5455 Boundary Road
Ottawa, ON
Servicing and Stormwater Management Report

Prepared For:

Ottawa D-Squared Asphalt Limited

Prepared By:

Robinson Land Development

Our Project No. 20003
July 2020

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1.0 INTRODUCTION

Robinson Land Development has been retained by Ottawa D-Squared Asphalt Limited to prepare a servicing and stormwater management design for the property located at 5455 Boundary Road in the City of Ottawa. The 11.82 hectare subject site (currently zoned rural heavy industrial, RH) is bounded by Boundary Road to the west and other rural industrial properties to the east, north and south (refer to **Figure 1 – Key Plan** following page 1). The Owner is proposing to construct a hot mix asphalt plant with associated features. This report will document the proposed means of servicing the property and provide details on achieving the stormwater management control targets for the site.

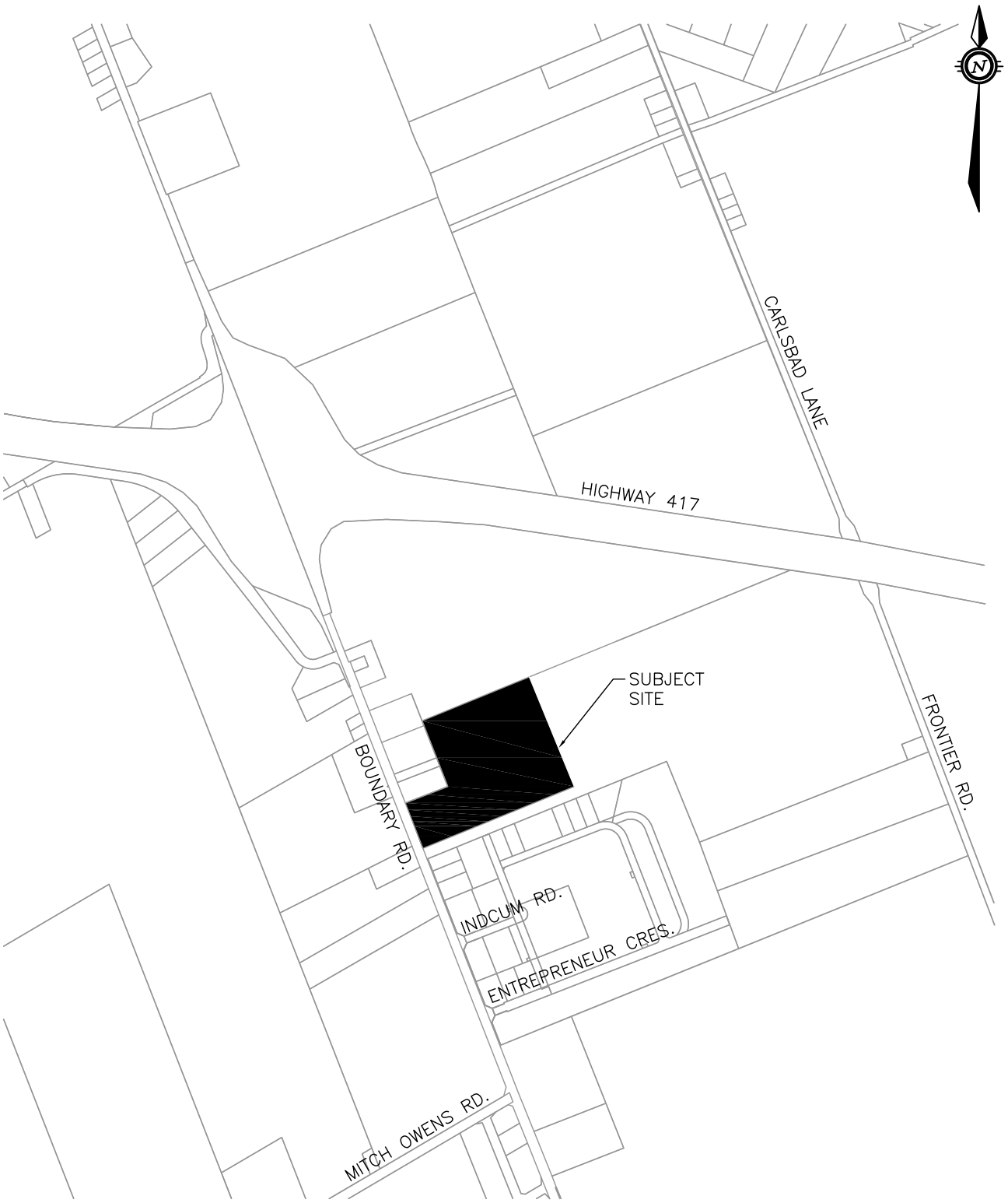
2.0 EXISTING CONDITIONS

Under current site conditions, the 11.82 hectare property is being used as a construction works yard for storage and supply of construction materials and equipment. The existing site contains various material stockpiles (i.e. granulars, topsoil, crushed concrete, etc.) across the entire property. An existing Quonset structure (to be relocated) used for storage is located along the western property boundary. An existing truck scale used for the subject site but located primarily on the adjacent property to the north is to also be relocated. The topography of the site is generally flat with lower grades towards the north-east of the property at the location of an existing drainage ditch which conveys localized runoff towards the east. The existing ground surface of the property consists primarily of compacted granular and compacted sand materials. The property is currently accessed via a connection to Boundary Road. Refer to **Figure 2 – Existing Conditions** below:

Figure 2 – Existing Condtions

3.0 PROPOSED DEVELOPMENT

The Owner is proposing to develop the property into a hot mix asphalt plant with associated features (i.e. material stockpiles, truck scale, etc.). An existing Quonset structure located along the western property boundary is to be relocated (to conform with zoning requirements) and used for storage. The existing truck scale (located primarily on the



Robinson
Land Development

scale N.T.S.	5455 BOUNDARY ROAD	project no. 20003
date 19/06/20		
drawn by BLM	KEY PLAN	FIG 1

adjacent property to the north) is to be relocated to a more central location contained within the site boundary. A combination of fencing and landscaping noise control measures will be provided along the interface with Boundary Road. In addition, multiple on-site noise berms are also proposed in accordance with the air and noise Environmental Compliance Approval (ECA). New landscaping is also proposed within the outer perimeter of the stormwater management (SWM) pond as detailed on the landscape plans. Asphalt material from the plant (once in production) will be used to construct an on-site access road of similar alignment to the "truck travel route" as indicated on the Site Plan. The Site Plan (DWG. 20003-SP1), along with the complete set of design drawings have been provided in **Appendix A**. Access to the site will be provided by the current connection to Boundary Road. As requested by the City, a traffic impact assessment (TIA) has been prepared, reviewed and accepted (available under a separate cover).

3.0 WATER SUPPLY

An existing 102 mm diameter watermain fed by the Carlsbad Trickle System is located within the Boundary Road right-of-way adjacent to the subject site, however, potable water supply is not required for the proposed development. The Owner has indicated that water supply is not required for the asphalt plant or other on-site processes. A relocatable washroom (which does not require water supply) will be provided for the on-site employees. The existing site currently contains no source of water supply. Water and wastewater servicing are further discussed in the accompanying Planning Rational Report (available under a separate cover).

Ottawa Fire Services have been contacted to comment on the requirements for fire protection at the subject site. The on-site design will be revised to accommodate any comments received from Fire Services as required.

4.0 SANITARY SERVICING

No municipal sanitary sewers are located within the vicinity of the subject site, however, sanitary servicing is not required for the proposed development. The Owner has indicated that no sanitary servicing will be required for the asphalt plant or other on-site processes. All runoff from the asphalt plant building and surrounding on-site areas will be fully captured and treated by the proposed on-site SWM pond (refer to **Section 5.5**). A relocatable washroom (which is self-contained and does not require a sanitary outlet) will be provided for the on-site employees. The existing site currently contains no sanitary servicing of any kind.

5.0 STORM & STORMWATER MANAGEMENT DESIGN

5.1 Storm Sewer Servicing

Stormwater runoff from the subject site will be conveyed by overland sheet flow to on-site drainage swales and conveyed to the proposed on-site SWM pond. An on-site storm sewer system to capture stormwater runoff will therefore not be required.

5.2 Stormwater Management Design Criteria

Pre-consultation with the City of Ottawa and South Nation Conservation Authority (SNCA) have identified the following stormwater management design criteria for the subject site:

- Control post-development stormwater outflows to pre-development levels for the 5 year and 100 year design events.
- Provide enhanced level (80 percent TSS removal) quality control of stormwater runoff discharging from the site.

The above noted quantity and quality control requirements have been incorporated into the on-site stormwater management design detailed in the following sections. Vegetation is proposed around the outer perimeter of the SWM pond to support thermal mitigation objectives for the downstream receiver (i.e. Regimbald Municipal Drain). Refer to the pre-consultation notes provided in **Appendix B**.

