, directives and guidelines of the MECP. No construction shall commence until after a commence work notification is given by Development Review. Please also note that by the time the ECA is applied for with this application that a different type of process may be underway.

Ministry of the Environment, Conservation and Parks	Mississippi Valley Conservation Authority

Contact Information:
Christina Des Rochers
Water Inspector
613-521-3450 ext. 231
Chstina.Desrochers@ontario.ca

Contact Information:
Erica Ogden
eogden@mvc.on.ca

Plan Submission Requirements for engineering:

Site Servicing Plan*
Grading and Drainage Area Plan*
Erosion and Sediment Control Plan*

*All identified required plans are to be submitted on standard A1 size sheets as per City of Ottawa Servicing and Grading Plan Requirements and shall note the survey monument used to establish datum on the plans with sufficient information to enable a layperson to locate the monument.

Report Submission Requirements:

-Site Servicing Report
To be prepared as per requirements.
-Storm Water Management Report
-Noise Feasibility Report
-Erosion and Sediment Control Measures
-Geotechnical Investigation Study
The geotechnical consultant will need to provide full copies of any published and peer reviewed papers relied on to determine results and conclusions
Earthquake analysis is now required to be provided in the report.

-Phase 1 Environmental Site Assessment (ESA)

The Phase 1 Environmental Site Assessment (ESA) shall be as per O.Reg. 153/04. Phase 1 ESA documents performed to CSA standards are not acceptable. Documents older than 18 months from the time of draft approval will not be accepted

Guide to preparing City of Ottawa Studies and Plans:

http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans

To request City of Ottawa plan(s) or report information please contact the ISD Information Centre:

Information Centre
(613) 580-2424 ext. 44455

Joseph Zagorski, P.Eng. Senior Project Manager Asset Management Branch – Infrastructure Planning

Additional comments provided in lieu of pre-consult meeting on state of water servicing for the Village of Carp provided to applicant's consultant:

- Currently peak wet weather flows to the Carp PS are approaching (exceeded) its rated capacity of 57.7 L/s pumping ability, limiting available capacity for the new residential and commercial development in the village. The station is 25 years old with some mechanical and electrical components quickly reaching the end of their design life. In addition, no overflow is provided to protect the station and houses located close to the Carp River during equipment failure or extreme I/I event. The preferred **long-term** *(to accommodate projected wastewater flows from the Carp build-out development inside village boundary)* solutions to the Carp wastewater system includes emergency overflows at both sewage pumping stations, twinning existing forcemain, upgrading pumps and back-up power. Implementing long term solutions to the Carp water and wastewater systems as proposed in the 2009 Class EA is a time-consuming process, required extensive design and construction work including significant capital budget allocation.

- The City has hired a consultant to investigate the possibility of **short-term** options to increase the Carp PS interim capacity (such as installation of new pumps which would deliver more flow but still be below design operating pressures of the existing forcemain) to provide capacity for the new development. This assignment will also confirm if Carp water facility has presently enough capacity to accommodate additional village and Carp Airport development.

Reid Shepherd, Parks

We understand that during the pre-consultation it was suggested there was a clause in the Green Meadows Subdivision (Former Rivington lands opposite Donald B. Munro Dr.) that spoke to an over-dedication of parkland. More specifically, clause 8b page 31 of the Green Meadows subdivision agreement states:

> "In recognition of the over-dedication of parkland by the Owner, the City agrees to transfer the parkland dedication in excess of 5% to the future development of other lands owned by the Owner described as Part of Lot 17, Concession 2, Geographic Township of Huntley, City of Ottawa being Part 1 on Plan 4R-7027". (Agreement attached).

This matter was forwarded to Legal Services for an opinion on the agreement. We understand that the over dedication is applicable to the one who signed the agreement and developed the Rivington subdivision only. Such a clause is not transferable to a new Owner of the lands in question.

As such the following is required with your submission:

Park and Facility Planning Comments:

- The density of this proposal is above 18 units per net hectare and therefore a parkland dedication of 0.43 ha is required based on the current unit numbers.
- Based on the above requirement of 0.43 ha, a parkette located within the development would be feasible. Please revise the concept to include a parkette centrally located within the development. Parkette requirements (location, amenities, etc) and further details can be found within the Park Development Manual, 2nd Edition.
- The Carp CDP proposes a north-south pathway connection to link up with the existing pathway across Donald B Munro, and a second east-west pathway along the northern edge of the development. Please revise the concept to show improved pathway connections within the site and to adjacent subdivisions in line with the vision of the CDP.

Mark Young, Urban Design Planner

Please accept the following comments on behalf of PRUD for the proposed plan of subdivision and zoning by-law amendment in the Village of Carp. A Design Brief will be required. The terms of reference is attached.

Plan of Subdivision:

1. Please review for compliance with the Village of Carp CDP which is being converted into a Secondary Plan as part of the New Official Plan.
2. The CDP identifies an open space corridor across the subject lands linking the park lands to the west with the Carp Ridge to the east. Open space connection blocks are identified as having a width of 10 m and should include tree retention and a publicly accessible path.
3. The CDP does not identify street townhomes as a permitted use in the subject land use designation.
4. Efforts should be taken to minimize the need for noise walls on Donald B. Munro Drive. Options include a window street, rear lane product or fronting lots and driveways directly onto the existing roadway as-is the case in most of the Village.
5. Connectivity to the Carp Ridge is a significant asset for the site. A minimum of two connection points to the natural area to the east should be provided and should be of an adequate width to allow for some views and vistas of this feature.

Zoning By-law Amendment:

1. The Zoning By-law amendment should reflect the need for adequate setbacks and buffering from existing low-density residential uses.
2. The zoning should be reflective of soil conditions, if clay soil tree setbacks are required in front and corner side yards.
3. The zoning should be reflective of the product types proposed. An R1 zone should be utilized abutting the existing dwellings and a minimum lot width and lot coverage should be reflective of the desire to locate the most compatible dwellings adjacent to the existing dwellings.

Sami Rehman, Environmental Planner Planning

The proposed development will require an Integrated Environmental Review (IER) and Environmental Impact Statement (EIS).

- The EIS will review the:
    - NEA boundary,
    - ANSI boundary
    - PSW & wetlands associated with Sign Woodlands
    - SAR, throughout the area
    - Significant Woodlands
    - Sign Wildlife Habitat
    - Results from the RMOC's NESS
    - The surface water feature and the appropriate setbacks from OP 4.7.3.

Plan of Subdivision will require a Tree Conservation Report (TCR), which can be combined with an EIS to avoid duplication.

NEA (and EP3) boundary will need to be verified during the growing season.

Site Visit December 18, 2020

Thank you for inviting me to join your site visit. It was helpful to explore the property, understand the boundaries of your potential purchase and to have the current zoning boundary (as illustrated in GeoOttawa) staked out on the subject property. While it was also useful to explore the geological features when much of the vegetation was in dormancy, it is difficult to identify the boundary of the Natural Environment Area (NEA) until we can examine the vegetation communities during the growing season. As discussed with my colleagues, we would anticipate re-visiting the site after May 2021 to assess the flora and better determine the boundary of the NEA. It is acknowledged that the final NEA boundary will also be the zoning boundary.

Josiane Gervais, P.Eng. Project Manager, Infrastructure Approvals

Follow Traffic Impact Assessment Guidelines:

- Traffic Impact Assessment will be required.
- Screening and Scoping can be submitted together. Start this process asap.
- The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable), draft functional plans (if applicable) and/or monitoring report (if applicable).
- Request base mapping asap if RMA is required. Contact Engineering Services (https://ottawa.ca/en/city-hall/planning-and-development/engineering-services)

Local and collector roadways are to be designed for a 30km/hr posted speed, as per the approved Road Safety Action Plan. Further information on design elements to achieve the 30 km/hr design speed can be provided upon request.

If any collector roads are considered, you must follow collector road guidelines for subdivisions, desired 26m ROW for collector Roads.

Geometric Road Design (GRD) drawings will be required with the first submission of underground infrastructure and grading drawings. These drawings should include such items as, but are not limited to:

- Road signage and pavement markings;
- Location of depressed curbs and tactile walking surface indicators (TWSI);
- Traffic calming measures aimed at reducing vehicle speed and enhancing pedestrian safety. Measures may include either vertical or horizontal features, however such measures shall not interfere with stormwater management and overland flow routing. Traffic calming measures shall reference best management practices from the Canadian Guide to Neighbourhood Traffic Calming, published by the Transportation Association of Canada, and/or Ontario Traffic Manual, and/or the City of Ottawa's Traffic Calming Design Guidelines;
- Intersection control measures at new internal intersections; and
- ROW protection on Donald B. Munro between Langstaff and Farm Ridge is 23m even, and between Farm Ridge and March Road is 26m even.
- Requesting to change the speed limit on Donald B. Munro as part of the application is not supported.
- Corner triangles as per OP Annex 1 - Road Classification and Rights-of-Way at the following locations on the final plan will be required:
    - Local Road to Local Road: 3 m x 3 m
    - Local Road to Arterial Road: 5 m x 5 m
- Ensure to pair driveways where possible.
- Noise Impact Studies are required. Both studies must assess:
    - Road, site is within 100m of Donald B. Munro, which is a collector roadway.
    - Rail, site is within the buffer zone Renfrew Rail Corridor, which is an active rail corridor.

It is highly recommended to review noise conditions as soon as possible so that noise effects can be avoided or mitigated as part of the subdivision design. The Noise Feasibility Study is required at the time of application. A detailed Noise Study will be required prior to registration.

Erica Ogden. Environmental Planner MVCA

Please find below a summary of the Conservation Authority's comments.

- The property contains a watercourse and unevaluated wetlands. The Environmental Impact Statement should assess each of these features in regards to their significant under Ontario Regulation 153/06. These features

should be taken into consideration when determining the area for development on the property.

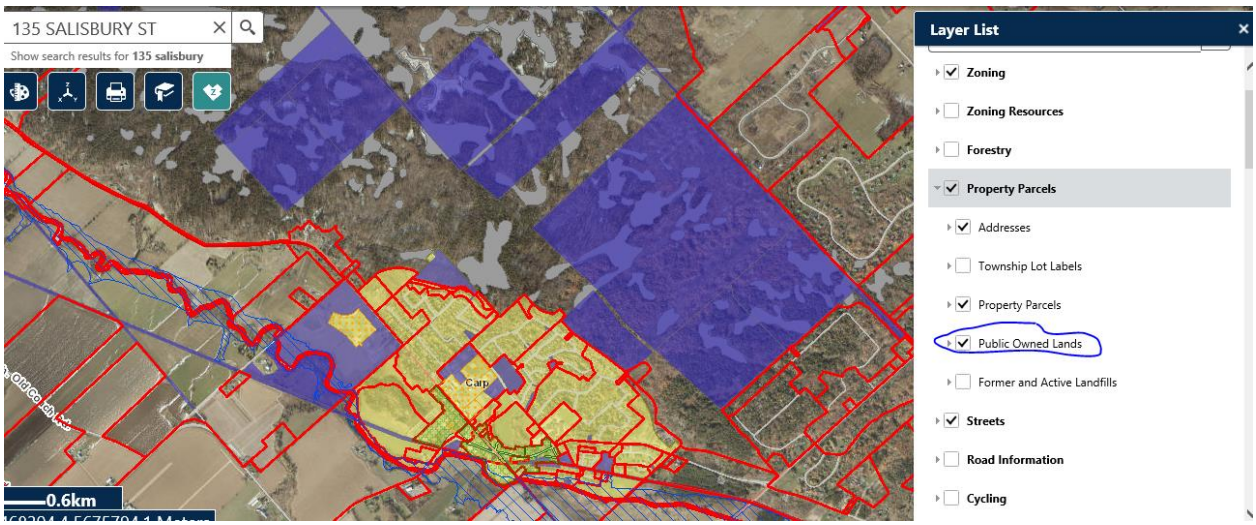
- A headwater feature assessment will be required for the watercourse on the property to provide an understanding of the feature's seasonal functions and develop a mitigation plan. Any hydraulic connection between the wetlands and watercourse should be assessed.
- MVCA will review the stormwater management for the proposed development. The water quality requirement for the Carp River is a normal level of protection which requires 70% total suspended solids removal.
- There is the potential for organic soils on the property, which must be appropriately assessed.

Adam Brown, Manager Development Review

Some information about the Carp Hills.

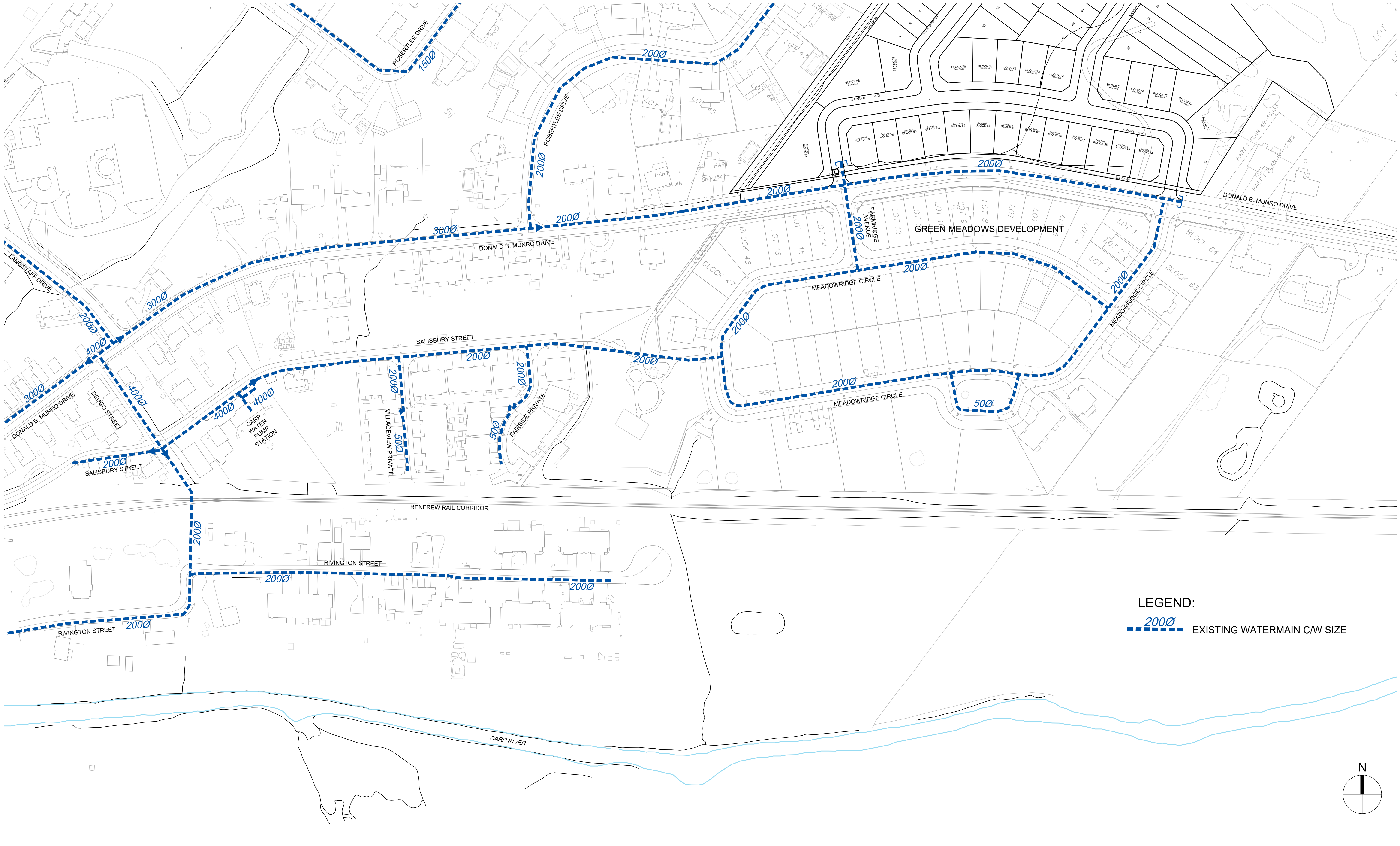
https://carphills.com/
https://ottawa.ca/en/living-ottawa/environment-conservation-and-climate/conservation-areas#carp-hills

To see what land the City owns in the area, you can go on geoOttawa and turn on the "Property Parcels – Public Owned Lands" box and you will see the City-owned lands in blue.



Appendix B

Water



ARCADIS

Scale

N.T.S.

Project Title

ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

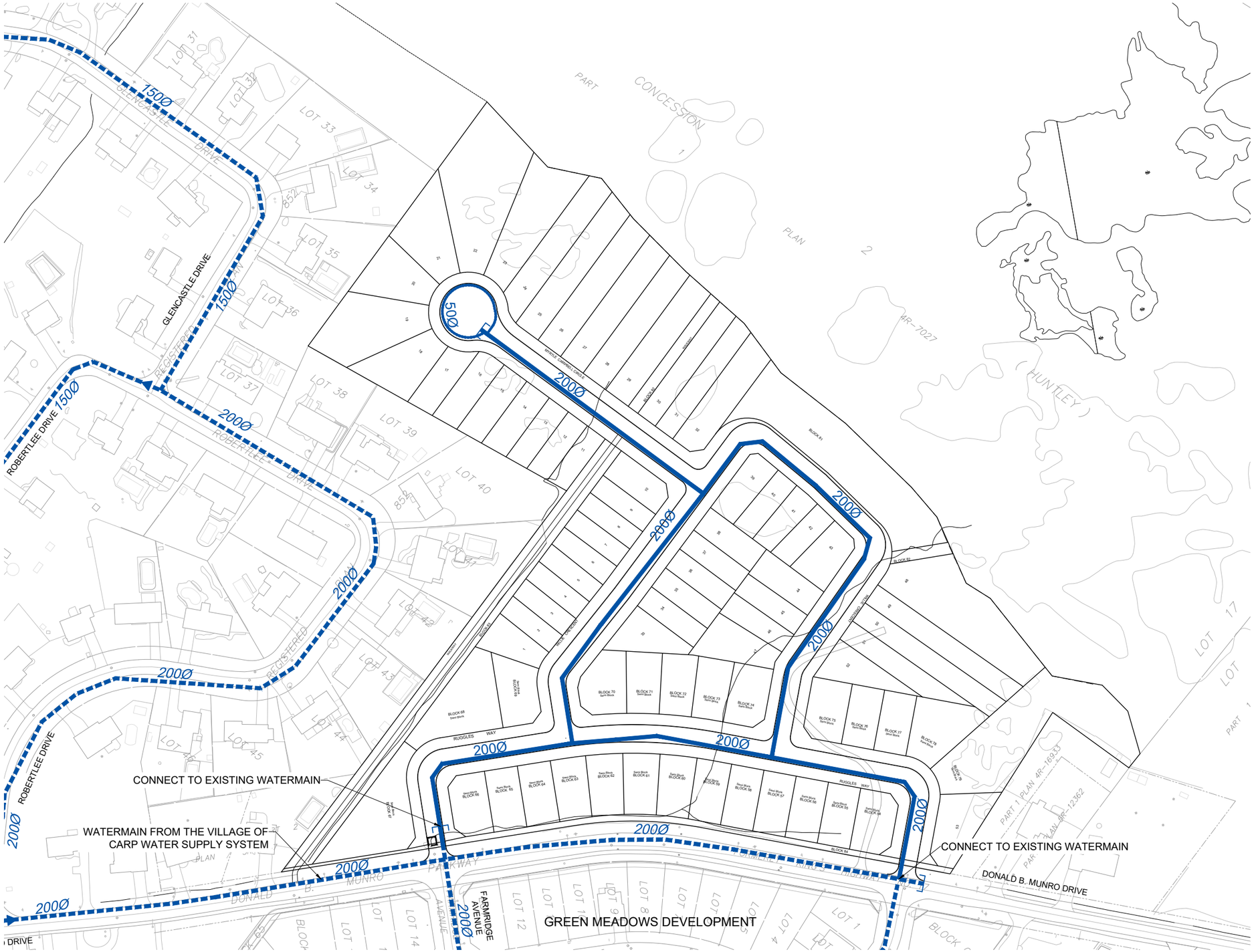
Drawing Title

EXISTING WATERMAINS

Sheet No.

FIGURE 2.1

2025/01/10



Scale: N.T.S.

Project Title: ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title: CONCEPTUAL WATERMAIN PLAN

Sheet No.: FIGURE 2.2

2025/01/10

ARCADIS
IBI GROUP
Arcadis
333 PRESTON STREET
OTTAWA, ON
K1S 5N4

WATERMAIN DEMAND CALCULATION SHEET

PROJECT : 232 Donald B. Munro Drive
LOCATION : Village of Carp
DEVELOPER : 2087575 Ontario Ltd.

