PETAWAWA NET-ZERO PROJECT
STORMWATER MANAGEMENT AND SECONDARY CONTAINMENT
DESIGN REPORT
560 ABBIE LANE, PETAWAWA, ONTARIO

STONECREST ENGINEERING INC.
440 Wright Blvd.
STRATFORD, ONTARIO

File no. 8549
August 16, 2024

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1.0 INTRODUCTION

Stonecrest Engineering Inc. was retained by Anaergia to provide the design for secondary containment and stormwater management to satisfy the requirements for a Renewable Energy Approval under Ontario Regulation 359/09.

The subject property is located at 560 Abbie Lane, Petawawa, Ontario. The property is an established Water Pollution Control Plant (WPCP) with anaerobic digestion.

This report documents the design of a stormwater management system secondary containment design for the site located at 560 Abbie Lane in the Town of Petawawa. This report is to be read in conjunction with other submitted documents, including the engineering design drawings (provided separately) which provide the proposed design and construction details.

2.0 SITE INFORMATION

2.1 Overview of Site Operations

The Petawawa Water Pollution Control Plant has existing anaerobic digestion facilities to digest an organic slurry and wastewater solids. The Petawawa Net-Zero Project is upgrading the existing facilities to generate electricity using combined heat and power (CHP). Overall, the upgrades account for an impervious area increase of less than 1%.

The modifications to the site include:

- Improving the anaerobic digesters so they are compliant with current regulations administered by Technical Standards and Safety Authority;
- Modifying the digesters so they can accept an organic slurry;
- Construction of concrete pads for placement of equipment;
- Addition of biogas cleaning and conditioning equipment; and
- Installation of a CHP with a nameplate capacity of 200 kWe to generate electricity and heat.

2.2 Contaminant Overview

The anaerobic digestion facility is designed to handle and process biomass, source separated organics, farm materials, and digestate. The primary function of the anaerobic digestion facility is to treat

wastewater from the Town of Petawawa, reducing the risk of contamination. The wastewater solids fed into the digester have a total solids content of 2-3%. The organic slurry is expected to have a total solids content of 15%, and will make up approximately 10% of the liquid being fed into the digesters.

2.3 Existing Drainage Patterns

The site has an established stormwater management network which utilizes swales to reduce flow velocities and directs water towards the property outlets.

The drainage patterns and features referenced in this report are from the Site Investigation Report completed by Cambium (Cambium 11757-002) and the topographical survey provided to Stonecrest by Anaergia.

Figure 1 provides an overview of the existing drainage at the site. Most of the property outlets through the swale and culvert located on the east side of the property. These flows ultimately are received by the Ottawa River. The north-west corner of the property is drained via a swale to the unnamed water course.

