Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology •

(613) 860-0923
FAX: (613) 258-0475

SERVICING AND STORMWATER MANAGEMENT REPORT

800 EAGLESON ROAD
OTTAWA, ONTARIO

Prepared For:
Ironclad Developments Inc.
101-57158 Symington Road 20E
Springfield, MB R2J 4L6

PROJECT #: 180084

DISTRIBUTION
4 copies – City of Ottawa
1 copy – Ironclad Developments Inc.
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Issued for Site Plan Approval	June 12, 2018
Revision 1 - Revised for Site Plan Control Approval	September 12, 2018
Revision 2 – Response to Review Comments	December 11, 2018

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1 INTRODUCTION

Kollaard Associates was retained by Ironclad Developments Inc. to complete a Site Servicing and Stormwater Management Report for a new residential development in the City of Ottawa, Ontario.

This report will address the serviceability of the proposed site, specifically relating to the adequacy of the existing municipal storm sewer, sanitary sewer, and watermain to hydraulically convey the necessary storm runoff, sanitary sewage and water demands that will be placed on the existing system as a result of the proposed development located at 800 Eagleson Road, Ottawa, Ontario. The report shall also summarize the stormwater management (SWM) design requirements and proposed works that will address stormwater flows arising from the site under post-development conditions. The report will identify any stormwater servicing concerns and also describe any measures to be taken during construction to minimize erosion and sedimentation.

2 BACKGROUND

2.1 Site Location and Description

The development being proposed by Ironclad Developments Inc is located on the south side of Fernbank Road immediately west of Eagleson Road within the City of Ottawa. The site is triangular in shape and is bordered on the southwest side by the Monahan Drain / Mahoney Creek Stormwater Management Facility. Results of an updated Monahan Drain subwatershed model indicate a 100 year storm elevation in the Monahan Drain Facility adjacent the site of 94.62 metres.

The site has a total area of 0.7293 hectares and is located within an area of existing commercial, institutional and residential development. At the time of this report, the existing ground surface of the site is relatively low lying with an average elevation of about 2 to 2.5 metres below the centerline elevation of Fernbank Road and about 1.5 to 2 meters below the centerline elevation of Eagleson Road. The site slopes towards Cell 2 of the existing Monahan Drain Stormwater Management Facility. The Facility has a normal water level of about 1.8 metres below the average existing ground surface elevation of the site and a 100 year flood level of about 0.6 metres above the average existing ground surface elevation of the site.

It is understood that the owner of the subject property intends to construct a 6 storey apartment building containing 143 residential units.

2.2 City of Ottawa Pre-consultation

A pre-consultation meeting with the City of Ottawa was attended by a representative of Ironclad Developments Inc. The City of Ottawa was represented by members of various departments including: Planning; Infrastructure; Transportation; Forestry and Urban Design. A summary of the pre-consultation meeting is included in Appendix A at the end of this report. The following Engineering related information was provided to the client during the meeting:

- The site is underlain by soils of pour quality and high clay composition;
- There is a high groundwater table;
- A sanitary sewer is in place on Fernbank
- A watermain is available on both Fernbank Road and Eagleson Road
- The existing storm sewer on Fernbank Road outlets to the Monahan Drain Pond so site runoff can be routed into the pond by passing the City sewers;
- Stormwater Quantity criteria is provided in the Monahan Drain Report prepared by Novatech.

3 STORMWATER DESIGN

3.1 Stormwater Management Design Criteria

Design of the storm sewer system was completed in conformance with the City of Ottawa Design Guidelines. (October 2012). Section 5 “Storm and Combined Sewer Design”.

The stormwater management design was completed to ensure that runoff from the proposed development is controlled in accordance with the stormwater management criteria established for the receiving water body.

The stormwater management criteria from a quantity control perspective was established by the Monahan Drain Constructed Wetlands Phase 2 Final Design Report prepared by Novatech Engineering Consultants Ltd. Revised February 14, 2007.

The stormwater management criteria from a quality control perspective is established by the Rideau Valley Conservation Authority and the Ministry of Environment and Climate Change for discharge into a sensitive aquatic habitat. The above referenced Monahan Drain report suggests that hydrodynamic separators be used for water quality control in future developments upstream of the drain.

3.2 Quantity Control Design Criteria

3.2.1 Minor System Design Criteria

The storm sewers have been designed and sized based on the rational formula and the Manning's Equation under free flow conditions for the 5-year storm using a 10-minute inlet time.

An additional criteria was added to the stormwater management design for site. This criteria consisted of no surface ponding during a two year storm event. In order to meet the requirements of this criteria, a 2 year storm event was added to the 5 year and 100 year storm events normally assessed.

3.2.2 Major System Design Criteria

The major system has been designed to accommodate on-site detention with sufficient capacity to control the runoff generated onsite during post-development conditions to the 5-year pre-development level assuming a runoff coefficient of 0.20

Ensure that the lowest openings to the proposed building are at least 0.3 meters above the 100 year flood level or are protected from flooding by elevated grading at least 0.3 meters above the 100 year flood level of Cell 2 of the Monahan Drain.

Calculations of the required storage volumes have been prepared based on the Rational Method as identified in Section 8.3.10.3 of the City's Sewer Guidelines and have been provided in Appendix B.

3.3 Quality Control Design Criteria

Stormwater Runoff from the site will be directed to the Monahan Drain which is a sensitive aquatic habitat. Enhanced Protection corresponding to 80 percent total suspended solids removal will be provided. A hydrodynamic separator will be used to provide at least 80 percent total suspended solids removal.

3.4 Stormwater Analysis Variables

3.4.1 Runoff Coefficients

Runoff coefficients for impervious surfaces (roofs, asphalt, and concrete) were taken as 0.90, semi pervious areas (patio stones, gravel) were taken as 0.70 and pervious surfaces (grass) were taken as 0.20.

A 25% increase for the post development 100-year runoff coefficients was used as per City of Ottawa guidelines. Refer to Appendix B for pre-development and post development runoff coefficients.

3.4.2 Impervious Ratio

The impervious ratio for the developed portion of the site is equal the total impervious area divided by the total developed area.

The impervious ratio for the site is equal to 0.5601 / 0.7293 = 0.77

3.4.3 Time of Concentration

3.4.3.1 Pre-Development

The time of concentration for the site during pre-development conditions was calculated using a combination of the Airport formula and the Upland Method. The airport formula, developed by the U.S. Department of Transportation's Federal Aviation Administration (FAA), is more commonly used for rural development where the runoff coefficient is less than 0.40. The Uplands Method is commonly used when calculating flow velocity for shallow concentrated overland flow. It is considered that after the first 30 metres of sheet flow, the runoff will become more concentrated and flow along preferred flow channels.

TR55 Urban Hydrology for Small Watersheds, Second Ed, June 1986, provides a maximum limit of 300 ft for sheet flow. Research by USDA NRCS shows that this is an over estimate and many sources show that this length should be reduced. William Merkel, Hydraulic Engineer USDA, NRCS, National Water and Climate Center Beltsville, MD December 17, 2001. For this reason, the overland flow or sheet flow length was reduced to 30 metres.

It is considered that 30 metres may be an overestimate for the length of sheet flow for pre-development flow conditions over an unevenly graded "grass" covered surface. This overestimation increases the time of concentration for the pre-development conditions resulting in a lower pre-development flow rate. This would make the analysis more conservative than using a shorter time of concentration for pre-development conditions.

Airport Formula:

$$t_{ca} = \frac{3.26\ x\ (1.1 - C)\ x\ {l_c}^{0.5}}{S^{0.33}}$$

Where C = Runoff Coefficient = 0.2
l_c = length of flow path = 30 m

S = Slope of flow path percent = 1.2 for this site.

Upland Method

$$V = K\ x\ \sqrt{S}$$

$$t_{cu} = \frac{l_c}{60\ x\ V}$$

The K intercept was obtained from the Comprehensive Urban Hydrologic Modeling Handbook for Engineers and Planners First Edision 2006, By Nicklow/Boulos/Muleta Chapter 5. K is the intercept coefficient for shallow concentrated flow and is 0.213 m/s for grass covered surfaces.

For this site, the longest distance of travel for rainfall landing on the site is 90 metres. Since the first 30 metres is considered sheet flow, the remaining 60 metres will be along preferred channels. As such l_c = 60 m.

$$t_c = t_{ca} + t_{cu}$$

For this site, t*c* = 15.57 + 4.48 = 20.05 rounded to 20 minutes
Calculations are presented in Appendix B.

3.4.3.2 Post-Development

In keeping with the City of Ottawa sewer design guidelines, a time of concentration of 10 minutes was used to model post-development conditions.

3.5 Stormwater Quantity Control

Peak Flow for runoff quantities for the Pre-Development and Post-Development stages of the project were calculated using the rational method. The rational method is a common and straightforward calculation, which assumes that the entire drainage area is subject to uniformly distributed rainfall. The formula is:

$$Q = \frac{CiA}{360}$$

Where
Q is the Peak runoff measured in ***m^3/s***
C is the Runoff Coefficient, **Dimensionless**
A is the runoff area in ***hectares***

i is the storm intensity measure in ***mm/hr***

All values for intensity, i, for this project were derived from IDF curves provided by the City of Ottawa for data collected at the Ottawa International airport. For this project three return periods were considered, 2, 5 and 100-year events. The formulas for each are:

2-Year Event

$$i = \frac{732.951}{(t_c + 6.199)^{0.810}}$$

5-Year Event

$$i = \frac{998.071}{(t_c + 6.053)^{0.814}}$$

100-Year Event

$$i = \frac{1735.688}{(t_c + 6.014)^{0.82}}$$

where t_c is time of concentration

Using a pre-development time of concentration of 20 minutes, the 5-year storm intensity is 70.25 mm/hr.

3.5.1 Pre-development Site Conditions

As previously indicated, the site has a surface area of 0.7293 hectares and is located on the south side of Fernbank Road. The existing ground surface of the site is relatively low lying and ranges in elevation from about 93.5 to 94.7 metres. The site slopes towards Cell 2 of the existing Monahan Drain Stormwater Management Facility. The study prepared by Novatech 2007 indicates that that Cell 2 has a normal water level of 92.86 m, a 1:5 year level of 93.96 m and a 1:100 year level of 94.52 m. Recent information indicates that an updated subwatershed shed is being completed for the Manahan Drain. Preliminary reports indicate that the 1:100 year level will be increased to 94.62 m. It is expected that the 5 year level will also increase to as much as 94.06.

The site is currently undeveloped and is covered with unmaintained forest and grass.

Based on the stormwater management criteria the pre-development runoff coefficient is 0.2.

3.5.1.1 Pre-development Site Drainage Patterns

Existing stormwater runoff from the entire site in general consists of uncontrolled sheet flow towards the Monahan Drain. There is an earthern berm between the site and Cell 2 of the Drain Facility. Flow from the site is intersected by the berm and routed around either end of the berm to Cell 2. Due to the overgrowth of vegetation on the site, it was not apparent if the berm was cut or if a culvert(s) had been installed to facilitate additional drainage of the site.

3.5.1.2 Pre-development Off Site Drainage

The site is currently receiving runoff from the south half of Fernbank Road and the west half of Eagleson Road. Runoff from both roads is directed by sheet flow to the site. The back slope of the ditch adjacent Fernbank Road is non existing and of the ditch adjacent Eagleson Road is limited.

The off-site drainage will be collected and re-routed around the site during post development conditions. As such the offsite catchments were not included in the pre-development runoff rate calculations.

3.5.1.3 Pre-Development Runoff Rate

Using the Rational Method with the above calculated time of concentration, runoff coefficient and storm intensity, The pre-development runoff rate for the 5-year storm is:

5 year = 0.20 x 70.25 x 0.7293 / 360 = 0.0285 m^3/s or 28.5 L/s

3.5.2 Post-Development Site Conditions

As previously stated, the site will be developed to contain a 6 storey 143 unit residential apartment building. The building will be provided with both "underground" (basement) and surface parking. The proposed building will have a foot print of about 2436 square meters. The asphalt surfaced parking area, sidewalks and access roadways will have a combined surface area of about 3309 square meters.

Stormwater from the roof, sidewalks and proposed parking area will be directed to storage provided either on the parking area surface or in underground storage tanks below the parking area. Runoff from the perimeter landscaped/grass surfaced areas will be directed to the Monahan Drain without restriction.

3.5.2.1 Controlled and Uncontrolled Areas

For the purposes of this storm water management design, the site has been divided into uncontrolled and controlled areas as outlined on drawing 180084-POST-CA. The controlled area is defined as area CA1 and uncontrolled areas are defined as UA1. The Un-controlled area

consists of those locations from which runoff flows directly off the site without restriction. The controlled areas are those from which the runoff rate is restricted and runoff in access of the allowable release rate is temporarily stored and released at a controlled rate following the storm event. All of the impervious areas on the site, with the exception of about 128 square meters of sidewalk and patio, will be controlled. Controlled and uncontrolled areas for the site are listed in Appendix B.

Run-off from all of the roof drains will be directed without restriction to the underground storage below the parking area.

Post-development site conditions are summarised for the proposed development in the following Table 2.1

Table 3.1 – Summary of Post Development Site Conditions
Controlled and Uncontrolled Areas

Total Site Area 0.7293 hectares					
	Event Frequency	2,5 Year Return Period		100 year Return Period	
Surface Covering	Area of surface ha	Runoff Coef. C	C avg.	Runoff Coef. C	C avg.
Controlled Area CA1 – 0.6170 hectares					
Roof	0.2436	0.9	0.84	1.0	0.93
Landscape	0.0553	0.2		0.25	
Asphalt/Sidewalk	0.3181	0.9		1.0	
Time of Concentration				10 min	
UnControlled Area UA1 – 0.1123 hectares					
Roof	0	0.9	0.25	1.0	0.31
Landscape	0.1035	0.2		0.25	
Asphalt/Sidewalk	0.0088	0.9		1.0	
Time of Concentration				10 min	

3.5.3 Allowable Post Development Runoff Rate

Based on the stormwater management criteria, the total allowable runoff rate from the site is equal to the pre-development runoff rate for the 5-year storm event using a runoff coefficient of 0.2.

The allowable release rate from the site is equal to the total allowable runoff rate from the site less the runoff rate from the uncontrolled areas of the site.

As previously stated, the post-development flow rates were calculated assuming a time of concentration of 10 minutes. A time of concentration of 10 minutes yields an intensity of 76.81 mm/hr, 104.19 mm/hr and 178.56 mm/hr for the 2 year, 5 year and 100 year return periods, respectively.

Using the Rational Method the post-development flow rates from the uncontrolled areas (uncontrolled area runoff rate) are as follows:

2 year = 0.25 x 76.81 x 0.1123 / 360 = 0.0060 m^3/s
5 year = 0.25 x 104.19 x 0.1123 / 360 = 0.0081 m^3/s
100 year = 0.31 x 178.56 x 0.1123 / 360 =0.0173 m^3/s

The allowable release rates are calculated as follows:

Pre-development runoff rate – Uncontrolled area runoff rate = allowable release rate
2 year = 0.0285 m^3/s – 0.0060 m^3/s = 0.0225 m^3/s
5 year = 0.0285 m^3/s – 0.0081 m^3/s = 0.0204 m^3/s
100 year = 0.0285 m^3/s – 0.0173 m^3/s = 0.0112 m^3/s

3.5.4 Post Development Restricted Flow and Storage

In order to meet the stormwater quantity control restriction, the post development runoff rate cannot exceed the 5 year pre-development runoff rate. Runoff generated on site in excess of the allowable release rate will be temporarily stored on the exterior parking area surface and within underground storage tanks. The stored water will be released at a controlled rate following the storm event.

In order to achieve the allowable controlled area storm water release rate, storm water runoff will be controlled by an inlet control device (ICD) that is to be installed in CBMH- ST1. The ICD will consist of a 75 mm diameter orifice installed with an inlet invert of 94.35 m. The orifice will be above the 5 year ponding level in Cell 2 of the Monahan Drain and below the 100 year Flood in Cell 2. The discharge through the Orifice is controlled by the head across the Orifice. The head across the Orifice during a minor storm event will be a function of the invert elevation of the Orifice. During a major storm event the ponding level in Cell 2 will rise above the invert of the Orifice reducing the head across the Orifice. During a 100 year storm, the head will be controlled by the 100 year ponding elevation of Cell 2 of the Monahan Drain which is 94.62 m.

The orifice will restrict the flow during a 100 year storm event to 10.5 L/sec. Total storage volume required to restrict the flows from 100 year storm event to 10.5 L/s is 303 m^3. The chosen ICD will result in a restricted flow rate of about 10.5 L/sec during a 5 year storm event and 9.8 L/s during 2 year storm event. The following Table 3.2 provides a summary of the

available storage and discharge for the site. The release rate and storage requirements are summarized in the following Table 3.3.

Table 3.2 – Summary of Storage vs Discharge Rate.

Stage Elevation (m)	Available Storage Volume (m^3)	2 Year and 5 Year Events		100 Year Event	
		head* (m)	Discharge Rate (m^3/sec)	head* (m)	Discharge Rate (m^3/sec)
95.60	418	1.21	12.1	0.98	10.9
95.55	346	1.16	11.9	0.96	10.6
95.50	278	1.11	11.6	0.88	10.3
95.45	216	1.06	11.3	0.83	10.0
95.40	173	1.01	11.1	0.78	9.7
95.35	152	0.96	10.8	0.73	9.4
95.30	144	0.91	10.5	0.68	9.1
95.15	97	0.76	9.6	0.53	8.0
95.95	34	0.56	8.3	0.33	6.3
94.84	0	0.45	7.3	0.22	5.1

Note 1: During the 2 year and 5 year storm events, the head is equal to the difference between the surface water elevation and the center elevation of the 0.075 mm diameter outlet Orifice.
For example: 95.60 – (94.35+0.04) = 1.21 m.

Note 2: During the 100 year storm event, the head is equal to the difference between the surface water elevation and the 100 year flood elevation in the Monahan Drain Cell 2.
For example: 95.60 – 94.62 = 0.98 m.

Table 3.3 – Summary of Post-Development Catchment Area Release rates and Storage Requirements.

Return period	Total Allowable release rate	uncontrolled area release	Allowable controlled area release	Actual Controlled area Release rate	Required Storage	Available Storage
(years)	(L/s)	(L/s)	(L/s)	(L/s)	(m^3)	(m^3)
2	28.5	6.4	22.1	9.4	91	415
5	28.5	8.7	19.8	10.2	132	
100	28.5	17.9	10.6	10.4	300	

3.5.5 Underground Storage Tanks

The underground storage will be provided using Brentwood StormTank Modular Tanks. A Brentwood StormTank Module is a subsurface storage unit load-rated for use under surfaces such as parking lots, athletic fields, and parks. Design information for the Brentwood StormTanks is provided in Appendix C.

The underground tanks proposed for the site are comprised of ST-18 Modular Units. Each unit has a height of 0.457 m, a width of 0.457 m and a length of 0.914 m. The modules will be placed in two tank locations.

The first location is southwest of the proposed building. The second is along the east side of the parking area east of the building. The first tank group will consist of 250 modules placed 10 modules wide by 25 modules long arranged as 10 x 0.457 m by 25 x 0.914 m. The total tank width will be 4.57m and the length will be 22.85 m. The second tank group will consist of 500 modules placed 20 modules wide by 25 modules long arranged as 20 x 0.457 m by 25 x 0.914 m. The total tank width will be 9.14 m and the length will be 22.85 m.

The tanks will be placed with a bottom elevation of 94.84 meters to be above the 100 year flood level in Cell 2 of the adjacent Monahan Drain.

There is a total of 136.5 cubic meters of storage available within the storage tanks. There will be an additional about 28.2 cubic meters of storage available in the clear stone layer above the tanks assuming a 30 percent void ratio typical of clear stone.

Based on the storage available within the storage tanks, there will be no surface ponding during the 2 year and 5 year design storm events.

3.5.6 Surface Water Storage

There is about 245.8 cubic meters for surface storage available on the parking area at the south side of the site below an elevation of 95.60 meters. The lowest surface storage elevation is 95.30 meters. The 100 year ponding elevation is 95.53 meters resulting in a ponding depth of 0.23 meters during a 100 year storm event. The surface storage is designed to outlet directly to Cell 2 of the Monahan Drain above an elevation of 95.60 meters by means of overflow along the length of the entire south curb.

3.5.7 Parking Ramp Runoff

Runoff generated on the parking ramp will be captured by a trench drain placed across the ramp immediately before the entrance door. The following Table 3.4 provided the required storage versus pump rate for a 100 year storm event.

Table 3.4 – Required Storage Versus Pump Discharge Rate

Runoff Coefficient, C = 1.00			Drainage Area (ha) = 0.018			Return Period = 1:100 years		
Pump Rate (USGPM)			30	40	50	60	70	80
Pump Rate (L/s)			1.89	2.52	3.15	3.79	4.42	5.05
Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)	Storage Required (m^3)					
0	398.6	20.4	0.00	0.00	0.00	0.00	0.00	0.00
2	315.0	16.1	1.71	1.63	1.56	1.48	1.40	1.33
5	242.7	12.4	3.16	2.97	2.78	2.59	2.40	2.21
10	178.6	9.1	4.34	3.97	3.59	**3.21**	**2.83**	**2.45**
15	142.9	7.3	4.87	4.31	**3.74**	3.17	2.60	2.04
20	120.0	6.1	5.09	**4.33**	3.58	2.82	2.06	1.31
25	103.8	5.3	**5.13**	4.18	3.24	2.29	1.34	0.40
30	91.9	4.7	5.05	3.92	2.78	1.64	0.51	-0.63
35	82.6	4.2	4.90	3.57	2.25	0.92	-0.40	-1.73

The trench drain will discharge to a 4500 Liter pre-cast underground storage tank/pump chamber located adjacent the doorway below the basement floor by means of 150 mm diameter PVC storm lead. The lead will have a minimum slope of 6.7 percent resulting in a capacity of at least 39 L/sec which is sufficient to accommodate the maximum flow rate generated during a 100 year storm event. The storage tank/pump chamber will be discharged by means of a submersible grinder pump capable of discharging a minimum of 50 USGPM at a head of 18 ft (5.5 m). The storage tank/pump chamber shall be equipped with a duplicate back up pump and be supplied with back power by means of a generator. The pumps shall be fitted with high water alarms and shall discharge to the catchbasin adjacent the exterior stormwater storage tanks.

3.6 Stormwater Quality Control

3.6.1 Stormwater Quality Criteria

As previously indicated, the stormwater Runoff from the site will be directed to the Monahan Drain which is a sensitive aquatic habitat. Enhanced Protection corresponding to 80 percent total suspended solids removal will be provided.

3.6.2 Quality Control Methodology

Quality control for the site will be achieved by the use of a hydrodynamic separator which is designed to remove floatable debris, oils, grease and grit from stormwater. The proposed hydrodynamic separator (oil/grit separator) will consist of an Aqua-Swirl AS03IN treatment unit or approved alternative. The Aqua-Swirl AS03IN is an inline treatment unit which will be installed downstream of the outlet manhole containing the ICD controlling the runoff rate from the site.
The AQUALSWIRL units are underground treatment devices that allow for the settlement of grit and hydrodynamic separation of oil from the stormwater as it passes through, and will remove 80% of TSS to meet the enhanced treatment requirements. AQUASWIRL design information is included in Appendix D. The proposed AQUASWIRL treatment unit is designed to have a maximum flow rate (maximum water quality treatment flow rate) of 50.9 litres per second. This is more than 4 times the maximum allowable release rate from the site during a 100 year storm event.

The particle size distribution used for the sizing of an Aquaswirl treatment unit is the NJDEP particle size distribution

Particle (um)	(%)	Specific Gravity
1	5	2.65
4	15	2.65
29	25	2.65
75	15	2.65
175	30	2.65
375	5	2.65
750	5	2.65

The proposed oil/grit separator will have oil and floating debris storage capacity of 416 Liters and a sediment storage capacity of 600 Liters.

As note in the US EPA Stormwater Best Management Practice Design Guide, Volume 1 – General Considerations, 2004 quoted below, the majority of the annual pollutant load is transported by small frequent storm events. Conversely, large infrequent events carry an insignificant percentage of the total annual pollutant load.

"Increasingly stormwater professionals have come to realize that small storms (i.e. < 1 in. rainfall) dominate watershed hydrologic parameters typically associated with water quality management issues and BMP design. These small storms are responsible for most annual urban runoff and groundwater recharge. Likewise, with the exception of eroded sediment, they are responsible for most pollutant washoff from urban surfaces. Therefore, the small storms are of most concern for the stormwater management objectives of ground water recharge, water quality resource protection and thermal impacts control." (US EPA Stormwater Best Management Practice Design Guide, Volume 1 – General Considerations, 2004)

The MOE Manual states that "Oil/grit separators will be required to be sized to capture and treat at least 90% of the runoff volume that occurs for a site on a long-term average basis for water quality objectives of 'enhanced protection.'.

Because the runoff rate through the proposed treatment unit is controlled and restricted, there will be no flow by-pass during high flow events. This means all runoff generated on the controlled areas of the site will be treated and the criteria set out in the MOE manual for Oil/Grit separators will be met.

3.7 Stormwater System Operation and Maintenance

3.7.1 Inlet Control Device (ICD)

The inlet control device (ICD) should be inspected on a semi-annual basis and following major storm events. Any blockages, trash or debris should be removed. If surface ponding on the parking area does not recede in a normal manner, the ICD should be inspected and cleaned.

3.7.2 Catchbasin/ Manhole and Inspection Ports

The catchbasin / manhole and inspection ports (including sediment traps in storm tanks) should be cleaned with a hydrovac excavation truck following completion of construction, paving of the asphaltic concrete surface and establishment of adequate vegetative cover on the landscaped areas.

Following the initial cleaning these structures should be inspected on a semi-annual basis and following major storm events. Any blockages, trash or debris should be removed. Once the sediment accumulation in the catchbasin / manhole has reached a level equal to 0.15 metres below the outlet invert of the structure, or a thickness of 0.15 metres in the sediment traps, the sediment should be removed by hydro excavation.

3.7.3 Brentwood StormTank Storage Tanks

Detailed installation, operation and maintenance guidelines are provided in the StormTank Module Design Guide included in Appendix C. In general maintenance procedures consist of Inspection and cleaning as follows:

Inspection:

- Inspect all observation ports, inflow and outflow connections, and the discharge area.
- Identify and log any sediment and debris accumulation, system backup, or discharge rate changes.
- If there is a sufficient need for cleanout, contact a local cleaning company for assistance.

Cleaning:

- If a pretreatment device is installed, follow manufacturer recommendations.
- Using a vacuum pump truck, evacuate debris from the inflow and outflow points.
- Flush the system with clean water, forcing debris from the system.
- Repeat steps 2 and 3 until no debris is evident.

3.7.4 Aqua-Swirl AS03IN Treatment Unit

Detailed installation, operation and maintenance guidelines are provided in Aqua-Swirl Stormwater Treatment System Inspection and Maintenance Manual included in Appendix D.

The Treatment Unit should be cleaned with a hydrovac excavation truck following completion of construction, paving of the asphaltic concrete surface and establishment of adequate vegetative cover on the landscaped areas. A quarterly inspection is recommended for the first year of operation to develop an appropriate schedule of maintenance. Based on the first years operation, an inspection schedule should be developed.

The Aqua-Swirl® has been designed to minimize and simplify the inspection and maintenance process. The single chamber system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. Furthermore, the entire structure (specifically, the floor) is accessible for visual inspection from the surface. Inspection of any free floating oil and floatable debris can be directly observed and maintained through the manhole access provided directly over the swirl chamber.

Floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water. The maintenance trigger for Aqua-Swirl® Models AS-3 through AS-13 occurs when the sediment pile is within 42 to 48 inches of the standing water surface.

Free-floating oil, floatable debris and sediment can be removed directly through the 30-inch service access riser provided. A vacuum truck is typically used to remove the accumulated

sediment, debris and oil. Disposal of recovered material is typically handled in the same fashion as catch basin cleanouts.

3.8 Storm Sewer Design

3.8.1 Onsite Storm Sewer

The on-site storm sewers were designed to be in general conformance with the City of Ottawa Sewer Design Guidelines (October 2012). These storm sewers are limited to the pipes designed to convey runoff to the underground storage tanks and from the storage to the discharge location. Specifically, storm sewers were sized using Manning's Equation, assuming a roughness coefficient N = 0.013, to accommodate the uncontrolled runoff from the 5-year storm, under 'open-channel' conditions. The uncontrolled runoff was determined using the rational method and the City of Ottawa IDF curve for a 10-minute time of concentration. Refer to Storm Sewer Design Sheet in Appendix B.

3.8.2 Sewer along Eagleson Road and Along Fernbank Road

As part of the development of the proposed lot, it is intended to fill in the ditch between the site and Fernbank Road to form an Urban residential road allowance. The resulting section along the south side of Fernbank will be in keeping with the development along the north side of Fernbank across from the site, and with the residential development west of the site. A 300 mm diameter HDPE R320 storm pipe complete with Catch Basin – Elbow or Tee as per City of Ottawa Standard Drawing S31 will be used to direct the flows originating between the proposed building and the center line of Fernbank Road to the Monahan Drain. Calculations for the proposed sewer are included on the Storm Sewer Design Sheet in Appendix B.

The section of ditch between the proposed building and Eagleson road north of the first entrance will also be filled in. A manhole with a perforated cover installed at the end of the existing CSP culvert under Fernbank road. The manhole will discharge by means of a 450 mm diameter HDPE R320 storm pipe which will outlet on the south side of the entrance to the site nearest Fernbank Road. Calculations for the proposed sewer are included on the Storm Sewer Design Sheet in Appendix B.

4 SANITARY SEWER DESIGN

4.1 Existing Sanitary Sewer

As indicated during the pre-consultation meeting, the existing sewer to which the proposed development will be connected is located along Fernbank Road. This sewer consists of a 450 mm diameter PVC sewer installed with a 0.144 percent slope. This sewer is extended north along Eagleson Road for a distance of about 230 meters then west along an easement and then along Carronbridge Circle to the sanitary trunk line at the intersection of Cope Drive and Akerson Road. The existing 450 mm diameter sewer main has a capacity of 95 L/s at the minimum allowable design slope of 0.11 percent.

The existing sewer along Fernbank Road is located slightly north of the paved surface. Based on as-built plan and profile drawings obtained from the City of Ottawa, lightweight fill was installed beneath the roadway pavement structure of Fernbank Road and above the sanitary sewer. The lightweight fill beneath the roadway pavement structure extends east from the Monahan Drain to about 92 meters from the east property line of the site or west side of the Eagleson Road allowance. The lightweight fill above the sanitary sewer extends east from the Monahan Drain to about 50 meters from the east property line of the site. The total length of the north property line of the site is about 143 meters.

