760 MOSLEY STREET – ADA HOMES LTD.
TOWN OF WASAGA BEACH
FUNCTIONAL SERVICING AND STORM WATER MANAGEMENT REPORT

Prepared by:

Pinestone Engineering Ltd.
Barrie Office
20 Bell Farm Road, Unit 1
Barrie, Ontario L4M 6E4

Phone: 705-503-1777

Email: pinestone@pel.ca
Web: www.pel.ca

September 19, 2017
17-11290B – rev. 0

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 Background

ADA Homes Ltd. are proposing to construct a 14-unit townhouse development at 760 Mosley Street in the Town of Wasaga Beach. The property area is approximately 0.27 hectares in size and is legally described as all of Lots 37, 38 and 49, and Part of Lot 48, Registered Plan No.674, in the Town of Wasaga Beach, County of Simcoe. The property is bounded by 18th Street North to the north, existing commercial development to the south, Mosley Street to the south-east and Dunkerron Avenue to the north-west.

The site location is illustrated on Figure 1.

The property is currently vacant, and almost entirely covered with gravel and asphalt. Development on the property is proposed to include 14 three-storey townhouse units, each with a garage, paved driveway and a rear landscape amenity area. A paved main driveway will extend from Mosley Street through the site to Dunkerron Avenue, providing access to each unit.

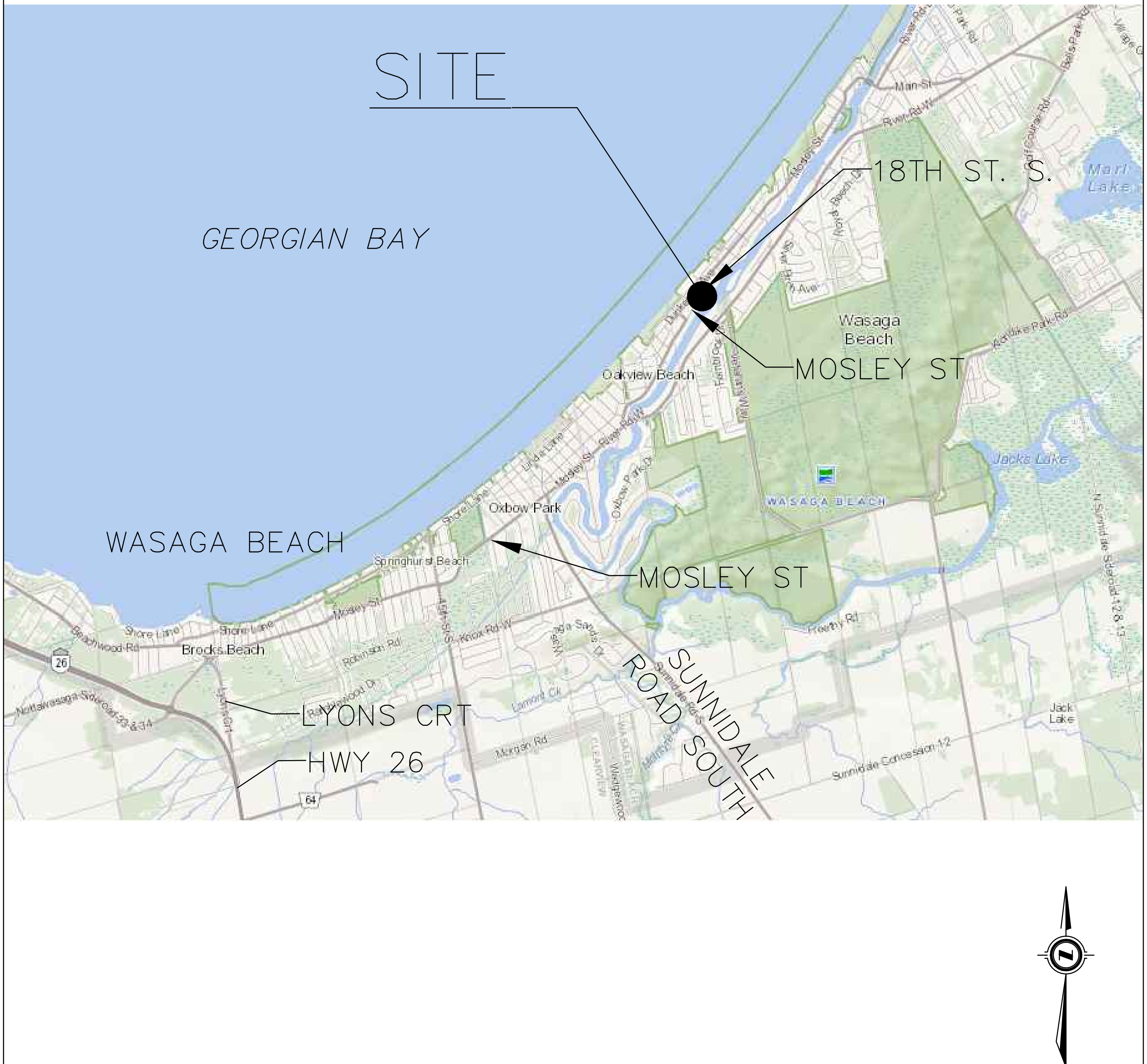
1.2 Purpose and Scope

Pinestone Engineering Ltd (PEL) has been retained by the developer to prepare a Functional Servicing and Storm Water Management Report in support of site plan approval. The report describes the proposed servicing, storm water quality and quantity control strategy for the site.

2.0 REFERENCE REPORTS

The following reports and studies have been used for reference in the preparation of this Servicing and Storm Water Management Plan:

i) *Ministry of the Environment and Energy's Storm Water Management Planning and Design Manual, March 2003.*
ii) *Sediment Control Planning Central Region Group, prepared by the Ministry of Natural Resources.*
iii) *Town of Wasaga Beach Engineering Standards, March 2015.*
iv) *Low Impact Development Manual prepared by Credit Valley Conservation and Toronto and Region Conservation, 2010*



PINESTONE ENGINEERING LIMITED | www.pel.ca

MOSLEY STREET TOWNHOMES

LOCATION PLAN

DATE:	SCALE:	PROJECT No.	FIGURE No.
SEPT. 2017	N.T.S.	17-11290-B	FIGURE 1

3.0 EXISTING CONDITIONS

3.1 General

The subject property is currently vacant. The majority of the property is cleared of vegetation, with the exception of a small cluster of tree stands along the south property limit and two large pine trees along the north-east property limit. The remainder of the property is predominately covered with gravel and asphalt.

The site is currently serviced via two sets of water and sanitary services. The first pair extend from the 350mm dia. watermain and 200mm dia. sanitary sewer on 18th Street North to the north-east property limit. The second set of services are installed from the 150mm dia. watermain and 450mm dia. sanitary sewer on Dunkerron Avenue to the north-west property limit. There is an existing 350mm dia. watermain and 200mm dia. sanitary sewer installed along Mosley Street east of the property. A 300mm dia. storm sewer and catch basin are also installed east of the property on Mosley Street. Culverts and open ditches are located along the north-west property frontage.

3.2 Topography

The topography through the entire site is gentle, with elevations ranging between 181.10m in the central portion of the property to 180.40/180.50m at the north-west and south-east property limits.

3.3 Site Geology

A geotechnical investigation of the site was completed by Peto MacCallum in December 2016 in support of the original site plan which included units 1-7. Three test pits were excavated to a depth of 2.1m. The boreholes generally consist of 100-200mm of granular fill, a 0.7-1.3m layer of sand fill containing some silt, and a native sand layer below the fill extending to the depth of the test pits. Groundwater was not encountered in any of the test pits. The location of the test pits is shown on Drawing EX-1 – Existing Conditions Plan appended to this report.

Based on our review of the soils descriptions outlined in the *MTO Drainage Manual Volume 3, Chart H2-2*, we have classified the site material as a Type A under the Soil Conservation Service, hydrologic soil group.

In addition, we have reviewed geotechnical information prepared for a project at 878 Mosley Street, the sub soils are fine sand with a coefficient of permeability of 2 x 10^{-2} cm/sec, or 150mm/hr which is very permeable. This number will be utilized for the sizing of storm water infiltration measures.

A copy of the soils investigation and borehole logs is included in Appendix A.

3.4 Drainage Conditions

Drainage from the site splits and drains north-west to Dunkerron Avenue and south-east to Mosley Street in the form of overland sheet flow. Run-off to Dunkerron Avenue is collected by open ditches and is conveyed downgradient to an existing storm sewer system.

Run-off to Mosley Street is collected by an existing catch basin installed south-east of the site along the edge of pavement. A 300mm dia. storm sewer conveys drainage downgradient to the 18th Street South storm sewer system.

4.0 PROPOSED DEVELOPMENT

The proposed development consists of 14 three-storey townhouse units, each with a paved driveway and rear landscape amenity area. Access to the units will be provided via a main driveway which will traverse the south property limit and extend from Mosley Street to Dunkerron Avenue.

Municipal water and sanitary sewer servicing will be extended to the site from the mains on Dunkerron Avenue north-west of the site. The existing services will be abandoned per Town guidelines. Low impact development practices have been utilized to provide both quantity and quality control of storm water.

5.0 SANITARY SEWERS

5.1 Existing Sanitary Servicing

A 200mm dia. PVC sanitary sewer currently exists along both Mosley Street and 18th Street North, flowing south-west and north-west respectively. An existing 150mm dia. PVC service lateral extends to the north-east property limit. A 450mm dia. concrete sanitary sewer which flows south-west exists along Dunkerron Avenue. A 150mm dia. service lateral has been extended to the north-west property limit.

The Town has indicated there are no servicing constraints in this area.

Existing sizes and locations of sanitary sewer infrastructure in the area of the subject site were taken from record plan and profile drawings provided by the Town.

5.2 Proposed Servicing Strategy

To achieve adequate frost cover on the proposed services, the development will be serviced by gravity sanitary sewers which will be extended from Dunkerron Avenue. The connection to the existing concrete main will be completed utilizing an approved manufacturers tee. A sanitary manhole will be installed at the end of the proposed 200mm dia. PVC SDR35 sanitary sewer reach, which will be installed at a minimum gradient of 1% per Town requirements. A manhole will also be installed at the right of way limit per

Town guidelines. Each townhouse unit will be serviced via an individual 125mm dia. PVC SDR28 service lateral installed to Town standards.

The proposed peak sanitary design flow for the development were calculated using Town of Wasaga Beach design criteria as follows:

- A residential average sewage flow of 350 litres/capita/day
- A residential population density of 2.6 persons/unit
- A extraneous flow rate of 0.28 litres/ha/sec

The proposed development concept includes 14 townhouse units with a population of 37 people. Incorporating extraneous flows, the peak sewage flow generated by the proposed development was determined to be 0.70 l/sec. The conveyance capacity of the downstream 450mm dia. sewer reach on Dunkerron Avenue installed at 0.12% is approximately 98.7 l/sec. The proposed peak flow from the development represents 0.7% of the capacity of the immediate downstream reach of sewer. It is expected that available capacity exists within the existing sewer infrastructure to support the development.

A copy of the sanitary sewer design sheet is included in Appendix B. The proposed sanitary sewer servicing is shown on Drawing SS-1-Site Servicing Plan appended to this report.

6.0 WATERMAIN

6.1 Existing Water Servicing

There is an existing 350mm ductile iron watermain installed on Mosley Street and a 150mm dia. ductile iron watermain installed on 18th Street North in the vicinity of the site. A 150mm dia. PVC watermain has been installed on Dunkerron Avenue north-west of the property. Currently, there are two water services installed to the property. 38mm dia. water services have been installed to both the north-east and north-west property limits.

Through pre-consultation with the Town, it was confirmed that a hydrant flow test would not be required given the small scale of the development.

6.2 Proposed Water Demands

The domestic water demands for the proposed development are listed in Table 1 below:

Table 1
Domestic Water Demand

Population	**Per Capita Flow (L/day)**	**Peaking Factors** (based on MOECC Guidelines)		**Flows (L/sec)**	
		Peak Hour	Maximum Day	Peak Hour	Maximum Day
37	350	4.1	2.75	0.61	0.41

The fire flow requirement for this development was calculated based on guidance provided in the document "Water Supply for Public Fire Protection" prepared by the Fire Underwriters Survey. The fire flow for this development was determined to be 212 L/sec. The combined domestic and fire flow demand for the site is 212.4 L/sec.

It is advised that the Town confirm with their ultimate water model that a minimum system pressure of 140 kPa (20.3 psi) can be maintained in the event of a fire onsite based on the calculated demand above.

Detailed fire flow calculations are included in Appendix B.

6.2 Proposed Water Servicing

Water servicing for the proposed development will be provided by a new service connection to the existing 150mm dia. PVC watermain located within the Dunkerron Avenue right-of-way. A proposed 150mm dia. PVC DR18 watermain will be extended into the site along the proposed main driveway, and will terminate with a 50mm dia. blow off assembly for flushing of the line. Each townhouse unit will be serviced by a 25mm dia. PE Series 160 water service with curb stop extending from the proposed 150mm dia. watermain. Depth of bury will be 1.7m minimum and pipe embedment and backfill will be in accordance with OPSD 802.010. A minimum 1.5m horizontal or 0.5m vertical pipe separation will be maintained between sanitary sewers and watermains. The existing hydrant on 18th Street North is located within 90m of all units and will provide fire protection for the units.

The proposed water servicing is illustrated on Drawing SS1-Site Servicing Plan appended to this report.

7.0 STORM WATER MANAGEMENT

7.1 Existing Storm Drainage

Drainage from the north-west portion of the site drains overland to open ditches and driveway culverts which drain south-easterly along Dunkerron Avenue. Downgradient storm structures collect run-off and convey it to a downstream outlet via a 300mm dia. storm sewer. Drainage from the south-east portion of the site drains overland to an existing catch basin installed along Mosley Street adjacent to the south-east property limit. The catch basin collects runoff and conveys drainage downgradient to a series of storm structures via a 375mm dia storm sewer. A 600mm dia. storm sewer on 18th Street South conveys drainage downgradient to an outlet.

7.2 Design Criteria

Based on correspondence with the Town of Wasaga Beach engineering department and a review of the Town of Wasaga Beach Storm Water Management (SWM) guidelines, the following design criteria, in accordance with the MOEE SWM Planning and Design Manual (MOEE,2003), were established for the site:

Water Quantity Control:

- Peak flow attenuation for the 2-year through 100-year storm events to pre-development rates based on the Rational Method using the City of Owen Sound's IDF rainfall data.

Water Quality Control:

- Water quality enhancement to a "basic" level of protection through the use of accepted control / low impact development techniques such as soak away pits, bioretention cells, enhanced grass swales and level spreaders.

- Preparation of detailed erosion, sediment control and construction mitigation plan to be implemented as part of the construction program.

7.3 Design Storms and Drainage Catchments

We have selected the 2-yr through 100-yr design storms as part of our evaluation.

The design storm parameters are outlined in Table 2 below:

Table 2
Design Storm Parameters - Chicago Rainfall Distribution

Rainfall Event	**Parameter**		
	A	**B**	**C**
2 Yr	567.413	3.75	0.766
5 Yr	809.360	4.50	0.778
10 Yr	939.087	4.50	0.778
25 Yr	1117.54	4.50	0.781
50 Yr	1241.422	4.50	0.781
100 Yr	1369.583	4.50	0.782

Rainfall intensity - duration frequency (IDF) values for the Owen Sound Area were entered into an equation that expresses the time relationship intensity for specific frequency, in the form of:

$$i = \frac{a}{(t+b)^c}$$

where:
i = intensity, mm/hr.
t = Time of concentration, minutes
a,b,c = constants developed to fit IDF curve

The rainfall data is included in Appendix C.

The Town recommends the rational method be used to calculate the peak run-off rates generated from the storm events. The following equation was used to determine the flows:

$$Q = 0.00278*CiA$$

where:
C = runoff coefficient
i = intensity, mm/hr
A = area, hectares

The rational method is generally considered to provide a more conservative (ie. higher) estimate of peak flow rates than other hydrological simulation models.

Runoff coefficients provided in the Town SWM Guidelines were utilized to calculate composite runoff coefficients.

In order to determine the peak flows generated from the site, two (2) pre-development and fifteen (15) post-development catchments were delineated using the catchment parameters listed in Table 2. The pre-development catchment areas represent the existing conditions of the site. The post development catchment represents the proposed grading concept for the site.

The pre-development and post-development catchment parameters are listed in Table 3.

Table 3
Sub-catchment Parameters

Catchments	**Area (ha)**	**Slope**	**Composite Runoff Coefficient "C"**
Pre-Development			
101 – Drains north-west to Dunkerron Avenue	0.1200	1.0%	0.77
102 – Drains south-west to Mosley Street	0.1500	1.1%	0.63
Post Development			
201 – Road and individual driveway runoff to bioretention cell #1	0.0179	2.1%	0.86
202 / 204 - 206 – Road and individual driveway runoff to bioretention cells #2 / #3 / #4 / #5	0.0121	2.0%	0.84
203 – Road and individual driveway runoff to bioretention cell #6	0.0206	2.2%	0.69

207 – Road and individual driveway runoff to bioretention cell #7	0.0106	1.8%	0.75
208 - 222 – Roof drains from each unit to single soakaway pit	0.0074	1.0%	0.90
223 – Landscape common area	0.0687	3.0%	0.66

The pre-development and post-development catchment boundaries for the site are illustrated on Figures 2 and 3.

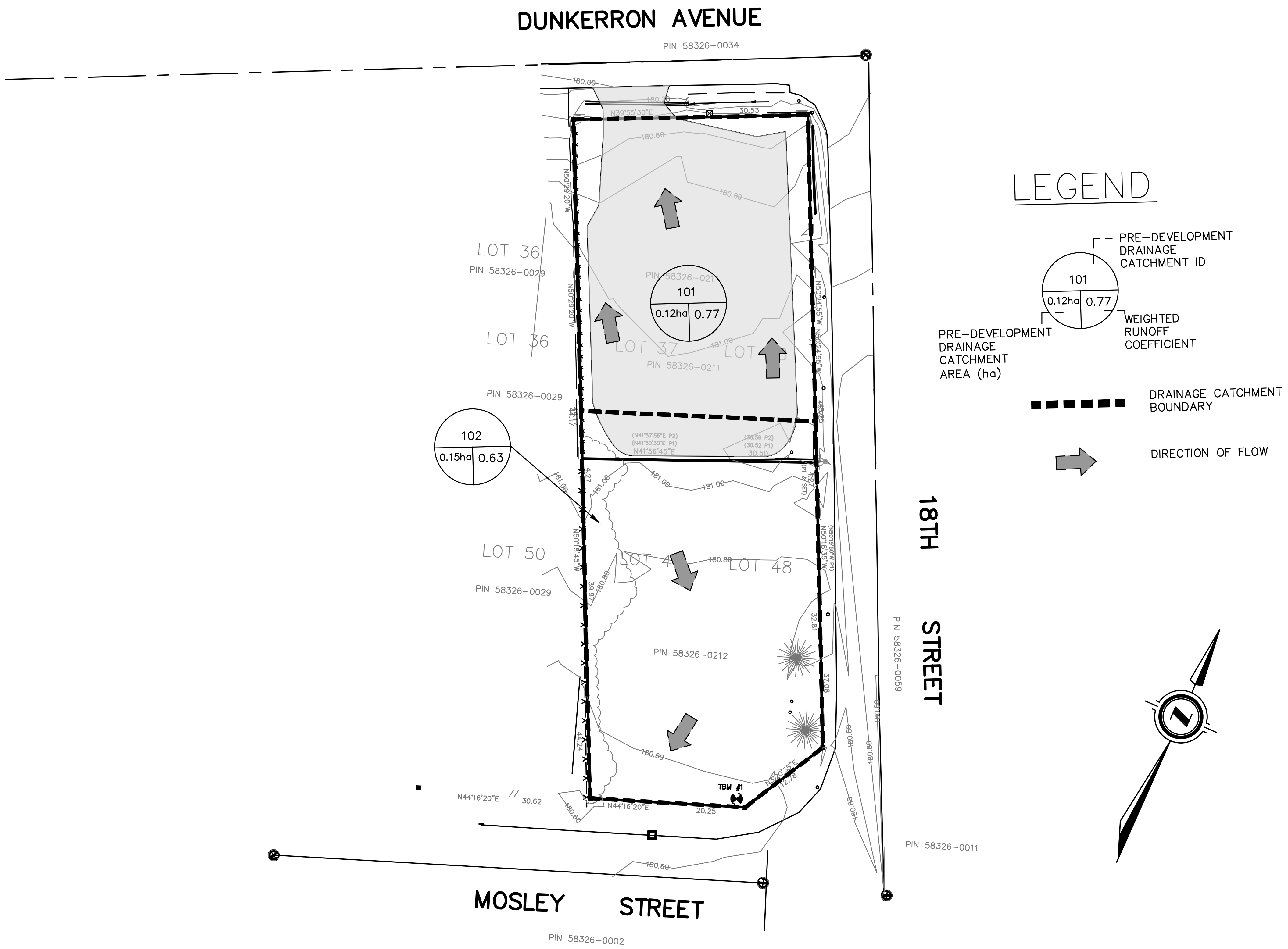
7.4 Rational Method Results

The peak flow rates from the 2 year to 100 year peak storm events are shown in Table 4 below.

Table 4
Rational Method – Peak Flows

	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**
Pre-Development (m^3/sec)						
Catchment 101	0.035	0.044	0.051	0.067	0.081	0.093
Catchment 102	0.033	0.042	0.049	0.064	0.078	0.089
Total Pre-Development Runoff Rate (m^3/sec)	**0.068**	**0.087**	**0.101**	**0.131**	**0.159**	**0.182**
Post Development (m^3/sec)						
Catchment 201	0.008	0.010	0.011	0.015	0.017	0.019
Catchment 202	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 203	0.007	0.009	0.010	0.014	0.017	0.019
Catchment 204	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 205	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 206	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 207	0.004	0.005	0.006	0.008	0.009	0.011
Catchments 208 – 222*	0.046	0.058	0.067	0.088	0.098	0.108
Catchment 223	0.024	0.030	0.035	0.045	0.055	0.063
Total Post Development Runoff Rate (m^3/sec)	**0.111**	**0.137**	**0.159**	**0.208**	**0.243**	**0.271**

*Combined flow from all catchments



PINESTONE ENGINEERING LIMITED | www.pel.ca

760 MOSLEY STREET TOWNHOMES

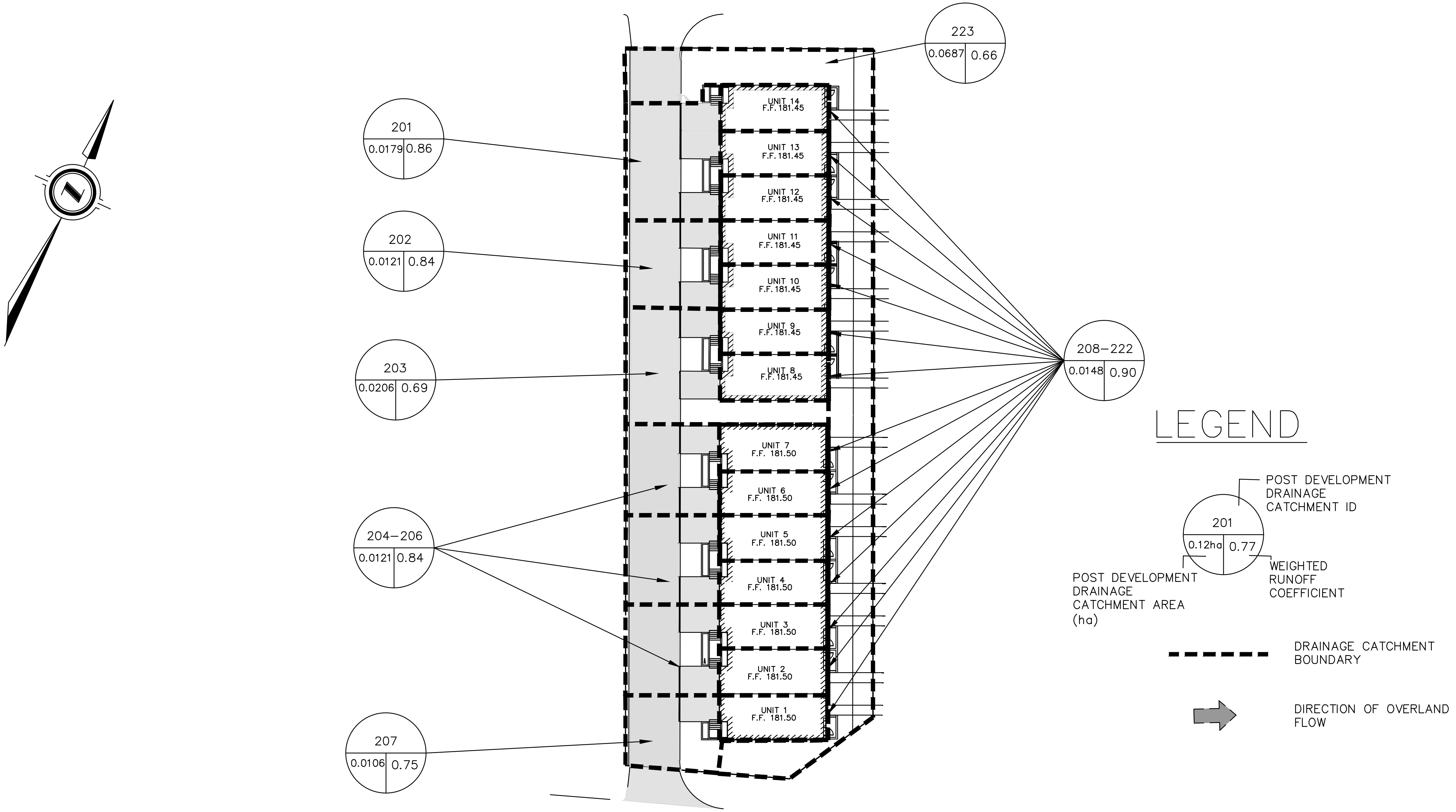
PRE-DEVELOPMENT DRAINAGE CATCHMENTS

PROJECT NO. 17-11290

SCALE: 1:600

DATE: SEPT, 2017

FIGURE 2



PINESTONE ENGINEERING LIMITED | www.pel.ca

760 MOSLEY STREET TOWNHOMES

POST DEVELOPMENT DRAINAGE CATCHMENTS

PROJECT NO. 17–11290

SCALE: 1:600 | DATE: SEPT, 2017

FIGURE 3

Based on the calculated results using the Rational Method, it is expected that post development flows will increase as a result of the proposed development and increased site imperviousness. The Rational Method design calculations are included in Appendix D.

