THE CORPORATION OF
TOWNSHIP OF WHITEWATER REGION

BY-LAW NUMBER 13-09-650

A By-Law authorizing the Township to enter into a Site Plan Agreement with the Cobden Travel Centre Inc.

WHEREAS the Cobden Travel Centre, Inc. is the owner of PT LT 1 CON 2 West Muskrat Lake, Part 1, Plan 49R-15080, WESTMEATH, TOWNSHIP OF WHITEWATER REGION known municipally as 18322 Highway 17;

AND WHEREAS the Cobden Travel Centre Inc. has made application to the Municipality to permit development of the lands;

AND WHEREAS the Municipality, by By-Law Number 09-04-379, has designated lands within the municipal limits as being subject to site plan control;

AND WHEREAS Section 41 of the Planning Act permits the registration of a Site Plan Agreement against the lands to which it applies in order to secure the provisions of certain works;

NOW THEREFORE the Council of the Corporation of the Township of Whitewater Region hereby ENACTS AS FOLLOWS:

1. **THAT** The Corporation of the Township of Whitewater Region enter into a Site Plan Agreement with the Cobden Travel Centre Inc., which agreement is attached and marked as Schedule "A" to this By-law.

2. **THAT** the Council of the Township of Whitewater Region hereby authorize the execution of this Agreement.

3. **THAT** the Mayor and CAO/Clerk be authorized to execute the said Site Plan Agreement together with all documents relating thereto, and further, to make such other motions as may be necessary to complete this matter.

THIS BYLAW shall come into effect upon the passing thereof and subsequent registration at the Land Registry Office for the Registry Division for the County of Renfrew.

All By-Laws or parts of By-Laws previously passed that are inconsistent with the provisions of By-Law 13-09-650 are hereby repealed.

PASSED this 18th day of September, 2013.

Jim Labow, MAYOR

Christine FitzSimons, CAO/CLERK

THIS SITE PLAN AGREEMENT made this 18th day of September, 2013
BETWEEN:

COBDEN TRAVEL CENTRE, INC.
Hereinafter called the "Owner"
OF THE FIRST PART

-AND-

THE CORPORATION OF THE TOWNSHIP OF WHITEWATER REGION
Hereinafter called the "Township"
OF THE SECOND PART

WHEREAS the "Owner" is the registered owner of the lands described in Schedule "A" attached hereto;

AND WHEREAS the "Owner" has applied to the Township to permit development on the Owner's lands;

AND WHEREAS Section 41 of the Planning Act, RSO 1990, C.P. 13, as amended, authorized municipalities to designate lands site plan control areas and to subsequently enter into agreements with respect to the conditions of development of lands so designated;

AND WHEREAS By-Law 09-04-379 of the Township of Whitewater Region designated the lands described in Schedule "A" attached hereto within the municipal limits as being subject to site plan control;

AND WHEREAS the Council of the "Township" has authorized the entering into of an agreement with respect to the development of the lands herein described.

NOW THEREFORE this Agreement witnesseth that in consideration of the mutual covenants hereinafter expressed and other good and valuable consideration, the parties hereto agree as follows:

1. **DEFINITIONS**

In this agreement;

"Chief Building Official" shall mean an employee of the Township of Whitewater Region who develops, administers, applies, interprets and enforces building code related statutes and holds a CBCO designation.

"Council" shall mean the Council of the Corporation of the Township of Whitewater Region;

"Development" means the construction, erection or placing of one or more buildings or structures on land or the making of an addition or alteration to a building or structure that has the effect of substantially increasing the size or usability thereof, or the laying out and establishment of a commercial parking lot or of sites for the location of three or more trailers as defined in subsection 164(4) of the Municipal Act or of sites for the location of three or more mobile homes as defined in subsection 46(1) of the Planning Act or of sites for the construction, erection or location of three or more land lease community homes as defined in subsection 46(1) of the Planning Act;

"Erect" means to build, construct, reconstruct or relocate and shall include any preliminary physical operations such as cutting, grading, excavating, filling or draining or any altering of an existing building by an addition, extension or other structural change for the doing of any work for which a building permit is required under the Building By-Law for the Municipality. The words "erect" and "erection" shall have a corresponding meaning;

"Maintain" includes repair;

"Owner" includes an individual, an association, a partnership or a corporation or any agent or contractor carrying out any works for the Owner as herein described or any subsequent Owner of any or all of the lands described in Schedule "A";

"Plan" means the proposed Plan submitted by the Owner for approval and includes the lands described in Schedule "A" and any Plan or Plans required in any supplementary agreements;

"Site Plan" means all of the plans included in Schedule "B" of this Agreement;

"Works" means the whole works, materials, matters and things required to be done or supplied and referred to in Schedule "C" of this Agreement or any supplementary agreement;

2. **SCHEDULES**

The following Schedules are attached hereto and form part of this Agreement:

"A" Description of lands to which this Agreement applies;

"B" Site Plan – Drawing prepared by FAD Group Architects, Project 1223 dated November 2012 – revised September 11, 2013;

"C" Schedule of "Works" to be constructed relating to this Agreement;

"D" Stormwater Design Brief entitled "Stormwater Design Brief – Cobden Travel Centre" dated August 2013 by The Greer Galloway Group Inc.

3. **GENERAL PROVISIONS**

a) Every provision of this Agreement by which the "Owner" is obligated in any way, or where the "Township" performs an obligation of the "Owner", shall be deemed to include the works, "at the sole expense of the Owner", unless otherwise expressly stated. The cost of any work done by the "Township" which is identified in this Agreement as an obligation of the "Owner" shall be calculated by the "Township", and invoiced to the "Owner".

b) The "Owner" agrees to maintain the works and facilities provided on the site and off-site pursuant to this Agreement, to the satisfaction of the "Township" and at the sole risk and expense of the "Owner". The "Owner" understands that in default of the "Owner" maintaining any and all of the Works and facilities, the "Township" may, after thirty (30) days' written notice by the "Township" to the "Owner", specifying with reasonable particularity the nature of such default and requiring the same to be remedied, enter on the subject property to remedy the default at the expense of the "Owner". The provisions of Section 446 of the Municipal Act 2001, S.O. 2001, c.25 shall apply. The responsibilities of the "Owner" pursuant to this paragraph are in addition to, and not in derogation of, the responsibilities of the "Owner" to fully comply with all of the Township By-Laws.

c) The "Owner" covenants and agrees that if they sell the lands described herein, the deed of grant shall contain a covenant on the part of the transferee binding himself, his heirs, executors, administrators and assigns to the terms of this Agreement and to carry out the obligations of the "Owner" under this Agreement and covenant to include a similar covenant on all subsequent deeds of grant of the lands. All obligations imposed upon the "Owner" are deemed to be covenants which run with the land and bind the land herein described and every part thereof.

d) The "Owner" acknowledges and agrees that by entering into this Agreement neither the rights of the "Township" or the "Owner" are exhausted under Section 41 of the Planning Act. In the event that the "Owner" wishes to alter the plans or drawings or circumstances arise or exist which prevent the "Development" contemplated by this Agreement as originally intended, the "Owner" covenants and agrees to submit revised plans or drawings which reflect any desired or necessary changes for review and approval. The revised plans or drawings as approved may be incorporated into this Agreement by an amending Agreement. No amendment is valid unless accepted in writing by both parties.

e) The "Owner" acknowledges that the "Township", in addition to any other remedy it may have at law, shall also be entitled to enforce this Agreement in accordance with Section 446 of the Municipal Act, S.O. 2001.

f) The "Owner" agrees that should there be any default or breach of covenant with respect to this Agreement, the "Township shall have the authority to issue a "Stop Work Order" with respect to the construction of the building or the "Works" herein described.

g) If any term or provision of this Agreement or the application thereto of any person shall to any extent be held to be invalid or unenforceable, the balance of the Agreement shall not be affected thereby and each term and provision of this Agreement shall be separately valid and enforceable to the fullest extent permitted by law.

4. **ELECTRONIC REGISTRATION/ENGINEER'S DRAWINGS**

a) The "Owner" hereby agrees that the lands affected by this Agreement are those lands described in Schedule "A", and it is agreed that this Agreement will be registered on title by electronic means, if possible, at the expense of the "Owner". The Agreement will be registered by the "Township's" Solicitor.

b) The "Owner" and the "Township" hereby agree that, if the stamp of an engineer or other professional individual is not shown on the electronic registered Schedule "B" documents, the "Owner" and the "Township" agree that both parties have reviewed the original drawings and agree that an original stamp and signature has been affixed thereto. The "Owner" and "Township" further agree to treat the electronically registered Schedule "B" documents the same as original drawings bearing the stamp and signature of the engineer or other professional individual.

c) The parties hereto acknowledge that the electronic registration format after scanning the document into registerable form may not have the same format as the original signed paper format of this Site Plan Agreement.