FILE: 1319476.04.04
DATE PRINTED: 07-Jan-25
DESIGN: LE
PAGE : 1 OF 1

NODE	RESIDENTIAL UNITS SF	RESIDENTIAL UNITS SD	RESIDENTIAL UNITS TH	RESIDENTIAL POP'N	NON-RESIDENTIAL INDTRL (ha.)	NON-RESIDENTIAL COMM. (ha.)	NON-RESIDENTIAL INST. (ha.)	AVERAGE DAILY DEMAND (l/s) Res.	AVERAGE DAILY DEMAND (l/s) Non-res.	AVERAGE DAILY DEMAND (l/s) Total	MAXIMUM DAILY DEMAND (l/s) Res.	MAXIMUM DAILY DEMAND (l/s) Non-res.	MAXIMUM DAILY DEMAND (l/s) Total	MAXIMUM HOURLY DEMAND (l/s) Res.	MAXIMUM HOURLY DEMAND (l/s) Non-res.	MAXIMUM HOURLY DEMAND (l/s) Total	FIRE DEMAND (l/min)
	53	52		321				1.04	0.00	1.04	2.60	0.00	2.60	5.71	0.00	5.71	10,000

ASSUMPTIONS

RESIDENTIAL DENSITIES
- Single Family (SF) 3.4 p / p / u
- Semi Detached (SD) 2.7 p / p / u
- Townhouse (TH) 2.7 p / p / u

AVG. DAILY DEMAND
- Residential 280 l / cap / day
- Institutional 15,000 l / ha / day

MAX. DAILY DEMAND
- Residential 700 l / cap / day
- Institutional 22,500 l / ha / day

MAX. HOURLY DEMAND
- Residential 1,540 l / cap / day
- Institutional 40,500 l / ha / day

FIRE FLOW
- SF, SD, TH & ST 10,000 l / min
- ICI 15,000 l / min

232 Donald B. Munro Drive - Water Quality Analysis

Street	Pipe Size (mm)	Pipe Length (m)	Volume of Water in Pipe (liters)	Buildings		Population	Basic Flow (200 l/c/d) (l/s)	Time to Empty (hours)
				Single	Towns			
Myrtle Campbell Circle								
Street No. 2	50	85	167	7		24		
	200	140	4398	15		51		
Total			4565			75	0.17	7.3

0.002314815

Fire Flow Requirement from Fire Underwriters Survey

Building Floor Area Lot 38

width	12.0	m
depth	22.0	m
stories	2	
	528.0	m^2

$F = 220C\sqrt{A}$

C	1.5		C =	1.5 wood frame
A	528	m^2		1.0 ordinary
				0.8 non-combustible
F	7,583	l/min		0.6 fire-resistive
use	8,000	l/min		

Occupancy Adjustment

		-25%	non-combustible
		-15%	limited combustible
Use	-15%	0%	combustible
		+15%	free burning
Adjustment	-1200 l/min	+25%	rapid burning
Fire flow	6,800 l/min		

Sprinkler Adjustment

		-30%	system conforming to NFPA 13
		-50%	complete automatic system
Use	0%		
Adjustment	0 l/min		

Exposure Adjustment

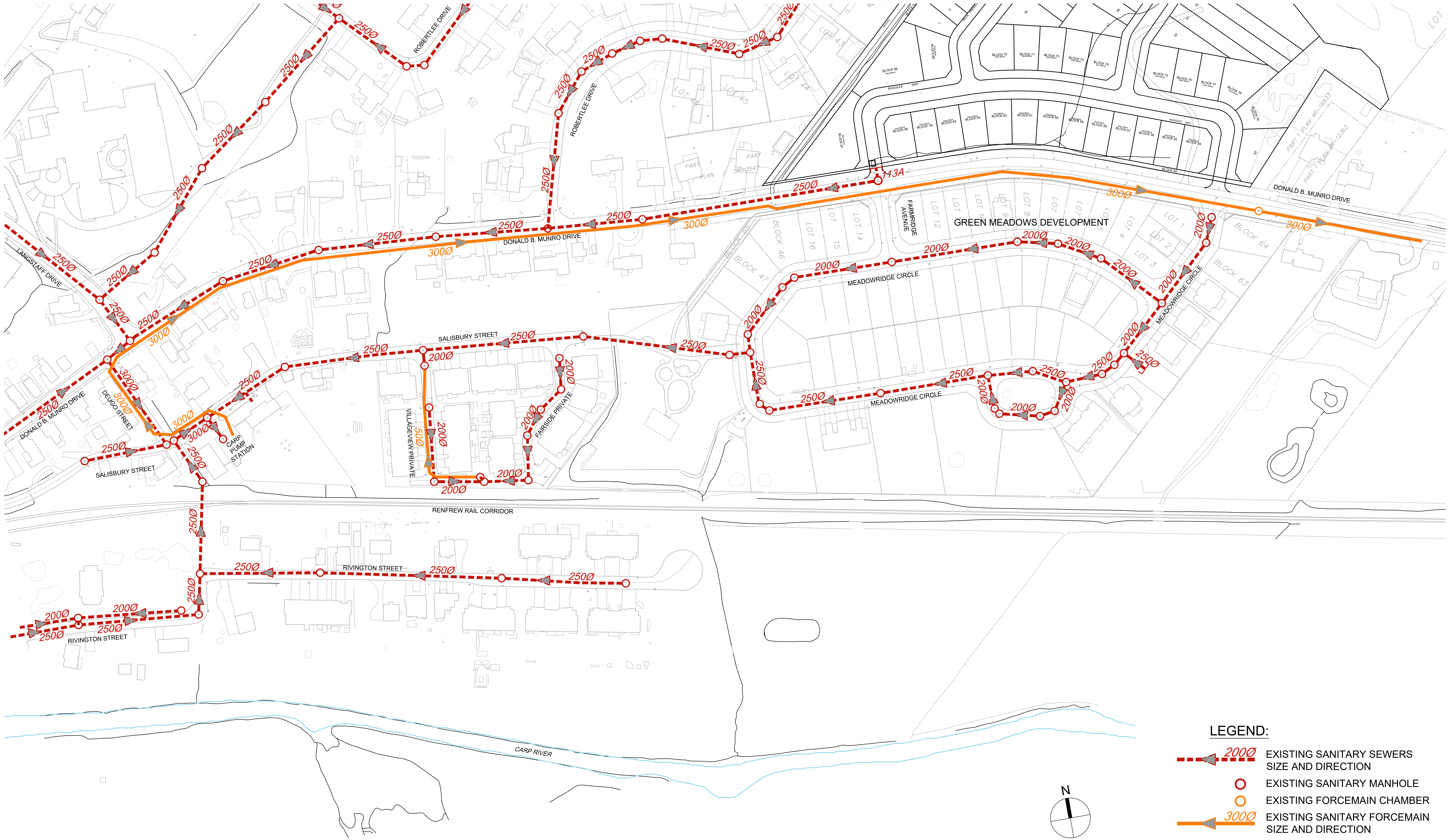
Building Face	Separation (m)	Adjacent Exposed Wall			Exposure Charge *
		Length	Stories	L*H Factor	
Lot 39-40	9.0	20.0	2	40	16%
Lot 44	15.0	10.0	2	20	10%
Lot 37	2.0	20.0	2	40	21%
Lot 10	25.0	10.0	2	20	0%
Total					47%

Adjustment	3,196	l/min
Total adjustments	3,196	l/min
Fire flow	9,996	l/min
Use	**10,000**	**l/min**
	166.7	**l/s**

* Exposure charges from Table 6 of 2020 Fire Underwriters Survey

Appendix C

Wastewater



ARCADIS

Scale
N.T.S.

Project Title
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title
EXISTING SANITARY SEWERS

Sheet No.
FIGURE 3.1
2025/01/10

LEGEND:

PROPOSED SANITARY SEWERS SIZE AND DIRECTION (200Ø)

PROPOSED SANITARY MANHOLE

EXISTING SANITARY SEWERS SIZE AND DIRECTION (200Ø)

EXISTING SANITARY MANHOLE

EXISTING FORCEMAIN CHAMBER

EXISTING SANITARY FORCEMAIN SIZE AND DIRECTION (300Ø)

ARCADIS

Scale: N.T.S.

Project Title: ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title: CONCEPTUAL SANITARY SEWER PLAN

Sheet No.: FIGURE 3.2

2025/01/10

IBI GROUP
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
ibigroup.com

SANITARY SEWER DESIGN SHEET

Carp Lands
CITY OF OTTAWA
Tartan Homes Corporation

LOCATION				RESIDENTIAL										ICI AREAS								INFILTRATION ALLOWANCE			FIXED FLOW (L/s)		TOTAL FLOW	PROPOSED SEWER DESIGN						
				AREA w/ Units (Ha)	UNIT TYPES				AREA w/o Units (Ha)	POPULATION		RES PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)						ICI PEAK FACTOR	PEAK FLOW (L/s)	AREA (Ha)		FLOW				CAPACITY	LENGTH	DIA	SLOPE	VELOCITY (full)	AVAILABLE CAPACITY	
STREET	AREA ID	FROM MH	TO MH		SF	SD	TH	APT		IND	CUM			INSTITUTIONAL		COMMERCIAL		INDUSTRIAL				IND	CUM	(L/s)	IND	CUM	(L/s)	(L/s)	(m)	(mm)	(%)	(m/s)	L/s	(%)
														IND	CUM	IND	CUM	IND	CUM														
total subdivision				6.53	53	52				320.6	320.6	3.45	3.59		0.00	0.00	0.00		0.00	1.00	0.00	6.53	6.53	2.15		0.00	5.74	19.66	75.25	200	0.33	0.606	13.91	70.79%
Donald B Munro Drive					0	0	0	0	0.20	0.0	320.6	3.45	3.59									0.20	6.73	2.22		0.00	5.81	35.64	79.90	250	0.33	0.703	29.83	83.70%
Donald B Munro Drive				0.53	2					6.8	327.4	3.45	3.66									0.53	7.26	2.40		0.00	6.06	42.08	82.40	250	0.46	0.830	36.02	85.61%

Design Parameters:

Residential			ICI Areas			
SF	3.4	p/p/u	INST	28,000	L/Ha/day	
TH/SD	2.7	p/p/u	COM	28,000	L/Ha/day	
APT	1.9	p/p/u	IND	35,000	L/Ha/day	MOE Chart
Other	60	p/p/Ha		17000	L/Ha/day	

Notes:
1. Mannings coefficient (n) = 0.013
2. Demand (per capita): 280 L/day 200 L/day
3. Infiltration allowance: 0.33 L/s/Ha
4. Residential Peaking Factor:
Harmon Formula = 1+(14/(4+(P/1000)^0.5))0.8
where K = 0.8 Correction Factor
5. Commercial and Institutional Peak Factors based on total area, 1.5 if greater than 20%, otherwise 1.0

Designed: JIM

Checked:

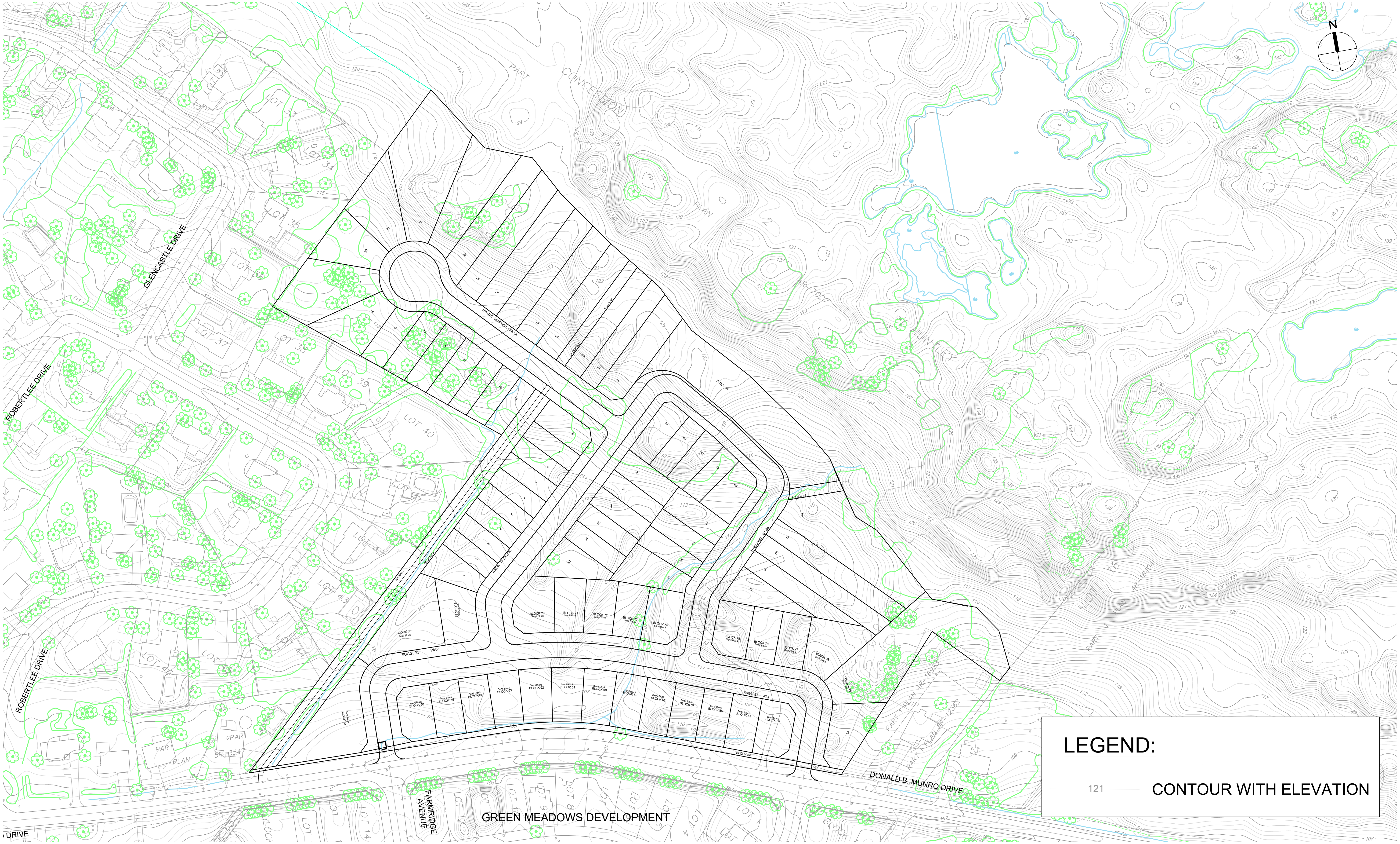
Dwg. Reference: 131397

No.	Revision	Date
1.	Submission No. 1 To City of Ottawa	2021-09-10
2.	Submission No. 2 To City of Ottawa	20225-01-10

File Reference: 131397-6.04
Date: 2021-01-06
Sheet No: 1 of 1

Appendix D

Stormwater and Macro Grading



Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES 232 DONALD B. MUNRO DRIVE VILLAGE OF CARP	EXISTING TOPOGRAPHY	FIGURE 4.1 2025/01/10

ARCADIS

Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES 232 DONALD B. MUNRO DRIVE VILLAGE OF CARP	EXISTING STORM SEWERS	FIGURE 4.2 2025/01/10

N

CONCESSION 2 (HUNTLEY)

PART 1 PLAN 4R-7027

TC=36.53min
Q=173.95l/s

TC=19.14min
Q=18.65l/s

TC=12.25min
Q=15.69l/s

TC=18.94min
Q=57.97l/s

TC=22.24min
Q=43.88l/s

TC=43.18min
Q=255.66l/s

TC=11.59min
Q=38.95l/s

0.25

MYRTLE CAMPBELL CIRCLE

WILLIE CRESCENT

RUGGLES WAY

BLOCK 81

BLOCK 82

BLOCK 83

BLOCK 84

WALKWAY

DONALD B. MUNRO DRIVE

GLENCASTLE DRIVE

ROBERTLEE DRIVE

FARMRIDGE AVENUE

MEADOWRIDGE CIRCLE

GREEN MEADOWS DEVELOPMENT

REPLACE EXISTING STORM SEWERS IN DONALD B. MUNRO DRIVE

LOT 33 LOT 34 LOT 35 LOT 36 LOT 37 LOT 38 LOT 39 LOT 40 LOT 41 LOT 42 LOT 43 LOT 44 LOT 45

LOT 1 LOT 2 LOT 3 LOT 4 LOT 5 LOT 11 LOT 12 LOT 14 LOT 15 LOT 16 LOT 17

BLOCK 63 BLOCK 64

PART 1 PLAN 4R-16933

PART 1 PLAN 5R-12362

PART 1 PLAN 5R-13547

LEGEND:

- 1050Ø — PROPOSED STORM SEWERS SIZE AND DIRECTION
- PROPOSED STORM MANHOLE
- 200Ø — EXISTING STORM SEWERS SIZE AND DIRECTION
- EXISTING STORM MANHOLE
- S5 / 0.68 | 0.20 — AREA NUMBER / RUNOFF COEFFICIENT / AREA IN HECTARES

J:\131947_Corp\7.0_Production\7.03_Design\04_Civil_Land_AssessmentReports_SheetsSet\Figure 4.3 CONCEPTUAL STORM DRAINAGE PLAN.dwg Last Saved By: slurnad3150 Last Saved At: Jan. 9, 25

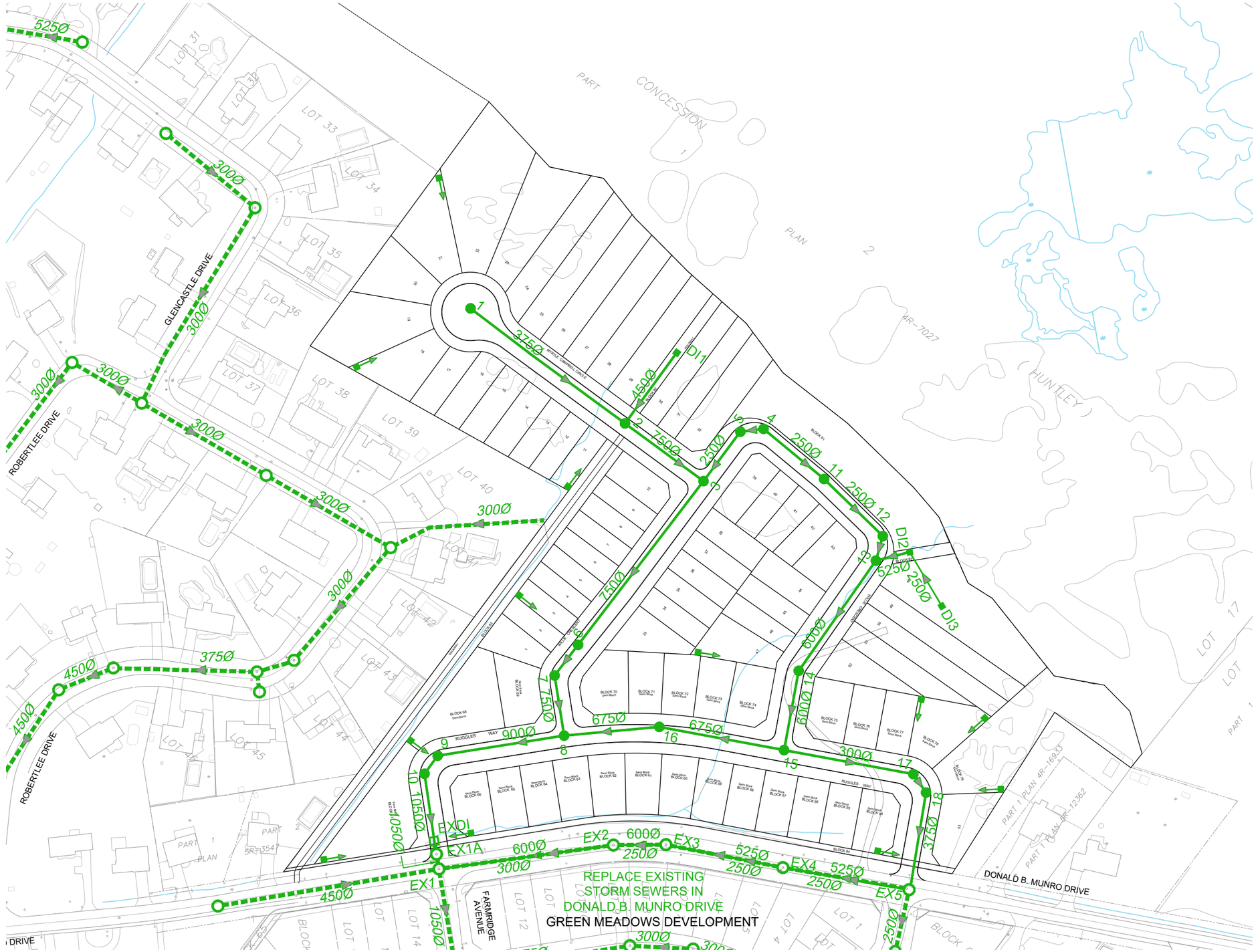
ARCADIS

Scale: N.T.S.

Project Title: ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title: CONCEPTUAL
STORM DRAINAGE PLAN

Sheet No.: FIGURE 4.3
2025/01/10



Scale

N.T.S.

Project Title

ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title

CONCEPTUAL
STORM SEWER PLAN

Sheet No.

FIGURE 4.4
2025/01/10

Legend

- CB
- MH
- Culvert
- Proposed STM
- Existing STM
- Outlet Link
- Subcatchments
- Major Flow
- LP1 Low Point

Catchment ID	
% Imp.	Area (ha)

Catchment ID		
CN	Tc (min)	Area (ha)

Project

ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Figure 4.5

CONCEPTUAL STORMWATER MANAGEMENT MODEL
DRAINAGE AREA PLAN

0 40 80 120 160 m

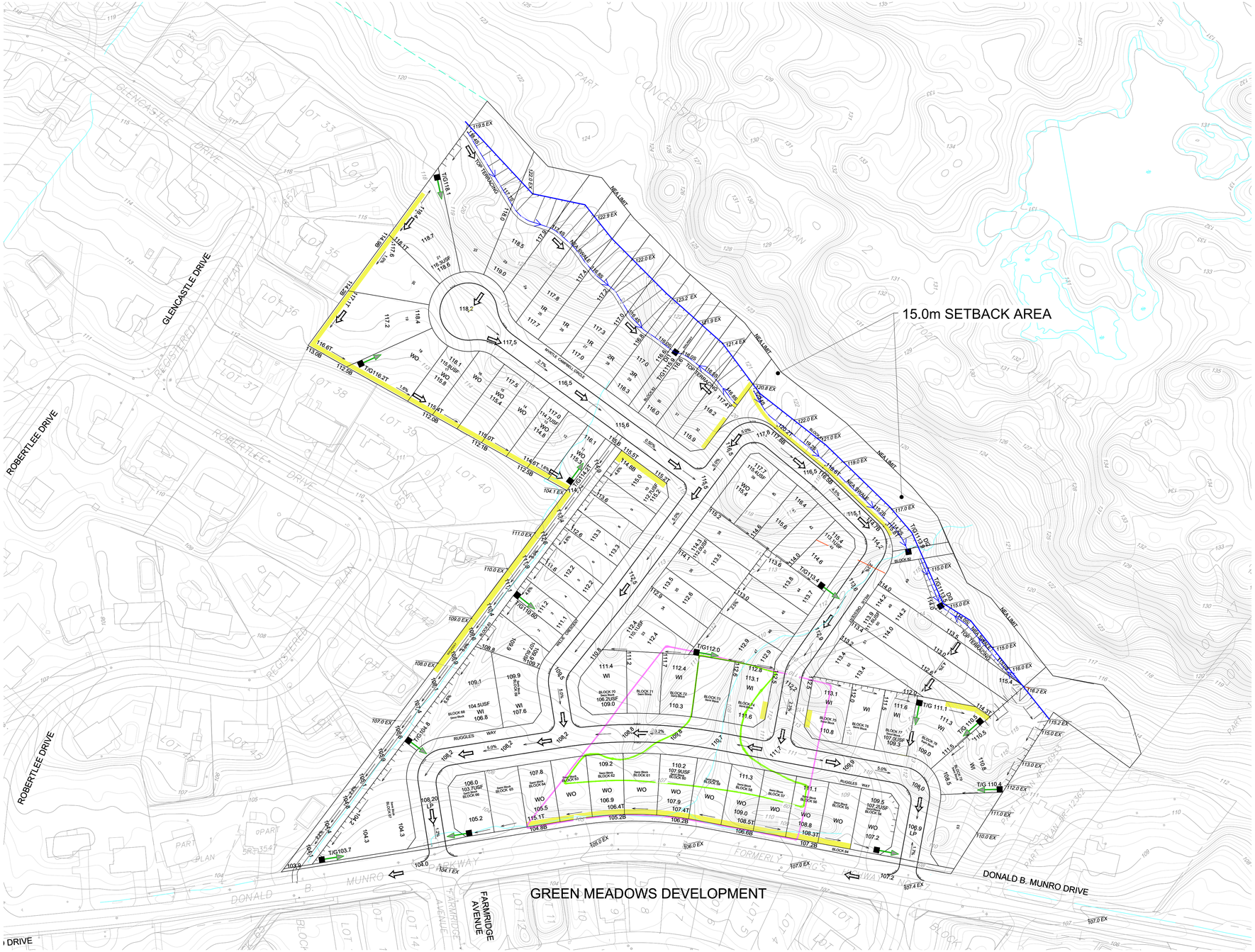
1:3,500 NAD 1983 CSRS MTM 9

ARCADIS

Project #: 131947

1/9/2025

J:\131947_Carp\7.0_Production\7.07_Spatial_Design\SWM\Projects\131947 - SWM APSR\131947 - SWM APSR.aprx



LEGEND:

115.0 EX	EXISTING GRADE
108.0	PROPOSED GRADE
109.5	FRONT YARD GRADE
107.2USF	UNDER SIDE FOOTING ELEVATION
107.2	REAR YARD GRADE
WO	POTENTIAL WALKOUT UNITS
WI	POTENTIAL WALK IN UNITS
2R	ADDITIONAL RISERS REQUIRED
108.3T / 107.2B	TOP RETAINING WALL ELEVATION POTENTIAL RETAINING WALLS BOTTOM RETAINING WALL ELEVATON
	POTENTIAL TERRACING
	NEA SWALE IN REAR YARDS
5.0%	SLOPE GRADE AND DIRECTION
	FLOW DIRECTION
	MAJOR FLOW DIRECTION
T/G 110.5	REAR YARD CATCHBASIN , ELEVATION AND OUTLET PIPE
DI2 T/G 110.5	DITCH INLET AND TOP OF GRATE ELEVATION
	1.8m PERMISSIBLE GRADE RAISE LIMITS
	POTENTIAL AREA EXCEEDING PERMISSIBLE GRADE RAISE LIMITS