5.3 Pre-Development Flows

The ground surface of the property under current site conditions consists primarily of compacted granular and compacted sand materials. For the purpose of stormwater management design calculations, a runoff coefficient value of 0.70 has been assumed for the site under current (i.e. pre-development) site conditions. The 5 year and 100 year pre-development flows for the subject site have been calculated using the Rational Method as follows:

Given:

Site Area = 11.82 hectares
5 Year Runoff Coefficient = 0.70
100 Year Runoff Coefficient = 0.88 (C Value + 25%)
5 Year Rainfall Intensity = 48.5 mm/hr (using Tc=35min, refer to calculations in **Appendix B**)
100 Year Rainfall Intensity = 82.6 mm/hr (using Tc=35min, refer to calculations in **Appendix B**)

5 Year Pre-Development Flow:

$Q_5 = 2.78CiA$
$Q_5 = 2.78(0.70)(48.5)(11.82)$
$Q_5 = 1116.4$ L/s

100 Year Pre-Development Flow:

$Q_{100} = 2.78CiA$
$Q_{100} = 2.78(0.88)(82.6)(11.82)$
$Q_{100} = 2375.2$ L/s

As calculated above, the 5 year and 100 year pre-development flows for the subject site have been calculated to be 1116.4 L/s and 2375.2 L/s respectively. Therefore, as directed by the SNCA, outflows from the site in post-development must be controlled to the above noted pre-development levels for the 5 year and 100 year design events.

5.4 Post-Development Flows

The post-development conditions of the site will closely resemble the current pre-development conditions. Additional impervious surfaces in post-development will include the asphalt plant and asphalt access road. However, new landscaping provided along the interface with Boundary Road and outer perimeter of the SWM pond will marginally lower the overall runoff coefficient from the pre-development value of 0.70 to a value of 0.69 under post-development conditions (refer to runoff coefficient calculations in **Appendix B**). The 5 year and 100 year post-development flows for the subject site have been calculated using

the Rational Method at the same pre-development time of concentration (given that the catchment area, slope and length will remain largely unchanged in post-development). A comparison of the pre-development and post-development flows have been provided in **Table 1** below:

Table 1 – Pre-Development and Post-Development Flows

Design Storm Event	Pre-Development Flow (L/s)	Uncontrolled Post-Development Flow (L/s)
5 Year	1116.4	1105.0
100 Year	2375.2	2351.0

Notes:
1. Flows calculated using the Rational Method.
2. Rainfall intensity calculated using City of Ottawa IDF curve equations.
3. $C_{100\ YR}$ = C + 25%.
4. Time of concentration calculated using Bransby William Formula (refer to **Appendix B**).
5. Uncontrolled post-development flow is a theoretical value assuming no quantity control measures.

As indicated in **Table 1** above, the addition of landscape areas will slightly decrease the runoff from the site under post-development conditions. However, an outlet structure (installed within the proposed SWM pond, refer to **Section 5.5**) utilized for pond controls will further restrict the post-development flows to less than pre-development levels.

5.5 SWM (Wet) Pond Design

Wet ponds can be designed to efficiently provide for water quality and quantity control. The proposed wet pond for the subject site has been designed in accordance with the Ministry of the Environment (currently known as the Ministry of the Environment, Conservation and Parks) Stormwater Management Planning and Design Manual, March 2003 (herein referred to as the MOE SWM Manual). Details of the SWM pond design are provided in the sections below.

5.5.1 Quality Control

As mentioned previously, the subject site is required to provide enhanced level (80 percent TSS removal) quality control of stormwater runoff discharging from the site. Quality control of the site's runoff will be provided by a proposed on-site SWM pond. The water quality storage requirements for the site have been determined using Table 3.2 from the MOE SWM Manual. The water quality storage requirements have been summarized in **Table 2** below:

Table 2 – Water Quality Storage Requirements

Drainage Area (ha)	Storage Volume for Impervious Level[*1,2] (m^3/ha)	Extended Detention [*3] (m^3/ha)	Permanent Pool[*4] (m^3/ha)	Extended Detention Storage Volume (m^3)	Permanent Pool Storage Volume (m^3)
11.82	250	40	210	472.6	2481.3

Notes:
1. Storage volume for impervious level from MOE SWM Manual, Table 3.2.
2. Assumed enhanced protection level, wet pond SWMP type and 85% impervious level.
3. Assumed 40 m^3/ha extended detention as per MOE SWM Manual, Section 3.3.2.

4. Permanent pool = storage volume for impervious level – extended detention

In order to provide enhanced level quality control of stormwater runoff (in accordance with the MOE SWM Manual), the proposed SWM pond must provide a minimum extended detention storage volume of 472.6 m^3 and a minimum permanent pool storage volume of 2481.3 m^3. Refer to **Section 5.5.4 – Permanent Pool & Extended Detention** for more details.

5.5.2 Wet Pond Forebay

The sediment forebay of a wet pond facilitates maintenance and improves pollutant removal by trapping larger particles near the inlet of the pond (MOE SWM Manual, Section 4.6.2). The forebay has been designed with a proposed length of 32.0 metres, width of 4.0 metres (measured along pond bottom and not including side slopes) and depth of 1.5 metres. The forebay will be separated from the permanent pool by a rip-rap berm submerged 0.30 metres below the normal water level of the pond. The rip-rap berm will be constructed using 250 mm diameter rip-rap with a top width of 1.0 metre and 2:1 side slopes.

Equation 4.5 of the MOE SWM Manual defines the appropriate forebay length for a given settling velocity. Using Equation 4.5, the minimum settling length for the forebay has been calculated as follows:

$Dist = \sqrt{(rQ_p/V_s)}$ (Equation 4.5, MOE SWM Manual)

Where:

Dist = forebay length (m)
r = length-to-width ratio of forebay
Q_p = peak flow rate from the pond during design quality storm (m^3/s)
V_s = settling velocity. Recommended that a value of 0.0003 m/s be used in most cases

Given:

r = 8 (minimum ratio of 2:1 as per MOE SWM Manual, Table 4.6)
Q_p = 0.0065 m^3/s (refer to pond stage-discharge table in **Appendix B**)
V_s = 0.0003 m/s (recommended value as per MOE SWM Manual)

$Dist = \sqrt{(8)(0.0065) / (0.0003)}$
Dist = 13.2 m

As calculated above, the minimum forebay length for settling is 13.2 m. The proposed forebay has a length of 32.0 m which is greater than the minimum calculated value.

Equation 4.6 of the MOE SWM Manual is used to check the forebay length calculated using Equation 4.5 to ensure that there is adequate dispersion, required to dissipate flows from the inlet to the forebay. Using Equation 4.6, the minimum dispersion length for the forebay has been calculated as follows:

$Dist = 8Q / dV_r$ (Equation 4.6, MOE SWM Manual)

Where:

Dist = length of dispersion (m)

Q = inlet flowrate (m^3/s)
d = depth of permanent pool in the forebay (m)
V_r = desired velocity in the forebay (m/s). Recommended velocity =< 0.5 m/s.

Q = CiA / 360 (Equation 4.8, MOE SWM Manual)

Where:

Q = peak flow rate (m^3/s)
C = runoff coefficient
i = rainfall intensity (mm/hr)
A = drainage area (ha)

i = 43C + 5.9 (Equation 4.9, MOE SWM Manual)

Where:

i = rainfall intensity (mm/hr)
C = runoff coefficient

i = 43(0.71) + 5.9 (Equation 4.9, MOE SWM Manual)
i = 36.48 mm/hr

Q = (0.71)(36.48)(11.82) / 360 (Equation 4.8, MOE SWM Manual)
Q = 0.85 m^3/s

Given:

Q = 0.85 m^3/s (estimated using Equation 4.8, MOE SWM Manual)
d = 1.5 m (minimum depth of 1m as per MOE SWM Manual, Table 4.6)
V_r = 0.5 m/s (recommended value as per MOE SWM Manual)

Dist = 8(0.85) / (1.5)(0.5)
Dist = 9.08 m

As calculated above, the minimum length of dispersion is to be 9.08 m. The proposed forebay has a length of 32.0 m which is greater than the minimum calculated value.

A guideline for the minimum bottom width of the deep zone of the forebay is given by Equation 4.7 of the MOE SWM Manual. Using Equation 4.7, the minimum bottom width of the forebay has been calculated as follows:

Width = Dist / 8 (Equation 4.7, MOE SWM Manual)

Where:

Dist = Dispersion length calculated using Equation 4.6
Width = 9.08 / 8
Width = 1.14 m

As calculated above, the minimum width of the forebay is to be 1.14 m. The proposed forebay has a width of 4.0 m which is greater than the minimum calculated value. The proposed forebay has been designed to meet the minimum requirements for settling length,

dispersion length and width and therefore is in accordance with the design criteria outlined in the MOE SWM Manual.

5.5.3 Sediment Loading

The estimated annual sediment loading for the forebay has been calculated using Table 6.3 of the MOE SWM Manual as follows:

Given:

Catchment Area = 11.82 ha
Percent Impervious = 85 %
Annual Sediment Loading = 3.8 m^3/ha (Table 6.3, MOE SWM Manual)
Sediment Removal Efficiency = 80 % (Enhanced level quality control target)

Annual Sediment Loading = (3.8 m^3/ha) x (11.82 ha) = 44.9 m^3

Adjusted Annual Sediment Loading for Removal Efficiency = (44.9 m^3) x (0.8) = 35.9 m^3

9 Year Sediment Accumulation = (35.9 m^3/yr) x (9 yr) = 323.3 m^3

Provided Forebay Storage Volume = 323.5 m^3

As calculated above, the proposed forebay will have sufficient capacity to contain over 9 years of sediment accumulation. However, sediment accumulation should be monitored annually and maintained by the Owner as required.

5.5.4 Permanent Pool & Extended Detention Storage

The permanent pool (including the forebay) has been designed with a length of 218.4 metres, a width of 4.0 metres (measured along the pond bottom and not including side slopes) and a permanent pool depth of 1.5 metres in accordance with the MOE SWM Manual. The sizing of the permanent pool provides 2824.7 m^3 of storage volume at an elevation of 75.70 metres which is greater than the required permanent pool quality storage volume of 2481.3 m^3 calculated in **Section 5.5.1** above.