5. **PHASED DEVELOPMENT**

a) The Parties hereto agree that this Agreement is a Site Plan Agreement which allows new "Development" of the lands herein described. Where there is a conflict between this Site Plan Agreement or any previous Site Plan Agreement registered on title, this Site Plan Agreement shall prevail.

b) The Parties agree that the only "Works" presently authorized pursuant to this Agreement are the "Works" set out in Schedule "B" of this Agreement.

6. **SCOPE OF WORK**

Any "Works" to be constructed by the "Owner" pursuant to Schedule "C" of this Agreement shall also be constructed in accordance with the drawings set out in Schedule "B" to this Agreement. The "Owner" agrees that the "Works" to be constructed pursuant to this Agreement and any supplementary agreement shall be

completed by the "Owner" in a good and workmanlike manner in accordance with good engineering practice.

7. **COMPLETION DATE OF WORK**

Any "Works" to be constructed by the "Owner" pursuant to Schedule "B" and "C" of this Agreement shall be completed within one (1) year of the date of registration of this Agreement.

8. **PROSECUTION OF WORK**

If, in the opinion of the "Township", the "Owner" is:

a) not prosecuting the "Works" required in connection with this Agreement;
b) failing to obtain easements or rights-of-way required pursuant to this Agreement;
c) failing to obtain required approvals pursuant to this Agreement'
d) improperly performing the "Works" required in connection with this Agreement;
e) neglecting or abandoning any of the "Works" before its completion or unreasonably delaying or abandoning any of the "Works" before its completion or unreasonably delaying the same so that the conditions of this Agreement are being violated or carelessly executed or performed in bad faith;
f) neglecting or failing to renew or again perform such "Works" as may be rejected by the "Chief Building Official" as being or having become defective or unsuitable;
g) failing to carry out any maintenance required under this Agreement;
h) making default in the performance of any of the terms of this Agreement

the "Owner" shall be notified in writing of such default, failure, delay or neglect. If the "Owner" does not remedy such default, failure, delay or neglect within thirty (30) days after such notice then the Council may direct the municipal staff to obtain any necessary approvals, purchase such materials and to employ such tools, machinery and workers that shall be required for the proper completion of the said "Works" at the cost and expense of the "Owner".

In cases of emergency, such "Works" may be completed without notice.

9. **ENGINEERING SERVICES**

a) It is agreed between the "Township" and the "Owner" that the "Owner" is responsible for the design and the supervision of the construction of the "Works" to be provided by the "Owner" pursuant to this Agreement.

b) The "Owner" shall employ competent engineers registered by the Association of Professional Engineers of Ontario,
   i. To design;
   ii. To prepare the necessary specifications for;

iii. To obtain the necessary approvals in conjunction with the "Township";
iv. To supervise the construction of;
v. To maintain all records of construction relating to;
vi. To prepare and furnish all plans and drawings including "as constructed drawings" of all the "Works" as may be required by the "Township" and to provide an Engineering Certificate to the satisfaction of the "Township" that all "Works" have been completed in accordance with the plans and specifications and good engineering practice. Upon receipt, review and approval of the "Owner's" Engineering Certificate, the "Township" shall provide written confirmation that the "Township" is satisfied that the "Works" have been completed in accordance with the plans and specifications and good engineering practice.

c) The "Owner" shall have competent engineering personnel on site during the period of construction to supervise and lay out the "Works" and the "Township" shall have the right at all times to inspect the installation of the "Works". If it is found that such personnel are not on site or are incompetent in the performance of their duties, or said "Works" are not being carried out in accordance with approved plans or specifications or in accordance with good engineering practice, the "Township" may order all work on the project to be stopped.

d) The "Owner" shall furnish at its own cost all plans, specifications, calculations, contours or other information pertaining to the "Works" which may be required by the "Chief Building Official" so that he can review the design and supervision proposals.

e) No contract shall be awarded by the "Owner" and no "Works" commenced or continued without the prior written approval of the design and supervision of the "Works" by the "Township", which approval shall not be unreasonably withheld.

f) It is understood and agreed that the examination and the acceptance of any drawings, specifications and contract documents by the "Township" does not relieve the "Owner" of its obligations to construct all services and "Works" strictly in accordance with standard engineering requirements and "Township" standards and specifications.

g) The "Owner" agrees to submit to the "Township", if requested, copies of all executed contracts relating to the construction of the "Works".

h) The "Chief Building Official" may require any qualitative or quantitative tests which he feels may be necessary to be provided and such tests shall be carried out under the supervision of the "Chief Building Official" at the "Owner's" expense. Nothing herein shall relieve the "Owner" of its responsibility to carry out any tests required by good engineering practice.

10. **STORMWATER DESIGN BRIEF/DRAINAGE**

a) The Parties acknowledge that a Stormwater Design has been prepared for the "Lands" and a report has been provided to the Parties by the Greer Galloway Group Inc. dated August 2013, a copy of which is attached hereto and marked as Schedule "D".

b) The "Owner" shall construct all "Works" which are necessary to provide proper drainage of the "Lands" as per the Stormwater Design Brief including any "Works" necessary for drainage to an adequate outlet outside the development. The "Owner" shall not direct any drainage onto any abutting properties, excepting a good and sufficient outlet acceptable to the "Township". In addition, the "Owner" shall not interfere with any existing drain or water course, without the written permission of the "Township". Granting such permission shall not relieve the "Owner" of responsibility for any damage caused by such interference and the "Owner" agrees to indemnify the "Township" against any claims against the "Township" relating to such damage, provided that the "Township" will give to the "Owner", at the expense of the "Owner", an opportunity to defend any such claim.

11. **MINISTRY REQUIREMENTS**

a) The "Owner" agrees to comply, at the "Owner's" expense, with all conditions set out in the Building and Land Use Permit No. BL-2013-42O-30 issued on August 26, 2013 by the Ministry of Transportation for the "Lands".

b) The "Owner" agrees to apply for and obtain an Environmental Compliance Approval for the site under Section 53 of the Ontario Water Resources Act. The "Owner" agrees that the Environmental Compliance Approval will be required prior to the "Township" granting occupancy on the site.

12. **ROADS/ENTRANCEWAYS**

Any road work required shall be completed at the expense of the "Owner". In particular, all entrances and exits shall be designed and constructed in accordance with the standards of the appropriate road authority and will be subject to the approval of the appropriate road authority.

13. **SEWER AND WATER SERVICES**

All private water and septic "Works" are the responsibility of the "Owner".

14. **HYDRO AND TELEPHONE SERVICES**

The "Owner" shall arrange with Hydro One Networks Inc. and the appropriate Telephone Company for the installation of services to the development and for the provisions of any required easements with respect to such installations. The

"Owner" agrees to pay any cost involved in relocating any existing services required by the construction of works in the development.

15. **LIGHTING, SEEDING, LANDSCAPING AND FENCING**

a) Any lighting provided by the "Owner" for the "Lands" and/or the exterior of the building shown on the "Site Plan", shall be subject to the approval of the "Township". All lighting shall be oriented and its intensity so controlled to prevent glare on adjacent roadways and properties. In the event the lighting is unsatisfactory in the opinion of either the "Township" or the Ministry of Transportation, the "Owner" shall redirect or shield any lighting that may cause direct or indirect glare that adversely impacts neighbouring properties or the travelling public. The "Owner" agrees, that in the event the lighting is unsatisfactory as aforesaid, to immediately take steps to remove, redirect or shield the lighting to the satisfaction of the "Township" and/or the Ministry of Transportation at the "Owner's" expense.

b) The "Owner" acknowledges that any signage to be installed on the "Lands" must be approved by the Ministry of Transportation. The "Owner" agrees that if the erection of the sign does not comply with the Ministry of Transportation requirements or adversely affects sight lines along Highway 17 and MacFarlane Road, then the "Owner" agrees to move the signage to the satisfaction of the Ministry of Transportation and the "Township".

c) The "Owner" hereby agrees to seed and landscape all open areas, excluding the internal roadways and parking areas as shown on the "Site Plan".

16. **MAINTENANCE OF "WORKS"**

a) The "Owner" shall maintain those "Works" located on the "Lands" to this Agreement to be constructed to the satisfaction of the "Township" at the sole risk and expense of the "Owner".

17. **RELEVANT LEGISLATION**

The "Owner" agrees to comply with all relevant municipal by-laws, Provincial and Federal Statutes and Regulations relating to the construction of any buildings, "Works" and services.

18. **OCCUPANCY PERMIT**

The "Township" shall not be obligated to issue an occupancy permit relating to any building or structure on the "Lands" until all "Works" have been substantially completed to the satisfaction of the "Chief Building Official".