4.2 Sanitary Demand

Sewage discharges from the proposed development will be domestic in type and in compliance with the City of Ottawa Sewer Use By-law. As previously indicated, the proposed development will consist of a 6 storey, 143 unit residential apartment building. Since the unit break down is provided on the proposed site plan and is summarised below.

The sanitary sewage flow for the proposed building was calculated based on the City of Ottawa Sewer Design Guidelines (Section 4.4.1.2) and Technical Bulletin ISTB-2018-01.

Design Flows
Residential

Total domestic pop:

Type of Unit	Number of Units	Persons Per Unit	Population
1 Bedroom	44	1.4	61.6
2 Bedroom	71	2.1	149.1
3 Bedroom	28	3.1	86.8
Total Occupancy	143		297.5

$Q_{Domestic}$ = 297.5 x 280 L/person/day x (1/86,400 sec/day) = 0.96 L/sec

Peaking Factor = $1 + \frac{14}{4 + (297.5/1000)^{0.5}}$ = 4.08 use 4 maximum

Correction Factor = 0.8 (residential)

$Q_{Peak\ Domestic}$ = 0.96 L/sec x 4 x 0.8 = 3.09 L/sec

Infiltration

$Q_{Infiltration}$ = 0.33 L/ha/sec x 0.7293 ha = 0.24 L/sec

Total Peak Sanitary Flow = 3.09 + 0.24 = 3.33 L/sec

4.3 Sanitary Service Lateral

4.3.1 Size

The proposed building will be serviced by a 200 mm diameter sanitary service lateral based on the following design requirements from the Ontario Building Code.

The Ontario Building Code specifies minimum pipe size and maximum hydraulic loading for horizontal sanitary sewer pipe. The sanitary service lateral is governed by the Ontario Building Code.

OBC 7.4.10.8 (2) states "Horizontal sanitary drainage pipe shall be designed to carry no more than 65% of its full capacity." A 150 mm diameter sanitary service with a minimum slope of 1.0% has a capacity of 15.23 Litres per second. 65 percent of the full capacity is 9.9 L/s.

OBC 7.4.10.8 (1) states "the hydraulic load that is drained to a horizontal sanitary drainage pipe shall conform to Table 7.4.10.8. based on the size and the slope" The hydraulic load is calculated in terms of fixture units in OBC Table 7.8.10.8.

The fixture units of the proposed building are calculated in the following table:

Table 4.1 Fixture Unit Consideration

Apartment Unit Type	Number of Apartments	Number of fixture units per apartment	Total number of Fixture Units.
• 1Bedroom • 1 bathrooms	44	10	440
• 2 Bedroom • 2 bathroom	71	16	1136
• 3 Bedroom • 2 bathroom	28	16	448
• Total Fixtures			2024

From OBC Table 7.4.10.8, the allowable number of fixture units for a 150 mm diameter sanitary service pipe at a 1.0% slope is 700. In order to meet the hydraulic load requirement of Table 7.4.10.8, the service size will have to be increased to have diameter of 200 mm and a minimum slope of 2 percent. The allowable number of fixture units for a 200 mm diameter sanitary service pipe at a 2.0% slope is 2250.

4.3.2 Location and Connection

The proposed building will be serviced by a 200 mm diameter sanitary service lateral which will be installed in accordance with City of Ottawa standards and specifications. The lateral will extend from the building to the existing 450 mm diameter PVC sanitary sewer along Fernbank. The sanitary service will be connected to the existing sewer about 43 meters west of the east property line of the site to avoid impacting the light weight fill above the sanitary sewer main.

The proposed service lateral will be have an anticipated connection invert of 92.30 and will be connected above the spring line of the existing sanitary sewer. The invert of the proposed service lateral at the proposed entry to the building is 93.14 m. Based on the proposed grading plan, the elevation of the parking garage floor (basement floor) is 92.95 meters. The elevation of the first floor is 96.45 meters.

Based on the proposed building elevations with respect to the anticipated sanitary service invert, the parking area floor drains will be directed by gravity to a basement sump pit and pumped and will be discharged by pump to the sanitary sewer. The discharge line from the sump pit will require a backflow preventer. There are no anticipated sources of water with the parking garage. That is, no water lines will be installed to facilitate car washing or similar use.

Flow from the remainder of the proposed building will be directed by gravity into the 200 mm sanitary service lateral.

In order to avoid settlement of the sanitary service and changes in the service pipe slope resulting from settlement, the proposed sanitary service lateral will require the installation of lightweight fill above the lateral due to the poor soil conditions at the site. From the geotechnical report, the maximum allowable grade raise above the service pipes is 1.0 meters without the use of lightweight fill. The extent of the lightweight fill is shown on the Servicing Drawing. Based on the geotechnical report and the proposed grading plan, the lightweight fill will have to extend from the south edge of the shoulder of Fernbank Road to the north wall of the proposed building.

5 WATERMAIN DESIGN

5.1 Existing Watermain

A 305 mm diameter PVC watermain exists along the south side of Fernbank Road approximately 2 meters north of the south curb. There is a second watermain in close proximity to the site. The second watermain consists of a 610 mm diameter Hyprescon Concrete Pipe along Eagleson Road. It is not an option to connect the proposed water services to the watermain along Eagleson Road due to its size and construction.

5.2 Water Demand

The water demand for the proposed development was calculated based on the City of Ottawa Water Distribution Design Guidelines as follows:

Residential
Total occupancy as calculated in section 4.2 of this report: 297.5

Residential Average Daily Demand = 350 L/c/d.

- Average daily demand of 350 L/c/day x 297.5 persons =104125 Litres/day or 1.21 L/s
- Maximum daily demand (factor of 2.5) is 1.21 L/s x 2.5 = 3.01 L/s
- Peak hourly demand (factor of 2.2) = 3.01 L/s x 2.2 = 6.63 L/s

5.3 Fire Flow

Fire flow protection requirements were calculated as per the Fire Underwriter's Survey (FUS) taking into account the methodology provided in Technical Bulletin ISTB-2018-02. The calculated fire flow demand based on FUS was 171.4 L/s

Calculations of the fire flow required are provided in Appendix E following the text of this report.

Fire protection will be provided by existing fire hydrants located the south side of Fernback Road immediately north of the proposed building. In addition, the proposed development will have an automatic sprinkler system.

5.4 Boundary Conditions

The water demand due to occupancy together with the fire flow requirements were provided to the City of Ottawa. These demands consist of a peak hourly demand of 6.9 L/s (414.6 L/min) a maximum daily demand of 3.1 L/s (188.4 L/min) and a fire flow demand of 171.4 L/s (10,285

L/min) in order to obtain the boundary conditions for the site. The water service will be connected to the 305 mm Diameter PVC watermain along Fernbank Road.

The following are boundary conditions, HGL, for hydraulic analysis were provided.

Maximum HGL	= 161.6 m – (93.2 psi at an elevation of 96.04 meters)
Peak Hour	= 156.9 m – (86.5 psi at an elevation of 96.04 meters)
Max Day Plus Fire Flow 10,473 L/min	= 157.0 m – (86.6 psi at an elevation of 96.04 meters)

The request for Boundary Conditions and response received from the City of Ottawa are included in Appendix F attached.

5.5 Hydraulic Watermain Analysis

Minimum residual pressure in a watermain or service is 276 kPa (40 psi) as recommended by the Ministry of Environment and Climate Change. A minimum residual pressure of 138 kPa (20 psi) is required during fire flow conditions.

As per the Ontario Building Code 7.6.3.3 in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.). As per City of Ottawa technical bulletin ISD-2010-2 the desired range of system pressure should be approximately 350 to 480 kPa (50 to 70psi)

Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 480 kPa (50 to 70 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

MaxDay + FireFlow (174.5 L/s) = 157 m

$$HGL = \frac{P}{\gamma} + Z$$

$$P = (HGL - Z) \times \gamma$$

P = Pressure (KPa)

- Minimum pressure 276 KPa
- Maximum pressure 552 KPa

Z = ground elevation + Siamese connection height ~ 97.0m

ɣ = 9.79 KN/m^3 (unit weight of water)

$$P = (157.0m - 97.0m) \times 9.79\text{KN/m3}$$
$$P = 587.4\ \text{KPa}$$

Neglecting minor and frictional pipe losses in the lateral, the residual pressure while meeting the fire flow and maximum daily demand is above 276 KPa. It is further noted that the residual pressure is above the recommended maximum before which a pressure reducing valve is required.

Maximum HGL = 161.6 m

$$P = (161.6m - 97m) \times 9.79\text{KN/m3}$$
$$P = 632\ \text{KPa}$$

Neglecting minor and frictional pipe losses in the lateral, the maximum pressure at the ground floor is well above the recommended maximum pressure before a reducing valve is required 480 KPa.

The expected pressure at the 6th floor of the proposed building including minor and frictional pipe losses was calculated using the Bernoulli Equation in combination with the Darcy – Weisbach Equation and the Colebrook Equation for turbulent flow. It is assumed that each floor would have a height of 3.5 meters.

Using a 150 mm water service:

- The water pressure distributed along the 6th floor would be 263 kPa during peak hourly flow conditions assuming the water pressure is reduced to 480 kPa or slightly less than the recommended maximum pressure by a pressure reducer;
- The available pressure would be insufficient to meet the fire flow requirements at the 6th floor of the proposed building without the use of a booster pump even if no pressure reduction was used on the incoming water service;
- The available pressure entering the first floor of the building before the pressure reducer would be about 279 kPa during fire flow conditions.

Using a 200 mm water service:

- The water pressure distributed along the 6th floor would be 264 kPa during peak hourly flow conditions assuming the water pressure is reduced to slightly less than the recommended maximum pressure by a pressure reducer.;
- The available pressure at the most remote location from the service entry point along the 6th floor would be about 111 kPa during fire flow conditions assuming the water pressure is reduced to 480 kPa or slightly less than the recommended maximum pressure by a pressure reducer. The adequacy of the available pressure for the proposed sprinkler system should

be assessed by the mechanical engineer. Should this available pressure be insufficient, a booster pump will be required for fire protection purposes;

- The available pressure entering the first floor of the building before the pressure reducer would be about 467 kPa during fire flow conditions.

Based on the above hydraulic analysis, it is recommended that a 200 mm diameter service be used. The service should be PVC DR 18 C150 pressure pipe.

5.6 Water Service

The proposed 200 mm water service will be connected to the existing 305 mm watermain using a tee connection. The excavation for the service will be completed by the contractor. The contractor will also supply the service and necessary components. Connection of the service to the City watermain will be completed by City forces. A pressure reducing valve is to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

As per Ottawa Design Guidelines - Water Distribution – July 2010 two connection locations are required for residential developments exceeding 50 units. Alternatively, one connection is possible provided two valves are installed, one on each side of connection in order to prevent water service interruptions to future residents. Since a second connection to the watermain on Eagleson Road is not possible, a water valve will be require immediately west of the proposed tee connection. Since there is an existing water valve about 30 meters east of the proposed tee connection with no services between the existing valve and the proposed tee connection, it is considered that a second valve will not be required. The valve will be installed in a valve chamber in accordance with the City of Ottawa water distribution guidelines.

6 EROSION AND SEDIMENT CONTROL

The owner (and/or contractor) agrees to prepare and implement an erosion and sediment control plan at least equal to the stated minimum requirements and to the satisfaction of the City of Ottawa, appropriate to the site conditions, prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and during all phases of site preparation and construction in accordance with the current best management practices for erosion and sediment control. It is considered to be the owners and/or contractors responsibility to ensure that the erosion control measures are implemented and maintained.

In order to limit the amount of sediment carried in stormwater runoff from the site during construction, it is recommended to install a silt fence along the berm adjacent the south side of the site. The silt fence should be extended to tie into the roadside slope at both ends. The silt fence may be polypropylene, nylon, and polyester or ethylene yarn.

If a standard filter fabric is used, it must be backed by a wire fence supported on posts not over 2.0 m apart. Extra strength filter fabric may be used without a wire fence backing if posts are not over 1.0 m apart. Fabric joints should be lapped at least 150 mm (6") and stapled. The bottom edge of the filter fabric should be anchored in a 300 mm (1 ft) deep trench, to prevent flow under the fence. Sections of fence should be cleaned, if blocked with sediment and replaced if torn.

Filter socks should be installed across existing storm manhole and catch basin lids. As well, filter socks should be installed across the proposed catch basin lids immediately after the catch basins are placed. The filter socks should only be removed once the asphaltic concrete is installed and the site is cleaned.

Mud Mats or Sediment Control Mats are to be installed and maintained at construction access points to minimize sediment transfer or track-out by construction traffic onto existing roadways. The mud mat should have span the width of the access roadway and should have a minimum length of 10 meters. A manufactured construction site track-out plate (also known as: exit grid, rumble plates, or shaker plates) system may be used in place of the mud mats. The mud mat or track-out plate must be maintained throughout the construction period by removing accumulated sediment in order to maintain its effectiveness.

Roadways are to be swept or cleaned by the contractor as required or directed by the engineer and/or City of Ottawa and/or Conservation Authority.

Straw bale flow check dams (OPSD 219.180) should be installed in roadside ditches downstream of the site.

The proposed landscaping works should be completed as soon as possible. The proposed granular and asphaltic concrete surfaced areas should be surfaced as soon as possible.

The silt fences should only be removed once the site is stabilized and landscaping is completed.

These measures will reduce the amount of sediment carried from the site during storm events that may occur during construction.

7 CONCLUSIONS

SWM for the proposed development will be achieved by restricting the 100 year post development flow to the 5 year pre-development flow assuming a runoff coefficient of 0.2.

The average daily sewer flow from the proposed development will be 0.96 L/sec with a peak sewage flow rate including infiltration of 3.09 L/sec. A 200 mm diameter service pipe at 2 percent slope will be installed to accommodate this flow. The below grade parking (basement) floor drains will be directed to a sump which will be discharged by pumping into the sanitary service. The existing municipal sanitary sewer should have adequate capacity to accommodate the increase in peak flow.

The proposed water service will consist of a 200 mm diameter PVC DR 18 C150 pressure pipe connected to the existing water main along Fernbank Road. A pressure reducer will be required immediately following the service entry and water meter in the building.

During all construction activities, erosion and sedimentation shall be controlled.

We trust that this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we can be of any further assistance to you on this project, please do not hesitate to contact our office.

Sincerely,
Kollaard Associates, Inc.

_____
Steven deWit, P.Eng.

Appendix A: Summary of Pre-Consultation Meeting

- Pre-Consultation Notes
- Applicant's Study and Plan Identification List

File No. PC2017-0342

Subject / Objet : **800 Eagleson Road – Pre-Consultation Notes**
December 12, 2017 – 9:30 AM, Room 4103E

Attendees

Name	Position	Organization
Kathy Rygus	Planner	City of Ottawa
Mary Dickinson	Planner	
Victoria Bissonnette	Planner	
Santhosh Kuruvilla	Project Manager, Infrastructure	
Rosanna Baggs	Project Manager, Transportation	
Mark Richardson	Forester, Planning	
Amy MacPherson	Planner, Natural Systems	
Mark Young	Planner, Urban Design	
Ben Crooks	Planning Assistant	
Pascal Toupin-Selinger	Design and Development Manager	Ironclad Developments Inc.

Development Proposal

- Six-storey rental apartment building, with approximately 150 units (preliminary unit counts: 5 bachelor suites, 41 one-bedroom suites, 75 two-bedroom suites and 27 three-bedroom suites)
- The building will also include a fitness room for tenants and leasing office
- 209 surface and underground parking spaces are proposed, with vehicle access from both Fernbank Road and Eagleson Road
- Applicant's website: https://www.ironcladdevelopments.com/

Meeting Notes

Engineering

- Soil on the site is relatively poor quality with a high clay composition;
- The previous applicant abandoned the project based on difficulties with the soil; Geotechnical background information is available at the following location: https://app01.ottawa.ca/postingplans/appDetails.jsf?lang=en&appId=__96Q8D9
- The ground water table is high;
- A City stormwater management pond is adjacent to the south and the 100-year flood elevation is high;
- A sanitary sewer is in place on Fernbank Road;
- A watermain is available on both Fernbank and Eagleson Road;

- The existing storm sewer on Fernbank Rd. outlets to the pond, so applicant can consider directing flows to the pond;
- Consult with MOECC local office (Ottawa) to determine whether this site requires MOECC ECA or not. Include email correspondence or meeting minutes in the Appendix of the Servicing or Stormwater Management Report;
- Consult with Conservation Authority to determine any on-site stormwater quality treatment is required prior to discharging to the pond;
- Stormwater quantity criteria – Refer to Novatech's Monahan Drain Report (Flow must be controlled to the 5-year storm event with runoff coefficient 0.20);

Transportation

- It is recommended that a local transportation engineer who is familiar with the City's Transportation Impact Assessment (TIA) guidelines be hired;
- The TIA process involves multiple modules and the application is not deemed complete until the final submission is completed, so it's recommended that the transportation work be started early;
- Any required roadway modifications will be determined through the TIA process;
- Both Eagleson and Fernbank Roads have protected Rights-of-Way (ROW); a surveyor must confirm that these widenings have been taken (Eagleson: 44.5 m Fernbank: 30 m);
- Curb-work and line-work must be shown for both Eagleson and Fernbank;
- Ensure that adequate distances is provided between the site accesses and the adjacent intersection (70 m for arterials) - follow the Transportation Association of Canada guidelines;
- Provide adequate clear-throat lengths for parking lot accesses - for a lot with 100 to 200 spaces, at least 15 m must be provided;
- If OC Transpo runs bus routes adjacent to the property, consider paying for a bus shelter;
- Keep corner radii tight;
- Properly design the loading / move-in area to be large enough for moving trucks, with simple turning templates;
- If the underground parking garage extends past the building footprint under a fire route, these sections need to be built to a higher standard;
- Provide bike room at grade to ensure that direct and easy access is possible.

Noise

- A Noise Impact Assessment (NIA) will be required for roadway traffic;
- A stationary NIA will also be required if there is any exposed mechanical equipment;
- Any patios greater than 4 sq m in depth are considered outdoor living spaces for the purpose of analyzing noise.

Tree Conservation / Forestry

- A Tree Conservation Report (TCR) must be supplied for review along with the suite of other plans/reports required by the City; an approved TCR is a requirement of Site Plan Approval;
- The TCR must list all trees on site by species, diameter and health condition; note that the TCR must address all trees with a critical root zone that extends into the developable area. For groupings of trees (stands), species distribution, average diameter by species, and general health status may be supplied instead of a full list of every tree;
- If trees are to be removed, the TCR must clearly show where they are and document the reason they can not be retained;
- All retained trees must also be shown and all retained trees within the area impacted by the development process must be protected as per the City guidelines listed on Ottawa.ca
- Any removal of privately-owned trees 10cm or larger in diameter requires a tree permit issued under the Urban Tree Conservation Bylaw; the permit is based on the approved TCR;
- The City does encourage the retention of healthy trees wherever possible;
- Grading of the site will reduce expectation of tree retention and preservation - the Eagleson side of the site may have a higher potential for retention;
- Consider planting trees on the berm on the southern edge of the site - berm is on City property, coordinate with Mark Richardson regarding the planting process;
- Tree cover extends onto the City ROW; the removal of City-owned trees will require the permission of Forestry Services who will also review the submitted TCR;
- Any trees planted should be a locally appropriate native species;
- The previous application did not indicate that butternut trees were present on site; however, this does not mean that they are not there and it is the client's responsibility to ensure that they adhere to the legislative requirements within the Ontario governments Endangered Species Act;
- The Environmental Impact Statement (EIS) and TCR may be combined and prepared by one consultant.

  For more information on process or help with tree retention options, contact Mark Richardson mark.richardson@ottawa.ca

Environmental

- Please do not plant any non-native invasive species on the site;
- Species at Risk to be addressed:
  - Barn Swallows: Likely using the adjacent pond as a foraging habitat, may or may not be nesting in a nearby culvert; the property itself would likely classified as Category III Habitat at most, which is the most tolerant to change;
  - Butternut Trees:
- A tree clearing permit does not mean that Butternut trees can be removed without proceeding through the provincial permit process;

- The property could be a significant wildlife habitat, and must be evaluated based on provincial criteria:
    - The low, wet nature of the site and proximity to the pond could mean that the property functions as an amphibian breeding habitat;
    - Likely classified as a Category III Habitat, which is the most tolerant to change;
    - Need to demonstrate that the development will have no negative impact on habitat;
- Field assessments must be completed at specific times: work will not be possible until the spring
- A preliminary/desktop EIS can be submitted with the site plan application, on the understanding that follow-up fieldwork will be required;
- The Site Plan application can be deemed complete, with a reference to the need for a seasonal study that will be submitted later;
- Tree clearing cannot be conducted during the breeding season of migratory birds (between March and mid-August).
- Any site layout/engineering work proposed before the seasonal studies are completed and approved are at the applicant's own cost and risk;
- Site Plan Approval will not be granted until all EIS matters are resolved;
- A list of local environmental consultants who provide EIS services is available if needed.

<u>Urban Design/Planning</u>

- Because the Official Plan designates Eagleson Road as an Arterial Mainstreet, the site is within a Design Priority Area, and will be subject to the Urban Design Review Panel (UDRP). Expectations for the quality of the project are high.
- Although only a formal review by the panel is required, a preconsultation in advance of submission of the site plan application is highly encouraged to obtain comments early in the process;
- Consider opening up part of the rear property line onto the stormwater management pond in order to connect the building to an outdoor amenity area;
- Reduce the amount of surface parking to the greatest extent possible (a minor variance to reduce the resident parking rate could be pursued, but visitor parking rates should not be changed);
- Consider moving the access to the drop-off area to the Eagleson Road side, and change the central area into a courtyard;
- Activate the Eagleson frontage of the site through provision of amenity spaces;
- Consider orienting the ground-floor units onto Fernbank Road, through functional doors and patios;
- The Eagleson/Fernbank corner of the building should be made prominent and not stepped down; consider step-downs along Fernbank frontage instead;
- Provide different façade treatments for the first four stories and the upper two stories.

- Relocate garbage storage to the inside of the building - Waste Services will remove the containers from the building;
- The landscaped buffer around the parking area must meet the provisions of the Zoning By-law.
- Floor Space Index is not applicable to the site.

Moving Forward

- The project will require a Site Plan Control application, Manager Approval, Public Consultation;
- The Site Plan Control process will take approximately 4-6months, depending on factors such as quality of submission, technical comments received, and applicant's turnaround times for resubmission in response to comments;
- Public notification for site plan applications is limited to on-site billboards; although public comments are expected, this is a permitted use;
- Approval is by delegated authority of the Development Review Manager, with concurrence from Councillor Allan Hubley;
- Applicant should consider notifying the Trail West Community Association and Councillor Hubley;
- Helpful resources:
    - DevApps – All development applications subject to public consultation have their plans and studies available here: https://app01.ottawa.ca/postingplans/home.jsf?lang=en
    - In My Neighbourhood – This system integrates a range of City data into a geobrowser, including nearby development applications, City facilities, schools, and parks: http://maps.ottawa.ca/imn/desktop.htm

Costs

- Application fee (2017): $21,087. Fees expected to increase on January 1, 2018 by approximately 2%
- Additional engineering review are incurred, based on cost of site works;
- The application fee does not include costs incurred through the preparation of the required plans and studies;
- Securities must also be posted, at 50% of the value of any on-site works and 100% of the value of any off-site works, including roadway modifications;
- Cash-in-lieu of parkland must also be paid for the uplift between the original institutional zoning of the site and the development as proposed (site valuation by City appraiser forms the basis of the cash-in-lieu calculation)
- Watermain frontage fees will also be payable.

APPLICANT'S STUDY AND PLAN IDENTIFICATION LIST

Legend: **S** indicates that the study or plan is required with application submission.
A indicates that the study or plan may be required to satisfy a condition of approval/draft approval.

For information and guidance on preparing required studies and plans refer to:

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

S/A	Number of copies	ENGINEERING		S/A	Number of copies
S	**15**	1. Site Servicing Plan	2. Assessment of Adequacy of Public Services / Site Servicing Report	**S**	**4**
S	**15**	3. Grade Control and Drainage Plan	4. Geotechnical Study / Slope Stability Study	**S**	**4**
	2	5. Composite Utility Plan	6. Groundwater Impact Study		6
	5	7. Servicing Options Report	8. Wellhead Protection Study		6
S	**8**	9. Community Transportation Study and / or Transportation Impact Study / Brief	10.Erosion and Sediment Control Plan	**S**	**15**
S	**4**	11.Storm water Management Report	12.Hydro geological and Terrain Analysis		8
S	**4**	**13.Hydraulic Water main Analysis**	14.Noise Impact Assessment	**S**	**3**
	35/50/55	15.Roadway Modification Design Plan	16.Confederation Line Proximity Study		9

S/A	Number of copies	PLANNING / DESIGN / SURVEY		S/A	Number of copies
	50	17.Draft Plan of Subdivision	18.Plan Showing Layout of Parking Garage	**S**	**2**
	30	19.Draft Plan of Condominium	20.Planning Rationale	**S**	**3**
S	**15**	21.Site Plan	22.Minimum Distance Separation (MDS)		3
	20	23.Concept Plan Showing Proposed Land Uses and Landscaping	24.Agrology and Soil Capability Study		5
	3	25.Concept Plan Showing Ultimate Use of Land	26.Cultural Heritage Impact Statement		3
S	**15**	27.Landscape Plan	28.Archaeological Resource Assessment		3
S	**2**	29.Survey Plan	30.Shadow Analysis		3
S	**3**	31.Architectural Building Elevation Drawings (dimensioned)	32.Design Brief (includes the Design Review Panel Submission Requirements)	**S**	**3**
	6	33.Wind Analysis			

S/A	Number of copies	ENVIRONMENTAL		S/A	Number of copies
	3	34. Phase 1 Environmental Site Assessment	35.Impact Assessment of Adjacent Waste Disposal/Former Landfill Site		6
	5	36.Phase 2 Environmental Site Assessment (depends on the outcome of Phase 1)	37.Assessment of Landform Features		7
	4	38.Record of Site Condition	39.Mineral Resource Impact Assessment		4
S	**3**	**40.Tree Conservation Report**	41.Environmental Impact Statement / Impact Assessment of Endangered Species	**S**	**3**
	4	42.Mine Hazard Study / Abandoned Pit or Quarry Study	43.Integrated Environmental Review (Draft, as part of Planning Rationale)		3

S/A	Number of copies	ADDITIONAL REQUIREMENTS		S/A	Number of copies
		44.	45.		

Meeting Date: December 12, 2017

Application Type: Site Plan Control

File Lead (Assigned Planner): Kathy Rygus

Infrastructure Approvals Project Manager: Gabrielle Schaeffer

Site Address (Municipal Address): 800 Eagleson Road

*Preliminary Assessment: 1☐ 2☐ 3☒ 4☐ 5☐

*One (1) indicates that considerable major revisions are required before a planning application is submitted, while five (5) suggests that proposal appears to meet the City's key land use policies and guidelines. **This assessment is purely advisory and does not consider technical aspects of the proposal or in any way guarantee application approval.**

Please note that PDF versions of all the of the listed requirements must be submitted with the application, stored in a USB drive or CD.