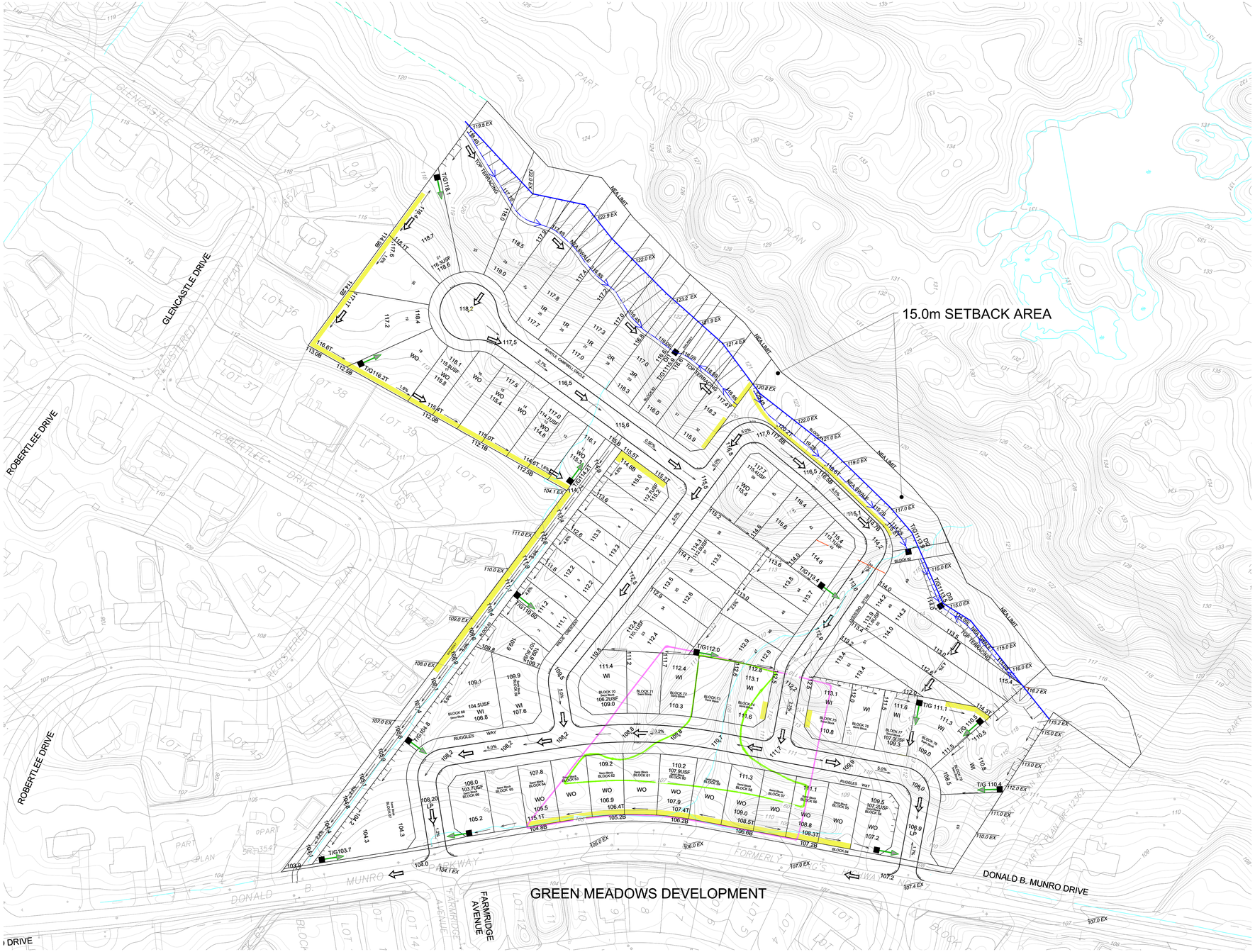
ARCADIS

Scale
N.T.S.

Project Title
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title
MACRO GRADING PLAN

Sheet No.
FIGURE 4.6
2025/01/10



N

LEGEND:

115.0 EX	EXISTING GRADE
108.0	PROPOSED GRADE
109.5	FRONT YARD GRADE
107.2USF	UNDER SIDE FOOTING ELEVATION
107.2	REAR YARD GRADE
WO	POTENTIAL WALKOUT UNITS
WI	POTENTIAL WALK IN UNITS
2R	ADDITIONAL RISERS REQUIRED
108.3T / 107.2B	TOP RETAINING WALL ELEVATION; POTENTIAL RETAINING WALLS; BOTTOM RETAINING WALL ELEVATON
	POTENTIAL TERRACING
	NEA SWALE IN REAR YARDS
5.0%	SLOPE GRADE AND DIRECTION
	FLOW DIRECTION
	MAJOR FLOW DIRECTION
T/G 110.5	REAR YARD CATCHBASIN , ELEVATION AND OUTLET PIPE
DI2 T/G 110.5	DITCH INLET AND TOP OF GRATE ELEVATION
	1.8m PERMISSIBLE GRADE RAISE LIMITS
	POTENTIAL AREA EXCEEDING PERMISSIBLE GRADE RAISE LIMITS

ARCADIS

Scale
N.T.S.

Project Title
ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES
232 DONALD B. MUNRO DRIVE
VILLAGE OF CARP

Drawing Title
MACRO GRADING PLAN

Sheet No.
FIGURE 4.6
2025/01/10

LOCATION			AREA	comp. C	INDIV.	ACCUM.	TIME OF	RAINFALL INTENSITY	PEAK FLOW	PROPOSED SEWER						
STREET	FROM MH	TO MH	(ha)	R=	2.78AR	2.78AR	CONC.	I	Q (l/s)	PIPE SIZE (mm)		GRADE (%)	LENGTH (m)	CAPACITY (l/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min)
Street 1	211	210	0.03	0.55	0.05	0.05	10.00	104.19	4.78	254		2.45	31.3	97.20	1.9	0.27
Street 1	210	209	0.20	0.43	0.24	0.28	10.27	102.78	29.29	254		4.80	50.5	136.06	2.7	0.31
Street 1	CB 3	main	0.28	0.44	0.34	0.34	15.00	83.56	28.62	254		1.00	39.1	62.10	1.2	0.53
Street 1	209	208	0.00		0.00	0.63	15.53	81.88	51.37	304.8		4.76	63.2	220.32	3.0	0.35
Street 1	208	207	0.24	0.47	0.31	0.94	15.88	80.82	76.05	304.8		3.30	29.4	183.45	2.5	0.19
Street 1	207	206	0.00		0.00	0.94	16.08	80.24	75.50	381		1.85	28.7	249.04	2.2	0.22
Street 1	206	205	0.00		0.00	0.94	16.29	79.60	74.90	381		1.75	29.4	242.21	2.1	0.23
Street 2	207	220	0.00		0.00	0.00	10.00	104.19	0.00	254.0		4.00	24.2	124.20	2.5	0.16
Street 2	220	219	0.00		0.00	0.00	10.16	103.33	0.00	254.0		1.50	40.7	76.06	1.5	0.45
Street 2	219	205	0.27	0.54	0.41	0.41	10.62	101.05	40.96	254.0		1.00	26.7	62.10	1.2	0.36
Street 1	205	204	0.52	0.43	0.62	1.97	16.53	78.93	155.34	533.4		0.50	75.8	317.57	1.4	0.89
Street 1	CB 13	main	0.78	0.38	0.82	0.82	15.00	83.56	68.85	300.0		1.50	11.5	118.55	1.7	0.11
Street 1	204	203	0.52	0.46	0.66	3.46	17.41	76.49	264.42	609.6		0.35	76.5	379.34	1.3	0.98
Street 1	203	202	0.00		0.00	3.46	18.40	73.98	255.75	609.6		0.35	10.9	379.34	1.3	0.14
Street 1	223	217	0.00		0.00	0.00	10.00	104.19	0.00	254.0		1.00	34.9	62.10	1.2	0.47
Street 1	217	216	0.69	0.43	0.82	0.82	10.47	101.75	83.93	304.8		1.00	31.5	100.98	1.4	0.38
Street 1	216	215	0.00		0.00	0.82	10.85	99.89	82.39	304.8		1.30	32.4	115.14	1.6	0.34
Street 1	215	214	0.50	0.45	0.63	1.45	11.20	98.27	142.53	381.0		1.46	88.5	221.24	1.9	0.76
Donald B.	224	222	0.11	0.74	0.23	0.23	10.00	104.19	23.58	254.0		0.75	71.2	53.78	1.1	1.12
Donald B.	227	226	0.10	0.75	0.21	0.21	10.00	104.19	21.72	254.0		1.82	60.3	83.78	1.7	0.61
Donald B.	226	225	0.12	0.71	0.24	0.45	10.61	101.09	45.02	254.0		2.58	26.0	99.75	2.0	0.22
Donald B.	225	222	0.03	0.90	0.08	0.52	10.83	100.01	52.05	254.0		1.02	88.4	62.72	1.2	1.19
Street 3	222	214	0.19	0.54	0.29	1.03	12.02	94.62	97.64	1066.8	[1]	0.89	51.5	2682.69	3.0	0.29
Street 1	214	213	0.25	0.49	0.34	2.82	11.96	94.88	267.84	1066.8	[1]	0.89	68.5	2682.69	3.0	0.38
Street 1	213	212	0.00		0.00	2.82	12.34	93.28	263.32	1066.8	[1]	0.89	49.4	2682.69	3.0	0.27
Street 1	212	202	0.57	0.49	0.78	3.60	12.61	92.16	331.72	1066.8	[1]	0.89	49.6	2682.69	3.0	0.28
Outlet	202	201	0.0		0.00	7.06	18.53	73.64	519.62	1219.2	[1]	0.75	29.6	3525.94	3.0	0.16
Outlet	201	pond headwall	0.0		0.00	7.06	18.70	73.24	191.57	381.0	[1,2]	1.10	1.5	192.03	1.7	0.01
Outlet	201	ditch headwall	0.0		0.00	7.06	18.71	73.21	519.62	762.0	[1]	0.20	41.5	519.92	1.1	0.61
North Lands Future	Stub	222	28.58	0.50	39.73	39.73	25.80	59.65	2369.59	1066.8		0.89	11.4	2682.69	3.0	0.06
Street 3	222	214	0.19	0.58	0.31	40.03	25.86	59.55	2384.01	1066.8		0.89	52.0	2682.69	3.0	0.29
Street 1	214	213	0.25	0.49	0.34	41.82	26.15	59.12	2472.47	1066.8		0.89	69.9	2682.69	3.0	0.39
Street 1	213	212	0.00		0.00	41.82	26.54	58.54	2448.47	1066.8		0.89	50.8	2682.69	3.0	0.28
Street 1	212	202	0.57	0.49	0.78	42.60	26.82	58.13	2476.50	1066.8		0.89	47.8	2682.69	3.0	0.27
Outlet	202	201	0.00		0.00	46.06	27.09	57.75	2659.99	1219.2		0.75	29.6	3525.94	3.0	0.16
Outlet	201	pond headwall	0.00		0.00	46.06	27.25	57.52	1612.66	914.0	[2]	0.73	5.0	1613.35	2.5	0.03
Outlet	201	ditch headwall	0.00		0.00	46.06	27.28	57.48	1047.33	914.0		0.31	41.5	1051.35	1.6	0.43

INTERIM PIPE FLOWS REFER TO DWG 2681-STM

INCLUDING NORTH LANDS REFER TO DWG 2681-STM

Run-off Coefficient = 0.20 for Grassed areas
= 0.50 for pervious area consisting of shallow soils over nearly impervious layers
= 0.90 for Impervious areas

Rainfall Intensity = $998.071/(T+6.053)^{0.814}$ T= time in minutes
(City of Ottawa, 5 year storm)

Accummulated 2.78AR x Rainfall Intensity

First Flush Interim SWM Flows = 191.57
First Flush Ultimate SWM Flows = 1612.66

Inflow Rate of the Water Quality Storm

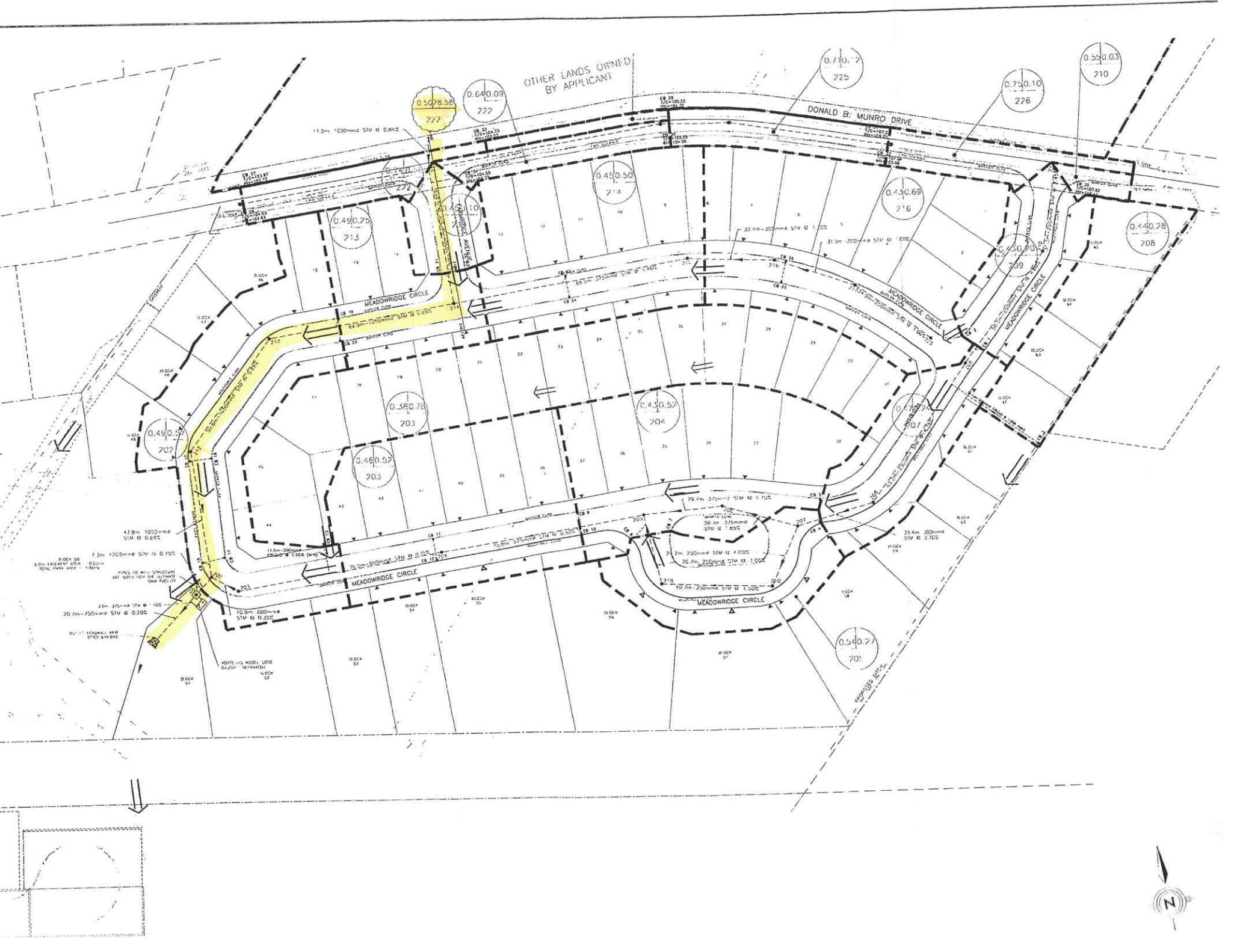
Q = CiA / 360 Equation 4.8: Rational Method*
i = 43C + 5.9 Equation 4.9: 25mm Storm Intensity*

		Interim	Ultimate	
Runoff Coefficient	C =	0.47	0.57	
Rainfall Intensity	i =	26.11	30.195	mm/hr
Total Drainage Area	A =	5.62	34.03	ha
Peak Inflow Rate	Q =	0.19	1.61	m^3/s
Peak Inflow Rate	Q =	191.57	1612.66	L/s

*MOE SWM Planning & Design Manual, 2003, pg 4-57

NOTES:
[1] Pipe Sized for Ultimate Development
[2] Sized for 25mm storm. All other flows to bypass to downstream pipe (pipe acts as orifice)

LICENSED PROFESSIONAL ENGINEER
Aug. 10 20 08
A. H. JONKMAN
PROVINCE OF ONTARIO


OTHER LANDS OWNED BY APPLICANT
DONALD B. MUNRO DRIVE
MEADOWRIDGE CIRCLE
MEADOWRIDGE CIRCLE
MEADOWRIDGE CIRCLE
FAIRRIDGE AVENUE
0.5028.58
222
0.640.09
222
0.490.25
213
0.450.50
214
0.450.69
216
0.440.78
208
0.490.55
202
0.380.78
203
0.460.57
203
0.430.52
204
0.540.27
201
0.750.10
226
0.550.03
210
N

Pervious Pipe Systems

Pervious pipe systems must be installed in soils with good infiltration potential and a deep groundwater table. Pre-treatment (removal of coarser solids) of road runoff is necessary to prevent clogging and is typically achieved through the use of grassed swales in the boulevard.

End-of-Pipe Systems

Due to the relatively small drainage areas, end-of-pipe **interceptor solutions** such as oil-grit separators (e.g. Stormceptor) may be considered. This type of SWMP is acceptable if it captures and treats at least a 90% of the runoff volume.

SWMPs in area F (part of 8a and 8b) will outlet to the existing SWM facility upstream of Donald B. Munro Drive. In area G (remainder of 8a and 8c), discharge is to the ravine that outlets to the Regional Road 5 sewer.

4.1.7 Area H

This small area of 1.92 ha is physically separated from the village by Regional Road 5, Donald B. Munro Drive, and the Carp River. The development designation of the area is Village Core. The land is very low lying (between 91.4 and 93.0 m). As a result, drainage towards regional Road #5 (elevation approximately 94.0 m) does not appear feasible.

Because the development area is very small, and the "Village Core" land use indicates high density development, appropriate SWMPs appear to be limited to **interceptors**, in combination with **natural buffer strips** along the Carp River.

4.1.8 Areas I and J

Area I includes the development areas 9, 10, and 11. Proposed development for area 9 is medium density residential (1.86 ha), for area 10 low density residential (4.72 ha), and for area 11 low density residential (6.38 ha). Medium density residential is proposed for Area 12 (1.17 ha), which is separated from the other areas by the Ottawa Central Railway (OCR) embankment. Access to Area 12 (parcel J) will be required through an extension of Rivington Street (subject to the provision of a balanced cut and fill to mitigate the loss of flood storage).

The preferred stormwater management solution for this area would consist of a facility or facilities that address the requirements for areas I and J. Available options include lot level and conveyance controls, and end-of-pipe solutions. However, the sandy loam soils that cover most of this area offer only limited opportunities for infiltration. Additionally, the water table is less than 1 metre below existing grade.

The existing railway culvert consists of a 1.98 m diameter concrete pipe. Without surcharging, the capacity of this culvert is approximately 8 m^3/s. Existing 100 year flow at the culvert is approximately 3.59 m^3/s (Village of Carp Drainage Study). Although the existing culvert may have sufficient capacity, the discharge of uncontrolled post-development flows will be subject to the requirements and approval of the Ottawa Central Railway. The development proponent will be required to ascertain the need for peak flow control with the OCR prior to draft plan approval and/or confirmation of the SWM block required.

Peak flows at key locations, as determined by the Carp Drainage Study, are presented in **Appendix B**.

Ontario

Ministry of the Environment
Ministère de l'Environnement

ENVIRONMENTAL COMPLIANCE APPROVAL
NUMBER 5689-8UCR8W
Issue Date: May 29, 2012

D & H Rivington Enterprises Inc.
134 Glenncastle Dr
Post Office Box, No. 190
Ottawa, Ontario
K0A 1L0

Site Location: 277 Donald B. Munro Drive
Lot 17, Concession 2
Ottawa, Ontario

You have applied under section 20.2 of Part II.1 of the Environmental Protection Act , R.S.O. 1990, c. E. 19 (Environmental Protection Act) for approval of:

a **stormwater management facility** to be constructed to serve Green Meadows Subdivision, in the City of Ottawa, comprising the following:

Oil/grit interceptor
- one (1) oil/grit interceptor, model CDS5678-10 located offline downstream of MH 202, servicing a drainage area of 36.4 hectares, providing long term average total suspended solids removal of 79% at an average treatment rate of 682 L/s, discharging to the proposed swale;

all in accordance with the application dated October 14, 2011 and received on November 22, 2011, and all supporting documentation and information associated with the application including final plans and specifications prepared by exp Services Inc.

For the purpose of this environmental compliance approval, the following definitions apply:

(1) "Approval" means this Environmental Compliance Approval, including the application and supporting information;

(2) "Director" means any Ministry employee appointed by the Minister pursuant to Part II.1 of the Environmental Protection Act;

(3) "Ministry" means the Ontario Ministry of the Environment;

(4) "Owner" means D & H Rivington Enterprises Inc. and includes its successors and assignees; and

(5) "Works" means the sewage works described in the Owner's application, this Approval and in the supporting documentation referred to herein, to the extent approved by this Approval.

You are hereby notified that this environmental compliance approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL CONDITIONS

1.1 The Owner shall ensure that any person authorized to carry out work on or operate any aspect of the Works is notified of this Approval and the conditions herein and shall take all reasonable measures to ensure any such person complies with the same.

1.2 Except as otherwise provided by these Conditions, the Owner shall design, build, install, operate and maintain the Works in accordance with the description given in this Approval, the application for approval of the works and the submitted supporting documents and plans and specifications as listed in this Approval.

1.3 Where there is a conflict between a provision of any submitted document referred to in this Approval and the Conditions of this Approval, the Conditions in this Approval shall take precedence, and where there is a conflict between the listed submitted documents, the document bearing the most recent date shall prevail.

1.4 Where there is a conflict between the listed submitted documents, and the application, the application shall take precedence unless it is clear that the purpose of the document was to amend the application.

1.5 The requirements of this Approval are severable. If any requirement of this Approval, or the application of any requirement of this Approval to any circumstance, is held invalid or unenforceable, the application of such requirement to other circumstances and the remainder of this Approval shall not be affected thereby.

2. EXPIRY OF APPROVAL

2.1 This Approval will cease to apply to those parts of the Works which have not been constructed within five (5) years of the date of this Approval.

3. CHANGE OF OWNER

3.1 The Owner shall notify the District Manager and the Director, in writing, of any of the following changes within thirty (30) days of the change occurring:

(a) change of Owner;

(b) change of address of the Owner;

(c) change of partners where the Owner is or at any time becomes a partnership, and a copy of the most recent declaration filed under the Business Names Act , R.S.O. 1990, c.B17 shall be included in the notification to the District Manager; and

(d) change of name of the corporation where the Owner is or at any time becomes a corporation, and a copy of the most current information filed under the Corporations Information Act , R.S.O. 1990, c. C39 shall be included in the notification to the District Manager.

4. OPERATION AND MAINTENANCE

4.1 The Owner shall make all necessary investigations, take all necessary steps and obtain all necessary approvals so as to ensure that the physical structure, siting and operations of the

stormwater works do not constitute a safety or health hazard to the general public.