19. **MUNICIPAL EXPENSES**

a) The "Owner" shall pay to the "Township" the reasonable and necessary costs for all outside technical and professional expenses plus reasonable disbursements plus HST that it has incurred to date and which it will incur in the future arising out of the proposed "Development" set out in this Agreement or any supplementary Agreement. Internal administrative expenses for services by "Township" staff are not included.

b) The "Owner" shall have the right to refer any issue pursuant to paragraph (a) above to the Chief Administrative Officer and/or the Council of the "Township" for review and to make representations relating thereto.

c) All accounts rendered by the "Township" to the "Owner" shall be paid within thirty (30) days of the date of billing, and in the event of failure to pay, interest shall be charged on the amount outstanding at the rate of twelve percent (12%) per annum. Any issue which has been referred to the Chief Administrative Officer and/or Council for review pursuant to paragraph (b) above, the said interest shall be charged commencing thirty (30) days following the review.

20. **INDEMNITY**

a) The "Owner", its successors and assigned in title, shall indemnify and save harmless the "Township" from all actions, causes of actions, suits, claims or demands whatsoever, which arise directly or indirectly by reason of the development herein, and the construction and maintenance of the "Works".

21. **NOTICES**

Any Notice required to be given to either party by the other shall be mailed or delivered to:

A. The Owner at:

Cobden Travel Centre, Inc.
257 Bronson Avenue
Ottawa ON K1R 6H6

B. The Township at:

Township of Whitewater Region
PO Box 40
44 Main Street
Cobden ON K0J 1K0

Dated at Cobden, Ontario this 19th day of September, 2013

Cobden Travel Centre, Inc.

Witness

Owner

Dated at Cobden, Ontario this 18th day of September, 2013

The Corporation of the Township of Whitewater Region

Witness

Per: James Labow, Mayor

Witness

Per: Christine FitzSimons, CAO

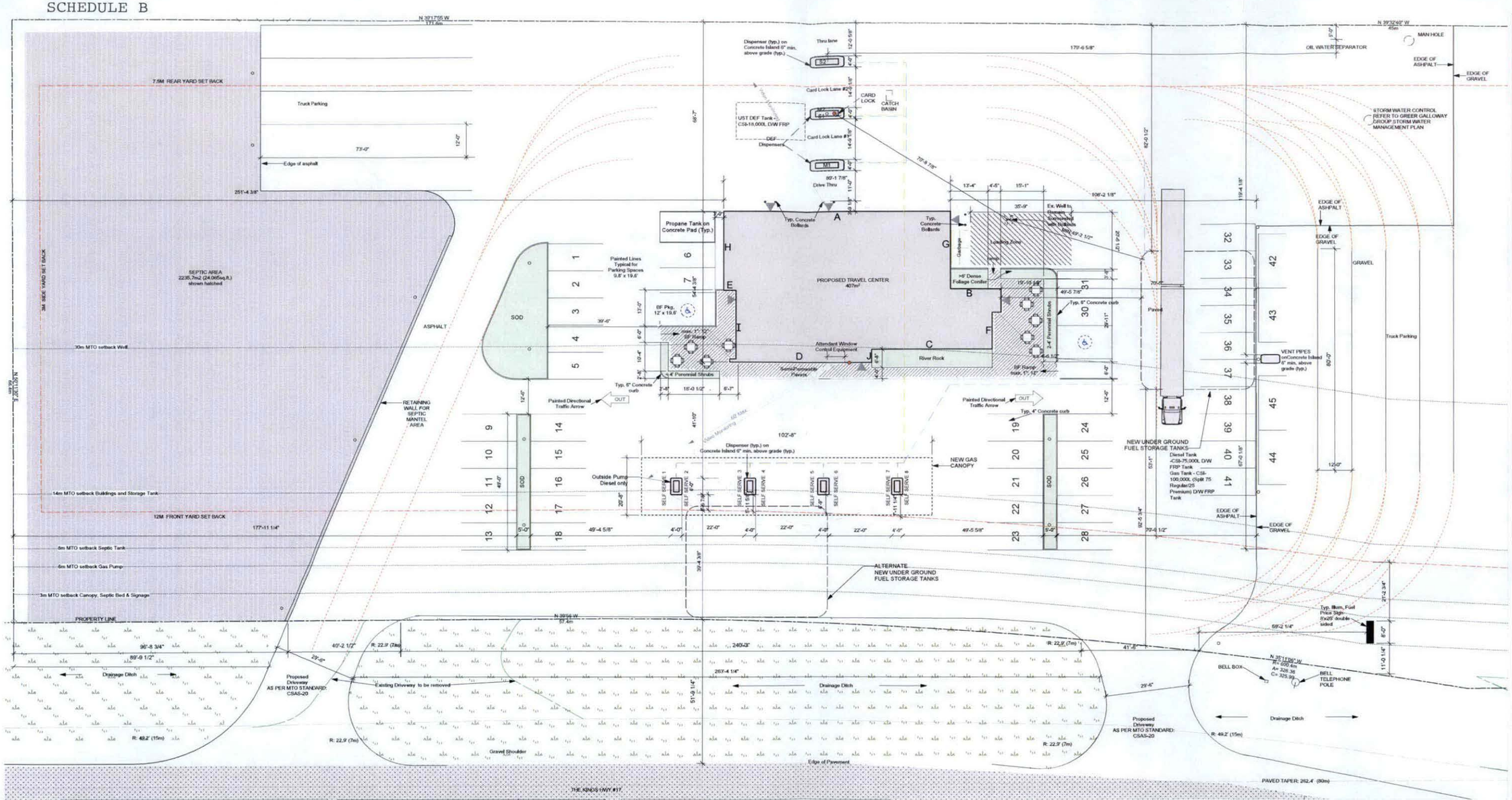
We have the authority to bind the Corporation

SCHEDULE "A"

DESCRIPTION OF LANDS TO WHICH THIS AGREEMENT APPLIES

Part Lot 1, Concession 2 West Muskrat Lake, Part 1 on Plan 49R-15080, Township of Whitewater Region, municipally described as 18322 Highway 17, hereinafter referred to as the "Lands"

SCHEDULE B



DRAWINGS SHOULD NOT BE SCALED

CONTRACTORS MUST CHECK AND VERIFY ALL DIMENSIONS ON THE PROJECT AND REPORT ANY DISCREPANCIES TO FAD BEFORE PROCEEDING WITH THE WORK.

THE CONTRACTOR IS TO BE FAMILIAR WITH THE ONTARIO BUILDING CODE AND ITS LATEST REVISIONS.

ISSUES

DESCRIPTION	DATE
Eng. Review	Nov. 2012
Eng. Review	Nov. 28 2012
Septic review	Dec 10 2012
Coating review	Dec 11 2012
Consultant review	Jan 11 2013
Husky review	March 12 2013
Consultant review	Mar. 14 2013
Consultant review	Mar. 18 2013
Town review	April 16 2013
Cons. Meeting	June 12 2013
Keller Site	July 23 2013
FOR PERMIT	AUG 06 2013
Parking Revisions	Aug 29 2013
Parking Revisions	Sept. 11 2013

FAD architects
furniture:architecture:design
92 james st.
parry sound ont.
P2A 1T9
t. 705. 746. 5272
f. 1.866. 270. 0845
info@fad.ca

CONSULTANTS

PROFESSIONAL SEAL
ONTARIO ASSOCIATION OF ARCHITECTS
BRENDA RYAN
LICENCE
5093

NORTH ARROW

PROJECT
COBDEN TRAVEL CENTER
18322 HWY #17
COBDEN, ON K0J 1K0,
CLIENT: LECLERC

DRAWN BY	CHECKED BY
LB	MR

PROJECT NUMBER 1223 — DATE NOV. 2012

DRAWING TITLE
SITE PLAN

DRAWING SCALE
AS NOTED

DRAWING NUMBER
A2

Firm Name: Furniture Architecture and Design Group (FAD Group)
Certificate of Practice Number: 6174
92 James St.
Parry Sound, Ont.
P2A 1T9
Brenda Ryan, Architect