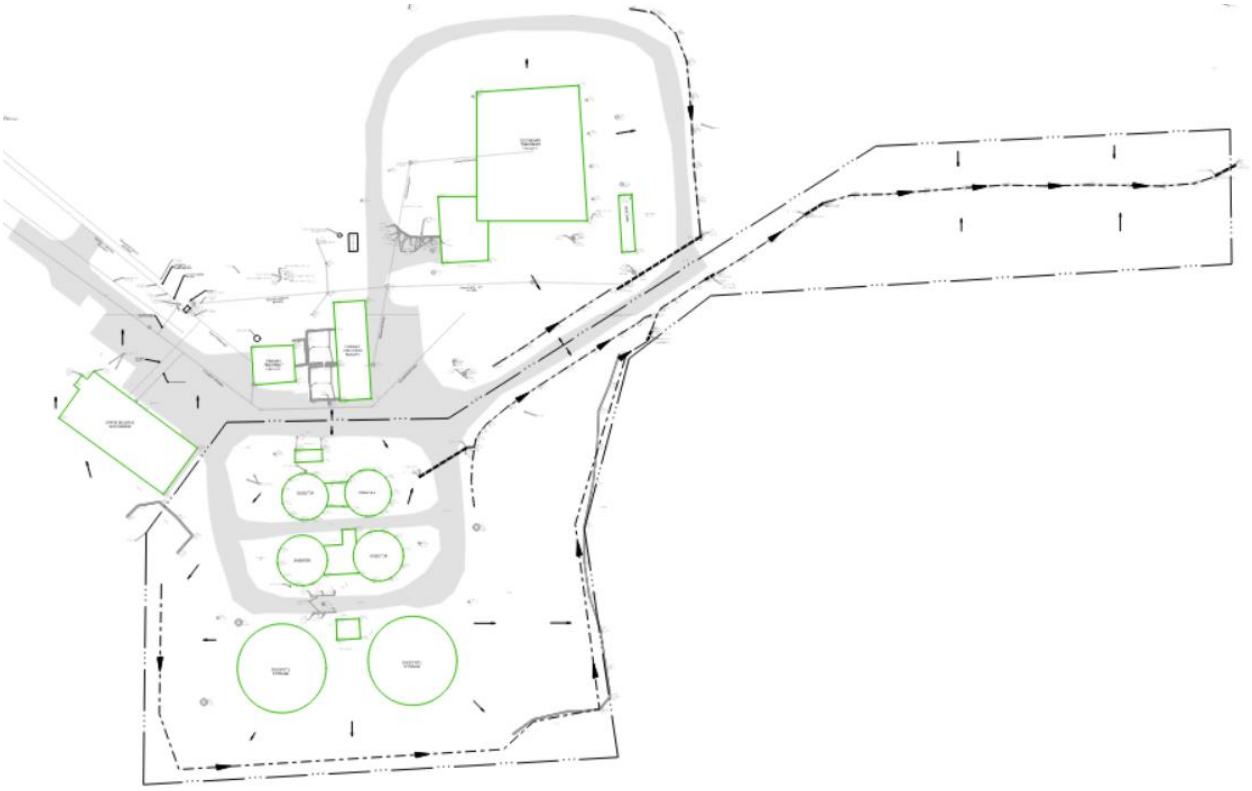

Figure 1: Existing Drainage Patterns and Features on the Site

3.0 DESIGN CRITERIA

3.1 Site Definition

The area of study for the secondary containment and stormwater quantity controls were limited to the areas which may be affected by the current proposed development. It was decided that the stormwater in all areas outside of areas outside of secondary containment were appropriately handled by existing stormwater infrastructure.

The area of study was determined by observing the flow directions (as shown in Figure 1) around the anaerobic digestion equipment. The study area boundary encapsulates the area that may be affected in the event of a spill.

3.2 Secondary Containment Design Criteria

The *Guidelines for environmental protection measures at chemical and waste storage facilities* set out by the Government of Ontario recommend a containment capacity of 100% of the volume of the largest tank plus the greater of 10% of the volume of the largest tank or 10% of the aggregate volume of all remaining tanks. Other factors to consider during design include:

- Ensure the containment area shall be structurally sound and has soils or is lined with material having adequate hydraulic conductivity to prevent excessive infiltration.
- The containment area shall be designed to withstand a 100-year storm event.
- All grades within the project area shall be sloped towards the containment pond to ensure no pooling of contaminants occurs.

3.3 Stormwater Management Design Criteria

The Town of Petawawa follows the Stormwater Management Criteria set out in the Ontario Ministry of the Environment *Stormwater Management Planning and Design Manual (2003)* for Water Quality.

As the receiving aquatic habitat of the project area (Ottawa River) is relatively insensitive to stormwater impacts, Basic Protection can be used for the design of end-of-pipe volumes. Basic Protection corresponds to the long-term average removal of 60% of suspended solids. Table 1 outlines the requirements for Basic Protection set out by the MECP Design Manual.

Table 1: Water Quality Storage Requirements

% Impervious	0%	35%	20.8%
SWMP Type	Dry-Pond (Continuous Flow)		
Storage Volume Requirement	0 m^3/ha	90 m^3/ha	53.6 m^3/ha

The new additions to the site account for less than a 1% increase in impervious area. With such minimal increase to this value, the Town of Petawawa permitted the assumption that the existing infrastructure on the site could handle storm water runoff volumes.

To protect the receiving aquifer, the secondary containment capacity must also be able to handle the volumes produced by a 100-year design storm event.

4.0 SECONDARY CONTAINMENT DESIGN

Secondary containment must be provided for the structures associated with the renewable energy project that store potential contaminants. This includes Digesters 3 and 4, and both Digestate Storage tanks. Digesters 1 and 2 have been decommissioned and no longer store any material, nor is there an intention to store material in these digesters in the future. Table 2 outlines the above grade capacities of these facilities.

Table 2: Above Grade Storage Volumes.