7.5 Storm Water Management Plan

Quantity Control:

As noted in the comparison of the pre-development and post development flows, an increase in run-off will occur as a result of the proposed development of the site to construct the townhouse units and associated access driveway and individual unit driveways.

To satisfy the selected design criteria, peak flow attenuation of post development flows to pre-development levels for all storm events up to and including the 100-year storm event will be provided by utilizing low impact development techniques including bioretention cells and roof leaders discharging to soakaway pits.

Drainage from catchments 201 – 207, which includes runoff from the main driveway and the individual unit driveways will be directed to bioretention cells, located in the landscape areas adjacent to the main driveway. Road / driveway grading will direct runoff to 1m wide curb cuts adjacent to each bioretention cell. The bioretention cells will provide reduction of peak flow rates through evapotranspiration and infiltration of runoff. The infiltration rate of the existing fine sand soil is estimated to be 150 mm/hr based on geotechnical information obtained for a neighboring development. Based on guidance provided in the “Low Impact Development Stormwater Management Planning Design Guide, 2010”, prepared by the Credit Valley Conservation Authority (CVC) and the Toronto and Region Conservation Authority (TRCA), it is estimated that bioretention cells can provide a 45% reduction in runoff rates when designed in accordance with these guidelines and when an underdrain is utilized.

Each bioretention cell will be 8.8m^2 (2.2m wide x 4m long), and has been sized for the 10 year water quality volume assuming a 48 hour drain down time and a soil infiltration rate of 150 mm/hr. The detailed sizing calculations are included in Appendix E.

Runoff from storm events greater than the 100 year event will overflow down the main driveway to the existing storm systems on Mosley Street and Dunkerron Avenue.

A maximum ponding depth of 150mm will be permitted in each cell. A 150mm dia. overflow pipe will be installed in each cell and will be connected to the underdrain. A 200mm dia. perforated underdrain wrapped in a filter sock will be installed for the cells between units 1-7, and has been designed for the 100 year storm event. The drain will be installed at 0.4% and will discharge to the existing downgradient catch basin #2 on Mosley Street. A 250mm dia. perforated underdrain will be installed for the cells between units 8-14, and has also been designed for the 100 year storm event. The drain will be installed at 0.4% and will discharge to a proposed ditch inlet catch basin #1 to be installed with the

Dunkerron Avenue ROW south-west of the site. A 300mm dia. storm sewer will be extended within the boulevard to the downgradient storm sewer system.

Drainage from catchments 208 – 222, which includes roof runoff only from each unit, will be directed to soak away pits to be constructed in the rear yard landscaped space (north portion of property). Roof drainage will be directed to the soakway pits via roof leaders, and will have an overflow disconnection to surface. The soak away pits have been designed in accordance with the LID Design Guide. Each pit will accept runoff from the rooftop area of one unit and will need to have a minimum footprint of 4.5m^2 (1.7m wide x 2.7m long x 2.0m deep). The pits were sized utilizing the 10 year water quality volume assuming a soil infiltration rate of 150mm/hr, stone reservoir depth of 2.0m and a 48 hour drain down time. Based on guidance provided in the LID Design Guide, it is estimated that soak away pits can provide an 85% reduction in runoff rates. The detailed sizing calculations are included in Appendix E.

Catchment 223, which includes the rear landscaped yards of the units, a small section of the driveway (south-west portion), and the landscaped areas abutting the south-east and north-west property limits, will drain overland uncontrolled to the neighboring ROW’s.

The proposed grading and low impact infiltration features are detailed on Drawing GP-1-Grading Plan appended to this report.

Table 5 summarizes the effectiveness of the proposed storm water low impact development techniques which serve as attenuation features based on the hydrologic model results.

Table 5
Model Results – Rational Method

	2Yr	**5Yr**	**10Yr**	**25Yr**	**50Yr**	**100Yr**
Pre-Development (m^3/sec)						
Catchment 101	0.035	0.044	0.051	0.067	0.081	0.093
Catchment 102	0.033	0.042	0.049	0.064	0.078	0.089
Total Pre-Development Runoff Rate (m^3/sec)	**0.068**	**0.087**	**0.101**	**0.131**	**0.159**	**0.182**
Post Development (m^3/sec)						
Catchment 201	0.008	0.010	0.011	0.015	0.017	0.019
Catchment 202	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 203	0.007	0.009	0.010	0.014	0.017	0.019
Catchment 204	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 205	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 206	0.005	0.006	0.007	0.010	0.012	0.013
Catchment 207	0.004	0.005	0.006	0.008	0.009	0.011
Catchments 208 – 222*	0.046	0.058	0.067	0.088	0.098	0.108
Catchment 223	0.024	0.030	0.035	0.045	0.055	0.063
Total Post Development Runoff Rate (m^3/sec)	**0.111**	**0.137**	**0.159**	**0.208**	**0.243**	**0.271**
Post Development with SWM (m^3/sec)						
Catchment 201	0.004	0.005	0.006	0.008	0.009	0.010
Catchment 202	0.003	0.004	0.004	0.005	0.006	0.007
Catchment 203	0.004	0.005	0.006	0.007	0.009	0.010
Catchment 204	0.003	0.004	0.004	0.005	0.006	0.007
Catchment 205	0.003	0.004	0.004	0.005	0.006	0.007
Catchment 206	0.003	0.004	0.004	0.005	0.006	0.007
Catchment 207	0.002	0.003	0.003	0.004	0.005	0.006
Catchments 208-222*	0.007	0.009	0.010	0.013	0.015	0.016
Catchment 223	0.024	0.030	0.035	0.045	0.055	0.063
Total Post Development with SWM Runoff Rate (m^3/sec)	**0.053**	**0.066**	**0.076**	**0.100**	**0.199**	**0.134**

*Combined flow from all catchments.

Quality Control:

The primary objective of the storm water management plan for this development is to maintain acceptable water quality within the receiving storm sewer systems by maintaining existing site drainage patterns and providing low impact techniques for infiltration of road and roof runoff. In addition, protecting existing facilities downstream of the site from erosion and flooding is critical.

The strategy to reduce sediment load released from the site will be achieved through the implementation of low impact development practices which will provide water quality enhancement to a minimum 'basic' level of protection (60% TSS removal). For this development, we have incorporated the following elements:

- Provision of "soft" landscaping where feasible.
- Installation of splash pads at roof downspout overflow locations.
- Yard grading using minimal surface slopes to promote infiltration.
- Construction of bioretention cells to treat runoff from the main driveway and individual driveways.
- Construction of soakaway pits for rooftop runoff to infiltrate and evaporate all rooftop runoff.
- Suitable construction mitigation measures to be utilized during the site development.

Table 6 summarizes the proposed measures that in conglomeration will provide an overall TSS removal of greater than 75% which meets and exceeds the criteria outlined.

Table 6
Proposed Approach for Water Quality Treatment

Surface	Method	Effective TSS	Area (m2)	% Area of Site	Overall TSS Removal (%)
Asphalt Main Driveway & Individual Driveways directed to bioretention cells	LID Bioretention Cells	50%	975	36.1%	18.0
Rooftop leaders directed to soakaway pits	LID Soakaway Pit	100%	1,038	38.4%	38.4
Landscape Area	Filtration / Evapotranspiration	80%	648	24.1%	19.3
South-west portion of driveway draining to Dunkerron Ave. ROW	N/A	0%	39	1.4%	0.0%
Total			**2,700**	**100**	**75.7**

Detailed sizing calculations for the proposed bioretention cells and soakaway pits based on guidance provided in the LID manual are included in Appendix E.

7.6 Storm Sewer System

As part of the site development, a storm sewer is proposed to be installed within the boulevard south-east of Dunkerron Avenue. The storm sewer will collect and convey overflow drainage from the bioretention cells for units 8-14, as well as runoff from the east side of Dunkerron Avenue (67m of road / boulevard / front of lots). The proposed storm sewers have been sized for the 5 year design storm event. Two off road catch basins will be installed as part of the work, which will eliminate the need for the existing driveway culverts in the area of the proposed storm sewer. The boulevards will be re-graded to ensure a 150mm depression below the edge of gravel shoulder elevation and will provide a minimum slope of 2% from the property line to depression. The external proposed storm sewer network and grading notes are shown on the engineering plans appended to this report.

The design calculations are included in Appendix E.

8.0 EROSION AND SEDIMENT CONTROL

Sedimentation and erosion control measures are required during construction and until such a time that site development has been completed, the internal driveway has been paved and vegetation established.

The use of various siltation control measures will be implemented to protect the adjacent properties and receiving storm sewer from migrating sediments.

These works include but may not be limited to:

- Installation of a 1.2m high steel wire silt fence along the perimeter of the property.
- Filter cloth and stone placement over catch basins in the vicinity of the site until the driveways have been paved and landscaped areas have been vegetated.
- Installation of construction mud mat at site entrances.

The location of the sediment controls and typical details are shown on Drawing ESC-1 – Erosion and Sediment Control Plan appended to this report.

8.1 During Construction

Prior to carrying out site grading the siltation barriers and mud mat noted above shall be in place.

Other temporary installations of silt fence or other appropriate measures may be required during grading to minimize silt migration from the site. The measures will need to be removed, replaced and relocated as required during the construction period until the site works have been completed and vegetation established.

During construction all stockpiled material will be placed up-gradient of the siltation controls.

If site works are to continue through the winter and spring the engineer shall be contacted by the owner to review the measures in place with the contractor on a regular basis to ensure that the facilities are adequate and in good working order.

All reasonable methods to control erosion and sedimentation are to be taken during construction.

8.2 Monitoring and Maintenance

It is the responsibility of the contractor and owner to maintain the siltation control devices until suitable grass cover has been established.

A regular review of the facilities by the contractor shall be carried out during the construction period to ensure that the facilities are being properly maintained, and if necessary replaced. Inspection reports are to be completed weekly and distributed to the owner, contractor, and Town.

The contractor should inspect the siltation devices immediately after each rainfall. Damaged devices should be repaired immediately and additional devices installed if necessary.

Silt should be removed from the fencing when deposits reach approximately 250mm above original ground.

8.3 Contingency Plan

Should the erosion control measures fail and sediment migrate beyond the limits of the control works, the following tasks are required to be completed:

- The Town of Wasaga Beach, County of Simcoe and Ministry of the Environment should be notified of the event. The area will be assessed and cleaned up to the satisfaction of the agencies.

- Additional sedimentation facilities be installed in the area of the migration and down gradient to contain the sediment.

- The Ministry of Natural Resources should be contacted in the event that sediment reaches any adjacent water bodies.

9.0 SUMMARY AND CONCLUSIONS

The findings of this report are summarized as follows:

- Sanitary servicing for the proposed development will be provided via a 200mm dia. sewer connection to the existing 450mm dia. concrete sanitary sewer on Dunkerron Avenue.
- Water supply for the site will be provided via a 150m dia. water service connection to the existing 150mm dia. PVC watermain on Dunkerron Avenue.
- Peak flow attenuation for all storm events will be provided utilizing low impact development techniques including bioretention cells and soakaway pits.
- Quality control for the development will be provided using low impact development techniques, soft landscaping and gentle grading across the site.
- Suitable measures can be implemented during construction to protect the adjacent properties and ROW's from migrating sediments.

It is therefore recommended that:

1) This report and drawings be submitted to the Town of Wasaga Beach in support of site plan approval.
2) The construction mitigation measures outlined in this report are utilized as a guideline for construction mitigation management on this site.

All of which is respectfully submitted.

PINESTONE ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
J. H. VOISIN
100172758
SEP. 18. 2017
PROVINCE OF ONTARIO

Brigitte South

Brigitte South, C.E.T.

Joe Voisin, P.Eng.,

APPENDIX A

Geotechnical Report prepared by Peto MacCallum – December 2016

Peto MacCallum Ltd.
CONSULTING ENGINEERS

TEST PIT INVESTIGATION
SEVEN TOWNHOMES
760 MOSLEY STREET
WASAGA BEACH, ONTARIO
for
ADA HOMES LTD.

PETO MacCALLUM LTD.
19 CHURCHILL DRIVE
BARRIE, ONTARIO
L4N 8Z5
PHONE: (705) 734-3900
FAX: (705) 734-9911
EMAIL: barrie@petomaccallum.com

Distribution:
2 cc: ADA Homes Ltd. (+email)
1 cc: PML Barrie

PML Ref.: 16BF078
Report: 1
December 2016

Peto MacCallum Ltd.
CONSULTING ENGINEERS

December 7, 2016

PML Ref.: 16BF078
Report: 1

Mr. Andrew Adamak
ADA Homes Ltd.
1 Channen Court
Barrie, Ontario
L4M 6T4

Dear Mr. Adamak

Test Pit Investigation
Seven Townhomes
760 Mosley Street
Wasaga Beach, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for the work was provided by Mr. A. Adamak, verbally, and by reception of a full retainer.

It is understood that the property at 760 Mosley Street is slated for a seven unit townhouse development. The building will be three stories slab-on-grade, without basement. PML was requested to attend the site to witness and log test pits to be excavated around the proposed building. It is understood that a furniture store previously occupied the now vacant site, which has since been demolished and removed.

The purpose of this investigation was to explore the subsurface soil and ground water conditions at the site, and based on the findings, provide comments and geotechnical recommendations for foundation design.

Geoenvironmental assessment of the site, observations, recording, testing or assessment of the environmental conditions of the site and ground water was not within the Terms of Reference and no work has been carried out in this regard. If excess materials requiring off-site disposal are generated during construction, a program of soil sampling and testing will be needed to determine the chemical properties of the material and evaluate options for off-site disposal.

The comments provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as described in the report. Any changes in plans, will require review by PML to assess the applicability of the report, and may require modified recommendations, additional analysis and/or investigation.

19 Churchill Drive, Barrie, Ontario L4N 8Z5
Tel: (705) 734-3900 Fax: (705) 734-9911
E-mail: barrie@petomaccallum.com
BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO

INVESTIGATION PROCEDURES

The field work for this investigation was carried out on December 2, 2016 and consisted of Test Pits 1 to 3 excavated to 1.7 to 2.1 m depth around the proposed townhome at the locations as shown on Drawing 1, attached.

Co-ordination of clearances of public and private underground utilities was provided by the Client.

The test pits were advanced using a rubber track miniature excavator, supplied and operated by a local excavating contractor working under the direction of the Client.

Ground water conditions in the test pits were closely monitored during the course of the field work.

The test pit locations were established in the field by PML, after consultation with the Client, and cognizant of existing underground utilities.

The surface elevation of the test pit was established based on a Temporary Bench Mark (BM) provided by the client, described as follows:

TBM: Temporary Bench Mark

Top of Top Nut of Fire Hydrant, at North Corner of Site

Elevation 100.00 (Metric, Assigned)

SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Log of Test Pit sheets for details of the subsurface conditions, including soil classifications, and ground water observations.

A 100 to 200 mm layer of granular base was encountered at the surface of all three test pits.

Below the granular base, sand fill was observed to 0.7 to 1.3 m depth (elevation 97.7 to 98.35). Trace organics were noted in Test Pit 1; plastic pieces in Test Pit 2; and topsoil pockets, roots, concrete blocks, pipe pieces and bricks were observed in Test Pit 3.

Below the fill in all three test pits, a native sand deposit was encountered to the 1.7 to 2.1 m depth of excavation. The sand was judged to be compact and was observed to be moist.

Upon completion of excavation, no water or wet cave was observed in any of the test pits.

Ground water levels will fluctuate seasonally, and in response to variations in precipitation.

GEOTECHNICAL ENGINEERING CONSIDERATIONS

It is understood that the property at 760 Mosley Street is slated for a seven unit townhouse development. The building will be three stories slab-on-grade with no basement. The site is pictured below:

Photograph 1 – The site, view from the east corner, looking northwest. It is understood that a furniture store previously occupied the now vacant site, which has since been demolished and removed.

Photograph 2 - Test Pit 3 showing upper fill containing construction debris.

It is assumed that the finished floor slab-on-grade will be just above existing ground grade, with exterior footings at about 1.5 m depth, cognizant of the normal earth cover for frost protection, and interior footings at about 0.5 m depth.

Based on the test pits, there is existing fill to 0.7 to 1.3 m depth, with compact native sand below. The upper existing fill is not suitable for supporting footings or floor slab-on-grade.

It is necessary to remove all existing fill down to the native soil (encountered at 0.7 to 1.3 m depth in the test pits) and replace it with engineered fill, comprising select soil placed in maximum 300 mm thick lifts and compaction to 100% Standard Proctor maximum dry density.

It is cautioned that, due to the old furniture store that was demolished, the extent of fill and construction debris could be variable across the site.

The engineered fill pad must extend at least 1 m beyond the edge of the perimeter footings, then downward at no steeper than 1 Horizontal: 1 Vertical, to meet the underlying native soil.

Excavated site soil will be suitable for reuse on a select basis only, subject to moisture content control and exclusion of organics, construction debris and other deleterious materials.

Full time field review by geotechnical personnel will be needed to approve subgrade preparation, backfill materials, placement procedures and ensure the specified compaction is achieved throughout.

Reference is made in Appendix A for General Guidelines for Engineered Fill Construciton.

Provided the site is improved with engineered fill as discussed above, then the building can be supported on standard spread and strip footings at normal design depth, founded on engineered fill or native soil, whichever is first encountered. A geotechnical bearing resistance at SLS of 150 kPa and factored geotechnical resistance at ULS of 225 kPa are available for design.

The geotechnical bearing resistance at SLS is based on 25 mm of settlement in the bearing stratum. Differential settlement should not exceed 75% of this value.

Footings subject to frost action should be provided with 1.2 m of earth cover or equivalent.

Prior to placement of concrete for footings, the subgrade surface must be examined by PML to check the design bearing capacity is available and/or assess areas where a reducing bearing capacity may be necessitated.

Floor slab-on-grade can be constructed on the engineered fill. A minimum of 150 mm of clear stone (19 mm nominal size) or Granular A compacted to 100% Standard Proctor maximum dry density is recommended as a moisture barrier under the concrete floor slab. The floor slab should be at least 150 mm above the outside ground grade, which should be sloped to promote surface drainage away from the building.

The site soils should be considered as Type 3 soil requiring excavation sidewalls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation in accordance with the Occupational Health and Safety Act.

Ground water was not encountered during excavation of the test pits. Accordingly, conventional sump pumping techniques should be adequate to handle any nuisance ground water seepage quantities, if encountered.

The comments and recommendations provided in the report are based on the information revealed in the test pits. Conditions away from the test pits may vary, particularly where service trenches exist. Geotechnical review during construction should be on going to confirm the subsurface conditions are substantially similar to those encountered in the test pit, which may otherwise require modification to the original recommendations.

CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.

LICENSED PROFESSIONAL ENGINEER
R. R. BLAIR
100222748
Dec. 7, 2016
PROVINCE OF ONTARIO

Richard Blair, P.Eng.
Project Engineer

LICENSED PROFESSIONAL ENGINEER
T. LEE-BUN
26277509
Dec 7/16
PROVINCE OF ONTARIO

Turney Lee-Bun, P.Eng.
Vice-President

RB/TLB:tc

Enclosures:
List of Abbreviations
Log of Test Pit Nos. 1 to 3
Drawing 1 - Test Pit Location Plan
Appendix A – Guidelines for Engineered Fill

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 1

1 of 1

PROJECT Test Pit Investigation - Seven Townhomes
LOCATION 760 Mosley Street, Wasaga Beach, Ontario
EXCAVATION METHOD Excavator
BORING DATE December 2, 2016
PML REF. 16BF078
ENGINEER TLB
TECHNICIAN RB

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q — 50 100 150 200
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● — 20 40 60 80
PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L
WATER CONTENT (%) — 10 20 30 40
UNIT WEIGHT kN/m³
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

SOIL PROFILE		SAMPLES					
DEPTH ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	UNIT WEIGHT	GROUND WATER OBSERVATIONS AND REMARKS
0.0	SURFACE ELEVATION 99.10						
	SURFACE GRANULAR: 100 mm granular base, moist						
99.00	FILL: Brown, sand, some silt, trace gravel, trace organics, moist				99		
0.80 98.30	SAND: Compact, light brown, sand, trace silt, stratified, moist				98		
2.1 97.0	TEST PIT TERMINATED AT 2.1 m				97		Upon completion of excavating No seepage No sidewall sloughing

Depth scale: 0.0 1.0 2.0 3.0 4.0 5.0

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF TEST PIT NO. 2

PROJECT Test Pit Investigation - Seven Townhomes
LOCATION 760 Mosley Street, Wasaga Beach, Ontario
EXCAVATION METHOD Excavator
BORING DATE December 2, 2016
PML REF. 16BF078
ENGINEER TLB
TECHNICIAN RB

SOIL PROFILE			SAMPLES			ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q 50 100 150 200 DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● 20 40 60 80	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30 40	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES					
	SURFACE ELEVATION 99.05									
0.15	SURFACE GRANULAR: 150 mm granular base, moist					99				
98.90 0.70	FILL: Brown, sand, some silt, trace gravel, plastic pieces, moist									
98.35 1.7	SAND: Compact, light brown, sand, trace silt, stratified, moist					98				
97.4	TEST PIT TERMINATED AT 2.1 m									Upon completion of excavating No seepage No sidwall sloughing