It is important to note that the need for additional studies and plans may result during application review. If following the submission of your application, it is determined that material that is not identified in this checklist is required to achieve complete application status, in accordance with the Planning Act and Official Plan requirements, the Planning, Infrastructure and Economic Development Department *will notify you of outstanding material required within the required 30 day period. Mandatory pre-application consultation will not shorten*

Appendix B: Storm Design Information

- Pre-Development Flows and Allowable Release Rate
- Uncontrolled Area Flow
- Required Storage and Release Rate
- Outlet Control Structure Design Sheet
- Stage Storage Curve
- Discharge-Storage Curve
- Storm Sewer Design Sheet

APPENDIX B: STORMWATER MANAGEMENT MODEL

PRE DEVELOPMENT FLOWS & ALLOWABLE RELEASE RATE

Client: Ironclad Developments Inc
Job No.: 180084
Location: 800 Eagleson Road, Ottawa, Ontario
Date: December 11, 2018

PRE DEVELOPMENT FLOW

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

Pre Dev run-off Coefficient "C"

			5 Year Event		100 Year Event	
Area (Ha)	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt/Roof	0.000	0.90	**0.20**	1.00	**0.25**
0.729	Gravel	0.000	0.70		0.88	
	Scrub/woodland	0.729	0.20		0.25	

*C value multiplied by 1.25 to a max. Of 1.00 for 100 year event

5 Year Event			
Pre Dev.	**C**	**Intensity**	**Area**
5 Year	0.20	70.25	0.729
2.78CIA=	28.49		
	28.5 L/s		
**Use a	20	minute time of concentration	

100 Year Event			
Pre Dev.	**C**	**Intensity**	**Area**
100 Year	0.25	119.95	0.729
2.78CIA=	60.80		
	60.8 L/s		
**Use a	20	minute time of concentration	

Pre Dev Time of Concentration "t_c"

$$t_{ca} = \frac{3.26\ x\ (1.1 - C)\ x\ l_c^{0.5}}{S^{0.33}}$$

C = Runoff Coefficient	0.20
lc = length of flow path	30
S = Slope of flow path	1.1

t_c = 15.57

$t_c =$ L/(60V) $V = K\ x\ \sqrt{S}$

	L(m)	V(m/s)	t_c
Grass /Field	60	0.22	**4.48**

Total t_c **20.05**

Equations:

Flow Equation

Q = 2.78 x C x I x A

Where:

C is the runoff coefficient

I is the intensity of rainfall, City of Ottawa IDF

A is the total drainage area

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{tot}$

APPENDIX B: STORMWATER MANAGEMENT MODEL
UNCONTROLLED AREA FLOW

Client: Ironclad Developments Inc
Job No.: 180084
Location: 800 Eagleson Road, Ottawa, Ontario
Date: December 11, 2018

Post Dev run-off Coefficient "C" - UA1

			5 Year Event		100 Year Event	
Area	**Surface**	**Ha**	**"C"**	**C_{avg}**	**"C" x 1.25**	**$C_{100\ avg}$**
Total	Asphalt	0.004	0.90	**0.24**	1.00	**0.29**
0.125	Roof	0.000	0.90		1.00	
	Sidewalk	0.004	0.90		1.00	
	Grass	0.117	0.20		0.25	

Post Dev Free Flow
2 Year Event

Post Dev.	**C**	**Intensity**	**Area**
2 Year	0.24	76.81	0.12
2.78CIA=	6.39		
6.4	L/S		

**Use a 10 minute time of concentration for 5 year

Post Dev Free Flow
5 Year Event

Post Dev.	**C**	**Intensity**	**Area**
5 Year	0.24	104.19	0.12
2.78CIA=	8.66		
8.7	L/S		

**Use a 10 minute time of concentration for 5 year

100 Year Event

Post Dev.	**C***	**Intensity**	**Area**
5 Year	0.29	178.56	0.125
2.78CIA=	17.94		
17.9	L/S		

**Use a 10 minute time of concentration for 100 year

Summary

Total Allowable Release Rate: 28.5 L/s

Design Storm	Uncontrolled Runoff Rate:	Allowable Release Rate:	Required Storage
2-Year	6.4	22.1	
5-Year	8.7	19.8	
100-Year	17.9	10.6	

APPENDIX B: STORMWATER MANAGEMENT MODEL
REQUIRED STORAGE VS. RELEASE RATE

Client: Ironclad Developments Inc
Job No.: 180084
Location: 800 Eagleson Road, Ottawa, Ontario
Date: December 11, 2018

Post Dev run-off Coefficient "C" - CA1

			5 Year Event		100 Year Event	
Area (ha)	Surface	Area (ha)	"C"	C_{avg}	"C" x 1.25	$C_{100\ avg}$
Total	Roof	0.245	0.90	**0.84**	1.00	**0.94**
	Asphalt	0.251	0.90		1.00	
0.605	Sidewalk	0.057	0.90		1.00	
	Grass/Field	0.052	0.20		0.25	

REQUIRED STORAGE VERSUS RELEASE RATE FOR 2 YEAR STORM

Runoff Coeffcient, C = **0.84** Duration Interval (min) = **10**
Drainage Area (ha) = **0.605** Release Rate Start (L/s) = **0**
Return Period (yrs) = **2** Release Rate Interval (L/s) = **2**

			Release Rate -->	0	2	4	6	8	10	12	14	16	18
Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)		Storage Required (m^3)									
0	167.2	236.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	76.8	108.5		65.1	63.9	62.7	61.5	60.3	59.1	57.9	56.7	55.5	54.3
20	52.0	73.5		88.2	85.8	83.4	81.0	78.6	76.2	73.8	71.4	69.0	66.6
30	40.0	56.5		101.8	98.2	94.6	91.0	87.4	83.8	80.2	76.6	73.0	69.4
40	32.9	46.4		111.4	106.6	101.8	97.0	92.2	87.4	82.6	77.8	73.0	68.2
50	28.0	39.6		118.8	112.8	106.8	100.8	94.8	88.8	82.8	76.8	70.8	64.8
60	24.6	34.7		124.8	117.6	110.4	103.2	96.0	88.8	81.6	74.4	67.2	60.0
70	21.9	30.9		130.0	121.6	113.2	104.8	96.4	88.0	79.6	71.2	62.8	54.4
80	19.8	28.0		134.4	124.8	115.2	105.6	96.0	86.4	76.8	67.2	57.6	48.0
90	18.1	25.6		138.3	127.5	116.7	105.9	95.1	84.3	73.5	62.7	51.9	41.1
100	16.7	23.6		141.9	129.9	117.9	105.9	93.9	81.9	69.9	57.9	45.9	33.9
110	15.6	22.0		145.1	131.9	118.7	105.5	92.3	79.1	65.9	52.7	39.5	26.3
120	14.6	20.6		148.1	133.7	119.3	104.9	90.5	76.1	61.7	47.3	32.9	18.5
130	13.7	19.3		150.8	135.2	119.6	104.0	88.4	72.8	57.2	41.6	26.0	10.4
140	12.9	18.3		153.3	136.5	119.7	102.9	86.1	69.3	52.5	35.7	18.9	2.1
150	12.3	17.3		155.7	137.7	119.7	101.7	83.7	65.7	47.7	29.7	11.7	-6.3
160	11.7	16.5		157.9	138.7	119.5	100.3	81.1	61.9	42.7	23.5	4.3	-14.9
170	11.1	15.7		160.1	139.7	119.3	98.9	78.5	58.1	37.7	17.3	-3.1	-23.5
180	10.6	15.0		162.1	140.5	118.9	97.3	75.7	54.1	32.5	10.9	-10.7	-32.3
190	10.2	14.4		164.0	141.2	118.4	95.6	72.8	50.0	27.2	4.4	-18.4	-41.2
Maximum Storage Rate =				164.0	141.2	119.7	105.9	96.4	88.8	82.8	77.8	73.0	69.4

REQUIRED STORAGE VERSUS RELEASE RATE FOR 5 YEAR STORM

Runoff Coeffcient, C = **0.84** Duration Interval (min) = **10**
Drainage Area (ha) = **0.605** Release Rate Start (L/s) = **0**
Return Period (yrs) = **5** Release Rate Interval (L/s) = **2**

			Release Rate -->	0	2	4	6	8	10	12	14	16	18
Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)		Storage Required (m^3)									
0	230.5	325.5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	104.2	147.1		88.3	87.1	85.9	84.7	83.5	82.3	81.1	79.9	78.7	77.5
20	70.3	99.2		119.0	116.6	114.2	111.8	109.4	107.0	104.6	102.2	99.8	97.4
30	53.9	76.2		137.1	133.5	129.9	126.3	122.7	119.1	115.5	111.9	108.3	104.7
40	44.2	62.4		149.7	144.9	140.1	135.3	130.5	125.7	120.9	116.1	111.3	106.5
50	37.7	53.2		159.5	153.5	147.5	141.5	135.5	129.5	123.5	117.5	111.5	105.5
60	32.9	46.5		167.5	160.3	153.1	145.9	138.7	131.5	124.3	117.1	109.9	102.7
70	29.4	41.5		174.2	165.8	157.4	149.0	140.6	132.2	123.8	115.4	107.0	98.6
80	26.6	37.5		180.0	170.4	160.8	151.2	141.6	132.0	122.4	112.8	103.2	93.6
90	24.3	34.3		185.2	174.4	163.6	152.8	142.0	131.2	120.4	109.6	98.8	88.0
100	22.4	31.6		189.8	177.8	165.8	153.8	141.8	129.8	117.8	105.8	93.8	81.8
110	20.8	29.4		194.1	180.9	167.7	154.5	141.3	128.1	114.9	101.7	88.5	75.3
120	19.5	27.5		197.9	183.5	169.1	154.7	140.3	125.9	111.5	97.1	82.7	68.3
130	18.3	25.8		201.5	185.9	170.3	154.7	139.1	123.5	107.9	92.3	76.7	61.1
140	17.3	24.4		204.8	188.0	171.2	154.4	137.6	120.8	104.0	87.2	70.4	53.6
150	16.4	23.1		207.9	189.9	171.9	153.9	135.9	117.9	99.9	81.9	63.9	45.9
160	15.6	22.0		210.9	191.7	172.5	153.3	134.1	114.9	95.7	76.5	57.3	38.1
170	14.8	20.9		213.6	193.2	172.8	152.4	132.0	111.6	91.2	70.8	50.4	30.0
180	14.2	20.0		216.3	194.7	173.1	151.5	129.9	108.3	86.7	65.1	43.5	21.9
190	13.6	19.2		218.7	195.9	173.1	150.3	127.5	104.7	81.9	59.1	36.3	13.5
Maximum Storage Rate =				218.7	195.9	173.1	154.7	142.0	132.2	124.3	117.5	111.5	106.5

REQUIRED STORAGE VERSUS RELEASE RATE FOR 100 YEAR STORM

Runoff Coeffcient, C = **0.94** Duration Interval (min) = **15**
Drainage Area (ha) = **0.605** Release Rate Start (L/s) = **0**
Return Period (yrs) = **100** Release Rate Interval (L/s) = **2**

			Release Rate -->	0	2	4	6	8	10	12	14	16	18
Duration (min)	Rainfall Intensity (mm/hr)	Peak Flow (L/sec)		Storage Required (m^3)									
0	398.6	629.9		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15	142.9	225.8		203.2	201.4	199.6	197.8	196.0	194.2	192.4	190.6	188.8	187.0
30	91.9	145.2		261.3	257.7	254.1	250.5	246.9	243.3	239.7	236.1	232.5	228.9
45	69.1	109.1		294.6	289.2	283.8	278.4	273.0	267.6	262.2	256.8	251.4	246.0
60	55.9	88.3		318.0	310.8	303.6	296.4	289.2	282.0	274.8	267.6	260.4	253.2
75	47.3	74.7		336.0	327.0	318.0	309.0	300.0	291.0	282.0	273.0	264.0	255.0
90	41.1	65.0		350.8	340.0	329.2	318.4	307.6	296.8	286.0	275.2	264.4	253.6
105	36.5	57.7		363.3	350.7	338.1	325.5	312.9	300.3	287.7	275.1	262.5	249.9
120	32.9	52.0		374.3	359.9	345.5	331.1	316.7	302.3	287.9	273.5	259.1	244.7
135	30.0	47.4		383.9	367.7	351.5	335.3	319.1	302.9	286.7	270.5	254.3	238.1
150	27.6	43.6		392.7	374.7	356.7	338.7	320.7	302.7	284.7	266.7	248.7	230.7
165	25.6	40.5		400.6	380.8	361.0	341.2	321.4	301.6	281.8	262.0	242.2	222.4
180	23.9	37.8		407.9	386.3	364.7	343.1	321.5	299.9	278.3	256.7	235.1	213.5
195	22.4	35.4		414.7	391.3	367.9	344.5	321.1	297.7	274.3	250.9	227.5	204.1
210	21.1	33.4		421.0	395.8	370.6	345.4	320.2	295.0	269.8	244.6	219.4	194.2
225	20.0	31.6		426.9	399.9	372.9	345.9	318.9	291.9	264.9	237.9	210.9	183.9
240	19.0	30.0		432.5	403.7	374.9	346.1	317.3	288.5	259.7	230.9	202.1	173.3
255	18.1	28.6		437.7	407.1	376.5	345.9	315.3	284.7	254.1	223.5	192.9	162.3
270	17.3	27.3		442.7	410.3	377.9	345.5	313.1	280.7	248.3	215.9	183.5	151.1
285	16.6	26.2		447.5	413.3	379.1	344.9	310.7	276.5	242.3	208.1	173.9	139.7
300	15.9	25.1		452.0	416.0	380.0	344.0	308.0	272.0	236.0	200.0	164.0	128.0
Maximum Storage Rate =				452.0	416.0	380.0	346.1	321.5	302.9	287.9	275.2	264.4	255.0

APPENDIX A: STORMWATER MANAGEMENT MODEL

OUTLET CONTROL DESIGN SHEET

Client: Ironclad Developments Inc
Job No.: 180084
Location: 800 Eagleson Road, Ottawa, Ontario
Date: December 11, 2018

Orifice Information

Dia (m):	0.075
Area (mm.):	0.0041
Coeff, C:	0.61
Orifice Top (m):	94.43
Orifice Cen (m):	94.39
Orifice Inv (m):	94.35

Stage, WSE Elev (m)	Comments	Layer Thickness (m)	Top Layer Area (m^2)	Bottom Layer Area (m^2)	Layer Volume (m^3)	Top Layer Area (m^2)	Bottom Layer Area (m^2)	Layer Volume (m^3)	Quantity Storage (m3)	Orifice Flow 2 yr & 5 yr Head* (m)	Orifice Flow 2 yr & 5 yr Orifice Flow (m^3/sec)	2 yr & 5 yr Outflow (L/sec)	Orifice Flow 100 yr Head* (m)	Orifice Flow 100 yr Orifice Flow (m^3/sec)	100 yr Outflow (L/sec)	Quantity Storage m3)
95.60	Top of Clear Stone Cover	0.050	313	313	4.7	1364	1315	67.0	418.0	1.21	0.0121	12.1	0.98	0.0109	10.9	418.0
95.55		0.050	313	313	4.7	1315	1222	63.4	346.3	1.16	0.0119	11.9	0.93	0.0106	10.6	346.3
95.50		0.050	313	313	4.7	1222	1064	57.1	278.2	1.11	0.0116	11.6	0.88	0.0103	10.3	278.2
95.45		0.050	313	313	4.7	1064	497	38.1	216.4	1.06	0.0113	11.3	0.83	0.0100	10.0	216.4
95.40		0.050	313	313	4.7	497	190	16.6	173.6	1.01	0.0111	11.1	0.78	0.0097	9.7	173.6
95.35		0.050	313	313	4.7	190	3	3.6	152.3	0.96	0.0108	10.8	0.73	0.0094	9.4	152.3
95.30	Top of Brentwood Tanks / Bottom of Surface Parking	0.150	313	313	46.9	3	0		144.0	0.91	0.0105	10.5	0.68	0.0091	9.1	144.0
95.15		0.200	313	313	62.6				97.0	0.76	0.0096	9.6	0.53	0.0080	8.0	97.0
94.95		0.110	313	313	34.4				34.4	0.56	0.0083	8.3	0.33	0.0063	6.3	34.4
94.84	Bottom of Brentwood Tanks	0.000	313	313	0.0				0.0	0.45	0.0073	7.3	0.22	0.0051	5.1	0.0

Orifice FLOW

$Q_{ORIFICE} = C\ A\ (2\ g\ H)^{0.5}$

where:

C = Discharge Coefficient
$Q_{ORIFICE}$ = Orifice Flow (m^3/s)
A = Orifice Area (m^2)
g = Accel due to Gravity (9.81 m/s^2)
H = Head above centre of orifice (m)

*Note: The head during a 100 year storm event is measured relative to the ponding level in Cell 2 of the Monahan Drain

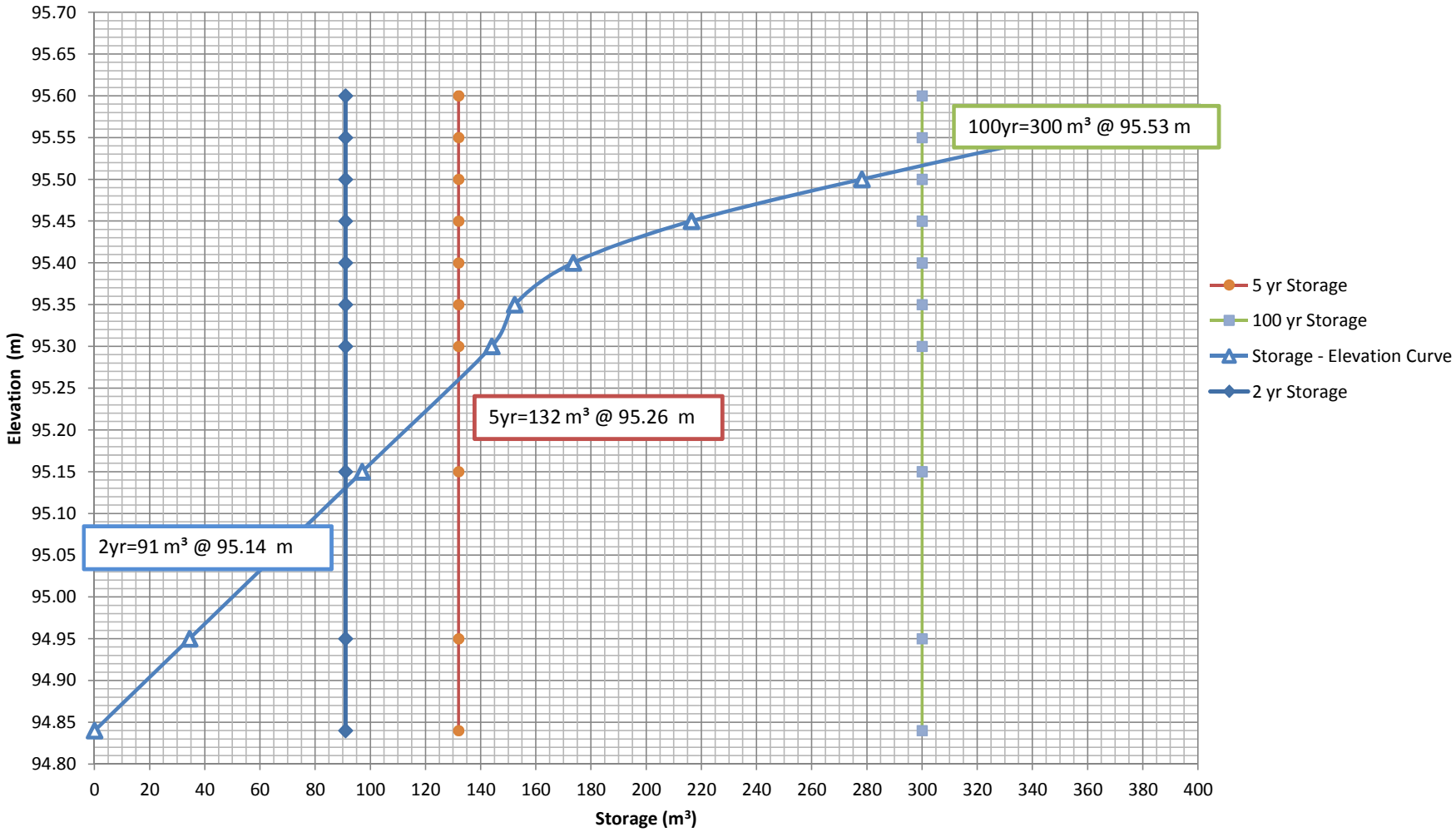
Monahan Drain Cell 2 100 year Flood Level 94.62 m

The head during a Minor Storm event (2 yr & 5 yr) is controlled by the invert of the outlet Orifice as the flood level In Cell 2 of the Monahan Drain will be lower than the invert of the Orifice.

APPENDIX B: STORMWATER MANAGEMENT MODEL

Stage - Storage Curve

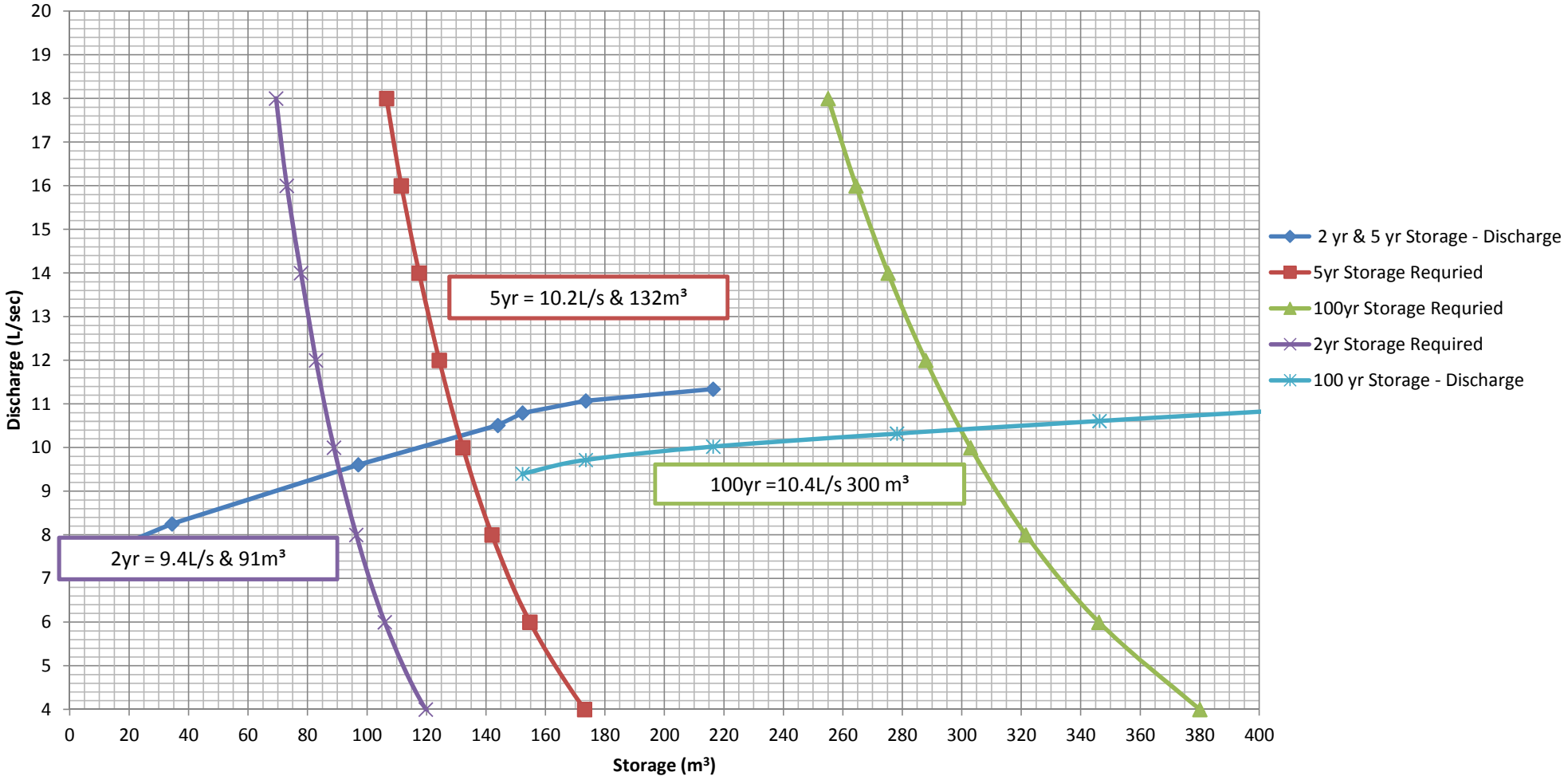
Client: Ironclad Development Inc
Job No.: 180084
Location: 800 Eagleson Road, Ottawa, ON
Date: December 11, 2018



APPENDIX B: STORMWATER MANAGEMENT MODEL

Discharge-Storage Curve

Client: Ironclad Development Inc.
Job No.: 180084
Location: 800 Eagleson Road, Ottawa, ON
Date: December 11, 2018



Appendix C: Brentwood StormTank Modules

DESIGN GUIDE

STORMTANK® Module

BRENTWOOD®

Contents

General Notes

1. Brentwood recommends that the installing contractor contact either Brentwood or the local distributor prior to installation of the system to schedule a pre-construction meeting. This meeting will ensure that the installing contractor has a firm understanding of the installation instructions.
2. All systems must be designed and installed to meet or exceed Brentwood's minimum requirements. Although Brentwood offers support during the design, review, and construction phases of the Module system, it is the ultimate responsibility of the Engineer of Record to design the system in full compliance with all applicable engineering practices, laws, and regulations.
3. Brentwood requires a minimum cover of 24" (610 mm) and/or a maximum Module invert of 11' (3.35 m). Additionally, a minimum 6" (152 mm) leveling bed, 12" (305 mm) side backfill, and 12" (305 mm) top backfill are required on every system.
4. Brentwood recommends a minimum bearing capacity and subgrade compaction for all installations. If site conditions are found not to meet any design requirements during installation, the Engineer of Record must be contacted immediately.
5. All installations require a minimum two layers of geotextile fabric. One layer is to be installed around the Modules, and another layer is to be installed between the stone/soil interfaces.
6. Stone backfilling is to follow all requirements of the most current installation instructions.
7. The installing contractor must apply all protective measures to prevent sediment from entering the system during and after installation per local, state, and federal regulations.
8. The StormTank® Module carries a Limited Warranty, which can be accessed at www.brentwoodindustries.com.

1.0 Introduction

About Brentwood

Brentwood is a global manufacturer of custom and proprietary products and systems for the construction, consumer, medical, power, transportation, and water industries. A focus on plastics innovation, coupled with diverse production capabilities and engineering expertise, has allowed Brentwood to build a strong reputation for thermoplastic molding and solutions development.

Brentwood's product and service offerings continue to grow with an ever-increasing manufacturing presence. By emphasizing customer service and working closely with clients throughout the design, engineering, and manufacturing phases of each project, Brentwood develops forward-thinking strategies to create targeted, tailored solutions.

StormTank® Module

The StormTank Module is a strong, yet lightweight, alternative to other subsurface systems and offers the largest void space (up to 97%) of any subsurface stormwater storage unit on the market. The Modules are simple to assemble on site, limiting shipping costs, installation time, and labor. Their structural PVC columns pressure fit into the polypropylene top/bottom platens, with side panels inserted around the perimeter of the system. This open design and lack of internal walls make the Module system easy to clean compared to other subsurface box structures. When properly designed, applied, installed, and maintained, the Module system has been engineered to achieve a 50-year lifespan.

Technical Support

Brentwood's knowledgeable distributor network and in-house associates emphasize customer service and support by parterning with customers to extend the process beyond physical material supply. These trained specialists are available to assist in the review of proposed systems, conversions of alternatively designed systems, or to resolve any potential concerns before, during, and after the design process. To provide the best assistance, it is recommended that associates be provided with a site plan and cross-sections that include grading, drainage structures, dimensions, etc.

2.0 Product Information

Applications

The Module system can be utilized for detention, infiltration, capture and reuse, and specialty applications across a wide range of industries, including the commercial, residential, and recreational segments. The product's modular design allows the system to be configured in almost any shape (even around utilities) and to be located under almost any pervious or impervious surface.

Module Selection

Brentwood manufactures the Module in five different heights (Table 1) that can be stacked uniformly up to two Modules high. This allows for numerous height configurations up to 6' (1.83 m) tall. The Modules can be buried up to a maximum invert of 11' (3.35 m) and require a minimum cover of 24" (610 mm) for load rating. When selecting the proper Module, it is important to consider the minimum required cover, any groundwater or limiting zone restrictions, footprint requirements, and all local, state, and federal regulations.

Table 1: Nominal StormTank® Module Specificiations

	ST-18	ST-24	ST-30	ST-33	ST-36
Height	18" (457 mm)	24" (610 mm)	30" (762 mm)	33" (838 mm)	36" (914 mm)
Void Space	95.5%	96.0%	96.5%	96.9%	97.0%
Module Storage Capacity	6.54 ft^3 (0.18 m^3)	8.64 ft^3 (0.24 m^3)	10.86 ft^3 (0.31 m^3)	11.99 ft^3 (0.34 m^3)	13.10 ft^3 (0.37 m^3)
Min. Installed Capacity*	9.15 ft^3 (0.26 m^3)	11.34 ft^3 (0.32 m^3)	13.56 ft^3 (0.38 m^3)	14.69 ft^3 (0.42 m^3)	15.80 ft^3 (0.45 m^3)
Weight	22.70 lbs (10.30 kg)	26.30 lbs (11.93 kg)	29.50 lbs (13.38 kg)	31.3 lbs (14.20 kg)	33.10 lbs (15.01 kg)

Min. Installed Capacity includes the leveling bed, Module, and top backfill storage capacity for one Module. Stone storage capacity is based on 40% void space.* ***Side backfill storage is not included.*

3.0 Manufacturing Standards

Brentwood selects material based on long-term performance needs. To ensure long-term performance and limit component deflection over time (creep), Brentwood selected polyvinyl chloride (PVC) for the Module's structural columns and a virgin polypropylene (PP) blend for the top/bottom and side panels. PVC provides the largest creep resistance of commonly available plastics, and therefore, provides the best performance under loading conditions. Materials like polyethylene (HDPE) and recycled PP have lower creep resistance and are not recommended for load-bearing products and applications.

Materials:

Brentwood's proprietary PVC and PP copolymer resins have been chosen specifically for utilization in the StormTank® Module. The PVC is blended in house by experts and is a 100% blend of post-manuacturing/pre-consumer recycled material. Both materials exhibit structural resilience and naturally resist the chemicals typically found in stormwater runoff.

Methods:

Injection Molding

The Module's top/bottom platens and side panels are injection molded, using proprietary molds and materials. This allows Brentwood to manufacture a product that meets structural requirements while maintaining dimensional control, molded-in traceability, and quality control.

Extrusion

Brentwood's expertise in PVC extrusion allows the structural columns to be manufactured in house. The column extrusion includes the internal structural ribs required for lateral support.

Quality Control

Brentwood maintains strict quality control in order to ensure that materials and the final product meet design requirments. This quality assurance program includes full material property testing in accordance with American Society for Testing and Materials (ASTM) standards, full-part testing, and process testing in order to quantify product performance during manufacturing. Additionally, Brentwood conducts secondary finshed-part testing to verify that design requirements continue to be met post-manufacturing.

All Module parts are marked with traceability information that allows for tracking of manufacturing. Brentwood maintains equipment at all manufacturing locations, as well as at its corporate testing lab, to ensure all materials and products meet all requirements.

4.0 Structural Response

Structural Design

The Module has been designed to resist loads calculated in accordance with the American Association of State Highway and Transportation Official's (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design manual. This fully factored load includes a multiple presence factor, dynamic load allowance, and live load factor to account for real-world situations. This loading was considered when Brentwood developed both the product and installation requirements. The developed minimum cover ensures the system maintains an adequate resistance factor for the design truck (HS-20) and HS-25 loads.

Full-Scale Product Testing

Engineers at Brentwood's in-house testing facility have completed full-scale vertical and lateral tests on the Module to evaluate product response. To date, Brentwood continues in-house testing in order to evaluate long-term creep effects.

Fully Installed System Testing

Brentwood's dedication to providing a premier product extends to fully installed testing. Through a partnership with Queen's University's GeoEngineering Centre in Kingston, Ontario, Brentwood has conducted full-scale installation tests of single- and double-stacked Module systems to analyze short- and long-term performance. Testing includes short-term ultimate limit state testing under fully factored AASHTO loads and minimum installation cover, lateral load testing, long-term performance and lifecycle testing utilizing time-temperature superposition, and load resistance development. Side backfill material tests were also performed to compare the usage of sand, compacted stone, and uncompacted stone.

5.0 Foundation

The foundation (subgrade) of the subsurface storage structure may be the most important part of the Module system installation as this is the location where the system applies the load generated at the surface. If the subgrade lacks adequate support or encounters potential settlement, the entire system could be adversely affected. Therefore, when implementing an underground storage solution, it is imperative that a geotechnical investigation be performed to ensure a strong foundation.

Considerations & Requirements:

Bearing Capacity

The bearing capacity is the ability of the soil to resist settlement. In other words, it is the amount of weight the soil can support. This is important versus the native condition because the system is replacing earth, and even though the system weighs less than the earth, the additional load displacement of the earth is not offset by the difference in weight.

Using the Loading and Resistance Factor Design (LRFD) calculation for bearing capacity, Brentwood has developed a conservative minimum bearing capacity table (see Appendix). The Engineer of Record shall reference this table to assess actual cover versus the soil bearing required for each unit system.