Name of Project: CORDEN TRAVEL CENTER

Location: 18322 HWY 17, CORDEN, ON K0J 1K0

Date of Issuance: AUG. 6, 2013

Item	Ontario's 2006 Building Code Data Matrix Part 3 or 9			BC References (References are for Division B unless noted [A] for Division A or [C] for Division C)
1	Project Description:	X New ☐ Addition ☐ Change of Use ☐ Alteration	☐ Part 11 ~~☐ Part 9~~ ~~11.1 to 11.4~~	☐ Part 3 ~~☐ Part 9~~ 1.1.2. [A] ~~1.1.2. [A] to 9.10.1.3~~ 1.1.2.2.(1)(b) ~~1.1.2.2.(1)(b)~~
2	Major Occupancy(s): **Assembly, Restaurant**			3.1.2.1.(1) ~~9.10.1.~~
3	Building Area (m²): Existing ___ m2 New **407** m2 Total **407** m2			3.4.2.1 ~~1.4.1.2.[A]~~
4	Street Area: Existing ___ m2 New **407** m2 Total **407** m2			1.4.1.2. [A] ~~1.4.1.2.[A]~~
5	Number of Storeys: Above grade **1** Below grade **0**			1.4.1.2. [A]3.2.1.1. ~~1.4.1.2.[A] & 9.10.4~~
6	Number of Streets/Fire Fighter Access: **2**			3.2.2.10. & 3.2.5. ~~9.10.20.~~
7	Building Classification: **Group A, Division 2**			3.2.2.46-78 ~~9.10.2.~~
8	Sprinkler System Proposed	☐ entire building ☐ selected compartments ☐ selected floor areas ☐ basement ☐ in lieu of roof rating **X** not required		3.2.2.20.-83 ~~9.10.2.~~ 3.2.1.5. 3.2.1.17 INDEX ~~INDEX~~
9	Standpipe required	☐ Yes X No		3.2.9.1.(18)(a) ~~N/A~~
10	Fire Alarm required	☐ Yes X No		3.2.4.1.(2)(a)(i) ~~9.10.18.~~
11	Water Service Supply is Adequate	X Yes ☐ No		3.2.5.7. ~~N/A~~
12	High Building	☐ Yes X No		3.2.5.1.(d) ~~N/A~~

13	Construction Restrictions / Actual Construction	☐ Combustible permitted / ☐ Combustible	☐ Non-combustible required / ☐ Non-combustible	X Both / X Both	3.2.2.44-78 ~~9.10.6.~~
14	Mezzanine(s) Area m²	N/A			3.2.1.1.(2)-(5) ~~9.10.4.1.~~
15	Occupant load based on: Food Court, Kitchen, Office, Store, Storage	X m²/person ☐ design of building; Occupancy ___ Load: person = 0; **40 Patrons**; Occupancy ___ A ___ Load: person = **5 Design**; Occupancy ___ A ___ 6m² Load: 9.3 person = 1; Occupancy ___ E ___ 52m² Load: 3.5 person = 14; Occupancy ___ E ___ 13.5m² Load: 46 persons = 1; **TOTAL: 65 Person**			3.1.17. ~~9.8.3.3.~~
16	Barrier-free Design	X Yes ☐ No (Explain)			3.8. ~~9.8.~~
17	Hazardous Substances	☐ Yes X No			3.3.1.2. & 3.3.1.19. ~~9.10.1.3.(4)~~
18	Required Fire Resistance Rating (FRR)	Horizontal Assemblies FRR (hours): Floors N/A Hours; Roof N/A Hours; Mezzanine N/A Hours	Listed Design No. or Description (SG-2): ONE STORY		3.2.2.20.-83 & 3.2.1.4. ~~9.10.8. 9.10.9~~
		FRR of Supporting Members: Floors N/A Hours; Roof N/A Hours; Mezzanine N/A Hours	Listed Design No. Or Description (SG-2)		
19	Spatial Separation – Construction of Exterior Walls				3.2.3. ~~9.10.14.~~

Wall	L.D. (m)	L/H or H/L	Permit. Max. % of Open's	Propo. % of Openings	FRR (Hrs.)	Listed Design or Desc.	Comb. Const	Comb. Const. Non. Cladding	Non-comb. Const.
North	A / B	21 / 29	NO LIMITS						
South	C / D / E	47 / 61 / 54							
East	F/G/I	113 / 127 / 136							
West	H / I	36 / 36							

20	Plumbing Fixture Requirements					
	Male/Female Count @ 50% / 50%, except as noted otherwise	Occupant Load	BC Table Number	Fixtures Required	Fixtures Provided	BC Reference: X Part 3 ~~☐ Part 9~~
	Occupant A, Food Court (40 persons total)	20 female	3.7.4.3.D	1	4	3.7.4.3
		20 male	3.7.4.3.D	1	4	3.7.4.3
	Occupant A, Food Court Employees	5	3.7.4.3.F	1 for both sexes	1	3.7.4.3.F (ii)
	Occupant E, Store, Employee, (1 person)	1	3.7.4.5	1 for both sexes	1	3.7.4.8
24	Other (describe)					

AREA

Site	15,161 m²	[163,197 ft², 3.75 acres]
Travel Center	407 m²	[4,381 ft²]

WESTMEATH TOWNSHIP ZONING BYLAWS, 8.2 Set Backs Min. distance

Side Yard	3.0m	[9.8']
Rear Yard	7.5m	[24.6']
Ext. Side Yard	12m	[39.4']
Front Yard	12m	[39.4']
Build height	10.5m	[34.4']
Lot Coverage	33%	**Proposed Lot Coverage= 2.6%**

3.0 Parking

3.22.1 a) xvi) Eating Establishment/Fast food: 29 spaces per 100m2 of gross leaseable area= (57m2food court + 88m2kitchen)=140m2 / 100 x 29= **42spaces**
xix) Convenience Store: 5.4 spaces per 100m2 of gross leasable area = 52m2 / 100 x 5.4 = **3 spaces**
g) Parking Space min. size : **3 x 6 m [9.8 x 19.6']**

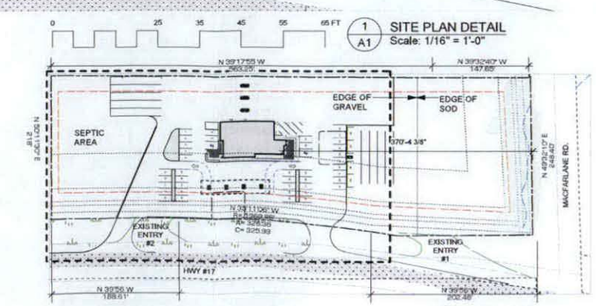
3.22.2 i)Loading: One 3.5m x 9m x4m (LxWxH) spaces per 1,500 m² of bldg floor area above a 300m² = (407-300 m²) / 1,500m² = **1 space**

LEGEND:

Fuel Line (Double Wall Plastic Pipes)
Fuel line Electrical Conduit
Entry to be relocated
Building Entrances
Emergency Stop

MTO BLDG & LAND USE POLICY 2009, Appendix pg. 26

Fence Structure	0.3m	[0.9']
Foundation Building- Commercial	14m	[45.9']
Gasoline Pump Island Structure	6.0m	[19.7']
Gasoline Canopy / Shelter Structure -	3.0m	[9.8']
Hedge/Plantings/Trees	0.3m	[0.9']
Hotel & Motel	14m	[45.9']
Illumination-Light Standard	0.3m	[0.9']
Parking Lot - Commercial	3.0m	[9.8']
Restaurant Building - Commercial	14m	[45.9']
Septic Tank Structure	8.0m	[26.2']
Septic Bed Structure	3.0m	[0.9']
Service Station Building	14m	[45.9']
Pilon Service Sign	14m	[45.9']
Storage Tank (Bulk)	27m	[88.6']
Storage Tank Above or Below St	14m	[45.9']
Store Building - Commercial	14m	[45.9']



1 A1 SITE PLAN DETAIL
Scale: 1/16" = 1'-0"

2 A1 SITE PLAN
Scale: 1"= 100 ft

SCHEDULE "C"

SCHEDULE OF WORKS TO BE CONSTRUCTED

1. DRAINAGE WORKS INCLUDING LANDSCAPING

   The Owner agrees to construct and maintain the landscaped areas and necessary drainage works required to provide the surface water drainage within the Lands to the satisfaction of the Township and in accordance with FAD Group Architects, Project No. 1223, Cobden Travel Centre, Inc., Site Plan dated November 2012 – revised September 11, 2013 attached as Schedule "B" herein.

2. STORMWATER MANAGEMENT WORKS

   The Owner agrees to implement stormwater management control measures in accordance with the Stormwater Design Brief prepared by the Greer Galloway Group Inc. dated August 2013 attached as Schedule "D" herein.

3. ACCESS AND PARKING

   The Owner agrees to construct and maintain the access and parking lot within the Lands to the satisfaction of the Township and in accordance with FAD Group Architects, Project No. 1223, Cobden Travel Centre, Inc., Site Plan dated November 2012 – revised September 11, 2013 attached as Schedule "B" herein.