Storage Structure	Above Grade Volume
Digester 3	776 m^3
Digester 4	967 m^3
Digestate Storage 1	2100 m^3
Digestate Storage 2	2100 m^3

As per the criteria outlined in Section 3.3, the volume required for secondary containment is 2484 m^3. This value does not include the necessary volumes to withstand a 100-year storm. The secondary containment pond shall be lined with suitable soils.

5.0 STORMWATER MANAGEMENT DESIGN

5.1 Design Approach

The increase in stormwater quantity is of minimal concern as there is only a 0.9% increase in imperviousness in the study area. However, to properly design a secondary containment system the containment area must be able to hold both the secondary containment design volume with the additional safety factor of the volume for a 100-year storm.

Runoff volumes for a 100-year 24-hour storm were calculated using the Modified Rational Method. IDF data used was for PEMBROKE CLIMATE Station (6106367).

5.3 Drainage Area and Control Methods

The discharge rates are consistent with the previous discharge rates due to the minimal increase in impervious surfaces. The following components form the conditions of the study area:

Study Area Conditions

i)	Buildings/digesters	1657 m^2
ii)	Pavement/concrete	2380 m^2
iii)	Grassed	15341 m^2
		19378 m^2

To meet the stormwater management quantity control criteria, an additional 510 m^3 of storage is required.

5.4 Quality Control

The study area is 19378 m2 (1.9 ha), with an imperviousness of 21%. Based on the criteria outlined in Section 3.3, 104 m3 of Continuous Flow Dry-Pond is prescribed to achieve 60% suspended solids removal. Due to the increased pond volume required for secondary storage, the storage volume required for water quality control is exceeded.

To ensure water quality is protected from surface water contamination, the surface water features (swales and pond) are to be vegetated.

6.0 DESIGN SUMMARY

The study area drains into the existing swales surrounding the study area which direct surface water to the pond. The pond has sufficient volume to hold both the required volume for secondary containment and for a 100-year storm event. The total storage volume required is 2994 m^3.

The outlet of the pond shall be through a 600 mm pipe with a gate valve. The valve shall be left open to allow for stormwater flow to pass through the site outlet. As a spill is unlikely to occur rapidly and the with the length of the proposed flow path there should be sufficient time to manually close the valve prior to discharging into the receiver. In the event of a spill, the valve shall be manually closed and kept closed until the spill can be appropriately remediated. The pond shall be lined with material having a low hydraulic conductivity to minimize excessive infiltration.

The area north of the study area which previously drained to the same swale has been redirected to a new, adjacent swale of equivalent storage volumes. This outlet of this swale ties into the existing outlet to the Ottawa River. No additional runoff volumes are expected on the site.

All swales and the pond shale be vegetated to enhance nutrient uptake and reduce erosion, improving water quality reaching the site outlet. Several factors to consider when selecting plants include but are not limited to climate conditions, soil conditions, frequency of flooding, maintenance requirements, and availability.

7.0 CONCLUSION AND RECOMMENDATIONS

In summary, the features of the storm water management system are as follows:

- A containment pond sized for secondary storage of digester and digestate storage materials able to withstand the runoff volumes produced from a 100-year design storm event.
- Recreation of the existing outlet swale to handle the stormwater from the rest of the site.

We recommend the storm water management system be constructed as shown on the Drawing G1 which accompanies this report.

All of which is respectfully submitted.

STONECREST ENGINEERING INC.

Per:

N. Hendry, P.Eng.

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APPENDIX A – STORMWATER VOLUME ANALYSIS

Modified Rational Method:

Q=kCiA

k	2.78
C	Runoff coefficient
i	Rainfall Intensity (mm/hr)
A	Contribution Area (ha)

Rainfall Parameters:

Climate Station	Rainfall Event	I (mm/hr)	Duration (hr)
PEMBROKE CLIMATE	100-yr	3.4	24

Catchment Characteristics:

Surface Type	Area (m^2)	Runoff Coefficient (C)
Building	1657	0.9
Asphalt/Concrete	2379	0.9
Grassed	15342	0.17
Total:	19378	0.32

Storage Volume Calculation:

Rainfall Event	C	I (mm/hr)	A (ha)	Q (L/s)	Duration (hr)	Volume (m3)
100-yr	0.32	3.4	1.94	5.9	24	509.7

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APPENDIX B – STORAGE VOLUME ANALYSIS