NOTES

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

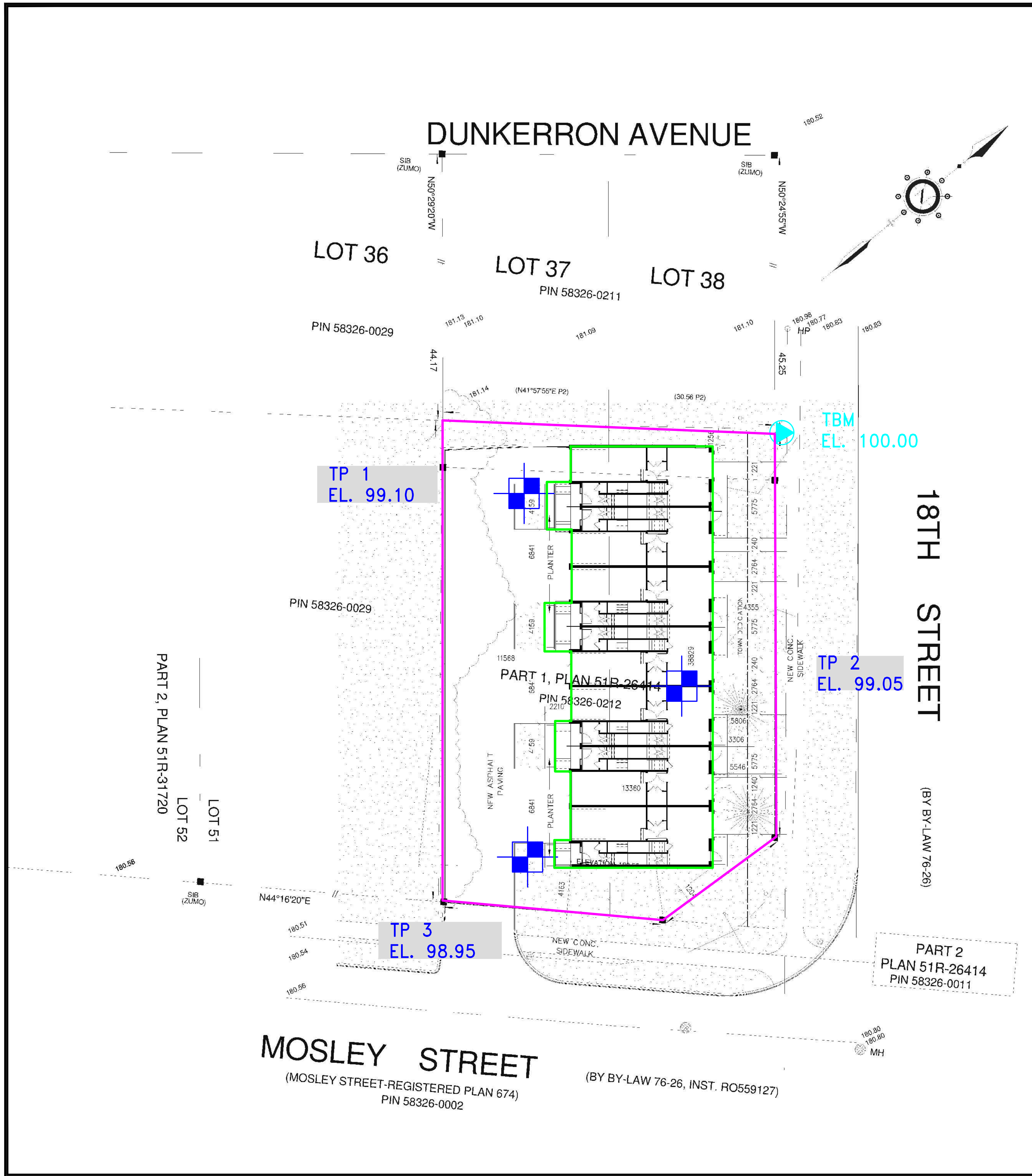
LOG OF TEST PIT NO. 3

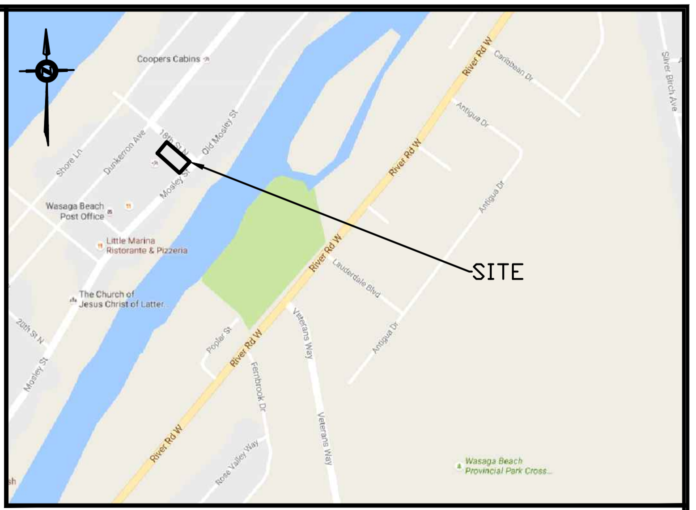
1 of 1

PROJECT Test Pit Investigation - Seven Townhomes
LOCATION 760 Mosley Street, Wasaga Beach, Ontario
EXCAVATION METHOD Excavator
BORING DATE December 2, 2016
PML REF. 16BF078
ENGINEER TLB
TECHNICIAN RB

SOIL PROFILE			SAMPLES							
DEPTH / ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q 50 100 150 200 DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● 20 40 60 80	PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%) 10 20 30 40	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	SURFACE ELEVATION 98.95									
	SURFACE GRANULAR: 200 mm granular base, moist									
0.20 98.75	FILL: Brown, sand, some silt, trace gravel, topsoil pockets, roots, concrete blocks, pipe pieces, bricks, moist									
1.0						98				
1.3 97.7	SAND: Compact, light brown, sand, trace silt, stratified, moist									
1.7 97.3	TEST PIT TERMINATED AT 2.1 m									Upon completion of excavating No seepage No sidewall sloughing
2.0										
3.0										
4.0										
5.0										

NOTES





KEY PLAN
WASAGA BEACH, ONTARIO

LEGEND:

🟪	PROPOSED SITE LIMITS
🟩	PROPOSED BUILDING
TP 1 EL. 99.10	TEST PIT 1 SURFACE ELEVATION
TBM EL. 100.00	TEMPORARY BENCH MARK TOP OF TOP NUT OF FIRE HYDRANT, AT NORTH CORNER OF SITE ELEVATION 100.00 (METRIC, ASSIGNED)

REFERENCE:

BASE PLAN PROVIDED BY CLIENT.

0m 20 40 60 80 100

SCALE

TEST PIT LOCATION PLAN

TEST PIT INVESTIGATION – SEVEN TOWNHOMES
760 MOSLEY STREET
WASAGA BEACH, ONTARIO

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	TLB	DEC. 2016	AS SHOWN	16BF078	1
APPROVED	TLB				

APPENDIX A

Guidelines for Engineered Fill

ENGINEERED FILL

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

1. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

2. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and

- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

3. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

4. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

5. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

6. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

7. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

8. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

9. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

10. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

11. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.

APPENDIX B

Sanitary Sewer Design Sheet
Fire Flow Calculation for Water Supply

PEL
PINESTONE ENGINEERING LTD.

760 Mosley Street
Wasaga Beach

Project Number: 17-11290B
Date: May 12, 2017
Design By: BS
Checked By: JV
File: Z:\Project Documents\11290B Mosley St. Townhomes\SWM.FSR\Sanitary Calcs.xls

SANITARY SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Drainage Area Plan No: SS1

Design Parameters

Average Daily Flow
Residential 0.0041 L/s/c
Commercial 1.5 L/s/ha
Industrial 1.0 L/s/ha
Inst. / School 2.5 L/s/ha

Mannings "*n*" 0.0130
Min. Velocity 0.40 m/sec
Max. Velocity 3.0 m/sec
Residential Harmon Peaking Factor (F)
Residential Areas Infiltration 0.28 L/s/ha

PINESTONE ENGINEERING LTD.

LOCATION				RESIDENTIAL AREAS and POPULATION						SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN						
										HECTARES AND FLOW OF EACH ZONING																			
										2.50 *L/s/ha*			1.50 *L/s/ha*			1.00 *L/s/ha*													
STREET	AREA NO.	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA	UNITS	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	TOTALS-C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
				ha	*2.6pp/unit*	*1000s*	*1000s*		*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*m*	*%*	*mm*	*L/sec.*	*m/s*	*m/s*
Site		SANMH1	SANMH2	0.20	14.00	0.036	0.036	4.340661	0.6399											0.20	0.20	0.0560	0.6959	80.0	1.00	200	32.7818	1.044	0.421
Site		SANMH2	Prop. Tee	0.01	0.00	0.000	0.036	4.340661	0.6399											0.01	0.21	0.0588	0.6987	7.0	1.00	200	32.7818	1.044	0.421
																Capacity of Immediate Downstream Reach of 450mm dia. Sanitary Sewer =								112.0	0.12	450	98.7135	0.621	

Fire Flow Calculations – Fire Underwriters Survey 1999

Building Area = 3,008.92 (3 storeys-all 14 units)

Fire demands for the proposed development were calculated in accordance with the Fire Underwriters Survey (FUS) as follows:

$$F = 220C(A)^{0.5}$$

Where,
F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
A = total floor area of building (excluding basements) calculated as per FUS

C = 1.0 for wood construction

F = 220*1.0(3,008.92)^0.5
F = 12,068 L/min
F = 201 L/sec

Reductions:

Reduction for low hazard occupancy (-25%)
Fire Flow = 150.8 L/sec

Exposure charge for existing building to the north-east (+10%)
Exposure charge for existing building to the south-east (+5%)
Exposure charge for existing building to the south-west (+15%)
Exposure charge for existing building to the north-west (+10%)

Total charge = 40% or 60.3 L/sec on the 150.8 L/sec fire flow

Required fire flow as per FUS 1999 calculation = 212 L/sec

APPENDIX C

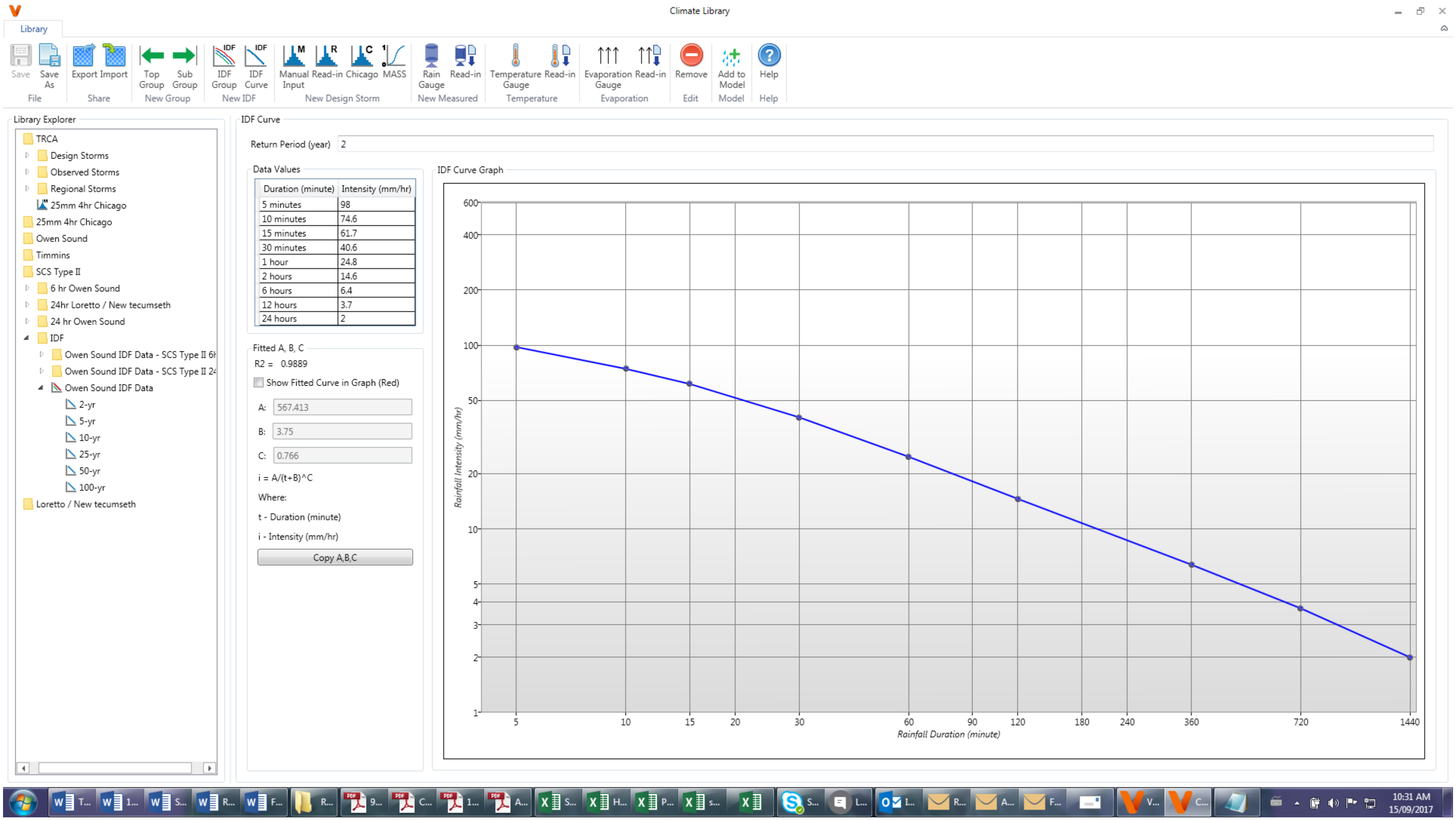
Owen Sound IDF Rainfall data
IDF Parameter Logs

PINESTONE ENGINEERING LTD.

```
                        Appendix C - Owen Sound IDF Data.txt
                    Environment Canada/Environnement Canada

           Short Duration Rainfall Intensity-Duration-Frequency Data
          Données sur l'intensité, la durée et la fréquence des chutes
                            de pluie de courte durée

                 Gumbel - Method of moments/Méthode des moments

                                   2014/12/21

================================================================================

 OWEN SOUND MOE                                         ON        6116132

 Latitude:  44 35'N    Longitude: 80 56'W    Elevation/Altitude: 178        m

 Years/Années :  1965 - 2006         # Years/Années :     37

================================================================================

********************************************************************************

Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

********************************************************************************

          Year  5 min 10 min 15 min 30 min    1 h    2 h    6 h   12 h   24 h
         Année
          1965   12.7   16.0   23.9   28.7   32.3   35.1   35.1   35.1   35.1
          1966    6.9    8.9   13.2   18.8   21.8   22.1   30.5   32.0   32.3
          1967   11.4   15.7   21.3   38.1   43.9   43.9   43.9   46.5   52.6
          1968   14.7   19.6   24.4   31.2   43.9   56.4   63.8   68.1   75.9
          1969    6.6   13.0   17.0   22.9   30.2   39.4   49.3   71.9   71.9
          1970   10.2   18.8   25.4   32.5   41.4   42.7   42.7   55.6   55.6
          1971    7.6   12.2   17.3   26.9   36.1   39.1   55.6   55.6   55.9
          1972    7.4   13.2   18.3   19.3   20.1   23.6   36.8   42.7   42.7
          1973    5.8   10.2   12.4   16.3   16.5   16.5   18.3   29.7   33.5
          1974    6.6   10.4   11.7   16.3   18.8   23.9   43.9   43.9   45.0
          1975    6.9    9.4    9.4   11.2   17.0   17.0   24.6   25.4   25.4
          1976    7.1   13.2   17.3   22.4   22.6   22.6   29.2   31.7   34.8
          1977   13.0   14.7   18.0   22.9   22.9   25.1   26.9   37.3   37.3
          1979   18.4   26.0   26.4   30.4   32.1   32.2   41.1   47.1   48.3
          1980    9.4   16.1   19.8   30.8   32.0   41.3   45.7   45.7   72.4
          1981  -99.9  -99.9  -99.9  -99.9   14.5   19.7   29.4   40.6   41.4
          1982   11.8   11.8   12.0   12.0   12.6   23.0   52.6   56.6   56.8
          1983    5.6    7.8    8.2   15.7   27.3   38.2   46.8   50.0   53.4
          1984    6.9   11.4   15.6   22.3   36.4   45.1   47.0   47.0   47.0
          1985   10.1   16.0   18.0   22.4   25.9   32.1   44.8   62.4   73.0
          1986    4.6    8.4   11.2   12.4   16.2   16.3   39.2   43.3   60.9
          1987    9.0   13.5   15.1   15.1   15.5   15.8   17.0   28.0   28.0
          1988   11.4   14.2   18.0   21.0   24.8   27.7   35.9   45.0   54.0
          1989    6.9   12.1   12.7   13.5   13.9   14.0  -99.9  -99.9   47.2
          1990   10.6   15.0   18.7   27.4   34.1   35.9   40.0   45.4   45.4
          1991    5.6    7.0    8.1    8.3   10.5   18.0   27.3   28.6   38.9
          1992    4.8    7.4    8.4    8.9   14.1   18.2   27.9   43.3   47.5
          1993    7.7   15.4   23.1   25.9   27.9   28.6   33.1   39.0   49.9
          1994    5.2   10.4   15.4   27.4   32.4   32.6   35.7   35.7   48.0
          1995    7.6   12.0   12.5   12.5   16.4   21.6   30.5   33.2   38.7
          1996   10.8   15.3   18.1   27.8   32.5   41.7   47.0   55.9   55.9
          1999    7.2   11.1   15.2   20.6   21.7   21.7   36.5   40.8   42.4
          2000    7.2   14.1   18.0   33.0   53.0   70.3   79.3   79.5   80.5
          2001    5.2    9.0   11.6   14.6   21.4   24.4   30.8   35.6   42.0
          2002    8.2   11.0   12.8   15.8   16.4   25.8   53.0   54.8   65.2
```

```
          2003   11.2   16.3   20.6   24.5   30.5   32.2   32.4   32.4   48.1
          2004    6.5    9.7   11.3   16.9   27.8   35.4   54.6   70.8   76.2
          2006   12.2   17.4   20.0   30.6   53.1   74.8   74.8   76.6   85.8
        ---------------------------------------------------------------------
        # Yrs.     37     37     37     37     38     38     37     37     38
        Années
          Mean    8.7   13.1   16.2   21.5   26.6   31.4   40.6   46.3   51.2
       Moyenne
     Std. Dev.    3.1    3.9    4.9    7.6   10.9   14.0   13.8   14.1   15.1
    Écart-type
         Skew.   1.08   0.96   0.23   0.13   0.73   1.39   0.89   0.76   0.58
   Dissymétrie
      Kurtosis   4.39   5.17   2.55   2.32   3.23   5.37   4.30   3.09   2.87

          *-99.9 Indicates Missing Data/Données manquantes

 Warning: annual maximum amount greater than 100-yr return period amount
 Avertissement : la quantité maximale annuelle excède la quantité
                 pour une période de retour de 100 ans
          Year/Année      Duration/Durée       Data/Données          100-yr/ans
                1979               5 min               18.4                18.4
                1979              10 min               26.0                25.2

********************************************************************************

Table 2a : Return Period Rainfall Amounts (mm)
           Quantité de pluie (mm) par période de retour

********************************************************************************

 Duration/Durée        2        5       10       25       50      100   #Years
                  yr/ans   yr/ans   yr/ans   yr/ans   yr/ans   yr/ans   Années
          5 min      8.2     10.9     12.7     15.0     16.7     18.4       37
         10 min     12.4     15.9     18.1     21.0     23.1     25.2       37
         15 min     15.4     19.8     22.7     26.3     29.0     31.7       37
         30 min     20.3     27.0     31.5     37.1     41.3     45.5       37
          1 h       24.8     34.5     40.8     48.9     54.9     60.9       38
          2 h       29.1     41.5     49.7     60.1     67.8     75.5       38
          6 h       38.4     50.5     58.6     68.7     76.3     83.8       37
         12 h       44.0     56.5     64.7     75.2     83.0     90.7       37
         24 h       48.7     62.0     70.9     82.0     90.3     98.5       38

********************************************************************************

Table 2b :

 Return Period Rainfall Rates (mm/h) - 95% Confidence limits
 Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

********************************************************************************

 Duration/Durée        2        5       10       25       50      100   #Years
                  yr/ans   yr/ans   yr/ans   yr/ans   yr/ans   yr/ans   Années
          5 min     98.0    130.8    152.4    179.8    200.2    220.3       37
                +/- 11.0 +/- 18.5 +/- 24.9 +/- 33.6 +/- 40.2 +/- 46.9       37
         10 min     74.6     95.2    108.7    125.9    138.7    151.3       37
                +/-  6.9 +/- 11.6 +/- 15.6 +/- 21.1 +/- 25.2 +/- 29.4       37
         15 min     61.7     79.1     90.6    105.2    116.0    126.8       37
                +/-  5.8 +/-  9.8 +/- 13.3 +/- 17.9 +/- 21.4 +/- 24.9       37
         30 min     40.6     54.1     63.0     74.3     82.7     91.0       37
                +/-  4.5 +/-  7.6 +/- 10.3 +/- 13.8 +/- 16.6 +/- 19.3       37
          1 h       24.8     34.5     40.8     48.9     54.9     60.9       38
                +/-  3.2 +/-  5.4 +/-  7.3 +/-  9.8 +/- 11.7 +/- 13.6       38
```

```
          2 h       14.6     20.8     24.9     30.1     33.9     37.7       38
                +/-  2.0 +/-  3.5 +/-  4.7 +/-  6.3 +/-  7.5 +/-  8.8       38
          6 h        6.4      8.4      9.8     11.5     12.7     14.0       37
                +/-  0.7 +/-  1.1 +/-  1.5 +/-  2.1 +/-  2.5 +/-  2.9       37
         12 h        3.7      4.7      5.4      6.3      6.9      7.6       37
                +/-  0.3 +/-  0.6 +/-  0.8 +/-  1.1 +/-  1.3 +/-  1.5       37
         24 h        2.0      2.6      3.0      3.4      3.8      4.1       38
                +/-  0.2 +/-  0.3 +/-  0.4 +/-  0.6 +/-  0.7 +/-  0.8       38

********************************************************************************

Table 3 : Interpolation Equation / Équation d'interpolation: R = A*T^B

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)
RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)
 T = Rainfall duration (h) / Durée de la pluie (h)

********************************************************************************

       Statistics/Statistiques      2      5     10     25     50    100
                               yr/ans yr/ans yr/ans yr/ans yr/ans yr/ans
      Mean of RR/Moyenne de RR   36.3   47.8   55.4   65.0   72.2   79.3
    Std. Dev. /Écart-type (RR)   34.8   45.4   52.5   61.4   68.1   74.7
        Std. Error/Erreur-type   10.4   13.9   16.3   19.4   21.7   24.0
               Coefficient (A)   21.8   28.8   33.5   39.3   43.7   48.0
         Exponent/Exposant (B) -0.701 -0.703 -0.704 -0.705 -0.706 -0.706
 Mean % Error/% erreur moyenne   10.2   12.2   13.1   13.8   14.3   14.8
```



Return Period (year) 2

Data Values

Duration (minute)	Intensity (mm/hr)
5 minutes	98
10 minutes	74.6
15 minutes	61.7
30 minutes	40.6
1 hour	24.8
2 hours	14.6
6 hours	6.4
12 hours	3.7
24 hours	2

Fitted A, B, C

R2 = 0.9889

☐ Show Fitted Curve in Graph (Red)

A: 567.413

B: 3.75

C: 0.766

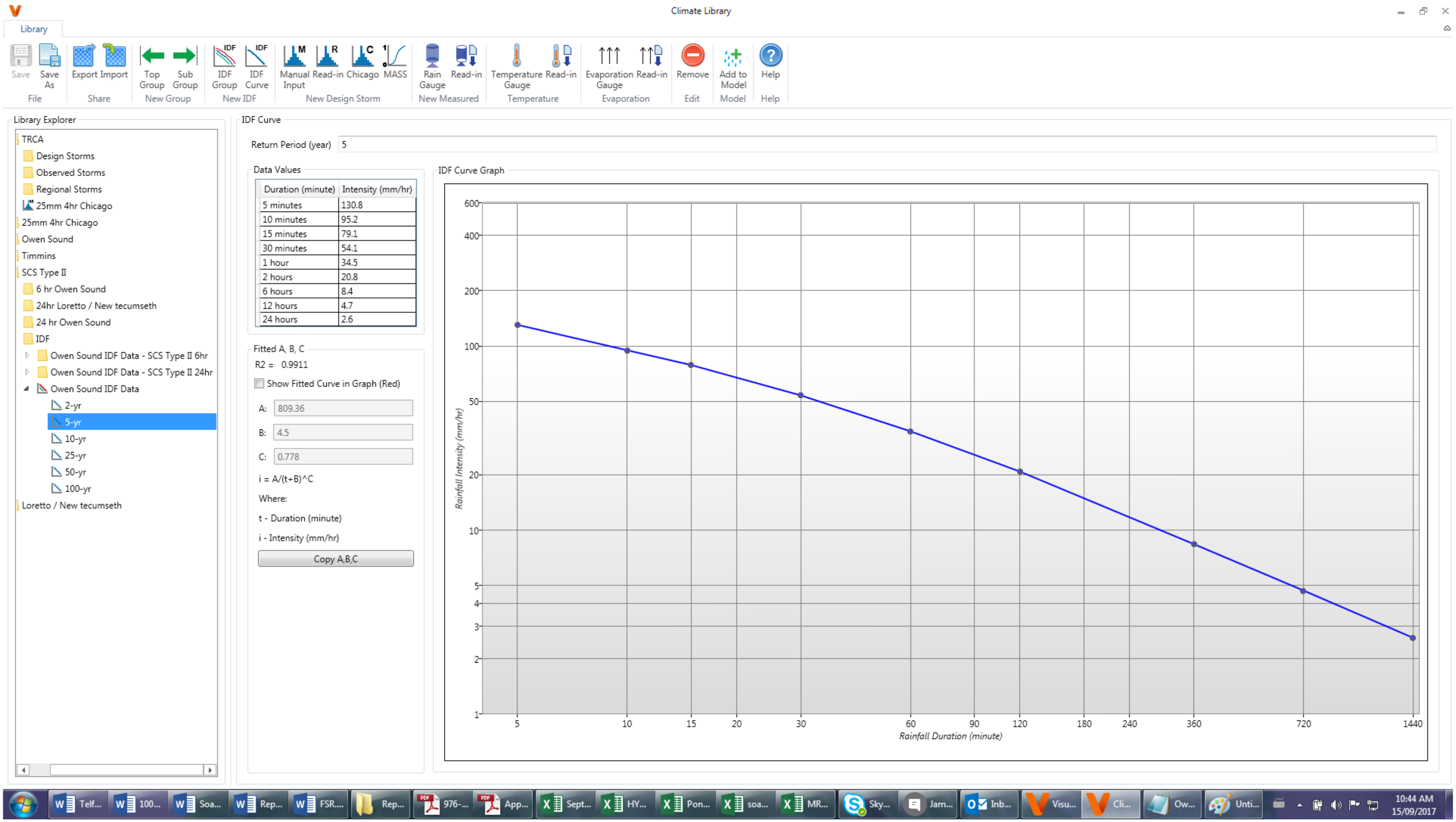
i = A/(t+B)^C

Where:

t - Duration (minute)

i - Intensity (mm/hr)