4.2 The Owner shall undertake an inspection of the condition of the stormwater management system, at least once a year, and undertake any necessary cleaning and maintenance to ensure that sediment, debris and excessive decaying vegetation are removed from the above noted stormwater management system to prevent the excessive build-up of sediment, debris and/or decaying vegetation to avoid reduction of capacity of the facility. The Owner shall also regularly inspect and clean out the inlet to and outlet from the works to ensure that these are not obstructed.

4.3 The Owner shall maintain a logbook to record the results of these inspections and any cleaning and maintenance operations undertaken, and shall make the logbook available for inspection by the Ministry upon request. The logbook shall include, but not necessarily be limited to, the following information:

(a) the name of the Works; and

(b) the date and results of each inspection, maintenance and cleaning, including an estimate of the quantity of any materials removed.

5. RECORD KEEPING

5.1 The Owner shall retain for a minimum of five (5) years from the date of their creation, all records and information related to or resulting from the operation and maintenance activities required by this Approval.

6. SOURCE WATER PROTECTION

6.1 The Owner shall, within sixty (60) calendar days of the Minister of the Environment posting approval of a Source Protection Plan on the environmental registry established under the Environmental Bill of Rights, 1993 for the area in which this Approval is applicable, apply to the Director for an amendment to this Approval that includes the necessary measures to conform with all applicable policies in the approved Source Protection Plan.

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is imposed to ensure that the Works are built and operated in the manner in which they were described for review and upon which approval was granted. This condition is also included to emphasize the precedence of Conditions in the Approval and the practice that the Approval is based on the most current document, if several conflicting documents are submitted for review. The condition also advises the Owners their responsibility to notify any person they authorized to carry out work pursuant to this Approval of the existence of this Approval.

2. Condition 2 is included to ensure that, when the Works are constructed, the Works will meet the standards that apply at the time of construction to ensure the ongoing protection of the environment.

3. Condition 3 is included to ensure that the Ministry records are kept accurate and current with respect to approved works and to ensure that subsequent owners of the Works are made aware of the Approval and continue to operate the Works in compliance with it.

4. Condition 4 is included as regular inspection and necessary removal of sediment and excessive decaying vegetation from this approved stormwater management Works are required to mitigate the impact of sediment, debris and/or decaying vegetation on the treatment capacity of the Works. It is also required to ensure that adequate storage is maintained in the stormwater management facilities at

all times as required by the design, and to prevent stormwater impounded in the works from becoming stagnant. Furthermore, Conditions 4 is included to ensure that the stormwater management Works are operated and maintained to function as designed.

5. Condition 5 is included to require that all records are retained for a sufficient time period to adequately evaluate the long-term operation and maintenance of the Works.

6. Condition 6 is included to ensure that the works covered by this Approval will conform to the significant threat policies and designated Great Lakes policies in the Source Protection Plan.

In accordance with Section 139 of the Environmental Protection Act, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 142 of the Environmental Protection Act provides that the Notice requiring the hearing shall state:

1. The portions of the environmental compliance approval or each term or condition in the environmental compliance approval in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

The Notice should also include:

3. The name of the appellant;
4. The address of the appellant;
5. The environmental compliance approval number;
6. The date of the environmental compliance approval;
7. The name of the Director, and;
8. The municipality or municipalities within which the project is to be engaged in.

And the Notice should be signed and dated by the appellant.

This Notice must be served upon:

The Secretary*****
Environmental Review Tribunal
655 Bay Street, Suite 1500
Toronto, Ontario
M5G 1E5

AND

The Director appointed for the purposes of Part II.1 of the Environmental Protection Act
Ministry of the Environment
2 St. Clair Avenue West, Floor 12A
Toronto, Ontario
M4V 1L5

*** Further information on the Environmental Review Tribunal 's requirements for an appeal can be obtained directly from the Tribunal at: Tel: (416) 212-6349, Fax: (416) 314-4506 or www.ert.gov.on.ca**

The above noted activity is approved under s.20.3 of Part II.1 of the Environmental Protection Act.

DATED AT TORONTO this 29th day of May, 2012

Sherif Hegazy, P.Eng.
Director
appointed for the purposes of Part II.1 of

the *Environmental Protection Act*

BH/
c: District Manager, MOE Ottawa
Angela Jonkman, P.Eng., exp Services Inc.

Runoff coefficients for different soil groups and slopes

The following table was adapted from Hydrologic Analysis and Design (4th Edition) (McCuen, 2017).

Runoff coefficients for different soil groups and slopes. Coefficients are for recurrence intervals less than 25 years. Source: Hydrologic Analysis and Design (4th Edition) (McCuen, 2017).

Link to this table

Land use	Soil Group A			Soil Group B			Soil Group C			Soil Group D		
	0-2%	2-6%	>6%	0-2%	2-6%	>6%	0-2%	2-6%	>6%	0-2%	2-6%	>6%
Residential (65% impervious)	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
Residential (30% impervious)	0.19	0.23	0.26	0.22	0.26	0.30	0.25	0.29	0.34	0.28	0.32	0.39
Residential (12% impervious)	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.29	0.35
Commercial	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Industrial	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
Streets	0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78
Parking	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87	0.85	0.86	0.87
Open space	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
Cultivated land	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
Pasture	0.12	0.20	0.30	0.18	0.28	0.37	0.24	0.34	0.44	0.30	0.40	0.50
Meadow	0.10	0.16	0.25	0.14	0.22	0.30	0.20	0.28	0.36	0.24	0.30	0.40
Forest	0.05	0.08	0.11	0.08	0.11	0.14	0.10	0.13	0.16	0.12	0.16	0.20

Source: Minnesota Stormwater Manual https://stormwater.pca.state.mn.us/index.php?title=Stormwater_runoff_coefficients/curve_numbers_for_different_land_uses

Arcadis
400-333 Preston Street
Ottawa, Ontario K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9868
2025-01-04

STORM SEWER DESIGN SHEET

Carp Lands
City of Ottawa
Tartan Group

LOCATION				AREA (Ha)										RATIONAL DESIGN FLOW													SEWER DATA								
STREET	AREA ID	FROM	TO	C= 0.20	C= 0.40	C= 0.50	C= 0.55	C= 0.70	C= 0.65	C= 0.68	C= 0.70	C= 0.73	C= 0.80	IND 2.78AC	CUM 2.78AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (2) (mm/hr)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	2yr PEAK FLOW (L/s)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm) DIA	W	H	SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (2yr) (L/s)	(%)
NEA Swale	NEA Swale	A	B																							173.95										
Myrtle Cambell Circle	R1					0.08								0.11	0.11	10.00			76.81	104.19	122.14	178.56	8.54					182.49									
		B	C																							18.65										
Myrtle Cambell Circle	R2					0.06								0.08	0.08	10.00			76.81	104.19	122.14	178.56	6.41					207.55									
		C	DI 1																							15.69										
Myrtle Cambell Circle	R3					0.07								0.10	0.10	10.00			76.81	104.19	122.14	178.56	7.47					230.71									
		D	DI 1																							57.97										
Myrtle Cambell Circle							0.05							0.08	0.08	10.00			76.81	104.19	122.14	178.56	5.87					63.84									
		DI 1	MH 2																									294.55	420.63	45.00	450			2.00	2.562	126.08	29.97%
		E	DI 2																							43.98		43.98									
		F	DI 3																							38.95		38.95									
		DI 3	DI 2																									38.95	75.98	35.00	250			1.50	1.500	37.03	48.74%
		NEA	DI 2																							255.66		255.66									
		DI 2	MH 13																									338.59	549.49	15.00	525			1.50	2.459	210.90	38.38%
Myrtle Cambell Circle	R4, R5, S1	MH 1	MH 2			0.21	0.07		0.66					1.59	1.59	10.00	0.70	10.70	76.81	104.19	122.14	178.56	122.24					122.24	258.68	95.00	375			2.00	2.269	136.44	52.74%
Myrtle Cambell Circle	S2, R6, DI 1	MH 2	MH 3			0.31			0.31					0.99	2.58	10.70	0.42	11.12	74.23	100.65	117.96	172.42	191.70					608.49	899.63	50.00	750			0.60	1.973	291.14	32.36%
Willie Crescent	S3	MH 4	MH 3						0.10					0.18	0.18	10.00	0.42	10.42	76.81	104.19	122.14	178.56	13.88					13.88	96.11	48.00	250			2.40	1.897	82.23	85.56%
Willie Crescent	S4, S5, R7	MH 3	MH 8				0.21		0.54					1.30	4.06	11.12	0.86	11.98	72.76	98.63	115.59	168.93	295.40					917.77	1,324.21	150.00	750			1.30	2.904	406.45	30.69%
Willie Crescent	S6	MH 4	MH 12					0.20						0.39	0.39	10.00	0.67	10.67	76.81	104.19	122.14	178.56	29.89					29.89	87.74	70.00	250			2.00	1.731	57.84	65.93%
Willie Crescent	DI 2,S7, S8, R8, R9	MH 12	MH 15			0.52		0.38						1.46	1.85	10.67	0.71	11.39	74.31	100.76	118.10	172.63	137.59					506.07	784.52	115.00	600			1.50	2.688	278.45	35.49%
Ruggles Way	S9,S10	MH 15	MH 8						0.51					0.92	2.77	11.39	0.68	12.06	71.86	97.40	114.14	166.80	199.27					705.34	999.86	110.00	675			1.30	2.707	294.52	29.46%
Ruggles Way	S11,R10	MH 8	MH 10				0.19		0.25					0.74	7.58	11.98	0.46	12.44	69.95	94.78	111.05	162.27	529.92					1,235.26	1,888.58	80.00	900			1.00	2.876	653.32	34.59%
Ruggles Way	S12,R11,R12	MH 10	EX 1			0.11	0.31		0.13					0.86	8.44	12.44	0.22	12.67	68.54	92.84	108.77	158.92	578.29					1,813.55	2,687.55	40.00	1050			0.89	3.007	874.00	32.52%
Ruggles Way	S13,R13,R14,R15	MH 15	MH 18		0.46		0.02		0.40					1.26	1.26	10.00	0.56	10.56	76.81	104.19	122.14	178.56	97.15					97.15	174.73	80.00	300			3.00	2.395	77.58	44.40%
Ruggles Way	S14,R16	MH 18	Ex 5				0.14		0.18					0.54	1.80	10.56	0.43	10.98	74.73	101.34	118.78	173.62	134.83					134.83	200.37	45.00	375			1.20	1.757	65.54	32.71%
Donald B Munro Drive	DBM1,DBM2	EX 5	EX 3						0.26					0.47	2.27	10.98	0.95	11.93	73.22	99.27	116.34	170.04	166.51					301.35	491.48	125.00	525			1.20	2.199	190.13	38.69%
Donald B Munro Drive	DBM3,DBM4	EX 3	EX 1						0.27					0.49	2.76	11.93	0.71	12.64	70.11	94.99	111.31	162.65	193.64					494.98	784.52	115.00	600			1.50	2.688	289.54	36.91%
Exist Sewer			Ex Sewer											0.00	11.20	12.67	0.00	12.67	67.89	91.94	107.72	157.37	760.27					2,308.53	*2,687.55*	*0.00*	*1050*			*0.89*	*3.007*	*379.01*	*14.10%*

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013
2. Initial T of C = 10 min

Designed:

Checked:

Dwg. Reference:

No.	Revision	Date
1	Submission No. 1 To City of Ottawa	2021-10-13
2	Submission No. 2 To City of Ottawa	2025-01-10

File Reference: 131397
Date: 2021-01-15
Sheet No: 1 of 1

Carp Lands 252 Donald B. Munro Drive
External Drainage Area (NEA)
Time of Concentration calculation (Minutes)

Area 1

Area (ha)			Airport Formula (min)
	High Point	134.00	= $\frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
	Low Point	122.00	
	Distance	320.00	= 36.53
	Slope	3.75%	
	C_{factor}	0.16	

100 Year Design Flow

Area (ha)	Tc (min)	C	i (mm/hr)	Q (L/s)
4.88	36.53	0.16	80.14	173.95

Area 2

Area (ha)			Airport Formula (min)
	High Point	131.00	= $\frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
	Low Point	123.00	
	Distance	125.00	= 19.14
	Slope	6.40%	
	C_{factor}	0.16	

100 Year Design Flow

Area (ha)	Tc (min)	C	i (mm/hr)	Q (L/s)
0.34	19.14	0.16	123.31	18.65

Area 3

Area (ha)			Airport Formula (min)
	High Point	131.00	= $\frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
	Low Point	123.00	
	Distance	73.00	= 12.25
	Slope	10.96%	
	C_{factor}	0.16	

100 Year Design Flow

Area (ha)	Tc (min)	C	i (mm/hr)	Q (L/s)
0.22	12.25	0.16	160.34	15.69

Area 4

Area (ha)			Airport Formula (min)
	High Point	133.00	= $\frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
	Low Point	121.00	
	Distance	145.00	= 18.94
	Slope	8.28%	
	C_{factor}	0.16	

100 Year Design Flow

Area (ha)	Tc (min)	C	i (mm/hr)	Q (L/s)
1.05	18.94	0.16	124.13	57.97

Area 5

Area (ha)			Airport Formula (min)
	High Point	133.00	= $\frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
	Low Point	122.00	
	Distance	170.00	= 22.24
	Slope	6.47%	
	C_{factor}	0.16	

100 Year Design Flow

Area (ha)	Tc (min)	C	i (mm/hr)	Q (L/s)
0.88	22.24	0.16	112.10	43.88

Area 6

Area (ha)			Airport Formula (min)
	High Point	134.00	= $\frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
	Low Point	116.00	
	Distance	460.00	= 43.18
	Slope	3.91%	
	C_{factor}	0.16	

100 Year Design Flow

Area (ha)	Tc (min)	C	i (mm/hr)	Q (L/s)
8.08	43.18	0.16	71.13	255.66

Area 7

Area (ha)			Airport Formula (min)
	High Point	132.00	= $\frac{3.36\ (1.1 - C_{factor})\ distance^{0.5}}{slope^{0.33}}$
	Low Point	116.00	
	Distance	90.00	= 11.59
	Slope	17.78%	
	C_{factor}	0.16	

100 Year Design Flow

Area (ha)	Tc (min)	C	i (mm/hr)	Q (L/s)
0.53	11.59	0.16	165.21	38.95

Rational Method
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (Ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 732.951 / (TC+6.199)^0.810] 2 YEAR
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY	APP'D
13	REVISED AS PER CITY COMMENTS	15/08/12	SAB	AHJ
12	ISSUED FOR CONSTRUCTION	31/07/12	SAB	AHJ
11	ISSUED TO CITY	23/07/12	SAB	AHJ
10	ADDITION OF EX. SANITARY FORCEMAIN	12/07/12	SAB	AHJ
9	ISSUED FOR TENDER	18/05/12	AHJ	AHJ
8	ISSUED FOR MOE APPROVAL	14/10/11	AHJ	AHJ
7	REVISED AS PER CITY COMMENTS	03/10/11	AHJ	AHJ
6	REVISED AS PER CITY COMMENTS	05/08/11	AHJ	AHJ
5	OGS RESUBMISSION	07/06/11	AHJ	AHJ
4	UPDATED PARK GRADING	21/12/10	AHJ	AHJ
3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
2	REVISED STORM SEWER	10/03/10	AHJ	AHJ
1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE
HORZ 1:500
VERT 1:50
0 5 10 15 20

DESIGNED BY: A. H. JONKMAN – LICENSED PROFESSIONAL ENGINEER – PROVINCE OF ONTARIO – Aug/15/12

REVIEWED BY: M. CZAHARYNSKI – LICENSED PROFESSIONAL ENGINEER – PROVINCE OF ONTARIO – Aug/15/12

CLIENT: D. & H. RIVINGTON ENTERPRISES INC.

exp.
The new identity of Trow / DME

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

BASEPLAN	EXP
DESIGN	AHJ / BFP
CHECKED	AHJ
CAD	SWB
PROJ. MAN.	AHJ
APPROVED	AHJ

PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

TITLE: PLAN AND PROFILE
MEADOWRIDGE CIRCLE
STA. 1+000 TO STA.1+325

PROJ. NO.	2681
SURVEY	EXP
DATE	MAY 2012
DRAWING NO.	2681–P1

MEADOWRIDGE CIRCLE
C FARMRIDGE AVENUE
KEY PLAN
APPROXIMATE EXTENT OF PROPOSED EPS FILL INSTALLATION TO BE MONITORED AND APPROVED BY GEOTECHNICAL ENGINEER
NOTE:
PRIOR TO PLACING WATERMAIN IN FILL AREAS, ENGINEERED MATERIAL MUST BE PLACED IN 0.3m LIFTS, TO A MINIMUM OF 0.8m ABOVE THE TOP OF THE PIPE. THE MATERIAL MUST BE COMPACTED TO A MINIMUM OF 98% S.P.D ON A FIELD DENSITY REPORT ISSUED BY A SOILS ENGINEER.
CONTRACTOR TO PLACE UNSHRINKABLE BACKFILL (0.4 TO 0.7 MPa) BETWEEN SEWER CROSSING
SAFETY PLATFORM REQUIRED PER OPSD 404.20
203mmø - PVC WATERMAIN DR 18 CL150
600mmø STORM SEWER - CONCRETE PIPE CLASS 65-D
1200mmø STORM SEWER - CONCRETE PIPE CLASS 65-D
BEDDING PER OPSD 802.010 CLASS B
250mmø SANITARY SEWER - PVC SDR 35
200mmø SANITARY SEWER - PVC SDR 35
375mmø STORM SEWER - PVC SDR 35
300mmø STORM SEWER - PVC SDR 35
PROPOSED ROAD C ELEVATION
TOP OF WATERMAIN ELEVATION
STORM SEWER INVERT
SANITARY SEWER INVERT
EXISTING C R.O.W ELEVATION
CHAINAGE

NOTES

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8	ISSUED FOR MOE APPROVAL	14/10/11	AHJ	AHJ
7	REVISED AS PER CITY COMMENTS	03/10/11	AHJ	AHJ
6	REVISED AS PER CITY COMMENTS	05/08/11	AHJ	AHJ
5	OGS RESUBMISSION	07/06/11	AHJ	AHJ
4	UPDATED PARK GRADING	21/12/10	AHJ	AHJ
3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
2	REVISED STORM SEWER	10/03/10	AHJ	AHJ
1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE: HORZ 1:500, VERT 1:50

DESIGNED BY: A. H. JONKMAN — LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO, Aug/15/12

REVIEWED BY: A.M. CZAHARYNSKI — LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO, Aug/15/12

CLIENT: D. & H. RIVINGTON ENTERPRISES INC.

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BASEPLAN	EXP
DESIGN	AHJ / BFP
CHECKED	AHJ
CAD	SWB
PROJ. MAN	AHJ
APPROVED	AHJ

PROJECT: GREEN MEADOWS SUBDIVISION, PART OF LOT 17 CONCESSION 2, CITY OF OTTAWA

TITLE: PLAN AND PROFILE, MEADOWRIDGE CIRCLE, STA. 1+325 TO STA.1+675

PROJ. NO.	2681
SURVEY	EXP
DATE	MAY 2012
DRAWING NO.	2681-P2

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Last Plotted: 8/15/2012 9:19:20 AM Plotted by: butlers
Pen Table: ----
References: 2681 SERVICING.dwg; 2681 BASE.dwg; 2681 REVandPEOxref.dwg

NOTES

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8	ISSUED FOR MOE APPROVAL	14/10/11	AHJ	AHJ
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5	UPDATED PARK GRADING	21/12/10	AHJ	AHJ
4	UPDATED PER CITY COMMENTS	17/12/10	AHJ	AHJ
3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
2	REVISED STORM SEWER	10/03/10	AHJ	AHJ
1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE
HORZ 1:500
VERT 1:50

DESIGNED BY: A. H. JONKMAN
REVIEWED BY: M. CZAHARYNSKI

CLIENT: D. & H. RIVINGTON ENTERPRISES INC.

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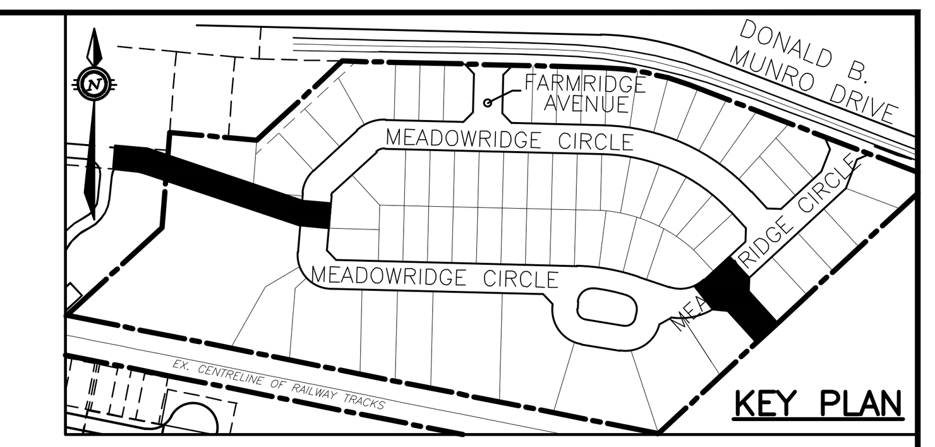
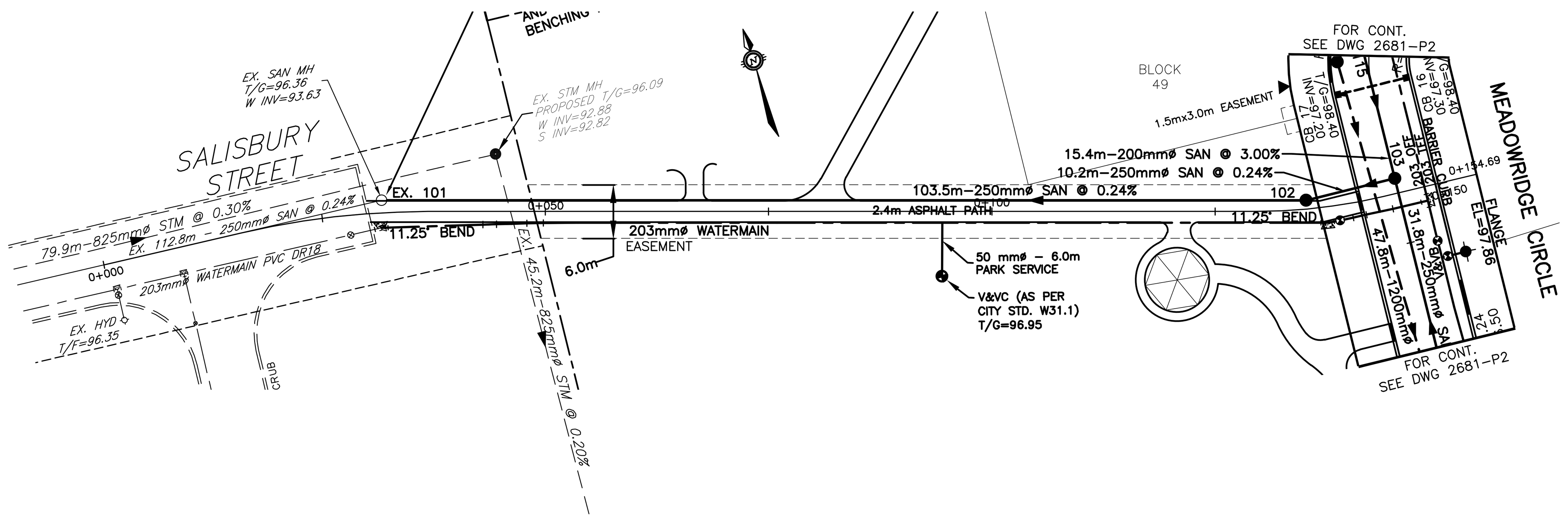
BASEPLAN: EXP
DESIGN: AHJ / BFP
CHECKED: AHJ
CAD: SWB
PROJ. MAN: AHJ
APPROVED: AHJ