The design of the proposed SWM pond will provide an active storage volume of 473.3 m^3 at an elevation of 75.85 metres (0.15 metres above the permanent pool) which is greater than the required extended detention quality storage volume of 472.6 m^3 calculated in **Section 5.5.1** above. Refer to the SWM pond stage-storage table provided in **Appendix B** for more details.

5.5.5 Outlet Structure

An outlet structure with orifice and weir flow controls installed at the end of the SWM pond will control stormwater flows discharging from the site. An orifice control will be utilized to detain the extended detention quality storage volume (in accordance with the MOE SWM Manual) and a weir control will be utilized to control the 5 year and 100 year design events to pre-development levels (as outlined by the SNCA).

5.5.5.1 Orifice Control

A proposed 97.62 mm diameter circular orifice control will be utilized to detain the required extended detention quality storage volume in accordance with the design criteria of the MOE

SWM Manual. Using Equation 4.11 from the MOE SWM Manual, the drawdown time (for extended detention) has been estimated to be 20.1 hours which is in the range of the recommended value of 24 hours (12 hours if in conflict with minimum orifice size). A smaller orifice size to provide a greater detention time would be more prone to clogging and is therefore not desired. Refer to the orifice sizing and drawdown time calculations in **Appendix B**.

5.5.5.2 Weir Control

A weir control will be utilized to control the 5 year and 100 year design storm events to less than pre-development levels (as outlined by the SNCA). A suppressed rectangular weir with a proposed crest width of 3.0 metres and crest elevation of 75.85 m will provide a total discharge rate (including orifice flow) of 830.5 L/s and 1967.5 L/s for the 5 year and 100 year design events respectively which are less than the pre-development flows of 1116.4 L/s and 2375.2 L/s. The flows have been summarized in **Table 3** below.

Table 3 – Post-Development Controlled Flows

Design Storm Event	Pre-Development Flow (L/s)	Post-Development Controlled Flow[*1] (L/s)
5 Year	1116.4	830.5
100 Year	2375.2	1967.5

Notes:
1. Combination of orifice and weir flow. Refer to stage-discharge table in **Appendix B**.

Based on the post-development controlled flows noted above, 965.3 m^3 and 1890.6 m^3 of on-site quantity storage volume will be required to be provided within the SWM pond as active storage volume for the 5 year and 100 year design storm events respectively. The pond has been designed to provide 1030.3 m^3 of active storage at an elevation of 76.13 m and 1976.20 m^3 of active storage at an elevation of 76.35 m. Therefore, the pond has been adequately sized to provide the required active storage volume for the 5 year and 100 year design events respectively. A freeboard of 0.30 metres has been provided from the 100 year water level of 76.35 m to the top of pond elevation of 76.65 m. Refer to the SWM pond stage-storage table and storage volume tables in **Appendix B**.

5.5.6 Off-Site Outlet Ditch

Stormwater which discharges from the proposed outlet structure in the SWM pond will be conveyed by a rip-rap lined spillway to a proposed off-site outlet ditch located along the northern property boundary. The off-site outlet ditch is to be designed and constructed in conjunction with the site plan application for the adjacent property (5471 Boundary Road) to the east. The off-site outlet ditch will convey stormwater runoff from the subject site to the realigned ditch located on the adjacent property to the north (5371 Boundary Road, "Amazon Site") and ultimately to the culvert crossing under Highway 417. Under current site conditions stormwater runoff is conveyed to the same outlet via existing drainage ditches which are to be filled as part of the proposed development works for the subject site and adjacent property to the east. Refer to the *Boundary Road Distribution Centre Stormwater Management Report* and design drawings, prepared by Novatech for additional details. The outlet ditch has been designed with a 0.5 metre flat bottom and 3H:1V side slopes in order to have capacity to convey the 100 year design event from the subject site. Refer to the outlet ditch sizing calculations in **Appendix B** for more details.

6.0 EROSION AND SEDIMENT CONTROL

It will be necessary to implement the following erosion and sediment control measures, in accordance with current Ministry of Environment, Conservation and Parks (MECP) Best Management Practice guidelines, in order to minimize the transport of sediments to adjacent lands:

- Straw bale check dams within existing and proposed drainage ditches
- Silt fence along property boundaries where construction is taking place

These measures will be installed prior to construction and maintained in good order until construction has been completed. The erosion and sediment control measures are detailed on the erosion and sediment control plan (DWG. 20003-ESC1) in **Appendix A**.

7.0 CONCLUSION

The proposed development of the property located at 5455 Boundary Road, into a hot mix asphalt plant (with associated features), can be accomplished. The subject site can be adequately serviced and provide stormwater management controls in accordance with the requirements of the City of Ottawa and South Nation Conservation Authority (SNCA). Specifically, the on-site servicing and stormwater management design will include the following key design features:

- Enhanced level (80 percent TSS removal) quality control of stormwater runoff will be provided by an on-site SWM pond.
- Post-development flows will be controlled to less than pre-development levels (for the 5 year and 100 year design storm events) by use of an orifice and weir controls.
- An off-site outlet ditch will be utilized to convey stormwater outflows from the subject site to the pre-development outlet.
- Erosion and sediment control measures will be implemented and maintained until construction has been completed.

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Reviewed By:

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S. M. CZAHARYNSKI
JULY 8 2020
PROVINCE OF ONTARIO

Sean M. Czaharynski, P.Eng.
Manager – Land Development

Appendix A

Site Plan
(DWG. 20003-SP1)

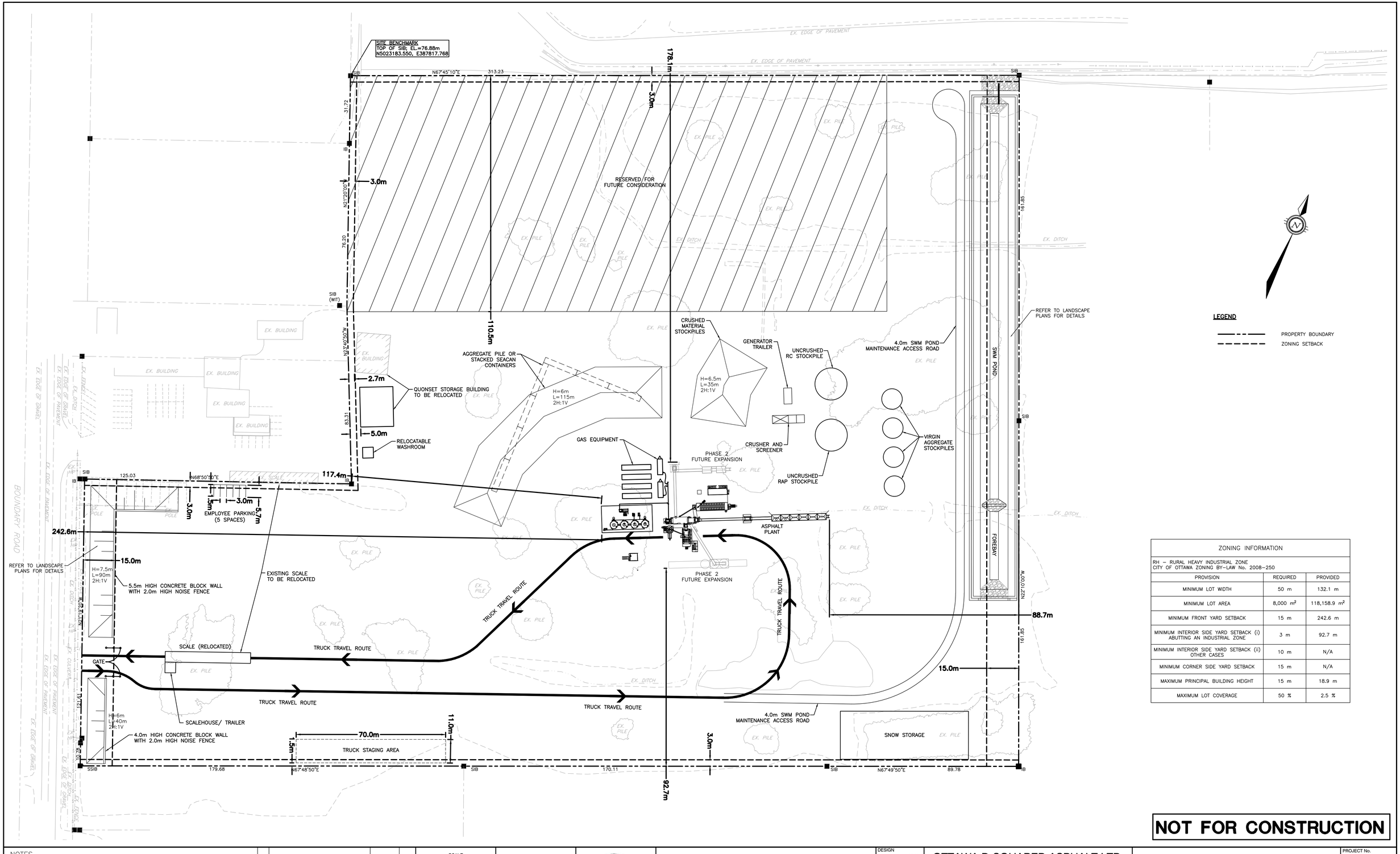
Grading Plan
(DWG. 20003-GR1)

Erosion and Sediment Control Plan
(DWG. 20003-ESC1)

SWM Pond Details
(DWG. 20003-D1)

SWM Pond and Off-Site
Outlet Ditch Details
(DWG. 20003-D2)