Copy A,B,C



Return Period (year) 5

Duration (minute)	Intensity (mm/hr)
5 minutes	130.8
10 minutes	95.2
15 minutes	79.1
30 minutes	54.1
1 hour	34.5
2 hours	20.8
6 hours	8.4
12 hours	4.7
24 hours	2.6

R2 = 0.9911

☐ Show Fitted Curve in Graph (Red)

A: 809.36

B: 4.5

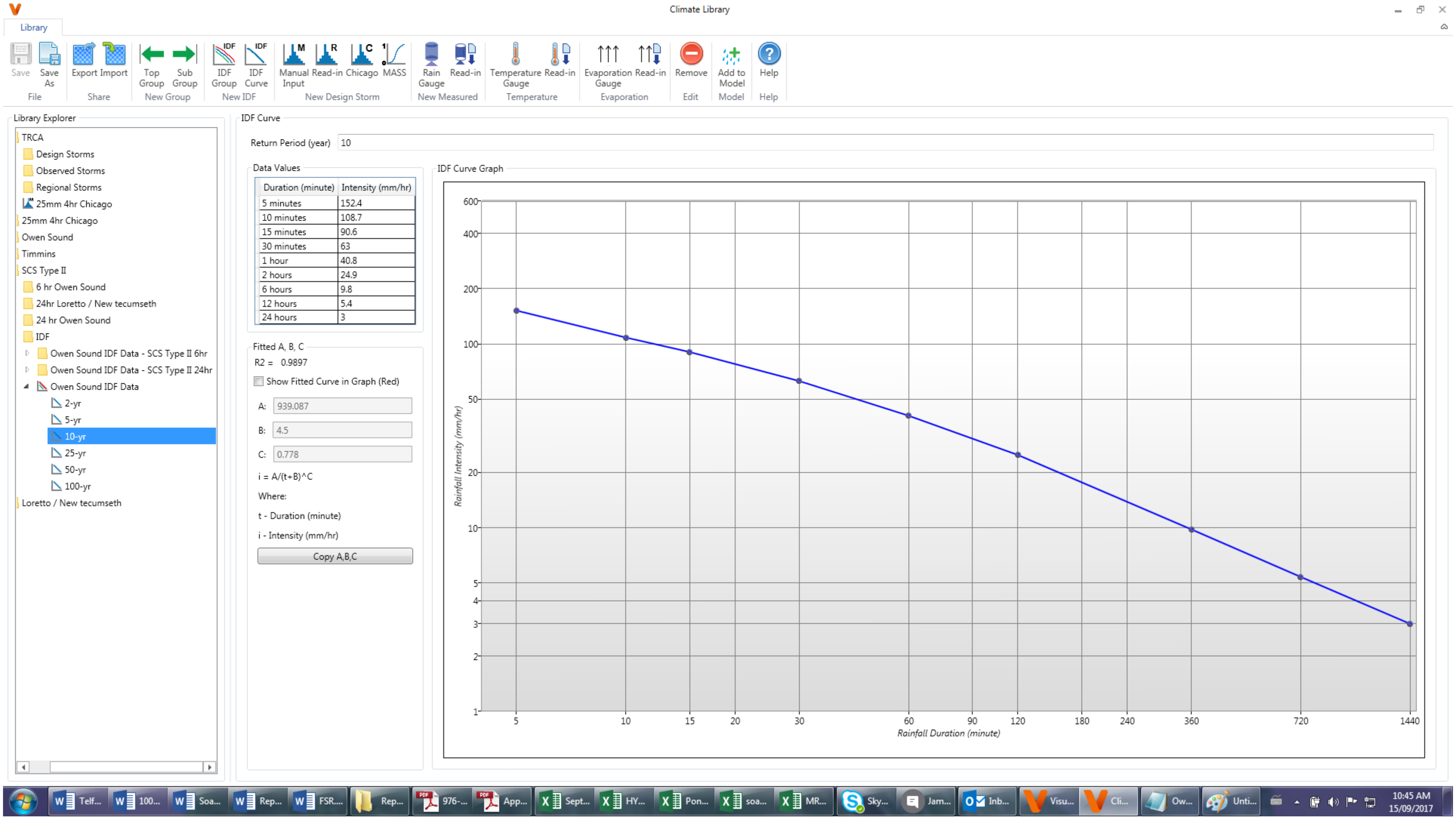
C: 0.778

i = A/(t+B)^C

Where:

t - Duration (minute)

i - Intensity (mm/hr)



Return Period (year) 10

Duration (minute)	Intensity (mm/hr)
5 minutes	152.4
10 minutes	108.7
15 minutes	90.6
30 minutes	63
1 hour	40.8
2 hours	24.9
6 hours	9.8
12 hours	5.4
24 hours	3

R2 = 0.9897

☐ Show Fitted Curve in Graph (Red)

A: 939.087

B: 4.5

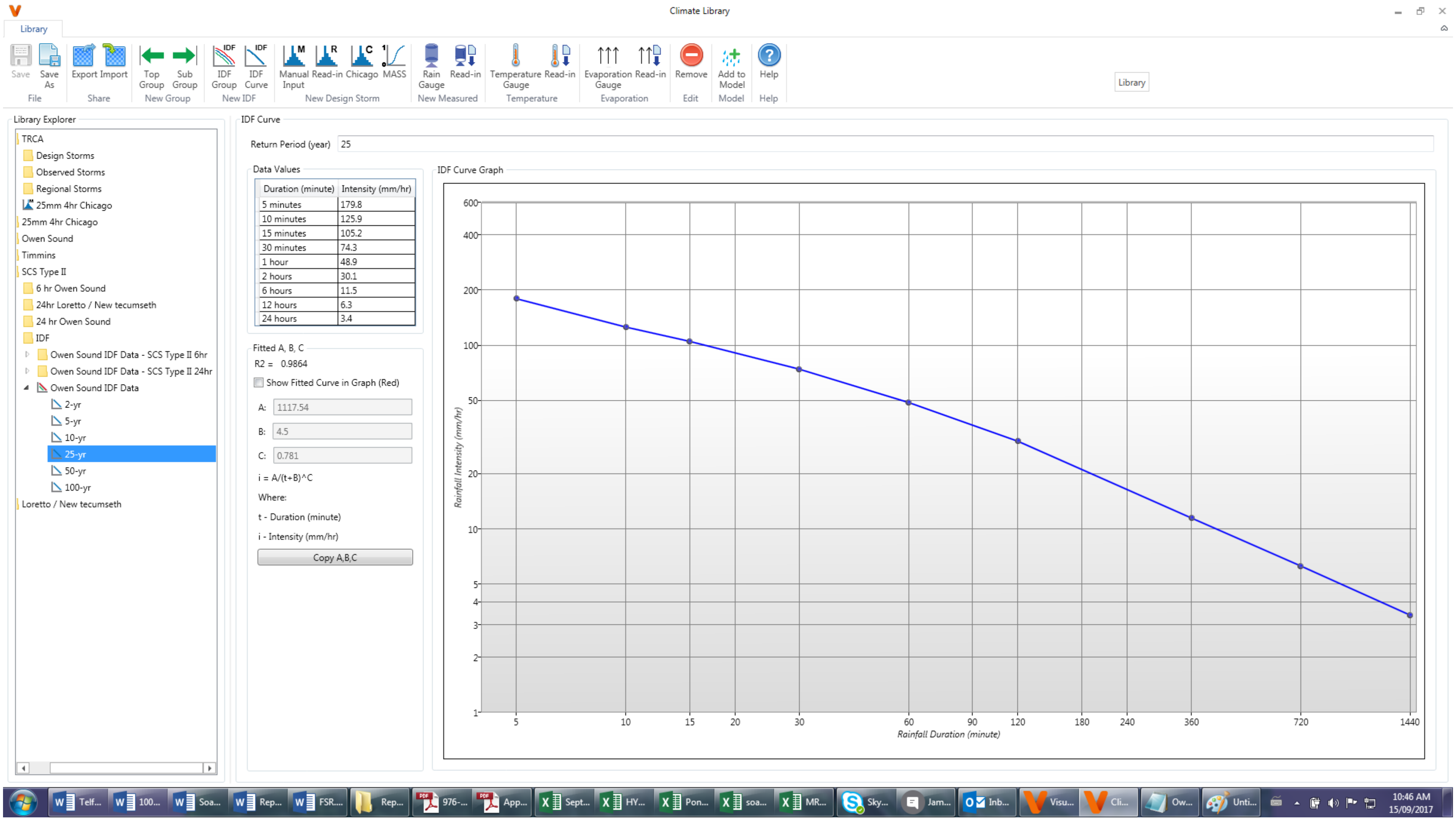
C: 0.778

i = A/(t+B)^C

Where:

t - Duration (minute)

i - Intensity (mm/hr)



Return Period (year) 25

Duration (minute)	Intensity (mm/hr)
5 minutes	179.8
10 minutes	125.9
15 minutes	105.2
30 minutes	74.3
1 hour	48.9
2 hours	30.1
6 hours	11.5
12 hours	6.3
24 hours	3.4

R2 = 0.9864

☐ Show Fitted Curve in Graph (Red)

A: 1117.54

B: 4.5

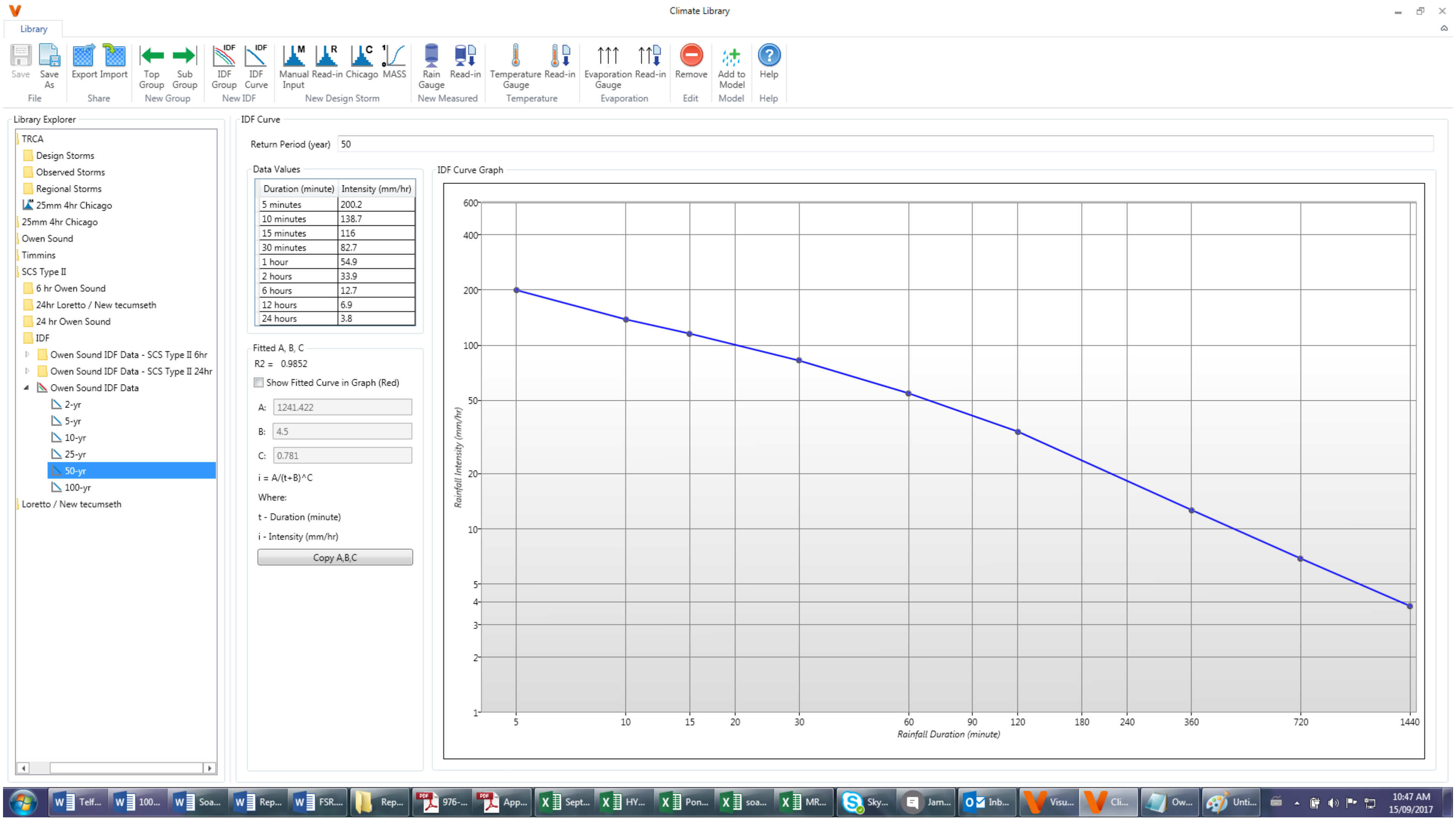
C: 0.781

i = A/(t+B)^C

Where:

t - Duration (minute)

i - Intensity (mm/hr)



Return Period (year) 50

Duration (minute)	Intensity (mm/hr)
5 minutes	200.2
10 minutes	138.7
15 minutes	116
30 minutes	82.7
1 hour	54.9
2 hours	33.9
6 hours	12.7
12 hours	6.9
24 hours	3.8

R2 = 0.9852

☐ Show Fitted Curve in Graph (Red)

A: 1241.422

B: 4.5

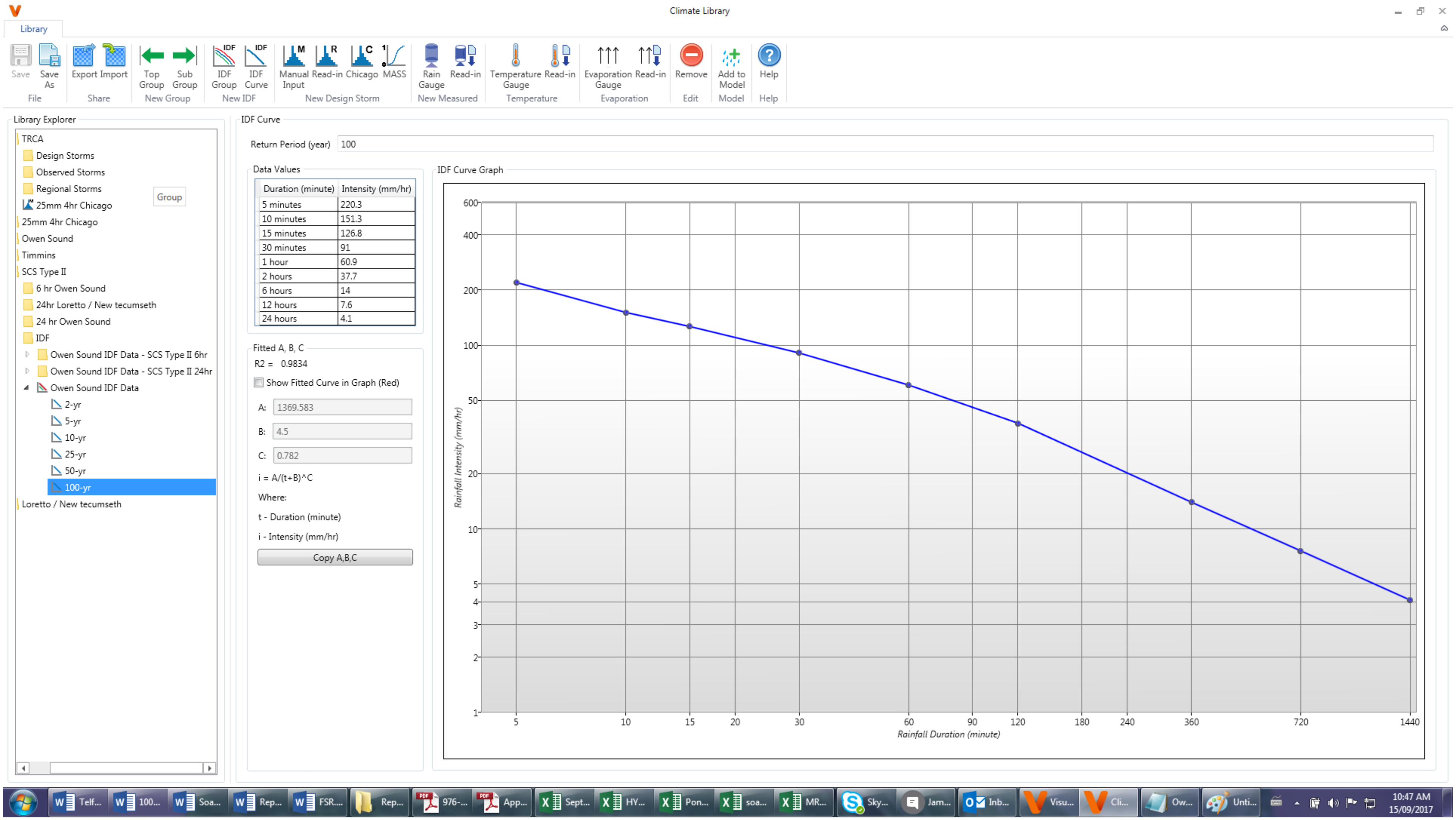
C: 0.781

i = A/(t+B)^C

Where:

t - Duration (minute)

i - Intensity (mm/hr)



Return Period (year) 100

Data Values

Duration (minute)	Intensity (mm/hr)
5 minutes	220.3
10 minutes	151.3
15 minutes	126.8
30 minutes	91
1 hour	60.9
2 hours	37.7
6 hours	14
12 hours	7.6
24 hours	4.1

Fitted A, B, C

R2 = 0.9834

☐ Show Fitted Curve in Graph (Red)

A: 1369.583

B: 4.5

C: 0.782

i = A/(t+B)^C

Where:

t - Duration (minute)

i - Intensity (mm/hr)

Copy A,B,C

APPENDIX D

Rational Method Calculations

PEL
PINESTONE ENGINEERING LTD.

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH
MODIFIED RATIONAL METHOD - PRE-DEVELOPMENT CATCHMENT 101
Town of Wasaga Beach

Project Number:	17-11290B
Date:	September 15, 2017
Design By:	TG / BS
File:	Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

IDF Curve Parameters				Intensity
Storm Event	**A**	**B**	**C**	**(mm/hr)**
2 year	567.413	3.75	0.7660	134.48
5 year	809.36	4.5	0.7780	172.38
10 year	939.087	4.5	0.7780	200.00
25 year	1117.54	4.5	0.7810	236.60
50 year	1241.422	4.5	0.7810	262.82
100 year	1369.583	4.5	0.7820	289.38

Tc = 2.8 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	101	
Catchment Area	=	0.1200	ha
Flow Length	=	40	m
Slope	=	0.01	m/m
Weighted Runoff Coefficient	=	0.77	

Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	2.8	min.
Airport Formula (use for C<0.4)	=	6.8	min.

Pre-Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
101	1,200					964			236				0.77

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
101	0.77	0.77	0.77	0.85	0.93	0.97

Pre-Development Peak Flow Rates:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
101	0.035	0.044	0.051	0.067	0.081	0.093

Notes:
1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH

MODIFIED RATIONAL METHOD - PRE-DEVELOPMENT CATCHMENT 102

Town of Wasaga Beach

PEL
PINESTONE ENGINEERING LTD.

Project Number: 17-11290B
Date: September 15, 2017
Design By: TG / BS
File: Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

IDF Curve Parameters				Intensity
Storm Event	**A**	**B**	**C**	**(mm/hr)**
2 year	567.413	3.75	0.7660	125.75
5 year	809.36	4.5	0.7780	162.10
10 year	939.087	4.5	0.7780	188.08
25 year	1117.54	4.5	0.7810	222.44
50 year	1241.422	4.5	0.7810	247.10
100 year	1369.583	4.5	0.7820	272.05

Tc = 3.4 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	102	
Catchment Area	=	0.1500	ha
Flow Length	=	50	m
Slope	=	0.011	m/m
Weighted Runoff Coefficient	=	0.63	

Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	3.4	min.
Airport Formula (use for C<0.4)	=	10.5	min.

Pre-Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
102	1,500			148		147		892	313				0.63

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
102	0.63	0.63	0.63	0.69	0.75	0.78

Pre-Development Peak Flow Rates:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
102	0.033	0.042	0.049	0.064	0.078	0.089

Notes:

1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH
MODIFIED RATIONAL METHOD - POST DEVELOPMENT CATCHMENTS 201
Town of Wasaga Beach

PEL
PINESTONE ENGINEERING LTD.

Project Number: 17-11290B
Date: September 15, 2017
Design By: TG / BS
File: Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

IDF Curve Parameters				Intensity
Storm Event	**A**	**B**	**C**	**(mm/hr)**
2 year	567.413	3.75	0.7660	180.82
5 year	809.36	4.5	0.7780	224.44
10 year	939.087	4.5	0.7780	260.41
25 year	1117.54	4.5	0.7810	308.36
50 year	1241.422	4.5	0.7810	342.55
100 year	1369.583	4.5	0.7820	377.29

Tc = 0.7 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	201	
Catchment Area	=	0.0179	ha
Flow Length	=	10	m
Slope	=	0.021	m/m
Weighted Runoff Coefficient	=	0.86	

Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	0.7	min.
Airport Formula (use for C<0.4)	=	1.9	min.

Post Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
201	179					168			11				0.86

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
201	0.86	0.86	0.86	0.95	1.00	1.00

Post-Development Peak Flow Rates:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
201	0.008	0.010	0.011	0.015	0.017	0.019

Notes:
1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

* Runoff Reduction of 45% can be expected for areas that are draining to Biorentention cells. "Low Impact Development Stormwater Management Planning Design Guide 2010"

Post-Development Peak Flow Rates including run-off reduction from bioretention cell:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
201	0.004	0.005	0.006	0.008	0.009	0.010

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH

MODIFIED RATIONAL METHOD - POST DEVELOPMENT CATCHMENTS 202 , 204 - 206

Town of Wasaga Beach

PEL
PINESTONE ENGINEERING LTD.

Project Number:	17-11290B
Date:	September 15, 2017
Design By:	TG / BS
File:	Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

Storm Event	IDF Curve Parameters A	B	C	Intensity (mm/hr)
2 year	567.413	3.75	0.7660	184.00
5 year	809.36	4.5	0.7780	227.85
10 year	939.087	4.5	0.7780	264.37
25 year	1117.54	4.5	0.7810	313.08
50 year	1241.422	4.5	0.7810	347.78
100 year	1369.583	4.5	0.7820	383.06

Tc = 0.6 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	202, 204-206	
Catchment Area	=	0.0121	ha
Flow Length	=	8	m
Slope	=	0.02	m/m
Weighted Runoff Coefficient	=	0.84	

Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	0.6	min.
Airport Formula (use for C<0.4)	=	1.9	min.