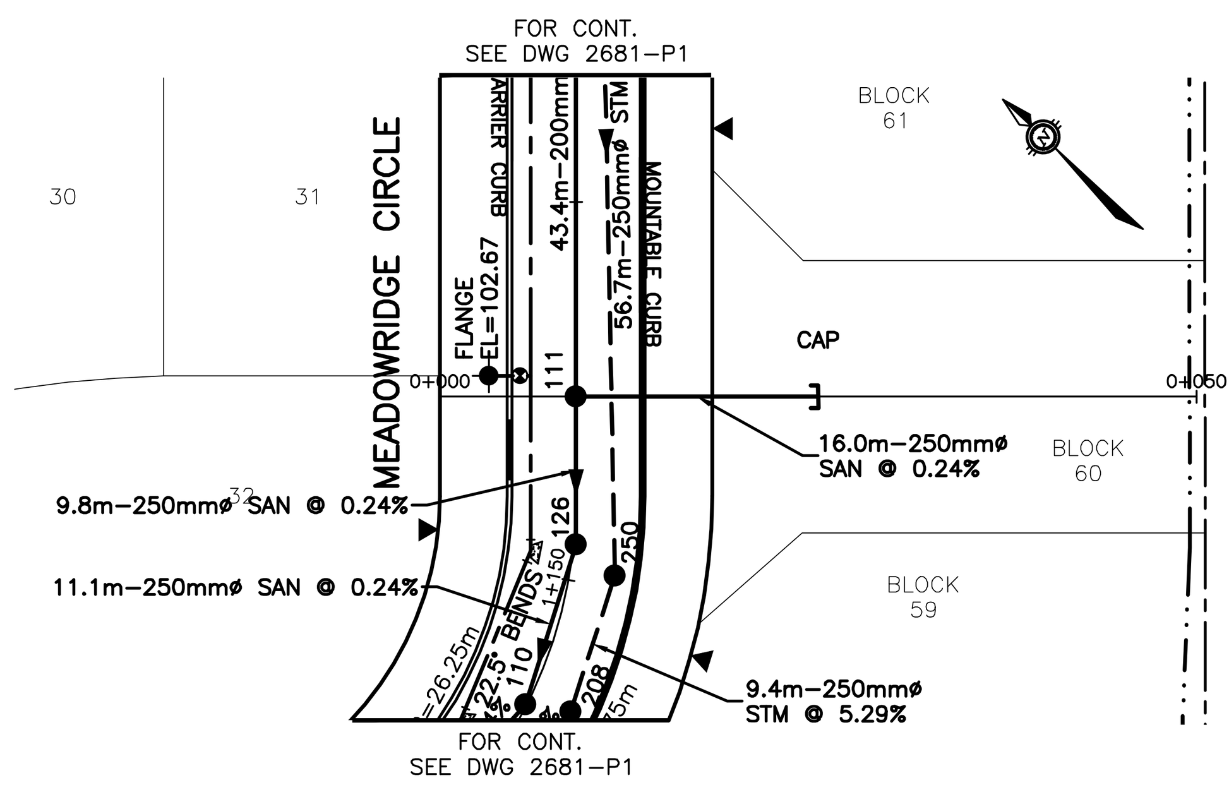
PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

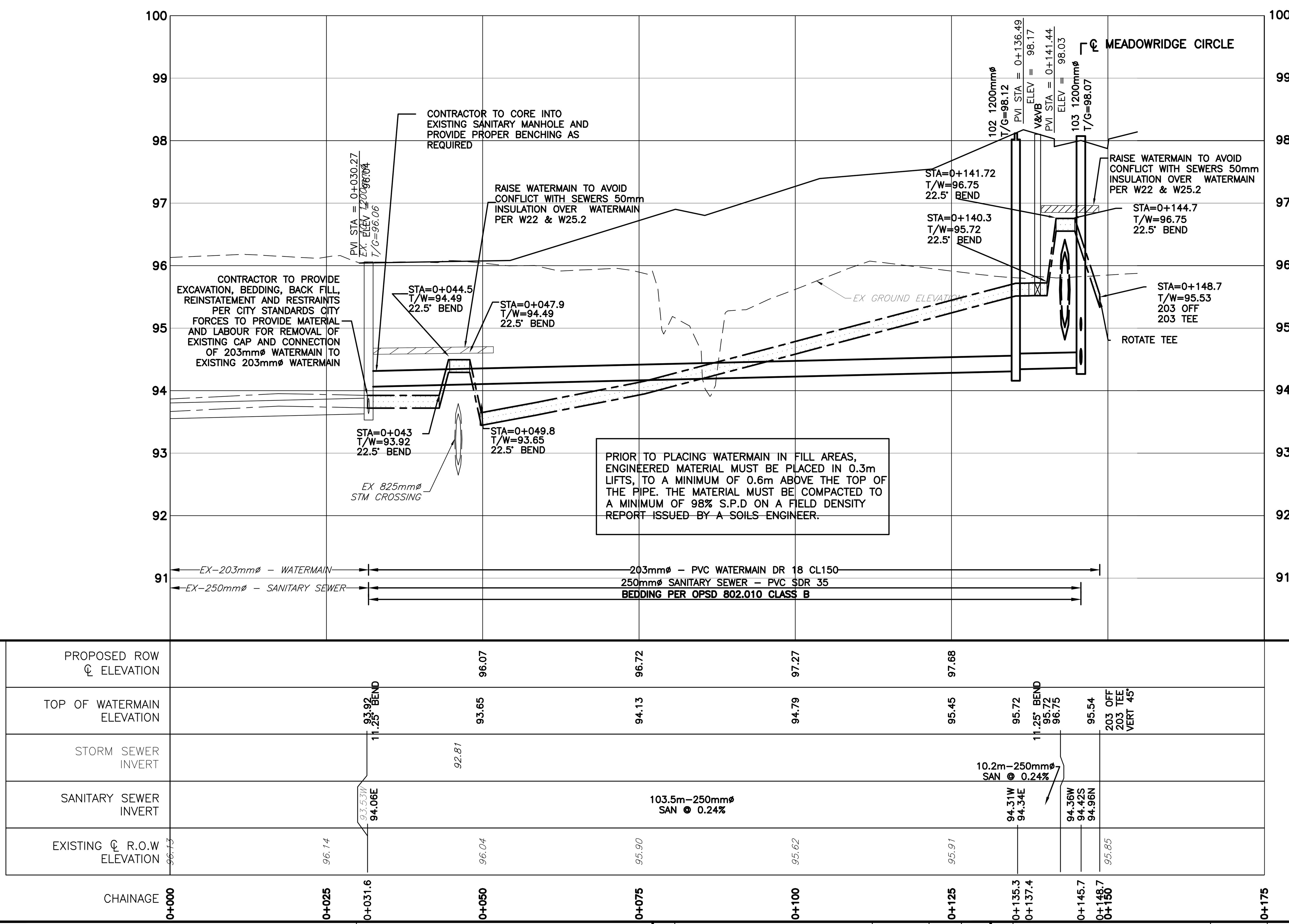
TITLE: PLAN AND PROFILE
MEADOWRIDGE – STA. 0+675 TO STA. 771.88
MEADOWRIDGE – STA. 2+000 TO STA. 109.61
FARMRIDGE – STA. 3+000 TO STA. 074.09

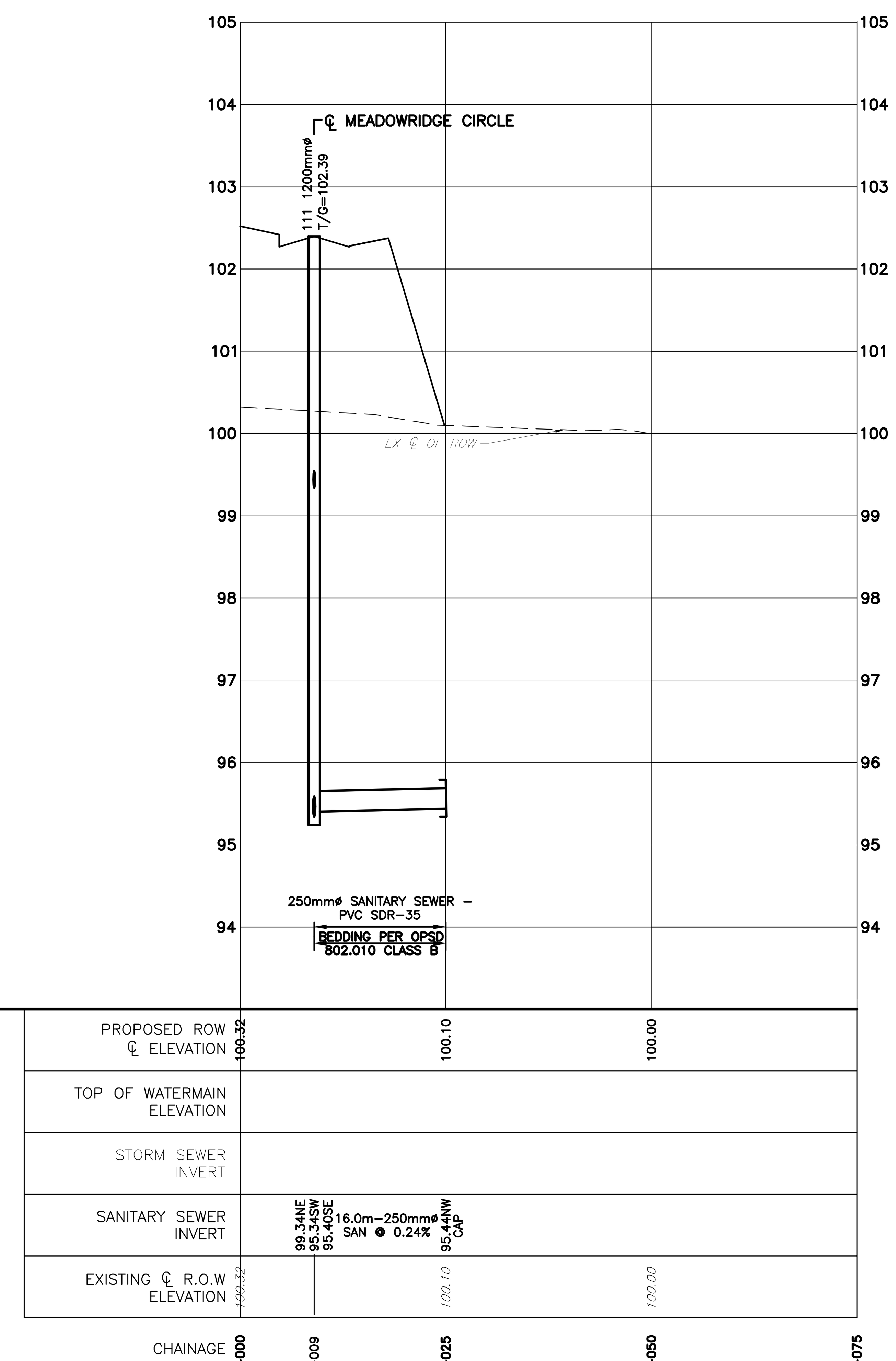
PROJ NO. 2681
SURVEY: EXP
DATE: MAY 2012
DRAWING NO. 2681–P3











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3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
2	REVISED STORM SEWER	10/03/10	AHJ	AHJ
1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE
HORZ 1:500
VERT 1:50

DESIGNED BY: A. H. JONKMAN (LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO) Aug/15/12
REVIEWED BY: A.M. CZAHARYNSKI (LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO) Aug/15/12

CLIENT: D. & H. RIVINGTON ENTERPRISES INC.

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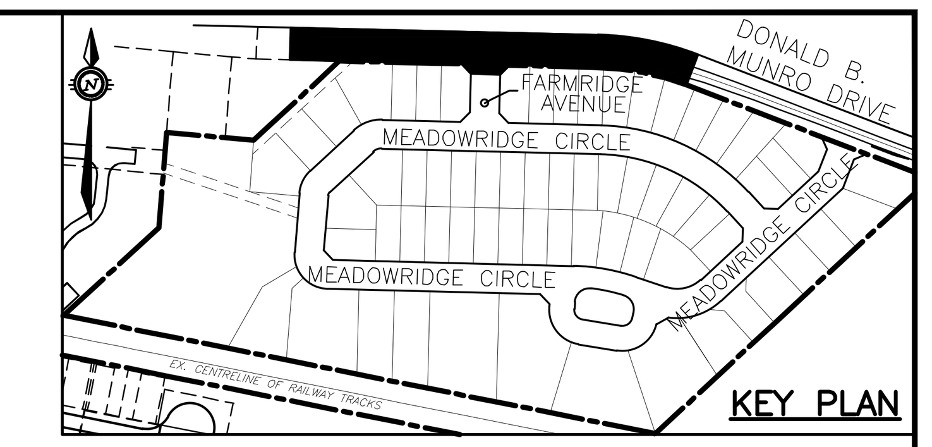
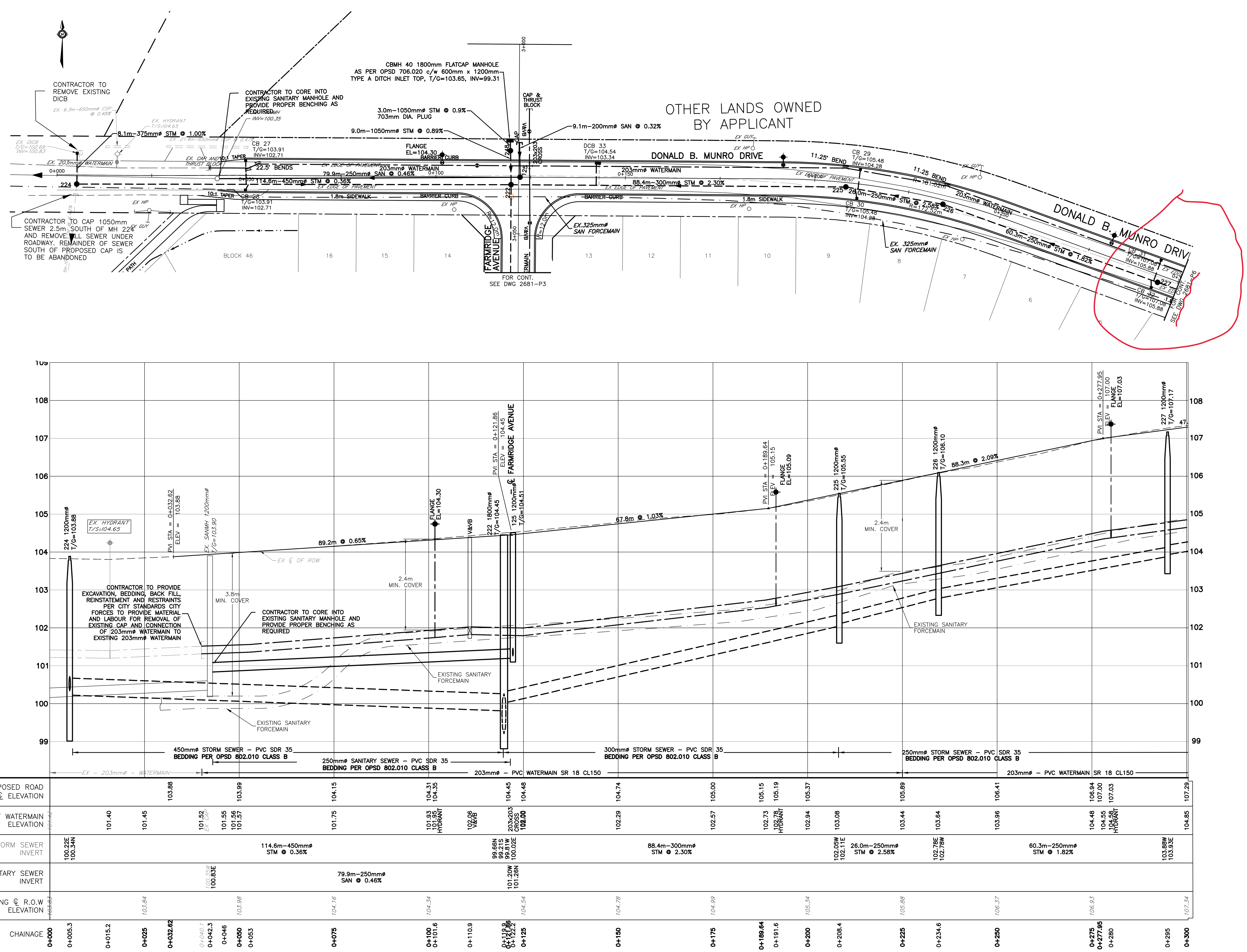
BASEPLAN	EXP
DESIGN	AHJ / BFP
CHECKED	AHJ
CAD	SWB
PROJ. MAN	AHJ
APPROVED	AHJ

PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

TITLE: PLAN AND PROFILE
EASEMENT 1 - STA. 0+000 TO STA. 0+154.69
BLOCK 60 - STA. 0+000 TO STA. 0+075

PROJ. NO.	2681
SURVEY	EXP
DATE	MAY 2012
DRAWING NO.	2681-P4





NOTES

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10	ISSUED TO CITY	23/07/12	SAB	AHJ
9	ISSUED FOR TENDER	18/05/12	AHJ	AHJ
8	ISSUED FOR MOE APPROVAL	14/10/11	AHJ	AHJ
7	REVISED AS PER CITY COMMENTS	03/10/11	AHJ	AHJ
6	REVISED AS PER CITY COMMENTS	05/08/11	AHJ	AHJ
5	OGS RESUBMISSION	07/06/11	AHJ	AHJ
4	UPDATED PARK GRADING	21/12/10	AHJ	AHJ
3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
2	REVISED AS PER CITY COMMENTS (05/02/10)	05/20/10	MGD	AHJ
1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE
HORZ 1:500
VERT 1:50
0 5 10 15 20

DESIGNED BY: LICENSED PROFESSIONAL ENGINEER A. H. JONKMAN Aug/15/12 PROVINCE OF ONTARIO

REVIEWED BY: LICENSED PROFESSIONAL ENGINEER B.M. CZAHARYNSKI Aug/15/12 PROVINCE OF ONTARIO

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BASEPLAN	EXP
DESIGN	AHJ / BFP
CHECKED	AHJ
CAD	SWB
PROJ. MAN	AHJ
APPROVED	AHJ

PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

TITLE: PLAN AND PROFILE
DONALD B. MUNRO DR.
STA. 0+000 TO STA. 0+300

PROJ NO. 2681
SURVEY EXP
DATE MAY 2012
DRAWING NO. 2681–P5

Filename: \\oxana\autocad server\autocad\projects\2600\2681 - donald b munro subdivision\26...
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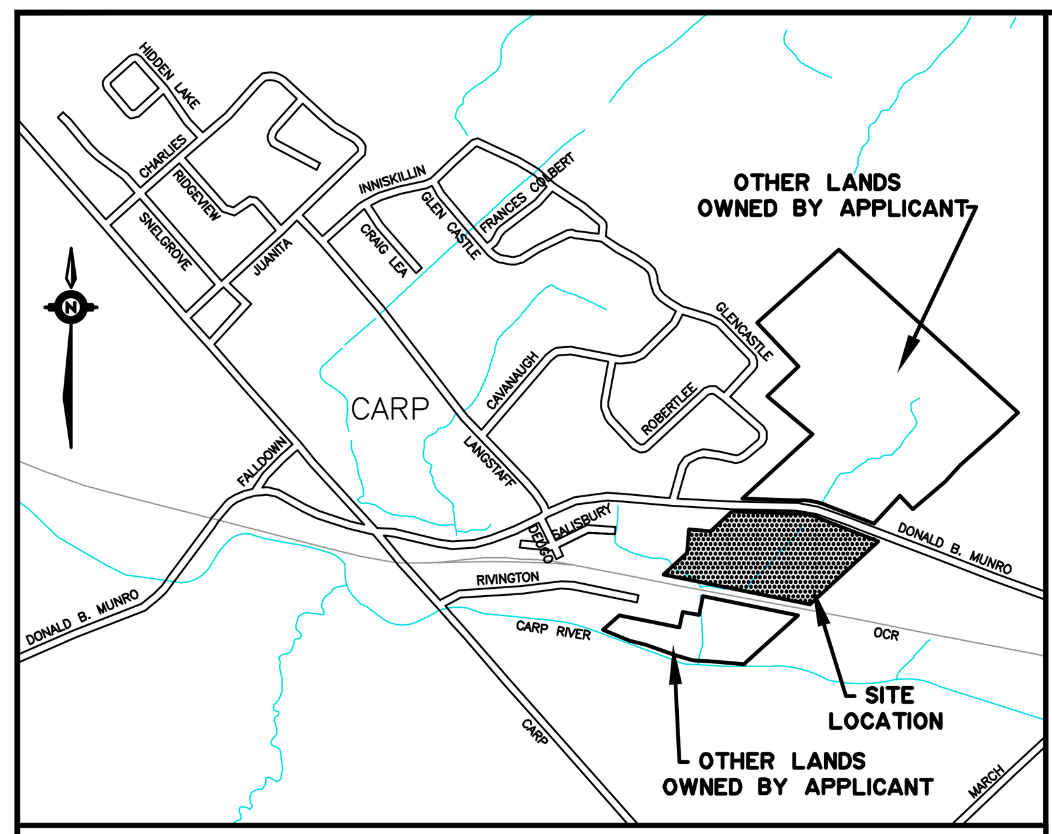
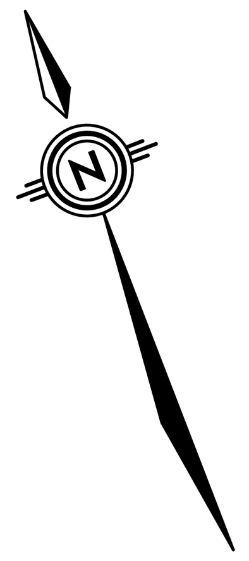
Last Plotted: 8/15/2012 9:23:00 AM Plotted by: butlers
Pen Table: ---
References: 2681 SERVICING.dwg; 2681 BASE.dwg; 2681 REVandPEOxref.dwg