Off-Site Outlet Ditch Details
(DWG. 20003-D3)



ZONING INFORMATION		
RH – RURAL HEAVY INDUSTRIAL ZONE CITY OF OTTAWA ZONING BY–LAW No. 2008–250		
PROVISION	REQUIRED	PROVIDED
MINIMUM LOT WIDTH	50 m	132.1 m
MINIMUM LOT AREA	8,000 m^2	118,158.9 m^2
MINIMUM FRONT YARD SETBACK	15 m	242.6 m
MINIMUM INTERIOR SIDE YARD SETBACK (i) ABUTTING AN INDUSTRIAL ZONE	3 m	92.7 m
MINIMUM INTERIOR SIDE YARD SETBACK (ii) OTHER CASES	10 m	N/A
MINIMUM CORNER SIDE YARD SETBACK	15 m	N/A
MAXIMUM PRINCIPAL BUILDING HEIGHT	15 m	18.9 m
MAXIMUM LOT COVERAGE	50 %	2.5 %

NOT FOR CONSTRUCTION

NOTES

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

GEODETIC SURVEY DERIVED FROM COSINE STATION 00819678105. LOCATION DESCRIPTION: GALVANIZED PIPE WITH BRONZE CAP NBENCH MARK ON THE WEST SIDE OF BOUNDARY ROAD, 1.6 KM SOUTH OF RUSSELL ROAD. BENCHMARK IS 10.7M WEST OF CENTERLINE OF BOUNDARY ROAD AND IS MARKED BY A YELLOW AND BLACK PICKET. VERTICAL CONTROL DATA, DATUM: CGVD2013, FIRST ORDER, ELEVATION: 79.733. COORDINATE SYSTEM: MTM ZONE 9; NAD 83 DATUM (CAN83–9)

NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR SITE PLAN APPLICATION	08/07/20	SMC

SCALE
0 5m 10m 30m
HORIZONTAL 1/750

LICENSED PROFESSIONAL ENGINEER S. M. CZARNOWSKI PROVINCE OF ONTARIO

Robinson Land Development
350 Palladium Drive
Ottawa, ON K2V 1A8
(613) 592-6060 rcii.com

DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

OTTAWA D-SQUARED ASPHALT LTD.
6811 HIRAM ROAD, GREELY, ON

5455 BOUNDARY ROAD
OTTAWA, ON

SITE PLAN

PROJECT No.	20003
SURVEY	RLD
DATED	JULY 2020
DWG. No:	20003-SP1

NOT FOR CONSTRUCTION

LEGEND

- PROPERTY BOUNDARY
- 76.00 — PROPOSED GRADE
- 1.0% — PROPOSED DRAINAGE SLOPE
- × 76.00 — EXISTING ELEVATION
- DRAINAGE SWALE
- EXISTING DITCH
- MAJOR OVERLAND FLOW ROUTE

SITE BENCHMARK
TOP OF SIB: EL=76.88m
N5023183.550, E387817.768

N67°45'10"E 313.23

MATCH EXISTING ELEVATIONS ALONG PROPERTY LINE

MATCH EXISTING ELEVATIONS ALONG PROPERTY LINE

N21°20'00"W 76.20

RESERVED FOR FUTURE CONSIDERATION

REFER TO POND DETAILS ON DWG. 20003-D1

SIB (WIT) 78.00

N20°50'00"W 83.31

EX. BUILDING

QUONSET STORAGE BUILDING TO BE RELOCATED

RELOCATABLE WASHROOM

AGGREGATE PILE OR STACKED SEACAN CONTAINERS

CRUSHED MATERIAL STOCKPILES

GENERATOR TRAILER

UNCRUSHED RC STOCKPILE

4.0m SWM POND MAINTENANCE ACCESS ROAD

SWM POND

MATCH EXISTING ELEVATIONS ALONG PROPERTY LINE

H=6m L=115m 2H:1V

H=6.5m L=35m 2H:1V

GAS EQUIPMENT

CRUSHER AND SCREENER

PHASE 2 FUTURE EXPANSION

UNCRUSHED RAP STOCKPILE

VIRGIN AGGREGATE STOCKPILES

ASPHALT PLANT

PHASE 2 FUTURE EXPANSION

EMPLOYEE PARKING (5 SPACES)

EXISTING SCALE TO BE RELOCATED

H=7.5m L=90m 2H:1V

5.5m HIGH CONCRETE BLOCK WALL WITH 2.0m HIGH NOISE FENCE

SCALE (RELOCATED)

GATE

SCALEHOUSE/ TRAILER

H=6m L=40m 2H:1V

4.0m HIGH CONCRETE BLOCK WALL WITH 2.0m HIGH NOISE FENCE

TRUCK TRAVEL ROUTE

TRUCK STAGING AREA

4.0m SWM POND MAINTENANCE ACCESS ROAD

SNOW STORAGE

N68°50'50"E 125.03

N67°48'50"E 179.68

N67°49'50"E 170.11 89.78

N22°10'00"W 161.85

MATCH EXISTING ELEVATIONS ALONG PROPERTY LINE

MATCH EXISTING ELEVATIONS ALONG PROPERTY LINE

BOUNDARY ROAD

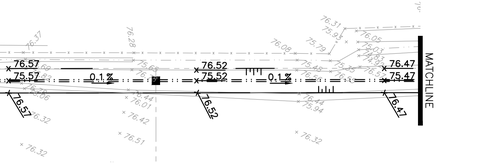
EX. EDGE OF GRAVEL

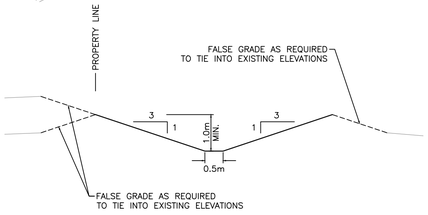
EX. EDGE OF PAVEMENT

EX. DITCH

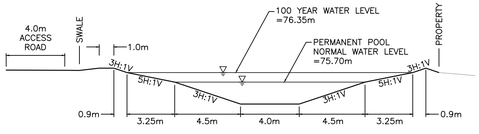
EX. CULVERT

EX. PILE

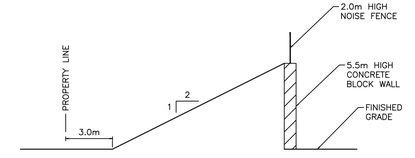




OFF-SITE OUTLET DITCH
SECTION B-B (TYP.)
N.T.S.



SWM POND
SECTION C-C (TYP.)
N.T.S.



SECTION D-D
N.T.S.

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR SITE PLAN APPLICATION	08/07/20	SMC

SCALE
0 5m 10m 30m
HORIZONTAL 1:750

LICENSED PROFESSIONAL ENGINEER
S. M. CZAMANSKI
PROVINCE OF ONTARIO
July 6, 2020

Robinson Land Development
350 Palladium Drive
Ottawa, ON K2V 1A8
(613) 592-6060 rcii.com

DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

OTTAWA D-SQUARED ASPHALT LTD.
6811 HIRAM ROAD, GREELY, ON

5455 BOUNDARY ROAD
OTTAWA, ON

GRADING PLAN

PROJECT No.	20003
SURVEY	RLD
DATED	JULY 2020
DWG. No:	20003-GR1

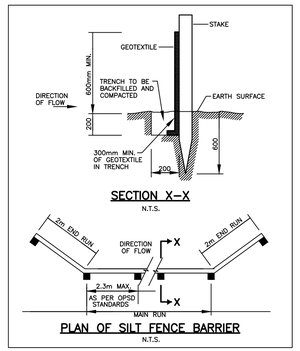
NOT FOR CONSTRUCTION

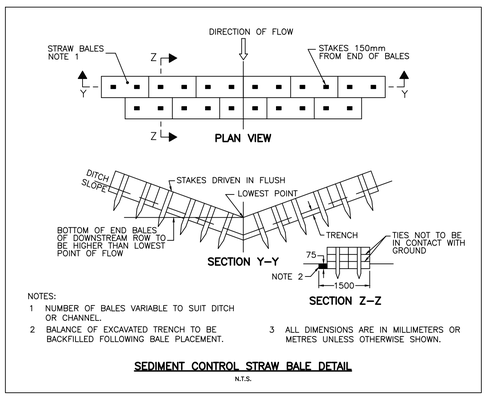
LEGEND

- PROPERTY BOUNDARY
- DRAINAGE SWALE
- EXISTING DITCH
- SILT FENCE
- STRAW BALE CHECK DAM

SITE BENCHMARK
TOP OF SIB: EL.=76.88m
N5023183.550, E387817.768

SIB
N67°45'10"E
313.23
31.72
IB
N21°20'00"W
76.20
SILT FENCE AS PER DETAIL
SIB (WIT)
N23°40'50"W
83.31
IB
SIB
125.03
N68°50'50"E
IB
EMPLOYEE PARKING (5 SPACES)
EX. POLE
EX. POLE
H=7.5m
L=90m
2H:1V
5.5m HIGH CONCRETE BLOCK WALL WITH 2.0m HIGH NOISE FENCE
N21°9'40"W
EXISTING SCALE TO BE RELOCATED
SCALE (RELOCATED)
GATE
H=6m
L=40m
2H:1V
4.0m HIGH CONCRETE BLOCK WALL WITH 2.0m HIGH NOISE FENCE
10.26
SCALEHOUSE/ TRAILER
SSIB
179.68
N67°48'50"E
TRUCK STAGING AREA
SIB
SILT FENCE AS PER DETAIL
170.11
SIB
N67°49'50"E
89.78
IB
SNOW STORAGE
4.0m SWM POND MAINTENANCE ACCESS ROAD
TRUCK TRAVEL ROUTE
TRUCK TRAVEL ROUTE
TRUCK TRAVEL ROUTE
TRUCK TRAVEL ROUTE
QUONSET STORAGE BUILDING TO BE RELOCATED
RELOCATABLE WASHROOM
AGGREGATE PILE OR STACKED SEACAN CONTAINERS
H=6m
L=115m
2H:1V
CRUSHED MATERIAL STOCKPILES
H=6.5m
L=35m
2H:1V
GENERATOR TRAILER
UNCRUSHED RC STOCKPILE
CRUSHER AND SCREENER
UNCRUSHED RAP STOCKPILE
GAS EQUIPMENT
PHASE 2 FUTURE EXPANSION
ASPHALT PLANT
PHASE 2 FUTURE EXPANSION
RESERVED FOR FUTURE CONSIDERATION
REFER TO POND DETAILS ON DWG. 20003-D1
4.0m SWM POND MAINTENANCE ACCESS ROAD
VIRGIN AGGREGATE STOCKPILES
SWM POND
FOREBAY
SILT FENCE AS PER DETAIL
STRAW BALE CHECK DAM AS PER DETAIL
SILT FENCE AS PER DETAIL
STRAW BALE CHECK DAM AS PER DETAIL
MATCHLINE
SILT FENCE AS PER DETAIL
STRAW BALE CHECK DAM AS PER DETAIL
MATCHLINE
STRAW BALE CHECK DAM AS PER DETAIL
SILT FENCE AS PER DETAIL
SIB
161.85
N22°10'00"W
161.85
IB
EX. EDGE OF PAVEMENT
EX. EDGE OF GRAVEL
EX. TREE LINE
EX. EDGE OF PAVEMENT
EX. EDGE OF GRAVEL
EX. TOP OF BANK
EX. EDGE OF PAVEMENT
EX. EDGE OF GRAVEL
EX. TOP OF BANK
EX. EDGE OF PAVEMENT
EX. EDGE OF GRAVEL
EX. TOP OF BANK
BOUNDARY ROAD
EX. BUILDING
EX. BUILDING
EX. BUILDING
EX. BUILDING
EX. BUILDING
EX. PILE
EX. DITCH
EX. EDGE OF PAVEMENT
EX. SCALE





NOTES:
1. NUMBER OF BALES VARIABLE TO SUIT DITCH OR CHANNEL.
2. BALANCE OF EXCAVATED TRENCH TO BE BACKFILLED FOLLOWING BALE PLACEMENT.
3. ALL DIMENSIONS ARE IN MILLIMETERS OR METRES UNLESS OTHERWISE SHOWN.

SEDIMENT CONTROL STRAW BALE DETAIL
N.T.S.

NOTES:

1. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED WHERE INDICATED AND MAINTAINED DURING CONSTRUCTION UNTIL VEGETATION HAS BEEN REESTABLISHED.
2. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED ONCE EVERY TWO WEEKS AND AFTER EACH SIGNIFICANT STORM EVENT (>25mm OF RAIN IN 24 HOUR PERIOD). CONTROLS WHICH HAVE ACCUMULATED SEDIMENT OR REQUIRE REPAIR SHALL BE ADDRESSED IMMEDIATELY IN ACCORDANCE WITH OPSS 805.
3. DURING THE COURSE OF CONSTRUCTION, IF THE ENGINEER BELIEVES THAT ADDITIONAL PREVENTION METHODS ARE REQUIRED TO CONTROL EROSION AND SEDIMENTATION, THE CONTRACTOR SHALL IMPLEMENT ADDITIONAL MEASURES, AS REQUIRED, TO THE SATISFACTION OF THE ENGINEER.
4. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH OPSS 805 – CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES.
5. SILT FENCE SHALL BE INSTALLED IN ACCORDANCE WITH OPSD 219.110.
6. STRAW BALE CHECK DAMS SHALL BE INSTALLED IN ACCORDANCE WITH OPSD 219.180.
7. THE CONTRACTOR SHALL IMPLEMENT BEST MANAGEMENT PRACTICES, TO PROVIDE FOR PROTECTION OF THE AREA DRAINAGE SYSTEM 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.

NOTES

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NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR SITE PLAN APPLICATION	08/07/20	SMC

SCALE
0 5m 10m 30m
HORIZONTAL 1:750

LICENSED PROFESSIONAL ENGINEER S. M. CZARDYBON JULY 6, 2020 PROVINCE OF ONTARIO

Robinson Land Development
350 Palladium Drive
Ottawa, ON K2V 1A8
(613) 592-6060 rcii.com

DESIGN	BLM
CHECKED	SMC
DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

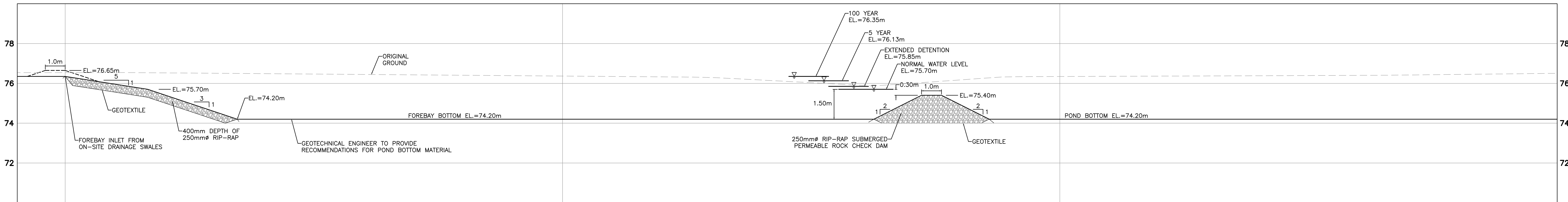
OTTAWA D-SQUARED ASPHALT LTD.
6811 HIRAM ROAD, GREELY, ON

5455 BOUNDARY ROAD
OTTAWA, ON

EROSION AND SEDIMENT CONTROL PLAN

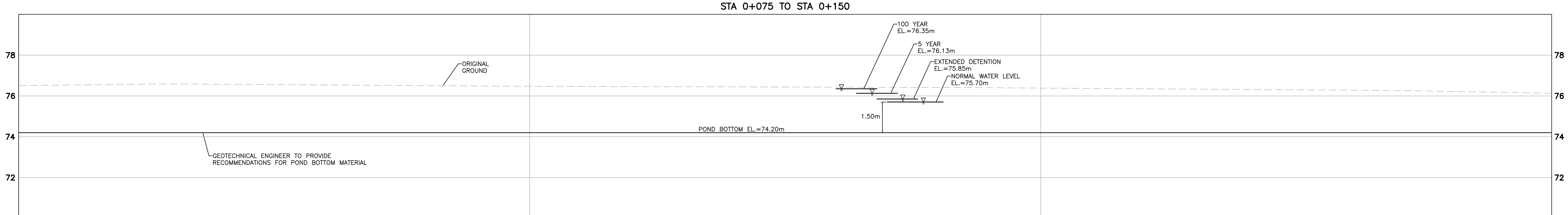
PROJECT No.	20003
SURVEY	RLD
DATED	JULY 2020
DWG. No:	20003-ESC1

SECTION A–A
STA 0+000 TO STA 0+075



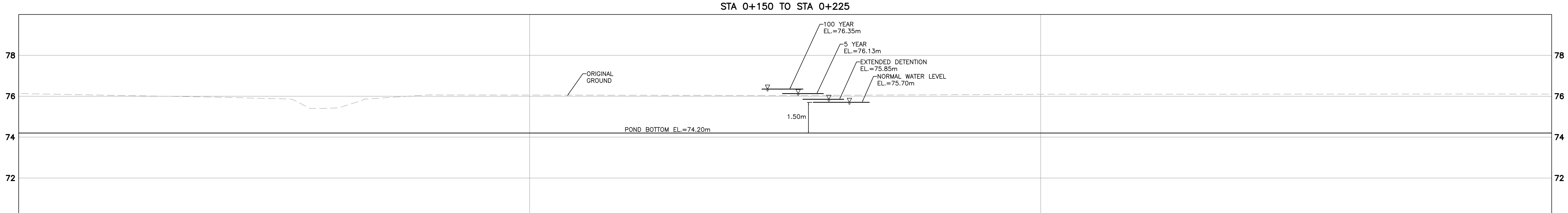
FINISHED GRADE	76.35	75.70	74.20	74.20	74.20	75.40	75.40	74.20	74.20	74.20	FINISHED GRADE
ORIGINAL GROUND ELEVATION	76.54			76.37					76.34	76.50	ORIGINAL GROUND ELEVATION
STATION	0+000			0+025					0+050	0+075	STATION

SECTION A–A
STA 0+075 TO STA 0+150



FINISHED GRADE	74.20	74.20	74.20	74.20	FINISHED GRADE
ORIGINAL GROUND ELEVATION	76.50	76.47	76.38	76.13	ORIGINAL GROUND ELEVATION
STATION	0+075	0+100	0+125	0+150	STATION

SECTION A–A
STA 0+150 TO STA 0+225



FINISHED GRADE	74.20	74.20	74.20	74.20	FINISHED GRADE
ORIGINAL GROUND ELEVATION	76.13	76.06	76.10	76.10	ORIGINAL GROUND ELEVATION
STATION	0+150	0+175	0+200	0+225	STATION