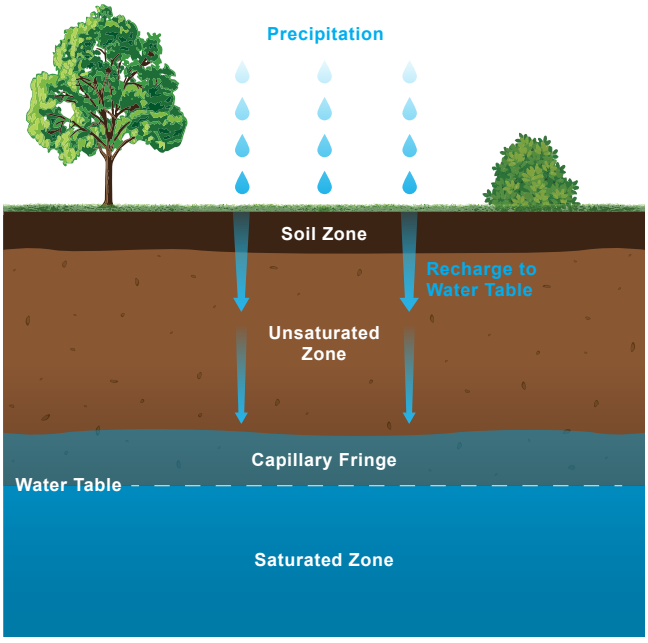
Soil Profile

Limiting Zones

Limiting zones are conditions in the underlying soils that can affect the maximum available depth for installation and can reduce the strength and stability of the underlying subgrade. The three main forms of limiting zones are water tables, bedrock, and karst topography. It is recommended that a system be offset a minimum of 12" (305 mm) from any limiting zones.

Compaction

Soil compaction occurs as the soil particles are pressed together and pore space is eliminated. By compacting the soils to 95% (as recommended by Brentwood), the subgrade strength will increase, in turn limiting both the potential for the soil to move once installed and for differential settlement to occur throughout the system. If designing the specific compaction requirement, settlement should be limited to less than 1" (25 mm) through the entire subgrade and should not exceed a 1/2" (13 mm) of differential settlement between any two adjacent units within the system over time.



Water Table Zones

Mitigation

If a minimum subgrade bearing capacity cannot be achieved because of weak soil, a suitable design will need to be completed by a Geotechnical Engineer. This design may include the over-excavation of the subgrade and an engineered fill or slurry being placed. Additional material such as geogrid or other products may also be required. Please contact a Geotechnical Engineer prior to selecting products or designing the subgrade.

6.0 System Materials

Geotextile Fabric

The 6-ounce geotextile fabric is recommended to be installed between the soil and stone interfaces around the Modules to prevent soil migration.

Leveling Bed

The leveling bed is constructed of 6”-thick (152 mm) angular stone (Table 2). The bed has not been designed as a structural element but is utilized to provide a level surface for the installation of the system and provide an even distribution of load to the subgrade.

Stone Backfill

The stone backfill is designed to limit the strain on the product through displacement of load and ensure the product’s longevity. Therefore, a minimum of 12”-wide (305 mm) angular stone must be placed around all sides of the system. In addition, a minimum layer of 12” (305 mm) angular stone is required on top of the system. All material is to be placed evenly in 12” (305 mm) lifts around and on top of the system and aligned with a vibratory plate compactor.

Table 2: Approved Backfill Material

Material Location	Description	AASHTO M43 Designation	ASTM D2321 Class	Compaction/Density
Finished Surface	Topsoil, hardscape, stone, concrete, or asphalt per Engineer of Record	N/A	N/A	Prepare per engineered plans
Suitable Compactable Fill	Well-graded granular soil/aggregate, typically road base or earthen fill (maximum 4" particle size)	56, 57, 6, 67, 68	I & II III (Earth Only)	Place in maximum 12" lifts to a minimum 90% standard proctor density
Top Backfill	Crushed angular stone placed between Modules and road base or earthen fill	56, 57, 6, 67, 68	I & II	Plate vibrate to provide evenly distributed layers
Side Backfill	Crushed angular stone placed between earthen wall and Modules	56, 57, 6, 67, 68	I & II	Place and plate vibrate in uniform 12" lifts around the system
Leveling Bed	Crushed angular stone placed to provide level surface for installation of Modules	56, 57, 6, 67, 68	I & II	Plate vibrate to achieve level surface

Impermeable Liner

In designs that prevent runoff from infiltrating into the surrounding soil (detention or reuse applications) or groundwater from entering the system, an impermeable liner is required. When incorporating a liner as part of the system, Brentwood recommends using a manufactured product such as a PVC liner. This can be installed around the Modules themselves or installed around the excavation (to gain the benefit of the void space in the stone) and should include an underdrain system to ensure the basin fully drains. This liner is installed with a layer of geotextile fabric on both sides to prevent puncture, in accordance with manufacturer recommendations.

7.0 Connections

Stormwater runoff must be able to move readily in and out of the StormTank® Module system. Brentwood has developed numerous means of connecting to the system, including inlet/outlet ports and direct abutment to a catch basin or endwall. All methods of connection should be evaluated as each one may offer a different solution. Brentwood has developed drawings to assist with specific installation methods, and these are available at www.brentwoodindustries.com.

Inlet/Outlet and Pipe Connections

To facilitate easy connection to the system, Brentwood manufactures two inlet/outlet ports. They are 12" (305 mm) and 14" (356 mm), respectfully, and utilize a flexible coupling connection to the adjoining pipe.

Another common installation method is to directly connect the pipe to the system. In order to do this, an opening is cut into the side panels, the pipe is inserted, and then the system is wrapped in geotextile fabric. When utilizing this connection method, the pipe must be located a minimum of 3" (76 mm) from the bottom of the system. This provides adequate clearance for the bottom platen and the required strength in the remaining side panel. To maintain the required clearances or reduce pipe size, it may be necessary to connect utilizing a manifold system.

Direct Abutment

The system can also be connected by directly abutting Modules to a concrete catch basin or endwall. This allows for a seamless connection of structures in close proximity to the system and eliminates the need for numerous pipe connections. When directly abutting one of these structures, remove any side panels that fully abut the structure, and make sure it is flush with the system to prevent material migration into the structure.

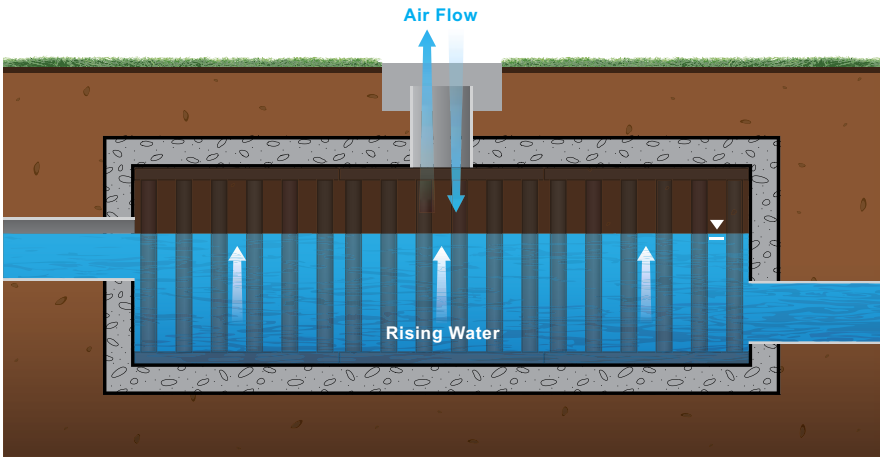
Underdrain

Underdrains are typically utilized in detention applications to ensure the system fully drains since infiltration is limited or prohibited. The incorporation of an underdrain in a detention application will require an impermeable liner between the stone-soil interface.

Cleanout Ports

Brentwood understands the necessity to inspect and clean a subsurface system and has designed the Module without any walls to allow full access. Brentwood offers three different cleanout/observation ports for utilization with the system. The ports are made from PVC, provide an easy means of connection, and are available in 6" (152 mm), 8" (203 mm) and 10" (254 mm) diameters. The 10" (254 mm) port is sized to allow access to the system by a vacuum truck suction hose for easy debris removal.

It is recommended that ports be located a maximum of 30' (9.14 m) on center to provide adequate access, ensure proper airflow, and allow the system to completely fill.



Ventilation and Air Flow

8.0 Pretreatment

Removing pollutants from stormwater runoff is an important component of any stormwater management plan. Pretreatment works to prevent water quality deterioration and also plays an integral part in allowing the system to maintain performance over time and increase longevity. Treatment products vary in complexity, design, and effectiveness, and therefore, should be selected based on specific project requirements.

Typical Stormwater System

StormTank® Shield

Brentwood's StormTank Shield provides a low-cost solution for stormwater pretreatment. Designed to improve sumped inlet treatment, the Shield reduces pollutant discharge through gross sediment removal and oil/water separation. For more information, please visit www.brentwoodindustries.com.

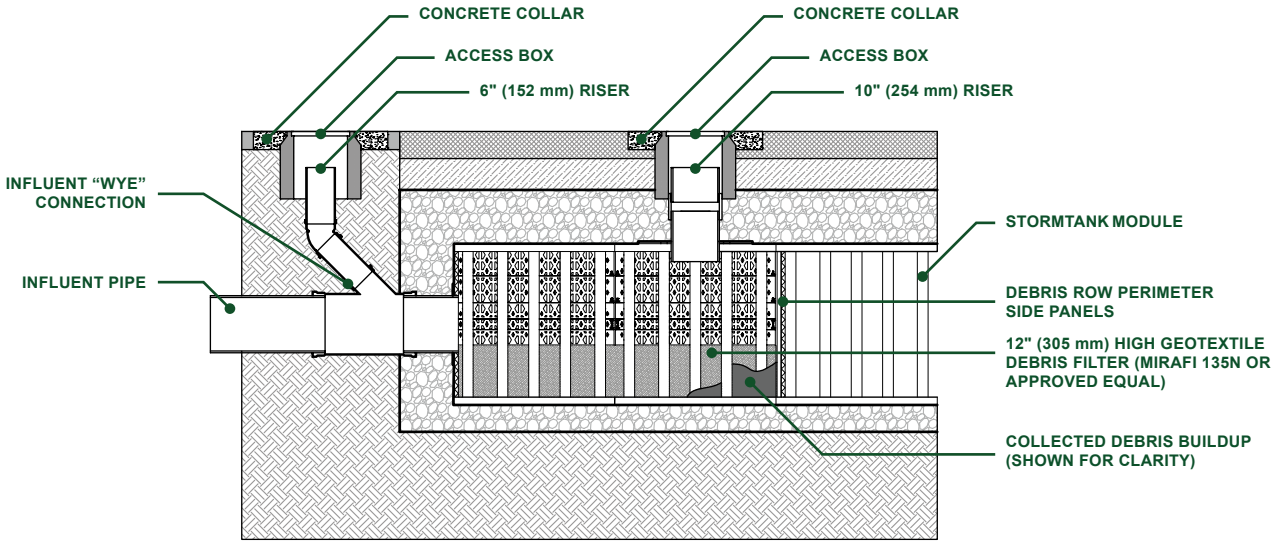
Debris Row (Easy Cleanout)

An essential step of designing, installing, and maintaining a subsurface system is preventing debris from entering the storage. This can be done by incorporating debris rows (or bays) at the inlets of the system to prevent debris from entering the rest of the system.

The debris row is built into the system utilizing side panels with a 12" (305 mm) segment of geotextile fabric. This allows for the full basin capacity to be utilized while storing any debris in an easy-to-remove location. To calculate the number of side panels required to prevent backing up, the opening area of the side panels on the area above the geotextile fabric has been calculated and compared to the inflow pipe diameter.

Debris row cleanout is made easy by including 10" (254 mm) suction ports, based on the length of the row, and a 6" (152 mm) saddle connection to the inflow pipe. If the system is directly abutting a catch basin, the saddle connection is not required, and the flush hose can be inserted through the catch basin. Debris is then flushed from the inlet toward the suction ports and removed.

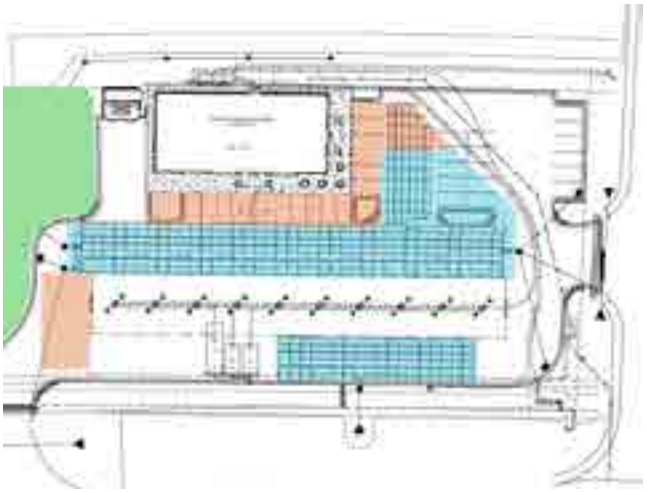
Brentwood has developed drawings and specifications that are available at www.brentwoodindustries.com to illustrate the debris row configuration and layouts.



Debris Row Section Detail

9.0 Additional Considerations

Many variable factors, such as the examples below, must be taken into consideration when designing a StormTank® Module system. As these considerations require complex calculations and proper planning, please contact Brentwood or your local distributor to discuss project-specific requirements.



Site Plan Module Layout Adaptability
(StormTank Modules shown in blue)

Adaptability

The Modules can be arranged in custom configurations to meet tight site constraints and to provide different horizontal and edge configurations. Modules can also be stacked, to a maximum 2 units tall, to meet capacity needs and can be buried to a maximum invert of 11' (3.35 m) to allow for a stacked system or deeper burial.

Adjacent Structures

The location of adjacent structures, especially the location of footings and foundations, must be taken into consideration as part of system design. The foundation of a building or retaining wall produces a load that is transmitted to a footing and then applied to the surface below. The footing is intended to distribute the line load of the wall over a larger area without increasing the larger wall's thickness. The reason this is important is because the load the footing is applying to the earth is distributed through the earth and could potentially affect a subsurface system as either a vertical load to the top of the Module or a lateral load to the side of the Module.

Based on this increased loading, it is recommended that the subsurface system either maintain a distance away from the foundation, footing equal to the height between the Module invert and structure invert of the system, or the foundation or footing extend at a minimum to the invert of the subsurface system. By locating the foundation away from the system or equal to the invert, the loading generated by the structure does not get transferred onto the system. It is recommended that all adjacent structures be completed prior to the installation of the Modules to prevent construction loads from being imparted on the system.

Adjacent Excavation

The subsurface system must be protected before, during, and after the installation. Once a system is installed, it is important to remember that excavation adjacent to the system could potentially cause the system to become unstable. The uniform backfilling will evenly distribute the lateral loads to the system and prohibit the system from becoming unstable and racking from unequal loads. However, it is recommended that any excavation adjacent to a system remain a minimum distance away from the system equal to the invert. This will provide a soil load that is equal to the load applied by the opposite side of the installation. If the excavation is to exceed the invert of the system, additional analysis may be necessary.

Sloped Finished Grade

Much like adjacent excavation, a finished grade with a differential cover could potentially cause a subsurface system to become disproportionately loaded. For example, if one side of the system has 10' (3.05 m) of cover and the adjacent side has 24" (610 mm) of cover, the taller side will generate a higher lateral load, and the opposite side may not have an equal amount of resistance to prevent a racking of the system. Additional evaluation may be required when working on sites where the final grade around a system exceeds 5%.

10.0 Inspection & Maintenance

Description

Proper inspection and maintenance of a subsurface stormwater storage system are vital to ensuring proper product functioning and system longevity. It is recommended that during construction the contractor takes the necessary steps to prevent sediment from entering the subsurface system. This may include the installation of a bypass pipe around the system until the site is stabilized. The contractor should install and maintain all site erosion and sediment per Best Management Practices (BMP) and local, state, and federal regulations.

Once the site is stabilized, the contractor should remove and properly dispose of erosion and sediment per BMP and all local, state, and federal regulations. Care should be taken during removal to prevent collected sediment or debris from entering the stormwater system. Once the controls are removed, the system should be flushed to remove any sediment or construction debris by following the maintenance procedure outlined below.

During the first service year, a visual inspection should be completed during and after each major rainfall event, in addition to semi-annual inspections, to establish a pattern of sediment and debris buildup. Each stormwater system is unique, and multiple criteria can affect maintenance frequency. For example, whether or not a system design includes inlet protection or a pretreatment device has a substantial effect on the system's need for maintenance. Other factors include where the runoff is coming from (hardscape, gravel, soil, etc.) and seasonal changes like autumn leaves and winter salt.

During and after the second year of service, an established annual inspection frequency, based on the information collected during the first year, should be followed. At a minimum, an inspection should be performed semi-annually. Additional inspections may be required at the change of seasons for regions that experience adverse conditions (leaves, cinders, salt, sand, etc).

Maintenance Procedures

Inspection:

1. Inspect all observation ports, inflow and outflow connections, and the discharge area.
2. Identify and log any sediment and debris accumulation, system backup, or discharge rate changes.
3. If there is a sufficient need for cleanout, contact a local cleaning company for assistance.

Cleaning:

1. If a pretreatment device is installed, follow manufacturer recommendations.
2. Using a vacuum pump truck, evacuate debris from the inflow and outflow points.
3. Flush the system with clean water, forcing debris from the system.
4. Repeat steps 2 and 3 until no debris is evident.

11.0 System Sizing

System Sizing Calculation

This section provides a brief description of the process required to size the StormTank® Module system. If you need additional assistance in determining the required number of Modules or assistance with the proposed configuration, it is recommended that you contact Brentwood or your local distributor. Additionally, Brentwood's volume calculator can help you to estimate the available storage volumes with and without stone storage. This tool is available at www.brentwoodindustries.com.

1. Determine the required storage volume (Vs):
It is the sole responsibility of the Engineer of Record to calculate the storage volume in accordance with all local, state, and federal regulations.

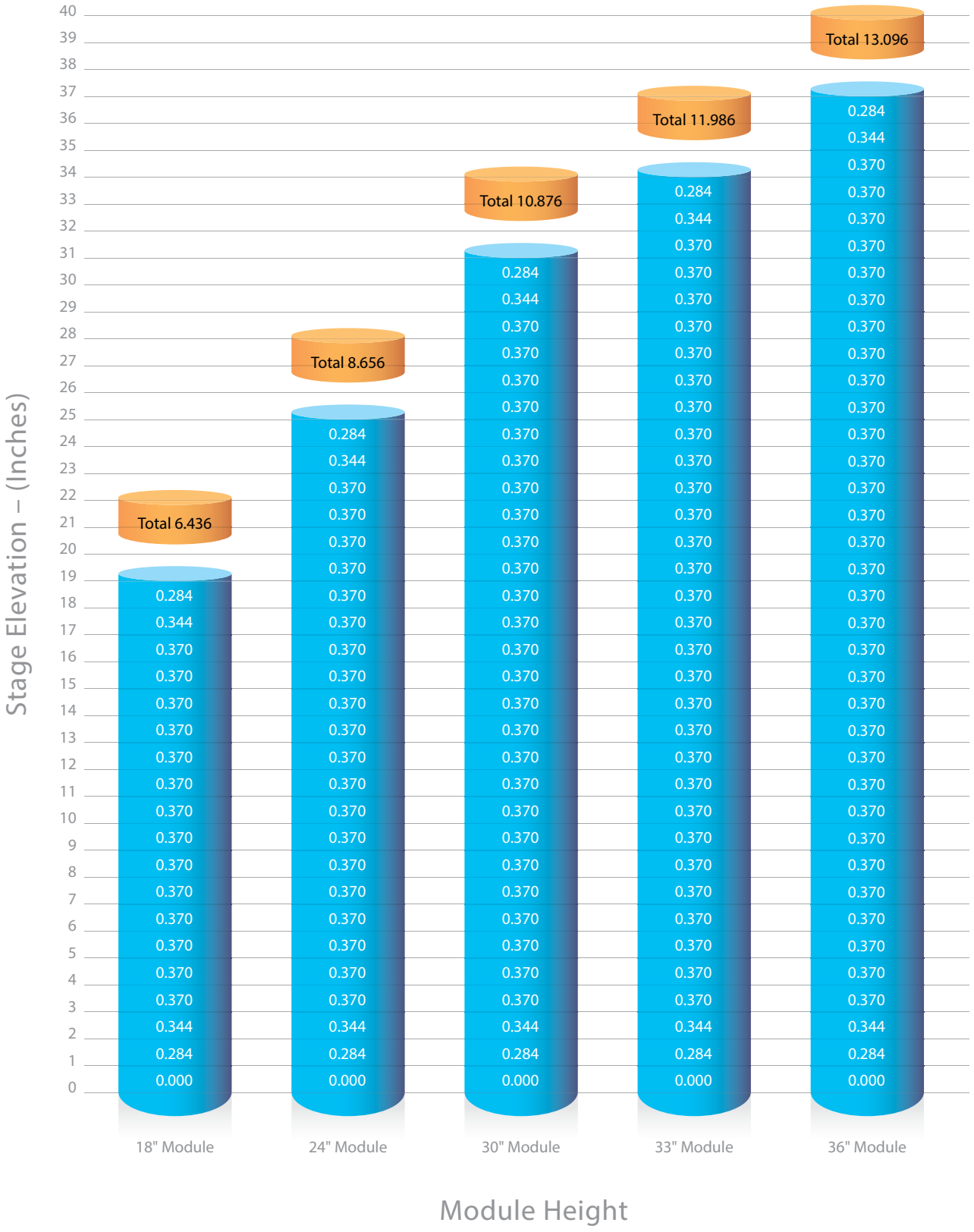
2. Determine the required number of Modules (N):
If the storage volume does not include stone storage, take the total volume divided by the selected Module storage volume. If the stone storage is to be included, additional calculations will be required to determine the available stone storage for each configuration.

3. Determine the required volume of stone (Vstone):
The system requires a minimum 6" (152 mm) leveling bed, 12" (305 mm) backfill around the system, and 12" (305 mm) top backfill utilizing 3/4" (19 mm) angular clean stone. Therefore, take the area of the system times the leveling bed and the top backfill. Once that value is determined, add the volume based on the side backfill width times the height from the invert of the Modules to the top of the Modules.

4. Determine the required excavation volume (Vexcv):
Utilizing the area of the system, including the side backfill, multiply by the depth of the system including the leveling bed. It is noted that this calculation should also include any necessary side pitch or benching that is required for local, state, or federal safety standards.

5. Determine the required amount of geotextile (G):
The system utilizes a multiple layer system of geotextile fabric. Therefore, two calculations are required to determine the necessary amount of geotextile. The first layer surrounds the entire system (including all backfill), and the second layer surrounds the Module system only. It is recommended that an additional 20% be included for waste and overlap.

11.1 Storage Volume



11.2 Material Quantity Worksheet

Project Name: | By:

Location: | Date:

System Requirements

Required Storage		ft^3 (m^3)
Number of Modules		Each
Module Storage		ft^3 (m^3)
Stone Storage		ft^3 (m^3)
Module Footprint		ft^2 (m^2) Number of Modules x 4.5 ft^2 (0.42 m^2)
System Footprint w/ Stone		ft^2 (m^2) Module Footprint + 1 ft (0.3048 m) to each edge
Stone		Tons (kg) Leveling Bed + Side Backfill + Top Backfill
Volume of Excavation		yd^3 (m^3) System Footprint w/ Stone x Total Height
Area of Geotextile		yd^2 (m^2) Wrap around Modules + Wrap around Stone/Soil Interface

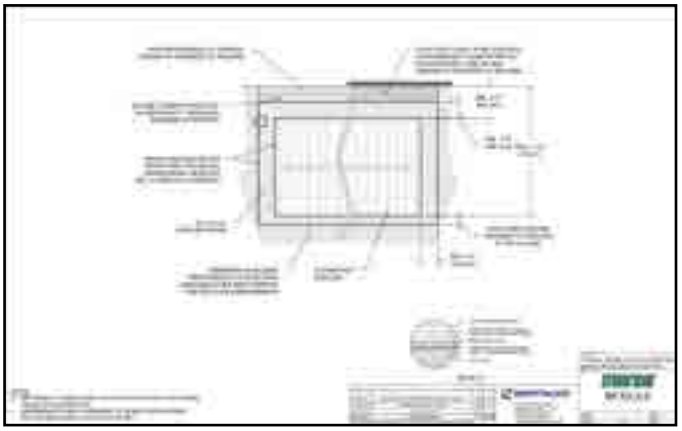
System Cost

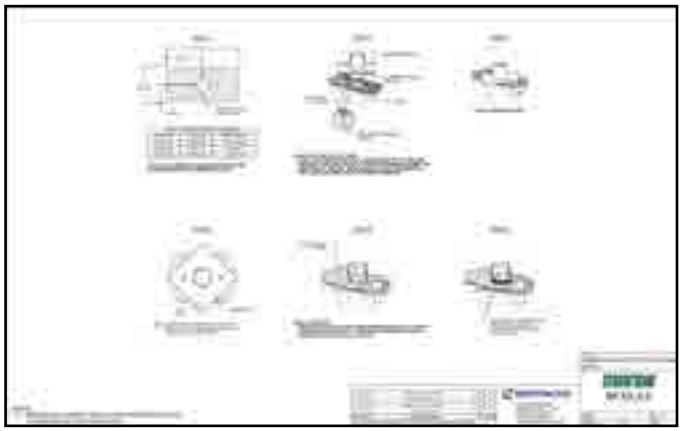
	Quantity			Unit Price			Total
Modules		ft^3 (m^3)	X	$	ft^3 (m^3)	=	$
Stone		Tons (kg)	X	$	Tons (kg)	=	$
Excavation		yd^3 (m^3)	X	$	yd^3 (m^3)	=	$
Geotextile		yd^2 (m^2)	X	$	yd^2 (m^2)	=	$
					Subtotal =		$
					Tons =		$

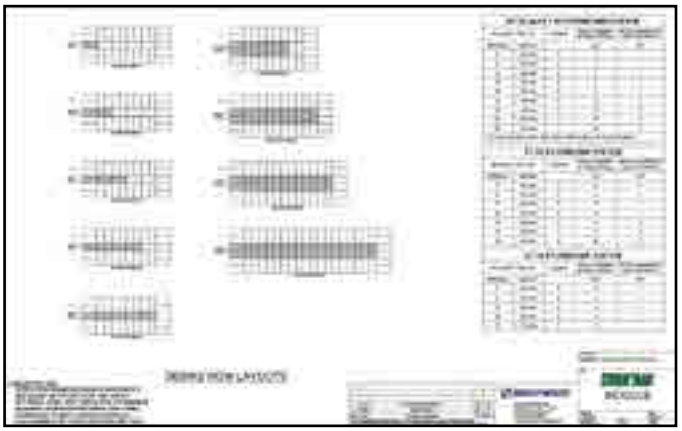
Material costs may not include freight.
Please contact Brentwood or your local distributor for this information.

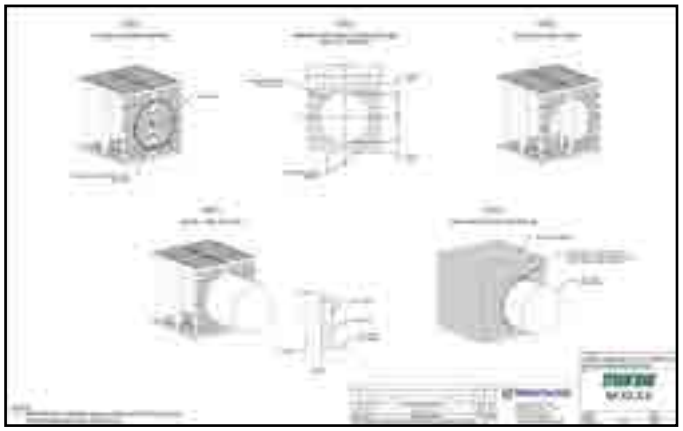
12.0 Detail Drawings

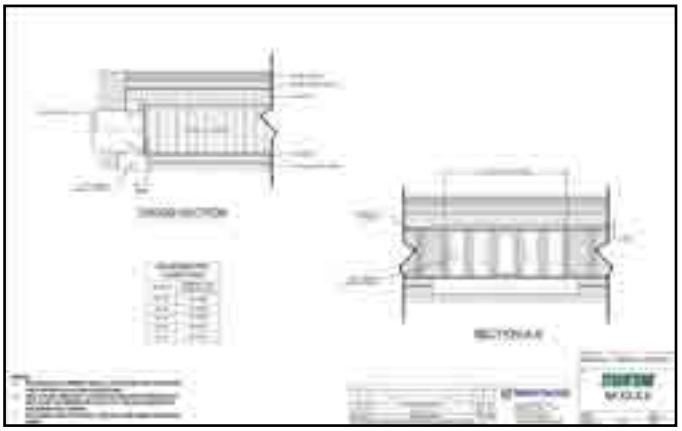
Brentwood has developed numerous drawings for utilization when specifying a StormTank® Module system. Below are some examples of drawings available at [www.brentwoodindustries.com.](http://www.brentwoodindustries.com)











13.0 Specifications

1) General

a) This specification shall govern the implementation, performance, material, and fabrication pertaining to the subsurface stormwater storage system. The subsurface stormwater storage system shall be manufactured by Brentwood Industries, Inc., 500 Spring Ridge Drive, Reading, PA 19610 (610.374.5109), and shall adhere to the following specification at the required storage capacities.

b) All work is to be completed per the design requirements of the Engineer of Record and to meet or exceed the manufacturer's design and installation requirements.

2) Subsurface Stormwater Storage System Modules

a) The subsurface stormwater storage system shall be constructed from virgin polypropylene and 100% recycled PVC to meet the following requirements:

i) High-Impact Polypropylene Copolymer Material

(1) Injection molded, polypropylene, top/bottom platens and side panels formed to a dimension of 36" (914 mm) long by 18" (457 mm) wide [nominal].

ii) 100% Recycled PVC Material

(1) PVC conforming to ASTM D-1784 Cell Classification 12344 b-12454 B.

(2) Extruded, rigid, and 100% recycled PVC columns sized for applicable loads as defined by Section 3 of the AASHTO LRFD Bridge Design Specifications and manufactured to the required length per engineer-approved drawings.

iii) Platens and columns are assembled on site to create Modules, which can be uniformly stacked up to two Modules high, in vertical structures of variable height (custom for each project).

iv) Modular stormwater storage units must have a minimum 95% void space and be continuously open in both length and width, with no internal walls or partitions.

3) Submittals

a) Only systems that are approved by the engineer will be allowed.

b) At least 10 days prior to bid, submit the following to the engineer to be considered for pre-qualification to bid:

i) A list of materials to be provided for work under this article, including the name and address of the materials producer and the location from which the materials are to be obtained.

ii) Three hard copies of the following:

(1) Shop drawings.