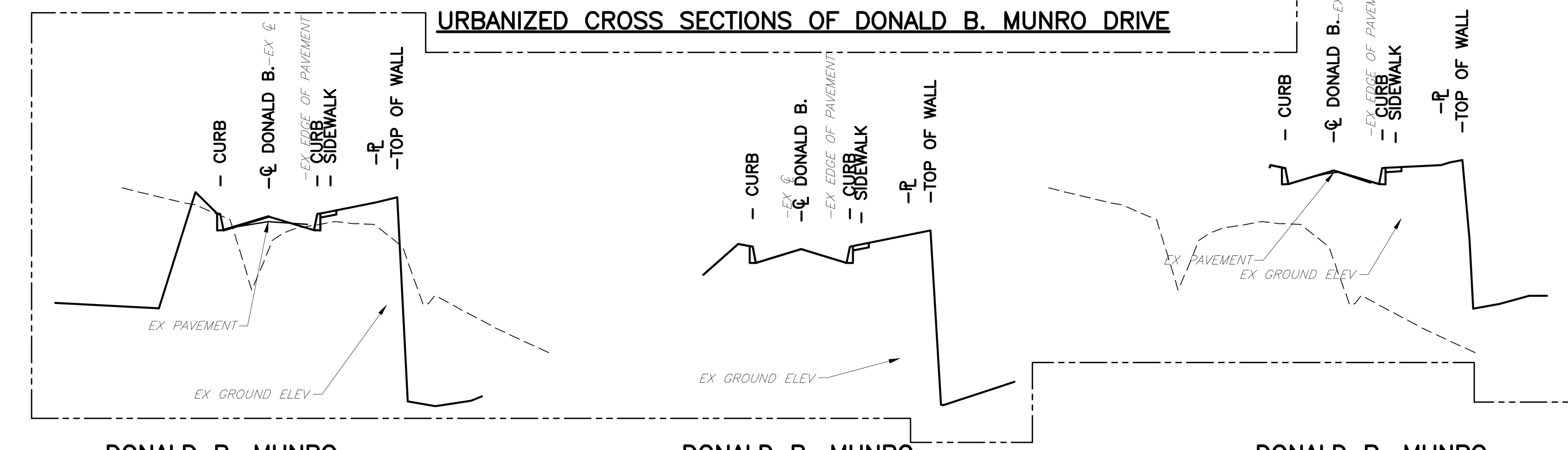
KEY PLAN



LEGEND

- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATERMAIN
- SANITARY SEWER
- STORM SEWER
- WATERMAIN
- PROPERTY LINE
- PROPOSED DITCH
- EXISTING DITCH
- SWALE c/w SUBDRAIN PER CITY OF OTTAWA DETAIL S29
- PROPOSED FENCE
- MH 100 SANITARY MANHOLE
- MH 200 STORM MANHOLE
- STORM CB
- VALVE AND VALVE BOX
- HYDRANT
- WATERMAIN TEE
- LOT SERVICES
- DOUBLE LOT SERVICES
- CSP ELBOW CATCHBASIN
- CSP TEE CATCHBASIN
- PROPOSED GRADE
- EXISTING GRADE
- SLOPE AND DRAINAGE DIRECTION
- TERRACING (SLOPE 3:1 MAX.)
- RETAINING WALL
- MAJOR OVERLAND FLOW

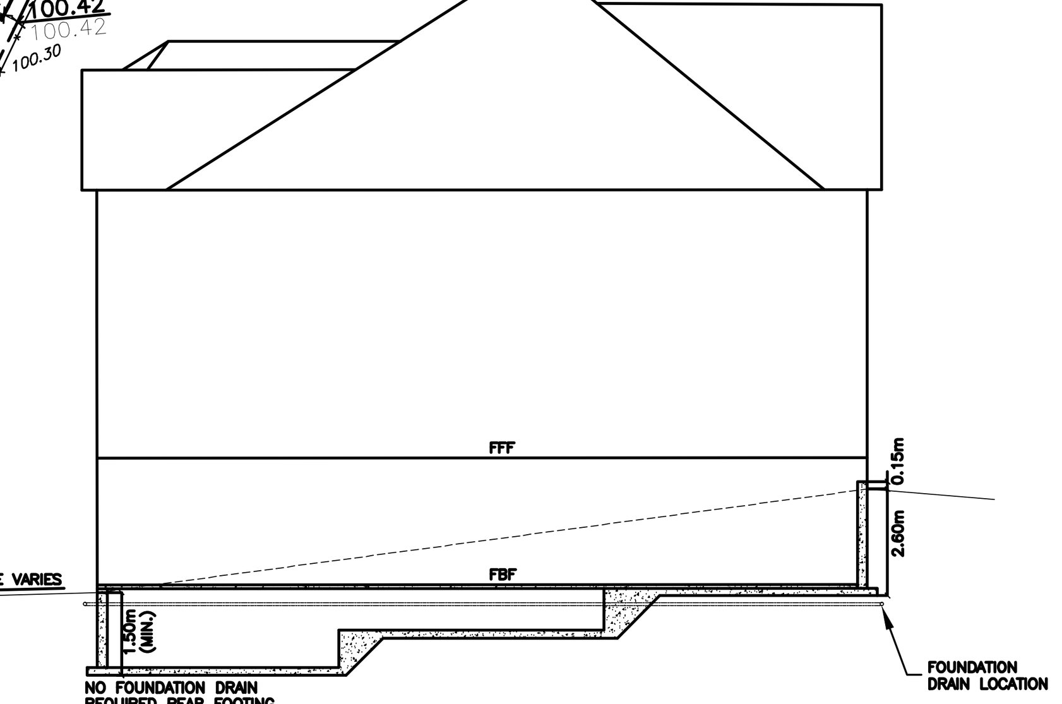
URBANIZED CROSS SECTIONS OF DONALD B. MUNRO DRIVE



DONALD B. MUNRO STATION 0+075
SCALE HORIZ=1:500 VERT=1:50

DONALD B. MUNRO STATION 0+225
SCALE HORIZ=1:500 VERT=1:50

DONALD B. MUNRO STATION 0+325
SCALE HORIZ=1:500 VERT=1:50



TYPICAL CROSS–SECTION FOR WALKOUT LOTS

NOTES

THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

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					7	REVISED AS PER CITY COMMENTS	05/08/11	AHJ	AHJ
13	REVISED AS PER CITY COMMENTS	15/08/12	SAB	AHJ	6	OGS RESUBMISSION	07/06/11	AHJ	AHJ
12	ISSUED FOR CONSTRUCTION	31/07/12	SAB	AHJ	5	UPDATED PARK GRADING	21/12/10	AHJ	AHJ
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SCALE
HORZ 1:500
0 5 10 15 20

DESIGNED BY: A. H. JONKMAN (LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO)
REVIEWED BY: S.M. CZAHARYNSKI (LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO)

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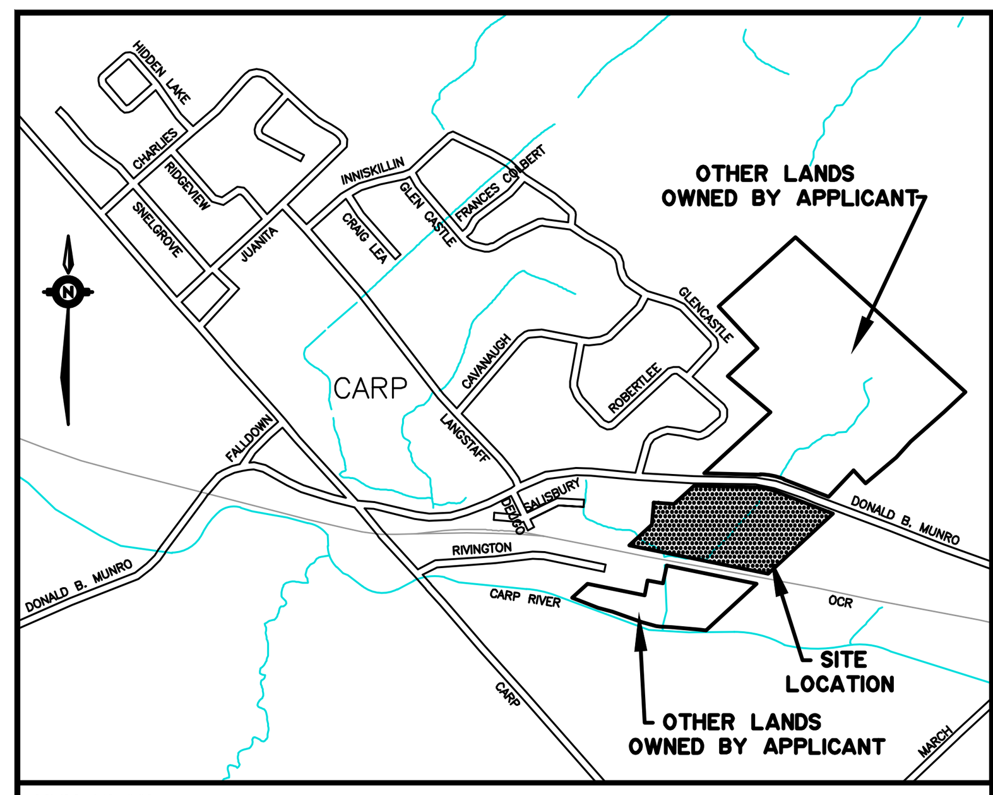
BASEPLAN	EXP
DESIGN	AHJ / BFP
CHECKED	AHJ
CAD	SWB
PROJ. MAN	AHJ
APPROVED	AHJ

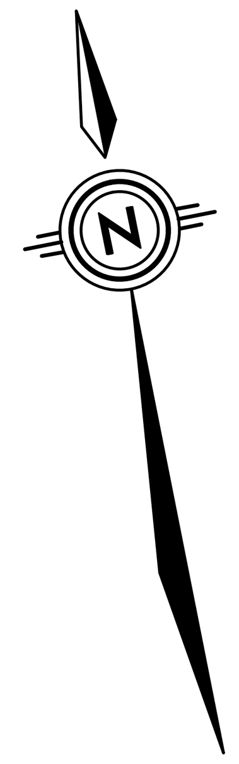
PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

TITLE: GRADING PLAN

PROJ NO.	2681
SURVEY	EXP
DATE	MAY 2012
DRAWING NO.	2681–GR1



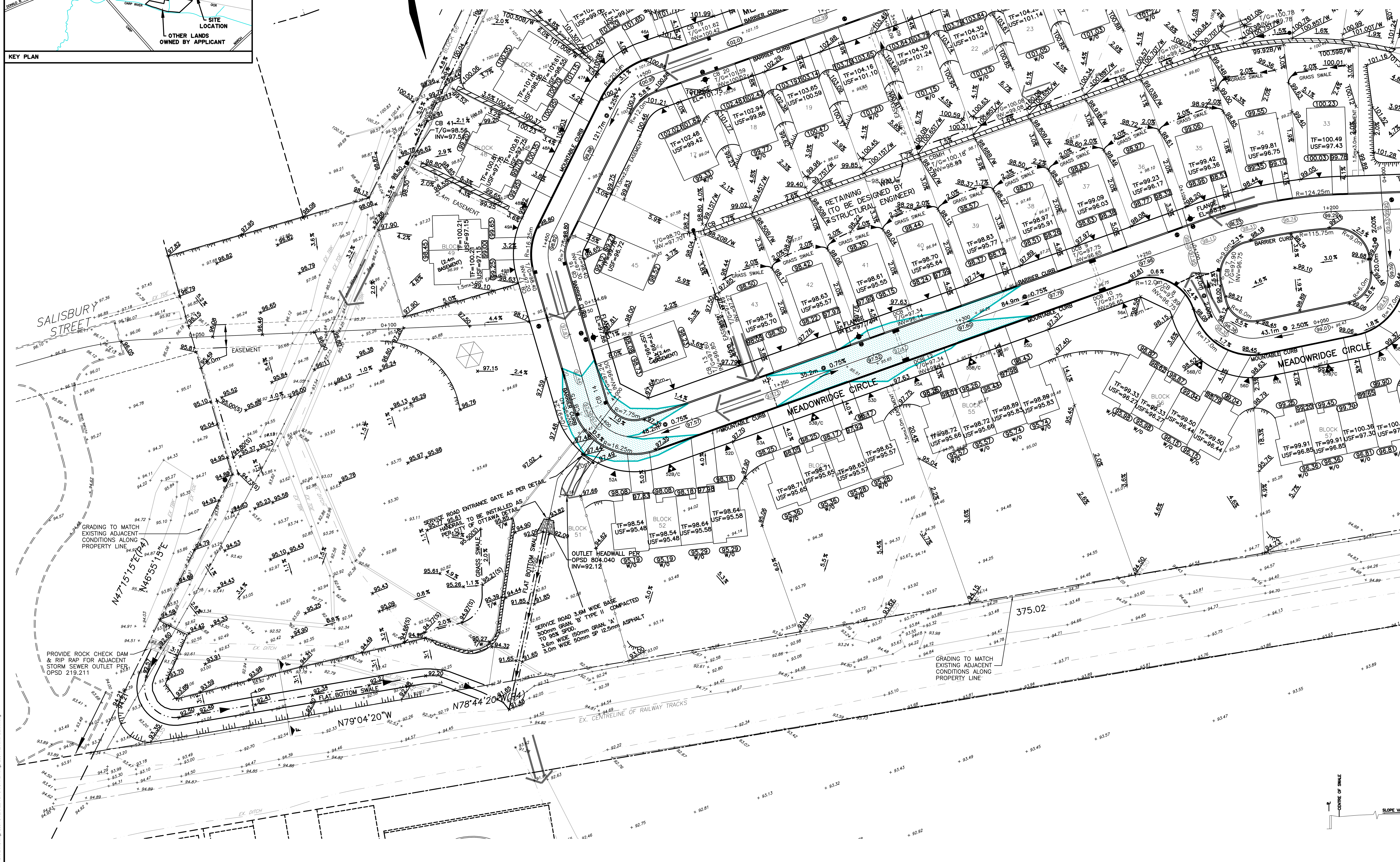
KEY PLAN

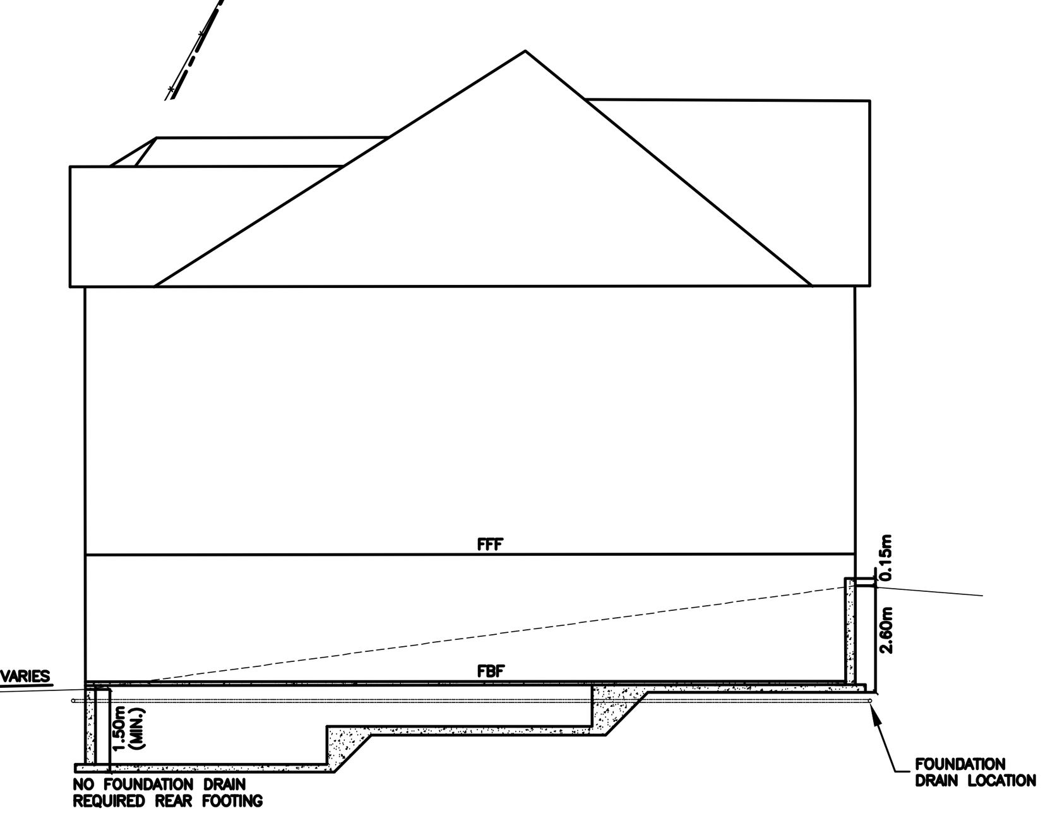


LEGEND

EXISTING SANITARY SEWER	MH 100 SANITARY MANHOLE
EXISTING STORM SEWER	MH 200 STORM MANHOLE
EXISTING WATERMAIN	STORM CB
SANITARY SEWER	VALVE AND VALVE BOX
STORM SEWER	HYDRANT
WATERMAIN	WATERMAIN TEE
PROPERTY LINE	LOT SERVICES
PROPOSED DITCH	DOUBLE LOT SERVICES
EXISTING DITCH	CSP ELBOW CATCHBASIN
SWALE c/w SUBDRAIN PER CITY OF OTTAWA DETAIL S29	CSP TEE CATCHBASIN
PROPOSED FENCE	

97.85	PROPOSED GRADE
92.37	EXISTING GRADE
1.7%	SLOPE AND DRAINAGE DIRECTION
	TERRACING (SLOPE 3:1 MAX.)
	RETAINING WALL
	MAJOR OVERLAND FLOW





TYPICAL CROSS-SECTION FOR WALKOUT LOTS

NOTES

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11	ISSUED TO CITY	23/07/12	SAB	AHJ	5	UPDATED PARK GRADING	21/12/10	AHJ	AHJ
10	ISSUED FOR TENDER	18/05/12	AHJ	AHJ	4	UPDATED PER CITY COMMENTS	17/12/10	AHJ	AHJ
9	ISSUED FOR MOE APPROVAL	14/10/11	AHJ	AHJ	3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
8	REVISED BASED ON HGL ANALYSIS	03/10/11	AHJ	AHJ	2	REVISED STORM SEWER	10/03/10	AHJ	AHJ
					1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE: HORZ 1:500

DESIGNED BY: A. H. JONKMAN, LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO, Aug/15/12

REVIEWED BY: M. CZAHARYNSKI, LICENSED PROFESSIONAL ENGINEER, PROVINCE OF ONTARIO, Aug/15/12

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BASEPLAN	EXP
DESIGN	AHJ / BFP
CHECKED	AHJ
CAD	SWB
PROJ. MAN.	AHJ
APPROVED	AHJ

PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

TITLE: GRADING PLAN

PROJ. NO.	2681
SURVEY	EXP
DATE	MAY 2012
DRAWING NO.	2681-GR2

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY	APPD	NO.	REVISION DESCRIPTION	DATE	BY	APPD
14	REVISED AS PER CITY COMMENTS	15/08/12	SAB	AHJ	7	REVISED AS PER CITY COMMENTS	05/08/11	AHJ	AHJ
13	ISSUED FOR CONSTRUCTION	31/07/12	SAB	AHJ	6	OGS RESUBMISSION	07/06/11	AHJ	AHJ
12	ISSUED TO CITY	23/07/12	SAB	AHJ	5	UPDATED PARK GRADING	21/12/10	AHJ	AHJ
11	ADDITION OF EX. SANITARY FORCEMAIN	12/07/12	SAB	AHJ	4	UPDATED PER CITY COMMENTS	17/12/10	AHJ	AHJ
10	ISSUED FOR TENDER	18/05/12	AHJ	AHJ	3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
9	ISSUED FOR MOE APPROVAL	14/10/11	AHJ	AHJ	2	REVISED STORM SEWER	10/03/10	AHJ	AHJ
8	REVISED AS PER CITY COMMENTS	03/10/11	AHJ	AHJ	1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE: HORZ 1:500 (0 5 10 15 20)

DESIGNED BY: LICENSED PROFESSIONAL ENGINEER A. H. JONKMAN Aug/15/12 PROVINCE OF ONTARIO

REVIEWED BY: LICENSED PROFESSIONAL ENGINEER S.M. CZAHARYNSKI Aug/15/12 PROVINCE OF ONTARIO

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BASEPLAN	EXP
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CHECKED	AHJ
CAD	SWB
PROJ. MAN	AHJ
APPROVED	AHJ

PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

TITLE: SERVICING PLAN

PROJ. NO. 2681
SURVEY: EXP
DATE: MAY 2012
DRAWING NO. 2681-S1

Filename: \\oxana\autocad server\autocad\projects\2600\2681 - donald b munro subdivision\2681-s1.dwg
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Last Plotted: 8/15/2012 9:15:51 AM Plotted by: butlers
Pen Table: c:\program files\acad2000\plot styles\cme_001.ctb
References: 2681 SERVICING.dwg; 2681 BASE.dwg; 2681 GRADING.dwg; 2681 OVERALL TOPO SURVEY.dwg; 2681 REVpmPEOwnrl.dwg

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY	APPD
13	REVISED AS PER CITY COMMENTS	15/08/12	SAB	AHJ
12	ISSUED FOR CONSTRUCTION	31/07/12	SAB	AHJ
11	ISSUED TO CITY	23/07/12	SAB	AHJ
10	ISSUED FOR TENDER	18/05/12	AHJ	AHJ
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8	REVISED AS PER CITY COMMENTS	03/10/11	AHJ	AHJ
7	REVISED AS PER CITY COMMENTS	05/08/11	AHJ	AHJ
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4	UPDATED PER CITY COMMENTS	17/12/10	AHJ	AHJ
3	REVISED PER CITY COMMENTS	08/10/10	AHJ	AHJ
2	REVISED STORM SEWER	10/03/10	AHJ	AHJ
1	ISSUED FOR REVIEW	01/02/10	AHJ	AHJ

SCALE: HORZ 1:500 (0 5 10 15 20)

DESIGNED BY: A. H. JONKMAN — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — Aug/15/12

REVIEWED BY: M. CZAHARYNSKI — LICENSED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — Aug/15/12

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BASEPLAN	EXP
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CHECKED	AHJ
CAD	SWB
PROJ. MAN	AHJ
APPROVED	AHJ

PROJECT: GREEN MEADOWS SUBDIVISION
PART OF LOT 17 CONCESSION 2
CITY OF OTTAWA

TITLE: SERVICING PLAN

PROJ. NO.	2681
SURVEY	EXP
DATE	MAY 2012
DRAWING NO.	2681–S2

SOILS OF THE REGIONAL MUNICIPALITY OF OTTAWA-CARLETON

(EXCLUDING THE OTTAWA URBAN FRINGE)

SHEET 3

ONTARIO

SOIL SURVEY REPORT No 58

1:50,000

Kilometres 1 0 1 2 3 4 Kilometres

Miles 1 ½ 0 1 2 3 Miles

Main highway
Secondary road
Other roads
Cart track
Trail
Railway
Horizontal control point
Bench mark (feet)
Spot elevation (feet)
Cemetery
Gravel, sand pit

International boundary
Provincial boundary
County boundary
Township boundary
Indian reserve, park boundary, etc.
Power transmission line
Stream
Contour interval 25 feet
Contours
Depression contours
Cliff

KEY MAP OF SOUTHERN ONTARIO

1 ALGOMA
2 SUDBURY (SUDBURY RM)
3 MANITOULIN
4 PARRY SOUND
5 NIPISSING
6 RENFREW
7 LANARK
8 OTTAWA-CARLETON (RM)
9 RUSSELL
10 PRESCOTT
11 GLENGARRY
12 STORMONT
13 DUNDAS
14 GRENVILLE
15 LEEDS
16 FRONTENAC
17 LENNOX AND ADDINGTON
18 HASTINGS
19 HALIBURTON
20 PETERBOROUGH
21 NORTHUMBERLAND
22 MUSKOKA RM
23 VICTORIA
24 DURHAM RM
25 SIMCOE
26 YORK RM
27 DUFFERIN
28 PEEL RM
29 HALTON RM
30 WELLINGTON
31 GREY
32 BRUCE
33 HURON
34 PERTH
35 WATERLOO
36 HALDIMAND-NORFOLK RM
37 PRINCE EDWARD
38 NIAGARA RM
39 HALDIMAND-NORFOLK RM
40 BRANT
41 OXFORD
42 MIDDLESEX
43 ELGIN
44 LAMBTON
45 KENT
46 ESSEX

EXPLANATION OF MAP UNIT SYMBOLS

A. SIMPLE MAP UNITS

Soil landscape or land type unit — Soil phase (when applicable)
Stoniness or rockiness class (when applicable) — Slope class

Example: G1-S 2 / R2.2

B. COMPOUND MAP UNITS

Dominant soil phase (when applicable) — Significant soil landscape or land type unit
Dominant soil landscape or land type unit — Significant soil phase (when applicable)
Dominant stoniness or rockiness class (when applicable) — Significant slope class
Dominant slope class — Significant stoniness or rockiness class

Example: G4-S 2 F2 / S3.3*-R1.2

MAP UNIT COMPONENTS — Descriptions of soil landscape or land type units are outlined in the map legend printed on this map sheet. Soil phase descriptions and stoniness, rockiness, and slope class values are outlined in the appropriate tables shown separately from the legend on this map sheet.