NOT FOR CONSTRUCTION

NOTES

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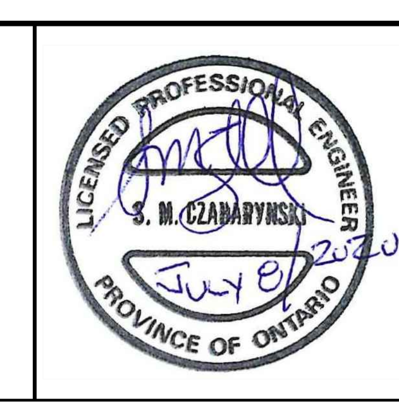
NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR SITE PLAN APPLICATION	08/07/20	SMC

SCALE
HORIZONTAL 1:100 (0, 1m, 2m, 4m)
VERTICAL 1:50 (0, 0.5m, 1m, 2m)



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CHECKED	SMC
APPROVED	SMC

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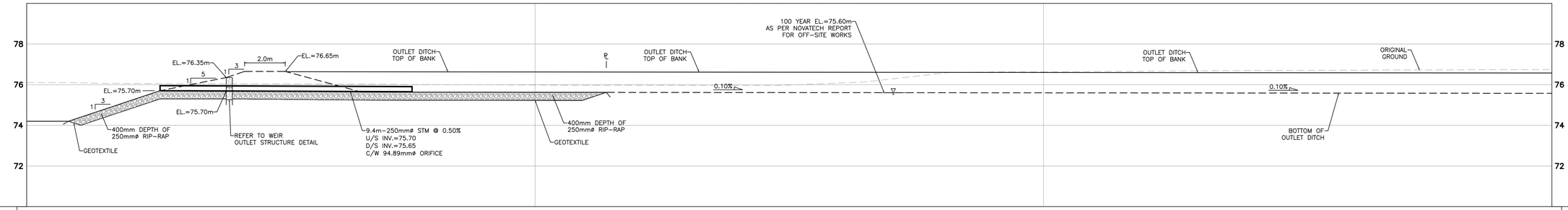
5455 BOUNDARY ROAD
OTTAWA, ON

SWM POND DETAILS

PROJECT No.	20003
SURVEY	RLD
DATED	JULY 2020
DWG. No:	20003-D1

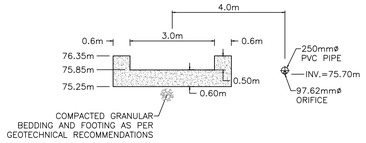
SECTION A–A
STA 0+150 TO STA 0+300



FINISHED GRADE	74.20	74.20	75.70	76.35	76.85	76.85	75.62	75.62	75.60	75.57	FINISHED GRADE
ORIGINAL GROUND ELEVATION	*76.10*						*75.98*		*76.63*	*76.75*	ORIGINAL GROUND ELEVATION
STATION	**0+225**						**0+250**		**0+275**	**0+300**	STATION

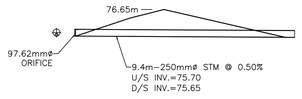
SECTION A–A
STA 0+300 TO STA 0+375

FINISHED GRADE	75.57	75.55	75.52	75.50	FINISHED GRADE
ORIGINAL GROUND ELEVATION	*76.75*	*76.62*	*76.64*	*76.54*	ORIGINAL GROUND ELEVATION
STATION	**0+300**	**0+325**	**0+350**	**0+375**	STATION



OUTLET DETAIL
ELEVATION
N.T.S.

OUTLET WEIR DETAIL
CROSS–SECTION
N.T.S.



OUTLET ORIFICE DETAIL
CROSS–SECTION
N.T.S.

NOT FOR CONSTRUCTION

NOTES

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SCALE
HORIZONTAL 1:100 (0, 1m, 2m, 4m)
VERTICAL 1:50 (0, 0.5m, 1m, 2m)

LICENSED PROFESSIONAL ENGINEER S. M. CZAJKOWSKI PROVINCE OF ONTARIO

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DESIGN	BLM
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DRAWN	BLM
CHECKED	SMC
APPROVED	SMC

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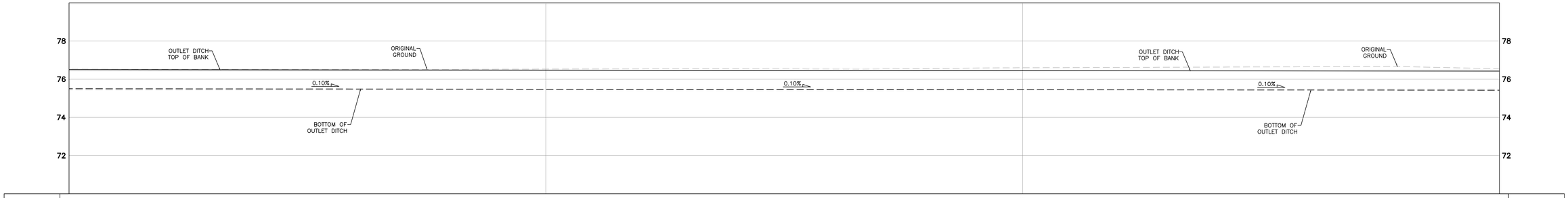
5455 BOUNDARY ROAD
OTTAWA, ON

SWM POND AND OFF-SITE OUTLET DITCH DETAILS

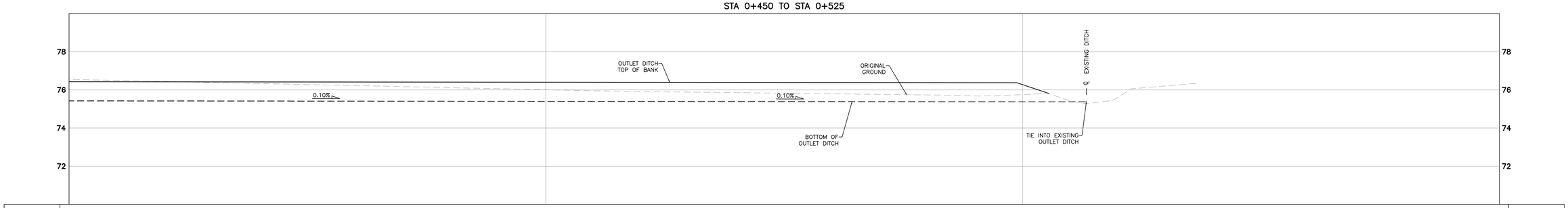
PROJECT No.	20003
SURVEY	RLD
DATED	JULY 2020
DWG. No:	20003-D2

SECTION A–A
STA 0+375 TO STA 0+450



FINISHED GRADE	75.50	75.47	75.45	75.42
ORIGINAL GROUND ELEVATION	76.54	76.53	76.60	76.55
STATION	0+375	0+400	0+425	0+450

SECTION A–A
STA 0+450 TO STA 0+525



FINISHED GRADE	75.42	75.40	75.37	75.37	
ORIGINAL GROUND ELEVATION	76.55	76.01	75.75		
STATION	0+450	0+475	0+500		0+525

NOT FOR CONSTRUCTION

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NO.	REVISION DESCRIPTION	DATE	BY
1	ISSUED FOR SITE PLAN APPLICATION	08/07/20	SMC

SCALE

HORIZONTAL 1:100 (0, 1m, 2m, 4m)

VERTICAL 1:50 (0, 0.5m, 1m, 2m)

LICENSED PROFESSIONAL ENGINEER — S. M. CHAMPAGNE — JULY 8, 2020 — PROVINCE OF ONTARIO

Robinson Land Development
350 Palladium Drive
Ottawa, ON K2V 1A8
(613) 592-6060 rcii.com

DESIGN	BLM
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CHECKED	SMC
APPROVED	SMC

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5455 BOUNDARY ROAD
OTTAWA, ON

OFF-SITE OUTLET DITCH DETAILS

PROJECT No.	20003
SURVEY	RLD
DATED	JULY 2020
DWG. No:	20003-D3

Appendix B

Pre-Consultation Notes

Time of Concentration Calculations

Runoff Coefficient Calculations

SWM Pond Stage-Storage

SWM Pond Stage-Discharge

Drawdown Time Calculations

Storage Volume Tables

Outlet Ditch Sizing Calculations

RE: 5455 Boundary Road - precon-notes

MA

McAlpine, Anissa <anissa.mcalpine@ottawa.ca>
To Jocelyn Chandler
Cc Rehman, Sami; James Holland; Alvey, Harry; Giampa, Mike; Kapusta, Stephen (MTO)

Hi Jocelyn,

Below are the pre-con notes. I know you and your team also asked about existing building permits and site plan agreements for the site. I made a request through our records department and came up with nothing. This does not mean that there is no history of approvals on site- but I will be treating all uses as "new" on the property and not "existing". Pomerleau's business on the site, if they are going to persist on any part of the property, should come in for site plan approval as well.

Please do not hesitate to let me know if you have any questions or comments- or still wish to have a telecon.

Anissa

Pre-Application Consultation Meeting Notes
Meeting held January 8th 2020
Property Address: 5455 Boundary Road
File PC-19-0337

Attendees:
Anissa McAlpine City of Ottawa –Planner and File Lead
(613)580-2424 ext. 26282, anissa.mcalpine@ottawa.ca
Harry Alvey, City of Ottawa, Project Manager
(613)580-2424 ext. 28103, Harry.Alvey@Ottawa.ca
Mike Giampa – Project manager, Infrastructure approvals
James Holland– South Nation Conservation Authority
Stephen Kapusta – Planner- Ministry of Transpiration via telephone

Regrets:
Sami Rehman – Environmental Planner, City of Ottawa

Subject:
- The applicant has requested to meet in advance of a site plan application to erect an asphalt plant.
- Property approx. 11.85 ha

- Install relocatable asphalt plant (batch plant), top be propane powered. The location of the plant on the site will be determined once site investigation and studies to support ECA's bring forward recommendations
- Private services for water and wastewater
- Building significantly less than 600 m2
- Plant to be dropped off in May 2020, with hopes of operating by June or July at the latest 2020.
- Adjacent land uses include other industrial uses. To the rear of the site will be, and natural heritage features are found opposite Boundary road.