Secondary Containment Volume Requirements

Structure	Above Grade Volume
Digester 3	776 m^3
Digester 4	967 m^3
Digestate Storage 1	2100 m^3
Digestate Storage 2	2100 m^3
Secondary Containment Required	**2484 m^3**

Total Storage Volume Required

100-year 24-hour Storm Volume	510 m^3
Secondary Containment Volume	2484 m^3
Total Volume:	**2994 m^3**

Existing Outlet Swale Stage Storage:

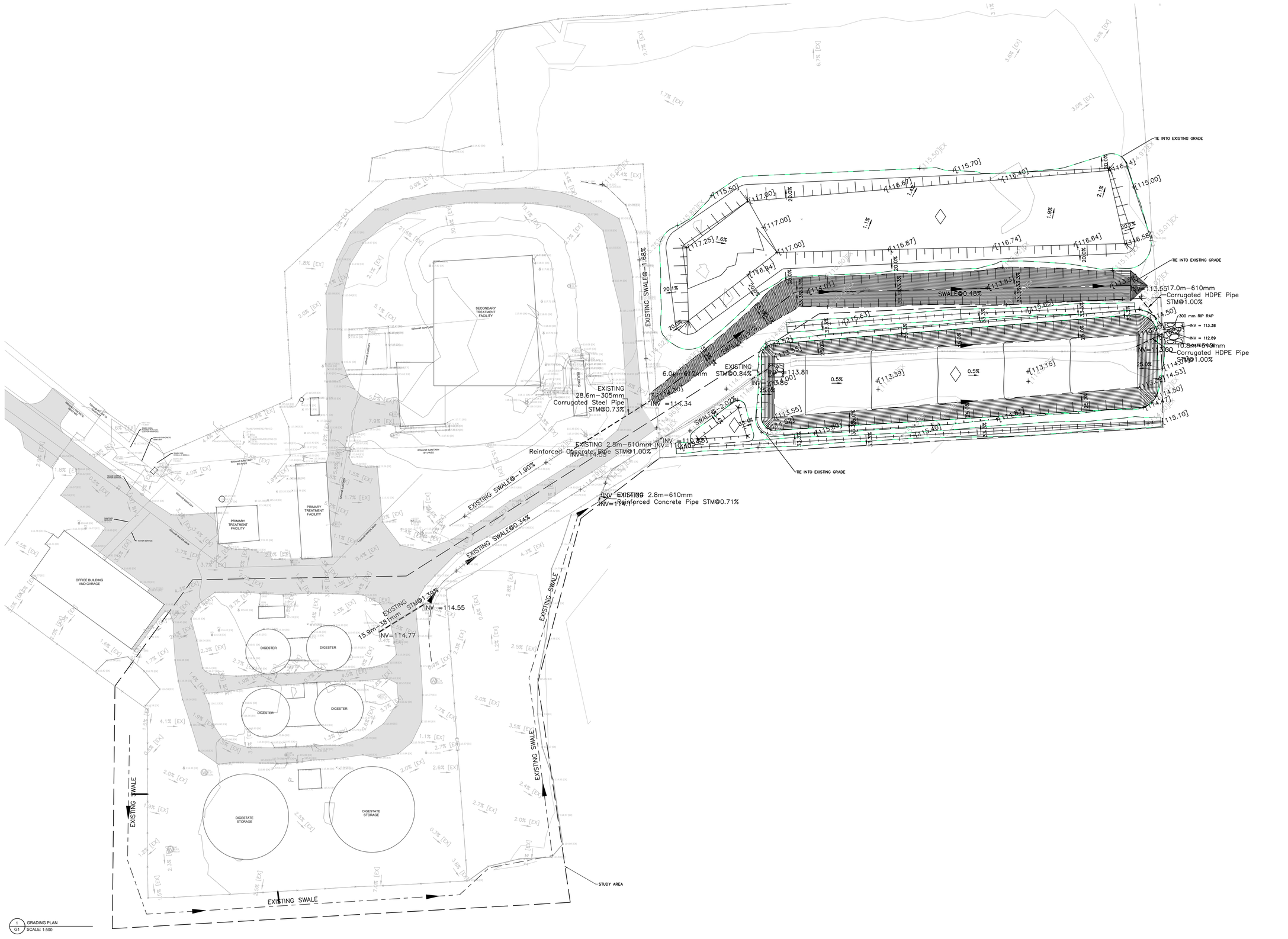
Pond Elevation	Area (m^2)	Volume (m^3)	Cumulative Volume (m^3)
113.40	0.59	0.00	0.00
113.50	13.35	0.70	0.70
113.60	47.88	3.06	3.76
113.70	112.05	8.00	11.75
113.80	205.12	15.86	27.61
113.90	291.39	24.83	52.44
114.00	418.90	35.51	87.95
114.10	5.27	21.21	109.16
114.20	8.26	0.68	109.84
114.30	11.95	1.01	110.85
114.40	16.28	1.41	112.26
114.50	21.28	1.88	114.14