DOMINANT AND SIGNIFICANT — These terms refer to the relative proportions of components which constitute either compound map units (as above) or soil landscape units (drainage components in map legend). **Dominant** means that more than 40% of the unit is composed of that component. **Significant** means that more than 20% but less than 40% of the unit is composed of that component. When only a dominant drainage component is given for a soil landscape unit, 80% or more of the unit is composed of that drainage component.

CONSTRAINTS — The user should understand that many soil boundaries are only approximately located because of the map scale and nature of the soil mapping. Furthermore, there may be inclusions of unidentified soil or nonsoil components within any map unit which could occupy up to 20% of the area represented by the map unit. Most soil information is based on the examination of soil characteristics to a depth of about 100 cm below the surface.

SOIL ASSOCIATION OR LAND TYPE	SOIL MATERIAL OR LAND TYPE DESCRIPTION	MAIN SURFACE TEXTURE(S)	SOIL LANDSCAPE OR LAND TYPE UNIT	SOIL LANDSCAPE UNIT DESCRIPTION: DRAINAGE DOMINANT (>40%)	SIGNIFICANT (20-40%)	ADDITIONAL INFORMATION
ANSTRUTHER	10-50 cm of acidic stony sandy loam, loamy sand, or sand undifferentiated drift material over igneous and metamorphic Precambrian bedrock	Loamy sand or sandy loam	A1	Excessive to good		
Recent Alluvium	Recently deposited flood plain material variable in texture	Variable	AR1 AR2	Poor to very poor Poor to very poor		Silty clay loam, clay loam, silty clay, or clay Very fine sandy loam, loam, silt loam, sandy loam, fine sandy loam
BEARBROOK	Reddish brown neutral heavy clay marine material, often containing bands of gray heavy clay	Silty clay or clay	B1 B2 B3 B4	Imperfect Poor Very poor Poor		Contains layers of sand
BORROMEE	40-160 cm of undecomposed feather moss and fen peat, over well decomposed fen peat, over clayey material	Organic	BR1	Poor to very poor		
CASTOR	40-100 cm of neutral to acidic very fine sandy loam, silt loam, or loam marine or fluvial material, over neutral to alkaline clay loam, silty clay loam, silty clay, or clay marine material	Very fine sandy loam, silt loam, or loam	C2 C3 C4 C5	Imperfect Imperfect Poor Poor	Poor Imperfect	
CHATEAUGUAY	40-100 cm of neutral silt loam, clay loam, silty clay loam, or silty clay marine material, over glacial till material	Silt loam, loam, or clay loam	CH3 CH4 CH5 CH6 CH7	Poor Imperfect Imperfect Poor Poor		Underlain by Granville material Underlain by Grenville material Underlain by Leitrim material Underlain by Leitrim material Underlain by Queensway material
DALHOUSIE	Gray neutral silty clay or clay marine material	Silty clay loam, silty clay, or clay	D1 D2 D3 D4 D5	Imperfect Imperfect Poor Very poor Poor	Poor Imperfect	
Eroded Channels	Eroded gullies, steep valley walls, and narrow creekbeds with slopes greater than 15%		ER			
FARMINGTON	10-50 cm of neutral to alkaline flaggy sandy loam, fine sandy loam, loamy fine sand, or loamy sand undifferentiated drift material, over Paleozoic limestone or dolomite bedrock	Fine sandy loam, sandy loam, or loam	F1 F2 F3 F4 F5 F6	Good Imperfect Poor Good Imperfect Good	 Imperfect Poor	
GRENVILLE	Alkaline stony sandy loam, fine sandy loam, loam, or silt loam glacial till material	Sandy loam, loam, or silt loam	G1 G2 G3 G4 G5 G6	Good Imperfect Poor Good Imperfect Very poor	 Imperfect Poor	
GOULBOURN	40-160 cm of moderately to well decomposed forest peat, over loamy or sandy material	Organic	GB1	Poor to very poor		Forest peat is woody
GREELY	40-160 cm of moderately to well decomposed forest peat, over loamy or sandy material and Paleozoic bedrock	Organic	GY1	Poor to very poor		Forest peat is woody
HUNTLEY	160 cm or more of moderately to well decomposed forest peat, over loamy or sandy material	Organic	H1	Poor to very poor		Forest peat is woody
IRONSIDE	40-100 cm of neutral to acid fine sand or loamy fine sand marine material, over glacial till material	Fine sandy loam, loamy fine sand, or fine sand	I1 I2 I3 I4 I5 I6	Good Imperfect Poor Good Poor Imperfect		Underlain by Grenville material Underlain by Grenville material Underlain by Grenville material Underlain by Leitrim material Underlain by Leitrim material Underlain by Queensway material
JOCKVALE	Neutral to medium acid fine sand or loamy fine sand marine or fluvial material	Fine sandy loam, loamy fine sand, or fine sand	J1 J2 J3 J4 J5 J7 J8	Good Imperfect Imperfect Poor Poor Very poor Good	Imperfect Poor Imperfect Poor	
KARS	Neutral to alkaline gravelly to very gravelly coarse sand or loamy coarse sand glaciofluvial material containing cobbles	Gravelly sandy loam or coarse sandy loam, sandy loam, or coarse sandy loam	K1 K2 K3 K4 K5	Excessive to good Imperfect to poor Excessive to good Imperfect to poor Excessive to good		Less gravelly, mainly coarse sand Less gravelly, mainly coarse sand Mainly coarse sand with gravel layers
LEITRIM	Acidic shaly gravelly to very gravelly loam, sandy loam, or coarse sandy loam glacial till material; shale bedrock at a depth greater than 1 m	Loam, sandy loam, or coarse sandy loam	L1 L2 L3 L4 L5 L7 L8 L9	Good Imperfect Good Imperfect Good Imperfect Good Good	 Imperfect Poor Imperfect Poor Imperfect	Comprised of black shale Comprised of black shale Comprised of black shale Comprised of black shale Comprised of red shale Comprised of gray shale Comprised of gray shale Comprised of gray-green shale
LEMIEUX*	160 cm or more of moderately to well decomposed fen peat, over clayey material	Organic	LE1	Poor to very poor		Upper peat layer is woody
MANOTICK	40-100 cm of acidic loamy fine sand, fine sand, or sand marine or fluvial material, over neutral to alkaline clay loam, silty clay loam, silty clay, or clay marine material	Fine sandy loam or loamy fine sand	M1 M3 M4 M5 M6 M7	Good Imperfect Imperfect Poor Poor Very poor	Imperfect Poor Imperfect 	
MER BLEUE	Undecomposed sphagnum peat, over moderately decomposed fen peat, over clay material at a depth greater than 160 cm	Organic	MB1	Poor		30-100 cm of sphagnum peat over woody fen peat
MILLE ISLE	Acidic coarse sand marine or fluvial material	Loamy coarse sand or coarse sand	MI1 MI2 MI3 MI4 MI5 MI6	Excessive to good Good Poor Imperfect Good Poor	 Imperfect Poor Good	
MALAKOFF	100-160 cm of moderately to well decomposed fen peat, over clayey material	Organic	MK1	Poor to very poor		Upper peat layer is woody
NEPEAN	10-50 cm of acidic stony or flaggy fine sandy loam, sandy loam, or loamy sand undifferentiated drift material, over Paleozoic sandstone bedrock	Sandy loam or loam	N1 N3 N4 N5	Good Poor Good Imperfect	 Imperfect Poor	
NORTH GOWER	Neutral to alkaline silty clay loam or clay loam marine material, over silty clay or clay marine material at a depth greater than 1m	Silt loam, loam, silty clay loam or clay loam	NG1 NG2 NG3 NG4 NG5	Imperfect Poor Imperfect Very poor Poor	 Poor 	 Contains layers of silt, silt loam or fine sandy loam
OKA	Neutral to alkaline gravelly to very gravelly coarse sandy loam, loamy coarse sand, or coarse sand marine material	Gravelly to very gravelly loamy sand, sandy loam or loam	O1 O3 O5 O6	Excessive to good Imperfect Good Good	 	Flaggy or stony Flaggy or stony Shaly (grey-green shale) Shaly (red shale)
OSGOODE	Slightly acidic to alkaline very fine sandy loam, loam, or silt loam marine or fluvial material, over neutral to alkaline clay loam, silty clay loam, silty clay, or clay marine material at a depth greater than 1m	Very fine sandy loam, loam, or silt loam	OS1 OS2 OS3 OS4	Imperfect Poor Poor Imperfect	 Imperfect	 Poor
OTTAWA	Strongly acidic medium sand fluvial or eolian material	Sand or loamy sand	OT1 OT2	Excessive to good Excessive to good	 	 Imperfect
QUEENSWAY	Acidic stony sandy loam or loamy sand glacial till material	Sandy loam or loamy sand	Q1 Q3 Q4	Good Poor Good	 	 Imperfect
RIDEAU	Gray neutral heavy clay marine material	Silty clay or clay	R1 R2 R3 R4 R5 R6	Imperfect Imperfect Poor Very poor Poor Poor	 	 Poor Imperfect

SOIL PHASES

S ..... Shallow Phase ..... 50-100 cm of mineral soil over bedrock
0 ..... Peaty Phase ..... 15-40 cm of organic material over mineral material
C ..... Coarse Phase ..... 15-40 cm of surface mineral material significantly coarser textured than the underlying mineral material
f ..... Fine Phase ..... 15-40 cm of surface mineral material significantly finer textured than the underlying mineral material

STONINESS CLASSES

Class	Description	% Stones on Surface
S1	Slightly stony	0.01 - 0.1
S2	Moderately stony	0.1 - 3.0
S3	Very stony	3.0 - 15.0
S4	Exceedingly stony	15.0 - 50.0
S5	Excessively stony	>50.0

Stones have a diameter greater than 15 cm.

ROCKINESS CLASSES

Class	Description	% Bedrock Exposed
R1	Slightly rocky	2.0 - 10.0
R2	Moderately rocky	10.0 - 25.0

Rockiness refers to the amount of surface which is either exposed bedrock or has bedrock within 10 cm. Lands which have rocky conditions occurring over 25% or more of the surface have been designated as Rockland.

SLOPE CLASSES

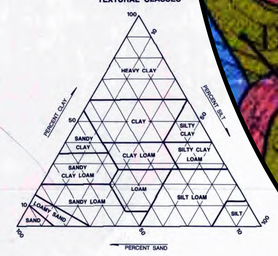
Class	Slope %
1 ..... Level	0.0 - 0.5
2 ..... Nearly level	0.5 - 2
3 ..... Very gently sloping	2.0 - 5
4 ..... Gently sloping	6.0 - 9
5 ..... Moderately sloping	10.0 - 15
6 ..... Steeply sloping	16.0 - 36

Multiple (irregular) slopes will have an asterisk (*) following the class number, whereas a simple (regular) slope will have a class number only.

MISCELLANEOUS LAND UNITS AND SYMBOLS

DL ..... Disturbed land; disrupted surface
LD ..... Landslide; undifferentiated landslide (colluvial) material consisting of clay or heavy clay material with interbedded vertical and horizontal layers of sand
LF ..... Landfill site; garbage dump or reclamation site
ML ..... Marshland; vegetated wetlands that remain inundated year round
SL ..... Sewage lagoon; retention reservoir
TR ..... Topsoil removed
U ..... Urban land; undifferentiated residential, industrial, or institutional land
W ..... Poorly to very poorly drained wet spot

TEXTURAL CLASSES



SOIL ASSOCIATION OR LAND TYPE	SOIL MATERIAL OR LAND TYPE DESCRIPTION	MAIN SURFACE TEXTURE(S)	SOIL LANDSCAPE OR LAND TYPE UNIT	SOIL LANDSCAPE UNIT DESCRIPTION: DRAINAGE DOMINANT (>40%)	SIGNIFICANT (20-40%)	ADDITIONAL INFORMATION
REEVECRAIG	Alkaline very fine sand, loamy very fine sand, fine sand, or loamy fine sand marine or fluvial material	Very fine sandy loam or fine sandy loam	RE1 RE2 RE3	Imperfect Poor Poor	Poor Imperfect	
Rockland	Exposures of Paleozoic or Precambrian bedrock comprising 25% or more of the area		RK1 RK2 RK3 RK4			Limestone or dolomite Paleozoic bedrock Igneous or metamorphic Precambrian bedrock Igneous or metamorphic Precambrian bedrock with marshland areas Sandstone Paleozoic bedrock
ST. THOMAS	Medium to strongly acid fine sand fluvial or eolian material	Fine sand, loamy fine sand, or fine sandy loam	ST1 ST2 ST3 ST4 ST5 ST6 ST7 ST8	Excessive to good Good Good Imperfect Poor Poor Poor Good	 Imperfect Poor Poor Good Imperfect Imperfect	 Contains layers of clay or heavy clay
UPLANDS	Medium to strongly acid sand marine, fluvial, or eolian materials	Sand or loamy sand	U1 U3 U5 U8 U11 U13 U15	Excessive to good Good Good Imperfect Poor Poor Excessive to good	 Imperfect Poor Poor Imperfect 	 Coarse sand and gravel over sand
Escarpment	Steeply to very steeply inclined clay, sand over clay, or bedrock material with slopes greater than 15%	Coarse sand	X1 X3			Marine clay or heavy clay Fluvial sand less than 2 m thick over clay or heavy clay marine material Limestone, dolomite or sandstone scarps

* This association appears as a secondary soil landscape unit in a compound map unit only.

Soil information by the Ontario Institute of Pedology (Cartographic data collected on site between 1976-1981)

Cartography by Land Resource Research Centre, Research Branch, Agriculture Canada, Ottawa, 1987.
Production: B. Edwards (Chief).
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GOULBOURN TOWNSHIP, WEST CARLETON TOWNSHIP AND CITY OF KANATA SHEET 3

Chapter 9 Hydrologic Soil-Cover Complexes

630.0900 General

A combination of a hydrologic soil group (soil) and a land use and treatment class (cover) is a hydrologic soil-cover complex. This chapter gives tables and graphs of runoff curve numbers (CNs) assigned to such complexes. This CN indicates the runoff potential of a complex during periods when the soil is not frozen. A higher CN indicates a higher runoff potential and specifies which runoff curve of appendix A or figure 10–2 in National Engineering Handbook, part 630 (NEH 630), chapter 10, is to be used in estimating runoff for the complex. Applications and further description of CNs are given in NEH 630, chapters 10 and 12.

630.0901 Determinations of complexes and curve numbers

(a) Agricultural land

Complexes and assigned CNs for combinations of soil groups of NEH 630, chapter 7 and land use and treatment classes of NEH 630, chapter 8 are given in table 9–1. Also given are some complexes that make applications of the table more direct. Impervious and water surfaces, which are not listed, are always assigned a CN of 98.

(1) Assignment of CNs to complexes

Table 9–1 was developed as follows:

- The data literature was searched for watersheds in single complexes (one soil group and one cover); watersheds were found for most of the listed complexes.
- An average CN for each watershed was obtained using rainfall-runoff data for storms producing the annual floods. The watersheds were generally less than 1 square mile in size, the number of watersheds for a complex varied, and the storms were of 1 day or less duration.
- The CNs of watersheds in the same complex were averaged and all CNs for a cover were plotted. A curve for each cover was drawn with greater weight given to CNs based on data from more than one watershed, and each curve was extended as far as necessary to provide CNs for ungaged complexes. All but the last three lines of CN entries in table 9–1 are taken from these curves.
- For the complexes in the last three lines of table 9–1, the proportions of different covers were estimated and the weighted CNs computed from previously derived CNs.

Table 9–1 has not been significantly changed since its construction in 1954 although CNs for crop residue cover treatment has been added. Supplementary tables for special regions have been developed and are shown later in this chapter.

(2) Use of table 9–1

Chapters 7 and 8 of NEH 630 describe how soils and covers of watersheds or other land areas are classified in the field. After the classification is completed, CNs are read from table 9–1 and applied as described in chapter 10. Because the principal use of CNs is for estimating runoff from rainfall, the examples of applications are given in chapter 10.

Table 9–1 Runoff curve numbers for agricultural lands [1/]

Cover description			CN for hydrologic soil group			
cover type	treatment [2/]	hydrologic condition [3/]	A	B	C	D
Fallow	Bare Soil	---	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C & T)	Poor	66	74	80	82
		Good	62	71	78	81
	C & T + CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C & T	Poor	61	72	79	82
		Good	59	70	78	81
	C & T + CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C & T	Poor	63	73	80	83
		Good	51	67	76	80

See footnotes at end of table.

Table 9–1 Runoff curve numbers for agricultural lands [1/] — Continued

Cover description			CN for hydrologic soil group			
cover type	treatment [2/]	hydrologic condition [3/]	A	B	C	D
Pasture, grassland, or range-continuous forage for grazing [4/]		Poor	68	79	86	89
		Fair	49	69	79	84
		Good	39	61	74	80
Meadow-continuous grass, protected from grazing and generally mowed for hay		Good	30	58	71	78
Brush-brush-forbs-grass mixture with brush the major element [5/]		Poor	48	67	77	83
		Fair	35	56	70	77
		Good	30 [6/]	48	65	73
Woods-grass combination (orchard or tree farm) [7/]		Poor	57	73	82	86
		Fair	43	65	76	82
		Good	32	58	72	79
Woods [8/]		Poor	45	66	77	83
		Fair	36	60	73	79
		Good	30	55	70	77
Farmstead–buildings, lanes, driveways, and surrounding lots		---	59	74	82	86
Roads (including right-of-way):						
Dirt		---	72	82	87	89
Gravel		---	76	85	89	91

1/ Average runoff condition, and I_a=0.2s.

2/ Crop residue cover applies only if residue is on at least 5 percent of the surface throughout the year.

3/ Hydrologic condition is based on combinations of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥20%), and (e) degree of surface toughness.
Poor: Factors impair infiltration and tend to increase runoff.
Good: Factors encourage average and better then average infiltration and tend to decrease runoff.
For conservation tillage poor hydrologic condition, 5 to 20 percent of the surface is covered with residue (less than 750 pounds per acre for row crops or 300 pounds per acre for small grain).
For conservation tillage good hydrologic condition, more than 20 percent of the surface is covered with residue (greater than 750 pounds per acre for row crops or 300 pounds per acre for small grain).

4/ Poor: < 50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.

5/ Poor: < 50% ground cover.
Fair: 50 to 75% ground cover.
Good: > 75% ground cover.

6/ If actual curve number is less than 30, use CN = 30 for runoff computation.

7/ CNs shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the CNs for woods and pasture.

8/ Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed, but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

630.1502 Methods for estimating time of concentration

Two primary methods of computing time of concentration were developed by the Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service (SCS)).

(a) Watershed lag method

The SCS method for watershed lag was developed by Mockus in 1961. It spans a broad set of conditions ranging from heavily forested watersheds with steep channels and a high percent of runoff resulting from subsurface flow, to meadows providing a high retardance to surface runoff, to smooth land surfaces and large paved areas.

$$L = \frac{\ell^{0.8}(S+1)^{0.7}}{1{,}900Y^{0.5}} \qquad \text{(eq. 15–4a)}$$

Applying equation 15–3, $L=0.6T_c$, yields:

$$T_c = \frac{\ell^{0.8}(S+1)^{0.7}}{1{,}140Y^{0.5}} \qquad \text{(eq. 15–4b)}$$

where:
L = lag, h
T_c = time of concentration, h
ℓ = flow length, ft
Y = average watershed land slope, %
S = maximum potential retention, in

$$= \frac{1{,}000}{cn'} - 10$$

where:
cn′ = the retardance factor

Flow length (ℓ)—In the watershed lag method of computing time of concentration, flow length is defined as the longest path along which water flows from the watershed divide to the outlet. In developing the regression equation for the lag method, the longest flow path was used to represent the hydraulically most distant point in the watershed. Flow length can be measured using aerial photographs, quadrangle sheets, or GIS techniques. Mockus (USDA 1973) developed an empirical relationship between flow length and drainage area using data from Agricultural Research Service (ARS) watersheds. This relationship is:

$$\ell = 209A^{0.6} \qquad \text{(eq. 15–5)}$$

where:
ℓ = flow length, ft
A = drainage area, acres

Land slope (Y), percent—The average land slope of the watershed, as used in the lag method, not to be confused with the slope of the flow path, can be determined in several different ways:

- by assuming land slope is equal to a weighted average of soil map unit slopes, determined using the local soil survey
- by using a clinometer for field measurement to determine an estimated representative average land slope
- by drawing three to four lines on a topographic map perpendicular to the contour lines and determining the average weighted slope of these lines
- by determining the average of the land slope from grid points using a dot counter
- by using the following equation (Chow 1964):

$$Y = \frac{100(CI)}{A} \qquad \text{(eq. 15–6)}$$

where:
Y = average land slope, %
C = summation of the length of the contour lines that pass through the watershed drainage area on the quad sheet, ft
I = contour interval used, ft
A = drainage area, ft^2 (1 acre = 43,560 ft^2)

Retardance factor—The retardance factor, cn´, is a measure of surface conditions relating to the rate at which runoff concentrates at some point of interest. The term "retardance factor" expresses an inverse relationship to "flow retardance." Low retardance factors are associated with rough surfaces having high degrees of flow retardance, or surfaces over which flow will be impeded. High retardance factors are associated with smooth surfaces having low degrees of flow retardance, or surfaces over which flow moves rapidly.

Thick mulches in forests are associated with low retardance factors and reflect high degrees of retardance, as well as high infiltration rates. Hay meadows have relatively low retardance factors. Like thick mulches in forests, stem densities in meadows provide a high degree of retardance to overland flow in small watersheds. Conversely, bare surfaces with little retardance to overland flows are represented by high retardance factors.

The retardance factor is approximately the same as the curve number (CN) as defined in NEH630.09, Hydrologic Soil-Cover Complexes. In practical usage, CN is used as a surrogate for cn´, and the CN tables in NEH 630.09 may be used to approximate cn´ in equations 15–4a and 15–4b. A CN of less than 50, or greater than 95 should not be used in the solution of equations 15–4a and 15–4b (Mockus 1961).

Applications and limitations—The watershed lag equation was developed using data from 24 watersheds ranging in size from 1.3 acres to 9.2 square miles, with the majority of the watersheds being less than 2,000 acres in size (Mockus 1961). Folmar and Miller (2000) revisited the development of this equation using additional watershed data and found that a reasonable upper limit may be as much as 19 square miles.

(b) Velocity method

Another method for determining time of concentration normally used within the NRCS is called the velocity method. The velocity method assumes that time of concentration is the sum of travel times for segments along the hydraulically most distant flow path.

$$T_c = T_{t1} + T_{t2} + T_{t3} + \ldots T_{tn} \qquad \text{(eq. 15–7)}$$

where:
T_c = time of concentration, h
T_{tn} = travel time of a segment n, h
n = number of segments comprising the total hydraulic length

The segments used in the velocity method may be of three types: sheet flow, shallow concentrated flow, and open channel flow.

Sheet flow—Sheet flow is defined as flow over plane surfaces. Sheet flow usually occurs in the headwaters of a stream near the ridgeline that defines the watershed boundary. Typically, sheet flow occurs for no more than 100 feet before transitioning to shallow concentrated flow (Merkel 2001).