Post Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
202, 204-206	121					110			11				0.84

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
202, 204-206	0.84	0.84	0.84	0.93	1.00	1.00

Post-Development Peak Flow Rates:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
202, 204-206	0.005	0.006	0.007	0.010	0.012	0.013

Notes:
1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

* Runoff Reduction of 45% can be expected for areas that are draining to Biorentention cells. "Low Impact Development Stormwater Management Planning Design Guide 2010"

Post-Development Peak Flow Rates including run-off reduction from bioretention cell:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
202, 204-206	0.003	0.004	0.004	0.005	0.006	0.007

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH
MODIFIED RATIONAL METHOD - POST DEVELOPMENT CATCHMENTS 203
Town of Wasaga Beach

PEL
PINESTONE ENGINEERING LTD.

Project Number:	17-11290B
Date:	September 15, 2017
Design By:	TG / BS
File:	Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

	IDF Curve Parameters			Intensity
Storm Event	**A**	**B**	**C**	**(mm/hr)**
2 year	567.413	3.75	0.7660	184.00
5 year	809.36	4.5	0.7780	227.85
10 year	939.087	4.5	0.7780	264.37
25 year	1117.54	4.5	0.7810	313.08
50 year	1241.422	4.5	0.7810	347.78
100 year	1369.583	4.5	0.7820	383.06

Tc = 0.6 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	203	
Catchment Area	=	0.0206	ha
Flow Length	=	8	m
Slope	=	0.022	m/m
Weighted Runoff Coefficient	=	0.69	

Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	0.6	min.
Airport Formula (use for C<0.4)	=	2.9	min.

Post Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
203	206					140			66				0.69

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
203	0.69	0.69	0.69	0.76	0.83	0.86

Post-Development Peak Flow Rates:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
203	0.007	0.009	0.010	0.014	0.017	0.019

Notes:
1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

* Runoff Reduction of 45% can be expected for areas that are draining to Biorentention cells. "Low Impact Development Stormwater Management Planning Design Guide 2010"

Post-Development Peak Flow Rates including run-off reduction from bioretention cell:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
203	0.004	0.005	0.006	0.007	0.009	0.010

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH

MODIFIED RATIONAL METHOD - POST DEVELOPMENT CATCHMENTS 207

Town of Wasaga Beach

PINESTONE ENGINEERING LTD.

Project Number:	17-11290B
Date:	September 15, 2017
Design By:	TG / BS
File:	Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

IDF Curve Parameters				Intensity
Storm Event	**A**	**B**	**C**	**(mm/hr)**
2 year	567.413	3.75	0.7660	187.31
5 year	809.36	4.5	0.7780	231.39
10 year	939.087	4.5	0.7780	268.48
25 year	1117.54	4.5	0.7810	317.96
50 year	1241.422	4.5	0.7810	353.20
100 year	1369.583	4.5	0.7820	389.04

Tc = 0.5 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	207	
Catchment Area	=	0.0106	ha
Flow Length	=	6	m
Slope	=	0.018	m/m
Weighted Runoff Coefficient	=	0.75	

Time of Concentration Results			
Bransby Williams Formula	=	0.5	min.
(use for C>=0.4)			
Airport Formula	=	2.3	min.
(use for C<0.4)			

Post Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
207	106					81			25				0.75

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
207	0.75	0.75	0.75	0.82	0.90	0.93

Post-Development Peak Flow Rates:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
207	0.004	0.005	0.006	0.008	0.009	0.011

Notes:
1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

* Runoff Reduction of 45% can be expected for areas that are draining to Biorentention cells. "Low Impact Development Stormwater Management Planning Design Guide 2010"

Post-Development Peak Flow Rates including run-off reduction from bioretention cell:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
207	0.002	0.003	0.003	0.004	0.005	0.006

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH
MODIFIED RATIONAL METHOD - POST DEVELOPMENT CATCHMENTS 208-222
Town of Wasaga Beach

PEL PINESTONE ENGINEERING LTD.

Project Number: 17-11290B
Date: September 15, 2017
Design By: TG / BS
File: Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

IDF Curve Parameters				Intensity
Storm Event	**A**	**B**	**C**	**(mm/hr)**
2 year	567.413	3.75	0.7660	166.66
5 year	809.36	4.5	0.7780	208.96
10 year	939.087	4.5	0.7780	242.46
25 year	1117.54	4.5	0.7810	287.03
50 year	1241.422	4.5	0.7810	318.85
100 year	1369.583	4.5	0.7820	351.15

Tc = 1.2 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	208-222	
Catchment Area	=	0.0074	ha
Flow Length	=	13.3	m
Slope	=	0.01	m/m
Weighted Runoff Coefficient	=	0.90	

Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	1.2	min.
Airport Formula (use for C<0.4)	=	2.4	min.

Post Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
208-222	74						74						0.90

* single unit

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
208-222	0.90	0.90	0.90	0.99	1.00	1.00

Post-Development Peak Flow Rates:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
208-222	0.003	0.004	0.004	0.006	0.007	0.007

Notes:
1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

* Runoff Reduction of 85% can be expected for areas that are draining to soakaway pits. "Low Impact Development Stormwater Management Planning Design Guide 2010"

Post-Development Peak Flow Rates including run-off reduction from bioretention cell:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
208-222	0.000	0.001	0.001	0.001	0.001	0.001

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH
MODIFIED RATIONAL METHOD - POST DEVELOPMENT CATCHMENTS 223
Town of Wasaga Beach

PINESTONE ENGINEERING LTD.

Project Number: 17-11290B
Date: September 15, 2017
Design By: TG / BS
File: Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

IDF Curve Parameters				Intensity
Storm Event	**A**	**B**	**C**	**(mm/hr)**
2 year	567.413	3.75	0.7660	194.35
5 year	809.36	4.5	0.7780	238.86
10 year	939.087	4.5	0.7780	277.14
25 year	1117.54	4.5	0.7810	328.26
50 year	1241.422	4.5	0.7810	364.64
100 year	1369.583	4.5	0.7820	401.66

Tc = 0.3 minutes

$$i = \frac{A}{(t_c + B)^c}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min)
(see time of concentration calculations for values)

Runoff Coefficients	
Land Use	"C"
Unimproved Area - <7%	0.25
Pasture Land	0.45
Woodlot	0.42
Lakes / Swamps	0.05
Impervious Area	0.90
Building Area	0.90
Gravel	0.75
Lawn	0.25
Townhouse Lot Area	0.60
Y	0.00
Z	0.00

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	223	
Catchment Area	=	0.0687	ha
Flow Length	=	5.6	m
Slope	=	0.03	m/m
Weighted Runoff Coefficient	=	0.66	

Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	0.3	min.
Airport Formula (use for C<0.4)	=	2.4	min.

Post Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	Townhouse Lot Area Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
223	687					132				555			0.66

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
223	0.66	0.66	0.66	0.72	0.79	0.82

Post-Development Peak Flow Rates:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
223	0.024	0.030	0.035	0.045	0.055	0.063

Notes:
1) Runoff coefficients from Town of Wasaga Beach Engineering Standards Manual - Pg 38 / 39
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per the Engineering Standards Manual - Pg 39

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH

MODIFIED RATIONAL METHOD - PRE TO POST DEVELOPMENT WITH SWM FLOW SUMMARY

Town of Wasaga Beach

Project Number:	17-11290 B
Date:	September 15, 2017
Design By:	TG / BS
File:	Z:\Project Documents\11290B Mosley St. Townhomes\Design\SWM\MRM SWM Calculations.xls

Storm Event	**2 Year**	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
	(m^3/s)	**(m^3/s)**	**(m^3/s)**	**(m^3/s)**	**(m^3/s)**	**(m^3/s)**
Pre-Development Catchment 101	0.035	0.044	0.051	0.067	0.081	0.093
Pre-Development Catchment 102	0.033	0.042	0.049	0.064	0.078	0.089
Total Pre-Development Flow	**0.068**	**0.087**	**0.101**	**0.131**	**0.159**	**0.182**
Post Development Catchment 201	0.008	0.010	0.011	0.015	0.017	0.019
Post Development Catchment 202	0.005	0.006	0.007	0.010	0.012	0.013
Post Development Catchment 203	0.007	0.009	0.010	0.014	0.017	0.019
Post Development Catchment 204	0.005	0.006	0.007	0.010	0.012	0.013
Post Development Catchment 205	0.005	0.006	0.007	0.010	0.012	0.013
Post Development Catchment 206	0.005	0.006	0.007	0.010	0.012	0.013
Post Development Catchment 207	0.004	0.005	0.006	0.008	0.009	0.011
Post Development Catchments 208-222	0.046	0.058	0.067	0.088	0.098	0.108
Post Development Catchment 223	0.024	0.030	0.035	0.045	0.055	0.063
Total Post Development Flow	**0.111**	**0.137**	**0.159**	**0.208**	**0.243**	**0.271**
Total Difference from Post to Pre	**0.043**	**0.051**	**0.059**	**0.077**	**0.084**	**0.089**
Post Development with SWM Catchment 201	0.004	0.005	0.006	0.008	0.009	0.010
Post Development with SWM Catchment 202	0.003	0.004	0.004	0.005	0.006	0.007
Post Development with SWM Catchment 203	0.004	0.005	0.006	0.007	0.009	0.010
Post Development with SWM Catchment 204	0.003	0.004	0.004	0.005	0.006	0.007
Post Development with SWM Catchment 205	0.003	0.004	0.004	0.005	0.006	0.007
Post Development with SWM Catchment 206	0.003	0.004	0.004	0.005	0.006	0.007
Post Development with SWM Catchment 207	0.002	0.003	0.003	0.004	0.005	0.006
Post Development with SWM Catchments 208-222	0.007	0.009	0.010	0.013	0.015	0.016
Post Development with SWM Catchment 223 (uncontrolled)	0.024	0.030	0.035	0.045	0.055	0.063
Total Post Development Flow with SWM	**0.053**	**0.066**	**0.076**	**0.100**	**0.119**	**0.134**

APPENDIX E

Bioretention Cell and Soakaway Pit Sizing Calculations

Storm Sewer System Sizing Calculations

PEL
PINESTONE ENGINEERING LTD.

760 Mosley Street

Town of Wasaga Beach

STORM SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 17-11290B
Date: May 1, 2017
Design By: BS
Checked By: BS
File: Z:\Project Documents\11290B Mosley St. Townhomes\SWM.FSR\11290 Storm Sewer Design Sheet (Owen Sound IDF).xls

Drainage Area Plan No: SEE DRAINAGE FIGURE 3 IN SWM REPORT

Design Parameters

100 YEAR STORM

Q=kAIR, k=0.00278
Intensity (I) = $a/(tc+b)^c$
a = 2721.062
b = 13.7983
c = 0.8900

Manning's "n" 0.013
Min. Velocity 0.800 m/s
Max. Velocity 6.000 m/s

5 YEAR STORM

Q=kAIR, k=0.00278
Intensity (I) = a/(tc+b)c
a = 1235.5320
b = 9.9424
c = 0.8452

Manning's "n" 0.01300
Min. Velocity 0.80000 m/s
Max. Velocity 6.00000 m/s

PINESTONE ENGINEERING LTD.

LOCATION				STORMWATER FLOW 5 YEAR STORM								DESIGN						
STREET	AREA NUMBER	MANHOLE LOCATION		AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME		RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY	% PIPE FULL
		FROM MH	TO MH					TOTAL	IN PIPE									
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/s*	*mm*	*m*	*%*	*L/s*	*m/s*	*m/s*	*%*
* Townhouse block adjacent to south-east property limit	204-207	Bioretention Cell between Units 6/7	EX. CB #2	0.047	0.82	0.0385	0.0385	10.0000	1.3765	162.03639	17.26152	200	61.0	0.40	20.74355	0.6603	0.7386	83.21
* Townhouse block adjacent to north-west property limit	201-203	Bioretention Cell between Units 8/9	DICB#1	0.051	0.75	0.0380	0.0764	10.0000	0.7676	162.03639	34.29503	250	40.0	0.40	37.61057	0.7662	0.8685	91.18
Dunkerron Avenue	eastside road/blvd	DICB#1	DICB#2	0.086	0.52	0.0447	0.1211	10.7676	0.7240	95.35975	31.99554	300	38.0	0.40	61.15893	0.8652	0.8748	52.32
Dunkerron Avenue	eastside road/blvd	DICB#2	DICB#3	0.048	0.46	0.0221	0.1432	11.4916	0.4422	92.63010	36.74508	300	24.0	0.40	61.15893	0.8652	0.9045	60.08

* Sized for 100 year post development flow rate

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH
SOAKAWAY PIT SIZING
Town of Wasaga Beach

PINESTONE ENGINEERING LTD.

Project Number: 17-11290B
Date: September 15, 2017
Design By: TG / BS
File: Z:\Project Documents\11290B Mosley St. Townhomes\SWM.FSR\soakaway pit sizing.xlsx

Depth of Stone Reservoir Sizing:

Dr max = i*ts/Vr

Where:

dr max = Maximum stone Reservoir Depth (mm)
I = Infiltration rate for native soils (mm/hr)
Vr - Void space ratio for aggregate used (typically 0.4 for 50mm clean stone)
ts = Time to drain (design for 48 hour drain time recommended)

* Maximum recommended stone depth is 2 metres

i=	150
ts=	48
Vr=	0.4

Dr max=	18000

Water Quality Volume:

WQV = C * *d* rain * A

Where:

WQV = 10 year water quality volume (m3)
C = Runoff coefficient
d rain = depth of rain (10 year 4 hr storm) (mm)
A = Area of catchment (m2)

C=	0.9
drain =	54.1
A=	74

WQV=	3.60

Footpirnt Surface Area:

Af = WQV/(dr*Vr)

Where:

Af - Footprint Surface area (m2)
WQV = 10 year water quality volume (m3)
dr = Stone Reservoir depth (m)
Vr - Void space ratio for aggregate used (typically 0.4 for 50mm clean stone)

WQV=	3.60
dr =	2
Vr =	0.4

Af =	4.50

760 MOSLEY STREET TOWNHOUSE DEVELOPMENT, WASAGA BEACH
BIORETENTION CELL SIZING
Town of Wasaga Beach

PEL
PINESTONE ENGINEERING LTD.

Project Number: 17-11290B
Date: September 15, 2017
Design By: TG / BS
File: Z:\Project Documents\11290B Mosley St. Townhomes\SWM.FSR\soakaway pit sizing.xlsx

Sizing calculations based on recommendations provided in the Low Impact Development Stormwater Management Planning and Design Guide prepared by the Toronto and Region Conservation Authority and Credit Valley Conservation Authority.

For designs that include an underdrain, the stone reservoir is calculated using the following:

Dr max = i*ts/Vr

Where:

dr max = Maximum depth of stone below the underdrain pipe (mm)
I = Infiltration rate for native soils (mm/hr)
Vr - Void space ratio for aggregate used (typically 0.4 for 50mm clean stone)
ts = Time to drain (design for 48 hour drain time recommended)

i=	150
ts=	48
Vr=	0.4

Dr max=	18000

Water Quality Volume:

WQV = C * *d* rain * A

Where:
WQV = 10 year water quality volume (m3)
C = Runoff coefficient
d rain = depth of rain (10 year 4 hr storm) (mm)
A = Area of catchment (m2)

C=	0.86
d*rain* =	54.1
A=	179

WQV=	8.33

Footprint Surface Area:

Af = WQV/(dc*Vr)

Where:

Af - Footprint Surface area (m2)
WQV = 10 year water quality volume (m3)
dc = Bioretention cell depth (m)
Vr - Void space ratio for aggregate used (typically 0.4 for 50mm clean stone)

WQV=	8.33
dr =	2.4
Vr =	0.4

Af =	8.68

APPENDIX F

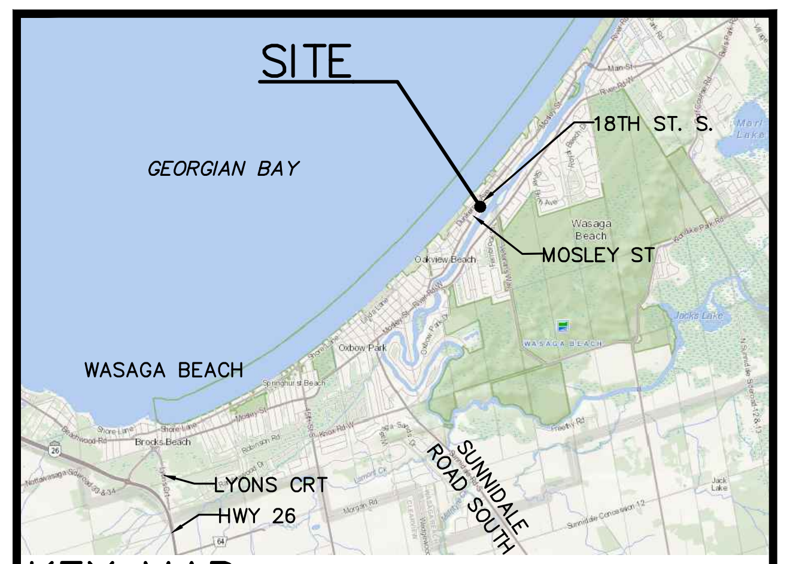
Drawings

PINESTONE ENGINEERING LIMITED | www.pel.ca

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

Drawings shall not be used for construction unless sealed and signed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

Any errors and/or omissions shall be reported to Pinestone Engineering Ltd. without delay.



KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY DINO ASTRI SURVEYING LTD., OCTOBER 2016.

LEGEND

●	EX. HP/LS
◘	EX. CATCHBASIN
⌖	EX. HYDRANT
⋈	EX. VALVE AND BOX
⊘	EX. SANITARY MANHOLE
○	EX. STORM MANHOLE
——246.00——	CONTOUR
HW———HW	OVERHEAD HYDRO LINE
⇦	DIRECTION OF MAJOR OVERLAND FLOW
▭	EX. ASPHALT
▨	EX. GRAVEL
◡◡◡◡◡	TREE LINE

BENCHMARK

TBM#1
SSIB AT THE SOUTHWEST CORNER OF PARCEL HAVING AN ELEVATION OF 180.55m

NO.	YY.MM.DD	REVISION	BY

SEAL

J. H. VOISIN
100172758

NORTH ARROW

DESIGN BY:	T.G./B.S.
DRAWN BY:	G.N.
CHECKED	J.V.
DATE:	SEPTEMBER 2017
SCALE:	1:250

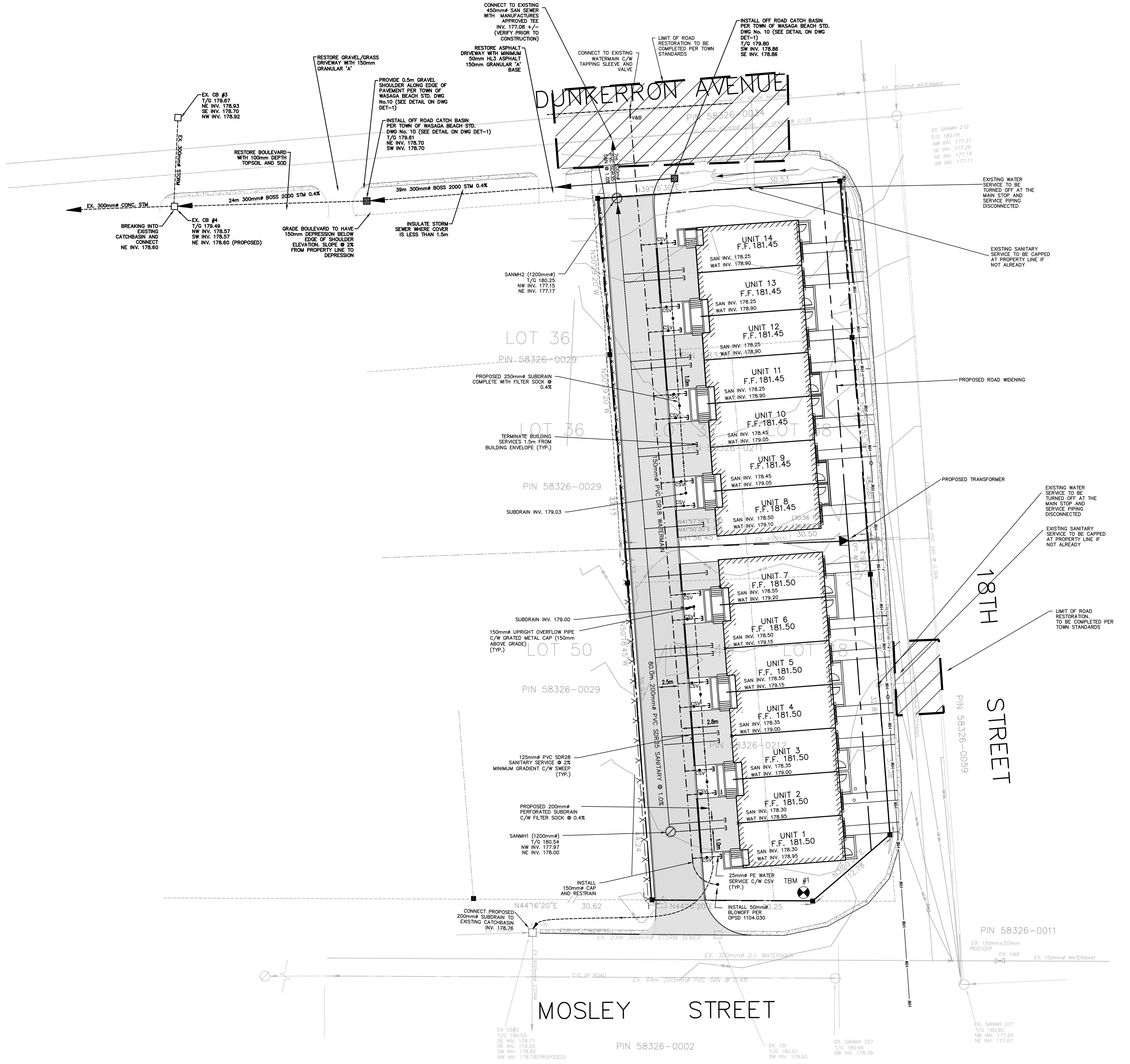
CLIENT/PROJECT

760 MOSLEY STREET
ADA HOMES
TOWN OF WASAGA BEACH

DRAWING TITLE

EXISTING CONDITIONS PLAN

PROJECT NO.	DRAWING NO.	REVISION
17-11290-B	EX-1	0



LEGEND

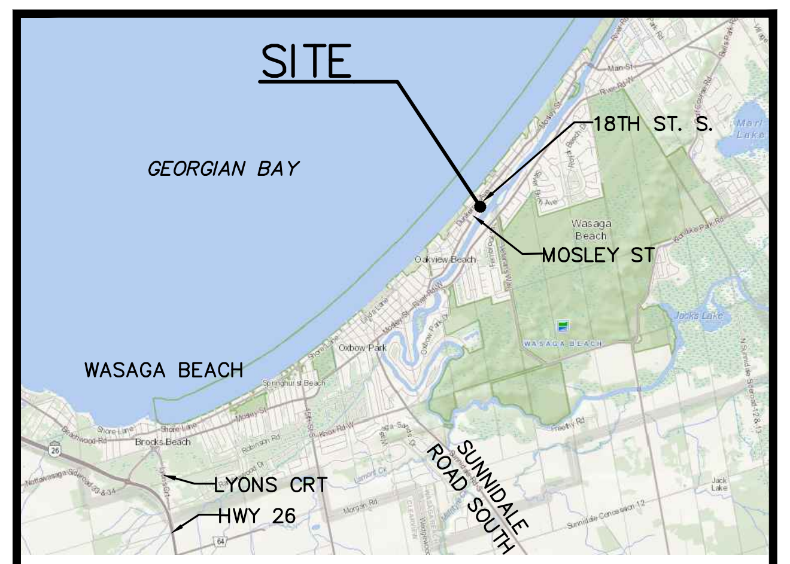
■	PROPOSED CATCHBASIN/DITCH INLET
◒	PROPOSED SANITARY MANHOLE
○	EX. HP/LS
⌑	EX. CATCHBASIN
⌖	EX. HYDRANT
⋈	EX. VALVE AND BOX
⊘	EX. SANITARY MANHOLE
○	EX. STORM MANHOLE
——246.00——	CONTOUR
HW———HW	OVERHEAD HYDRO WIRE
●	GRATED OVERFLOW PIPE
——●	PROPOSED 25mmø PE SERIES 160 WATER SERVICE C/W CSV
——⊐	PROPOSED 125mmø PVC DR28 SANITARY SERVICE
→----→	PROPOSED SUBDRAIN
◭	PROPOSED TRANSFORMER

PINESTONE ENGINEERING LIMITED | www.pel.ca

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

Drawings shall not be used for construction unless sealed and signed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

Any errors and/or omissions shall be reported to Pinestone Engineering Ltd. without delay.



KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY DINO ASTRI SURVEYING LTD., OCTOBER 2016.
2. SITE PLAN PROVIDED BY ISM ARCHITECTS

LEGEND

BENCHMARK

TBM#1
SSIB AT THE SOUTHWEST CORNER OF PARCEL HAVING AN ELEVATION OF 180.55m

NO.	YY.MM.DD	REVISION	BY

SEAL

NORTH ARROW

J. H. VOISIN
100172758
SEP. 18. 2017

DESIGN BY: T.G./B.S.
DRAWN BY: G.N.
CHECKED J.V.
DATE: SEPTEMBER 2017
SCALE: 1:250

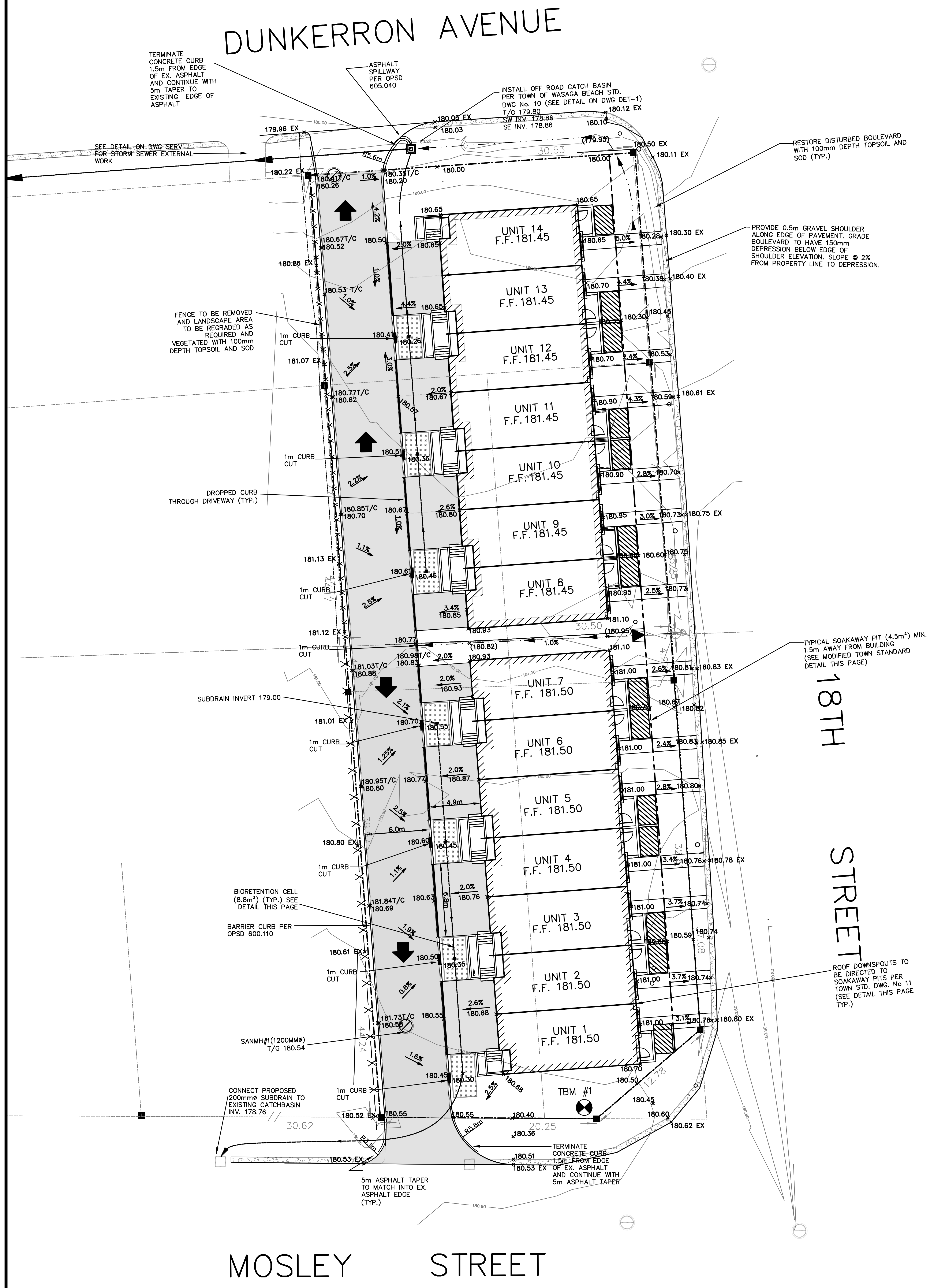
CLIENT/PROJECT

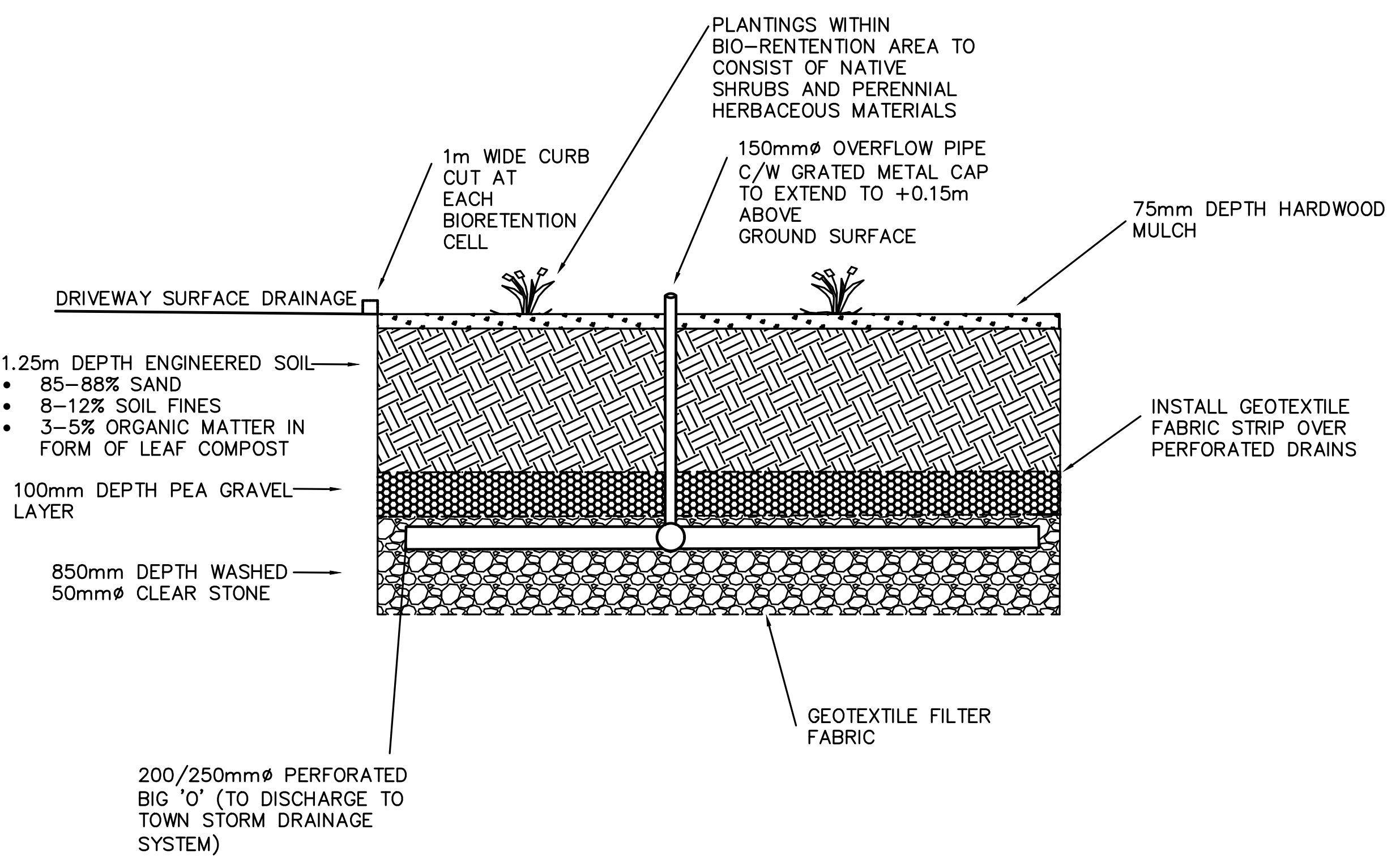
760 MOSLEY STREET
ADA HOMES
TOWN OF WASAGA BEACH

DRAWING TITLE

GENERAL SERVICING PLAN

PROJECT NO. 17-11290-B
DRAWING NO. SERV-1
REVISION 0



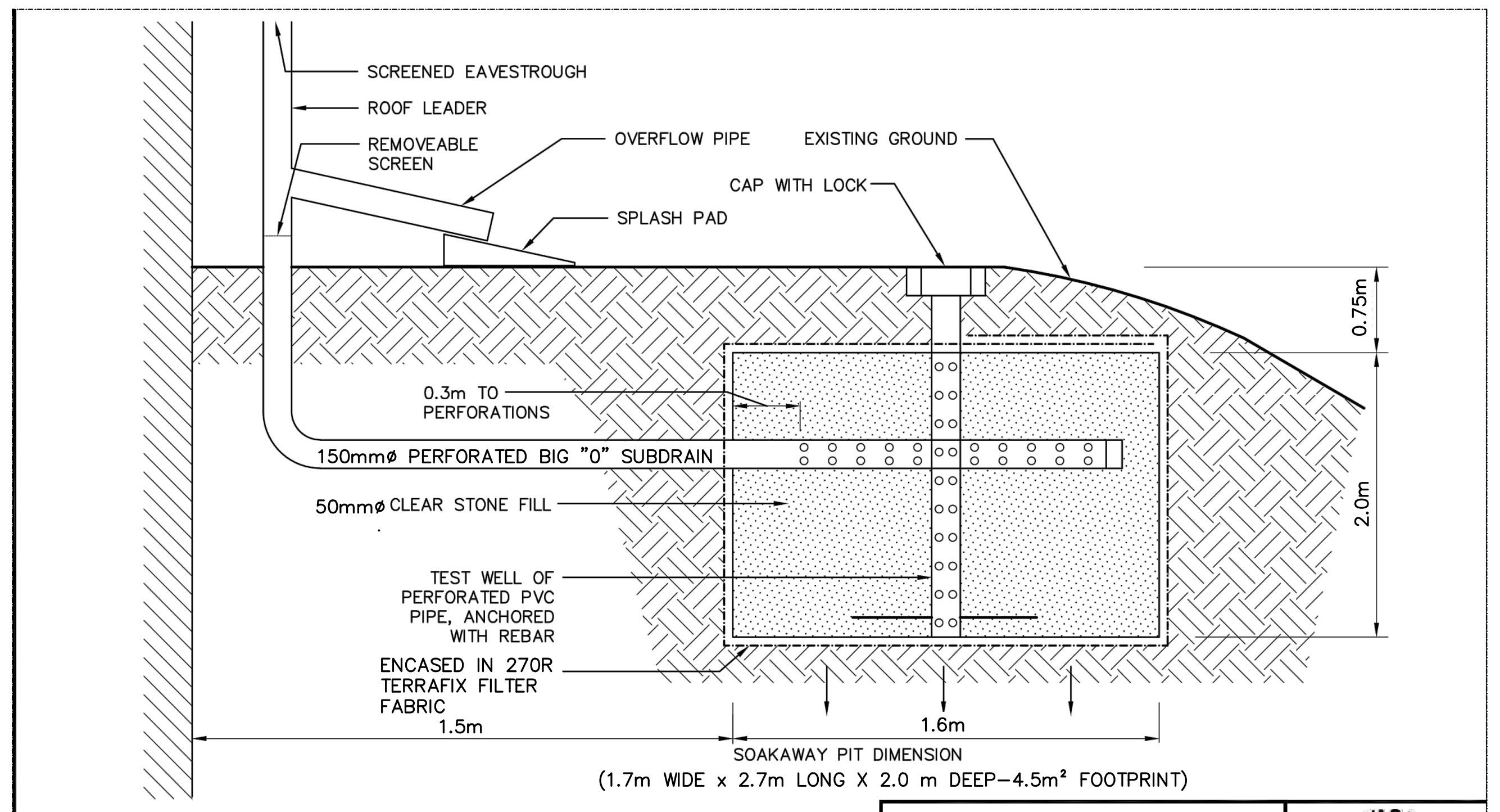


BIO–RETENTION CELL DETAIL

N.T.S.

LEGEND

×220.00	PROPOSED ELEVATION
×220.00T/C	TOP OF CURB ELEVATION
×(220.00)	PROPOSED SWALE ELEVATION
×220.00 EX.	EXISTING ELEVATION
⇦	DIRECTION OF MAJOR OVERLAND FLOW
⁙	PROPOSED GRAVEL SHOULDER
▬	PROPOSED ASPHALT
■	PROPOSED CATCHBASIN/DITCH INLET
◓	PROPOSED SANITARY MANHOLE
⁙	BIO–RETENTION CELL
▨	SOAK AWAY PIT
3.7% →	DIRECTION OF OVERLAND FLOW @ GRADIENT
F.F. 181.50	FINISHED FLOOR ELEVATION
– – – ▷	PROPOSED SUBDRAIN
◄ · · — · · —	DRAINAGE SWALE
▲	PROPOSED TRANSFORMER



NOTE:
1. FILTER FABRIC TERRAFIX 270R OR EQUAL.
2. PROVIDE MINIMUM 0.5m CLEARANCE TO WATER TABLE FROM BOTTOM OF PIT.
3. SOAKAWAY PIT DIMENSIONS SHALL BE SIZED PER DESIGN ENGINEER RECOMMENDATION.
4. SOAKAWAY PIT TO BE INSPECTED BY DEVELOPER'S ENGINEER PRIOR TO BACKFILL.

TOWN OF WASAGA BEACH

ROOF LEADER
SOAKAWAY PIT DETAIL
(MODIFIED)

DRAWN: TMM	SCALE: N.T.S.
DESIGN: MJP	PLOT: 1=1
CHECKED: MJP	DATE: MAR 2015

TOWN OF WASAGA BEACH INCORPORATED 1974

STD.DWG.No.11

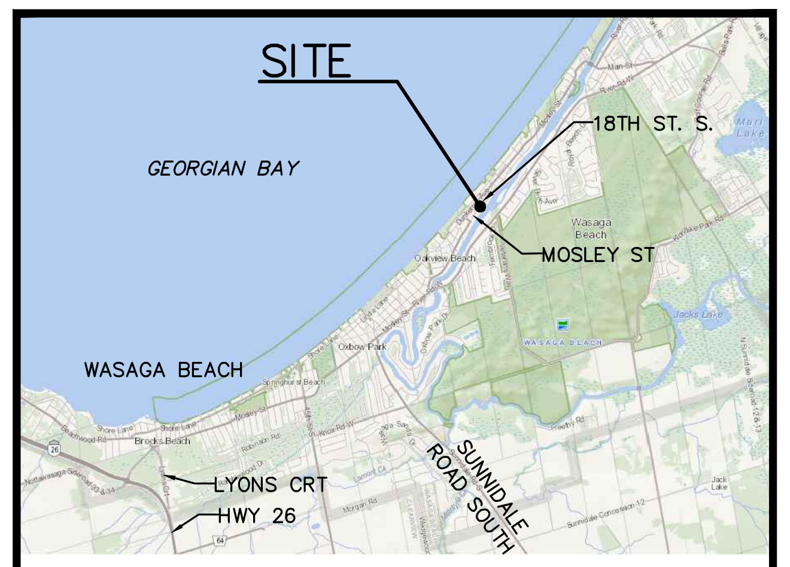
PAVEMENT LAYER	COMPACTION REQUIREMENTS	LIGHT DUTY ASPHALT
ASPHALT	92.0 to 96.5% MRD	40mm OPSS HL 3 OR HL 4 50mm OPSS HL 8
ASPHALT OPSS GRAN'A' OR 20mm CRUSHER RUN LIMESTONE	100% SPMDD	150mm
OPSS GRAN 'B'	100% SPMDD	300mm

PINESTONE ENGINEERING LIMITED | www.pel.ca

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

Drawings shall not be used for construction unless sealed and signed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

Any errors and/or omissions shall be reported to Pinestone Engineering Ltd. without delay.



KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY DINO ASTRI SURVEYING LTD., OCTOBER 2016.
2. SOAK AWAY PITS TO BE CONNECTED TO ROOF DRAINS AS PER TOWN OF WASAGA STANDARD DRAWING DWG 11.
3. SITE PLAN PROVIDED BY ISM ARCHITECTS

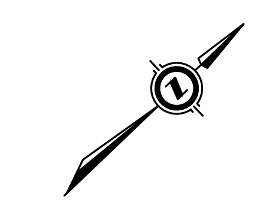
BENCHMARK

TBM#1
SSIB AT THE SOUTHWEST CORNER OF PARCEL HAVING AN ELEVATION OF 180.55m

NO.	YY.MM.DD	REVISION	BY

SEAL

NORTH ARROW



J.H. VOISIN
100172758
SEP. 18. 2017

DESIGN BY:	T.G./B.S.
DRAWN BY:	G.N.
CHECKED	J.V.
DATE:	SEPTEMBER 2017
SCALE:	1:250

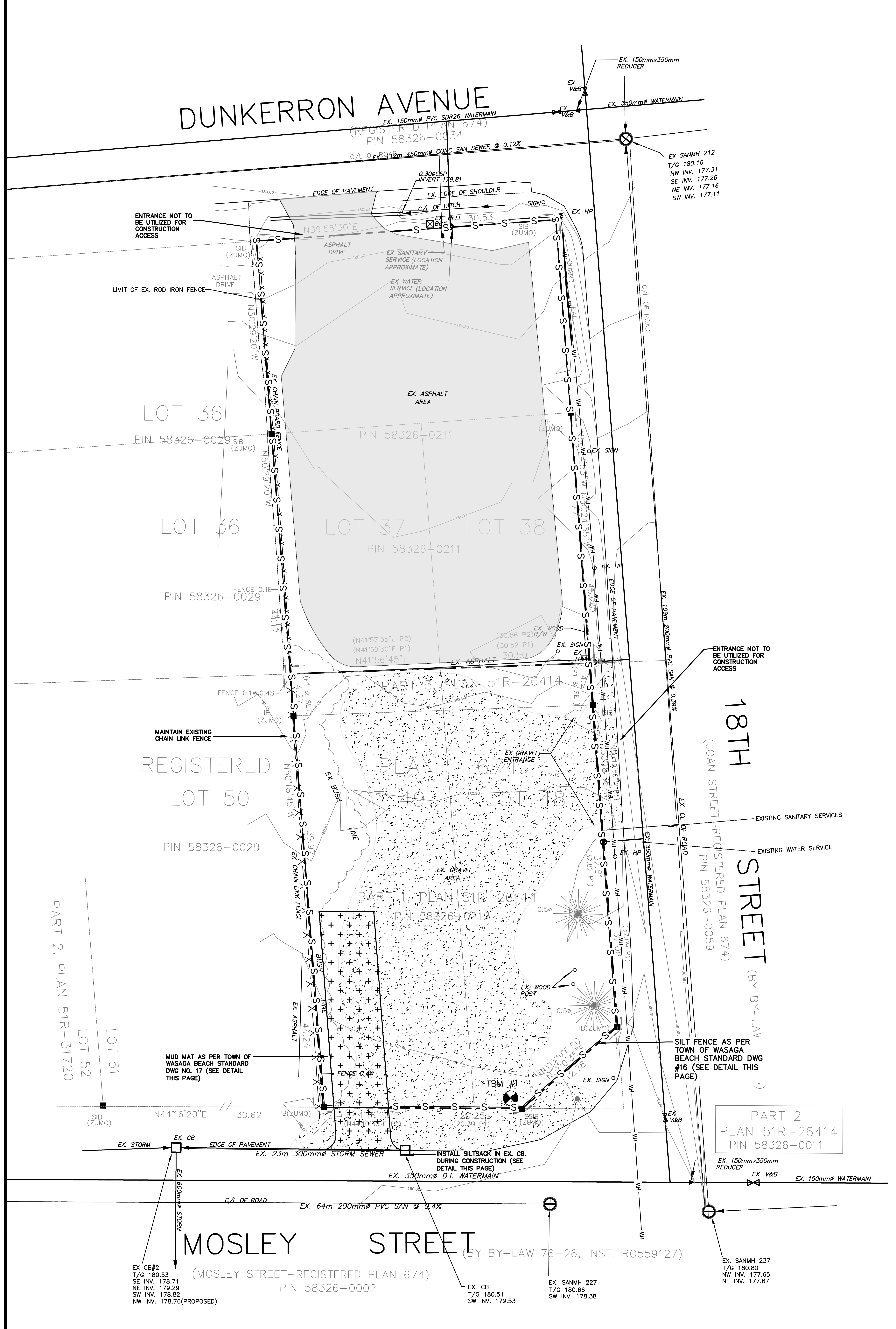
CLIENT/PROJECT

760 MOSLEY STREET
ADA HOMES
TOWN OF WASAGA BEACH

DRAWING TITLE

GRADING PLAN

PROJECT NO.	DRAWING NO.	REVISION
17-11290-B	GP-1	0

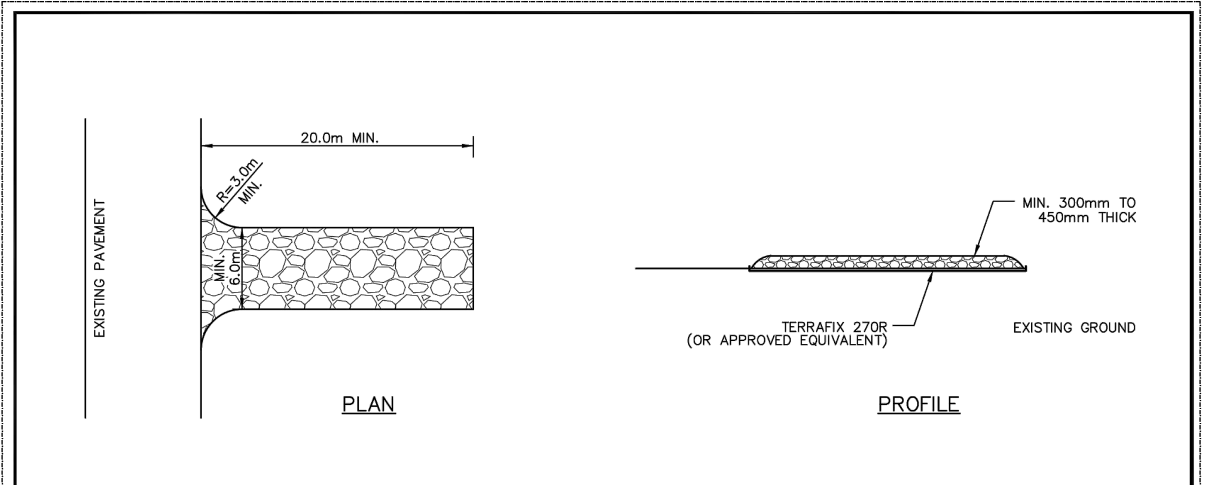


GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH TOWN OF WASAGA BEACH STANDARDS AND OPSS. WHERE INCONSISTANCY OCCURS, TOWN STANDARDS GOVERN.
3. CLEARSTONE WRAPPED IN FILTER FABRIC MAY BE SUBSTITUTED FOR PIPE BEDDING MATERIAL IF APPROVED BY THE ENGINEER.
4. DEWATERING TO BE CARRIED OUT IN ACCORDANCE WITH OPSS-517 AND 518. THE OWNER IS RESPONSIBLE FOR OBTAINING DEWATERING PERMITS AS REQUIRED TO MAINTAIN DRY TRENCH CONDITIONS.
5. UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION
6. HYDRO POLES TO BE SUPPORTED AND PROTECTED BY THE CONTRACTOR DURING CONSTRUCTION AS DIRECTED BY WASAGA DISTRIBUTION INC. AND BELL CANADA
7. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH UTILITIES WHICH MAY ALSO BE UNDER CONSTRUCTION
8. EXISTING GAS MAIN TO BE PROTECTED IN ACCORDANCE WITH ENBRIDGE GAS SPECIFICATIONS.
9. ALL EXISTING PAVED PRIVATE ENTRANCES TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE AND 150mm GRANULAR 'A' BASE TO THE LIMITOF CONSTRUCTION.
10. ALL EXISTING GRAVEL OR GRASSED PRIVATE ENTRANCES TO BE REINSTATED WITH 150mm GRANULAR 'A' BASE TO LIMITS OF CONSTRUCTION AND 50MM HL3 TO 2.8m BEHIND CURB.
11. ALL COMMERCIAL ENTRANCES TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE, MATCH EXISTING ASPHALT BASE COURSE(S), 150mm GRANULAR 'A' BASE AND 150mm GRANULAR 'B' SUBBASE TO LIMITS OF CONSTRUCTION.
12. JOINTS WITH EXISTING ASPHALT TO BE SAW CUT PRIOR TO PLACING NEW ASPHALT; DENSO REINSTATEMENT TAPE SHALL BE USED AT THE JOINT. SURFACE ASPHALT JOINTS TO HAVE MIN. 0.5m WIDE LAP JOINT.
13. ALL BOULEVARDS AND DISTURBED AREAS TO HAVE 100mm SCREENED TOPSOIL AND NURSERY SOD UNLESS OTHERWISE NOTED.
14. PAVED BOULEVARD AREAS TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE ASPHALT AND 150mm GRANULAR 'A' WHERE NOTED.
15. ACCESS TO BUSINESS AND RESIDENTIAL PROPERTIES MUST BE MAINTAINED AT ALL TIMES.
16. THE CONTRACTOR MUST GIVE MIN. 48 HOURS NOTICE TO THE TOWN OF WASAGA BEACH PUBLIC WORKS DEPARTMENT THROUGH THE TOWN ENGINEER FOR OFFICIALS TO BE PRESENT FOR THE OPERATION OF VALVES, TESTING, DISINFECTION AND CONNECTION OF WATERMAIN AND TESTING OF SEWERS.
17. EARTH FILL MATERIAL UP TO AND INCLUDING SUBGRADE TO BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD). GRANULAR BASE AND SUB-BASE TO BE COMPACTED TO 100% SPMDD. HOT MIX ASPHALT TO BE COMPACTED TO 97% SPMDD.
18. MINIMUM VERTICAL SEPARATION OF 150mm BETWEEN SEWERS AT CROSSINGS.
19. PRIOR TO THE COMMENT OF ON-SITE WORKS, INCLUDING TREE REMOVAL OR ROUGH GRADING, THE REQUIRED TREE HOARDING AND TREE PROTECTION BARRIERS/FENCING IS TO BE INSTALLED AROUND THE TREE(S) IDENTIFIED AS BEING RETAINED PER THE TREE PRESERVATION PLAN (TIPP-01)

SEDIMENT & EROSION CONTROL NOTES:

1. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED. SEDIMENT AND EROSION CONTROL MEASURES THAT ARE DESIGNED TO CONTROL RUNOFF FROM SPECIFIC AREAS MUST BE INSTALLED PRIOR TO ANY DISTURBANCE OF THAT PART OF THE SITE.
2. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES. SUCH MEASURES MUST BE PRESENTED IN WRITING FOR APPROVAL OF THE TOWN ENGINEER AND NOTTAWASAGA VALLEY CONSERVATION AUTHORITY.
3. THE CONTRACTOR SHALL HAVE MATERIALS AVAILABLE ON-SITE TO REPAIR SEDIMENT AND EROSION CONTROL MEASURES IN THE EVENT OF UNFORESEEN CONDITIONS: HIGH WATER, EXTREME RAINFALL EVENTS ETC.
4. ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSPECTED BY THE ENGINEER BI-WEEKLY AND AFTER EACH MAJOR STORM EVENT. INSPECTION REPORTS TO BE FORWARDED TO THE TOWN ENGINEER BI-WEEKLY. AREAS THAT ARE UNDEVELOPED FOR AN EXTENDED PERIOD OF TIME SHALL BE REVEGITATED WITH TOPSOIL AND HYDRAULIC SEED AND MULCH AS DIRECTED BY THE TOWN.