(2) Specification sheets.

(3) Installation instructions.

(4) Maintenance guidelines.

c) Subsurface Stormwater Storage System Component Samples for review:

i) Subsurface stormwater storage system Modules provide a single 36" (914 mm) long by 18" (457 mm) wide, height as specified, unit of the product for review.

ii) Sample to be retained by owner.

d) Manufacturers named as acceptable herein are not required to submit samples.

4) Structural Design

a) The structural design, backfill, and installation requirements shall ensure the loads and load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 3 are met.

b) Product shall be tested under minimum installation criteria for short-duration live loads that are calculated to include a 20% increase over the AASHTO Design Truck standard with consideration for impact, multiple vehicle presences, and live load factor.

c) Product shall be tested under maximum burial criteria for long-term dead loads.

d) The engineer may require submission of third-party test data and results in accordance with items 4b and 4c to ensure adequate structural design and performance.

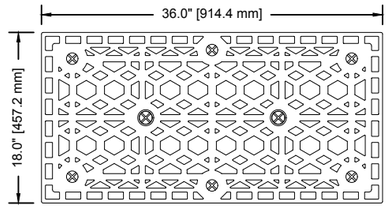
14.0 Appendix - Bearing Capacity Tables

Cover		HS-25 (Unfactored)		HS-25 (Factored)	
English (in)	Metric (mm)	English (ksf)	Metric (kPa)	English (ksf)	Metric (kPa)
24	610	1.89	90.45	4.75	227.43
25	635	1.82	86.96	4.53	216.90
26	660	1.75	83.78	4.34	207.80
27	686	1.69	80.88	4.16	199.18
28	711	1.63	78.24	3.99	191.04
29	737	1.58	75.82	3.84	183.86
30	762	1.54	73.62	3.70	177.16
31	787	1.50	71.60	3.57	170.93
32	813	1.46	69.75	3.45	165.19
33	838	1.42	68.06	3.34	159.92
34	864	1.39	66.51	3.24	155.13
35	889	1.36	65.10	3.14	150.34
36	914	1.33	63.80	3.05	146.03
37	940	1.31	62.62	2.97	142.20
38	965	1.29	61.54	2.90	138.85
39	991	1.26	60.55	2.83	135.50
40	1,016	1.25	59.65	2.76	132.15
41	1,041	1.23	58.54	2.70	129.28
42	1,067	1.21	58.09	2.67	127.84
43	1,092	1.20	57.42	2.60	124.49
44	1,118	1.19	56.81	2.55	122.09
45	1,143	1.18	56.26	2.50	119.70
46	1,168	1.16	55.77	2.46	117.79
47	1,194	1.16	55.33	2.42	115.87
48	1,219	1.15	54.94	2.39	114.43
49	1,245	1.14	54.59	2.36	113.00
50	1,270	1.13	54.29	2.33	111.56
51	1,295	1.13	54.03	2.30	110.12
52	1,321	1.12	53.80	2.27	108.69
53	1,346	1.12	53.62	2.25	107.73
54	1,372	1.12	53.46	2.23	106.77
55	1,397	1.11	53.34	2.21	105.82
56	1,422	1.11	53.24	2.19	104.86
57	1,448	1.11	53.18	2.17	103.90
58	1,473	1.11	53.14	2.16	103.42
59	1,499	1.11	53.12	2.14	102.46
60	1,524	1.11	53.13	2.13	101.98
61	1,549	1.11	53.16	2.12	101.51
62	1,575	1.11	53.21	2.11	101.03
63	1,600	1.11	53.28	2.10	100.55
64	1,626	1.11	53.37	2.09	100.07
65	1,651	1.12	53.48	2.08	99.59
66	1,676	1.12	53.61	2.08	99.59
67	1,702	1.12	53.75	2.07	99.11
68	1,727	1.13	53.91	2.07	99.11
69	1,753	1.13	54.08	2.06	98.63

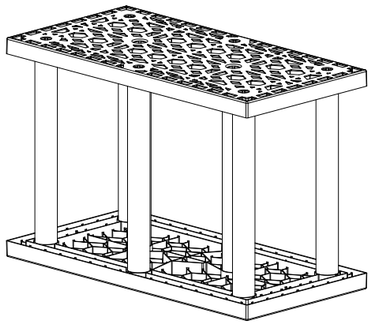
Cover		HS-25 (Unfactored)		HS-25 (Factored)	
English (in)	Metric (mm)	English (ksf)	Metric (kPa)	English (ksf)	Metric (kPa)
70	1,778	1.13	54.26	2.06	98.63
71	1,803	1.14	54.46	2.06	98.63
72	1,829	1.14	54.67	2.06	98.63
73	1,854	1.15	54.90	2.06	98.63
74	1,880	1.15	55.13	2.06	98.63
75	1,905	1.16	55.38	2.06	98.63
76	1,930	1.16	55.64	2.06	98.63
77	1,956	1.17	55.90	2.06	98.63
78	1,981	1.17	56.18	2.06	98.63
79	2,007	1.18	56.46	2.07	99.11
80	2,032	1.19	56.76	2.07	99.11
81	2,057	1.19	57.06	2.07	99.11
82	2,083	1.20	57.37	2.08	99.59
83	2,108	1.20	57.69	2.08	99.59
84	2,134	1.21	58.02	2.09	100.07
85	2,159	1.22	58.35	2.09	100.07
86	2,184	1.23	58.69	2.10	100.55
87	2,210	1.23	59.04	2.11	101.03
88	2,235	1.24	59.39	2.11	101.03
89	2,261	1.25	59.75	2.12	101.51
90	2,286	1.26	60.11	2.13	101.98
91	2,311	1.26	60.48	2.13	101.98
92	2,337	1.27	60.86	2.14	102.46
93	2,362	1.28	61.24	2.15	102.94
94	2,388	1.29	61.62	2.16	103.42
95	2,413	1.30	62.01	2.17	103.90
96	2,438	1.30	62.41	2.18	104.38
97	2,464	1.31	62.81	2.19	104.86
98	2,489	1.32	63.21	2.20	105.34
99	2,515	1.33	63.62	2.21	105.82
100	2,540	1.34	64.03	2.22	106.29
101	2,565	1.35	64.45	2.23	106.77
102	2,591	1.35	64.87	2.24	107.25
103	2,616	1.36	65.29	2.25	107.73
104	2,642	1.37	65.72	2.27	108.69
105	2,667	1.38	66.15	2.28	109.17
106	2,692	1.39	66.58	2.29	109.65
107	2,718	1.40	67.02	2.30	110.12
108	2,743	1.41	67.45	2.31	110.60
109	2,769	1.42	67.90	2.33	111.56
110	2,794	1.43	68.34	2.34	112.04
111	2,819	1.44	68.79	2.35	112.52
112	2,845	1.45	69.24	2.36	113.00
113	2,870	1.46	69.69	2.38	113.96
114	2,896	1.47	70.15	2.39	114.43

BRENTWOOD®

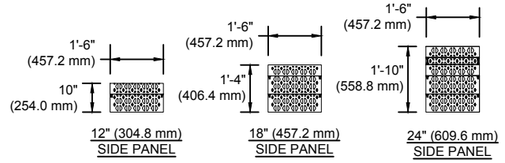
BRENTWOOD INDUSTRIES, INC.
brentwoodindustries.com
stormtank@brentw.com
+1.610.374.5109

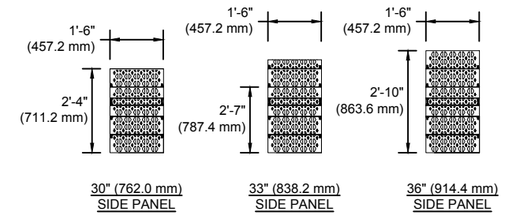


TOP



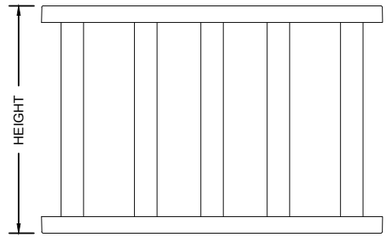
ISOMETRIC VIEW



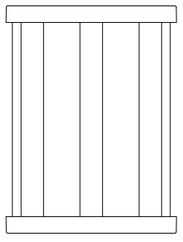


NOTES:
1. SIDE PANELS TO BE INSTALLED ALONG SYSTEM PERIMETER, UNLESS OTHERWISE SPECIFIED.
2. ALL HEIGHTS TO BE CUT FROM A 36" (914.4 mm) SIDE PANEL AT PRE-SCRIBED LOCATIONS, EXCEPT 33" (838.2 mm) & 12" (304.8 mm) SIDE PANEL.

SIDE PANEL DETAIL



FRONT



SIDE

MODULE DETAIL

STORMTANK® MODULE				
NAME	HEIGHT (mm)	CAPACITY (m^3)	VOID RATIO	NOMINAL WEIGHT (kg)
ST-12	12" (304.8)	4.22 cf (0.1194)	93.70%	17.56 lbs. (7.965)
ST-18	18" (457.2)	6.44 cf (0.1824)	95.50%	22.70 lbs. (10.29)
ST-24	24" (609.6)	8.66 cf (0.2452)	96.00%	26.30 lbs. (11.92)
ST-30	30" (762.0)	10.88 cf (0.3081)	96.50%	29.50 lbs. (13.38)
ST-33	33" (838.2)	11.99 cf (0.3395)	96.90%	29.82 lbs. (13.53)
ST-36	36" (914.4)	13.10 cf (0.3710)	97.00%	33.10 lbs. (15.01)

NOTES:
a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.
b. SIDE PANELS REQUIRED AROUND THE PERIMETER OF THE INSTALLATION ONLY, UNLESS OTHERWISE NOTED.
c. SIDE PANELS ARE TO BE CUT FROM A 36" PANEL AT THE PRE-SCRIBED LOCATIONS.

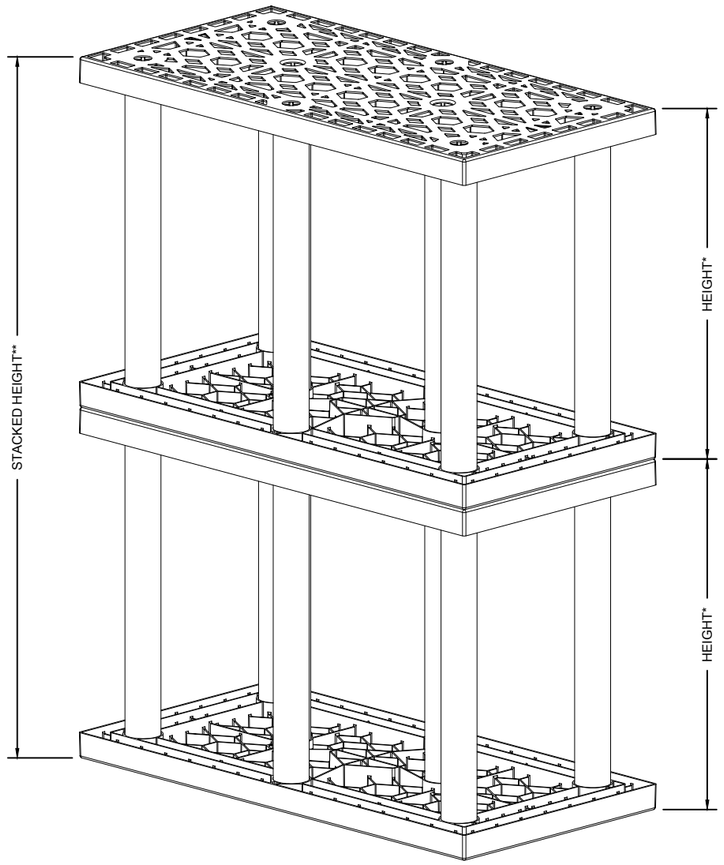
REV.	DATE	RECORD OF CHANGES	BY	APPRV.
D	2/17/17	ST-12 MODULE ADDED, METRIC DIMENSIONS UPDATED	CGB	
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

BRENTWOOD
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

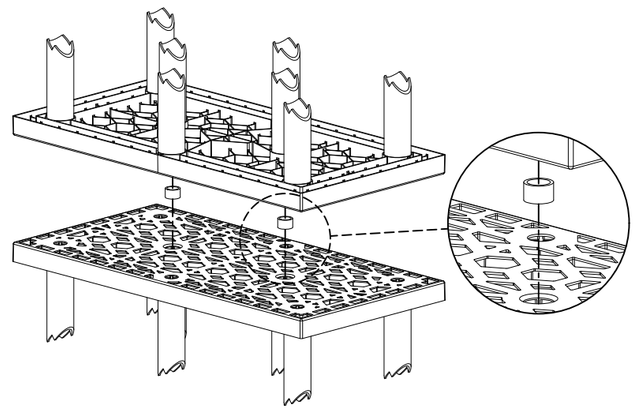
Project Name: MODULE DETAIL

Title: STORMTANK® MODULE

Drawn By: B.LINE | Date: 4/5/12
Drawing No.: STM-000-00 | Sheet: 1 of 2 | Scale: NTS



MODULE DOUBLE STACK DETAIL



STACKING PIN DETAIL

DOUBLE STACK CONFIGURATIONS:						
SYSTEM HEIGHT (mm)	ST-18	ST-24	ST-30	ST-33	ST-36	CAPACITY (m^3)
42" (1,067)	1	1	-	-	-	15.08 cf (0.4270)
48" (1,219)	1	-	1	-	-	17.30 cf (0.4899)
51" (1,295)	1	-	-	1	-	18.42 cf (0.5216)
54" (1,372)	1	-	-	-	1	19.50 cf (0.5522)
57" (1,448)	-	1	-	1	-	20.64 cf (0.5845)
60" (1,524)	-	1	-	-	1	21.75 cf (0.6159)
63" (1,600)	-	-	1	1	-	22.86 cf (0.6473)
66" (1,676)	-	-	-	2	-	23.97 cf (0.6788)
69" (1,753)	-	-	-	1	1	25.08 cf (0.7101)
72" (1,829)	-	-	-	-	2	26.20 cf (0.7419)

NOTES:
a. REFERENCE CURRENT INSTALLATION INSTRUCTIONS FOR PROPER ASSEMBLY AND INSTALLATION PRACTICES.
b. STACKING PINS REQUIRED BETWEEN MODULE LAYERS, FOR ALL STACKED SYSTEMS (SEE DETAIL).

REV.	DATE	RECORD OF CHANGES	BY	APPRV.
D	2/17/17	ST-12 MODULE ADDED, METRIC DIMENSIONS UPDATED	CGB	
C	9/12/13	NOTE REVISION, FORMATTING UPDATE & DWG. NO. UPDATE	JKB	JKB
B	9/11/12	FORMATTING & DWG. NO. UPDATE	JKB	FK
A	4/5/12	INITIAL RELEASE	BLL	FK

BRENTWOOD
610 Morgantown Road
Reading, PA 19611 U.S.A.
Phone: (610) 374-5109
Fax: (610) 376-6022
www.brentwoodindustries.com

Project Name
MODULE DOUBLE STACK DETAIL

Title
STORMTANK
MODULE

Drawn By		Date
B.LINE		4/5/12
Drawing No.	Sheet	Scale
STM-000-00	2 of 2	NTS

Appendix D: AquaSwirl Hydrodynamic Separator

SOLENO
Mastering Storm Water

DATA SHEET

AQUA-SWIRL®

PRODUCT DESCRIPTION : Hydrodynamic separator

FUNCTION : System that maximizes removal of Total Suspended Solids (TSS), oils and floating debris from surface runoff before it is conveyed to an outlet.

RAW MATERIALS : Made from high-density polyethylene (HDPE) ASTM D3350

TECHNICAL DATA : Diameter: 750 mm (30 in) to 3300 mm (132 in)
Higher flow rates are custom manufactured
Height: The height of the unit and the stack are variable
Size of particles to control: from coarse silt to very coarse sand (60 microns and over)
Installation: networked with or parallel to the storm water sewer system
Structural strength: CAN/CSA - S6 - 02 (CL-625) and AASHTO (H-25 and HS-25)

AVAILABLE COUPLERS : Adapts to all types of HDPE, PVC, concrete, steel and CSP pipes

AQUA-SWIRL

TECHNICAL DATA TABLE

Model	Nom. dia. of the chamber		Ext. dia. of the chamber		Height of the chamber		Weight		Maximum nom. diam. of the pipe connection				Oils and floating debris storage capacity		Sediment storage capacity	
									Off-line		On-line					
	mm	ft	mm	in	mm	in	kg	lb	mm	in	mm	in	liters	gallons	m^3	ft^3
AS-2	750	2.5	871	34.3	1524	60	141	311	200	8	300	12	140	37	0.3	10
AS-3	1050	3.5	1219	48	2642	104	464	1024	250	10	525	21	416	110	0.6	20
AS-4	1350	4.5	1549	61	2642	104	686	1512	300	12	600	24	719	190	0.9	32
AS-5	1500	5	1722	67.8	2642	104	816	1799	300	12	750	30	1022	270	1.3	45
AS-6	1800	6	2067	81.4	2642-2794	104-110	1108-1142	2443-2518	300	12	900	36	1476	390	1.8	65
AS-7	2100	7	2393	94.2	2896-2946	114-116	1467-1482	3235-3267	375	15	900	36	2044	540	2.6	90
AS-8	2400	8	2718	107	2896-3099	114-122	1770-1841	3901-4058	375	15	1200	48	2687	710	3.3	115
AS-9	2700	9	3045	119.9	2896-3251	114-128	2172-2315	4788-5103	450	18	1200	48	3444	910	4.1	145
AS-10	3000	10	3371	132.7	2896-3251	114-128	2523-2701	5563-5103	525	21	1500	60	4277	1130	5.1	180
AS-11	3300	11	3716	146.3	2896-3251	114-128	3277-3526	7226-7774	525	21	1500	60	5383	1422	6.3	222
AS-XX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Note 1: Values in the table are approximate and may change without notice.
AS-XX: Custom made unit.
* Contact your Soleno representative to know the treatment throughput for the unit, according to local regulations.

APPLICATION : Control of TSS, oils and floating debris by hydrodynamic separation

OPTION : Factory-welded bell with integrated gasket with clips

Aqua-Swirl™ Sizing Chart

Aqua-Swirl™ Model	Swirl Chamber Diameter (ft.)	Maximum Stub-Out Pipe Outer Diameter (in.)		Water Quality Treatment Flow[2] (cfs)	Oil/Debris Storage Capacity (gal)	Sediment Storage Capacity (ft^3)
		On/Offline	BYP[1]			
AS-2	2.50	8	15	1.1	37	10
AS-3	3.25	10	21	1.8	110	20
AS-4	4.25	12	27	3.2	190	32
AS-5	5.00	12	30	4.4	270	45
AS-6	6.00	14	36	6.3	390	65
AS-7	7.00	16	42	8.6	540	90
AS-8	8.00	18	48	11.2	710	115
AS-9	9.00	20	>48 *	14.2	910	145
AS-10	10.0	22	>48 *	17.5	1130	180
AS-11	11.0	24	>48 *	21.2	1422	222
AS-12	12.0	26	>48 *	25.2	1698	270
AS-13	13.0	28	>48 *	29.6	1986	310
AS-XX	Custom	--	--	>26 **	--	--

*** See Representative for larger pipe diameters available **Higher water quality treatment flow rates can be designed with multiple swirls.**

1) *The **Aqua-Swirl™ Internal Bypass (BYP)** provides full treatment of the "first flush," while the peak design storm is diverted and channeled through the main conveyance pipe. Please refer to your local representative for more information.*

2) *Many regulatory agencies are establishing "water quality treatment flow rates" for their areas based on the initial movement of pollutants into the storm drainage system. The treatment flow rate of the Aqua-Swirl™ system is engineered to meet or exceed the local water quality treatment criteria. This **"water quality treatment flow rate"** typically represents approximately 90% to 95% of the total annual runoff volume.*

The design and orientation of the Aqua-Filter™ generally entails some degree of customization. For assistance in design and specific sizing using historical rainfall data, please refer to an AquaShield™ representative or visit our website at www.AquaShieldInc.com. CAD details and specifications are available upon request.

Aqua-Swirl®
Stormwater Treatment System

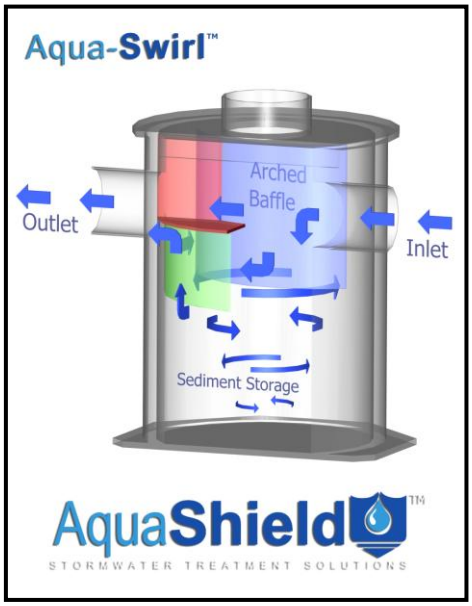
Inspection and Maintenance Manual

AquaShield™, Inc.
2733 Kanasita Drive
Suite 111
Chattanooga, TN 37343
Toll free (888) 344-9044
Phone: (423) 870-8888
Fax: (423) 826-2112
Email: info@aquashieldinc.com
www.aquashieldinc.com

November 2016

Aqua-Swirl® Stormwater Treatment System

The Aqua-Swirl® Stormwater Treatment System (Aqua-Swirl®) is a vortex-type hydrodynamic separator designed and supplied by AquaShield™, Inc. (AquaShield™). Aqua-Swirl® technology removes pollutants including suspended solids, debris, floatables and free-floating oil from stormwater runoff. Both treatment and storage are accomplished in the single swirl chamber without the use of multiple or hidden, blind access chambers.



Aqua-Swirl® Stormwater Treatment System

Floatable debris in the Aqua-Swirl®

System Operation

The treatment operation begins when stormwater enters the Aqua-Swirl® through a tangential inlet pipe that produces a circular (or vortex) flow pattern that causes contaminates to settle to the base of the unit. Since stormwater flow is intermittent by nature, the Aqua-Swirl® retains water between storm events providing both dynamic and quiescent settling of solids. The dynamic settling occurs during each storm event while the quiescent settling takes place between successive storms. A combination of gravitational and hydrodynamic drag forces encourages the solids to drop out of the flow and migrate to the center of the chamber where velocities are the lowest.

The treated flow then exits the Aqua-Swirl® behind the arched outer baffle. The top of the baffle is sealed across the treatment channel, thereby eliminating floatable pollutants from escaping the system. A vent pipe is extended up the riser to expose the backside of the baffle to atmospheric conditions, preventing a siphon from forming at the bottom of the baffle.

Custom Applications

The Aqua-Swirl® system can be modified to fit a variety of purposes in the field, and the angles for inlet and outlet lines can be modified to fit most applications. The photo below demonstrates the flexibility of Aqua-Swirl® installations using a "twin" configuration in order to double the water quality treatment capacity. Two Aqua-Swirl® units were placed side by side in order to treat a high volume of water while occupying a small amount of space.

Custom designed AS-9 Twin Aqua-Swirl®

Retrofit Applications

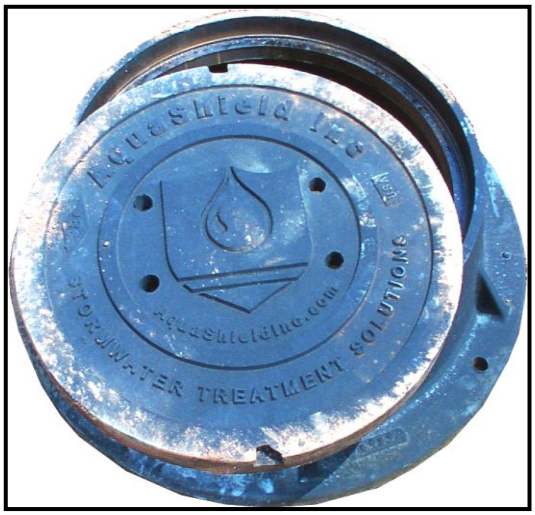
The Aqua-Swirl® system is designed so that it can easily be used for retrofit applications. With the invert of the inlet and outlet pipe at the same elevation, the Aqua-Swirl® can easily be connected directly to the existing storm conveyance drainage system. Furthermore, because of the lightweight nature and small footprint of the Aqua-Swirl®, existing infrastructure utilities (i.e., wires, poles, trees) would be unaffected by installation.

Aqua-Swirl® System Maintenance

The long term performance of any stormwater treatment structure, including manufactured or land based systems, depends on a consistent maintenance plan. Inspection and maintenance functions are simple and easy for the Aqua-Swirl® allowing all inspections to be performed from the surface.

It is important that a routine inspection and maintenance program be established for each unit based on: (a) the volume or load of the contaminants of concern, (b) the frequency of releases of contaminants at the facility or location, and (c) the nature of the area being drained.

In order to ensure that our systems are being maintained properly, AquaShield™ offers a maintenance solution to all of our customers. We will arrange to have maintenance performed.



Aqua-Swirl® manhole cover

Inspection

The Aqua-Swirl® can be inspected from the surface, eliminating the need to enter the system to determine when cleanout should be performed. In most cases, AquaShield™ recommends a quarterly inspection for the first year of operation to develop an appropriate schedule of maintenance. Based on experience of the system's first year in operation, we recommend that the inspection schedule be revised to reflect the site-specific conditions encountered. Typically, the inspection schedule for subsequent years is reduced to semi-annual inspection.

Maintenance

The Aqua-Swirl® has been designed to minimize and simplify the inspection and maintenance process. The single chamber system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. Furthermore, the entire structure (specifically, the floor) is accessible for visual inspection from the surface. There are no areas of the structure that are blocked from visual inspection or periodic cleaning. Inspection of any free-floating oil and floatable debris can be directly observed and maintained through the manhole access provided directly over the swirl chamber.

Aqua-Swirl® Inspection Procedure

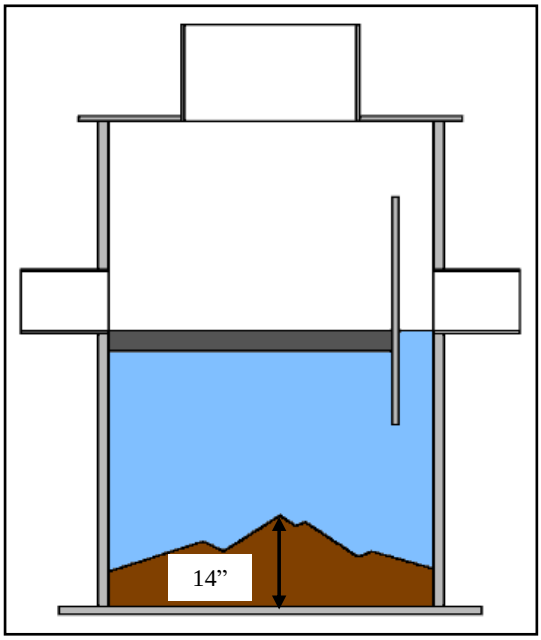
To inspect the Aqua-Swirl®, a hook is typically needed to remove the manhole cover. AquaShield™ provides a customized manhole cover with our distinctive logo to make it easy for maintenance crews to locate the system in the field. We also provide a permanent metal information plate affixed inside the access riser which provides our contact information, the Aqua-Swirl® model size, and serial number.

The only tools needed to inspect the Aqua-Swirl® system are a flashlight and a measuring device such as a stadia rod or pole. Given the easy and direct accessibility provided, floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water.

It should be noted that in order to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the *top* of the sediment pile. Keep in mind that the finer sediment at the top of the pile may offer less resistance to the measuring device than the larger particles which typically occur deeper within the sediment pile.

The Aqua-Swirl® design allows for the sediment to accumulate in a semi-conical fashion as illustrated below. That is, the depth to sediment as measured below the water surface may be less in the center of the swirl chamber; and likewise, may be greater at the edges of the swirl chamber.

Sediment inspection using a stadia rod



Maximum recommended sediment depth prior to cleanout
is 14 inches for all Aqua-Swirl® models

Aqua-Swirl® Cleanout Procedure

Cleaning the Aqua-Swirl® is simple and quick. Free-floating oil and floatable debris can be observed and removed directly through the 30-inch service access riser provided. A vacuum truck is typically used to remove the accumulated sediment and debris. An advantage of the Aqua-Swirl® design is that the entire sediment storage area can be reached with a vacuum hose

from the surface reaching all the sides. Since there are no multiple or limited (blind) access chambers in the Aqua-Swirl®, there are no restrictions to impede on-site maintenance tasks.

Disposal of Recovered Materials

AquaShield™ recommends that all maintenance activities be performed in accordance with appropriate health and safety practices for the tasks and equipment being used. AquaShield™ also recommends that all materials removed from the Aqua-Swirl® and any external structures (e.g, bypass features) be handled and disposed in full accordance with any applicable local and state requirements.

Vacuum (vactor) truck quickly cleans the single open access swirl chamber

Aqua-Swirl® Inspection and Maintenance Work Sheets on following pages

Aqua-Swirl® Inspection and Maintenance Manual
Work Sheets

SITE and OWNER INFORMATION

Site Name: _____

Site Location: _____

Date: _____ Time: _____

Inspector Name: _____

Inspector Company: _____ Phone #: _____

Owner Name: _____

Owner Address: _____

Owner Phone #: _____ Emergency Phone #: _____

INSPECTIONS

I. Floatable Debris and Oil

1. Remove manhole lid to expose liquid surface of the Aqua-Swirl®.
2. Remove floatable debris with basket or net if any present.
3. If oil is present, measure its depth. Clean liquids from system if one half (½) inch or more oil is present.

   Note: Water in Aqua-Swirl® can appear black and similar to oil due to the dark body of the surrounding structure. Oil may appear darker than water in the system and is usually accompanied by oil stained debris (e.g. Styrofoam, etc.). The depth of oil can be measured with an oil/water interface probe, a stadia rod with water finding paste, a coliwasa, or collect a representative sample with a jar attached to a rod.

II. Sediment Accumulation

1. Lower measuring device (e.g. stadia rod) into swirl chamber through service access provided until top of sediment pile is reached.
2. Record distance to top of sediment pile from top of standing water: _____ inches.
3. Maximum recommended sediment depth prior to cleanout is 14 inches for all models. Consult system shop drawing for treatment chamber depth as measured from the inlet pipe invert to base of the unit.