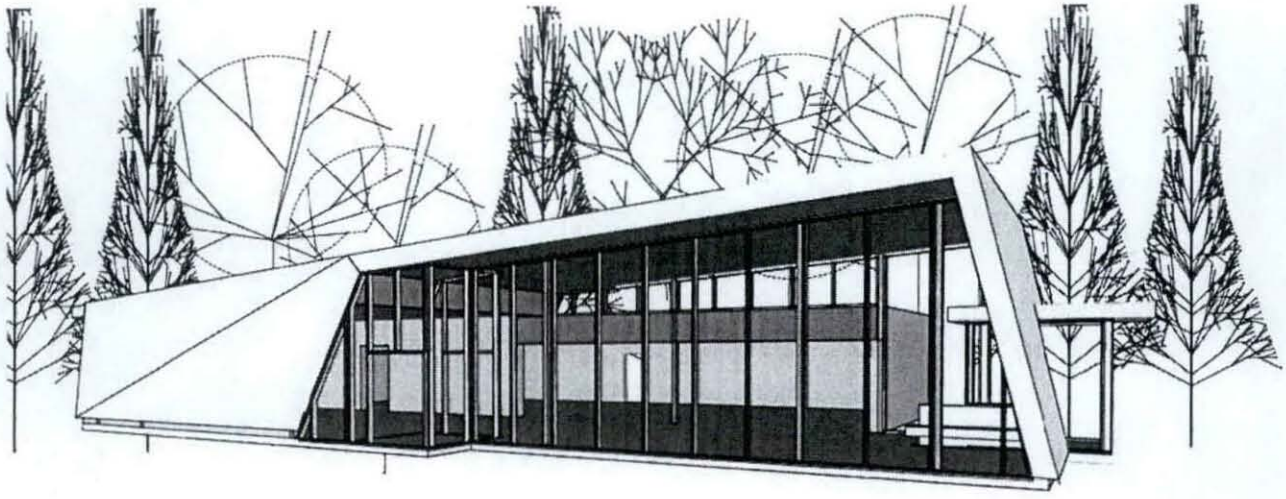
4. SITE LIGHTING

   The Owner agrees to construct and maintain the site lighting within the Lands to the satisfaction of the Township and in accordance with FAD Group Architects, Project No. 1223, Cobden Travel Centre, Inc., Site Plan dated November 2012 – revised September 11, 2013 attached as Schedule "B" herein.

SCHEDULE D

Stormwater Design Brief

Cobden Travel Centre



Structural Concept Model by FAD architects

Prepared for

Jp2g Consultants Inc.

Jp2g Consultants Inc.
1150 Morrison Drive, Suite 410
Ottawa, Ontario
K2H 8S9

Prepared by

THE GREER GALLOWAY GROUP INC.
ENGINEERS • PLANNERS

The Greer Galloway Group Inc.
973 Crawford Drive
Peterborough, Ontario
K9J 3X1

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Appendices

1. Introduction

The Greer Galloway Group Inc. has been retained by Jp2g Consultants Inc. to prepare a stormwater design brief for the first phase of the proposed Cobden Travel Centre in the Township of Whitewater Region, County of Renfrew. The 1.49 hectare site is located in Part Lot 1, Concession 2 WML, geographic Township of Westmeath, located at the northeast corner of the intersection of Highway 17 and MacFarlane Road. The purpose of the stormwater design brief is to examine the stormwater impacts due to the proposed development of the site and to develop a preliminary stormwater management concept for the consultants and review agency approval. See ***Figure 1.*** *Site location plan* for the location of the project site.

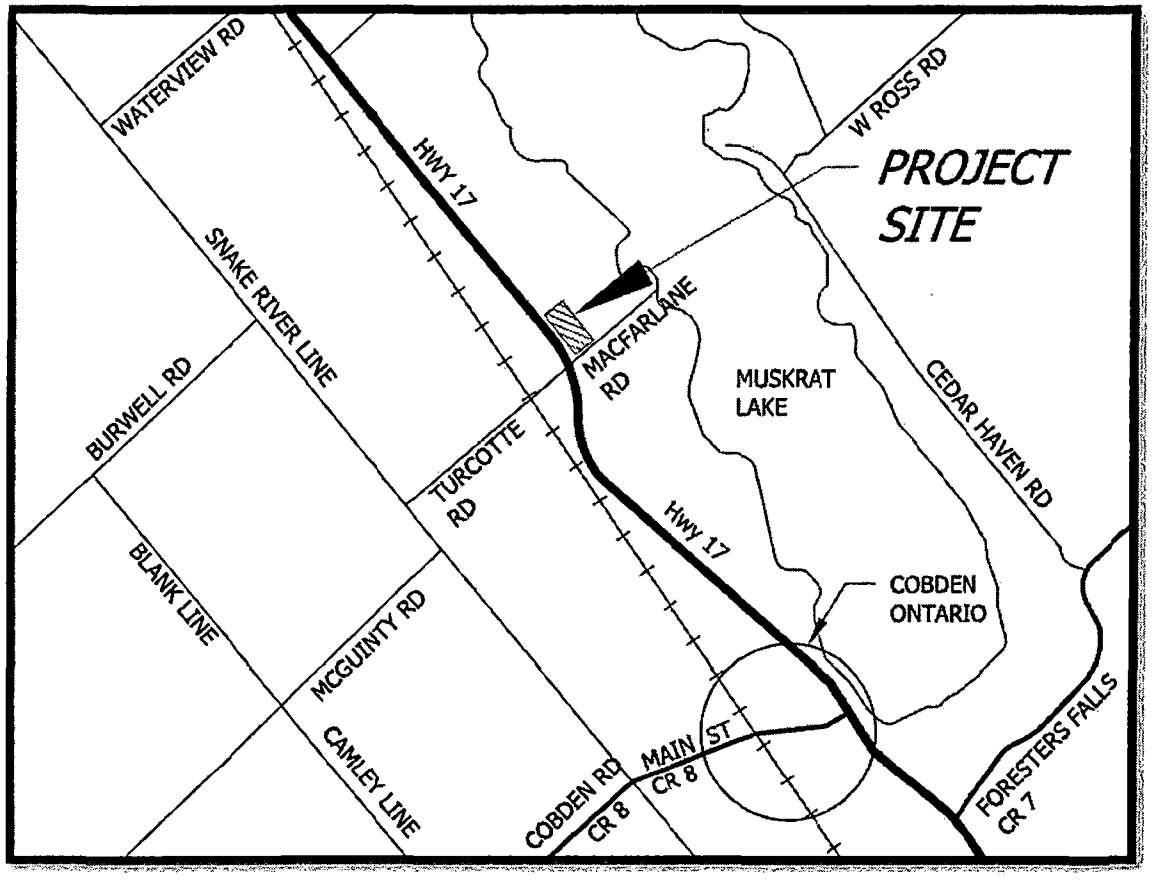


Figure 1. Site location plan

2. Site Description

The project site was comprised of an existing building, fueling station, asphalt pavement, gravel areas and grass areas. The site is bounded by Highway 17 to the southwest, MacFarlane Road to the southeast and by farmers' fields to the northwest and northeast. The site is over 500m from Muskrat Lake. The general topography slopes from northwest to southeast, averaging approximately 2%.

3. Pre-Development Drainage Conditions

The Pre-Development drainage conditions have been analysed as one drainage basin since the site generally drains to one outlet location at the southeast corner of the property. Refer to ***Figure 2 – Pre-Development Drainage Conditions*** in ***Appendix A*** for the Pre-Development site.

Runoff from the site is conveyed as sheet flow to the ditch along MacFarlane Road and outlets across the road through an existing 900mm diameter CSP. It should be noted that there are some small existing areas along the west property line that contribute runoff to the Highway 17 corridor. This flow is picked up by the existing Highway 17 storm sewer via catch basins and conveyed through a 900mm diameter CSP to an outlet into the ditch along MacFarlane Road.

4. Post-Development Drainage Conditions

Similar to the Pre-Development conditions, the Post-Development conditions are also analysed as one drainage basin. The overall Pre-Development drainage pattern across the site has been preserved by directing all Post-Development runoff to the existing ditch along MacFarlane Road. Refer to ***Figure 3 – Post-Development Drainage Conditions*** in ***Appendix A – Figures*** for Post-Development site conditions.

Flows from the site will be increased due to the addition of the new impervious areas. The small areas along the west property line that were contributing runoff to the Highway 17 corridor in the Pre-Development conditions will be improved by grading all new impervious areas to drain through the project site. This will relieve the existing Highway 17 drainage system of some flows and ensure that runoff from impervious areas can be treated through on-site quality and quantity controls prior to the MacFarlane Road outlet culvert.

5. Hydrological Calculations

5.1. Calculation Parameters

The Rational Method was used to calculate peak flows for the Pre and Post-Development scenarios. Information on rainfall data was taken from IDF Curve Lookup, provided by the MTO website. The nearest location of available IDF curves is utilized for coordinates 45.645833 N, -76.904167 E, located across from the site on the opposite side of Highway 17.

Runoff coefficients were taken from the MTO Drainage Manual and a factor of 1.10, 1.20 and 1.25 was applied to the 25, 50 and 100 year storms, respectively. The runoff coefficients used for determining a composite runoff coefficient for the site were as follows:

Grass Areas: C=0.25 Gravel Areas: C=0.60 Asphalt/Concrete/Building Areas: C=0.95

A minimum time of concentration of 10 minutes was used as recommended by the MTO Drainage Manual. The storms analysed were the 2, 5, 10, 25, 50, 100 year return events. A 4 hour, 25mm Chicago Storm was also analysed for the purpose of addressing quality control.