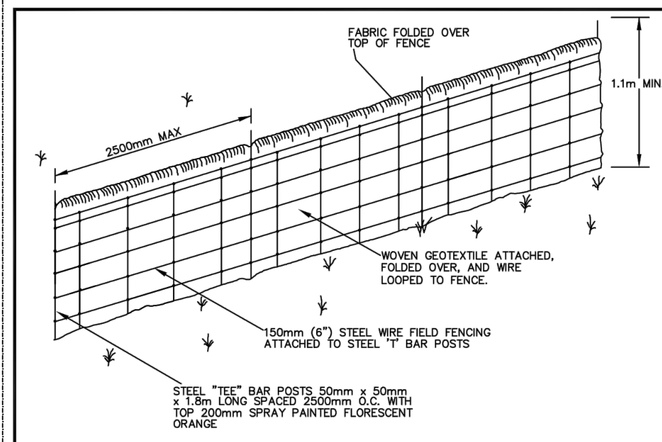
NOTES:

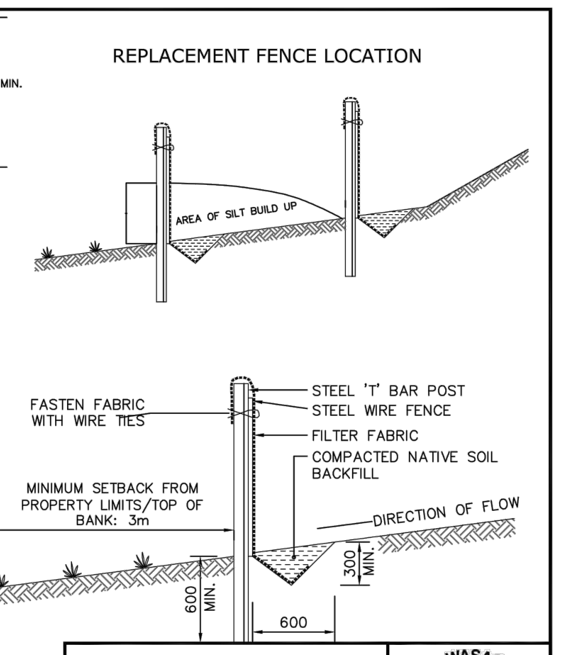
1. LENGTH AS REQUIRED BUT NOT LESS THAN 20m.
2. WIDTH OF 6m BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS AND EGRESS OCCURS.
3. MINIMUM 300mm TO 450mm THICKNESS OF 50mm MINIMUM STONE SIZE.
4. TERRAFIX 270R GEOTEXTILE (OR APPROVED EQUIVALENT) TO BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.
5. ENTRANCES SHALL BE PROVIDED WITH A CULVERT IF REQUIRED FOR ROADSIDE SURFACE DRAINAGE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE TO MAINTAIN THE ENTRANCE AND PROVIDE ADDITIONAL STONE TO THE SATISFACTION OF THE TOWN SUCH THAT SEDIMENT IS NOT TRACKED ONTO THE ADJACENT ROADWAY.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEARING ANY SEDIMENT THAT IS TRACKED ONTO MUNICIPAL RIGHTS-OF-WAY TO THE SATISFACTION OF THE TOWN.
8. INSPECTED DAILY AND REINSTATED ACCORDINGLY.

TOWN OF WASAGA BEACH

STONE MUD MAT DETAIL

DRAWN: TMM	SCALE: N.T.S.	
DESIGN: MJP	PLOT: 1=1	STD.DWG.No.17
CHECKED: MJP	DATE: MAR 2015	





NOTES:

1. SILT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW.
2. SILT/SEDIMENT CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFORM TO MTO DRAINAGE MANUAL VOLUME 2 "CHART F4-3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT."
3. SILT/SEDIMENT CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL A MIN. OF 300mm BY EITHER STATIC SLICING OR TRENCH METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% INSITU SOIL STRENGTH.
4. STEEL 'T' BAR POSTS ARE TO BE SPACED MAX. 2500mm ON CENTER.
5. FROZEN GROUND CONDITIONS REQUIRE FILTER FABRIC TO BE BACKFILLED IN TRENCH WITH CLEAR STONE.
6. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
7. GEOTEXTILE FABRIC TO BE COMPRISED OF WOVEN OR NON-WOVEN U.V. STABILIZED MATERIAL. FABRIC TO BE FOLDED OVER TOP OF FENCE MIN. 300mm AND WIRE FASTENED.

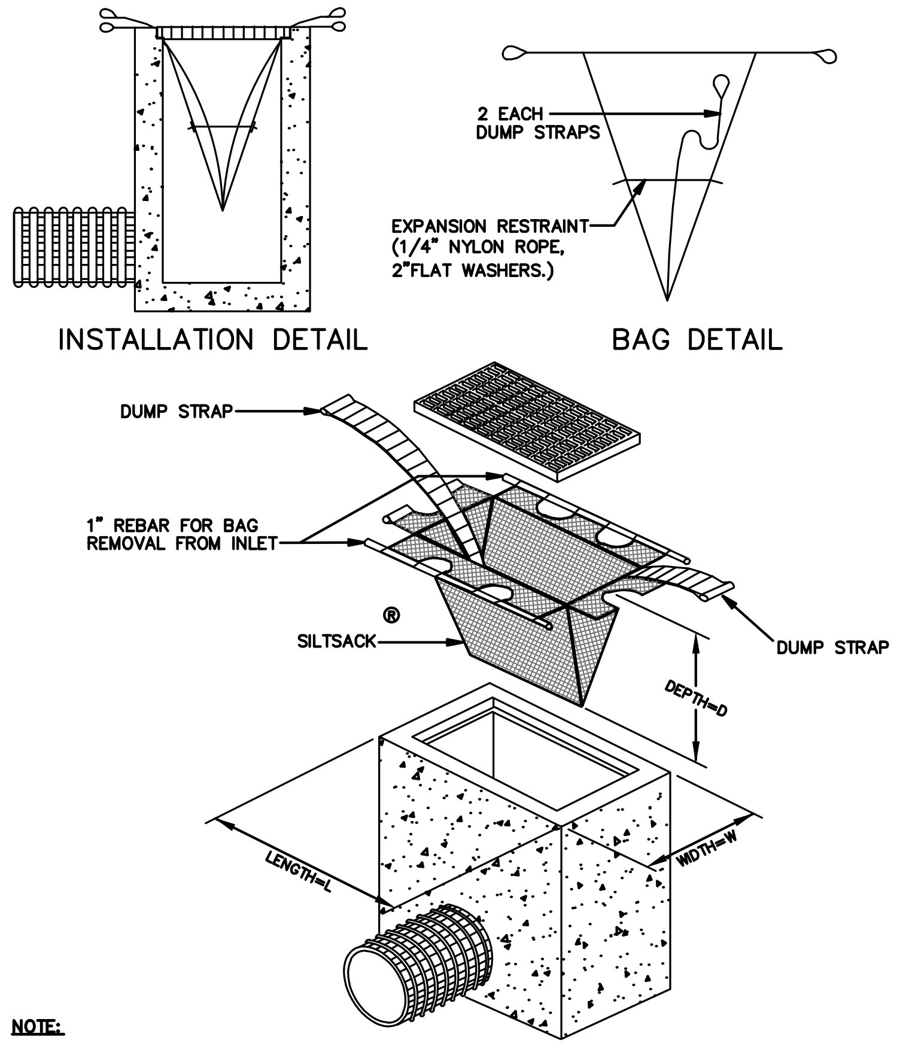
TOWN OF WASAGA BEACH

TYPICAL DETAIL OF SILT/SEDIMENT FENCE

DRAWN: TMM	SCALE: N.T.S.	
DESIGN: MJP	PLOT: 1=1	STD.DWG.No.16
CHECKED: MJP	DATE: MAR 2015	

LEGEND

◎	EX. HP/LS
☐	EX. CATCHBASIN
⌖	EX. HYDRANT
⋈	EX. VALVE AND BOX
⦸	EX. SANITARY MANHOLE
○	EX. STORM MANHOLE
——246.00——	CONTOUR
HW——HW	OVERHEAD HYDRO WIRE
⇦	DIRECTION OF OVERLAND FLOW
S——S	SILT FENCE
⊞	CONSTRUCTION ENTRANCE MAT
▨	TEMPORARY STOCKPILE LOCATION



NOTE:

1. SILT-SACK DEVICE TO BE INSTALLED AS PER MANUFACTURERS SPECIFICATIONS.
2. SILT-SACK TO BE REGULAR-FLOW TYPE.
3. SILT-SACK DEPTH (D) TO BE 1.0m (3'). LENGTH & WIDTH (LxW) TO BE AS REQUIRED TO FIT SINGLE/DOUBLE CATCH BASINS.

SILT-SACK CATCH BASIN SEDIMENT CONTROL DEVICE

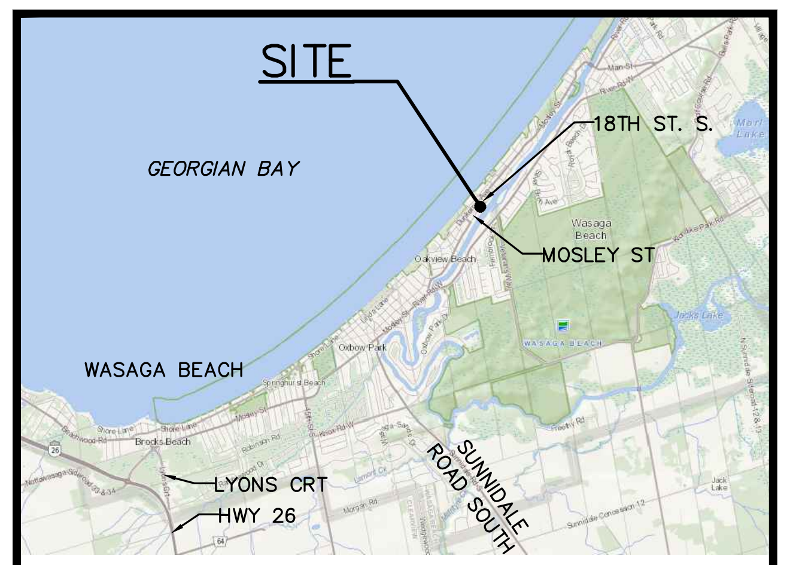
N.T.S.

PINESTONE ENGINEERING LIMITED | www.pel.ca

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

Drawings shall not be used for construction unless sealed and signed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

Any errors and/or omissions shall be reported to Pinestone Engineering Ltd. without delay.



KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY DINO ASTRI SURVEYING LTD., OCTOBER 2016.

BENCHMARK

TBM#1
SSIB AT THE SOUTHWEST CORNER OF PARCEL HAVING AN ELEVATION OF 180.55m

NO.	YY.MM.DD	REVISION	BY

SEAL

NORTH ARROW

J.H. VOISIN
100172758
SEP. 18, 2017

DESIGN BY:	T.G./B.S.
DRAWN BY:	G.N.
CHECKED	J.V.
DATE:	SEPTEMBER 2017
SCALE:	1:250

CLIENT/PROJECT

760 MOSLEY STREET
ADA HOMES
TOWN OF WASAGA BEACH

DRAWING TITLE

EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	DRAWING NO.	REVISION
17-11290-B	ESC-1	0

GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.
2. ALL WORK TO BE CARRIED OUT IN ACCORDANCE WITH TOWN OF WASAGA BEACH STANDARDS AND OPSS. WHERE INCONSISTENCY OCCURS, TOWN STANDARDS GOVERN.
3. CLEAR STONE WRAPPED IN FILTER FABRIC MAY BE SUBSTITUTED FOR PIPE BEDDING MATERIAL IF APPROVED BY THE ENGINEER.
4. DEWATERING TO BE CARRIED OUT IN ACCORDANCE WITH OPSS–517 AND 518. THE OWNER IS RESPONSIBLE FOR OBTAINING DEWATERING PERMITS AS REQUIRED TO MAINTAIN DRY TRENCH CONDITIONS.
5. UNDERGROUND UTILITITES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
6. HYDRO POLES TO BE SUPPORTED AND PROTECTED BY THE CONTRACTOR DURING CONSTRUCTED AS DIRECTED BY WASAGA DISTRIBUTION INC.
7. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH UTILITIES WHICH MAY ALSO BE UNDER CONSTRUCTION.
8. EXISTING GAS MAIN TO BE PROTECTED IN ACCORDANCE WITH ENBRIDGE GAS SPECIFICATIONS.
9. ALL EXISTING PAVED PRIVATE ENTRANCES TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE AND 150mm GRANULAR 'A' BASE TO LIMITS OF CONSTRUCTION.
10. ALL EXISTING GRAVEL OR GRASSED PRIVATE ENTRANCES TO BE REINSTATED WITH 150mm GRANULAR 'A' BASE TO LIMITS OF CONSTRUCTION AND 50mm HL3 TO 2.75m BEHIND CURB.
11. ALL COMMERCIAL ENTRANCES TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE, MATCH EXISTING ASPHALT BASE COURSE(S), 150mm GRANULAR 'A' BASE AND 150mm GRANULAR 'B' SUBBASE TO LIMITS OF CONSTRUCTION.
12. JOINTS WITH EXISTING ASPHALT TO BE SAW CUT PRIOR TO PLACING NEW ASPHALT; DENSO REINSTATEMENT TAPE SHALL BE USED AT THE JOINT OF SURFACE ASPHALT. SURFACE ASPHALT JOINTS TO HAVE MIN. 0.5m WIDE LAP JOINT.
13. ALL BOULEVARDS AND DISTURBED AREAS TO HAVE 150mm SCREENED TOPSOIL AND NURSERY SOD UNLESS OTHERWISE NOTED.
14. PAVED BOULEVARD AREAS TO BE REINSTATED WITH 50mm HL3 SURFACE COURSE ASPHALT AND 150mm GRANULAR 'A' WHERE NOTED.
15. ACCESS TO BUSINESS AND RESIDENTIAL PROPERTIES MUST BE MAINTAINED AT ALL TIMES.
16. THE CONTRACTOR MUST GIVE MIN. 48 HOURS NOTICE TO THE TOWN OF WASAGA BEACH PUBLIC WORKS DEPARTMENT THROUGH THE TOWN ENGINEER FOR OFFICIALS TO BE PRESENT FOR THE OPERATION OF VALVES, TESTING, DISINFECTION AND CONNECTION OF WATERMAIN AND TESTING OF SEWERS.
17. EARTH FILL MATERIAL UP TO AND INCLUDING SUBGRADE TO BE COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD). GRANULAR BASE AND SUB–BASE TO BE COMPACTED TO 100% SPMDD. HOT–MIX ASPHALT TO BE COMPACTED TO 97% MAXIMUM RELATIVE DENSITY.
18. MINIMUM VERTICAL SEPARATION OF 150mm BETWEEN SEWERS AT CROSSINGS.
19. THE CONTRACTOR MUST OBTAIN A ROAD OCCUPATION PERMIT FROM PUBLIC WORKS PRIOR TO INSTALLATION OF PROPOSED DRIVEWAY AND/OR ANY CONSTRUCTION WORKS WITHIN THE EXISTING MUNICIPAL RIGHT–OF–WAY.
20. ALL DISTURBED AREAS SHALL BE REINSTATED TO EXISTING CONDITION OR BETTER.

SEDIMENT & EROSION CONTROL NOTES:

1. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE UNTIL ALL DISTURBED AREAS HAVE BEEN STABILIZED. SEDIMENT AND EROSION CONTROL MEASURES THAT ARE DESIGNED TO CONTROL RUNOFF FROM SPECIFIC AREAS MUST BE INSTALLED PRIOR TO ANY DISTURBANCE OF THAT PART OF THE SITE.
2. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES. SUCH MEASURES MUST BE PRESENTED IN WRITING FOR APPROVAL OF THE TOWN ENGINEER AND THE NOTTAWASAGA VALLEY CONSERVATION AUTHORITY.
3. THE CONTRACTOR SHALL HAVE MATERIALS AVAILABLE ON–SITE TO REPAIR SEDIMENT AND EROSION CONTROL MEASURES IN THE EVENT OF UNFORESEEN CONDITIONS: HIGH WATER, EXTREME RAINFALL EVENTS ETC.
4. ALL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSPECTED BY THE ENGINEER BI–WEEKLY AND AFTER EACH MAJOR STORM EVENT. INSPECTION REPORTS TO BE FORWARDED TO THE TOWN ENGINEER BI–WEEKLY. AREAS THAT ARE UNDEVELOPED FOR AN EXTENDED PERIOD OF TIME SHALL BE REVEGETATED WITH TOPSOIL AND HYDRAULIC SEED AND MULCH AS DIRECTED BY THE TOWN.

STORM SEWER:

1. ALL MATERIALS SHALL BE CSA CERTIFIED AND IN ACCORDANCE WITH THE TOWN APPROVED MATERIALS LIST.
2. CLASS 'B' BEDDING AND COVER AS PER OPSD–802.030 (RIGID PIPE) OR EMBEDMENT AS PER OPSD–802.010 (FLEXIBLE PIPE) USING GRANULAR 'A'. USE SELECT NATIVE MATERIAL COMPACTED TO 95% MAXIMUM DRY DENSITY FOR COVER MATERIAL.
3. CATCHBASINS & MANHOLES TO BE BACKFILLED WITH SELECT NATIVE MATERIAL AND COMPACTED TO 95% MAXIMUM DRY DENSITY.
4. STEPS AS PER OPSD–405.010 HOLLOW CIRCULAR ALUMINUM.
5. CATCHBASIN LEADS; – 300mm DIA. FOR SINGLE AND DOUBLE CATCHBASINS.
6. CATCHBASIN FRAMES AND COVERS PER OPSD 400.020.
7. STORM SEWER SHALL BE CCTV INSPECTED.