III. Diversion Structures (External Bypass Features)

If a diversion (external bypass) configuration is present, it should be inspected as follows:

1. Inspect weir or other bypass feature for structural decay or damage. Weirs are more susceptible to damage than off-set piping and should be checked to confirm that they are not crumbling (concrete or brick) or decaying (steel).
2. Inspect diversion structure and bypass piping for signs of structural damage or blockage from debris or sediment accumulation.
3. When feasible, measure elevations on diversion weir or piping to ensure it is consistent with site plan designs.
4. Inspect downstream (convergence) structure(s) for sign of blockage or structural failure as noted above.

CLEANING

Schedule cleaning with local vactor company or AquaShield™ to remove sediment, oil and other floatable pollutants. The captured material generally does not require special treatment or handling for disposal. Site-specific conditions or the presence of known contaminants may necessitate that appropriate actions be taken to clean and dispose of materials captured and retained by the Aqua-Swirl®. All cleaning activities should be performed in accordance with property health and safety procedures.

AquaShield™ always recommends that all materials removed from the Aqua-Swirl® during the maintenance process be handled and disposed in accordance with local and state environmental or other regulatory requirements.

MAINTENANCE SCHEDULE

I. During Construction

Inspect the Aqua-Swirl® every three (3) months and clean the system as needed. The Aqua-Swirl® should be inspected and cleaned at the end of construction regardless of whether it has reached its maintenance trigger.

II. First Year Post-Construction

Inspect the Aqua-Swirl® every three (3) months and clean the system as needed.

Inspect and clean the system once annually regardless of whether it has reached its sediment or floatable pollutant storage capacity.

III. Second and Subsequent Years Post-Construction

If the Aqua-Swirl® did not reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl® reached full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months and cleaned as needed. The Aqua-Swirl® should be cleaned annually regardless of whether it reaches its sediment or floatable pollutant capacity.

IV. Bypass Structures

Bypass structures should be inspected whenever the Aqua-Swirl® is inspected. Maintenance should be performed on bypass structures as needed.

MAINTENANCE COMPANY INFORMATION

Company Name: _____

Street Address: _____

City: _____ State/Prov.:_____ Zip/Postal Code: _____

Contact: _____ Title: _____

Office Phone: _____ Cell Phone: _____

ACTIVITY LOG

Date of Cleaning: _____ (Next inspection should be 3 months from this data for first year).

Time of Cleaning: Start: _____ End: _____

Date of Next Inspection: _____

Floatable debris present: Yes No

Notes: _____

_____

_____

Oil present: Yes No Oil depth (inches): _____

Measurement method and notes: _____

_____

_____

STRUCTURAL CONDITIONS and OBSERVATIONS

Structural damage: Yes No Where: _____

Structural wear: Yes No Where: _____

Odors present: Yes No Describe: _____

Clogging: Yes No Describe: _____

Other Observations: _____

_____

_____

NOTES

Additional Comments and/or Actions To Be Taken	Time Frame

ATTACHMENTS

- Attach site plan showing Aqua-Swirl® location.
- Attach detail drawing showing Aqua-Swirl® dimensions and model number.
- If a diversion configuration is used, attach details showing basic design and elevations (where feasible).

Aqua-Swirl®

TABULAR MAINTENANCE SCHEDULE

Date Construction Started: _____

Date Construction Ended: _____

During Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity. In addition, the system should be cleaned at the **end of construction** regardless of whether it has reach full pollutant storage capacity.

First Year Post-Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed			X			X			X			X
Inspect Bypass and maintain as needed			X			X			X			X
Clean System*												X*

* The Aqua-Swirl® should be cleaned **once a year** regardless of whether it has reached full pollutant storage capacity.

Second and Subsequent Years Post-Construction

	Month											
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Inspect and Clean as needed												X*
Inspect Bypass, maintain as needed												X*
Clean System*												X*

* If the Aqua-Swirl® did **not** reach full sediment or floatable pollutant capacity in the First Year Post-Construction period, the system can be inspected and cleaned once annually.

If the Aqua-Swirl® **reached** full sediment or floatable pollutant capacity in less than 12 months in the First Year Post-Construction period, the system should be inspected once every six (6) months or more frequently if past history warrants, and cleaned as needed. The Aqua-Swirl® should be cleaned annually regardless of whether it reaches its full sediment or floatable pollutant capacity.

Appendix E: Fire Flow Calculations

- FUS

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

(613) 860-0923
FAX: (613) 258-0475

APPENDIX E: CALCULATION OF FIRE FLOW REQURIEMENTS - 800 Eagleson

Calculation Based on Fire Underwriters Survey

Using methodology provided in City of Ottawa Technical Bulletin ISTB-2018-02

1) An estimate of the Fire Flow required for a given fire area may be estimated by:

$$F = 220 \times C \times \sqrt{A}$$

where F = required fire flow in litres per minute

A = Fire-Resistive Buildings with 1hr fire rating. Consider only area of the largest floor plus 25 percent of each of the two immedately adjoining floors. Floors 2 to 6 are of equal size. 1st floor slightly smaller Therefore consider3rd floor area with 25% of 2nd and 25% of 4th floor areas.

C = coefficient related to the type of construction:

1.5	for wood construction (structure essentially combustible)
1.0	for ordinary construction (brick or other masonry walls, combustible floor and interior)
0.8	for noncombustible construction (unprotected metal structural components, masonary or metal walls)
0.6	for fire-resistive construction (fully protected frame, floors, roof)

Area of floor 3 = 2679 m^2 25% of 2nd Floor = 669.8 m^2

25% of 4th Floor = 669.8 m^2

A = 4018.5 m^2 (Fire Resistive Construction)

C = 0.8

F = 11,157 L/min ----------> Rounded to nearest 1000 = **11,000**

2) The value obtained in 1. may be reduced by as much as 25% for occupancies having a low

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

Reduction due to low occupancy hazard = -15% x 11,000 = = **9,350** L/min

3) The value above my be reduced by up to 50% for automatic sprinlker system

Reduction due to automatic sprinker system = -30% x 9,350 = **-2,805**

4) The value obtained in 2. may be increased for structures exposed within 45 metres by the fire area

Separation (metres)	Condtion	Charge
0m to 3.0m	1	25%
3.1m to 10.0m	2	20%
10.1m to 20.0m	3	15%
20.1m to 30.0m	4	10%
30.1m to 45.0m	5	5%
45.1m to	6	0%

Exposures	Distance(m)	Condtion		Charge
Side 1 (west)	30.0	4	-------->	10%
Side 2 (east)	25.0	4	-------->	10%
Front (Fernbank)	21.0	4	-------->	10%
Back	21.0	4	-------->	10%
				40%

Increase due to separation = 40% x 9,350 = **3,740** L/min

The fire flow requirement is = **9,350**

Reduction due to Sprinkler = **-2,805**

Increase due to Separation = 3,740

The Total fire flow requirement is = 10,285

or **171.4** **L/sec**

Appendix F: Boundary Conditions

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Materials Testing •

(613) 860-0923

FAX: (613) 258-0475

May 24, 2018

Santhosh Kuruvilla
Project Manager Infrastructure Approvals
Planning Infrastructure & Economic Development Department
Planning Services.

Re: Boundary Conditions 800 Eagleson Road – City of Ottawa File No. PC2017-0342

Kollaard Associates Inc has been retained by Ironclad Developments Inc. to complete the Site Servicing Plan and Site Servicing Report for the proposed residential development at 800 Eagleson Road.

Could you provide us with the boundary conditions for the property based on the following information.

Type of Development: Residential (6 storey, 144 unit apartment building)
Location of Services: 800 Eagleson Road (Eagleson at Fernbank)
Amount of Fire Flow: 171.4 L/s (see attached fire flow requirements)
Average daily water demand: 1.26 L/s
Maximum daily water demand: 3.14 L/s
Maximum Hourly water demand: 6.91 L/s
Peak sanitary flow: 3.21 L/s

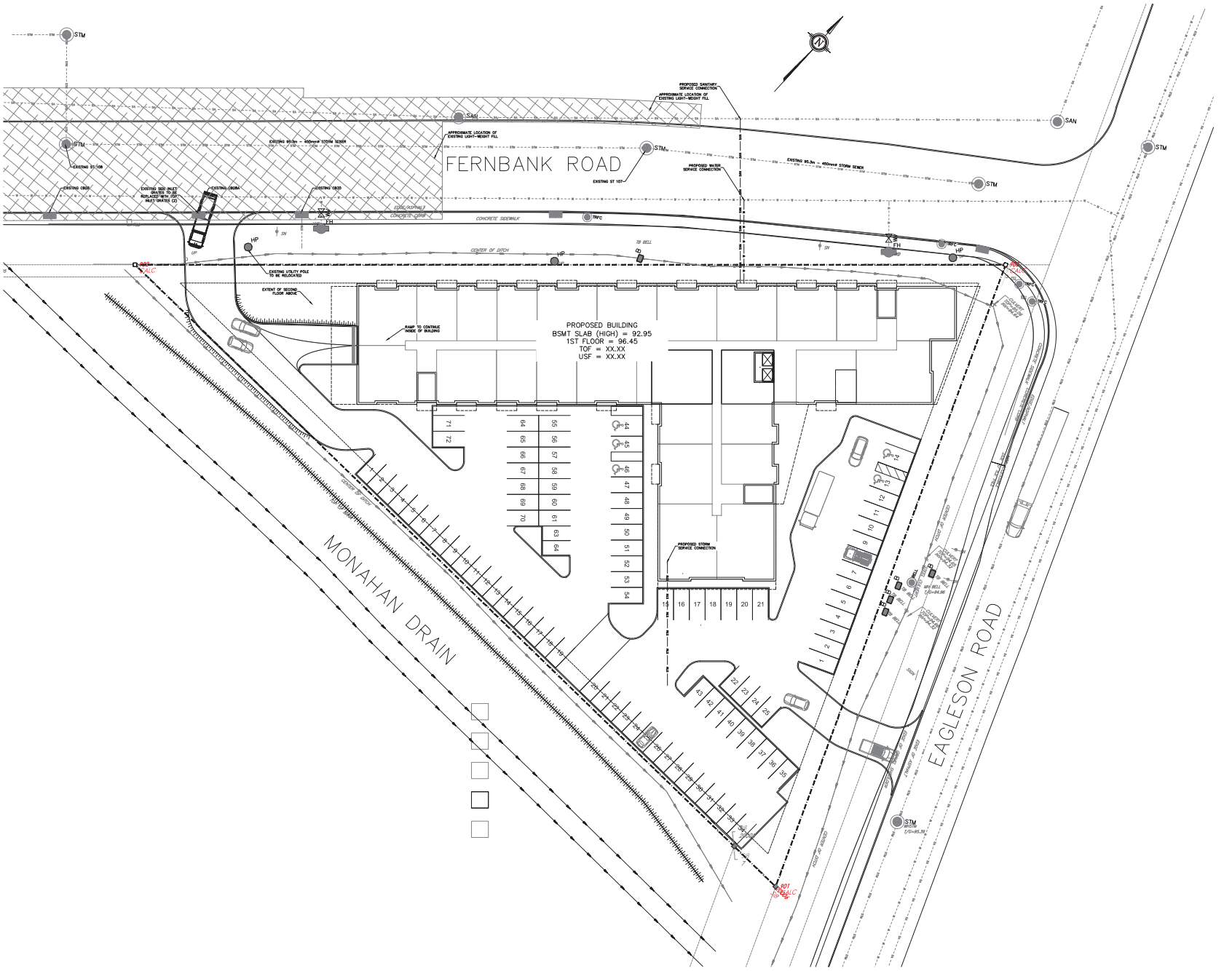
Please note:

- The sanitary calculations have been completed using Technical Bulletin ISTB-2018-01. The water demand calculations have not been updated to reflect the changes in sanitary demand calculations.
- Fire flow is based on FUS calculations and takes into account the methodology provided in Technical Bulletin ISTB-2018-02
- Design calculation spread sheets for FUS, Water and Sanitary are attached
- Servicing Sketch is attached showing proposed connection location

If there are any questions related to the above please contact the undersigned.

Sincerely,
KOLLAARD ASSOCIATES INC.

Steven deWit, P.Eng.



SITE SERVICING PLAN
SCALE = 1:300

DRAWING No.
180084-SER

DRAWING
SITE SERVICING PLAN

KEY PLAN:
N.T.S.

GENERAL PROJECT NOTES:

No.	REVISION	DATE	BY

Kollaard Associates Engineers
P.O. BOX 189, 210 PRESCOTT ST. (613) 860-0923
KEMPTVILLE, ONTARIO info@kollaard.ca
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

CLIENT NAME
IRONCLAD DEVELOPMENTS

PROJECT NAME
PROPOSED 6 STOREY APARTMENT DEVELOPMENT

PROJECT LOCATION
800 EAGLESON RD
KANATA, ON
K2M 0A8

DESIGNED BY	CHECKED BY
SD	SD
DRAWN BY	APPROVED BY
RR	SD

DATE
23.APR.2018

SCALE
1:300

PROJECT No.
PROJECT NO.

SHEET SET
3 OF 3

BOUNDARY CONDITIONS

Boundary Conditions For: 800 Eagleson Road

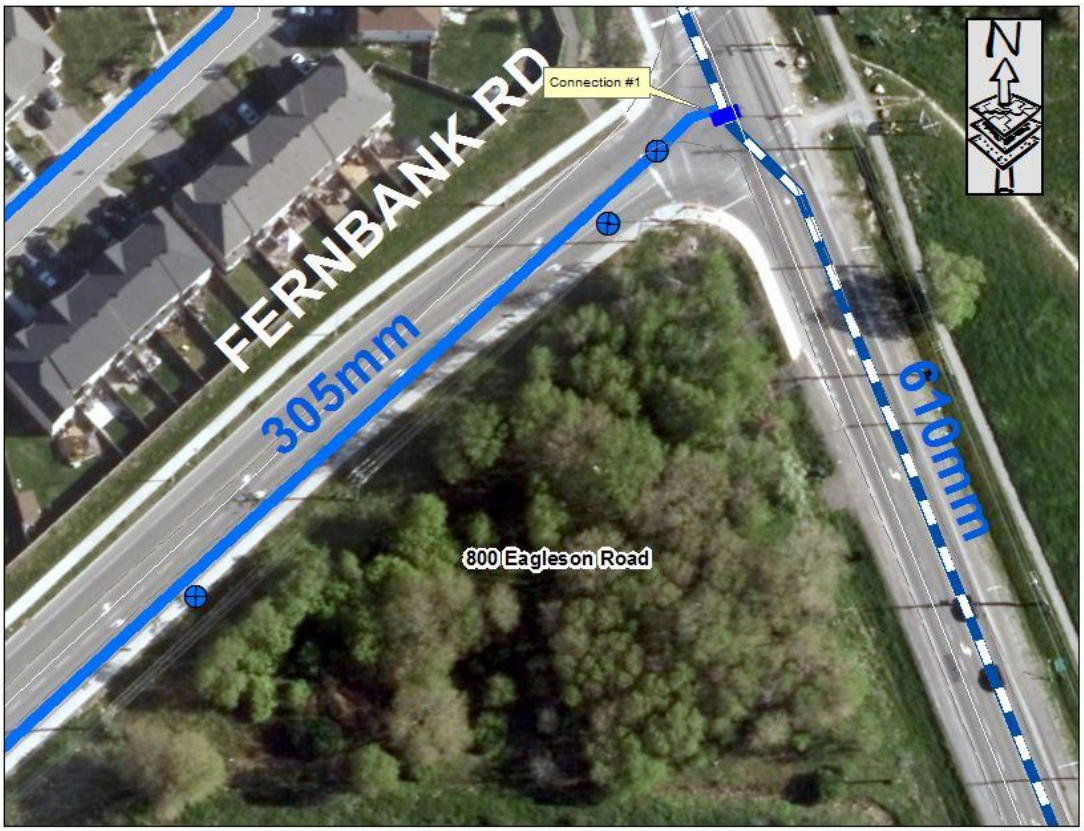
Date of Boundary Conditions: 2018-May-31

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	75.6	1.3
Maximum Daily Demand	188.4	3.1
Peak Hour	414.6	6.9
Fire Flow #1 Demand	10,285	171.4

Number of Connections: 1

Location:



BOUNDARY CONDITIONS

Results:

Connection #: 1

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	161.6	93.2
Peak Hour	156.9	86.5
Max Day Plus Fire (10,285) L/min	157.0	86.6

[1]Elevation: **96.040 m**

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

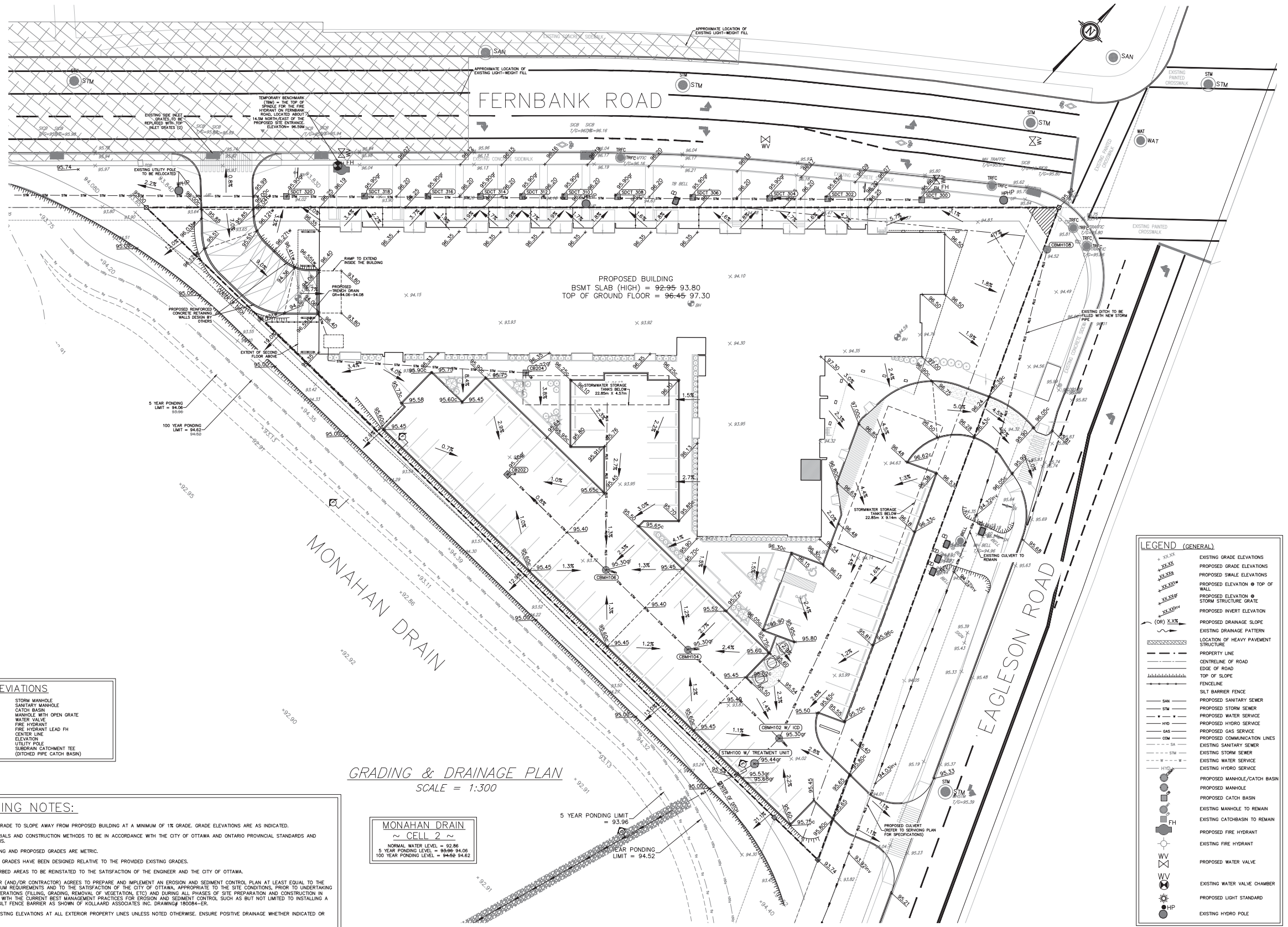
2) As per Ottawa Design Guidelines - Water Distribution – July 2010 two connection locations are required for residential developments exceeding 50 units. Alternatively, one connection is possible provided two valves are installed, one on each side of connection in order to prevent water service interruptions to future residents

Disclaimer

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

Appendix G: Drawings

- 180084 – PRE-CA – Pre development drainage
- 180084 – POST-CA – Post development drainage
- 180084 – SER – Site Servicing Plan
- 180084 – GR – Grading and Drainage Plan
- 180084 – DET – Details
- 180084 – ER – Erosion and Sediment Control Plan
- 180084 – SS-CA – Storm Sewer Catchment Area Plan



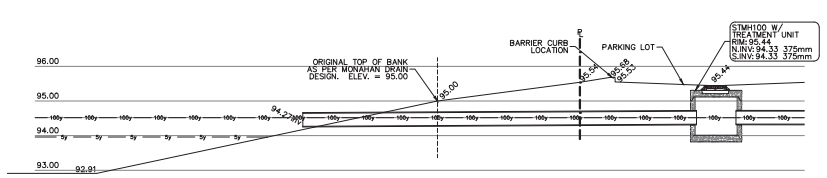
GRADING & DRAINAGE PLAN
SCALE = 1:300

ABBREVIATIONS

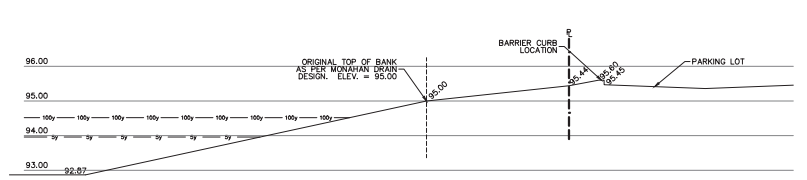
STM	STORM MANHOLE
SAN	SANITARY MANHOLE
CB	CATCH BASIN
CBMH	MANHOLE WITH OPEN GRATE
WV	WATER VALVE
FH	FIRE HYDRANT
FHL	FIRE HYDRANT LEAD FH
C/L	CENTER LINE
ELEV	ELEVATION
UP	UTILITY POLE
SDCT	SUBDRAIN CATCHMENT TEE (DITCHED PIPE CATCH BASIN)

GRADING NOTES:

1. FINISHED GRADE TO SLOPE AWAY FROM PROPOSED BUILDING AT A MINIMUM OF 1% GRADE. GRADE ELEVATIONS ARE AS INDICATED.
2. ALL MATERIALS AND CONSTRUCTION METHODS TO BE IN ACCORDANCE WITH THE CITY OF OTTAWA AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS.
3. ALL EXISTING AND PROPOSED GRADES ARE METRIC.
4. PROPOSED GRADES HAVE BEEN DESIGNED RELATIVE TO THE PROVIDED EXISTING GRADES.
5. ALL DISTURBED AREAS TO BE REINSTATED TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF OTTAWA.
6. THE OWNER (AND/OR CONTRACTOR) AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN AT LEAST EQUAL TO THE STATED MINIMUM REQUIREMENTS AND TO THE SATISFACTION OF THE CITY OF OTTAWA, APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL SUCH AS BUT NOT LIMITED TO INSTALLING A LIGHT DUTY SILT FENCE BARRIER AS SHOWN OF KOLLAARD ASSOCIATES INC. DRAWING# 180084-ER.
7. MATCH EXISTING ELEVATIONS AT ALL EXTERIOR PROPERTY LINES UNLESS NOTED OTHERWISE. ENSURE POSITIVE DRAINAGE WHETHER INDICATED OR NOT.
8. BUILDERS SHOULD CONSULT THE GEOTECHNICAL REPORT FOR THE SITE PRIOR TO CONSTRUCTION. BUILDERS SHOULD OBTAIN A SUBGRADE INSPECTION REPORT FROM QUALIFIED ENGINEER PRIOR TO CONCRETE PLACEMENT.
9. DRIVEWAY, PARKING LOT AND BUILDING SUBGRADES SHALL BE INSPECTED BY A LICENSED GEOTECHNICAL ENGINEER PRIOR TO THE PLACEMENT OF GRANULARS.
10. CONTRACTOR RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
11. CO-ORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
12. CONTRACTOR TO COMPLY WITH THE MUNICIPAL AUTHORITY REQUIREMENTS FOR TRAFFIC CONTROL WHEN WORKING NEAR MUNICIPAL STREET.
13. RESTORE PAVEMENT STRUCTURE AND SURFACES ON EXISTING ROADS TO A CONDITION AT LEAST EQUAL TO ORIGINAL AND TO THE SATISFACTION OF THE MUNICIPAL AUTHORITIES.
14. REFER TO SITE PLAN BY ARCHITECT FOR BUILDING DIMENSIONS AND SITE LAYOUT. DIMENSIONS AND LAYOUT INFORMATION SHALL BE CONFIRMED PRIOR TO COMMENCEMENT OF CONSTRUCTION.
15. THE CONTRACTOR SHALL CO-ORDINATE AND PAY FOR ALL CONSTRUCTION RELATED PERMITS, FEES, INSPECTIONS AND APPROVALS REQUIRED BY THE MUNICIPAL AUTHORITIES.
16. THE CONTRACTOR TO VERIFY LOCATION AND DEPTH OF ALL UTILITIES PRIOR TO BEGINNING AND SITE WORK.
17. FOR DETAILS OF GROUND CONDITIONS, REFERENCE SHOULD BE MADE TO GEOTECHNICAL REPORT.
18. DROP CURB HEIGHT AT DEPRESSED CURBS TO BE AS PER CITY OF OTTAWA DETAIL SC1.4. DROP CURB HEIGHT TO BE 5mm.
19. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW CUT TO FORM A NEAT AND STRAIGHT LINE PRIOR TO PLACING NEW PAVEMENT.



SECTION E-E
SCALE = 1:100



SECTION F-F
SCALE = 1:100

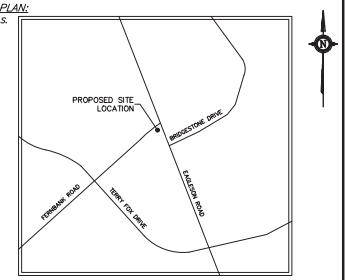
LEGEND (GENERAL)

- EXISTING GRADE ELEVATIONS
- PROPOSED GRADE ELEVATIONS
- PROPOSED SWALE ELEVATIONS
- PROPOSED ELEVATION @ TOP OF WALL
- PROPOSED ELEVATION @ STORM STRUCTURE GRATE
- PROPOSED INVERT ELEVATION
- PROPOSED DRAINAGE SLOPE
- EXISTING DRAINAGE PATTERN
- LOCATION OF HEAVY PAVEMENT STRUCTURE
- PROPERTY LINE
- CENTRELINE OF ROAD
- EDGE OF ROAD
- TOP OF SLOPE
- FENCELINE
- SILT BARRIER FENCE
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED WATER SERVICE
- PROPOSED HYDRO SERVICE
- PROPOSED GAS SERVICE
- PROPOSED COMMUNICATION LINES
- EXISTING SANITARY SEWER
- EXISTING STORM SEWER
- EXISTING WATER SERVICE
- EXISTING HYDRO SERVICE
- PROPOSED MANHOLE/CATCH BASIN
- PROPOSED MANHOLE
- PROPOSED CATCH BASIN
- EXISTING MANHOLE TO REMAIN
- EXISTING CATCHBASIN TO REMAIN
- PROPOSED FIRE HYDRANT
- EXISTING FIRE HYDRANT
- PROPOSED WATER VALVE
- EXISTING WATER VALVE CHAMBER
- PROPOSED LIGHT STANDARD
- EXISTING HYDRO POLE

DRAWING No.
180084-GR

DRAWING
GRADING & DRAINAGE PLAN

KEY PLAN:
N.T.S.



GENERAL PROJECT NOTES:

1. All dimensions are in metres.
2. Do not scale drawings.
3. All elevations are in metres and are geodetic. Geodetic information was obtained from the "Plan survey of part of Lot 31 ,Concession 9 (Geographic township of Goulbourn) City of Ottawa" completed by Stantec Geomatics Ltd. on March 7, 2018,Drawing# G:RL 161613\84-111
5. Temporary Benchmark (TBM) = the top of spindle for the fire hydrant on Fernbank Road, located about 14.5m northeast of the proposed site entrance. Elevation= 96.59m.
4. This drawing does not represent a legal survey.
5. All dimensions to be verified on site by contractor prior to construction.
6. Any changes made to this plan must be verified and approved by Kollaard Associates Inc.
7. All materials and construction to be in accordance with City of Ottawa standards and Ontario Provincial Standards and Specifications, including (but not limited to): sewer and watermain material types; disinfection, provide minimum 2.4 metres of cover for water services, cathodic protection, City of Ottawa insulation specifications for watermain, pipe bedding, reinstatement of disturbed areas and leakage testing.
8. Reference Kollaard file # 180084 Servicing and SWM Report for additional information relating to the site services design and the stormwater management design for this site.