Designed Outlet Swale Stage Storage:

Pond Elevation	Area (m^2)	Volume (m^3)	Cumulative Volume (m^3)
113.60	1.44	0.00	0.00
113.70	13.80	0.76	0.76
113.80	39.00	2.64	3.40
113.90	77.02	5.80	9.20
114.00	127.73	10.24	19.44
114.10	191.14	15.94	35.38
114.20	266.93	22.90	58.29
114.30	355.18	31.11	89.39
114.40	1306.17	83.07	172.46
114.50	1284.73	129.54	302.01
114.60	1265.37	127.50	429.51
114.70	1246.60	125.60	555.11

Secondary Storage Pond Design Stage Storage:

Pond Elevation	Area (m^2)	Volume (m^3)	Cumulative Volume (m^3)
113.00	0.00	0.00	0.00
113.10	337.94	16.90	16.90
113.20	694.06	51.60	68.50
113.30	1073.92	88.40	156.90
113.40	1477.82	127.59	284.48
113.50	1903.87	169.08	453.57
113.60	2162.67	203.33	656.89
113.70	2260.45	221.16	878.05
113.80	2359.23	230.98	1109.03
113.90	2458.95	240.91	1349.94
114.00	2559.64	250.93	1600.87
114.10	2661.30	261.05	1861.92
114.20	2763.92	271.26	2133.18
114.30	2867.50	281.57	2414.75
114.40	2972.05	291.98	2706.73
114.50	3077.56	302.48	3009.21



1 GRADING PLAN
G1 SCALE: 1:500

NOTES:
PLEASE READ NOTE PAGE AT BEGINNING OF DRAWING SET FOR ALL NOTES REGARDING THIS PROJECT

NO.	DATE:	DESCRIPTION:
A	AUG 16/24	ISSUED FOR REVIEW

LEGEND:

- PROPERTY LINE
- BUILDING
- FENCE LINE
- STORM SEWER
- SANITARY SEWER
- WATER SERVICE
- STUDY AREA
- [285.00] PROP. ELEVATION
- [285.00]EX EXIST. ELEVATION
- 2.8% PROP. SLOPE
- 2.8% EXIST. SLOPE
- 285.00 EXIST. CONTOUR
- SWALE