A simplified version of the Manning's kinematic solution may be used to compute travel time for sheet flow. This simplified form of the kinematic equation was developed by Welle and Woodward (1986) after studying the impact of various parameters on the estimates.

$$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5} S^{0.4}} \qquad \text{(eq. 15–8)}$$

where:
T_t = travel time, h
n = Manning's roughness coefficient (table 15–1)
ℓ = sheet flow length, ft
P_2 = 2-year, 24-hour rainfall, in
S = slope of land surface, ft/ft

Table 15–1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	n [1/]
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses [2/]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3/]	
Light underbrush	0.40
Dense underbrush	0.80

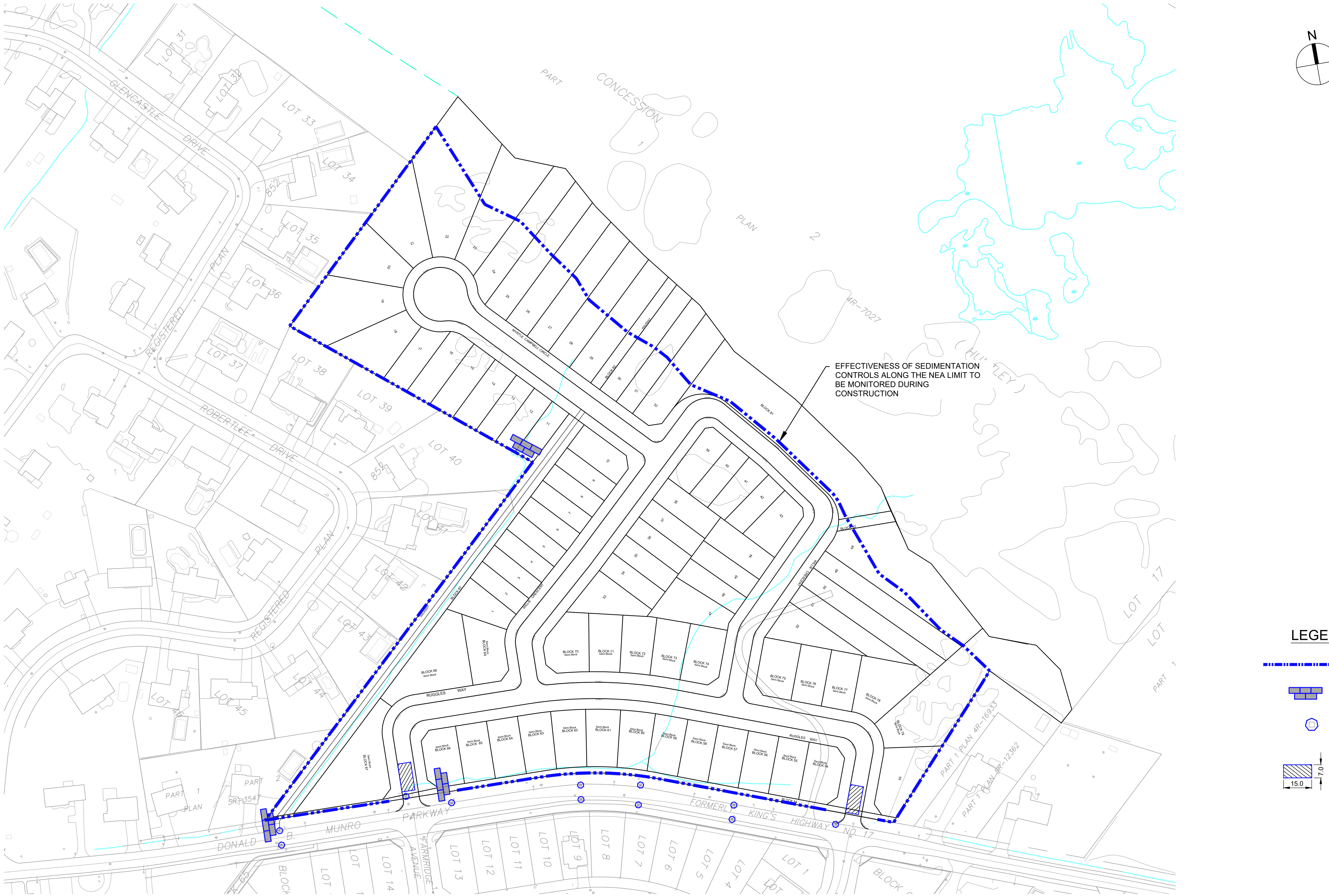
1 The Manning's n values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Table D.1 - Green Meadows OGS AxC Calculation

Name	Area (ha)	C	AxC
EX1-1	0.083	0.7	0.058
EX1-2	0.084	0.7	0.058
EX2-1	0.032	0.7	0.022
EX2-2	0.030	0.7	0.021
EX3-1	0.050	0.7	0.035
EX3-2	0.051	0.7	0.035
EX4-1	0.056	0.7	0.039
EX4-2	0.046	0.7	0.032
EX5-1	0.172	0.55	0.094
EX5-2	0.164	0.55	0.090
EX6	1.567	0.5	0.784
R1	0.249	0.55	0.137
R10	0.280	0.55	0.154
R11	0.150	0.55	0.083
R12	0.200	0.55	0.110
R13	0.140	0.55	0.077
R14	0.160	0.55	0.088
R15	0.530	0.55	0.292
R16	0.310	0.55	0.171
R2	0.251	0.55	0.138
R3	0.240	0.55	0.132
R4	0.780	0.55	0.429
R5	0.820	0.55	0.451
R6	0.260	0.55	0.143
R7	0.240	0.55	0.132
R8	0.150	0.55	0.083
R9	0.250	0.55	0.138
S1	0.400	0.7	0.280
S10	0.370	0.7	0.259
S2	0.390	0.7	0.273
S3	0.160	0.7	0.112
S4	0.560	0.7	0.392
S5	0.150	0.7	0.105
S6	0.180	0.7	0.126
S7	0.270	0.7	0.189
S8	0.278	0.7	0.194
S9	0.290	0.7	0.203
S-GM202-1	0.227	0.7	0.159
S-GM202-2	0.355	0.7	0.248
S-GM203-1	0.310	0.55	0.171
S-GM203-2	0.524	0.7	0.367
S-GM204	0.472	0.7	0.330
S-GM205	0.326	0.7	0.228
S-GM207	0.249	0.7	0.174
S-GM209	0.216	0.7	0.151
S-GM213-1	0.243	0.7	0.170
S-GM213-2	0.470	0.55	0.259
S-GM214-1	0.114	0.7	0.080
S-GM214-2	0.513	0.7	0.359
S-GM216	0.681	0.7	0.477
S-GM246	0.198	0.55	0.109
NEA	14.900	0.2	2.980
Total	**30.2**	**0.4**	**12.4**

Appendix E

Erosion and Sediment Control



LEGEND:

SILT FENCE BARRIER

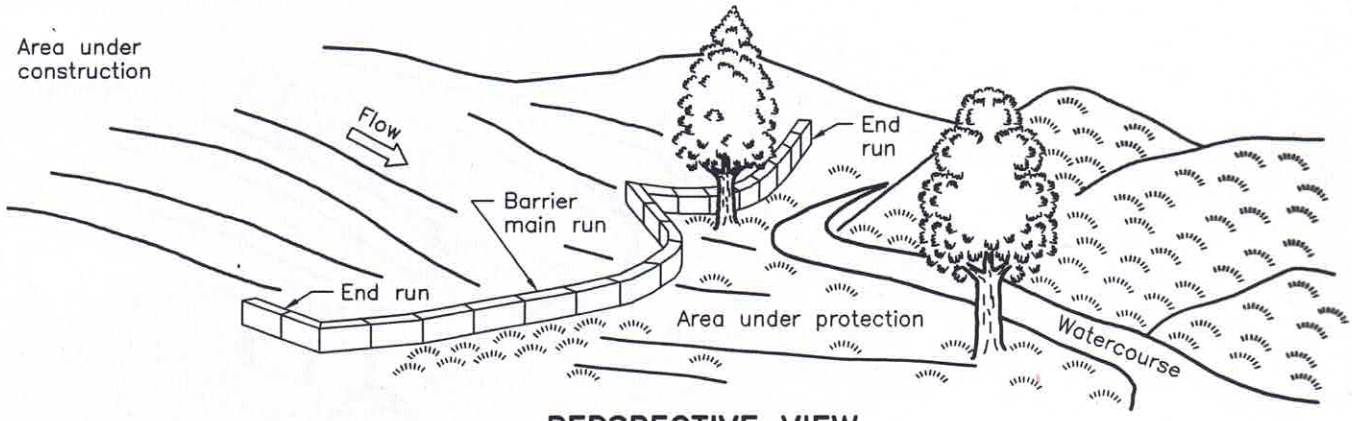
STRAW BALE BARRIER

FILTER SOCK TRAPS

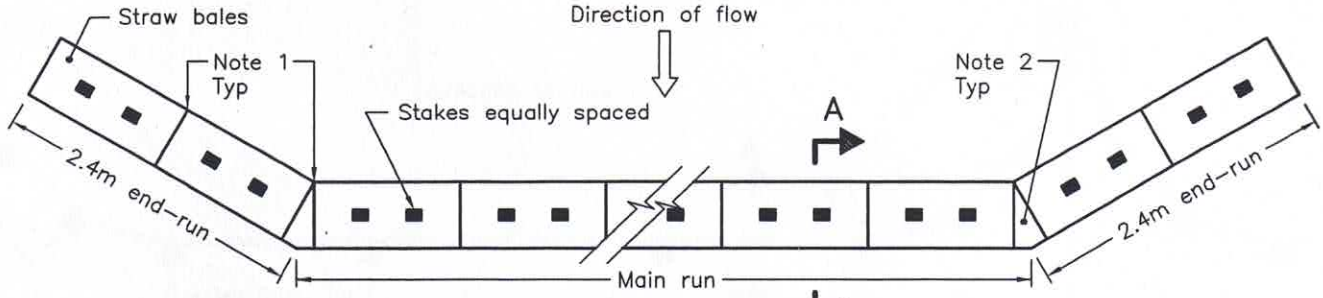
POTENTIAL LOCATION OF TEMPORARY MUD MAT 0.15m THICK 50mm CLEAR STONE ON NON WOVEN FILTER CLOT (15.0 × 7.0)

ARCADIS

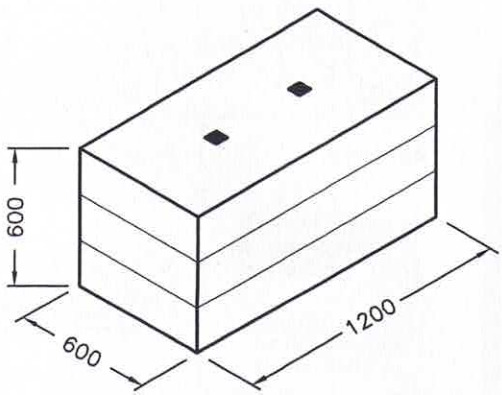
Scale	Project Title	Drawing Title	Sheet No.
N.T.S.	ASSESSMENT OF ADEQUACY OF PUBLIC SERVICES 232 DONALD B. MUNRO DRIVE VILLAGE OF CARP	CONCEPTUAL EROSION AND SEDIMENTATION CONTROL PLAN	FIGURE 4.7 2025/01/10



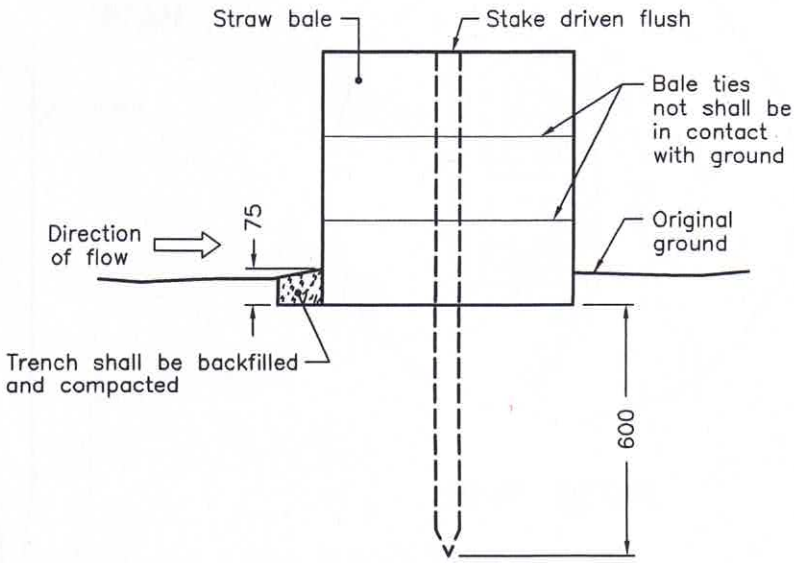
PERSPECTIVE VIEW



PLAN



ISOMETRIC VIEW



SECTION A–A

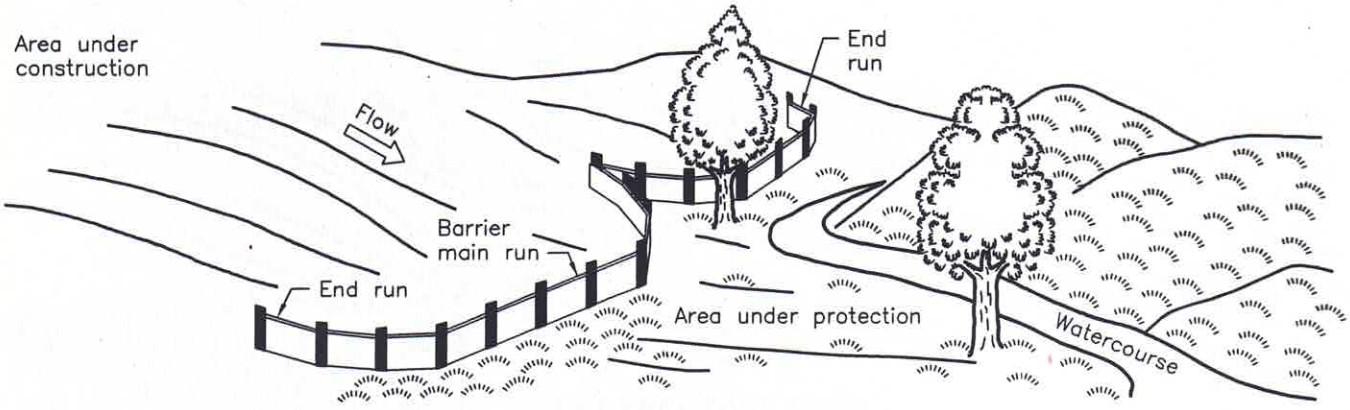
NOTES:

1 Straw bales shall be butted tightly against adjoining bales to prevent sediment flow through barrier.

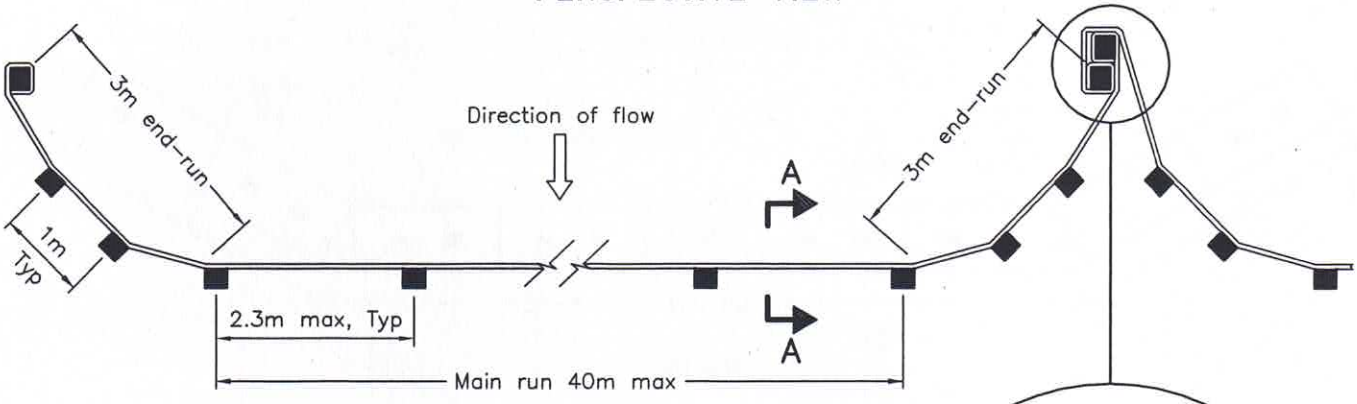
2 Caulk and compact gaps with loose straw.

A All dimensions are in millimetres unless otherwise shown.

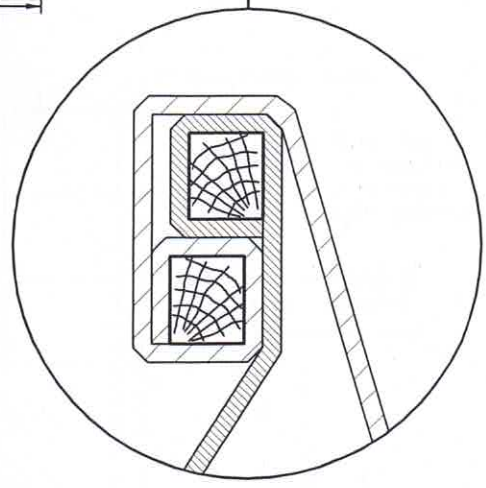
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
LIGHT–DUTY STRAW BALE BARRIER			
		OPSD 219.100	



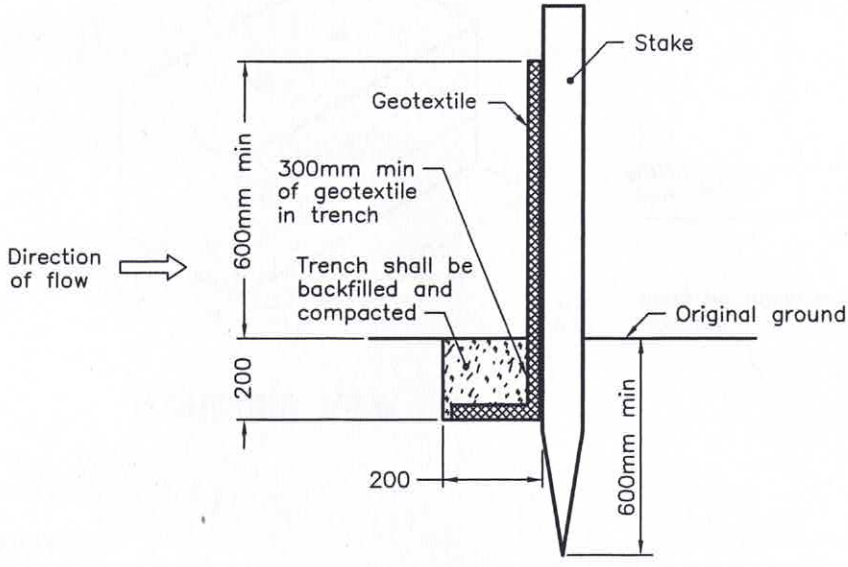
PERSPECTIVE VIEW



PLAN



JOINT DETAIL

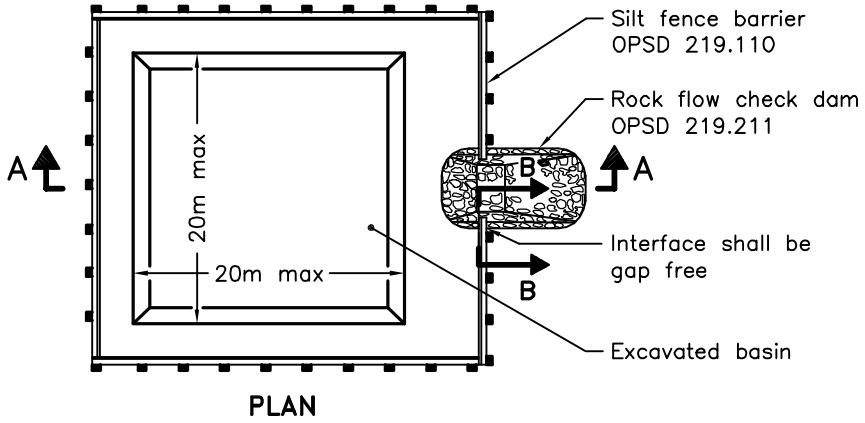


SECTION A–A

NOTE:

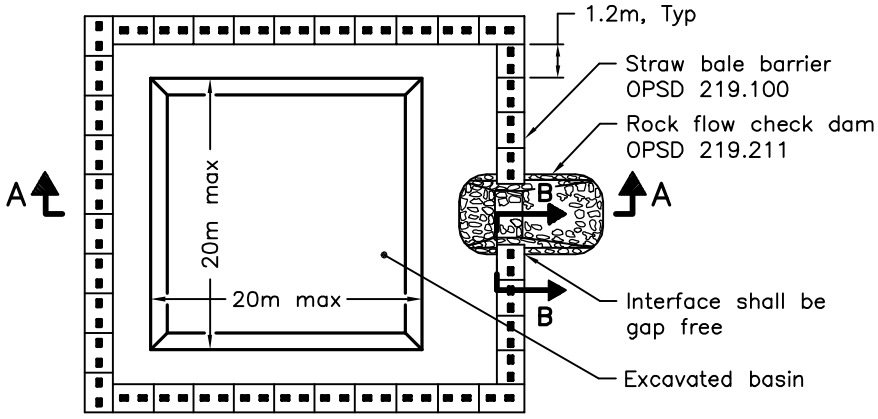
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
LIGHT–DUTY SILT FENCE BARRIER			
	OPSD 219.110		



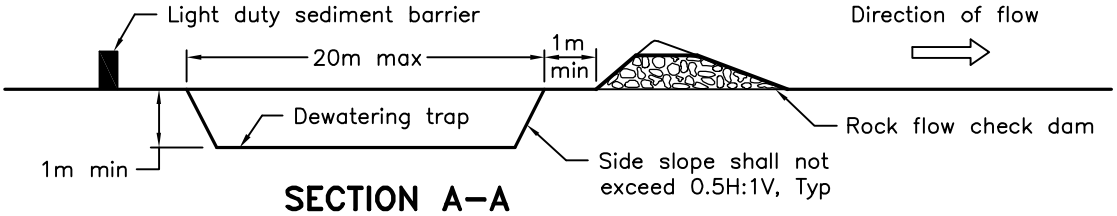
PLAN

DEWATERING TRAP WITH SILT FENCE

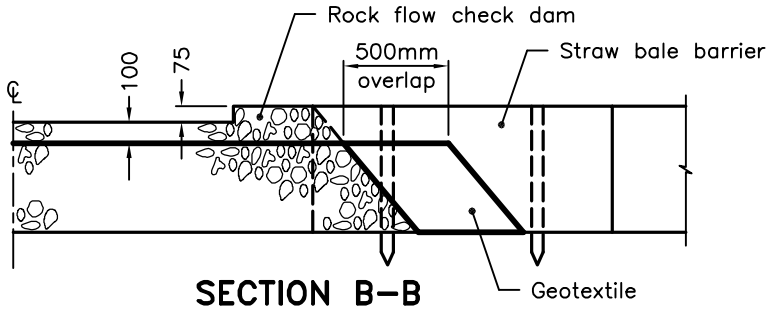


PLAN

DEWATERING TRAP WITH STRAW BALES



SECTION A–A



SECTION B–B

STRAW BALE BARRIER SHOWN

NOTE:

A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev	2
SEDIMENT TRAP FOR DEWATERING			
	OPSD 219.240		

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