5.2. Pre/Post-Development Comparison

The need for stormwater quantity controls will be addressed by analyzing the resulting increase in peak flow from the site due to the additional impervious areas. ***Table 5-1.*** *Pre/Post-Development comparison* shows the change in impervious areas from Pre to Post-Development conditions. The resulting change in peak flow for the 100-year storm event is also shown. Refer to ***Appendix B - Hydrologic Calculations*** for full hydrologic calculations using the Rational Method.

Table 5-1. Pre/Post-Development comparison

	Pre-Development	Post-Development	Increase/Decrease
Total Area (m^2)	14944	14944	0
Buildings/Asphalt/Concrete (m^2)	2782	6290	+3508
Gravel (m^2)	1631	2098	+467
Green Space (m^2)	10531	6556	-3975
Impervious Level (%)	29.5	56.1	+26.6
100-Year Peak Flow (m^3/s)	0.333	0.473	+0.140

The additional impervious areas due to the development of the site will increase the impervious level by about 27%. The resulting increase in 100-year peak flow is 0.140m^3/s (42.5%).

6. Stormwater Management

The increased imperviousness of the site and the increased amount of runoff will require quality and quantity controls prior to discharging via the existing 900mm diameter CSP culvert at MacFarlane Road.

6.1. Quality Control

Based on recommendations from the MOE Stormwater Management & Planning Design Manual (2002), a grass swale is provided for quality control. Grass swales are suitable on sites with an average slope of less than 5% and for drainage areas less than 2 ha. A grass swale is proposed along the east property line to convey flows from the impervious asphalt areas to the existing ditch along the south at MacFarlane Road. The ideal swale cross section to enhance quality control has a shallow flow depth and wide bottom, while having large enough capacity to convey major storm events. A proposed swale cross section is presented in *Section 7. Hydraulic Calculations.*

Additional quality control will be provided at the location of unmonitored fueling areas using an oil and water separator. Localized grading at this location will allow for any potential spills to be collected and conveyed to an underground oil and water separator for treatment prior to discharging from the site.

It is also recommended that the proposed vegetated areas on the site be constructed as infiltration or bioretention facilities. These Low Impact Development (LID) techniques can be implemented as infiltration trenches, soakaway pits, rain gardens and/or stormwater planters. These controls also aid in quantity control by reducing runoff from the site. Suitability of these techniques will be investigated during the detailed design phase.

6.2. Quantity Control

Quantity control is to be provided on the site to restrict the Post-Development peak flows to Pre-Development levels for all storms up to and including the 100-year storm. This can be achieved through a combination of rooftop and parking lot storage. Preliminary stormwater management calculations have been provided in ***Appendix B – Hydrologic Calculations***. Using the Modified Rational Method, approximately 98m^3 would be required to control the Post-Development 100-year storm to a Pre-Development level. It is anticipated that approximately 30m^3 is available for storage on a portion of the rooftop, indicated as 'Stormwater Control Facility 1' on ***Figure 3 – Post-Development Drainage Conditions*** in ***Appendix A***. The remaining storage will be provided at the south east corner of the new asphalt area using a depressed curb outlet. The estimated limits of ponding during the 100-year storm are indicated by 'Stormwater Control Facility 2' on ***Figure 3 – Post-Development Drainage Conditions*** in ***Appendix A***. Flow through the depressed curb will be restricted to Pre-Development levels for all storms up to and including the 100-year storm. These flows will be conveyed through the new grass swale and ultimately discharge from the site via the existing 900mm diameter CSP culvert at MacFarlane Road.

7. Hydraulic Calculations

As previously mentioned, a grass swale is required along the east property line to provide quality control for runoff from the asphalt areas. It is recommended that the velocity through the swale be less than 0.5m/s during a 4 hour, 25mm Chicago Storm to allow for the sedimentation of suspended solids. The swale should also have adequate capacity to convey the 100-year storm while maintaining a minimum 0.3m freeboard for safe conveyance. The proposed swale section that meets the outlined requirements is a 2m wide trapezoidal section with 3H:1V side slopes. The swale shall have a 0.5% channel slope.

Detailed calculations from FlowMaster are provided in ***Appendix C – Hydraulic Calculations*** and show that during a 4 hour, 25mm Chicago Storm, the velocity through the swale will be 0.44m/s, which is less than the recommended allowable velocity of 0.5m/s. A normal depth of 0.191m will be found in the swale during the 100-year storm event. Providing a minimum 0.5m depth in the swale will ensure that a minimum 0.3m freeboard is maintained for 100-year conveyance. The velocity through the swale during the 100-year storm event is calculated to be 0.68m/s and will not cause erosion. A summary of the grass swale criteria and calculations are provided in ***Table 7-1.*** *Proposed grass swale summary.*

Table 7-1. Proposed grass swale summary

	Required/Recommended	Provided/Calculated
Contributing Drainage Area (ha)	≤ 2	1.49
Bottom Width (m)	≥ 0.75	2
Side Slopes	≥ 2.5H:1V	3H:1V
Channel Slope (%)	≤ 1%	0.5%
4 Hour, 25mm Velocity (m/s)	≤ 0.5	0.44
100-Year Freeboard (m)	≥ 0.3	0.309
100-Year Velocity (m/s)	≤ 1.5	0.68

8. Conclusion

The development of the Cobden Travel Centre will introduce new impervious areas to the property, which will require quality and quantity control measures. Quality control is to be provided by a grass swale, oil and water separator and any feasible infiltration/bioretention LID techniques. Quantity control can be achieved using a combination of rooftop and parking lot storage. Providing the stormwater controls outlined in this design brief will control runoff from the new development to a Pre-Development level while providing appropriate quality control enhancement, ensuring no negative impact to the downstream outlet culvert at MacFarlane Road.

A detailed stormwater management report including design and calculations for the stormwater control facilities as well as detailed engineering drawings will be forthcoming upon receiving approval of this preliminary concept.

THE GREER GALLOWAY GROUP INC.
ENGINEERS AND PLANNERS

Prepared by:

David Leung, EIT

Reviewed and recommended by:

LICENSED PROFESSIONAL ENGINEER
H. K. WADHWANI
100182109
Aug. 13, 2013
PROVINCE OF ONTARIO

Harish K. Wadhwani, P.E., P.Eng.

APPENDIX A

Figures

METRIC
ALL DIMENSIONS SHOWN ARE IN METRIC UNLESS NOTED OTHERWISE

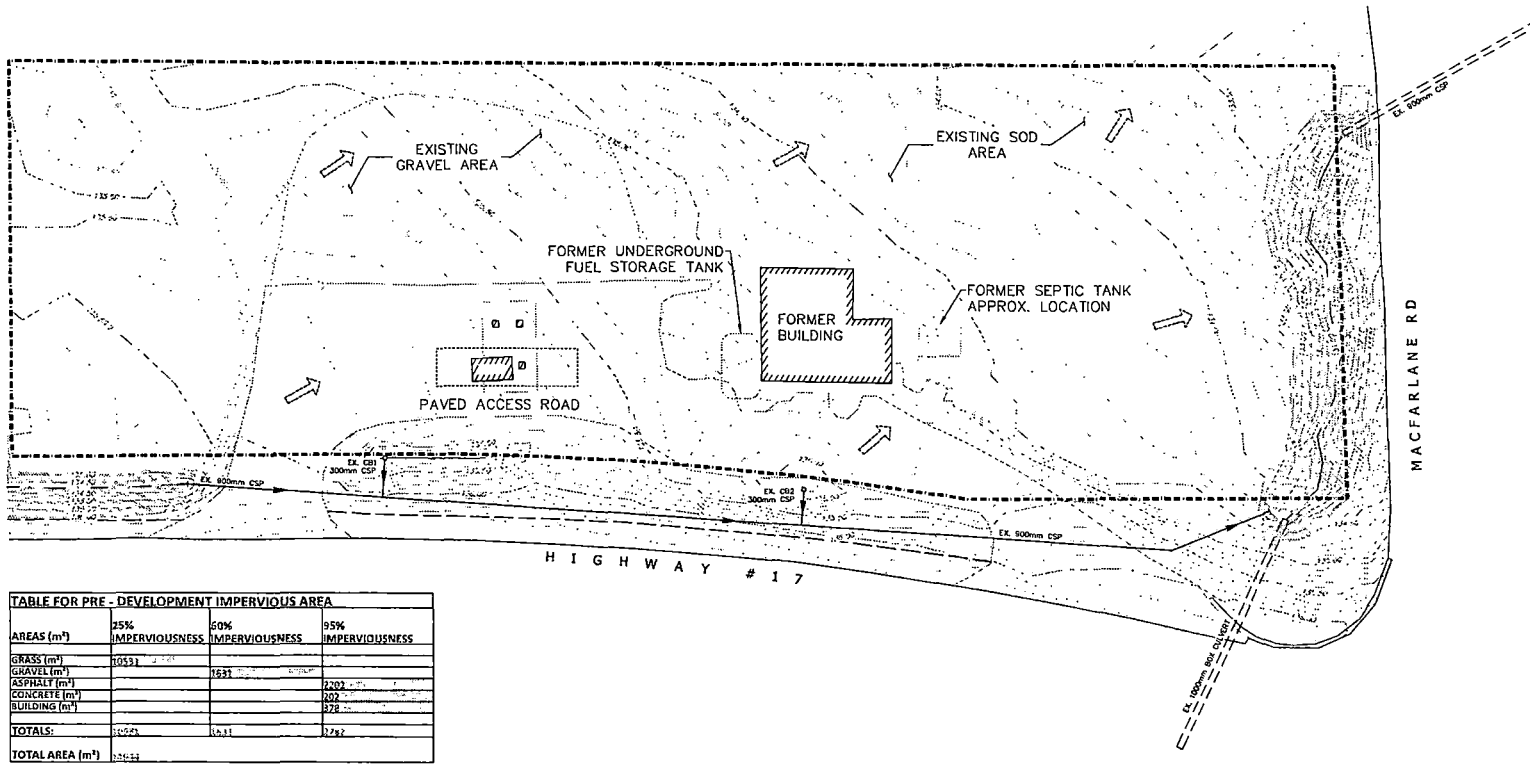
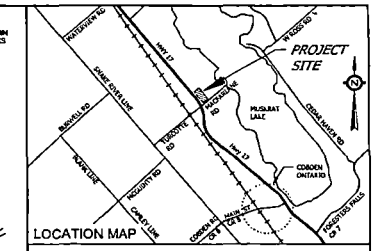