PROJECT NORTH | TRUE NORTH

DRAFT - NOT FOR CONSTRUCTION

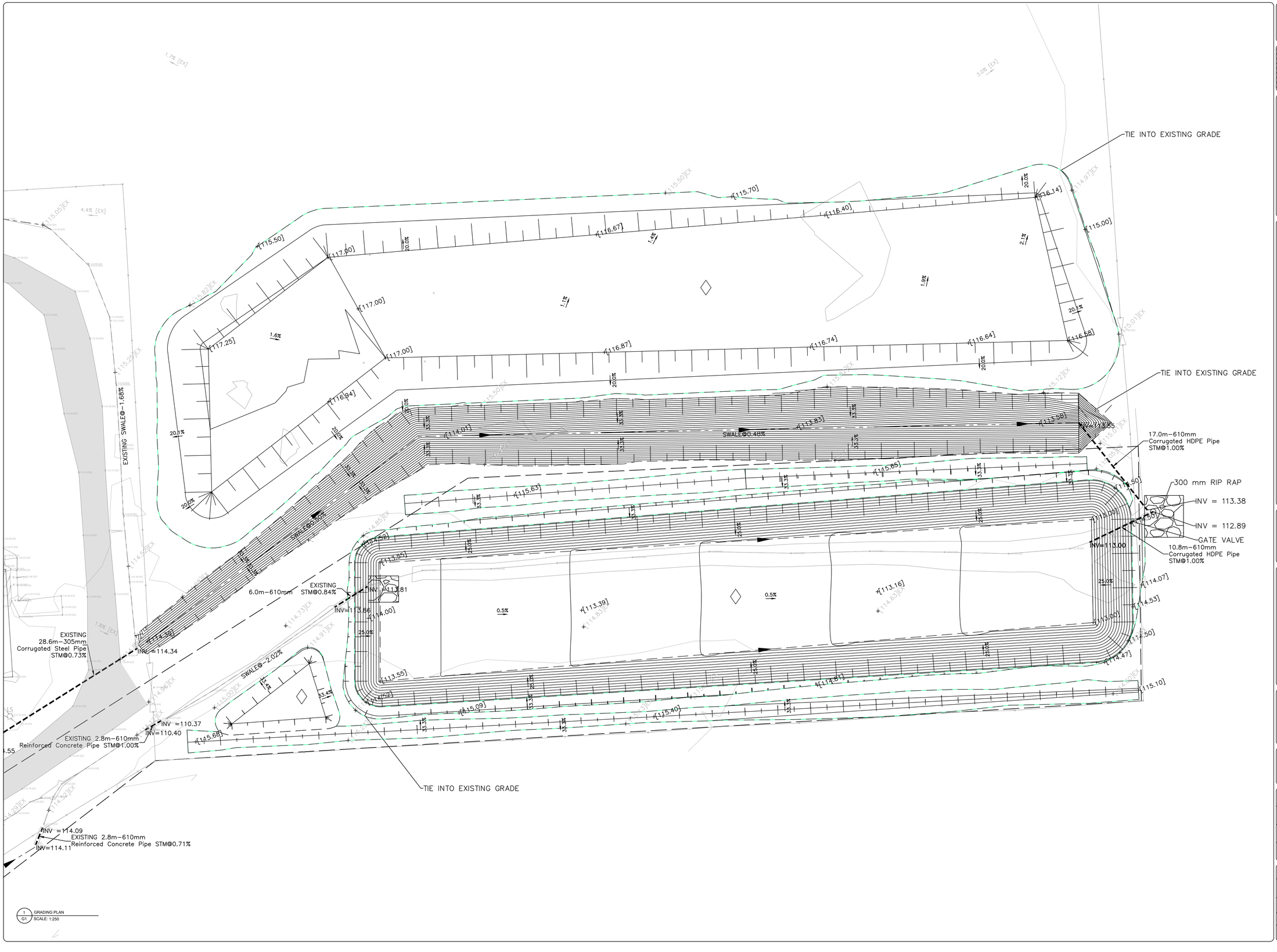
PROFESSIONAL ENGINEER'S SEAL

STONECREST ENGINEERING INC.
EST. 1995
440 Wright Blvd Unit #2, Stratford, ON, N4Z 1H3
519-625-8025 ~ info@stonecrestengineering.com

CONTRACTOR TO CHECK ALL DIMENSIONS AND ELEVATIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK

DO NOT SCALE THE DRAWINGS

CLIENT: ANAERGIA	
LOCATION: 560 ABBIE LANE, PETAWAWA, ON	
PROJECT TYPE: SECONDARY STORAGE AND STORMWATER DESIGN	
PROJECT STATUS AND VERSION: SITE GRADING	
DRAWN BY: S.C.	PRINT DATE: 2024-08-16
PAGE DESCRIPTION: GRADING PLAN	
SCALE: AS NOTED	
FILE: 8459-1	
PAGE NUMBER: G1	



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PAGE DESCRIPTION: GRADING PLAN