Planning Considerations

Official Plan

- The property is designated rural Employment Lands in the City of Ottawa's Official Plan Schedule A. Rural Employment Areas are intended to support and encourage clustering of primarily industrial uses not suitable in the Urban Area or General Rural Area (section 3.7.5).
- Uses permitted within rural employment areas include: New heavy and light industrial uses, such as steel and concrete fabrication, farm equipment and supply centres, machine and vehicle sales service and repair, construction yards, building products yards, landscape contractors, nurseries. The proposed use would appear to be appropriate in the current land use designation.
- **Development will be subject to Site Plan Control** and particular attention will be given to the physical design of the building and site including signage, buffering, landscaping and fencing. In particular suitable screening and landscaping must be provided for any new external storage areas for goods, material and equipment that abut a highway or arterial road.
- All new development must be supportable on individual well and septic systems unless the City agrees to the development of a number of sites on the basis of a small water and wastewater works as described in Section 4.4.2.4.

Zoning By-law

- The property is currently zoned RH (Rural Heavy Industrial) for which the purpose is to *accommodate a range of heavy industrial uses and limited service commercial uses at locations which are neither environmentally sensitive nor in close proximity to incompatible land uses*
- *Permitted uses include: light industrial use and heavy industrial use, storage yard.*
- *Zone provisions are provided in Table 221.*

Other

- MOECP requirements- Environmental compliance approvals are required for wastes: noise, dust as well as industrial storm water. The City does not concern

itself with dust or noise – however would ask to be notified when such approvals are obtained.
- The property appears to be outside the site alteration by-law, as identified on Schedule B of By-law 2018-164.
- The site has the potential to be contaminated. Pursuant to policy 4.8.4 of the City's official plan a Phase 1 ESA will be required, completed in accordance with Ontario Regulation 153/04. Where the Phase 1 ESA indicates that the property may be contaminated a Phase 2 ESA will also be required.

Engineering Considerations

- The Carlsbad Trickle Feed watermain extends to the south edge of this site along Boundary Rd. and there is one connection which is allotted to this site. The Trickle Feed water is limited to 2,700 L/day and can only be used for potable water.
- A Stormwater Management report needs to be prepared comparing pre to post for 5yr and 100yr storm events. This site will be required to achieve 80% TSS removal for any stormwater discharged from this site. This will require a Direct submission of an ESA for this site. The ESA will need to be routed through the City for their review and sign off prior to going to MECP.
- Due to the nature of the proposed business and the process materials that are used in this proposed plant it is suggested you contact Allan Evans, P.Eng at Ottawa Fire Services (Ph# (613) 580-2424 Ext. 24119) to determine if and what fire suppression apparatus/equipment may be needed/supplied.
- A Geotechnical study will also be required

Hydrogeological Considerations

- Groundwater in the area is known to be poor quality and is likely mineralized (as per the definition in O.Reg 903). The Wells Regulation states that if a well is constructed with mineralized water, the well must be immediately abandoned unless there is written permission from the Director (MECP) to not abandon the well. (Note that we went through this process with an industrial development on Mitch Owens road in July 2019, and we can follow a similar process).
- If the site will connect to the Carlsbad Springs trickle feed system the hydrological assessment will not be required to including an assessment of water quantity, water quality, hydrogeological impacts (on neighboring properties).
- An assessment of septic impacts does need to be provided.

Transportation and Noise Considerations

- Boundary Road has become significantly busier with the addition of Amazon so a TIA will be required.
- As per the submitted screening form, a TIA is warranted, and the process has been started by CGH consultants
- Steps 1-4 of the TIA should be submitted prior to an application
- Any road works required to accommodate the development will be at the proponent's cost
- Due to the additional traffic generated by Amazon and other proposed developments along Boundary Road, an appropriate access location and throat length will be required
- While the site is not in the MTO's permit control area, they will review and comment on the TIA
- There are no noise sensitive land uses within 100m of the site- therefore a stationary noise study is not required

Environmental Considerations

- The city's mapping identifies several watercourses on the property. Per the official plan and the Zoning bylaw, section 69, a minimum setback of: a) 30 m to the normal high-water mark of any watercourse or waterbody, or; b)15 m to the top of the bank of any watercourse or waterbody, whichever is the greater, must be provided unless, as established through conditions of approval, a different setback is determined to be appropriate in accordance with the criteria set forth in the Official Plan.
- The nature and extent of these watercourses will need to be confirmed and follow-up conversations may be necessary to determine the appropriate course of action.
- The applicant is expected to review recently completed studies identifying watercourses on this and adjacent properties. Watercourse identification and recommendations will need to take in to consideration, be compatible or improve any planned watercourse changes on adjacent properties.
- Watercourse setbacks may be addressed in a planning rational, alternatively a watercourse evaluation may be provided under separate cover.
- The applicant is recommended to consult with the South Nation Conservation Authority to determine what studies, approvals or permits are required under their regulations.
- The applicant should also visit the DFO website, "Projects Near Water" to verify if their project needs DFO review. https://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html

Design Considerations

- The public frontage of the site should be designed to include high quality landscaping.

- Fencing requirements
- Note that in the heavy rural industrial zone, outside storage is not permitted within any required front yard or corner side yard and outside storage must be screened from abutting residential uses and public streets by an opaque screen at least 1.8 metres in height from finished grade.
- Site plan should show the fencing will be located within the property boundary and not within the Municipal road allowance.

South Nation Conservation Authority Comments

- The landowner is responsible for confirming the existence watercourses and completing a DFO self assessment to determine whether a request for review is required.
- Interference with a watercourse may require a permit under O. Regulation 170/06 and restrictions may apply.
- The landowner immediately behind the property (Resource Recovery Center) completed a headwater drainage feature assessment and did not identify the mapped watercourses shown to extend onto the subject property. It is likely that these features no longer exist. The following study provides this information:
    - HEADWATER DRAINAGE FEATURES ASSESSMENT CAPITAL REGION RESOURCE RECOVERY CENTRE (CRRRC) LANDS, OTTAWA, ON. Prepared by Golder Associates. Project No. 1787048. Dated April 26, 2018.

Development Applications Required

To move forward with this proposal, a Site plan control, rural small (staff approval, no public consolation will be required. Please review the fees associated with this here.

Attached is the *Applicant's Study and Plan Identification List*, which identifies the required studies and plans to support your application. For additional information on preparing studies and plans, please click on the following hyperlink: Guide to Preparing Studies and Plans.

An ECA (direct submission via the city of Ottawa) to the Ministry of Environment for the industrial stormwater is required.

As you may know, the property is in Ward 19-Cumberland, with Councillor Stephen Blais. It is in your best interest to initiate contact with close neighbours as well as the Councillor and Registered Community Groups. In addition, it may be beneficial to contact key technical agencies that may be involved in this file to discuss the proposal before submitting an application.

You may also want to reference information available on the City's website for building permits/demolition permits and development charges as well. For additional information

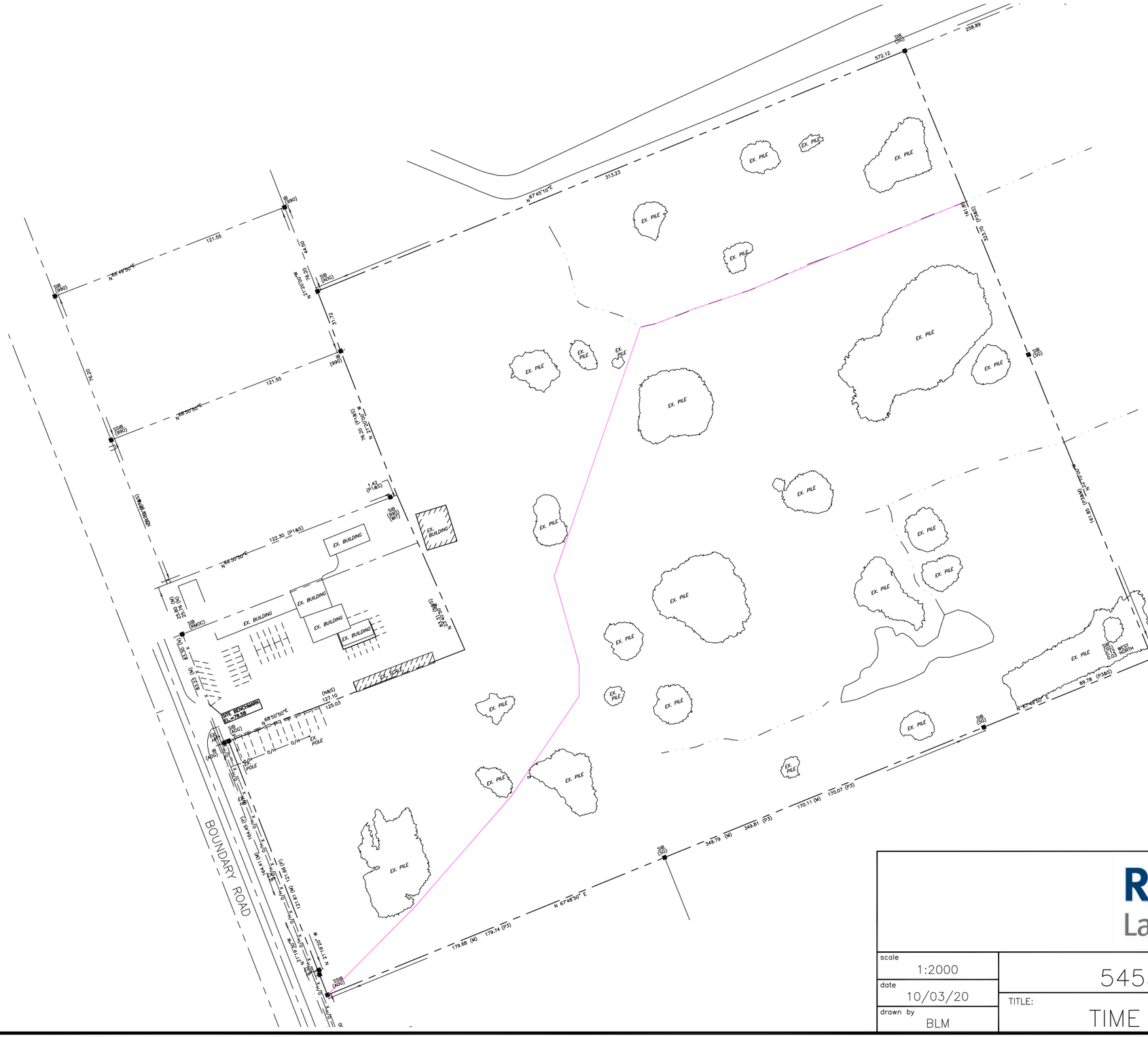
on these items, please follow the following associated links: Building Permits or Development Charges. Please contact Building Code Services if you have any questions regarding permits or charges; they can be reached by phoning 311.