TOWN OF WASAGA BEACH
GENERAL NOTES
DRAWN: TMM | SCALE: N.T.S.
DESIGN: MJP | PLOT: 1=1
CHECKED: MJP | DATE: MAR 2015
STD.DWG.No.1A

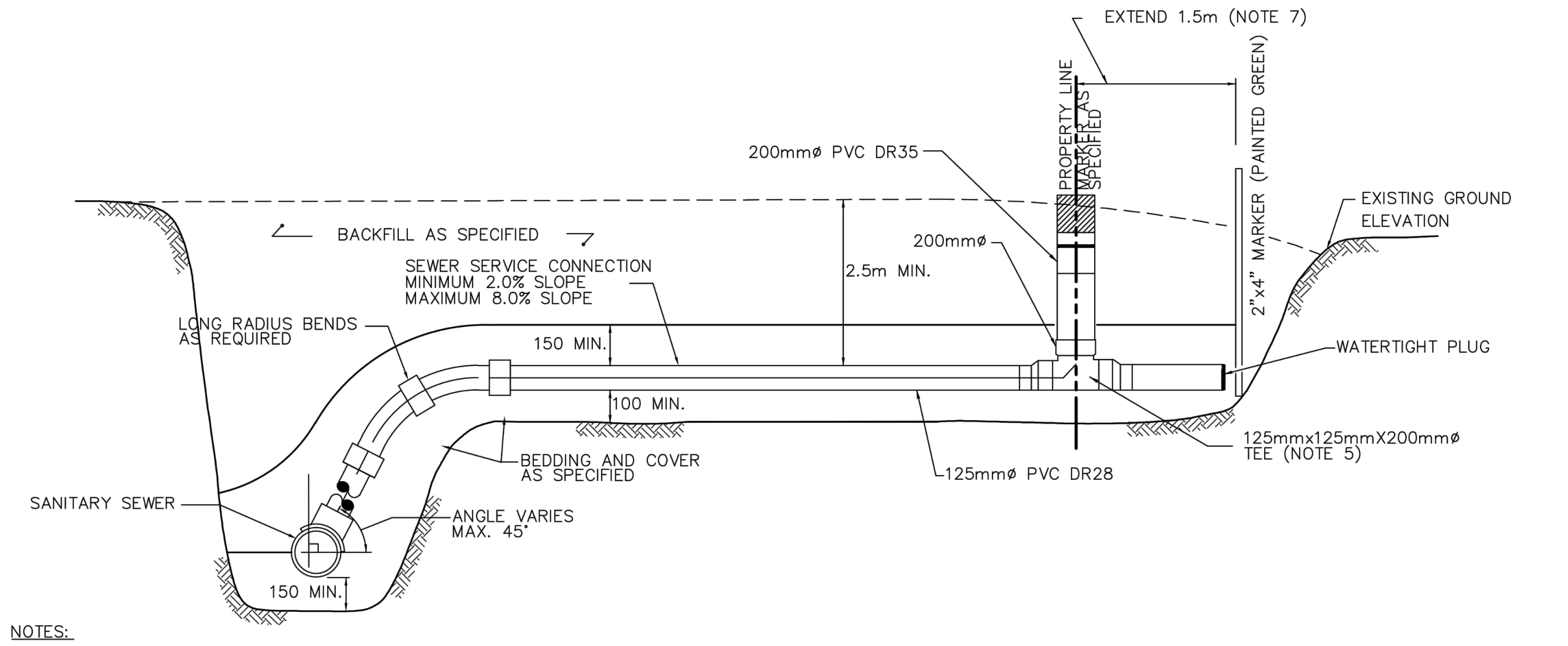
WATERMAIN:

1. ALL MATERIALS SHALL BE CSA CERTIFIED AND IN ACCORDANCE WITH THE TOWN APPROVED MATERIALS LIST.
2. ALL WATERMAIN TO HAVE MINIMUM 1.7m COVER OR APPROVED EQUIVALENT FROST PROTECTION WITH INSULATION.
3. BEDDING AND BACKFILL IN ACCORDANCE WITH OPSS–411.
4. PVC PIPE INSTALLATION TO INCLUDE 12awg TWH SOLID PLASTIC COVERED TRACER WIRE, TWU 75°C 600V OR APPROVED EQUAL. TRACER WIRE CONTINUITY MUST BE TESTED & CERTIFIED BY PUBLIC WORKS STAFF.
5. CATHODIC PROTECTION (S–12 ZINC ANODES @ 30m SPACING) TO BE PROVIDED IN ACCORDANCE WITH OPSS–442 AS REQUIRED BY THE GEOTECHNICAL REPORT.
6. CLASS 'B' BEDDING AS PER OPSD–802.030 (RIGID PIPE) OR BEDDING AS PER OPSD–802.010 (FLEXIBLE PIPE) USING GRANULAR 'A'.
7. THRUST PROTECTION SHALL BE PROVIDED USING MECHANICAL JOINT FITTINGS AND RESTRAINERS.
8. GATE VALVES TO BE LEFT HAND OPENING COMPLETE WITH SLIDE TYPE VALVE BOXES 125mm DIA. WITH LIDS MARKED WATER AS PER TOWN APPROVED MATERIAL AND PRODUCT LIST.
9. WATER SERVICES COMPLETE WITH MAIN STOP TO BE AS PER TOWN APPROVED MATERIAL AND PRODUCT LIST.
10. WHERE RESIDENTIAL WATER SERVICES ARE TO BE ABANDONED, EXPOSE MAIN STOP, CLOSE AND DISCONNECT SERVICE PIPE, AND SALVAGE THE CURB STOP AND RETURN TO PUBLIC WORKS YARD.
11. ALL WATERMAINS AND SERVICES SHALL BE BACKFILLED WITH APPROVED SITE MATERIAL. ALL BACKFILL SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY AS PER OPSS 514. ALL GRANULAR ROAD BASE SHALL BE COMPACTED TO 100% MAXIMUM DRY DENSITY.
12. EXISTING SERVICE LOCATIONS TO BE VERIFIED IN THE FIELD.
13. HYDRANT TO BE AS PER TOWN APPROVED MATERIAL AND PRODUCT LIST WITH MECHANICAL JOINT ENDS, WITH 2–50mm PORTS AND FACTORY INSTALLED STORZ FITTING PER OPSD–1105.010, INCLUDING GALVANIZED CHAIN CONNECTION FOR CAPS.
14. TESTING CONNECTION TO THE MUNICIPAL WATER SYSTEM SHALL BE PER TOWN STD. DWG. No. 13.
15. MINIMUM VERTICAL SEPARATION 500mm BETWEEN WATERMAINS AND SEWERS. MINIMUM HORIZONTAL SEPARATION OF 2.5m BETWEEN WATERMAINS AND SEWERS.
16. WATERMAINS SHALL BE SWABBED, FLUSHED, DISINFECTED AND TESTED IN ACCORDANCE WITH OPSS 441 WITH TOWN OFFICIALS PRESENT.
17. DISINFECTING OF WATERMAINS SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF AWWA C651 SPECIFICATIONS.

SANITARY SEWER:

1. ALL MATERIALS SHALL BE CSA CERTIFIED AND IN ACCORDANCE WITH THE TOWN APPROVED MATERIALS LIST.
2. BEDDING AS PER OPSD–802.010 USING GRANULAR 'A' COMPACTED TO 95% MAXIMUM DRY DENSITY. USE SELECTED SITE MATERIAL FOR BACKFILL COMPACTED TO 95% MAXIMUM DRY DENSITY.
3. SANITARY SERVICE LATERALS COMPLETE WITH CLEANOUT TO BE INSTALLED PER TOWN STD. DWG No. 12.
4. LOT SERVICE LOCATIONS TO BE VERIFIED BY CONTRACTOR.
5. MH'S PER OPSD–701.010 WITH FROST STRAPS PER OPSD 701.100 WITH "QUICK ANCHORED" BOLTS.
6. FRAMES AND COVERS PER OPSD–401.010 TYPE 'A'.
7. MH BENCHING PER OPSD–701.021 AND STEPS PER OPSD–405.010 CIRCULAR ALUMINUM.
8. SANITARY SEWER TESTING SHALL INCLUDE INFILTRATION, EXFILTRATION, DEFLECTION (MANDREL) AND CCTV.

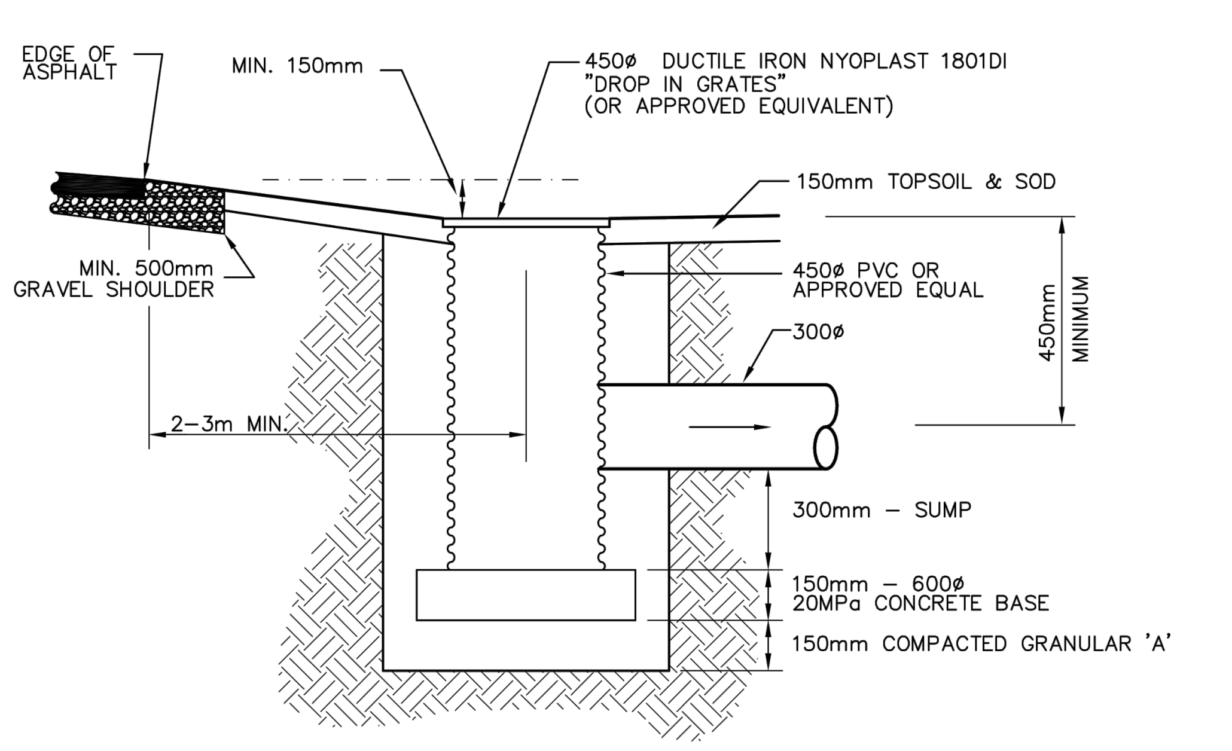
TOWN OF WASAGA BEACH
GENERAL NOTES
DRAWN: TMM | SCALE: N.T.S.
DESIGN: MJP | PLOT: 1=1
CHECKED: MJP | DATE: MAR 2015
STD.DWG.No.1B



NOTES:

1. MAXIMUM DEPTH OF SERVICE AT PROPERTY LINE TO BE 2.5m FROM FINISHED GRADE.
2. 200mmø CLEANOUT CHAMBER AT PROPERTY LINE TO BE RAISED BY BUILDER TO FINISHED GRADE TO A MAX 150mm BELOW FINISHED BOULEVARD GRADE ADJACENT TO PROPERTY LINE COMPLETE WITH DETECTABLE METAL CAP PER ROYAL PIPE SYSTEMS "IC LOCKING LID (GREEN)", C/W COLLAR (OR APPROVED EQUIVALENT).
3. A CAST IRON LID PER ROYAL PIPE SYSTEMS PART NO. 71A08DRVVOXG (OR APPROVED EQUIVALENT) SHALL BE USED FOR SERVICE CLEANOUT CHAMBERS LOCATED IN DRIVEWAYS. FOR GRANULAR DRIVEWAYS, THE LID SHALL SHALL BE 150mm BELOW SURFACE.
4. ADDITIONAL CLEANOUTS ARE TO BE PROVIDED ON PRIVATE PROPERTY AT EVERY 15m IN ACCORDANCE WITH ONTARIO BUILDING CODE SECTION 7.4.7.2.
5. 125mmx125mmx200mmø TEE CONNECTION AT PROPERTY LINE SHALL BE EQUIPPED WITH INSTALLATION OF CHECK VALVE AS PER ROYAL PIPE SYSTEMS PART NO. 70A5R4W/OPAL WITH "ADD–A–FLAP" OR AS PER TOWN APPROVED MATERIAL AND PRODUCT LIST.
6. CLEANOUT/INSPECTION CHAMBER TEES MAY BE PURCHASED "PRE–PLUGGED" BY THE MANUFACTURER TO ASSIST WITH LOW PRESSURE AIR TESTING. THE CONTRACTOR SHALL BE RESPONSIBLE TO REMOVE THE TEMPORARY PLUGS AFTER COMPLETING THE SANITARY SEWER LEAKAGE TESTING.
7. EXTEND THE 125mm DIA. SANITARY SERVICE 1.5m INTO THE PRIVATE LOT.
8. ALL SANITARY PVC FITTINGS ARE TO BE WATER TIGHT.

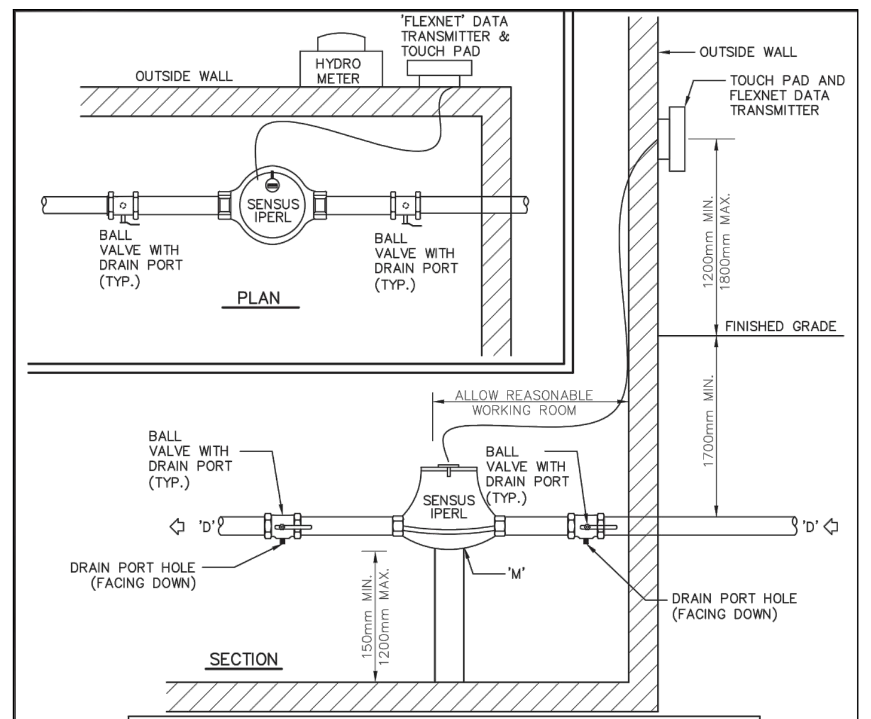
TOWN OF WASAGA BEACH
SANITARY SEWER
SERVICE CONNECTION DETAIL
DRAWN: TMM | SCALE: N.T.S.
DESIGN: M.J.P. | PLOT: 1=1
CHECKED: M.J.P. | DATE: MAR 2015
STD.DWG.No.12



NOTES

1) IN THE EVENT THAT THERE IS NO STORM SEWER COLLECTION SYSTEM, THE ABOVE MINIMUM GRADING SHALL BE PROVIDED FOR SURFACE WATER CONVEYANCE AND INFILTRATION.

TOWN OF WASAGA BEACH
OFF ROAD CATCHBASIN AND BOULEVARD GRADING DETAIL
DRAWN: TMM | SCALE: N.T.S.
DESIGN: MJP | PLOT: 1=1
CHECKED: MJP | DATE: MAR 2015
STD.DWG.No.10



*** AFTER WATER METER PACKAGE INSTALLATION IS COMPLETE/INSPECTED, THE OWNER/INSTALLER IS RESPONSIBLE TO CONTACT PUBLIC WORKS DEPT. TO CO-ORDINATE INSTALLATION OF THE 'FLEXNET' DATA TRANSMITTER PH. No. (705) 429-2540**

NOTES:

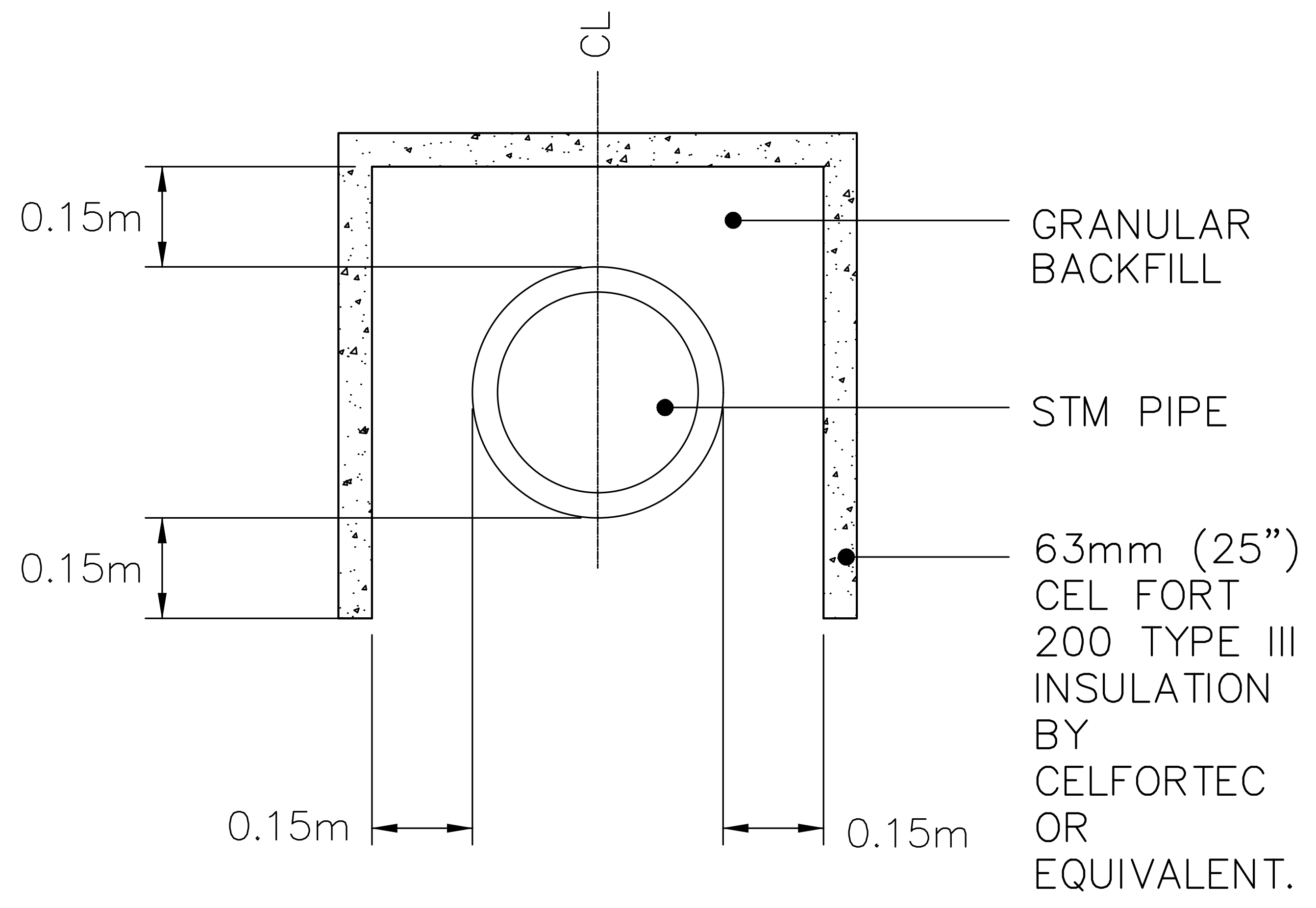
1. DATA TRANSMITTER TO BE LOCATED ADJACENT TO THE HYDRO ELECTRIC METER.
2. METERS SHALL BE INSTALLED IN A HORIZONTAL POSITION.
3. ALL PIPE AND APPURTENANCES TO BE SIZED AS REQUIRED FOR SERVICE DIA. 'D'
4. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN.
5. METERS SHALL BE 'SENSUS' AS OUTLINED IN TABLE 1 BELOW c/w FLEXNET REMOTE TOUCH PAD & TRANSMITTER.
6. PROVIDE SUPPORT FOR THE METER AND RELATED COMPONENTS.
7. WORKING SPACE AROUND THE METER SHALL ALLOW MIN. 600mm ACCESS FOR MAINTENANCE PURPOSES.
8. ALL LAWN WATERING SYSTEMS SHALL INLUDE A BACKFLOW PREVENTION DEVICE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE AND TOWN OF WASAGA BEACH STANDARDS.

TABLE 1

SERVICE ø 'D' (mm)	SENSUS METER SIZE 'M' (mm)	METER MODEL
25	25	IPERL
38	38	OMNIR2
50	50	OMNIR2

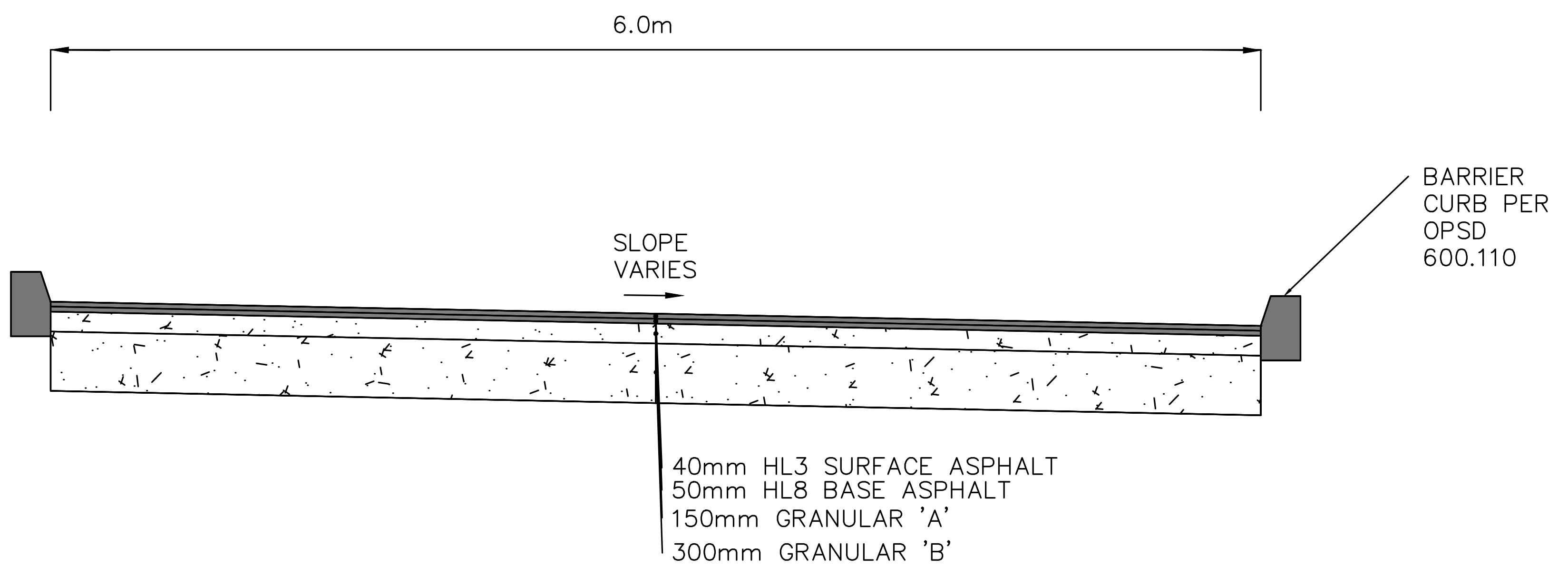
*METER SIZE MAY CHANGE BASED ON DEMAND REQUIREMENTS

TOWN OF WASAGA BEACH
TYPICAL WATER METER INSTALLATION 25mmø TO 50mmø
DRAWN: TMM | SCALE: N.T.S.
DESIGN: MJP/GER | PLOT: 1=1
CHECKED: GER | DATE: MAR 2015
STD.DWG.No.14A



TYPICAL INSULATION DETAIL

N.T.S.



DRIVEWAY CROSS SECTION

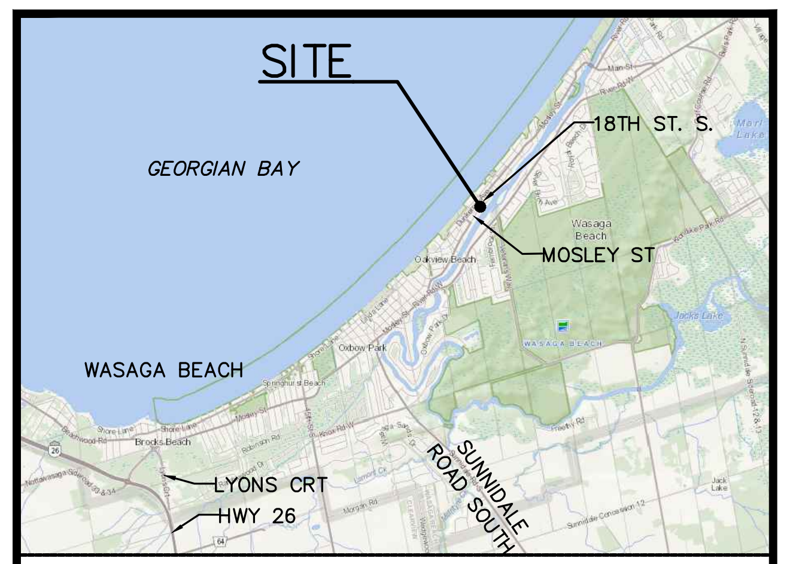
N.T.S.

PINESTONE ENGINEERING LIMITED | www.pel.ca

The position of existing above ground and underground utilities and facilities are not necessarily shown on the drawings, and where shown, the accuracy of the position of such utilities and facilities is not guaranteed. Before starting work, the contractor shall confirm the exact location of all existing utilities and facilities, and shall assume all liability for damage to them

Drawings shall not be used for construction unless sealed and signed. All work to be performed in accordance with the Occupational Health & Safety Act 1990.

Any errors and/or omissions shall be reported to Pinestone Engineering Ltd. without delay.



KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY DINO ASTRI SURVEYING LTD., OCTOBER 2016.

BENCHMARK

TBM#1
SSIB AT THE SOUTHWEST CORNER OF PARCEL HAVING AN ELEVATION OF 180.55m

NO.	YY.MM.DD	REVISION	BY

SEAL
NORTH ARROW

J. H. VOISIN
100172758
SEP. 18. 2017

DESIGN BY: B.S.
DRAWN BY: G.N.
CHECKED J.V.
DATE: SEPTEMBER 2017
SCALE: 1:200

CLIENT/PROJECT
760 MOSLEY STREET
ADA HOMES
TOWN OF WASAGA BEACH

DRAWING TITLE
CONSTRUCTION NOTES AND DETAILS

PROJECT NO. 17-11290-B
DRAWING NO. DET-1
REVISION 0