SCALE: AS NOTED

FILE: 9459-1

PAGE NUMBER: G2

NOTES

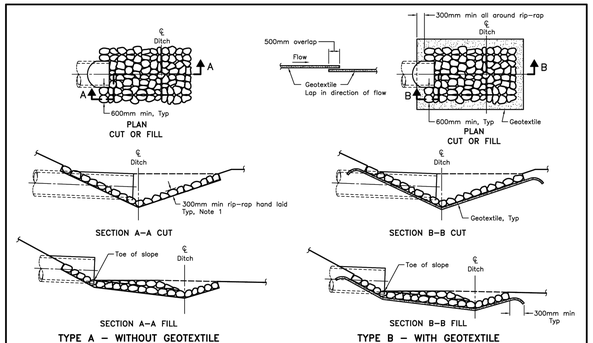
1. DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. ALL CONSTRUCTION WORK TO BE COMPLETED IN ACCORDANCE WITH ALL APPLICABLE (MOST RECENT) STANDARDS.
3. THE PLANS PREPARED BY STONECREST ENGINEERING INC. ARE NOT TO BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ENGINEER AND ACCEPTED BY THE APPROVING AGENCY. THESE PLANS ARE NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE PERMISSION OF STONECREST ENGINEERING INC.
4. THE CONTRACTOR IS TO VERIFY THE EXISTING CONDITION OF THE SITE. THE VERIFICATION INCLUDES AND NOT LIMITED TO THE SERVICE LOCATION, SERVICE ELEVATIONS, UTILITY CONFLICTS AND BENCHMARK ELEVATIONS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY AND PRIOR TO THE CONTINUATION OF CONSTRUCTION.
5. THESE PLANS ARE TO BE USED FOR SERVICING AND GRADING ONLY; ANY OTHER INFORMATION SHOWN IS FOR ILLUSTRATION PURPOSES ONLY. THESE PLANS MUST NOT BE USED TO SITE THE PROPOSED BUILDING.
6. UTILITY LOCATES AND ALL APPLICABLE PERMITS ARE TO BE OBTAINED PRIOR TO THE START OF CONSTRUCTION AND INSPECTION BEING COMPLETED.
7. PIPE BEDDING FOR SEWERS TO BE CLASS 'B' PER OPSD 802.010 UNLESS OTHERWISE NOTED.
8. CONTRACTOR IS RESPONSIBLE FOR ACQUIRING ALL INSPECTIONS ON ALL SERVICES AND ALL CONNECTIONS TO THE BUILDINGS.
9. ALL SERVICING TO MEET TOWN OF PETAWAWA SPECIFICATIONS, DESIGN GUIDELINES AND SUPPLEMENTARY SEPCIFICATIONS FOR MUNICIPAL SERVICES.
10. PARKING LOT GRADES SHOWN ARE TOP OF ASPHALT OR GRAVEL.
11. DISTURBED GRASSED AREAS ON SITE TO BE REINSTATED WITH 300mm OF TOPSOIL, SEED & MULCH. GRASSED AREAS WITHIN THE TOWNSHIP R.O.W. TO BE RESTORED WITH 300mm OF TOPSOIL, SEED & MULCH.
12. TYPICAL PAVEMENT STRUCTURE TO BE CONFIRMED BY A SOILS CONSULTANT.

ON SITE PAVEMENT	APRON TO ROADWAY
HL 3 – 50mm	HL 3 – 50mm
HL 8 – 50mm	HL 8 – 50mm
GRANULAR 'A' – 150mm	GRANULAR 'A' – 150mm
GRANULAR 'B' – 450mm	GRANULAR 'B' – 450mm

13. ALL DITCH INLET CATCH BASINS TO BE AS PER OPSD 705.010 WITH OPSD 400.120 FRAME AND GRATE (BIRDCAGE TYPE) AND TO INCLUDE 0.6m SUMPS.
14. ALL CATCH BASIN MANHOLES TO BE AS PER OPSD 701.010 WITH OPSD 401.010 TYPE 'B' FRAME AND GRATE AND TO INCLUDE 0.6m SUMPS.
15. SANITARY MANHOLES TO BE AS PER OPSD 701.010 WITH OPSD 401.010 TYPE 'A' FRAME AND GRATE AND BENCHED.
16. FOLLOWING COMPLETION OF PROPOSED WORKS AND PRIOR TO OCCUPANCY INSPECTION, ALL STORM AND SANITARY SEWERS ARE TO BE FLUSHED, AND ALL CATCHBASIN AND CATCHBASIN MANHOLE SUMPS ARE TO BE CLEANED OF DEBRIS AND SILT.
17. ALL COLLECTED SEDIMENT TO BE DISPOSED OF AT AN APPROVED LOCATION IN CONFORMANCE TO THE MECP EXCESS SOIL REGULATION.