No.	REVISION	DATE	BY
3	REVISED AS PER MUNICIPAL COMMENTS	2018/12/11	RR
2	REVISED FOR INCL. IN SSMR	2018/09/11	RR
1	REVISED FOR SITE PLAN CONTROL	2018/08/13	RR
0	ISSUED FOR SITE PLAN CONTROL	2018/06/18	RR

Kollaard Associates Engineers
P.O. BOX 189, 210 PRESCOTT ST.(613) 860-0923
KEMPTVILLE, ONTARIO info@kollaard.ca
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

CLIENT NAME
IRONCLAD DEVELOPMENTS

PROJECT NAME
PROPOSED 6 STOREY APARTMENT DEVELOPMENT

PROJECT LOCATION
800 EAGLESON RD
KANATA, ON
K2M 0A8

LICENSED PROFESSIONAL ENGINEER
December 11, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY: SD	CHECKED BY: SD
DRAWN BY: RR	APPROVED BY: SD
DATE: 23.APR.2018	
SCALE: 1:300	
PROJECT No.: 180084	
SHEET SET: 1 OF 7	

D07-12-18-0096

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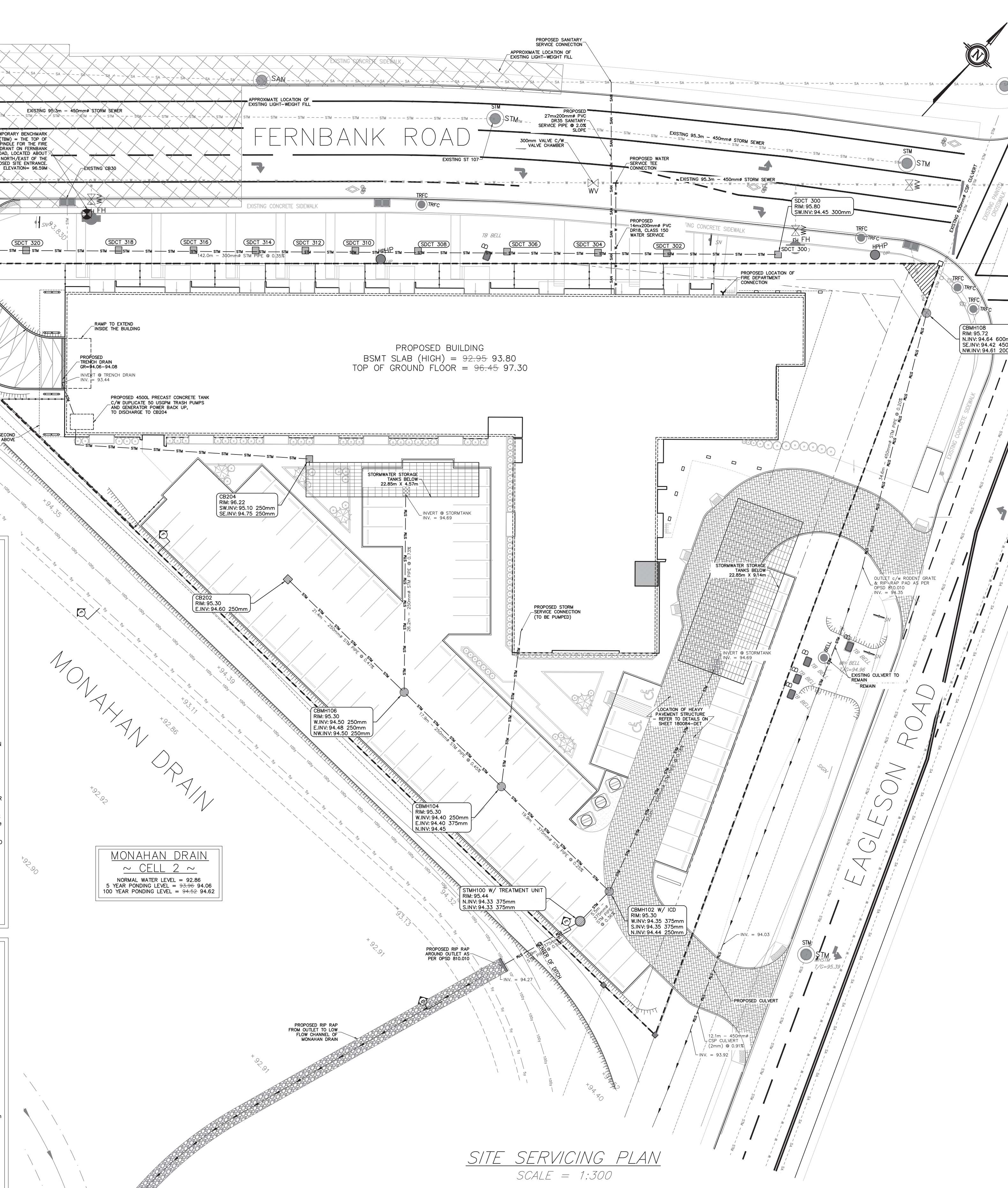


SITE SERVICING PLAN

SCALE = 1:300

WATER SERVICE NOTES:

1. CITY OF OTTAWA FORCES TO COMPLETE THE CONNECTION OF THE WATER SERVICE TO THE EXISTING WATER MAIN. CONTRACTOR IS RESPONSIBLE FOR THE SUPPLY OF PARTS AND MATERIALS AS WELL AS FOR EXCAVATION, BACKFILL AND REINSTATEMENT OF THE ROADWAY AS PER STD DWG R10. CONTRACTOR RESPONSIBLE FOR DISINFECTION AND PRESSURE TESTING.

2. SPECIFICATIONS:

ITEM REFERENCE	SPEC. No.	City Std Dwg No.
WATERMAIN BEDDING AND BACKFILL OPSD	802.010/802.031	W17 (trench detail)
CATHODIC PROTECTION OPSD	1109.010	W40
PRESSURE TESTING AWWA	C-605-5	
CHLORINATION AWWA	C-651-05	
WATERMAIN MATERIAL	PVC DR18 (CLASS 150)	

3. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED. WHERE LESS THAN 2.4m COVER, THERMAL INSULATION IS TO BE PROVIDED AS PER CITY STD DWG W22 (In shallow trenches), W23 (At open structures).

4. A MINIMUM OF 0.5m VERTICAL CLEARANCE IS REQUIRED BETWEEN THE WATERMAINS AND ALL UTILITIES AND SEWERS. IN LOCATIONS WHERE THIS IS NOT ACHIEVABLE, MUST FOLLOW PROCEDURE F-6-1 SEC. 5.2 OF THE ONTARIO DRINKING WATER RESOURCES ACT.

5. METALLIC WARNING TAPE SHALL BE USED OVER ALL WATERMAINS.

6. INSTALL AND TEST TRACER WIRE FOR ALL PROPOSED WATERMAIN IN ACCORDANCE WITH THE CITY OF OTTAWA DESIGN STANDARDS AS SPECIFIED IN SECTION 8.28.

7. EXISTING WATERMAIN INFORMATION SHOWN ON FERNBANK ROAD IS BASED ON BEST CURRENT INFORMATION. CONTRACTOR TO VERIFY EXACT LOCATION OF WATERMAIN AND REPORT ANY DISCREPANCIES TO KOLLAARD ASSOCIATES INC.

8. WATER SHUTOFF VALVE AND VALVE BOX TO BE WITHIN THE ROAD ALLOWANCE AND LOCATED A MINIMUM OF 1.0 METRES FROM THE BUILDING FOUNDATION. TYPICAL PRIVATE SERVICE AS PER STD. DWG. W50 (with the exception that the V&VB are to be located 1.0 m minimum from the foundation wall); VALVE BOX ASSEMBLY AS PER STD. DWG. W24.

9. CONNECTIONS AT ELBOWS AND TEEs IN WATER MAINS SHOULD BE MADE WITH THE USE OF JOINT RESTRAINERS DESIGNED FOR WATERMAIN APPLICATION. JOINT AND PIPE RESTRAINERS SHOULD MEET THE REQUIREMENTS OF AWWA C900, C905 AND C907 AND ASTM F1674-11. JOINT RETRAINERS SHOULD BE INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS.

10. ALL CONNECTORS, RODS AND VALVE BOLTS SHALL BE STAINLESS STEEL.

11. CATHODIC PROTECTION TO BE PROVIDED ON ALL METAL FITTINGS AS PER OPSS 702 AND OPSD 1109.010.

12. VALVES ARE TO BE OPERATED BY CITY OF OTTAWA STAFF ONLY.

13. NO CONNECTION TO EXISTING WATER NETWORK SHALL BE COMPLETED UNTIL A WATER PERMIT IS OBTAINED FROM THE CITY OF OTTAWA. THE CITY OF OTTAWA FORCES ARE TO MAKE WATERMAIN CONNECTIONS. EXCAVATION, BACKFILLING AND REINSTATEMENT IS TO BE COMPLETED BY THE CONTRACTOR.

SEWER NOTES:

1. SUPPLY AND CONSTRUCT ALL SEWERS AND APPURTENANCES IN ACCORDANCE WITH THE CITY OF OTTAWA STANDARDS AND SPECIFICATIONS AND ONTARIO PROVINCIAL STANDARDS FOR ROADS AND PUBLIC WORKS.

2. SPECIFICATIONS:

ITEM	SPEC. No.	CITY STD DWG No.
CATCH BASIN (600mm x 600mm)	OPSD 705.010	S2
STORM/SANITARY MANHOLE (1200ø)	OPSD 701.010	
SEWER SERVICE CONNECTION		S11 & S11.1
SANITARY BENCHING	OPSD 701.021	
CATCH BASIN & MANHOLE ADJUSTMENTS	OPSD 704.010	
STORM MANHOLE FRAME & COVER	OPSD 401.010	S24.1 & S25
CATCH BASIN FRAME & COVER	OPSD 400.020	S19, S22 & S23
SEWER TRENCH		S6 & S7
SANITARY MANHOLE FRAME & COVER	OPSD 401.030	S24 & S25
DITCHED PIPE STORM SEWER (FERNBANK RD)		S9
DITCHED PIPE CATCH BASIN (FERNBANK RD)		S31

SEWER TRENCH:
SITE SERVICES EXCAVATION, BEDDING & BACKFILL AS PER THE RECOMMENDATIONS OF THE GEOTECHNICAL INVESTIGATION PREPARE BY KOLLAARD ASSOCIATES INC.

3. INSULATE ALL STORM PIPES THAT HAVE LESS THAN 1.5m COVER AND ALL SANITARY PIPES THAT HAVE LESS THAN 2.1m COVER WITH THERMAL INSULATION. PROVIDE 150mm CLEARANCE BETWEEN PIPE AND INSULATION.

4. PIPE BEDDING, COVER AND BACKFILL ARE TO BE COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY.

5. FLEXIBLE CONNECTIONS ARE REQUIRED FOR CONNECTION PIPES TO MANHOLES (FOR EXAMPLE KOR-N-SEAL, PSX: POSITIVE SEAL AND DURASEAL). SANITARY RUBBER GASKET TYPE JOINTS SHALL CONFORM TO CSA (B-182.2,3,4).

6. THE OWNER SHALL REQUIRE THAT THE SITE SERVICING CONTRACTOR PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16, 410.07.16.04 AND 407.07.24. DYE TESTING IS TO BE COMPLETED ON ALL SANITARY SERVICES TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN. THE FIELD TESTS SHALL BE PERFORMED IN THE PRESENCE OF A CERTIFIED PROFESSIONAL ENGINEER WHO SHALL SUBMIT A CERTIFIED COPY OF THE TEST RESULTS.

7. STORM MANHOLES, CATCH BASINS AND CBMHS ARE TO HAVE 300mm SUMPS (AS PER SUMP DETAIL ON OPSD 701.010), UNLESS OTHERWISE INDICATED.

8. BUILDING CONTRACTOR TO PROVIDE TEMPORARY ADDITIONAL GRANULAR BACKFILL ABOVE SHALLOW CULVERTS AND STORM SEWERS TO SUPPORT HEAVY CONSTRUCTION EQUIPMENT.

9. CONTRACTOR TO TELEVISE (CCTV) ALL PROPOSED SEWERS, 200mmø OR GREATER PRIOR TO BASE COURSE ASPHALT. UPON COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES TO MUNICIPAL SATISFACTION.

10. WHERE THE SANITARY SEWER CROSSES ABOVE THE WATERMAIN, THE CONTRACTOR IS TO PROVIDE A MINIMUM OF 0.50m VERTICAL SEPARATION, ADEQUATE STRUCTURAL SUPPORT OF THE SEWER TO PREVENT SETTLING AND EXCESSIVE JOINT DEFLECTION AND ENSURE THAT THE LENGTH OF THE WATER PIPE BE CENTERED AT THE POINT OF CROSSING SO THAT THE JOINTS ARE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE SEWER.

ABBREVIATIONS

STM	STORM MANHOLE
SAN	SANITARY MANHOLE
CB	CATCH BASIN
CBMH	MANHOLE WITH OPEN GRATE
WV	WATER VALVE
FH	FIRE HYDRANT
FHL	FIRE HYDRANT LEAD FH
C/L	CENTER LINE
ELEV	ELEVATION
UP	UTILITY POLE
SDCT	SUBDRAIN CATCHMENT TEE (DITCHED PIPE CATCH BASIN)

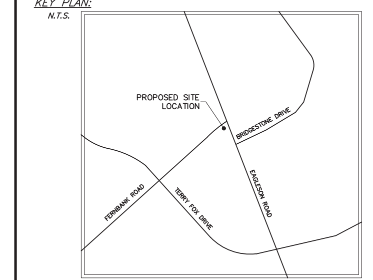
LEGEND (GENERAL)

EXISTING GRADE ELEVATIONS
PROPOSED GRADE ELEVATIONS
PROPOSED SWALE ELEVATIONS
PROPOSED ELEVATION @ TOP OF WALL
PROPOSED ELEVATION @ STORM STRUCTURE GRATE
PROPOSED INVERT ELEVATION
PROPOSED DRAINAGE SLOPE
EXISTING DRAINAGE PATTERN
LOCATION OF HEAVY PAVEMENT STRUCTURE
PROPERTY LINE
CENTRELINE OF ROAD
EDGE OF ROAD
TOP OF SLOPE
FENCELINE
SILT BARRIER FENCE
PROPOSED SANITARY SEWER
PROPOSED STORM SEWER
PROPOSED WATER SERVICE
PROPOSED HYDRO SERVICE
PROPOSED GAS SERVICE
PROPOSED COMMUNICATION LINES
EXISTING SANITARY SEWER
EXISTING STORM SEWER
EXISTING WATER SERVICE
EXISTING HYDRO SERVICE
PROPOSED MANHOLE/CATCH BASIN
PROPOSED MANHOLE
PROPOSED CATCH BASIN
EXISTING MANHOLE TO REMAIN
EXISTING CATCHBASIN TO REMAIN
PROPOSED FIRE HYDRANT
EXISTING FIRE HYDRANT
PROPOSED WATER VALVE
EXISTING WATER VALVE CHAMBER
PROPOSED LIGHT STANDARD
EXISTING HYDRO POLE

DRAWING No. 180084-SER

DRAWING: SITE SERVICING PLAN

KEY PLAN:
N.T.S.



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No.	REVISION	DATE	BY
3	REVISED AS PER MUNICIPAL COMMENTS	2018/12/11	RR
2	REVISED FOR INCL. IN SSMR	2018/09/11	RR
1	REVISED FOR SITE PLAN CONTROL	2018/08/13	RR
0	ISSUED FOR SITE PLAN CONTROL	2018/06/18	RR

Kollaard Associates Engineers
P.O. BOX 189, 210 PRESCOTT ST. KEMPTVILLE, ONTARIO K0G 1J0
(613) 860-0923 FAX (613) 258-0475
info@kollaard.ca
http://www.kollaard.ca

CLIENT NAME: IRONCLAD DEVELOPMENTS

PROJECT NAME: PROPOSED 6 STOREY APARTMENT DEVELOPMENT

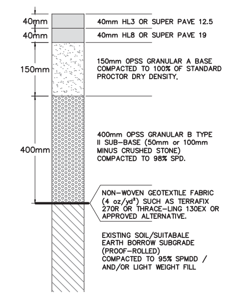
PROJECT LOCATION: 800 EAGLESON RD KANATA, ON K2M 0A8

DESIGNED BY: SD	CHECKED BY: SD
DRAWN BY: RR	APPROVED BY: SD
DATE: 23.APR.2018	
SCALE: 1:300	
PROJECT No.: 180084	
SHEET SET: 2 of 7	

LICENSED PROFESSIONAL ENGINEER
December 11, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

D07-12-18-0096

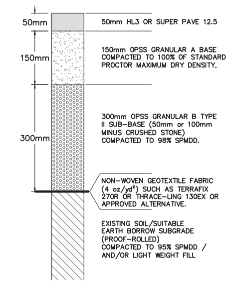
#17788



HEAVY PAVEMENT STRUCTURE DETAIL

NOTES:

- HEAVY PAVEMENT STRUCTURE TO BE PLACED WITHIN FIRE ROUTE AND GARBAGE COLLECTION AREA. LIGHT PAVEMENT STRUCTURE SUFFICIENT ELSEWHERE WITHIN SITE.
- ASPHALTIC CONCRETE TO HAVE A PERFORMANCE GRADE PG 58-34.
- SUBGRADE TO BE INSPECTED BY GEOTECHNICAL ENGINEER PRIOR TO THE ADDITION OF ANY GRANULAR MATERIAL OR EARTH BORROW.



LIGHT PAVEMENT STRUCTURE DETAIL

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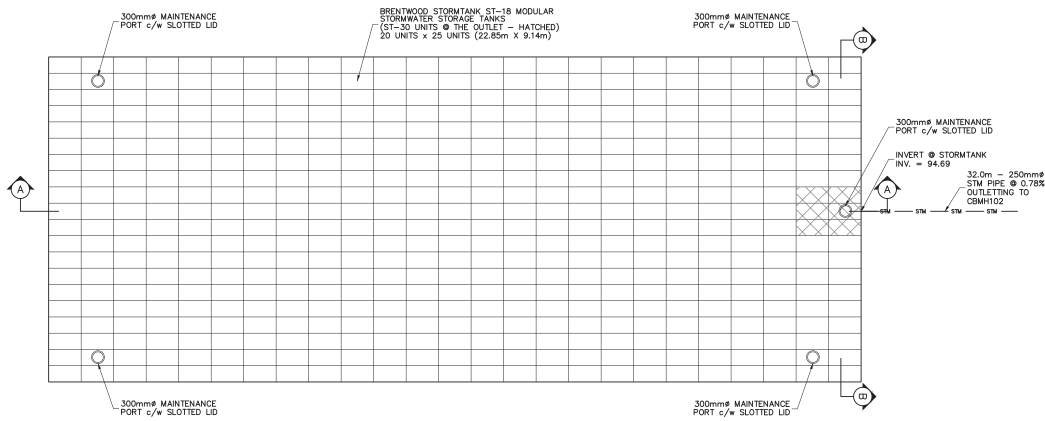
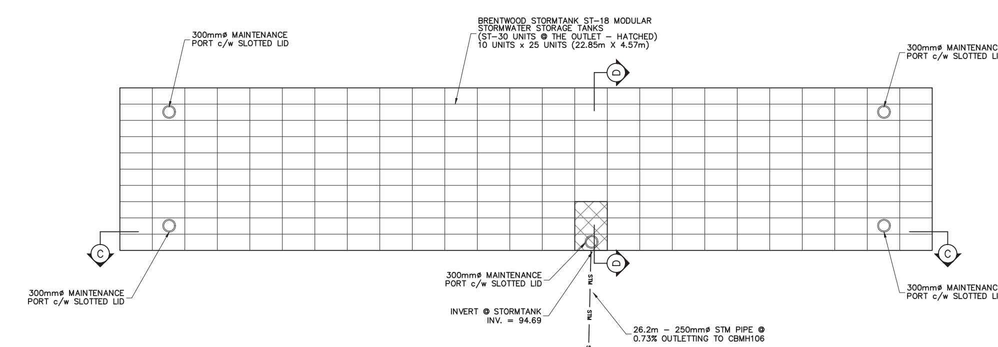
UNDERGROUND STORM STORAGE TANKS AND COMPONENTS TO BE INSTALLED AS PER MANUFACTURER'S SPECIFICATIONS

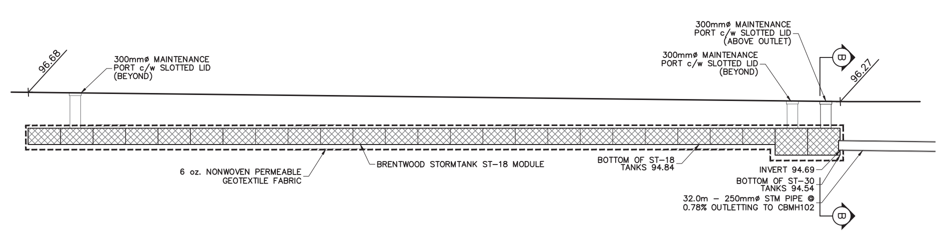


EAST UNDERGROUND STORAGE TANK LAYOUT
SCALE = 1:100

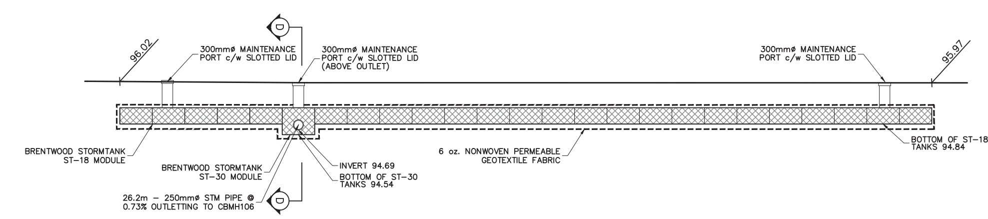
UNDERGROUND STORM STORAGE TANKS AND COMPONENTS TO BE INSTALLED AS PER MANUFACTURER'S SPECIFICATIONS



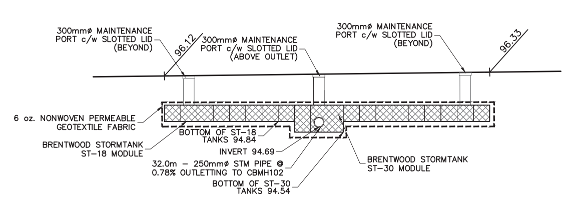
SOUTH/WEST UNDERGROUND STORAGE TANK LAYOUT
SCALE = 1:100



SECTION A-A
EAST UNDERGROUND STORAGE TANK SECTION 1
SCALE = 1:100



SECTION C-C
SOUTH/WEST UNDERGROUND STORAGE TANK SECTION 1
SCALE = 1:100



SECTION B-B
EAST UNDERGROUND STORAGE TANK SECTION 2
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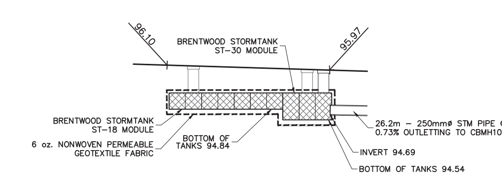
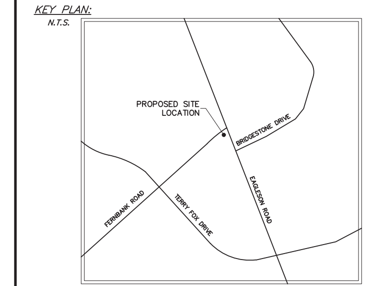


SECTION D-D
SOUTH/WEST UNDERGROUND STORAGE TANK SECTION 2
SCALE = 1:100

DRAWING No.
180084-DET

DRAWING
DETAILS

KEY PLAN:
N.T.S.



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No.	REVISION	DATE	BY
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Engineers
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CLIENT NAME
IRONCLAD DEVELOPMENTS

PROJECT NAME
PROPOSED 6 STOREY APARTMENT DEVELOPMENT

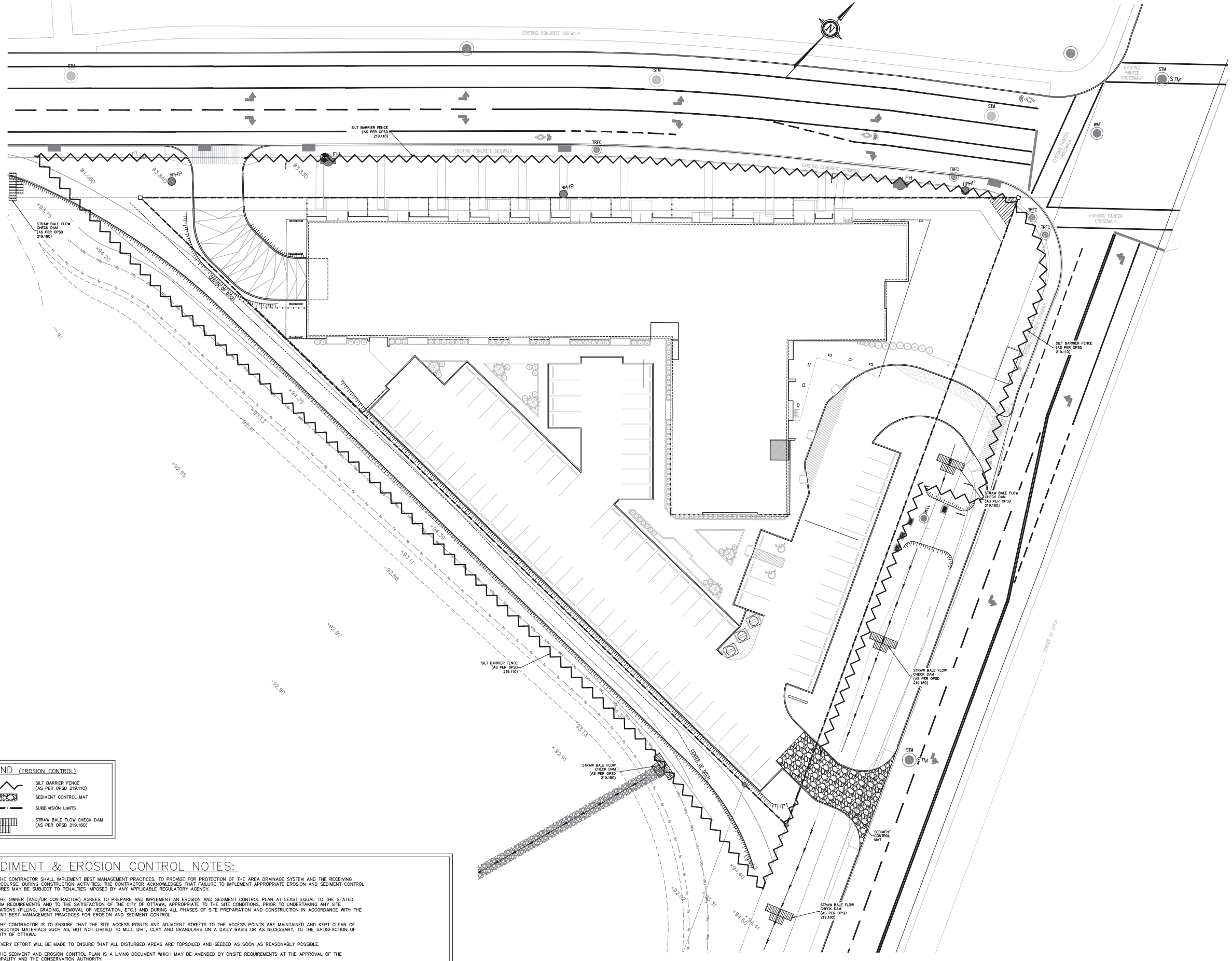
PROJECT LOCATION
800 EAGLESON RD
KANATA, ON
K2M 0A8

LICENSED PROFESSIONAL ENGINEER
December 11, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY	CHECKED BY
SD	SD
DRAWN BY	APPROVED BY
RR	SD

DATE 23.APR.2018
SCALE AS NOTED
PROJECT No. 180084
SHEET SET 3 OF 7

D07-12-18-0096
#17788



LEGEND (EROSION CONTROL)

- SILT BARRIER FENCE (AS PER OPSD 219.110)
- SEDIMENT CONTROL MAT
- SUBDIVISION LIMITS
- STRAW BALE FLOW CHECK DAM (AS PER OPSD 219.180)

SEDIMENT & EROSION CONTROL NOTES:

1. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM AND THE RECEIVING WATERCOURSE, DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

2. THE OWNER (AND/OR CONTRACTOR) AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN AT LEAST EQUAL TO THE STATED MINIMUM REQUIREMENTS AND TO THE SATISFACTION OF THE CITY OF OTTAWA; APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL.

3. THE CONTRACTOR IS TO ENSURE THAT THE SITE ACCESS POINTS AND ADJACENT STREETS TO THE ACCESS POINTS ARE MAINTAINED AND KEPT CLEAN OF CONSTRUCTION MATERIALS SUCH AS, BUT NOT LIMITED TO MUD, DIRT, CLAY AND GRANULARS ON A DAILY BASIS OR AS NECESSARY, TO THE SATISFACTION OF THE CITY OF OTTAWA.

4. EVERY EFFORT WILL BE MADE TO ENSURE THAT ALL DISTURBED AREAS ARE TOPSOILED AND SEEDED AS SOON AS REASONABLY POSSIBLE.

5. THE SEDIMENT AND EROSION CONTROL PLAN IS A LIVING DOCUMENT WHICH MAY BE AMENDED BY ONSITE REQUIREMENTS AT THE APPROVAL OF THE MUNICIPALITY AND THE CONSERVATION AUTHORITY.

SEDIMENT & EROSION CONTROL PLAN REQUIREMENTS:

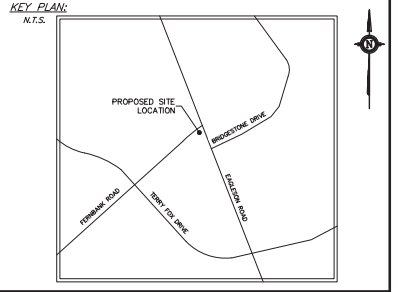
- TIME THE DEMOLITION AND EXCAVATION ACTIVITIES SO THAT THEY OCCUR NO SOONER THAN IS NECESSARY FOR SUBSEQUENT CONSTRUCTION ACTIVITIES.
- LANDSCAPE THE SITE AS SOON AS PRACTICALLY POSSIBLE.
- USE SILT FENCES AROUND ANY STOCKPILES OF SOIL.
- PRIOR TO CONSTRUCTION, SILT FENCE BARRIERS (OPSD 219.110) WILL BE PLACED ALONG THE PROPERTY LINES AS ON THE DRAWING.
- THE SILT FENCE SHOULD BE REMOVED ONLY WHEN THE SITE IS STABILIZED.
- INSTALL FILTER CLOTH ACROSS ALL EXISTING CATCH BASINS AND CATCH BASIN MANHOLES PRIOR TO CONSTRUCTION.
- INSTALL FILTER CLOTH ACROSS ALL PROPOSED CATCH BASINS, MANHOLES AND CATCH BASIN MANHOLES AS THEY ARE PLACED.

SEDIMENT & EROSION CONTROL PLAN
SCALE = 1:300

DRAWING No.
180084–ER

DRAWING
SEDIMENT & EROSION CONTROL PLAN

KEY PLAN:
N.T.S.