TABLE FOR PRE - DEVELOPMENT IMPERVIOUS AREA			
AREAS (m²)	25% IMPERVIOUSNESS	60% IMPERVIOUSNESS	95% IMPERVIOUSNESS
GRASS (m²)	10531		
GRAVEL (m²)		1631	
ASPHALT (m²)			2202
CONCRETE (m²)			202
BUILDING (m²)			378
TOTALS:	10531	1631	2782
TOTAL AREA (m²)	14944		

ORIGINAL SIZE 22" x 34" INCLUDED



LEGEND

- SITE BOUNDARY
- FLOW DIRECTION
- MAJOR CONTOURS
- MINOR CONTOURS
- ASPHALT AREA
- GRAVEL AREA
- CONCRETE AREA
- EXISTING BUILDING
- GRASSED/ LANDSCAPED AREA
- EX. STORM SEWER WITH FLOW DIRECTION
- CB EX. CATCH BASIN
- EX. CULVERT

NO.	DATE	DESN	APPR	DESCRIPTION	SIGN

DESIGN: D.L.	DRAWN: S.R.	CHECK: HKW	DATE: AUG. 2013
SEAL			SHEET SIZE: 22 x 34
			SCALE: 0 4 8 12 16 1:400

THE GREER GALLOWAY GROUP INC.
ENGINEERS • PLANNERS
PETERBOROUGH • (705) 743 - 5780

CLIENT
Jp2g Consultants Inc.

PROJECT
SITE PLAN APPLICATION FOR
18322 HWY #17
COBDEN, ON. K0J 1K0

TITLE
PRE-DEVELOPMENT DRAINAGE CONDITIONS

CONTRACT	CONSULTANT FILE 13-1-6734	
SHEET 1 OF 2	DRAWING FIGURE 2	REV.

METRIC
ALL DIMENSIONS SHOWN ARE IN METRIC UNLESS NOTED OTHERWISE

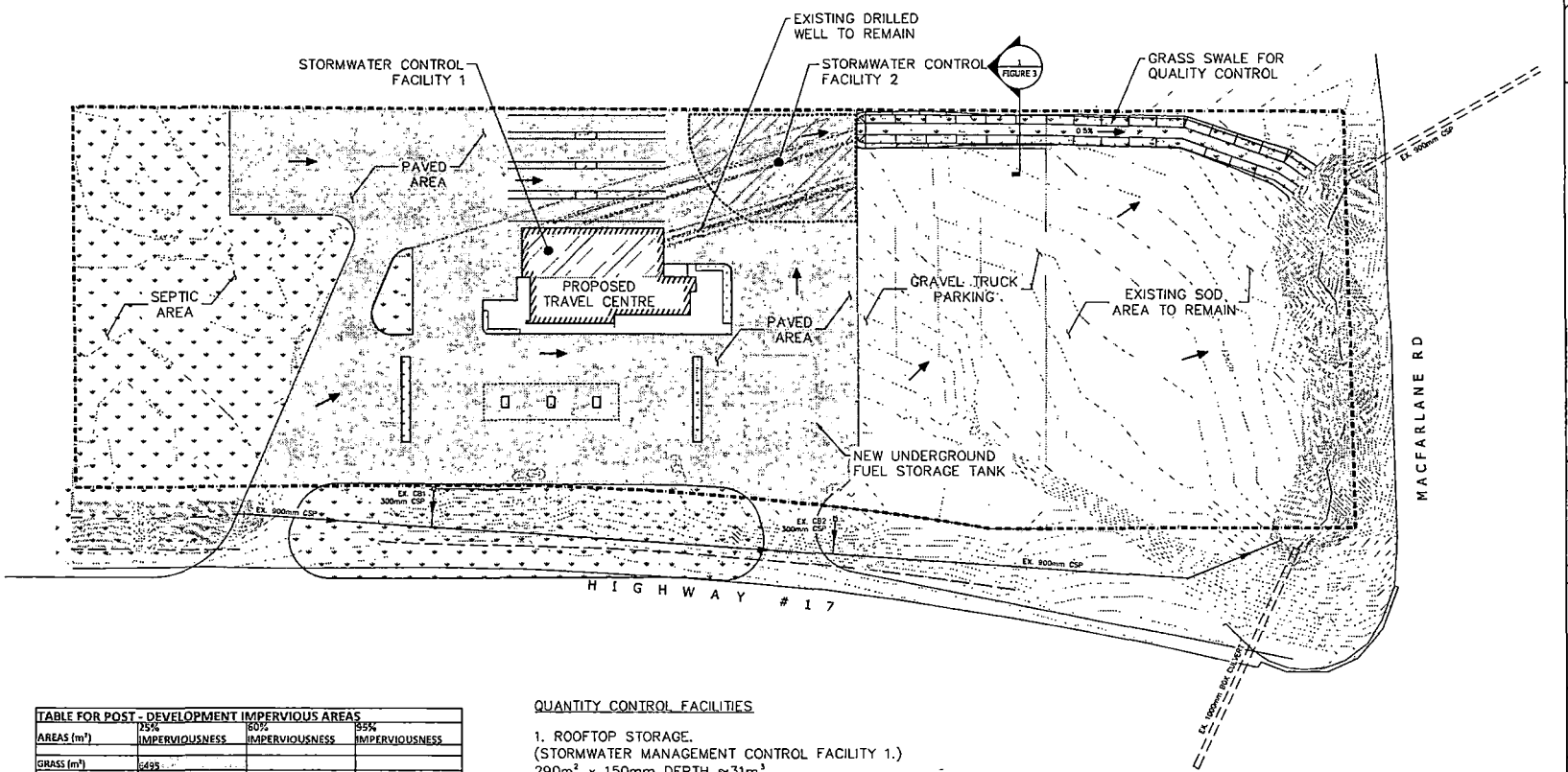


TABLE FOR POST - DEVELOPMENT IMPERVIOUS AREAS			
AREAS (m²)	25% IMPERVIOUSNESS	60% IMPERVIOUSNESS	95% IMPERVIOUSNESS
GRASS (m²)	6495		
LANDSCAPING (m²)	61		
GRAVEL (m²)		2098	
ASPHALT (m²)			5707
CONCRETE (m²)			174
BUILDING (m²)			414
TOTALS:	[illegible]	[illegible]	[illegible]
TOTAL AREA (m²)	[illegible]		

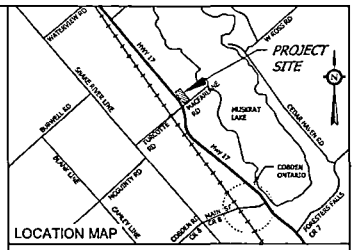
QUANTITY CONTROL FACILITIES

1. ROOFTOP STORAGE.
(STORMWATER MANAGEMENT CONTROL FACILITY 1.)
290m² x 150mm DEPTH ≈31m³

2. PARKING LOT STORAGE.
(STORMWATER MANAGEMENT CONTROL FACILITY 2.)
480m² x 140mm DEPTH ≈67m³

1 SWALE CROSS SECTION
SCALE: NTS

ORIGINAL SIZE 22" x 34" INCLUDED



LOCATION MAP

LEGEND

- SITE BOUNDARY
- APPROX. 100-YEAR PONDING LIMITS
- FLOW DIRECTION
- MAJOR CONTOURS
- MINOR CONTOURS
- PROPOSED SWALE GRADING
- ASPHALT AREA
- GRAVEL AREA
- CONCRETE AREA
- PROPOSED BUILDING
- GRASSED/ LANDSCAPED AREA
- EX. STORM SEWER WITH FLOW DIRECTION
- CB EX. CATCH BASIN
- EX. CULVERT

NO.	DATE	DESN	APPR	DESCRIPTION	SIGN

DESIGN: D.L.	DRAWN: S.R.	CHECK: HKW	DATE: AUG. 2013
SEAL			SHEET SIZE: 22 x 34
			SCALE: 0 4 8 12 16 1:400

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Jp2g Consultants Inc.