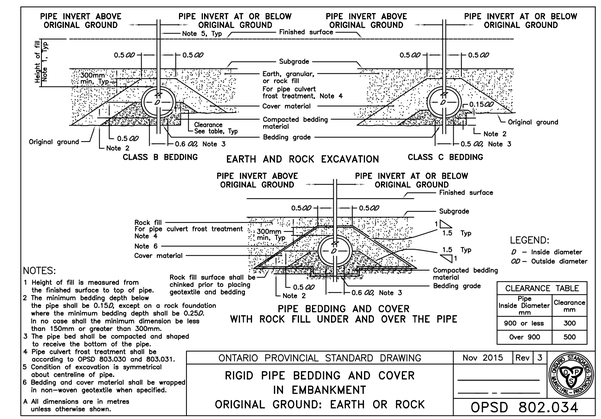
EROSION AND SEDIMENTATION CONTROL NOTES:

1. SITE WORKS ARE TO BE STAGED IN SUCH A MANNER THAT EROSION WILL BE MINIMIZED AND THAT BARRIERS AND SEDIMENTATION FACILITIES WITHIN THE SITE ARE PROVIDED TO CONTROL ANY EROSION THAT DOES OCCUR.
2. ALL SILT FENCING (OPSD 219.110) TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY GRADING, EXCAVATING OR DEMOLITION.
3. STOCKPILE OF EARTH OR TOPSOIL ARE TO BE LOCATED AND PROTECTED TO MINIMIZE ENVIRONMENTAL INTERFERENCE. STOCKPILES SHOULD NOT BE LOCATED IMMEDIATELY ADJACENT TO DITCHES OR ROAD ALLOWANCES. EROSION CONTROL FENCING IS TO BE INSTALLED AROUND THE BASE OF ALL STOCKPILES. A PERIMETER DITCH LEADING TO A SETTLING AREA OR SEDIMENTATION TRAP SHOULD BE INSTALLED AROUND THE STOCKPILE.
4. EROSION PROTECTION (SILT FENCE) TO BE PROVIDED AROUND ALL EXISTING DITCHES, SWALES AND WATERCOURSES.
5. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE DEVELOPMENT PROGRESSES. THE CONTRACTOR IS TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES.
6. EROSION CONTROL STRUCTURES ARE TO BE MONITORED REGULARLY AND ANY DAMAGE TO STRUCTURES REPAIRED IMMEDIATELY. SEDIMENTS ARE TO BE REMOVED WHEN ACCUMULATIONS REACH A MAXIMUM OF 1/2 THE HEIGHT OF THE FENCE. CLOGGED FILTER MATERIALS SUCH AS CRUSHED STONE, STRAW BALES OR FILTER CLOTH MUST BE REPLACED AS REQUIRED.
7. ALL EROSION CONTROL STRUCTURES ARE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RESTABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
8. NO ALTERNATIVE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THE ENGINEER AND APPROVING AUTHORITY.
9. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT MUNICIPAL ROADWAYS ARE CLEANED OF ALL SEDIMENTS FROM VEHICULAR TRACKING ETC. TO AND FROM THE SITE AT THE END OF EACH WORK DAY.



NOTES:
1 The thickness of the rip-rap layer shall be at least 1.5 times the rip-rap mean diameter.
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2007	Rev 1
RIP-RAP TREATMENT FOR SEWER AND CULVERT OUTLETS		
	OPSD 810.010	

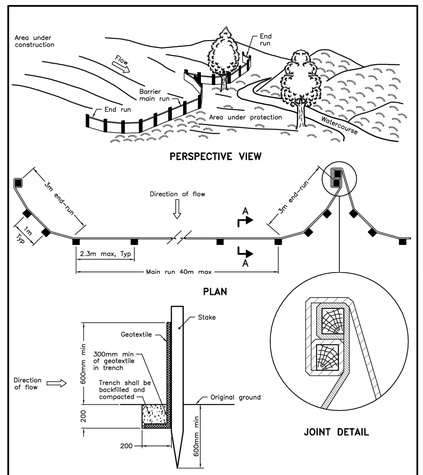


NOTES:
1 Height of fill is measured from the finished surface to top of pipe.
2 The minimum bedding depth below the pipe shall be 0.15∅, except on a rock foundation where the minimum bedding depth shall be 0.25∅, in no case shall the minimum dimension be less than 150mm or greater than 300mm.
3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
5 Condition of excavation is symmetrical about centreline of pipe.
6 Bedding and cover material shall be wrapped in non-woven geotextile when specified.
A All dimensions are in metres unless otherwise shown.

CLEARANCE TABLE

Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 3
RIGID PIPE BEDDING AND COVER IN EMBANKMENT ORIGINAL GROUND: EARTH OR ROCK		
	OPSD 802.034	



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

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