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CLIENT NAME
IRONCLAD DEVELOPMENTS

PROJECT NAME
PROPOSED 6 STOREY APARTMENT DEVELOPMENT

PROJECT LOCATION
800 EAGLESON RD
KANATA, ON
K2M 0A8

LICENSED PROFESSIONAL ENGINEER
December 11, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY	CHECKED BY
SD	SD
DRAWN BY	APPROVED BY
RR	SD

DATE
23.APR.2018

SCALE
1:300

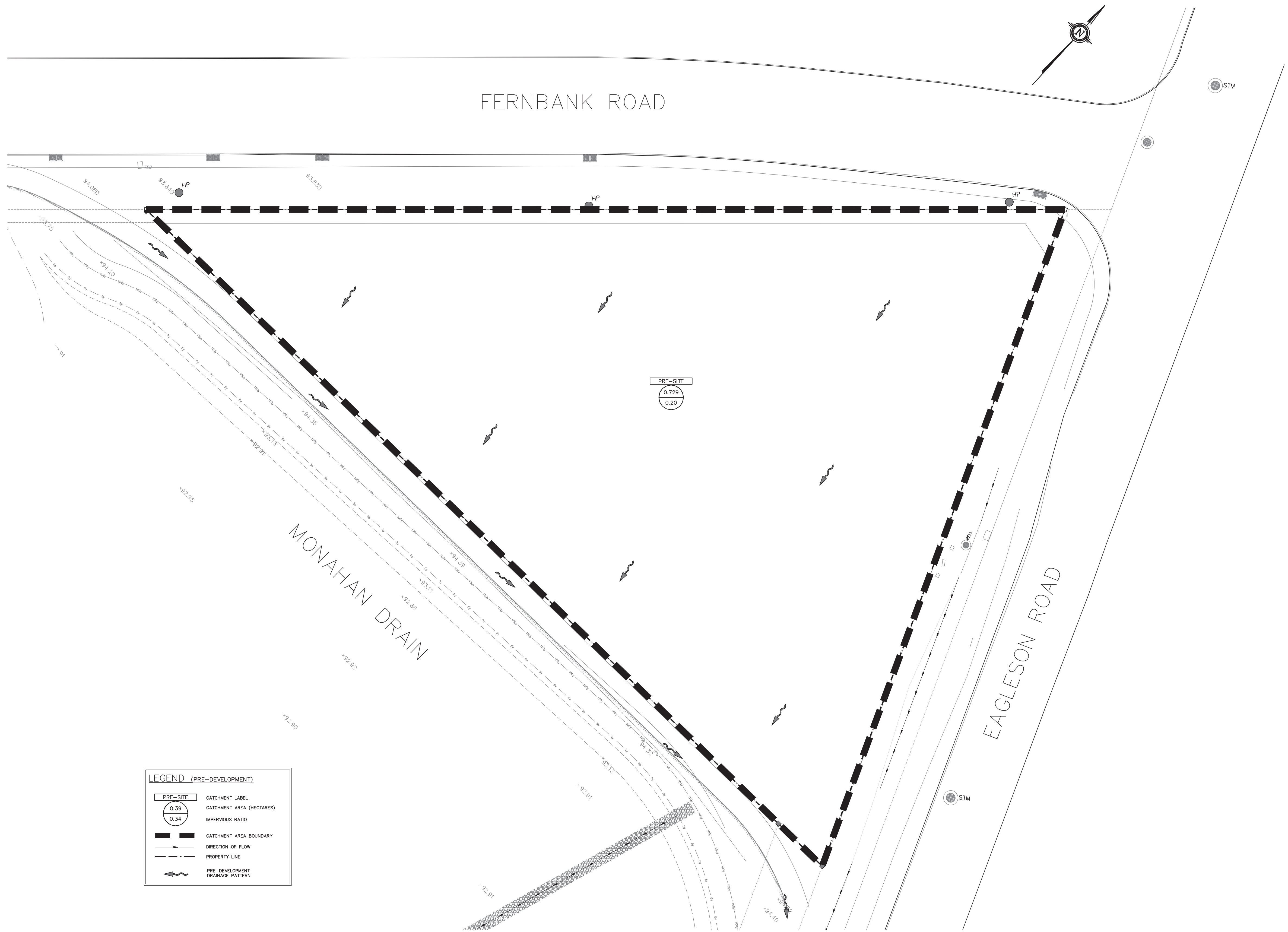
PROJECT No.
180084

SHEET SET
4 OF 7

ISO A1

D07-12-18-0096

#17788



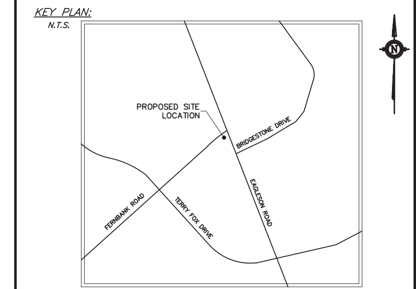
PRE-DEVELOPMENT CATCHMENT AREAS

SCALE = 1:300

DRAWING No.
180084-PRECA

DRAWING
PRE-DEVELOPMENT CATCHMENT AREAS

KEY PLAN:
N.T.S.



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0	ISSUED FOR SITE PLAN CONTROL	2018/06/15	RR

Kollaard Associates
Engineers
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CLIENT NAME
IRONCLAD DEVELOPMENTS

PROJECT NAME
PROPOSED 6 STOREY APARTMENT DEVELOPMENT

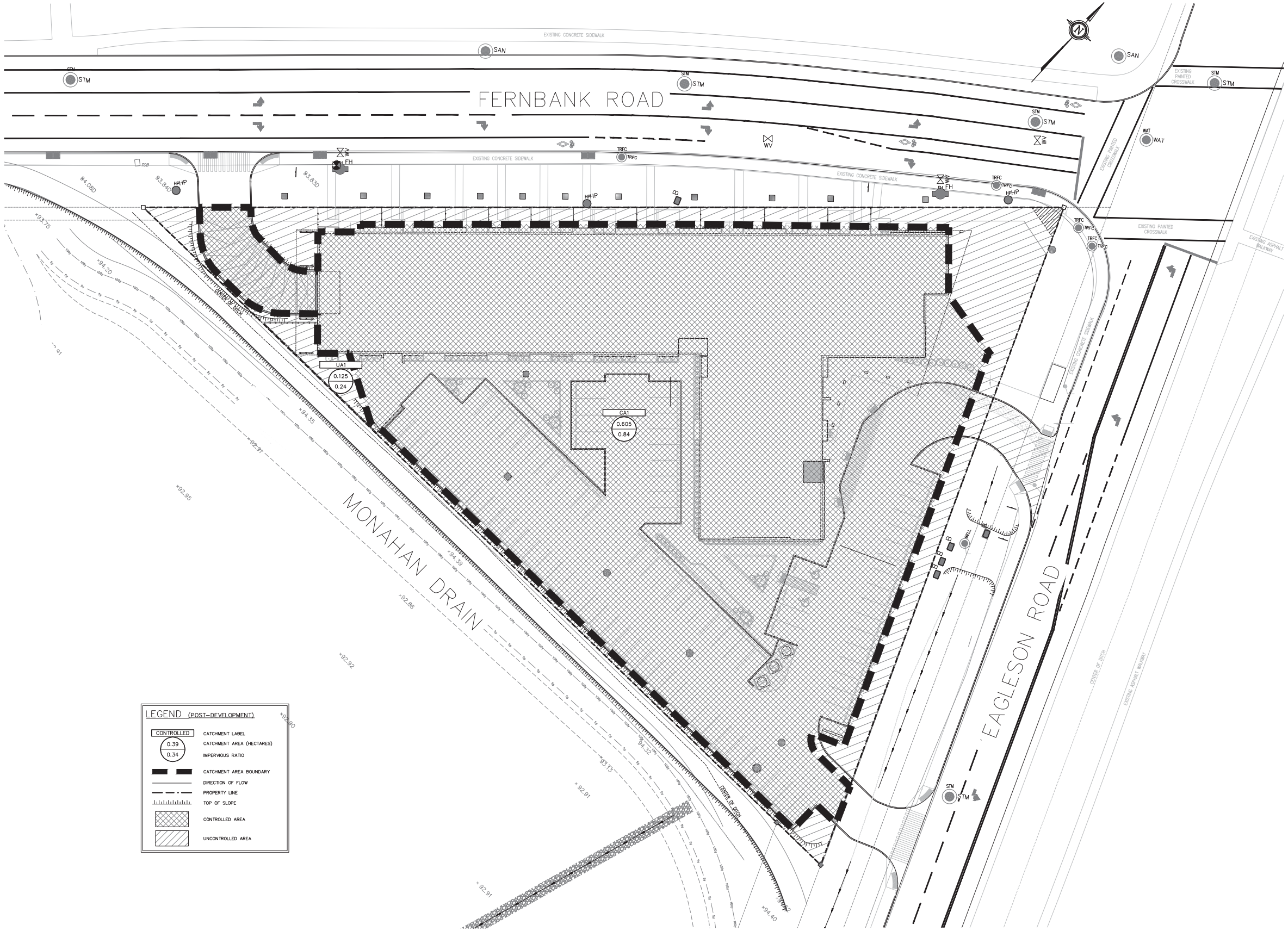
PROJECT LOCATION
800 EAGLESON RD
KANATA, ON
K2M 0A8

LICENSED PROFESSIONAL ENGINEER
December 11, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY: SD	CHECKED BY: SD
DRAWN BY: RR	APPROVED BY: SD
DATE: 23.APR.2018	
SCALE: 1:300	
PROJECT No.: 180084	
SHEET SET: 5 of 7	

D07-12-18-0096

#17788



LEGEND (POST-DEVELOPMENT)

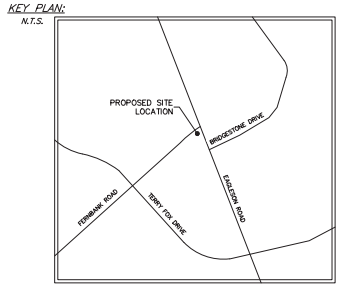
CONTROLLED	CATCHMENT LABEL
0.39 / 0.34	CATCHMENT AREA (HECTARES) / IMPERVIOUS RATIO
	CATCHMENT AREA BOUNDARY
	DIRECTION OF FLOW
	PROPERTY LINE
	TOP OF SLOPE
	CONTROLLED AREA
	UNCONTROLLED AREA

POST-DEVELOPMENT CATCHMENT AREAS
SCALE = 1:300

DRAWING No.
180084-POSTCA

DRAWING
POST-DEVELOPMENT CATCHMENT AREAS

KEY PLAN: N.T.S.



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P.O. BOX 189, 210 PRESCOTT ST. (613) 860-0923
KEMPTVILLE, ONTARIO info@kollaard.ca
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

CLIENT NAME
IRONCLAD DEVELOPMENTS

PROJECT NAME
PROPOSED 6 STOREY APARTMENT DEVELOPMENT

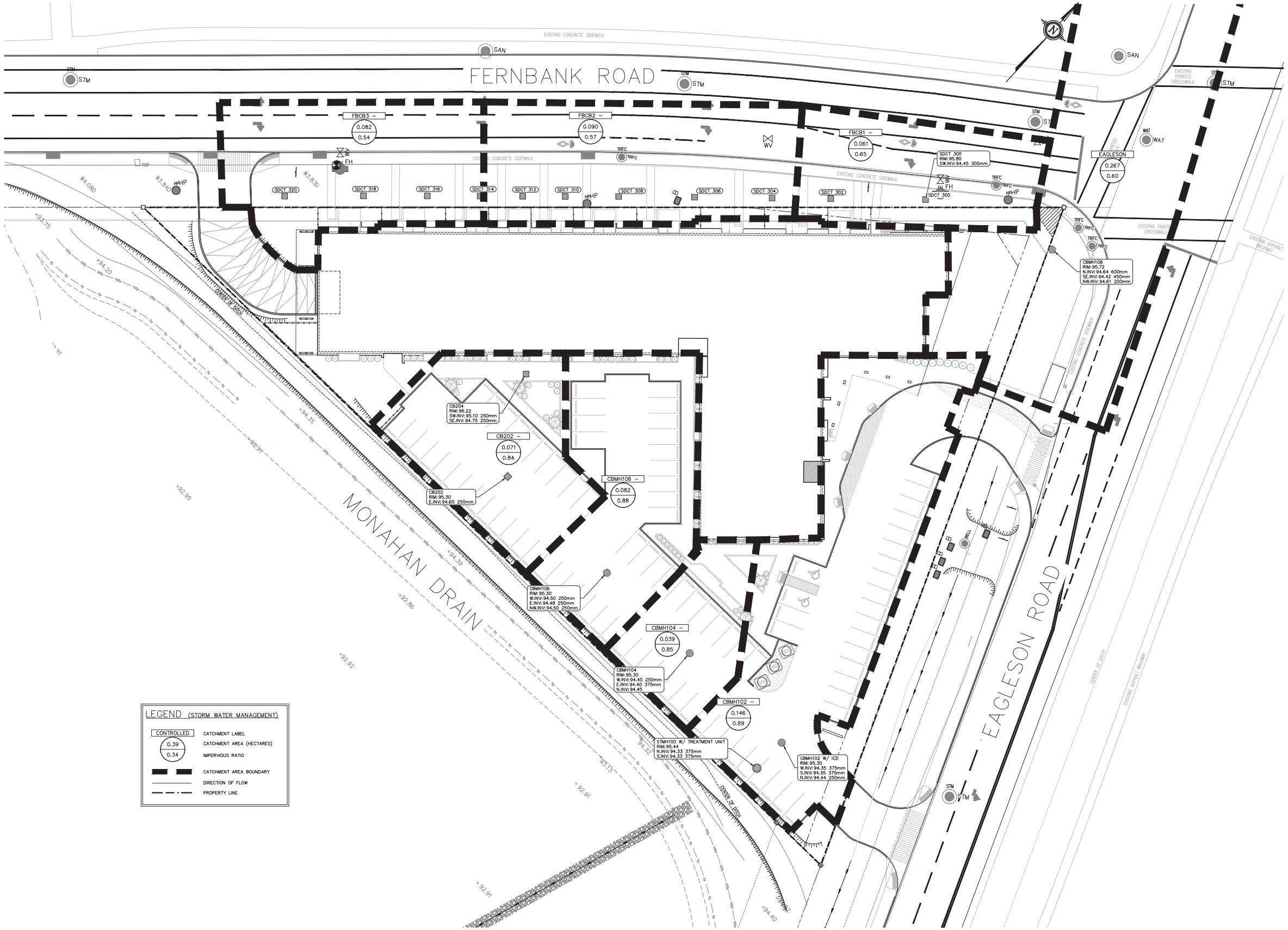
PROJECT LOCATION
800 EAGLESON RD
KANATA, ON
K2M 0A8

LICENSED PROFESSIONAL ENGINEER
Sept. 11, 2018
S.E. deWit
100079612
PROVINCE OF ONTARIO

DESIGNED BY: SD	CHECKED BY: SD
DRAWN BY: RR	APPROVED BY: SD
DATE: 23.APR.2018	
SCALE: 1:300	
PROJECT No.: 180084	
SHEET SET: 6 OF 7	

D07-12-18-0096

#17788



LEGEND (STORM WATER MANAGEMENT)

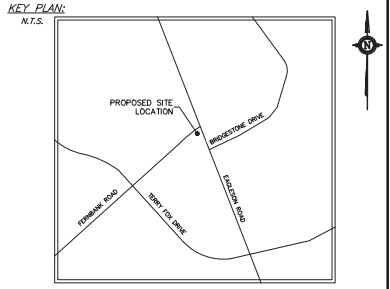
CONTROLLED	CATCHMENT LABEL
0.39 / 0.34	CATCHMENT AREA (HECTARES) / IMPERVIOUS RATIO
	CATCHMENT AREA BOUNDARY
	DIRECTION OF FLOW
	PROPERTY LINE

STORM SEWER CATCHMENT AREAS
SCALE = 1:300

DRAWING No.
180084-SSCA

DRAWING
STORM SEWER CATCHMENT AREAS

KEY PLAN:
N.T.S.



GENERAL PROJECT NOTES:

No.	REVISION	DATE	BY
3	REVISED AS PER MUNICIPAL COMMENTS	2018/12/11	RR
2	REVISED FOR INCL. IN SSMR	2018/09/11	RR
1	REVISED FOR SITE PLAN CONTROL	2018/08/13	RR
0	ISSUED FOR SITE PLAN CONTROL	2018/06/18	RR

Kollaard Associates
Engineers
P.O. BOX 189, 210 PRESCOTT ST. (613) 860-0923
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#17788

Appendix H: Servicing Guidelines Checklist

4.1 General Content

☒ Executive Summary (for larger reports only).

Comments: *N/A*

☒ Date and revision number of the report.

Comments: *Refer to cover page of the Servicing & Stormwater Management Report- Rev 1. dated September 12, 2018 (SSMR).*

☒ Location map and plan showing municipal address, boundary, and layout of proposed development.

Comments: *Refer to drawings180084-SER and 180084-GR in appendix G of the SSMR*

☒ Plan showing the site and location of all existing services.

Comments: *Refer to drawing 180084-SER in appendix G of the SSMR .*

☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.

Comments: *Refer to Architectural Site plan by Monteyne Architectural Works*

☒ Summary of Pre-consultation Meetings with City and other approval agencies.

Comments: *Pre-Consultation Meeting with City had taken place December 12th 2017. Included in Appendix A of the SSMR*

☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.

Comments: *Section 3 of SSMR - Reference to Monahan Drain Constructed Wetlands Phase 2 Final Design Report prepared by Novatech Engineering Consultants Ltd.*

☒ Statement of objectives and servicing criteria.

Comments: *Refer to section 3.0 of the SSMR.*

☒ Identification of existing and proposed infrastructure available in the immediate area.

Comments: *Refer to drawing 180084-SER for location, size and depth. Drawing located in appendix G of of the SSMR.*

☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

Comments: *Section 3 of SSWM - Monahan Drain*

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

Comments: *Refer to grading plan180084-GR located in appendix G of the SSMR.*

☒ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

Comments: *N/A*

☒ Proposed phasing of the development, if applicable.

Comments: *N/A*

☒ Reference to geotechnical studies and recommendations concerning servicing.

Comments: *Refer to Geotechnical Report prepared by Kollaard Associates (February 27, 2018).*

☒ All preliminary and formal site plan submissions should have the following information:

- ☒ Metric scale
- ☒ North arrow (including construction North)
- ☒ Key plan
- ☒ Name and contact information of applicant and property owner
- ☒ Property limits including bearings and dimensions
- ☒ Existing and proposed structures and parking areas
- ☒ Easements, road widening and rights-of-way
- ☒ Adjacent street names

Comments: *Refer to drawings in appendix G of the SSMR*

4.2 Development Servicing Report: Water

☒ Confirm consistency with Master Servicing Study, if available

Comments: *N/A*

☒ Availability of public infrastructure to service proposed development

Comments: *Refer to Section 5.0 of the SSMR .*

☒ Identification of system constraints

Comments: *Yes - boundary conditions were received. Boundary Conditions can be found in appendix F of of the SSMR - Also response from City including System Constraints*

☒ Identify boundary conditions

Comments: *Boundary Conditions can be found in appendix F of the SSMR*

☒ Confirmation of adequate domestic supply and pressure

Comments: *Refer to Section 5.0 - Watermain Design of the SSMR.*

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

Comments: *Refer to Appendix E of the SSMR*

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

Comments: *Pressure Reducing Valves Required. See section 5.0 of the SSMR*

☒ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

Comments: *No phasing involved with this project*

☒ Address reliability requirements such as appropriate location of shut-off valves

Comments: *N/A*

☒ Check on the necessity of a pressure zone boundary modification.

Comments: *The water pressure available at the site is above the minimum residual pressure Section 5.0 of the SSMR*

☒ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

Comments: *Refer to Section 5.0 - Watermain Design in the SSMR*

☒ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.

Comments: *6 storey residential building serviced by 300mm watermain, refer to Drawing 180084-SER in appendix G of the SSMR*

☒ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.

Comments: *N/A*

☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

Comments: *Refer to Section 5.0 - Watermain Design in the SSMR*

☒ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

Comments: *Refer to appendix F of the SSMR*

4.3 Development Servicing Report: Wastewater

☒ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).

Comments: *Refer to Section 4.0 of the SSMR .*

☒ Confirm consistency with Master Servicing Study and/or justifications for deviations.

Comments: *No Master Servicing Study, Design Conformance with Ottawa Sewer Design Guidelines.*

☒ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.

Comments: *There are no local conditions of this nature. Refer to Section 4.0 of the servicing and swm report.*

☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

Comments: *Refer to drawing 180084-SER is appendix G of the SSMR.*

☒ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)

Comments: *Refer to Section 4.0 of the SSMR*

☒ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

Comments: *N/A*

☒ Special considerations such as contamination, corrosive environment etc.

Comments: *N/A*

4.4 Development Servicing Report: Stormwater

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

Comments: *Refer to Section 3.0 of the SSMR.*

☒ Analysis of available capacity in existing public infrastructure.

Comments: *Refer to Section 3.0 of the SSMR - Proposed Storm not Connected to existing Storm Sewer.*

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

Comments: *Refer to drawings 180084-PRECA, 180084-POSTCA and180084-GR in appendix G of the SSMR.*

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

Comments: *Refer to Section 3.0 of the SSMR.*

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

Comments: *Refer to Section 3.0 of the SSMR.*

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

Comments: *Refer to Section 3.0 and Appendix C and D of the SSMR*

☒ Set-back from private sewage disposal systems.

Comments: *N/A*

☒ Watercourse and hazard lands setbacks.

Comments: *N/A*

☒ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

Comments: *Pre-consultation with Ministry of Environment is included Appendix I.*

☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

Comments: *Section 3 of SSMR - Reference to Monahan Drain Constructed Wetlands Phase 2 Final Design Report prepared by Novatech Engineering Consultants Ltd.*

☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).

Comments: *Refer to Appendix B of the SSMR and Section 3 of SSMR*

☒ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.

Comments: *Refer to section 3 of the SSMR, where hydrodynamic separators are to be used for quality control of the Monahan Municipal Drain*

☒ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.

Comments: *Refer to Appendix B of the SSMR and Section 3 of SSMR*

☒ Any proposed diversion of drainage catchment areas from one outlet to another.

Comments: *N/A*

☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.

Comments: *N/A - Refer to Drawing 180084 - SER - Appendix G of the SSMR*

☒ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.

Comments: *Quantity control is provided. Refer to section 3 of the SSMR*

☒ Identification of potential impacts to receiving watercourses

Comments: *Enhanced protection to mitigate impacts. Quality control outlined in section 3 of the SSMR .*

☒ Identification of municipal drains and related approval requirements.

Comments: *Receiving Waterbody is Cell 2 of the Monahan Stormwater Management Facility*

☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.

Comments: *Refer to section 3 of the SSMR*

☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

Comments: *100 year flood levels and major flow routing is shown on drawing180084-GR in appendix G of the SSMR .*

☒ Inclusion of hydraulic analysis including hydraulic grade line elevations.

Comments: *N/A*

☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.

Comments: *Refer to Section 6.0 of the SSMR*

☒ Identification of floodplains - proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.

Comments: *Refer to Section 2.0 and 3.5.1 of the SSMR*

☒ Identification of fill constraints related to floodplain and geotechnical investigation.

Comments: *N/A*

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

☒ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.

Comments: *Consultation with RVCA is ongoing*

☒ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

Comments: *C of A not be required - confirmed by Pre-consultation with MECP*

☒ Changes to Municipal Drains.

Comments: *N/A*

☒ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

Comments: *N/A*

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

Comments: *Refer to Section 7.0 of the SSMR*

☒ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

Comments: *-comments are to be received from review agencies and will be addressed item by item in response letters.*

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

Comments: *Signed and Stamped.*

Appendix I: MECP PRE-CONSULTATION

Subject: RE: Pre - Submission: 800 Eagleson Road
From: "Des Rochers, Christina (MECP)" <Christina.Desrochers@ontario.ca>
Date: 2018-07-25 8:58 AM
To: Amanda VanBruggen <amanda@kollaard.ca>
CC: 'Steve deWit' <steve@kollaard.ca>

Good morning,

Thank you for submitting the pre-submission consultation request for Ironclad Developments proposed 800 Eagleson Road project.

Based on the information provided in the form, that the works will be located on one non-industrial lot and will not discharge into combined sewer works, it is the Ministry's position that the proposed SWM facility for 800 Eagleson Road Block E qualifies for exemption under Section 3 of O. Reg. 525/98 – Approvals Exemptions.

By this email, I confirm that Kollard Associates Inc. has satisfied the requirement to consult with the Ministry of Environment, Conservation and Parks.

Thank you.

Christina Des Rochers
Water Inspector | Inspectrice de l'eau
Safe Drinking Water Branch | Direction du contrôle de la qualité de l'eau potable
Ministry of the Environment, Conservation and Parks | Ministère de l'Environnement, de la Protection de la nature et des Parcs
Tel. 613-521-3450 ex. 231
Fax. 613-521-5437
Spills Action Centre | Centre d'intervention en cas de déversement 1-800-268-6060

From: MOECCOttawaSewage (MOECC)
Sent: July-19-18 11:50 AM
To: Amanda VanBruggen
Cc: 'Steve deWit'; Des Rochers, Christina (MOECC)
Subject: RE: Pre - Submission: 800 Eagleson Road

Good Morning,

The MECP Ottawa District Office has received your pre-submission consultation request. The Water Inspector assigned to your file is Christina Des Rochers and will be contacting you.

Thank you,

Jéhanne Hurlbut
District Administrative Assistant (Bilingual)
Ministry of the Environment, Conservation and Parks | Ottawa District Office
2430 Don Reid Drive, Unit 103
Ottawa, ON K1H 1E1
Tel: (613) 521-3450 X 221 | Fax: 613-521-5437 | jehanne.hurlbut@ontario.ca

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From: Amanda VanBruggen [mailto:amanda@kollaard.ca]
Sent: Monday, July 16, 2018 10:37 AM
To: MOECCOttawaSewage (MOECC) <MOECCOttawaSewage@ontario.ca>
Cc: 'Steve deWit' <steve@kollaard.ca>
Subject: Pre - Submission: 800 Eagleson Road

To Whom it may Concern,

We have been retained to complete a site servicing and stormwater management report, along with associated drawings for a 6 storey residential development at 800 Eagleson Road. The city has asked us to consult the MOECC regarding the application for CofA, and if it is required for this site. I have attached our site plan and a pre-submission consultation request form.

Kind Regards,

Amanda Van Bruggen
--

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario
K0G 1J0
tel: 613-860-0923
www.kollaard.ca

Pre-Submission Consultation Request Form

Name of Proponent (Company): Ironclad Developments	**Date:** 2018-07-16	**Application File No. with the Municipality/City:**

Contact Information for Meeting Participants:

Name: Steve deWit **Company:** Kollaard Associates Inc. **Position:** Senior Engineer **Phone:** 613-860-0923 x 228 **Email:** steve@kollaard.ca	**Name:** Amanda Van Bruggen **Company:** Kollaard Associates Inc. **Position:** Engineer in Training **Phone:** 613-860-0923 x 223 **Email:** amanda@kollaard.ca

Name of the Project Manager assigned to the Municipality/City's Application filed with the Municipality/City: Mary Dickinson

Name of the Municipal/City Review Engineer assigned to review the Proposed Works Approval Application package: Santhosh Kuruvilla

Name of Project: 6 storey rental apartment building **Is this project subject to Environmental Assessment Act approvals?** Yes☐ No☐ **Municipal Class EA's Schedule and reason for the project's classification:** Schedule A, Sentence 11: Establish new outfall to detention pond	**Location of Project** (address including municipality): 800 Eagleson Road	**Is this a new works?** Yes☒ No☐ N/A☐ **Are there existing ECAs in place where an amendment is required?** Yes☐ No☒ N/A☐ **If yes, please provide the ECA/CofA number:** **Water Works Permit Amendment required?** Yes☐ No☒ N/A☐

Works to Service:
Residential☒ Municipal Infrastructure☐ Commercial ☐ Institutional ☐ Industrial ☐
Other:_____

Zoning: Residential☒ Commercial☐ Institutional☐ Industrial☐
Other: _____

Is the Proposed Works:
Direct Submission ☐ Transfer of Review *Standard* works☐ Transfer of Review *Additional* works☐

Facility Type: (i.e. STP, SWMF, storm, sanitary, forcemain, pumping station, pond, ditches, etc.)
SWMF

Proposed Property Use Description:
6 storey residential building

Pre-Submission Consultation Request Form

Project Description: (project size, capacity, type of equipment, etc.)

Proposed 6 storey appartment building containing 143 residential unit on a 0.73 ha lot. Stormwater quality control: post development runoff rate cannot exceed the 5 year pre-development runoff rate (As per City of Ottawa Guidelines) via means of an Inlet control device.

Stormwater quality control: provided through 80% TSS removal by means of a hydrodynamic separator for all storm events up to and including the 100-yr storm. Pre-treatment of urban runoff from the residential development , dischanrges to the adjacent existing Monahan Drain (Cell 2) - constructed wetland.

Project Timing (proposed construction / start up):**00/00/2018**
year/mm/dd

Expected Application Submission Date(year/month)**:** /2018
year/mm

Have municipal/city approvals/permits/authorization been secured?
Yes☐No☒N/A☐

Does the proposal qualify for exemption under O.Reg. 525/98 of OWRA?
Yes☒No☐ N/A☐

If yes please provide a description of how this proposal meets the exemption criteria:

The proposed stormwater management works for the site consist of the establishment of a stormwater management facility that is designed to service one lot or parcel of land intended for residental use.

The proposed stormwater management works discharges to the Monahan Drain, where 80% total suspendend solids removal will be provided prior to discharge to the constructed wetland.

For stormwater management applications has the local Municipality/City and Conservation Authority or MNRF Office been consulted with regard to effluent quality/quantity considerations?Yes☐No☐N/A☐

If yes, what is the required effluent quality and quantity? Normal ☐Enhanced☒

Name of closest natural watercourse/municipal drain/private drain to receive stormwater/drainage from the site of concern:

Monahan Drain - Constructed Wetland Cell 2

Name of the Conservation Authority (CA) having jurisdiction on the site and Name of CA contact person:

Rideau Valley CA

Is there an Erosion and Sediment Control Plan/Measures? Yes☒No☐N/A☐

If temporary erosion and sediment control measures and stormwater management are incorporated into the project has their design/construction been included in the application?
Yes☒No☐N/A☐

Where construction activities necessitate dewatering, have Permit To Take Water (PTTW) / Construction Dewatering Environmental Activity Sector Registry (EASR) considerations been addressed? Yes☐No☐N/A☒

Other Questions:

For infrastructure crossing highways and/or right-of-ways have required permits been secured from MTO? Yes☐No☐ N/A☒

For infrastructure crossing federal property have authorization/support letters been secured from the federal authority? Yes☐No☐ N/A☒

Are there potential First Nations considerations? Yes☐No☐ N/A☒

Where applicable, has spill containment been incorporated into design or installation contingencies?Yes☐No☐ N/A☒

Where applicable, are odour and/or noise controls incorporated into design or installation contingencies? Yes☐No☐ N/A☒

If applicable, is a contingency in place to deal with contaminated soils? Yes☐No☐ N/A☒

Questions and Issues requested to be addressed in the pre-submission consultation meeting:

1.
2.
3.
4.
5.
6.
7.
8.

Please return this completed form at least **3 weeks before** approximate preferred meeting date.

Email completed form to:MOECCOttawaSewage@ontario.ca
***Subject Line**: – Project Name/ Site Address/ Application File No.*

May 2017 v4r