PROJECT
SITE PLAN APPLICATION FOR
18322 HWY #17
COBDEN, ON, K0J 1K0

TITLE
POST-DEVELOPMENT DRAINAGE CONDITIONS

CONTRACT	CONSULTANT FILE	
SHEET 2 OF 2	DRAWING FIGURE 3	REV.

APPENDIX B

Hydrologic Calculations

RATIONAL METHOD CALCULATIONS

Design Storms: 25 mm, 2 Year, 5 Year, 10 Year, 25 Year, 50 Year, 100 Year
Rainfall Station: MTO IDF Curve Lookup for coordinates 45.645833 N, -76.904167 E

* Time of Concentration: T_c: 3.26*(1.1-C)*Length$^{0.5}$/Slope$^{0.33}$ (C<0.4, Airport Formula)
T_c: 0.057*Length/(Slope$^{0.2}$x Area$^{0.1}$) (C>0.4, Bransby Williams Formula)

**Minimum Time of Concentration taken as 10 minutes.

Ranfall Intensity (I): A/(T_c+B)^C Flow (Q): 0.0028 x A x C x I x "C" Factor

PRE-DEVELOPMENT CONDITIONS

Drainage Basin ID	Area (ha)	Length of Watershed (m)	Slope (%)	Grass Area (ha)	Gravel Area (ha)	Rooftop, Asphalt, Conc. Area (ha)	Composite "C"	T_c* Calculated (min)	T_c** Used (min)	4HR 25 mm Chicago		2 Year		5 Year		10 Year		25 Year		50 Year		100 Year	
				C= 0.25	C= 0.60	C= 0.95				I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)
										A= 495.57	"C"	A= 546.11	"C"	A= 721.93	"C"	A= 699.05	"C"	A= 1217.09	"C"	A= 1370.17	"C"	A= 1541.36	"C"
										B= 7.53	Factor	B= 4.50	Factor	B= 5.30	Factor	B= 3.00	Factor	B= 6.05	Factor	B= 6.00	Factor	B= 6.05	Factor
										C= 0.79	1.00	C= 0.79	1.00	C= 0.79	1.00	C= 0.75	1.00	C= 0.83	1.10	C= 0.83	1.20	C= 0.83	1.25
1	1.49	200	2.00	1.05	0.16	0.28	0.42	9.53	10.00	51.58	0.090	66.75	0.117	82.78	0.145	101.04	0.177	122.59	0.236	137.58	0.289	152.27	0.333

POST-DEVELOPMENT CONDITIONS (UNCONTROLLED)

Drainage Basin ID	Area (ha)	Length of Watershed (m)	Slope (%)	Grass Area (ha)	Gravel Area (ha)	Rooftop, Asphalt, Conc. Area (ha)	Composite "C"	T_c* Calculated (min)	T_c** Used (min)	4HR 25 mm Chicago		2 Year		5 Year		10 Year		25 Year		50 Year		100 Year	
				C= 0.25	C= 0.60	C= 0.95				I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)	I (mm/hr)	Q (m^3/s)
										A= 495.57	"C"	A= 546.11	"C"	A= 721.93	"C"	A= 699.05	"C"	A= 1217.09	"C"	A= 1370.17	"C"	A= 1541.36	"C"
										B= 7.53	Factor	B= 4.50	Factor	B= 5.30	Factor	B= 3.00	Factor	B= 6.05	Factor	B= 6.00	Factor	B= 6.05	Factor
										C= 0.79	1.00	C= 0.79	1.00	C= 0.79	1.00	C= 0.75	1.00	C= 0.83	1.10	C= 0.83	1.20	C= 0.83	1.25
1	1.49	200	2.00	0.66	0.21	0.63	0.59	9.53	10.00	51.58	0.128	66.75	0.166	82.78	0.206	101.04	0.251	122.59	0.335	137.58	0.410	152.27	0.473

Modified Rational Method

100 Year Post-Development Flow controlled to 100 Year Pre-Development Flow

Pre-Development Conditions		**Rainfall Parameters**	
Area	1.49 ha	A=	1541.358
Composite "C"	0.42	B=	6.047
"C" Factor	1.25	c=	0.834
Time of Concentration	10.00 min		
Rainfall Intensity	152.27 mm/hr		
100 Year Peak Flow	0.333 m^3/s		

Post-Development Conditions		**Rainfall Parameters**	
Area	1.49 ha	A=	1541.358
Composite "C"	0.59	B=	6.047
"C" Factor	1.25	c=	0.834
Time of Concentration	10.00 min		
Rainfall Intensity	152.27 mm/hr		
100 Year Peak Flow	0.473 m^3/s		

Quantity Control Storage Volume as per Modified Rational Method Calculations

Area	1.49	ha
Composite "C"	0.59	
Allowable Discharge	0.333	m^3/s

3	245.57	0.763	137.28	60.00	77.28	
4	225.01	0.699	167.71	79.99	87.72	
5	207.89	0.646	193.69	99.99	93.70	
6	193.40	0.601	216.22	119.99	96.23	← Max Storage
7	180.95	0.562	236.03	139.99	96.04	
8	170.14	0.528	253.64	159.99	93.65	
9	160.66	0.499	269.44	179.99	89.45	
10	152.27	0.473	283.73	199.99	83.74	
11	144.78	0.450	296.76	219.99	76.77	
12	138.06	0.429	308.71	239.98	68.72	
13	131.99	0.410	319.72	259.98	59.74	
14	126.47	0.393	329.93	279.98	49.95	
15	121.44	0.377	339.43	299.98	39.45	
16	116.83	0.363	348.32	319.98	28.34	
17	112.59	0.350	356.64	339.98	16.67	

APPENDIX C

Hydraulic Calculations

Worksheet for Grass Swale - 25mm Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	2.00	m
Discharge	0.090	m^3/s

Results

Normal Depth	0.091	m
Flow Area	0.21	m^2
Wetted Perimeter	2.57	m
Hydraulic Radius	0.080	m
Top Width	2.54	m
Critical Depth	0.06	m
Critical Slope	0.02372	m/m
Velocity	0.44	m/s
Velocity Head	0.01	m
Specific Energy	0.10	m
Froude Number	0.49	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.000	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.000	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.091	m
Critical Depth	0.06	m
Channel Slope	0.00500	m/m
Critical Slope	0.02372	m/m

Cross Section for Grass Swale - 25mm Storm

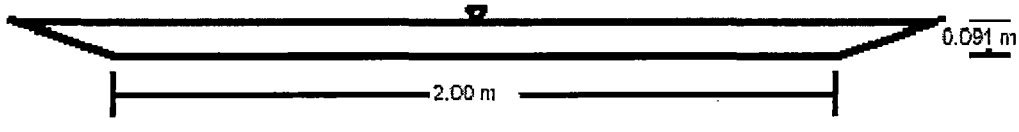
Project Description

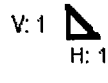
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	m/m
Normal Depth	0.091	m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	2.00	m
Discharge	0.090	m^3/s

Cross Section Image





Worksheet for Grass Swale - 100 Year Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	m/m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	2.00	m
Discharge	0.333	m^3/s

Results

Normal Depth	0.191	m
Flow Area	0.49	m^2
Wetted Perimeter	3.21	m
Hydraulic Radius	0.154	m
Top Width	3.15	m
Critical Depth	0.13	m
Critical Slope	0.01862	m/m
Velocity	0.68	m/s
Velocity Head	0.02	m
Specific Energy	0.21	m
Froude Number	0.55	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.000	m
Length	0.00	m
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.000	m
Profile Description		
Profile Headloss	0.00	m
Downstream Velocity	Infinity	m/s
Upstream Velocity	Infinity	m/s
Normal Depth	0.191	m
Critical Depth	0.13	m
Channel Slope	0.00500	m/m
Critical Slope	0.01862	m/m

Cross Section for Grass Swale - 100 Year Storm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.00500	m/m
Normal Depth	0.191	m
Left Side Slope	3.00	m/m (H:V)
Right Side Slope	3.00	m/m (H:V)
Bottom Width	2.00	m
Discharge	0.333	m^3/s

Cross Section Image