The above pre-consultation comments are valid for one year. If you submit a development application after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change.

Please do not hesitate to contact me if you have questions or require clarification.

Anissa McAlpine, *MCIP RPP*
Planner
Development Review, Rural Services
Planning, Infrastructure and Economic Development Department

City of Ottawa
110 Laurier Avenue West
Ottawa, ON, K1P 1J1
613.580.2424 ext. 26282



Robinson
Land Development

scale 1:2000	5455 BOUNDARY ROAD	project no. 20003
date 10/03/20	TITLE: TIME OF CONCENTRATION	Tc
drawn by BLM		

Runoff Coefficient Calculations

Drainage Area ID	Impervious Area (ha)	Pervious Area (ha)	Gravel Area (ha)	Total Area (ha)	C	C (100 YR)
PRE	0.03	0.00	11.79	11.82	0.70	0.88
POST	0.73	0.45	10.64	11.82	0.69	0.87

Notes:

1. $C_{impervious}$=0.90, $C_{pervious}$=0.20, C_{gravel}=0.70
2. 100 Year C = C + 25% (Max.=1.0)

Wet Pond Stage-Storage

Stage	Elevation (m)	Area (m^2)	Depth (m)	Provided Storage Volume			
				Forebay (m^3)	Main Cell (m^3)	Total	
						Active (m^3)	Total (m^3)
Bottom Pond	74.20	850.44	0.00	0.00	0.00	0.00	0.00
Top Submerged Berm	75.40	2515.62	1.20	323.52	1678.84	0.00	2002.36
Permanent Pool	75.70	2956.32	1.50	323.52	2501.15	0.00	2824.67
Extended Detention	75.85	3336.99	1.65	323.52	2974.47	473.32	3297.99
5 Year	76.13	4024.77	1.93	323.52	4004.76	1030.29	4328.28
100 Year	76.35	4575.86	2.15	323.52	4950.67	1976.20	5274.19

Notes:

1. For calculation purposes, forebay volume is constant once top of submerged berm elevation is reached.
2. 100 Year active storage volume = total storage @ 100 year - total storage @ extended detention.
3. 5 Year active storage volume = total storage @ 5 year - total storage @ extended detention.
4. Extended detention active volume = total storage @ extended detention - total storage @ permanent pool.

Orifice Design Parameters

Centre of Orifice Elev. (m)	Head (m)	Max. Outflow (L/s)	Max. Outflow (m^3/s)	Orifice Area (m^2)	Orifice Diameter (mm)	Orifice Type
75.750	0.10	6.50	0.007	0.0075	97.62	Circular

Weir Design Parameters

Crest Elev. (m)	Crest Width (m)	Weir Coefficient
75.85	3.00	1.84

Wet Pond Stage-Discharge

Stage	Elevation (m)	Discharge (L/s)			Discharge (m^3/s)		
		Orifice	Weir	Total	Orifice	Weir	Total
Pond Bottom	74.20	0.0	0.0	0.0	0.000	0.000	0.000
Permanent Pool	75.70	0.0	0.0	0.0	0.000	0.000	0.000
Extended Detention	75.85	6.5	0.0	6.5	0.007	0.000	0.0065
5 Year	76.13	12.7	817.9	830.5	0.013	0.818	0.831
100 Year	76.35	15.9	1951.6	1967.5	0.016	1.952	1.968
Pond Top	76.65	19.5	3949.8	3969.3	0.020	3.950	3.969

C2 =	2314.5	
C3 =	3215.8	
h =	0.05	m
g =	9.81	m/s^2
A =	0.0075	m^2

t =	72403	s
t =	20.1	hr

Linear Regression:

Y2 =	3337.0	X2 =	0.05
Y1 =	3215.8	X1 =	0

C2 =	2314.5
C3 =	3215.8

$$t = \frac{2 A_p}{C A_o (2g)^{0.5}} \left(h_1^{0.5} - h_2^{0.5} \right)$$ **Equation 4.10: Drawdown Time**

or if a relationship between A_p and h is known (i.e., $A = C_2 h + C_3$)

$$t = \frac{0.66 C_2 h^{1.5} + 2 C_3 h^{0.5}}{2.75 A_o}$$ **Equation 4.11**

where
- t = drawdown time in seconds
- A_p = surface area of the pond (m^2)
- C = discharge coefficient (typically 0.63)
- A_o = cross-sectional area of the orifice (m^2)
- g = gravitational acceleration constant (9.81 m/s^2)
- h_1 = starting water elevation above the orifice (m)
- h_2 = ending water elevation above the orifice (m)
- h = maximum water elevation above the orifice (m)
- C_2 = slope coefficient from the area-depth linear regression
- C_3 = intercept from the area-depth linear regression

Post-Development Flow Calculations

Given:

Area (ha) =	11.82	5 Year Pre-Development Flow (L/s) =	1116.4
C =	0.69	100 Year Pre-Development Flow (L/s) =	2375.2
C (100 YR) =	0.87		

Return Period	Time (min)	Rainfall Intensity (mm/hr)	Flow (L/s)	Release Rate (L/s)	Net Runoff to be Stored (L/s)	Storage Required (m^3)
5 Year	5	141.2	3215.5	830.5	2385.0	715.5
	10	104.2	2373.1	830.5	1542.6	925.6
	15	**83.6**	**1903.1**	**830.5**	**1072.6**	**965.3**
	20	70.3	1600.1	830.5	769.5	923.4
	25	60.9	1387.0	830.5	556.5	834.7
	30	53.9	1228.3	830.5	397.7	715.9
100 Year	5	242.7	6909.8	1967.5	4942.3	1482.7
	10	178.6	5083.6	1967.5	3116.1	1869.7
	15	**142.9**	**4068.2**	**1967.5**	**2100.7**	**1890.6**
	20	120.0	3415.0	1967.5	1447.5	1737.0
	25	103.8	2956.6	1967.5	989.0	1483.5
	30	91.9	2615.5	1967.5	648.0	1166.4

Notes:

1. Rainfall intensity calculated using City of Ottawa IDF curve equations.
2. Flow calculated using the Rational Method. (Q=2.78CiA)
3. $C_{100\ YR}$ = C + 25%
4. Release rate is based on combination of orifice and weir flow.

Outlet Ditch Sizing Calculations

Catchment Area	Return Period	Side Slope (m/m)	Ditch Slope (m/m)	Ditch Width (m)	Ditch Bottom Width, b (m)	Minimum Channel Depth, h (m)	Manning n Value	Flow, Q1 (m^3/s)	Flow Area (m^2)	Wetted Perimeter, WP (m)	Hydraulic Radius, R (m)	Velocity, V (m/s)	Calculated Flow, Q2 (m^3/s)	Q1/Q2
STM1	5 YR	0.333	0.001	6.50	0.500	0.679	0.033	0.831	1.723	4.794	0.359	0.484	0.834	1.00
STM1	100 YR	0.333	0.001	6.50	0.500	0.964	0.033	1.968	3.270	6.597	0.496	0.600	1.963	1.00

Notes:

1. Manning n value for rip-rap lined channel.
2. Flow, Q1, calculated using Rational Method. Refer to flow calculations.
3. Design based on trapezoidal shaped ditch.
4. To calculate minimum channel depth, h, iterate until Q1/Q2 is equal to 1.0.

Sample Calculations:

b - bottom width of ditch
h - height of ditch
z - side slope of ditch

Flow Area$= bh + 3h^2$

$R = A/WP$

$V = \frac{1}{n} R^{2/3} S^{1/2}$

$Q2 = A \times V$

$WP = b + 2h(1 + z^2)^{1/2}$